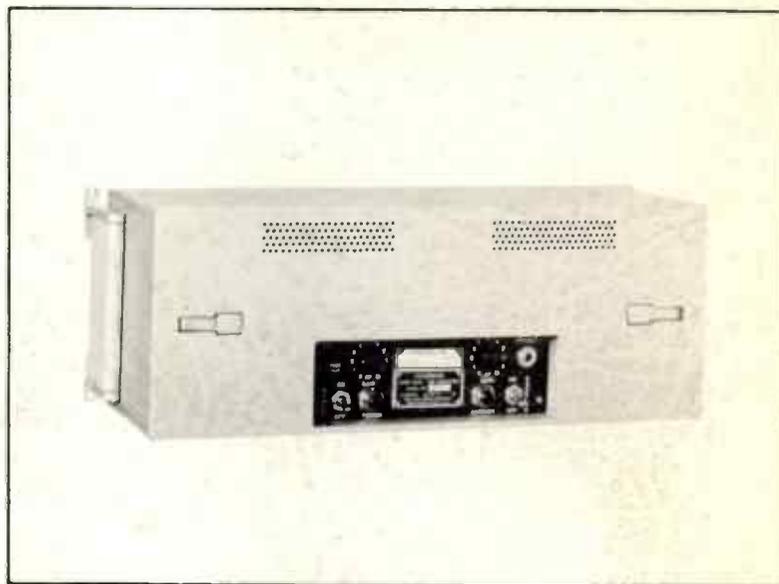


*Collins*

**INSTRUCTION BOOK**

**VHF FIXED-TUNED RECEIVER**

**51M-8**



**COLLINS RADIO COMPANY**

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The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

- (a) Notice of the claimed defect is given Collins within one (1) year from date of delivery and goods are returned in accordance with Collins instructions.
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- (D) Number of hours of service
- (E) Nature of trouble
- (F) Cause of trouble if known
- (G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
- (H) Item or symbol number of same obtained from parts list or schematic
- (I) Collins number (and name) of unit subassemblies involved in trouble
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- (A) Quantity required
- (B) Collins part number (9 or 10 digit number) and description
- (C) Item or symbol number obtained from parts list or schematic
- (D) Collins type number, name and serial number of principal equipment
- (E) Unit subassembly number (where applicable)

# VHF FIXED-TUNED RECEIVER

## 51M-8

**INSTRUCTION BOOK**

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Figure 1-1. 51M-8 Radio Receiver, Showing Flush Mounting Style

## SECTION 1 GENERAL DESCRIPTION

### 1-1. INTRODUCTION.

This instruction manual is to be used as a guide to the installation, operation, and the maintenance of the Collins 51M-8 Radio Receiver. Operators and technicians assigned to this equipment should familiarize themselves with this instruction manual. This procedure will enable each to detect any symptoms of trouble as they occur. Precautionary measures, such as this, could avert an extended breakdown of the equipment.

### 1-2. EQUIPMENT DESCRIPTION.

The Collins 51M-8 Radio Receiver is a fixed-tuned vhf radio receiver. This receiver was designed for the reception of amplitude-modulated radio-telephony (A3) on any fixed frequency over the range of 108 mc-152 mc. The 51M-8 Radio Receiver was designed primarily for use in aeronautical ground stations. However, it may be used for other point-to-point communication, where stability and reliability are prime requisites for operation.

The 51M-8 Radio Receiver is constructed on a sturdy chassis, which is punched to fit a standard 19-inch relay type mounting rack or cabinet. The 51M-8 Radio Receiver requires approximately seven inches of vertical mounting space. The receiver weighs approximately 15 pounds.

The 51M-8 Radio Receiver may be ordered in any one of three types of mountings. The receiver may

be ordered with a front panel flush mounting as shown in figure 1-1. The front cover of this type mounting is removed by loosening the Dzus fasteners. The 51M-8 may be ordered for midrail mounting. The front dust cover for this type of mounting is removed by releasing the snap fasteners. See figure 1-2. An alternate type mounting for the 51M-8 Radio Receiver provides for a hinge on the left side of the receiver. The right side of the receiver is mounted to the standard relay-type mounting rack or cabinet. This type mounting permits accessibility to the front or to the rear of the unit from the front of the relay-type rack or cabinet. See figure 1-3. The exterior design of the 51M-8 Radio Receiver makes it readily adaptable to any type of mounting in a normal installation. The 51M-8 Radio Receiver mounting style may be changed at any time by means of modification kits which are available.

The 51M-8 Radio Receiver is an 11-tube super-heterodyne type circuit, using dual conversion. The mixer stage of the receiver is separately excited by a Butler-type crystal-controlled oscillator. The receiver uses a Collins Mechanical Filter as the selective element in the receiver. The Collins Mechanical Filter Type F455K-350 provides improved selectivity in the receiver, as well as reduced maintenance. Two types of noise limiters are used within the receiver to minimize interference from ignition systems, static, heavy duty motors, or other allied electrical equipment. The 51M-8 Radio Receiver is designed for operation on either 115 or 230 volts single-phase a-c, 50/60 cps.



Figure 1-2. 51M-8 Radio Receiver, Showing Midrail Mounting Style

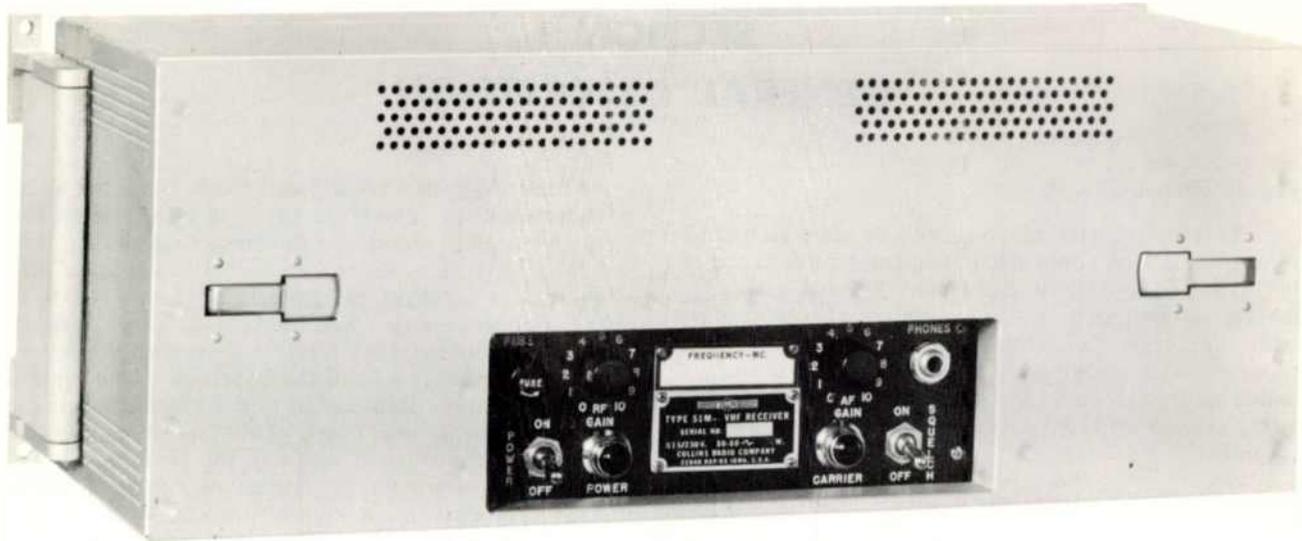


Figure 1-3. 51M-8 Radio Receiver, Showing Hinge-Type Mounting Style

TABLE 1-1. EQUIPMENT SUPPLIED

QUANTITY	DESCRIPTION	COLLINS PART NUMBER
1	51M-8 Radio Receiver, Flush Mounting, w/o tubes	522-0305-00
	or	
	Above receiver w/commercial-type tubes	522-0305-25
	or	
	Above receiver w/ruggedized tubes	522-0305-15
	or	
	51M-8 Radio Receiver, Midrail Mounting, w/o tubes	522-0306-00
	or	
	Above receiver w/commercial-type tubes	522-0306-25
	or	
	Above receiver w/ruggedized tubes	522-0306-15
	or	
1	51M-8 Radio Receiver, Hinge Mounting, w/o tubes	522-0307-00
	or	
	Above receiver w/commercial-type tubes	522-0307-25
	or	
	Above receiver w/ruggedized tubes	522-0307-15
	and	
	Instruction Manual	520-5383-00
	UG-21B/U Connector, for the r-f connection	357-9113-00
	Female a-c connector	372-9001-00
	Amphenol Type 15-pin connector	372-1079-00
	15-pin connector cover	372-1118-00

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY	DESCRIPTION
1	VHF Antenna
---	RG-8/U Coaxial Transmission Line
1	Loudspeaker with a 600-ohm transformer and a 4-ohm voice coil
1	19-inch relay-type mounting rack or cabinet

TABLE 1-3. ACCESSORY EQUIPMENT

QUANTITY	DESCRIPTION	COLLINS PART NUMBER
1	Conversion Kit. Converts 51M-8 Hinge Style to Flush Style	541-0189-00
1	Conversion Kit. Converts 51M-8 Flush Style to Hinge Style	541-0190-00
1	Conversion Kit. Converts 51M-8 Flush Style to Midrail Style	541-0191-00
1	Conversion Kit. Converts 51M-8 Hinge Style to Midrail Style	541-0192-00
1	Conversion Kit. Converts 51M-8 Midrail Style to Flush Style	541-0193-00
1	Conversion Kit. Converts 51M-8 Midrail Style to Hinge Style	541-1470-00
1	Commercial Tube Kit for 51M-8 Radio Receiver	541-0017-00
1	Ruggedized Tube Kit for 51M-8 Radio Receiver	541-0018-00
1	Antenna Modification Kit. Modifies antenna input to permit operation of two or more receivers from one antenna	541-0019-00
1	Remote Control Kit. Provides operation of receiver by a 48-volt power control relay	541-0020-00
1	Remote Control Kit. Provides operation of receiver by a 12-volt power control relay	541-0021-00
1	Audio Attenuation Kit. Attenuates audio output approximately 15 db when working into a low-level transmission or phone line	541-0022-00
1	6-foot power cable including a male plug-in connector	426-1003-00

TABLE 1-4. ELECTRON TUBE COMPLEMENT

REFERENCE SYMBOL	TYPE TUBE	FUNCTION
V1	6AK5/5654	R-F Amplifier
V2	6AK5/5654	1st Mixer
V3	12AT7/6201	1st Oscillator-Multiplier
V4	6AK5/5654	1st I-F Amplifier
V5	12AU7/5814	2nd Oscillator-Mixer
V6	6AK5/5654	455 Kc Amplifier
V7	6AK5/5654	455 Kc Amplifier
V8	6AK5/5654	455 Kc Amplifier
V9	12AU7/5814	Relay Actuator and Noise Detector
V10	12AX7/5751	Audio Driver and Squelch Amplifier
V11	6AQ5/6005	Audio Amplifier

1-3. REFERENCE DATA

- Size . . . . . 7 inches high x 19 inches wide x 7 inches deep, maximum overall.
- Weight . . . . . 15 lbs approximately.
- Finish . . . . . Anodized aluminum cover. Black enamel control panel.
- Frequency . . . . . Any fixed frequency in the range of 108 mc-152 mc.
- Frequency Control . . . . . Crystal oscillator.
- Type of Receiver . . . . . Superheterodyne, dual conversion with an automatic noise limiter, and a carrier-operated squelch circuit.
- Intermediate Frequencies. . . . . 7.050 mc and 455 kc.
- Receiver Output . . . . . 500 mw audio output into a 600 ohm load
- Type of Reception. . . . . Amplitude-modulated radiotelephony (A3).
- Frequency Stability . . . . . Dependent upon type of crystal used. With a CR-23/U better than 0.005%. Using premium type crystals, stability is better than 0.002% from 0°C to 40°C.
- Receiver Sensitivity. . . . . R-F GAIN control set at maximum. 2 uv signal at 30% modulation will produce not less than 6 db signal-to-noise ratio.
- Squelch Circuit. . . . . Squelch circuit will open on noise at maximum setting of R-F GAIN, and at least 10 uv at minimum setting. Provisions are made for remote operation of the r-f gain control.

1-3. REFERENCE DATA (Cont.)

Antenna Type . . . . .	Quarter-wave vhf ground plane or coaxial antenna having a 52-ohm impedance. Receiver input designed for modification to permit operation of two or more receivers from a single antenna.
Receiver Selectivity . . . . .	The bandwidth at 6 db is not less than 32 kc. The bandwidth at 80 db is not more than 65 kc.
Channel Spacing . . . . .	Adjacent channels may be spaced at 50-kc intervals.
AVC Characteristics . . . . .	Audio output constant within 3 db from signal input of 5 uv to 100,000 uv.
Power Dissipation . . . . .	Approximately 60 watts.
Power Requirements . . . . .	115- or 230- volt single-phase a-c, 50/60 cps
Ambient Temperature Range . . . . .	-40° C to 60°C.
Relative Humidity . . . . .	Up to 95%.
Maximum Altitude for Satisfactory Operation . . . . .	Up to 10,000 feet.



## SECTION 2 PRINCIPLES OF OPERATION

### 2-1. GENERAL DESCRIPTION.

The 51M-8 Radio Receiver is a vhf, 11-tube, dual-conversion, superheterodyne receiver, which operates on any fixed frequency within the range of 108 mc-152 mc. The first i-f operates at 7.050 mc, while the second i-f operates at 455 kc. A Butler-type crystal-controlled oscillator is used as the frequency determining element.

The circuitry of the 51M-8 Radio Receiver has a noise detector, as well as a squelch unit, and two stages of audio amplification. The 51M-8 Radio Receiver is designed for the reception of amplitude-modulated radiotelephony (A3) only. It is also possible to use this receiver for continuous-wave radiotelegraphy (A1) or frequency-shift keying.

Figure 2-1 is a simplified block diagram of the 51M-8 Radio Receiver. The incoming r-f signal passes through the antenna coil, a series of r-f coils, and one stage of r-f amplification. The r-f signal is then mixed with the output of the first oscillator, V3, to produce an i-f of 7.050 mc. The signal is then amplified by V4, and applied to the second mixer V5, where an i-f of 455 kc is produced. The 455-kc i-f signal is then amplified by a three-stage second i-f amplifier stage, consisting of V6, V7, and V8. The 455-kc i-f signal is then applied to the grid of the noise detector and to the audio detector and avc detector. The noise detector demodulates the audio signal which is impressed upon the i-f signal. This signal is then transmitted through a circuit, which reduces any impulse type noise appearing in the signal. The detector produces a d-c control

voltage. This control voltage is then applied to the various amplifier tubes in order to maintain a nearly constant audio output level for a wide variation of r-f signal strengths. The avc circuit produces a control voltage for the operation of the audio squelch circuit.

The audio signal is then fed through a series limiter, and is then amplified by the first audio amplifier. From this stage the signal is transmitted to a carrier-operated squelch circuit. The squelch circuit eliminates all noise in the receiver in the absence of a signal. The squelch circuit consists of V9B, which supplies the current for the operation of K1. K1 is operated by a d-c control signal, which is developed by the avc detector. The audio signal is further amplified by V11.

The power supply of the 51M-8 Radio Receiver consists of a full-wave bridge rectifier, which supplies the operating and the bias voltages for the receiver.

### 2-2. R-F AMPLIFIER. - (See figure 2-2.)

The r-f amplifier section of the 51M-8 Radio Receiver uses a type 6AK5/5654 pentode, V1, in conjunction with four tuned circuits. The tuned circuits are C1, L2; C2, L3; C8, L5; C9, and L6. The incoming r-f signal is coupled to the input of the first tuned circuit, C1, L2 by coupling loop, L1. L1 is connected between J1 and ground, with suitable mounting space made available to permit another connector to be added. The addition of another connector would provide a balanced input, permitting the operation of two or more receivers from one antenna. The r-f signal is coupled

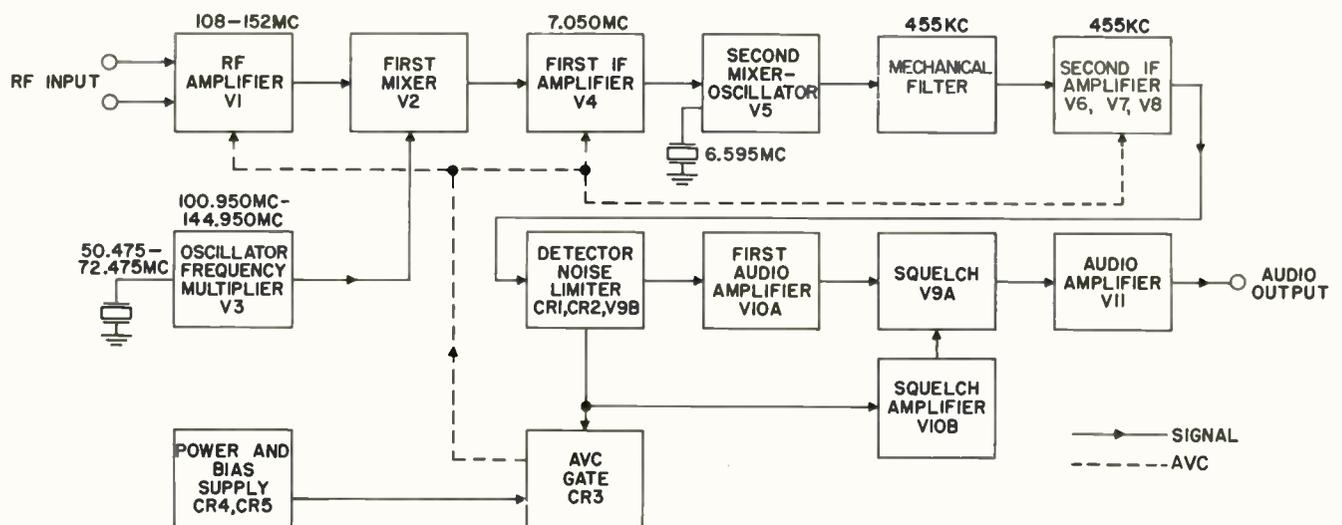


Figure 2-1. 51M-8 Radio Receiver, Simplified Block Diagram

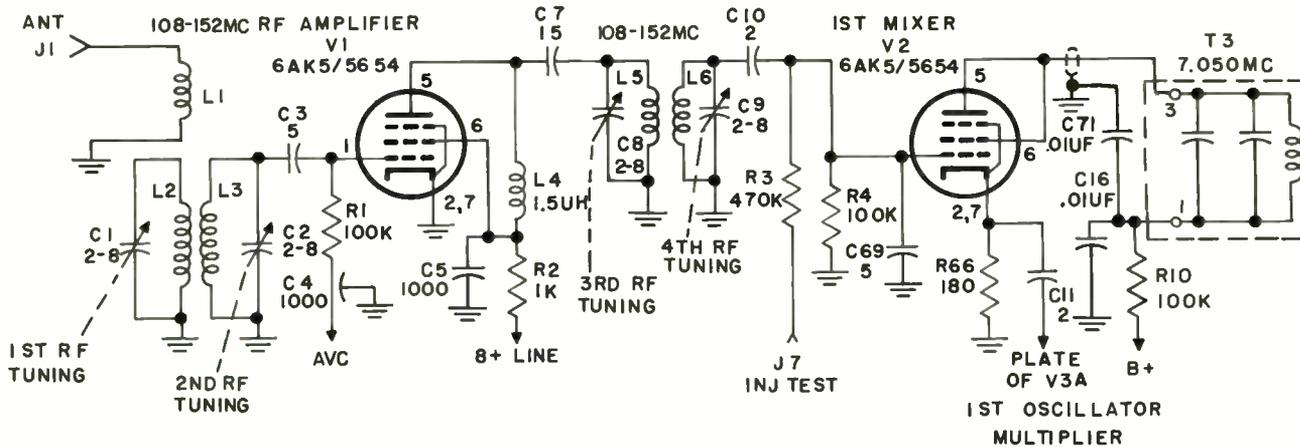


Figure 2-2. R-F Amplifier and First Mixer Circuit, Simplified Schematic

from the input r-f tuned circuit to the second r-f tuned circuit C2, L3, and through C3 to the grid of V1. Here the signal is amplified and passed through the plate circuit of V1 through C7 in the third r-f tuned circuit. The r-f signal is inductively coupled from this circuit to the fourth tuned circuit, consisting of C9 and L6. The fourth tuned circuit is coupled to the first mixer grid through C10. Avc voltage is applied to the grid of V1 through an r-c filter, R1, C4.

Both tuned circuits are adjusted by means of tuning slugs in L7 and L8. Y1 permits oscillation at only the crystal frequency. Here it is series resonant, providing a low-impedance feedback path. R-f choke L13 tunes out the crystal holder capacity, thereby eliminating spurious oscillations. The frequency of the crystal can be determined from the channel frequency by means of the following formula:

2-3. FIRST MIXER. - (See figure 2-2.)

The first mixer consists of a type 6AK5/5654 pentode which is connected as a triode. This circuit mixes the amplified r-f signal from the r-f amplifier with the injection signal which is provided by the high-frequency oscillator. This produces the first i-f signal which is 7.050 mc. The r-f signal is impressed upon the grid of V2 through C10. The injection signal is impressed upon the cathode through C11. R3 provides isolation for J7, the injection test point. The plate load of V2 is the primary of a double-tuned transformer, T3, which is tuned to 7.050 mc. The secondary of this transformer is coupled to the grid of the first i-f amplifier, V4, through blocking capacitor, C17.

$$F_{\text{xtal}} \text{ mc} = \frac{F \text{ channel} - 7.050 \text{ mc}}{2}$$

Likewise, the channel frequency may be determined by the formula:

$$F \text{ channel mc} = 2F_{\text{xtal}} \text{ mc} + 7.050 \text{ mc}$$

The output injection is coupled to the first mixer from the tuned circuit by C11.

For frequency stability of 0.002% over an ambient temperature range of 0° C to +40° C, premium quality crystals are required. Further information on achieving 0.002% stability with the 51M-8 Radio Receiver is found in the Maintenance section of this manual.

2-4. FIRST OSCILLATOR-MULTIPLIER. - (See figure 2-3.)

The high-frequency oscillator of the 51M-8 Radio Receiver consists of a 12AT7/6201 twin triode tube in a Butler-type crystal-controlled circuit. The crystal used in Y1 is a type CR-23/U quartz crystal, the frequency of which is between 50.475 mc and 72.475 mc, dependent upon the desired operating frequency of the receiver. Section B of V3 operates as a grounded-grid amplifier in conjunction with tuned circuit L7, tuned at the crystal frequency. The output of V3B is coupled through C13 to a cathode follower section of V3A. This is in conjunction with L8, which is tuned to twice the crystal frequency. This gives the desired injection frequency range of 100.95 mc-144.95 mc.

2-5: FIRST I-F AMPLIFIER. - (See figure 2-4.)

The 7.050-mc signal produced by the first mixer is amplified by V4. V4 is a type 6AK5/5654 pentode which is used as a first i-f amplifier. The plate load for V4 is the primary of another tuned transformer, T4. T4 is also tuned to 7.050 mc. The secondary of T4 applies the 7.050-mc i-f signal to the second mixer-oscillator, V5. Avc voltage is applied to the grid of V4 through R11 and C18. R12 provides isolation for avc test point J8.

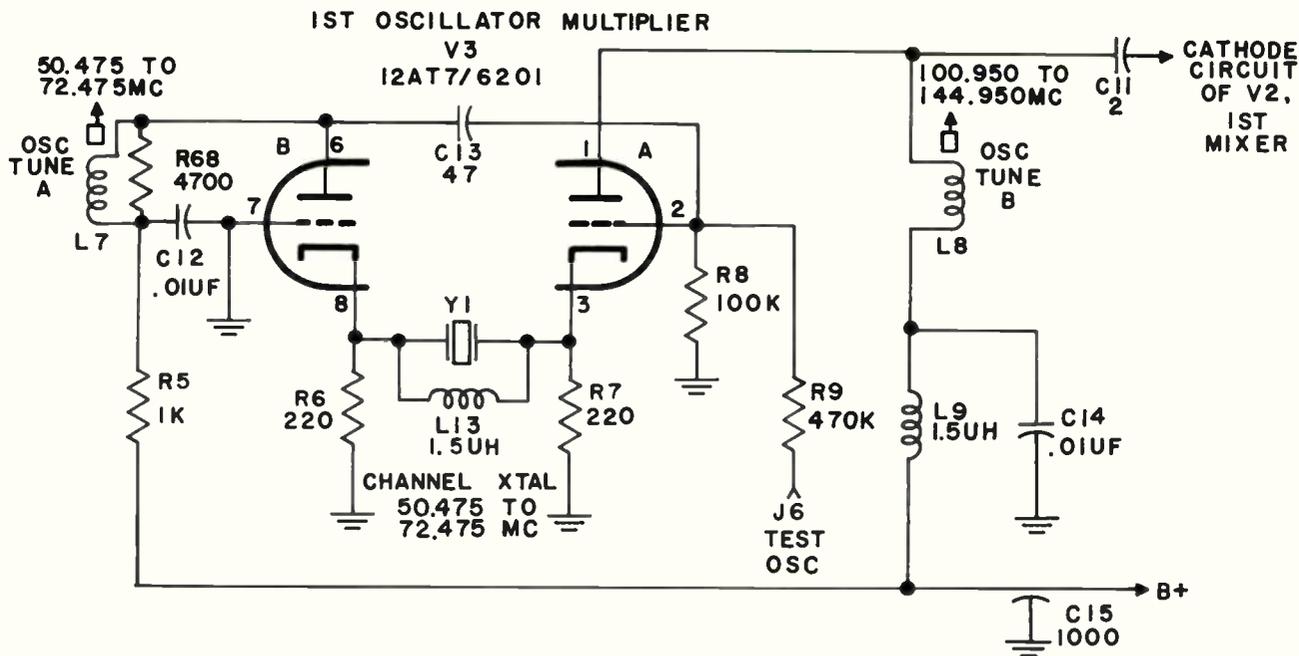
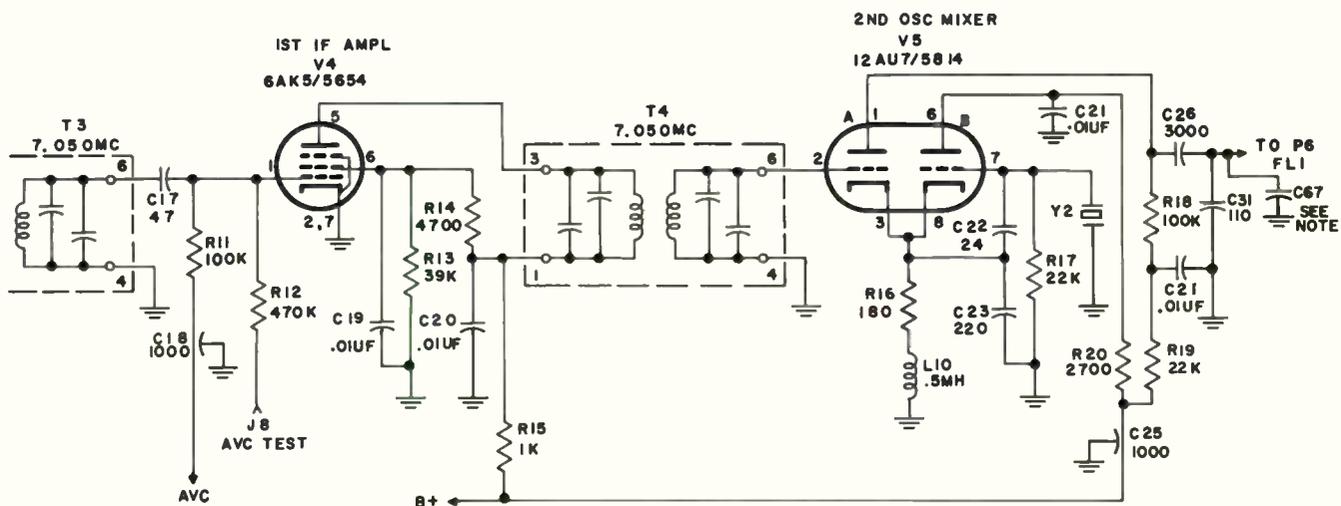


Figure 2-3. First Oscillator-Multiplier, Simplified Schematic



NOTE: VALUE DETERMINED BY TEST DEPT.

Figure 2-4. Second Mixer, Oscillator, and First I-F Circuit, Simplified Schematic

2-6. SECOND MIXER-OSCILLATOR. - (See figure 2-4.)

The second mixer-oscillator circuit uses a 12AU7/5814 dual triode as V5. Section V5A acts as a triode mixer, while Section V5B is used as a crystal-controlled oscillator. The crystal of the second oscillator uses a type CR-18/U quartz crystal, which has a frequency of 6.595 mc. The crystal is used in a modified Colpitts-type circuit in which no tuned circuit at the crystal frequency is required. In this circuit the crystal presents an inductive impedance which resonates with C22 and C23. The oscillator signal of 6.595 mc is mixed with the 7.050-mc first i-f signal from T4 in Section V5A. This produces a second i-f of 455 kc. The mixer receives its injection signal from the oscillator by the common cathode connection of the two triode sections. The plate load of the mixer consists of R18 and a Collins Mechanical Filter, FL1. The mechanical filter is an F455K-350 type used in the 51M-8 Radio Receiver. FL1 is protected from possible excessive d-c current by blocking capacitor C26.

The 455-kc signal from the second mixer is applied to FL1. FL1 is a mechanical device which is fixed-tuned at the second i-f of 455 kc. C31 resonates the input internal coupling coil of the filter to 455 kc. C32 resonates the output internal coupling coil of FL1 to 455kc. C68 is a variable capacitor which resonates FL1.

The Collins Mechanical Filter achieves unusual selectivity by a combination of electrical and mechanical elements. The filter is composed of three general sections: the input transducer; the resonant section; and the output transducer. The input and the output sections of the filter are identical, and function to convert electrical signals to a mechanical form of energy and vice versa.

The input signal is impressed on a small coil which surrounds a nickel wire. By means of magnetostriction, the magnetic field variations are converted

to mechanical vibrations. One end of the nickel wire is welded to the first of a series of disks, which comprise the resonant section of the filter. There are six of these resonant disks, composed of a special alloy, which has a very sharp resonance and excellent frequency stability. The vibrations of the nickel wire cause the end disk to vibrate, and these vibrations are coupled to the other disk by wires welded to their edges.

The output end of the filter is identical to the input end and is composed of a nickel wire and a coil. Here the magnetostriction action of the nickel wire functions to convert the mechanical vibrations of the disk into a varying magnetic field. The coil intercepts this field and supplies the output voltage.

The entire unit is hermetically sealed in a case smaller than a normal i-f transformer.

2-7. 455-KC I-F AMPLIFIER. - (See figure 2-5.)

The 455-kc i-f signal is applied to the grid of V6, which is a 6AK5/5654 type pentode. Avc voltage is applied to the grid of V6 through an R-C filter which consists of R23 and C33. The plate load for V6 consists of an r-f choke, L11, and a tuning capacitor C36. C36, L11, and R27 act as a broad-tuned circuit at 455 kc. The 455-kc signal is then coupled to the grid of V7 through grid resistor R27 and filter capacitor C37. The plate load for V7 consists of r-f choke L12 and tuning capacitor C41. L12 and C41 and R31 act as a broad-tuned circuit at 455 kc. The 455-kc signal is then coupled through C42 and R31, to the grid of V8, the last 455-kc amplifier. V8 is a 6AK5/5654 pentode. The plate load for V8 is the primary of T5, which is a toroidal-type i-f transformer. C65 tunes the primary of T5 to 455 kc while R67 loads T5 to provide the desired bandwidth. V6, V7, and V8 operate as conventional class A amplifiers.

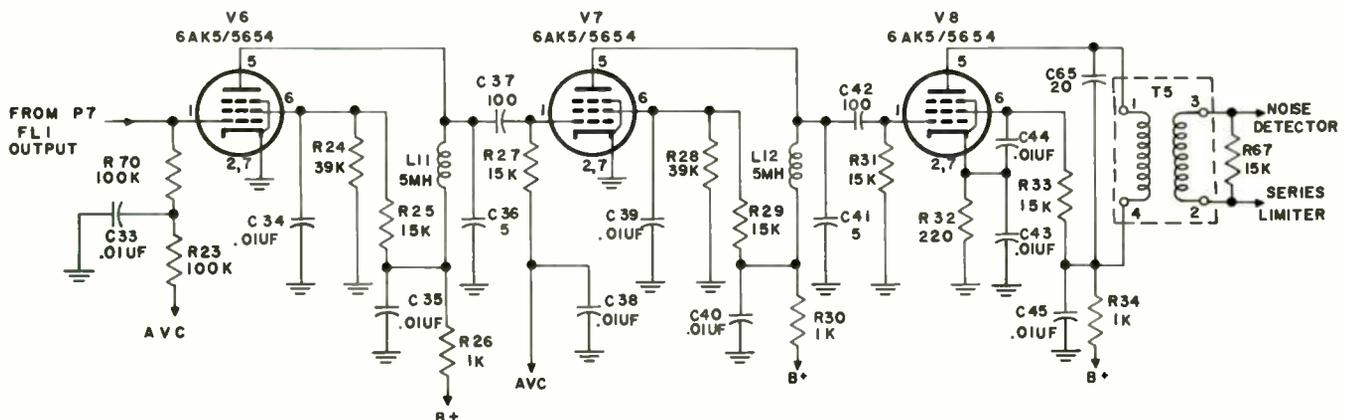


Figure 2-5. 455-Kc I-F Amplifier Circuit, Simplified Schematic

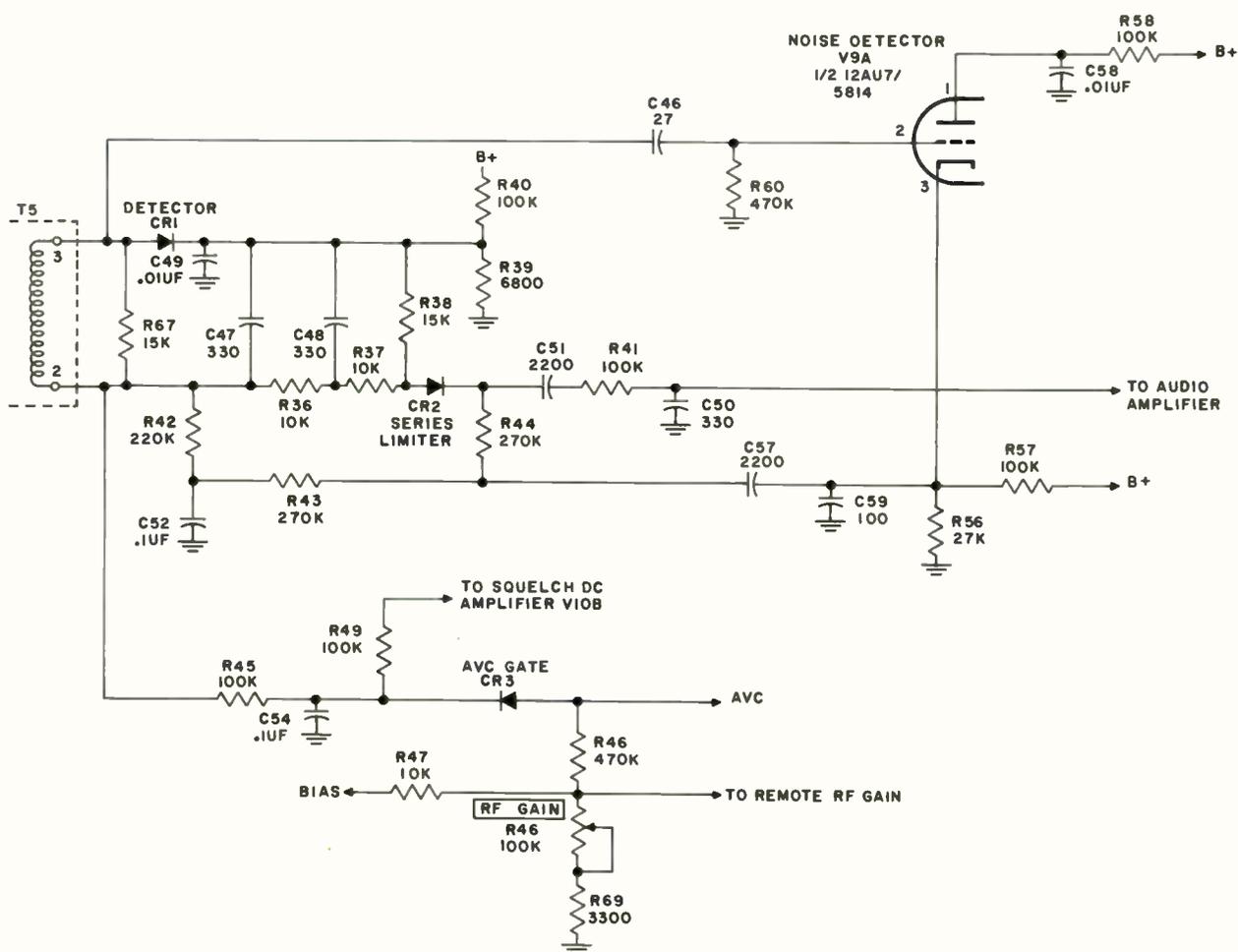


Figure 2-6. Detector, Noise Limiter, and AVC Gate, Simplified Schematic

### 2-8. DETECTOR, NOISE LIMITER, AND AVC GATE. (See figure 2-6.)

The 455-kc signal from the secondary of T5 is applied to the audio and the avc detector, CR1. CR1 is a silicon diode, which acts as a rectifier with the diode load, R36, R37, and R38, and filter capacitors, C47 and C48. A positive delay voltage of approximately 12 volts is applied to the cathode of CR1 by bleeder resistors R39, R40, and audio bypass capacitor, C49. This provides the desired avc and squelch operating points. The output of the detector with a 1000-microvolt signal is -5 volts.

The series diode limiter circuit uses a silicon junction diode, CR2, in a circuit which limits the audio output signal. This limiting action greatly reduces the amount of noise energy transmitted to the audio amplifier circuitry by limiting the high percent modulation noise peaks without adversely affecting the intelligibility of the voice signals. In the circuit

employed, the anode of CR2 is connected to the junction of R37 and R38. These resistors, with R36, act as a voltage divider. R42 and C52 act as an audio filter to establish a reference potential at the junction of R42, R43, and C52. When modulation at percentages greater than 40% are applied, the instantaneous voltage at the anode of CR2 becomes more negative than the cathode. This is because the cathode voltage is held constant by C52. When this occurs, the diode will be cut off until the modulation goes below 40%. Modulation lower than 40% is not affected by this circuit.

The amount of noise energy remaining in the output of the series limiter circuit is further reduced by the introduction of noise pulses of opposite polarity to cause noise cancellation. These pulses are generated by the noise cancellation detector, V9A. This tube operates as an infinite impedance detector in which the 455-kc signal is applied to the grid of the tube by C46 and R60. In this application, the tube is cathode-biased to about +25 volts by R56 and R57, so only



contacts used as a spst switch for the operation of the carrier lamp, I2; one set of spst contacts being provided for operation of remote equipment; and one set of spdt for audio disabling.

V10B is a d-c amplifier receiving its control voltage from the filtered rectified carrier signal on the cathode of CR3 through isolating resistor, R49. Plate voltage of approximately 30 volts is applied through R52 from the voltage divider consisting of R53, R54, and R55. V9B is another d-c amplifier having the carrier-operated relay K1, as a plate load. The grid of V9B is connected directly to the plate of V10B, while the cathode is connected to the 30 volts plate supply divider for V10B. Thus any voltage drop across R52 acts as a bias for V9B.

The operation of this circuit is best understood by assuming no applied signal and maximum r-f gain. V10B is cut-off by sufficient negative voltage applied to its grid from the rectified noise in the detector and the positive bias of about 2 volts applied to the cathode through S2 from the voltage divider, R55. No current flows through R52 from V10B and V9B conducts, energizing K1. The normally open contacts then apply audio to the audio gain control closing the carrier indicator lamps and remote contacts. Positive feedback is applied to the cathode of V10B by the cathode current of V9B flowing through R55, to reduce the relay chatter.

When the rectified noise or carrier negative voltage applied to the grid of V10B is reduced by adjustment of the r-f gain control, V10B starts to conduct.

The voltage drop across R52 biases V9B off, reducing its plate current until the relay is de-energized. This causes all contacts of K1 to revert to their normal position. This opens the indicator lamp circuits, the remote relay contacts, and grounds out the audio.

As the signal input level increases, the control voltage applied to the grid of V10B goes more negative until its plate current is reduced sufficiently so the voltage drop across R52 is small enough to permit V9B to conduct and energize K1. This closes the indicator lamp circuits, remote contacts, and connects the audio to the audio gain control. S2 is used to disable V10B, permitting V9B to conduct at all times. C53 and C56 eliminate relay chatter by reducing the effect of instantaneous signals on V10B.

2-11. AUDIO AMPLIFIER. - (See figure 2-8.)

The final audio amplifier consists of V11, a 6AQ5/6005 beam pentode operating as a degenerative amplifier, which, in conjunction with the audio output transformer, T2, provides output at either 4 or 600 ohms. The audio signal is coupled to the grid of V11 by R62. C61 provides additional audio filtering, while C62 provides d-c blocking for the application of remote r-f gain control over the audio output lines. Phone output is available from the 600 ohms secondary winding of T2 by connection of J5.

2-12. POWER AND BIAS SUPPLY. - (See figure 2-9.)

The power supply for the 51M-8 Radio Receiver includes a power transformer, T1, and a selenium-

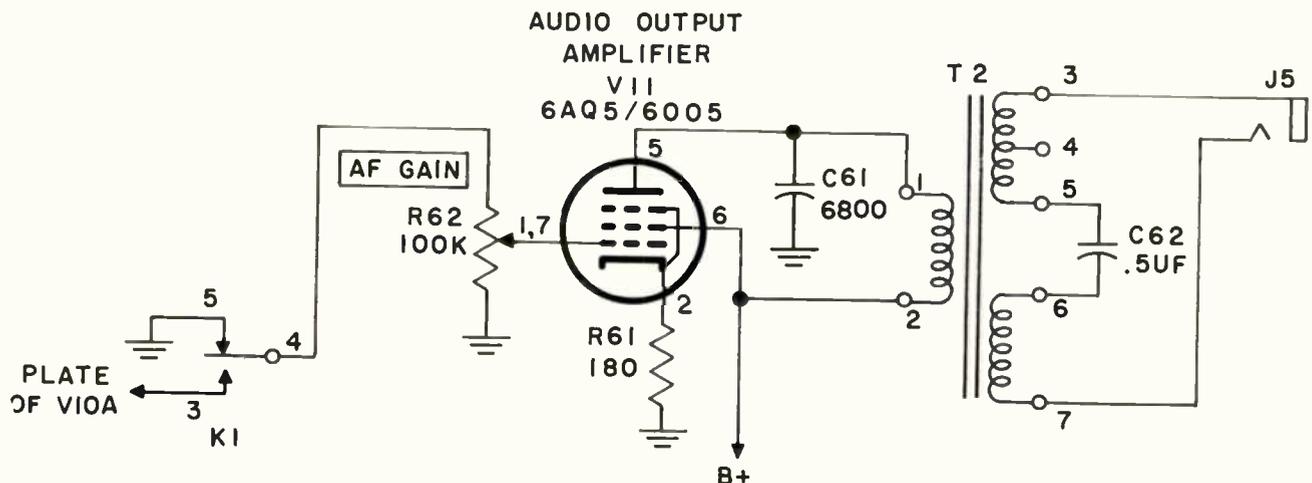


Figure 2-8. Audio Amplifier Circuit, Simplified Schematic

SECTION 2  
Paragraph 2-12

type rectifiers, CR4 and CR5. The selenium rectifiers are connected in a full-wave bridge arrangement, providing a more efficient, reliable system of rectification than is possible with a vacuum tube type rectifier arrangement. C63A, C63B, C63C, R64, and R65 function as a capacitor-input two-stage r-c filter. This provides a filtered high-voltage supply of approximately 130 volts. R66 provides a negative voltage for the r-f

gain control biasing circuit. Power input to the receiver is controlled by the power ON-OFF switch, S1. The receiver is protected by a .75 ampere slow-blow type 3AG cartridge-type fuse, F1. The primary of T1 has a double winding to permit operation on either 115- or 230-volt single-phase a-c, 50/60 cps. Power indicator lamp I1 lights when the power is applied to the receiver.

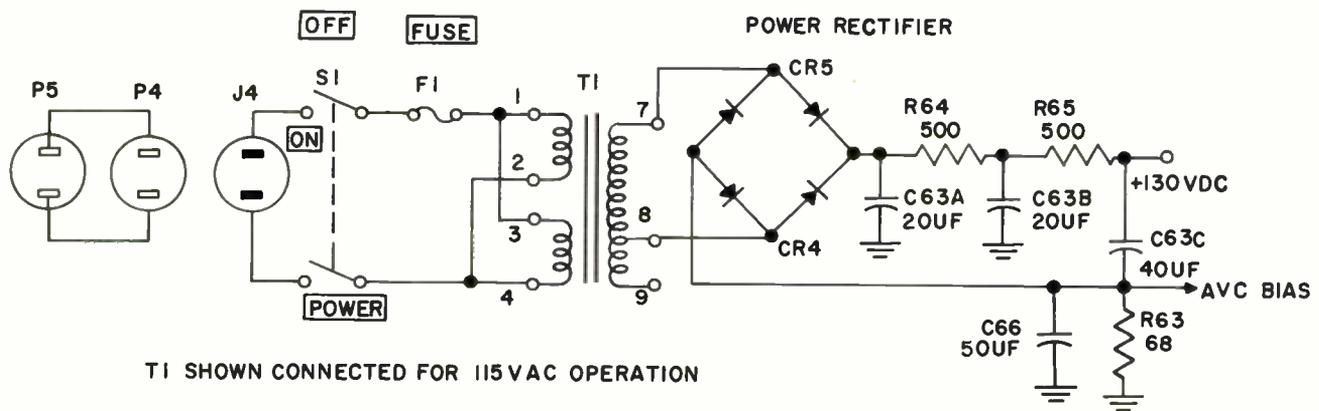
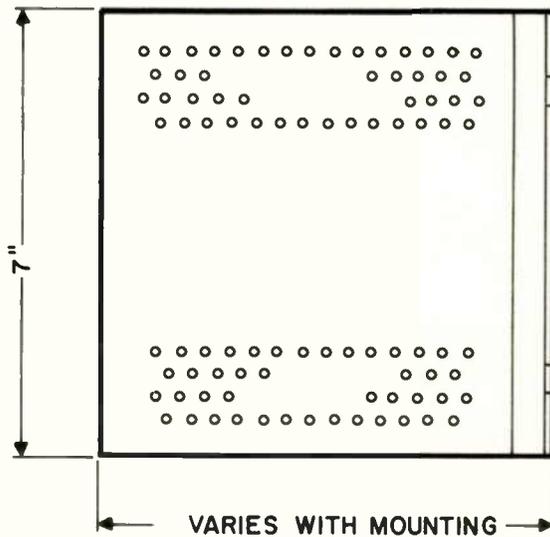
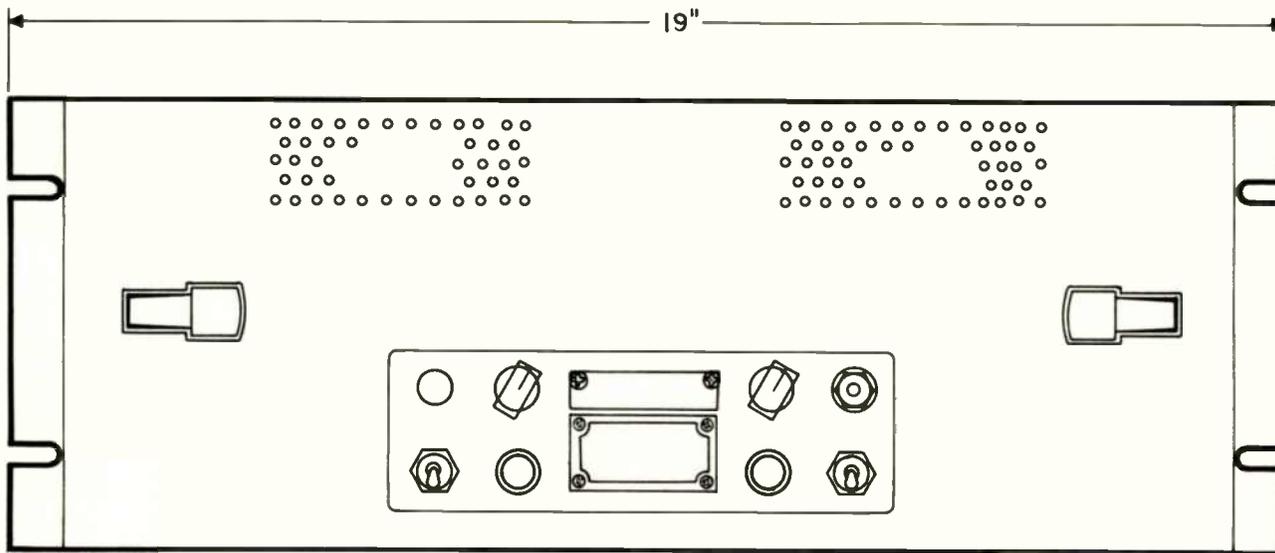


Figure 2-9. Power and Bias Supply Circuit, Simplified Schematic





## NOTES:

1. FOR FLUSH STYLE MOUNTING, CABINET DIMENSIONS ARE TO THE REAR OF MOUNTING FRAME.
2. HINGE STYLE MOUNTING SWINGS OUT APPROXIMATELY 70 DEGREES IN A CABINET. HINGE STYLE MOUNTING SWINGS OUT FULL 90 DEGREES IN RELAY-TYPE RACK.
3. CHASSIS PANEL PUNCHED ACCORDING TO RETMA STANDARDS.

Figure 3-1. Outline Mounting Dimensions, 51M-8 Radio Receiver

## SECTION 3 INSTALLATION AND INITIAL ADJUSTMENTS

### 3-1. UNPACKING.

All equipment supplied with the 51M-8 Radio Receiver is shipped in a single container. The receiver is shipped with all tubes and connectors in place, unless order instructions are explicitly different.

Remove the packing material and lift the equipment out carefully. Inspect the receiver thoroughly for any possible damage in shipping. If a claim for damage in transit is to be filed, the original shipping container and packing material, and the original bill of lading should be preserved.

### 3-2. MOUNTING. - (See figure 3-1.)

The 51M-8 Radio Receiver is designed for mounting in a standard 19-inch relay-type rack or cabinet. The 51M-8 features optional type mounting, depending upon specifications of the order. The particular mounting style of each receiver may be changed by the use of accessory modification kits listed in section 1 of this manual. The 51M-8 Radio Receiver requires 7 inches of vertical mounting space. The depth behind the receiver will vary from 2 inches to 7 inches, depending upon the style of mounting. Four 10-32 machine screws are required to mount the receiver in the relay-type rack or cabinet. Binder head screws with flat washers or oval head screws with finish washers are recommended.

### 3-3. LOCATION.

The receiver should be located so as to keep the length of the transmission line from the receiver to the antenna to a reasonable minimum. The attenuation of the type RG-8/U coaxial line normally used is 2.5 db per 100 feet in the frequency range of the receiver.

Immediate access to the receiver controls during operation is not necessary. The r-f gain can be controlled remotely up to a distance of several miles by the installation of a 100K-ohm R-F Gain Control at the operating position. After making the proper connections, the audio level can be controlled by means of a variable attenuator in the loudspeaker circuit. The mounting rack or cabinet in which the receiver is mounted must be accessible from both the front and the rear to permit servicing and tube changing, dependent upon the type of installation ordered. The hinge-type mounting eliminates this necessity.

The receiver should be mounted in a location in which the maximum temperature of the air immediately surrounding the equipment will not exceed +60°C. (140°F.). If the receiver is to be mounted along with other power dissipating equipment in a single cabinet or rack, the maximum temperature rise in the cabinet

should be checked. This normally occurs at the top of the cabinet. If necessary, forced ventilation should be installed to prevent excessive temperature rise. The life of most of the receiver components is adversely affected by high ambient temperatures.

### 3-4. ANTENNA LOCATION.

Since VHF reception is usually limited to the line-of-sight distance, which is in turn dependent on the height of the transmission and the receiving antennas, it is desirable to mount the receiving antenna in a location as high as possible and free from any metallic obstructions in all directions.

Receiving antennas should be located as far as possible from the VHF transmitting antennas. Although special precautions to reduce the effect of strong off-frequency signals are incorporated in the design of the 51M-8 Radio Receiver, strong signals induced in the receiving antenna from nearby transmission antennas can interfere seriously with the operation of the receiver.

### 3-5. RECEIVER CONNECTIONS.

If two or more receivers are to be operated in series from one antenna, the input circuit of the receiver will require modification for a balanced input. Antenna modification kit, Collins Part Number 541 0019 002, may be purchased and provides the necessary components.

The modification requires the addition of another connector in the mounting hole provided at the rear of the receiver chassis. The end of the single loop input coil would be removed from the grounding lug and reconnected to the new connection. The grounding lug may be discarded. The loop should be repositioned in the same location as before modification.

After the modification kit has been installed, J2 of one receiver should be connected to J1 of the next receiver going away from the antenna, using RG-8/U cable. Tests indicate two or more receivers may be operated from one antenna without appreciable loss in performance at frequencies as close as 100 kc.

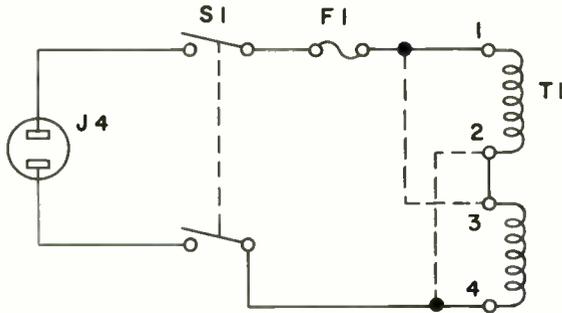
### 3-6. POWER CONNECTIONS.

The 51M-8 Radio Receiver is normally furnished for 115-volt a-c, 50/60-cps operation. Provisions are made for reconnection of T1 for operation at 230-volt a-c single-phase, 50/60 cps. See figure 3-2 for proper T1 reconnection. A .75-ampere slow-blow fuse, F1, is used for 115-volt a-c operation. This fuse should be changed to .5 ampere for operation at 230-volt a-c. Connection of the a-c power source is made by using P4,

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Paragraphs 3-6 - 3-11

which is furnished. P4 is plugged into J4 of the receiver. A 6-foot power cable may be purchased as an accessory item to facilitate power connections.

Remote control of power application is possible by using either the 48-volt d-c kit or the 12-volt d-c kit listed in table 1-3. Mounting holds have been provided for K2. Wires are provided in the cable terminating at terminals 14 and 15 of J3. The loose ends have been taped to the cable for application of control voltage. The primary power wires are brought to two standoffs to facilitate the connections to the respective relay contacts.



CONNECTIONS FOR 230 VAC SINGLE PHASE OPERATION  
115VAC SHOWN IN DOTTED LINES  
VALUE OF F1 FOR OPERATION ON 230 VAC IS .5 AMPERE.

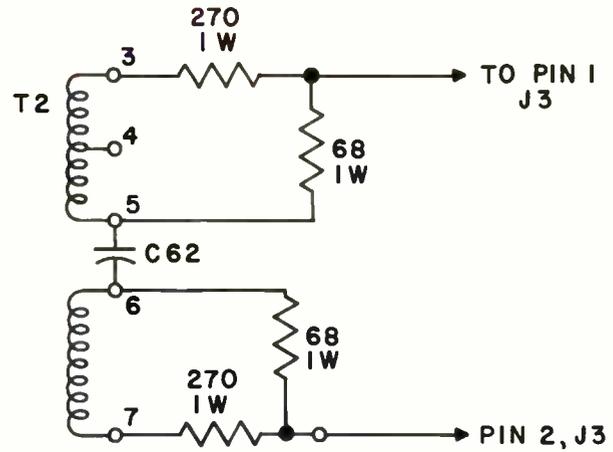
Figure 3-2. Connections for 230 VAC to 51M-8 Radio Receiver

3-7. AUDIO CONNECTIONS.

Two output impedances are provided in the 51M-8 Radio Receiver. The receiver is wired for 600 ohms output load. Connection to these points are made through terminals 1 and 2 of P3 and J3. This output is also connected to the PHONE jack J5 on the front panel. For 4 ohms output, the audio transformer, T2, must be reconnected putting the output lead from terminal 7 to pin 2 of J3 on terminal 4. Two mounting holes have been provided to permit addition of two standoffs for connection of audio output attenuating resistors contained in audio attenuation kit Collins part number 541 0022 002. For proper connections see figure 3-3.

3-8. CARRIER LIGHT CONNECTIONS.

Provisions have been made for operation of a remote carrier indicator lamp which will light whenever the squelch unit of the receiver is opened. Connection to this circuit is made through terminals 5 and 7 of J3. The remote lamp should be a 6-8 volts, 0.15 ampere pilot lamp, equivalent to a Mazda Type No. 47.



AUDIO OUTPUT CONNECTIONS

Figure 3-3. Audio Output Connections, Simplified Schematic

3-9. RELAY CONNECTIONS.

In addition to the contacts required for the operation of the carrier indicator lamps, K1 is equipped with a set of spst contacts for the operation of external equipment such as a recorder. These contacts are rated at 115 volts at 1 ampere. The connections for these contacts close when the squelch circuit opens, because of the application of an r-f carrier or operation of S2.

3-10. REMOTE R-F GAIN CONTROL.

Provisions have been made for remote control of the r-f gain of the 51M-8 Radio Receiver. The remote gain control is a 100K-ohm variable resistor. This is connected between pin 6 and pin 7 of P3. The variable resistor should be connected so the minimum resistance is obtained in the maximum clockwise position of the control. The R-F GAIN control of the front panel should be set at the minimum gain position or disconnected.

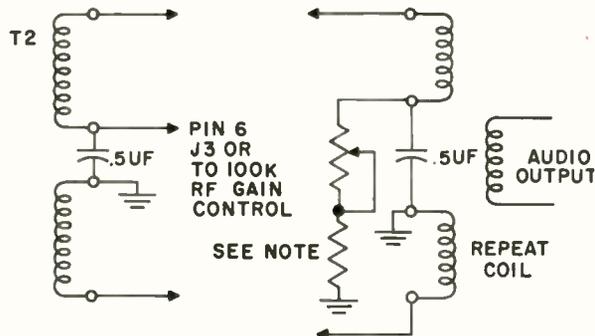
Provisions have also been made for remote r-f gain control over phone lines from a remote control point. The connections are shown in figure 3-4. The R-F GAIN control on the front panel should be disconnected.

3-11. INITIAL ADJUSTMENTS.

The 51M-8 Radio Receiver is normally supplied with a crystal unit for the specified frequency, and tuned to this frequency. The various tuning adjustments may be disturbed during shipment or installation, so it is very desirable the adjustment be checked before the equipment is commissioned. The tuning control location diagram in figure 3-5 shows the location of the controls to be adjusted.

The equipment required for tuning the receiver consists of a high-impedance voltmeter, preferably a

vacuum-tube voltmeter. The voltmeter probe should be inserted in the AVC TEST jack, J8, and the ground lead should be connected to the receiver chassis. The avc voltage is negative to ground and care should be taken to see the voltmeter polarity is correct. The signal generator output is connected to the R-F INPUT jack J1.



NOTE: TOTAL VALUE OF RESISTANCE INCLUDING LINE RESISTANCE IS 3300 OHMS.

Figure 3-4. Remote R-F Gain over Phone Lines

Turn the receiver on and permit it to warm up for at least ten minutes. Set the R-F GAIN control to the maximum clockwise position; set the SQUELCH switch to OFF. Adjust OSC TUNE A and OSC TUNE B for maximum output at J7 according to paragraph 6-3. Apply maximum output of the signal generator and tune it to the receiver frequency as indicated by the maximum negative reading on the voltmeter. Reduce the signal generator output to obtain a voltage reading of 3-4 volts and adjust the screwdriver-adjust controls: 1st, 2nd, 3rd, and 4th R-F TUNE for maximum reading at J8 AVC TEST, reducing the output of the signal generator, if necessary, to maintain a reading of 3 to 4 volts.

After the installation is complete, the 1st R-F TUNE should be adjusted for maximum output, while receiving a weak signal from an aircraft transmitter.

Do not adjust the settings of the 7.050 mc i-f transformers. Alignment of these components should be done only as described in section 6 of this manual.

### 3-12. PERFORMANCE TESTS.

The following tests should be made to insure the proper performance of the receiver.

With zero signal input to the receiver, the SQUELCH switch should be turned to ON position, and adjust the R-F GAIN control to a maximum position. The squelch circuit should be open, the carrier lamp on, and the noise present in the speaker or headphones.

Check the operation of the R-F GAIN control by measuring the signal input required to open the squelch circuit with minimum r-f gain. At least 10 microvolts should be required. This figure varies among different receivers, but in no case should it be less than 10 microvolts.

Check the operation of the avc circuit by increasing the signal generator output to 100,000 microvolts. As the input signal is increased, the audio output of the receiver should increase only slightly, if the avc circuit is operating properly.

Check the operation of the A-F GAIN control and the SQUELCH switch. If a remote carrier lamp and a remote R-F GAIN control have been installed, check their operation.

#### NOTE

When a signal generator is used in checking the equipment, considerable audio distortion may occur due to frequency modulation effects in the signal generator. This is due to the audio modulation applied. The signal generator should be tuned to the center of the passband by noting the avc voltages. This procedure will prevent erroneous output should the signal generator be tuned to the edge of the sharp selectivity characteristics.

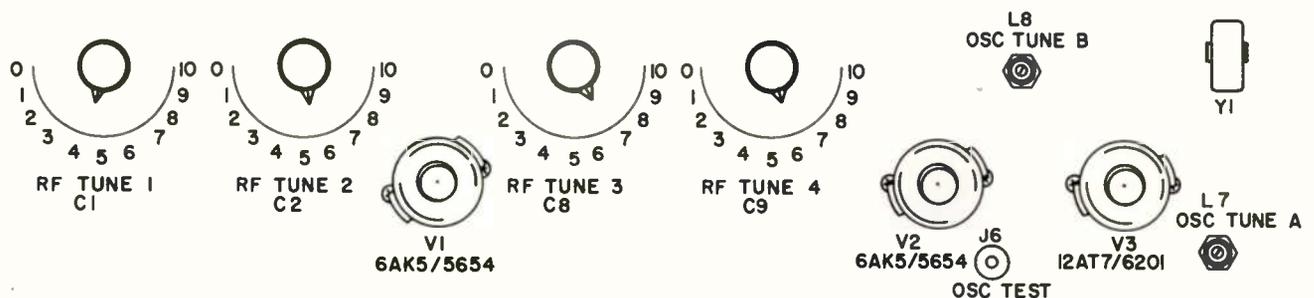


Figure 3-5. Tuning Control Location Diagram



## SECTION 4 OPERATION

### 4-1. OPERATING CONTROLS.

The 51M-8 Radio Receiver receives amplitude-modulated radiotelephony signals on a single fixed frequency within the range of 108 mc to 152 mc. All controls necessary for operation of the receiver are located on the front panel. See figure 4-1. Removal of the front panel will reveal additional controls, which are a screwdriver-adjust type. Once these controls have been set, they need not be set again, until a frequency is changed.

4.1.1. **POWER ON-OFF (S1)** - A dpst switch controlling the application of a-c power to the receiver.

4.1.2. **POWER LAMP (I1)** - Indicates when power is applied to the receiver.

4.1.3. **R-F GAIN (R46)** - A continuously variable control which regulates the amount of r-f gain, thereby controlling the squelch opening level of the receiver. By means of this control, the squelch opening level can be adjusted from zero microvolts to more than 10 microvolts with the control at maximum counterclockwise position.

4.1.4. **A-F GAIN (R62)** - A continuously variable control which regulates the audio output of the receiver. Maximum output is obtained at maximum clockwise position of the control.

4.1.5. **CARRIER INDICATOR (I2)** - Indicator lamp which lights when the squelch circuit of the receiver opens. Its principal function is to indicate which frequency is being called when several receivers are being operated simultaneously.

4.1.6. **SQUELCH ON-OFF (S2)** - The switch permits the squelch circuit to be disabled. In the ON position, the squelch circuit operates normally; in the OFF position, the squelch circuit remains open, permitting audio output, regardless of whether a carrier is being applied or not.

### 4-2. OPERATING PROCEDURE.

Since the 51M-8 is a fixed-tuned receiver, after the initial adjustments are made, only the R-F GAIN and the A-F GAIN need be adjusted. When the receiver is ready for operation, the A-F GAIN and the R-F GAIN should be set for the desired output.

The R-F GAIN control should be advanced to the point where the ambient noise existing at the location will open the squelch circuit, then reduced to the point where the noise will not open the squelch. This will insure operation of the receiver at the maximum sensitivity which will still allow the squelch circuit to silence the receiver between transmissions.

#### NOTE

ALL OPERATING PERSONNEL SHOULD BE INSTRUCTED AS TO THE PROPER ADJUSTMENT OF THE R-F GAIN CONTROL AS IMPROPER ADJUSTMENT MAY RESULT IN MISSED CALLS.

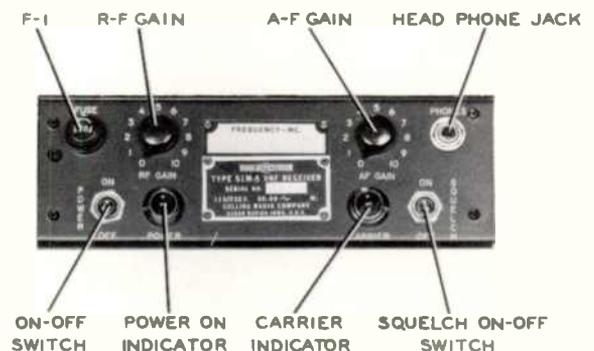


Figure 4-1. Operating Controls 51M-8 Radio Receiver



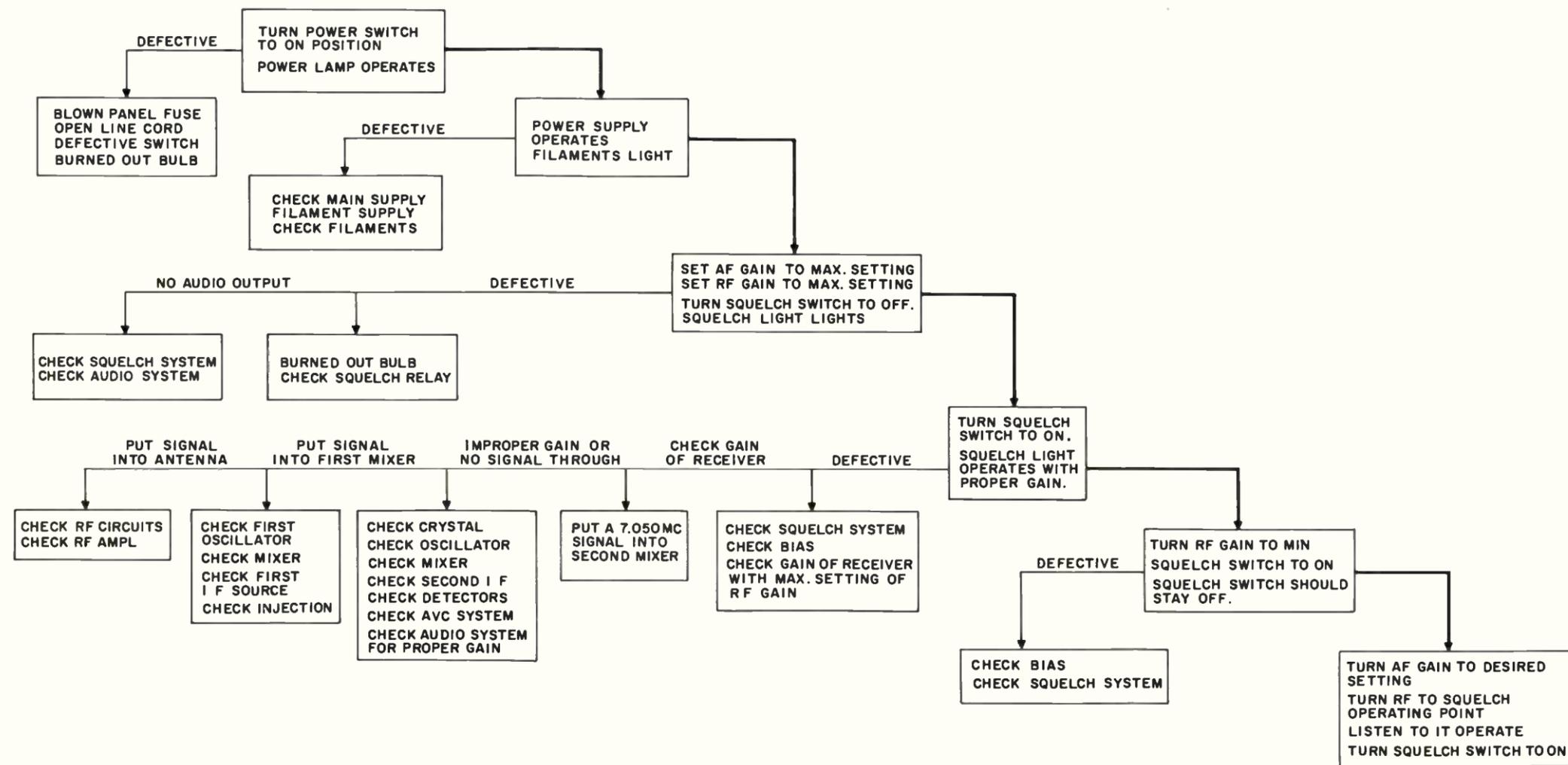


Figure 6-1. Trouble Locating Diagram, 51M-8 Radio Receiver

## SECTION 5 MAINTENANCE

### 5-1. PREVENTIVE MAINTENANCE.

The 51M-8 Radio Receiver is not equipped with mechanical devices which require any periodic maintenance or lubrication. However, the over-all sensitivity of the receiver should be checked periodically. If low sensitivity is encountered in the receiver, the

receiver should be realigned according to the procedure outlined in section 6, paragraphs 6-4, 6-5, and 6-6. Operating controls such as the R-F GAIN, A-F GAIN, and SQUELCH ON-OFF should be checked for proper operation. The R-F GAIN setting should be checked to insure operation of the receiver at the maximum setting of the R-F GAIN control, which permits the squelch circuit to close between transmissions.

## SECTION 6 CORRECTIVE MAINTENANCE

### WARNING

VOLTAGES ON THE ORDER OF 250 VOLTS ARE PRESENT IN THIS EQUIPMENT. ALL TESTING SHOULD BE DONE WITH PROPER REGARD FOR THE DANGER INVOLVED. WHENEVER POSSIBLE, TEST EQUIPMENT SHOULD BE CONNECTED WITH THE PRIMARY POWER TO THE RECEIVER TURNED OFF. ALL REPAIRS SHOULD BE DONE WITH THE POWER DISCONNECTED.

TABLE 6-1. TEST EQUIPMENT REQUIRED

UNIT	DESCRIPTION
Signal Generator	VHF Type. Covering range of 108 mc to 152 mc
Signal Generator	Medium Frequency Type. Covering range of 7.050 mc and 455 kc
VTVM	High impedance
Oscilloscope	
Audio Oscillator	

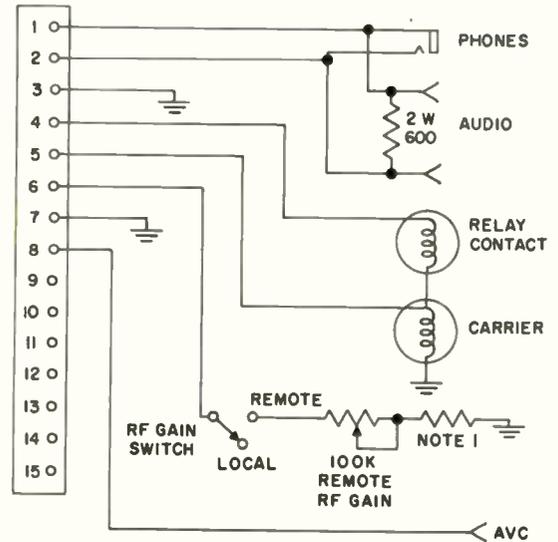
#### 6-1. TEST CONTROL BOX. (See figure 6-2.)

To provide a more convenient method of testing the 51M-8 Radio Receiver, it is desirable to set up a test control box. This would simplify the connection of measurement instruments to the receiver and provide the proper loading at the output circuit. A typical circuit diagram is shown in figure 6-2.

#### 6-2. TROUBLE SHOOTING.

Before any attempts are made to repair any part of this radio receiver, the Principles of Operation in section 2 of this manual should be thoroughly understood by the technical personnel assigned to this equipment. Many times an obvious source of trouble can be detected by operation of the receiver, such as a faulty switch or a control. Figure 6-1 is a trouble locating block diagram to be used with the 51M-8 Radio Receiver.

**6.2.1. POWER SUPPLY.** (See figure 2-12.) Since all the circuits of the receiver are dependent upon the proper supply voltage, the voltage output should be checked as follows using a high-impedance vacuum-tube voltmeter.



NOTE  
1. TOTAL RESISTANCE INCLUDING LINE RESISTANCE OF CONTROL CABLE IS 3300 OHMS.

Figure 6-2. Test Control Box for 51M-8 Radio Receiver

TABLE 6-2. POWER SUPPLY MEASUREMENTS

VOLTAGE SOURCE	TYPICAL VALUE	TEST POINT
Main Supply	130 volts dc	Bottom end of R65
Filament Supply	6.3 volts ac	Pin 6 T1
Bias	-5 volts dc (max R-F GAIN)	R63

**6.2.2. AUDIO AMPLIFIER.** - (See figures 2-9, 2-11.) In order to determine whether the difficulty lies in the r-f or the audio section of the receiver, a modulated signal of approximately 100 microvolts should be applied to the R-F INPUT connector at J1. The developed detector bias is measured at terminal 2 of T5. If a voltage of approximately -4 volts is obtained, and remains substantially constant as the input signal amplitude is varied, it is an indication of proper avc action. Therefore, the existing trouble in the receiver is evidently in the noise limiter or the audio amplifier circuits. In order to locate the trouble in the noise limiter or the audio amplifier

SECTION 6  
Paragraph 6-2

circuits, a cathode-ray oscilloscope should be used in tracing the audio signal from the detector on through the various audio circuits. The following points should be checked.

TABLE 6-3. DETECTOR, NOISE LIMITER, AUDIO AMPLIFIER MEASUREMENTS

CIRCUIT	CHECK POINT
Detector Output	Junction CR1, R37, and R38
Noise Limiter Output	C51, R44
Audio Driver Grid	V10 Terminal 2
Audio Driver Plate	V10 Terminal 1
A-F GAIN control	R62, V11 Terminal 1, 7
Audio Amplifier Grid	V11 Pin 1, 7
Audio Amplifier Plate	V11 Pin 5

6. 2. 3. 455-KC AMPLIFIER.- (See figure 2-7.) If there is no developed bias when an r-f signal is applied at the input of the receiver, the i-f and the r-f sections of the receiver should be checked with a signal generator. The following table lists the values of a 455-kc signal input required to produce a 3-volt avc output using the termination shown in figure 5-3.

TABLE 6-4. 455-Kc I-F AMPLIFIER MEASUREMENTS

POINT OF SIGNAL APPLICATION	INPUT REQUIRED
V8 pin 1 with V7 pulled	130, 000 uv
V7 pin 1 with V6 pulled	9000 uv
V6 pin 1 with FL1 disconnected and 100K across the input terminal	300 uv
V5 pin 2 with T4 disconnected and 100K resistor from pin 2 V5 to ground	200 uv at 455 kc

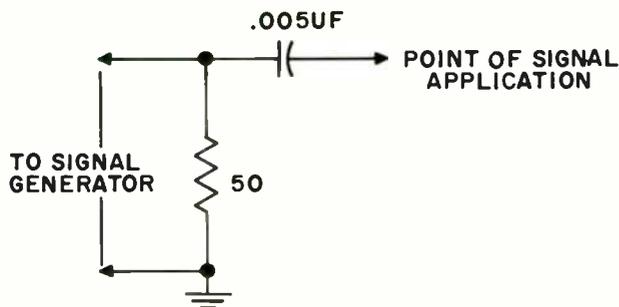


Figure 6-3. Termination to be Used in Checking 455-Kc AVC Voltage

6. 2. 4. 7. 050-MC R-F AMPLIFIER. - (See figure 2-5.) The following table lists the typical values of the 7.050-mc signal input required to produce a 3-volt avc output.

TABLE 6-5. 7.050-MC I-F AMPLIFIER MEASUREMENTS

POINT OF APPLICATION	INPUT REQUIRED
V5, pin 2	350 uv
V4, pin 1	40 uv
V2, pin 1	9 uv

6. 2. 5. 2ND OSCILLATOR-MIXER. - (See figure 2-6.) If the 455-kc i-f amplifier is operating satisfactorily, but a 7.050-mc signal produces no output, the second oscillator-mixer circuit may be defective. The oscillator-mixer normally develops about -4.5 volts dc as measured at pin 7 of V5. Absence of a developed bias indicates a failure in the oscillator circuit.

6. 2. 6. 1ST OSCILLATOR-MULTIPLIER. - (See figure 2-3.) If the 7.050-mc circuits appear to be operating satisfactorily, but the channel frequency does not produce an output, the oscillator multiplier circuits should be checked for defective circuits. The oscillator should develop approximately -1 volt dc as measured at J7. The oscillator-first multiplier should develop -5 volts at J6.

TABLE 6-6. OSCILLATOR TUNING CHART

CHANNEL FREQUENCY	NUMBER OF OSCILLATOR TURNS	
	Osc Tune A	Osc Tune B
108 mc	3-3/4	4
112 mc	4-3/4	4-1/2
116 mc	5-1/4	5-1/2
120 mc	6	6-1/4
124 mc	6-3/4	6-3/4
128 mc	7-1/4	7-1/2
132 mc	8	8-1/4
136 mc	8-1/2	9
140 mc	9	9-3/4
144 mc	9-3/4	10-1/2
148 mc	10-1/2	11-1/4
152 mc	11-1/4	12

TABLE 6-7. CONTROLS TUNING CHART

CHANNEL FREQUENCY	DIAL SETTING			
	1	2	3	4
108 mc	1.0	1.0	1.0	1.0
112 mc	1.7	1.7	1.8	1.7
116 mc	2.2	2.5	2.7	2.2
120 mc	3.0	3.5	3.8	3.0
124 mc	3.5	4.0	4.6	3.5
128 mc	4.0	4.8	5.7	4.1
132 mc	4.8	5.4	6.2	4.8
136 mc	5.5	6.0	6.5	5.5
140 mc	5.7	6.5	6.8	6.0
144 mc	5.9	7.0	7.3	6.5
148 mc	6.1	7.5	8.1	7.1
152 mc	6.5	8.5	8.8	7.5

### 6.3 CHANGING FREQUENCY ON THE RECEIVER CHANNEL.

Three steps are involved in changing the frequency of the 51M-8 Radio Receiver if it is desired to begin operation on a new channel. The crystal Y1 must be changed. The crystal Y1 is available from the front. The multiplier and the r-f amplifier circuits must be retuned. See figure 3-5 for location of the controls mentioned in the following paragraphs.

The first circuit to be retuned is the first oscillator-multiplier tuning A, a screwdriver adjustment slug in L7. This circuit is tuned for a maximum reading at J6. The oscillator-multiplier tuning B, a screwdriver-adjustment slug in L8, should be tuned for a maximum reading at J7 INJ TEST. Both oscillator tuning A and B should thus be adjusted for maximum reading at J7. Table 6-6 shows the approximate tuning point, from a maximum slug-out position, for the first multiplier tuning A and B.

The first, second, third, and fourth r-f tuning controls should be set. These controls are equipped with pointers. Refer to table 6-7 which shows the approximate dial settings, when adjusting the controls.

With the tuning controls set to the proper position, a vhf signal generator should be connected to the R-F INPUT connector J1. The signal generator should be set at maximum output. The signal generator should be tuned to the channel frequency as indicated by the maximum avc voltage. All the multiplier and r-f tuning controls should be carefully adjusted for maximum avc voltage, while reducing the output of the signal generator. A peak avc of less than 3 volts should be maintained.

#### NOTE

Do not tune the 4th R-F TUNE to the injection frequency. This condition is indicated by oscillation and a higher injection voltage reading at J7. To prevent this occurrence, turn the 4th R-F TUNE to a higher frequency (towards 10) then retune to the desired signal from the high frequency side for maximum AVC.

Retune OSC TUNE A and OSC TUNE B for maximum reading at J7, with zero signal input. Tune the signal generator for the channel position by setting the generator at the middle of the

response curve. This is determined by the avc. Then retune the four r-f circuits for maximum avc.

#### NOTE

In changing the receiver channel frequency, note the new frequency on the nameplate, in the erasable portion under FREQUENCY MC.

### 6-4. 455-KC I-F ALIGNMENT.

No alignment is required in the 455-kc second i-f section. The response curve may be checked by injection of either a 455-kc or a 7.050-mc signal at pin 2 of V5 through the terminating device shown in figure 6-3. The response should be not less than 32 kc at 6 db, 2X signal, and not more than 65 kc at 80 db, 10,000 signal.

### 6-5. 7.050-MC ALIGNMENT.

Alignment of the 7.050-mc i-f transformers should be checked periodically by injecting either an r-f signal to the antenna at the channel frequency, or a 7.050-mc signal to pin 1 of V2 using the terminating device shown in figure 6-3. Tune both the primary and the secondary coils for maximum indication of an avc reading at J8. The meter reading should be less than three volts. No selectivity measurements need be made inasmuch as the acceptance band of the 7.050-mc i-f is much broader than that of the 455-kc i-f.

### 6-6. INCREASING RECEIVER STABILITY.

The 51M-8 Radio Receiver can be aligned to obtain a 0.002% stability by the use of premium crystals for Y1. It is necessary, however, to tune the crystal oscillator controlled by Y1 to the specified frequency. This requires a calibrated frequency rack, beat oscillator, heterodyne meter, and/or a receiver capable of monitoring any frequency between 52 and 72 mc. Before such alignment is initiated, the radio should be permitted to stabilize at room temperature for at least 15 minutes.

### 6-7. CHECKING RESULTS.

Should complete performance tests be initiated, the r-f test signal should be set to the channel frequency by monitoring one of the i-f frequencies with a receiver. This is necessary to avoid erroneous results by having the carrier fall on the edge of the passband.

### 6-8. PRINTED CIRCUIT BOARD.

The 51M-8 Radio Receiver uses a printed circuit board, which contains the second i-f strip, the detector, the avc, the squelch, and the audio amplifiers. In making repairs to this portion of the receiver the following procedure should be followed. Clip the leads of the components as shown in figure 6-4. Remove the component. Use a pencil-type soldering iron, as shown in figure 6-5, heating the point where the component leads have been soldered on the bottom of the board. Push the leads through the board as shown in figure 6-6, out from the component side of the board. In replacing the new component, trim the leads of the component to fit the holes before any installation is made. Heat up the holes and insert the leads. Permit the solder to flow around the leads, making a solid connection.



Figure 6-4. Clip Leads of Component

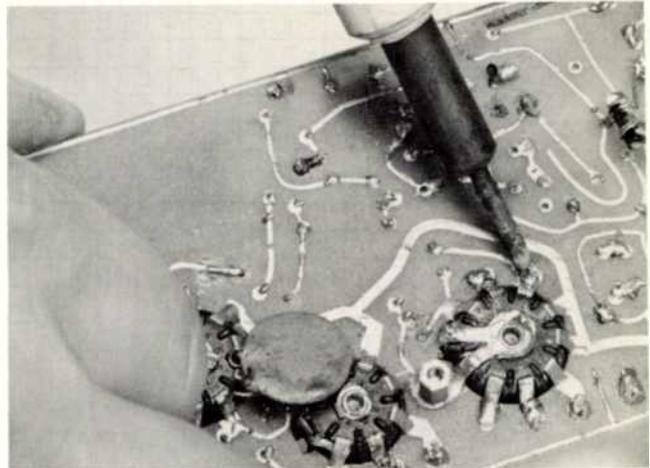


Figure 6-5. Heat-Soldered Connection on Bottom of Board



Figure 6-6. Push Leads Out Component Side of Board



TABLE 6-8. 51M-8 TYPICAL VOLTAGE MEASUREMENTS (Cont)

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V10 12AX7	90	-.3	.3	6.3 ac	6.3 ac	30	-3	2.2	0
V11 6AQ5	-1.6	4.8	6.3 ac	0	131	134	-1.6		

TABLE 6-9. 51M-8 TYPICAL RESISTANCE MEASUREMENTS

TUBE	PIN NUMBER								
	1	2	3	4	5	6	7	8	9
V1 6AK5	560K					9K			
V2 6AK5	105K	200			115K	115K	200		
V3 12AT7	8K	105K	110			9K		110	
V4 6AK5	560K				8.5K	12K			
V5 12AU7	140K		220			11K	25K	220	
V6 6AK5	560K	0	0	0	9K	16K			
V7 6AK5	460K	460K			8K	16K			
V8 6AK5	17K	280			9K	26K	280		
V9 12AU7	115K	520K	22K			19K	500K		
V10 12AX7	120K	460K	680			480K	260K		
V11 6AQ5		200			8.8K	8.4K			

## SECTION 7 PARTS LIST

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C1	1st R-F Tuning	CAPACITOR: air variable; 2-8 mmf, 9 plates	922-0034-00
C2	2nd R-F Tuning	CAPACITOR: air variable; 2-8 mmf, 9 plates	922-0034-00
C3	V1 Grid Coupling	CAPACITOR: Ceramic; 5 mmf $\pm 1/2$ mmf, 500 vdcw	916-0118-00
C4	V1 AVC Decoupling	CAPACITOR: Ceramic; .001 mf, 500 vdcw	913-1476-00
C5	V1 Screen Bypass	CAPACITOR: Ceramic; .001 mf, 500 vdcw	913-1476-00
C6	Plate Decoupling	CAPACITOR: Ceramic; .001 mf, 500 vdcw	913-1476-00
C7	Plate Coupling	CAPACITOR: Ceramic; 15 mmf $\pm 5\%$ , 500 vdcw	916-4180-00
C8	3rd R-F Tuning	CAPACITOR: air variable, 2-8 mmf, 9 plates	922-0034-00
C9	4th R-F Tuning	CAPACITOR: air variable, 2-8 mmf, 9 plates	922-0034-00
C10	V2 Grid Coupling	CAPACITOR: Ceramic, 2 mmf $\pm 1/2$ mmf, 500 vdcw	916-0076-00
C11	V2 Cathode Coupling	CAPACITOR: Ceramic, 2 mmf $\pm 1/2$ mmf, 500 vdcw	916-0076-00
C12	V3 Plate Decoupling	CAPACITOR: Ceramic, .01 mf +100 -20%	913-1188-00
C13	V3 Grid Coupling	CAPACITOR: Ceramic, 47 mmf $\pm 5\%$ , 500 vdcw	916-4362-00
C14	V3 Plate Decoupling	CAPACITOR: Ceramic, .01 mmf +100 -20%, 500 vdcw	913-1188-00
C15	V3 B+ Bypass	CAPACITOR: Ceramic, .001 mf, 500 vdcw	913-1476-00
C16	V2 B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C17	V4 Grid Coupling	CAPACITOR: 47 mmf $\pm 5\%$ , 500 vdcw	916-4362-00
C18	V4 AVC Decoupling	CAPACITOR: .001 mf $\pm 5\%$ , 500 vdcw	913-1476-00
C19	V4 Screen Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C20	V4 B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C21	V5B Plate Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C22	V5B Grid Feedback	CAPACITOR: 24 mmf $\pm 5\%$ , 500 vdcw	912-0449-00
C23	V5B Feedback Divider	CAPACITOR: 220 mmf $\pm 5\%$ , 500 vdcw	912-0518-00
C24	V5A B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C25	V5 B+ Bypass	CAPACITOR: .001 mf $\pm 5\%$ , 500 vdcw	913-1476-00

## SECTION 7

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C26	V5A Plate Coupling	CAPACITOR: 3000 mf +100% -20%, 500 vdcw	913-0996-00
C27	V1 Filament Bypass	CAPACITOR: .001 mf $\pm$ 5%, 500 vdcw	913-1476-00
C28	V2 Filament Bypass	CAPACITOR: .001 mf $\pm$ 5%, 500 vdcw	913-1476-00
C29	V3 Filament Bypass	CAPACITOR: .001 mf $\pm$ 5%, 500 vdcw	913-1476-00
C30	V4 Filament Bypass	CAPACITOR: .001 mf $\pm$ 5%, 500 vdcw	913-1476-00
C31	FL1 Tuning	CAPACITOR: 110 mmf $\pm$ 2%, 500 vdcw	912-0496-00
C32	FL1 Tuning	CAPACITOR: 100 mmf $\pm$ 2%, 500 vdcw	912-0493-00
C33	V6 AVC Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C34	V6 Screen Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C35	V6 B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C36	L11 Tuning	CAPACITOR: 5 mmf $\pm$ 1/2 mmf, 500 vdcw	916-0118-00
C37	V7 Grid Coupling	CAPACITOR: 100 mmf $\pm$ 2%, 500 vdcw	912-0493-00
C38	V7 AVC Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C39	V7 Screen Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C40	V7 B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C41	L12 Tuning	CAPACITOR: 5 mmf $\pm$ 1/2 mmf, 500 vdcw	916-0118-00
C42	V8 Grid Coupling	CAPACITOR: 100 mmf $\pm$ 2%, 500 vdcw	912-0493-00
C43	V8 Cathode Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C44	V8 Screen Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C45	V8 B+ Decoupling	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C46	V9B Grid Coupling	CAPACITOR: 27 mmf $\pm$ 5%, 500 vdcw	916-4332-00
C47	CR1 RF Filter	CAPACITOR: 330 mmf $\pm$ 2%, 500 vdcw	912-0529-00
C48	CR1 RF Filter	CAPACITOR: 330 mmf $\pm$ 2%, 500 vdcw	912-0529-00
C49	CR1 Audio Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C50	Audio Filter	CAPACITOR: 330 mmf $\pm$ 2%, 500 vdcw	912-0529-00
C51	V10A Coupling	CAPACITOR: .0022 mf $\pm$ 5%, 500 vdcw	935-4067-00
C52	R-C Series Limiter	CAPACITOR: .1 mf $\pm$ 10%, 400 vdcw	931-0299-00
C53	V10B Grid Feedback	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C54	CR3 Audio Bypass	CAPACITOR: .1 mf $\pm$ 10%, 400 vdcw	931-0299-00
C55	AVC Time Constant	CAPACITOR: .1 mf $\pm$ 10%, 400 vdcw	931-0299-00
C56	V10B Grid Feedback	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C57	Noise Feedback	CAPACITOR: .0022 mf $\pm$ 10%, 500 vdcw	935-4067-00

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C58	V9A Plate Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C59	V9A Cathode Bypass	CAPACITOR: 100 mmf $\pm$ 2%, 500 vdcw	912-0493-00
C60	Audio Coupling	CAPACITOR: .01 mf $\pm$ 10%, 300 vdcw	935-2117-00
C61	Audio Filter	CAPACITOR: 6800 mmf $\pm$ 10%, 500 vdcw	935-2110-00
C62	D-C Blocking	CAPACITOR: .5 mf $\pm$ 10%, 400 vdcw	931-7520-00
C63	H-V Filter	CAPACITOR: electrolytic; 20/40/40 mf, 400/350/350 vdcw	183-1126-00
C64	B+ Bypass	CAPACITOR: .01 mf +100%, -20%, 500 vdcw	913-1188-00
C65	T5 Tuning	CAPACITOR: 20 mmf $\pm$ 5%, 500 vdcw	916-4187-00
C66	Bias Filter	CAPACITOR: 50 mf -15%, +100%, 25 vdcw	183-1158-00
C67		Not normally used	
C68	Tunes FL1 Output	CAPACITOR: Variable, Ceramic, 8-50 mmf 350 vdcw	917-1075-00
C69	R-F Voltage Divider	CAPACITOR: Ceramic; 5 mmf $\pm$ 1/2 mmf, 500 vdcw	916-0118-00
C70	V1 Filament Bypass	CAPACITOR: Ceramic, .01 mf +100 -20%, 500 vdcw	913-1188-00
C71	V2 Plate Decoupling	CAPACITOR: Ceramic, .01 mf +100 -20%, 500 vdcw	913-1188-00
CR1	Audio Detector	DIODE: Silicon 622C	353-2513-00
CR2	Series Limiter	DIODE: Silicon 601C	353-0170-00
CR3	AVC Gate	DIODE: Silicon 601C	353-0170-00
CR4	Rectifier	RECTIFIER: Selenium	353-0179-00
CR5	Rectifier	RECTIFIER: Selenium	353-0179-00
E1	V1 Tube Shield V1 Shield Insert	SHIELD, tube: for 7-pin miniature INSERT, tube socket: for 7-pin socket	541-6550-003 541-6532-003
E2	V2 Tube Shield V2 Insert	SHIELD, tube: for 7-pin miniature INSERT, tube socket: for 7-pin socket	541-6550-003 541-6532-003
E3	V3 Tube Shield V3 Insert	SHIELD, tube: for 9-pin miniature INSERT, tube socket: for 9-pin socket	541-6554-003 541-6533-003
E4	V4 Tube Shield V4 Insert	SHIELD, tube: for 7-pin miniature INSERT, tube socket: for 7-pin socket	541-6550-003 541-6532-003
E5	V5 Tube Shield V5 Insert	SHIELD, tube: for 9-pin miniature INSERT, tube socket: for 9-pin socket	541-6554-003 541-6533-003
E6	V6 Tube Shield	SHIELD, tube: for 7-pin miniature	141-0331-00
E7	V7 Tube Shield	SHIELD, tube: for 7-pin miniature	141-0331-00
E8	V8 Tube Shield	SHIELD, tube: for 7-pin miniature	141-0331-00
E9	Encloses I2	LENS: amber, frosted	262-0095-00
E10	Encloses I1	LENS: green, frosted	262-0096-00
E11	Retains Y1	CLIP: crystal, holding	504-8229-001
*F1	Line Fuse	FUSE: cartridge, type 3AG, slow-blow, .75 amp	264-4270-00
FL1	Mechanical Filter	FILTER: band-pass type 455.00 center freq	526-9344-00
I1	Power Indicator	LAMP: incandescent, indicating type	262-3240-00
I2	Carrier Indicator	LAMP: incandescent, indicating type	262-3240-00
J1	Antenna Input	CONNECTOR: female, type UG-58/U	357-9003-00
J3	Output Connector	CONNECTOR: 15 contact, female	372-1081-00

\*Value of F1 for operation on 230 VAC is .5 ampere.

## SECTION 7

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
J4	Power Input	CONNECTOR: male, 2 contacts	368-3700-00
J5	Phone Output	JACK: phone type	358-1080-00
J6	Osc Test	CONNECTOR: pin type, female red	360-0062-00
J7	Inj Test	CONNECTOR: pin type, female, yellow	360-0066-00
J8	AVC Test	CONNECTOR: pin type, female, green	360-0064-00
K1	Squelch Relay	RELAY: armature; 10,000 ohms $\pm 10\%$ , sealed case	974-0011-00
L1	Antenna Input Coupling	COIL: air wound, 1 turn	541-0015-002
L2	1st R-F Tank	COIL: air wound, 5-1/2 turns	541-0010-002
L3	2nd R-F Tank	COIL: air wound, 4-1/2 turns	541-0009-002
L4	V1 Shunt Feed	CHOKE: r-f type; 1.5 mh $\pm 20\%$ , encased	240-0155-00
L5	3rd R-F Tank	COIL: air wound, 4-1/2 turns	541-0009-002
L6	4th R-F Tank	COIL: air wound, 4-1/2 turns	541-0009-002
L7	Osc Tune A	COIL: HF Osc; 8 turns, slug tuned	541-0014-002
L8	Osc Tune B	COIL: HF Osc; 5 turns, slug tuned	541-0013-002
L9	V3A Decoupling	CHOKE: r-f type; 1.5 mh $\pm 20\%$ , encased	240-0155-00
L10	V5 Cathode Impedance	CHOKE: r-f type; 500 mh $\pm 10\%$	240-0073-00
L11	V6 Plate Impedance	CHOKE: r-f type; 5 mh	240-0312-00
L12	V7 Plate Impedance	CHOKE: r-f type; 5 mh	240-0312-00
L13	Y1 Resonating	CHOKE: r-f type; 1.5 mh $\pm 20\%$ , encased	240-0155-00
P1	Mates with J1	CONNECTOR: plug, one female contact	357-9113-00
P3	Mates with J3	CONNECTOR: male type, 15 contacts	372-1079-00
P4	Mates with J4	CONNECTOR: female, 2 contacts	372-9001-00
R1	V1 AVC Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R2	V1 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R3	J7 Isolation	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R4	V2 Grid Resistor	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R5	V3 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R6	V3 Cathode	RESISTOR: 220 ohms $\pm 10\%$ , 1/2 w	745-1324-00
R7	V3 Cathode	RESISTOR: 220 ohms $\pm 10\%$ , 1/2 w	745-1324-00
R8	V3 Grid	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R9	J6 Isolation	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R10	V2 B+ Dropping	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R11	V4 AVC Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R12	J8 Isolation	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R13	V4 Screen Bleeder	RESISTOR: 39K ohms $\pm 10\%$ , 1 w	745-3419-00
R14	V4 Screen Bleeder	RESISTOR: 4700 ohms $\pm 10\%$ , 1/2 w	745-1380-00
R15	V4 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R16	V5 Cathode	RESISTOR: 180 ohms $\pm 10\%$ , 1/2 w	745-1321-00
R17	V5 Grid	RESISTOR: 22K ohms $\pm 10\%$ , 1/2 w	745-1408-00
R18	V5 Plate Load	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R19	V5 B+ Decoupling	RESISTOR: 22K ohms $\pm 10\%$ , 1/2 w	745-1408-00
R20	V5 B+ Dropping	RESISTOR: 2700 ohms $\pm 10\%$ , 1 w	745-3370-00
R21	AVC Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R22	AVC Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R23	V6 AVC Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R24	V6 Screen Bleeder	RESISTOR: 39K ohms $\pm 10\%$ , 1 w	745-3419-00
R25	V6 Screen Bleeder	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R26	V6 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R27	V7 AVC Decoupling	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R28	V7 Screen Grid Bleeder	RESISTOR: 39K ohms $\pm 10\%$ , 1 w	745-3419-00
R29	V7 Screen Grid Bleeder	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R30	V7 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R31	V8 Grid Resistor	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R32	V8 Cathode	RESISTOR: 220 ohms $\pm 10\%$ , 1/2 w	745-1324-00
R33	V8 Screen Dropping	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R34	V8 B+ Decoupling	RESISTOR: 1K ohms $\pm 10\%$ , 1/2 w	745-1352-00
R35	Remote AVC Isolation	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R36	Detector Load	RESISTOR: 10K ohms $\pm 10\%$ , 1/2 w	745-1394-00
R37	Detector Load	RESISTOR: 10K ohms $\pm 10\%$ , 1/2 w	745-1394-00
R38	Detector Load	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R39	AVC Delay Bleeder	RESISTOR: 10K ohms $\pm 10\%$ , 1/2 w	745-1394-00
R40	AVC Delay Bleeder	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R41	Audio Filter	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00

## SECTION 7

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R42	CR2 Bleeder	RESISTOR: 220K ohms $\pm 10\%$ , 1/2 w	745-1450-00
R43	CR2 Bleeder	RESISTOR: 270K ohms $\pm 10\%$ , 1/2 w	745-1454-00
R44	CR2 Bleeder	RESISTOR: 270K ohms $\pm 10\%$ , 1/2 w	745-1454-00
R45	CR3 Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R46	R-F Gain Control	RESISTOR: variable, 100K ohms $\pm 20\%$ 1/2 w	376-4010-00
R47	R-F Gain Divider	RESISTOR: 10K ohms $\pm 10\%$ , 1/2 w	745-1394-00
R48	CR3 Plate Resistor	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R49	V10B Isolation	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R50	V10A Grid	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R51	V10A Cathode Bias	RESISTOR: 680 ohms $\pm 10\%$ , 1/2 w	745-1345-00
R52	V9B Grid	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R53	V9B Bias Divider	RESISTOR: 15K ohms $\pm 10\%$ , 2 w	745-5701-00
R54	V9B Bias Divider	RESISTOR: 2700 ohms $\pm 10\%$ , 1 w	745-3370-00
R55	V10B Bias Divider	RESISTOR: 180 ohms $\pm 10\%$ , 1/2 w	745-1321-00
R56	V9A Cathode Resistor	RESISTOR: 27K ohms $\pm 10\%$ , 1/2 w	745-1412-00
R57	V9A Bias Divider	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R58	V9A B+ Decoupling	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R59	V10A Plate Load	RESISTOR: 100K ohms $\pm 10\%$ , 1/2 w	745-1436-00
R60	V9A Grid	RESISTOR: 470K ohms $\pm 10\%$ , 1/2 w	745-1464-00
R61	V11 Cathode	RESISTOR: 180 ohms $\pm 10\%$ , 1/2 w	745-1321-00
R62	A-F Gain Control	RESISTOR: variable, WW, 100K ohms $\pm 20\%$	376-3010-00
R63	Bias Supply Resistor	RESISTOR: 68 ohms $\pm 10\%$ , 1 w	745-3303-00
R64	B+ Filter	RESISTOR: WW, 500 ohms, 10 w	747-0537-00
R65	B+ Filter	RESISTOR: WW, 500 ohms, 10 w	747-0537-00
R66	V2 Cathode	RESISTOR: 180 ohms $\pm 10\%$ , 1/2 w	745-1321-00
R67	T5 Loading	RESISTOR: 15K ohms $\pm 10\%$ , 1/2 w	745-1401-00
R68	Damping Resistor	RESISTOR: 4700 ohms $\pm 10\%$ , 1/2 w	745-1380-00
R69	Equalizing Resistor	RESISTOR: 3300 ohms $\pm 10\%$ , 1/2 w	745-1373-00
S1	Power On-Off	SWITCH: Toggle, dpst	266-3043-00
S2	Squelch On-Off	SWITCH: Toggle, spst	266-3045-00
T1	Power Transformer	TRANSFORMER, power: Pri No. 1 115V, Pri #2 115 V; Sec #1 6.3 V at 4.5 amp; incl one resistor.	662-0177-00

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
T2	Audio Output	TRANSFORMER, a-f: Pri 5000 ohms $\pm 10\%$ ; sec #1 and #2 600 ohms $\pm 1\%$ .	667-0178-00
T3	I-F Transformer	TRANSFORMER, i-f: 7.050 mc	278-0238-00
T4	I-F Transformer	TRANSFORMER, i-f: 7.050 mc	278-0238-00
T5	I-F Transformer	TRANSFORMER, i-f: 455 kc	678-0816-00
V1	R-F Amplifier	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V2	1st Mixer	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V3	HF Oscillator	TUBE: electron type 12AT7/6201	255-0205-00 255-0218-00
V4	1st I-F Amplifier	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V5	LF Osc Mixer	TUBE: electron type 12AU7/5814	255-0199-00 253-0013-00
V6	2nd I-F Amplifier	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V7	2nd I-F Amplifier	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V8	2nd I-F Amplifier	TUBE: electron type 6AK5/5654	257-0040-00 253-0001-00
V9	Noise Detector and Squelch Tube	TUBE: electron type 12AU7/5814	255-0199-00 253-0013-00
V10	Audio Driver	TUBE: electron type 12AX7/5751	255-0201-00 253-0012-00
V11	Audio Output	TUBE: electron type 6AQ5/6005	255-0195-00 253-0014-00
XFL1	Mounts FL1	ADAPTOR: type Y mechanical filter	591-0617-002
XI1	Holds I1	SOCKET: lamp, miniature	262-1260-00
XI2	Holds I2	SOCKET: lamp, miniature	262-1260-00
XF1	Holds F1	FUSEHOLDER: Extractor Type	265-1002-00
XV1	Holds V1	SOCKET, tube: 7-pin miniature	220-1111-00
XV2	Holds V2	SOCKET, tube: 7-pin miniature	220-1111-00
XV3	Holds V3	SOCKET, tube: 9-pin miniature	220-1103-00
XV4	Holds V4	SOCKET, tube: 7-pin miniature	220-1111-00
XV5	Holds V5	SOCKET, tube: 9-pin miniature	220-1103-00
XV6	Holds V6	SOCKET, tube: 7-pin miniature	220-0935-00
XV7	Holds V7	SOCKET, tube: 7-pin miniature	220-0935-00
XV8	Holds V8	SOCKET, tube: 7-pin miniature	220-0934-00

## SECTION 7

REFERENCE SYMBOL	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XV9	Holds V9	SOCKET, tube: 9 pin	220-0919-00
XV10	Holds V10	SOCKET, tube: 9 pin	220-0919-00
XV11	Holds V11	SOCKET, tube: 7 pin	220-0934-00
XY1	Holds Y1	SOCKET, crystal: use with HC-6/U crystal holder	292-0082-00
XY2	Holds Y2	SOCKET, crystal: use with HC-6/U crystal holder	292-0082-00
Y1	Channel Crystal	CRYSTAL: Type CR-23/U	
Y2	Mixer Crystal	CRYSTAL: Type CR18/U	290-3239-00

# SECTION 8 ILLUSTRATIONS

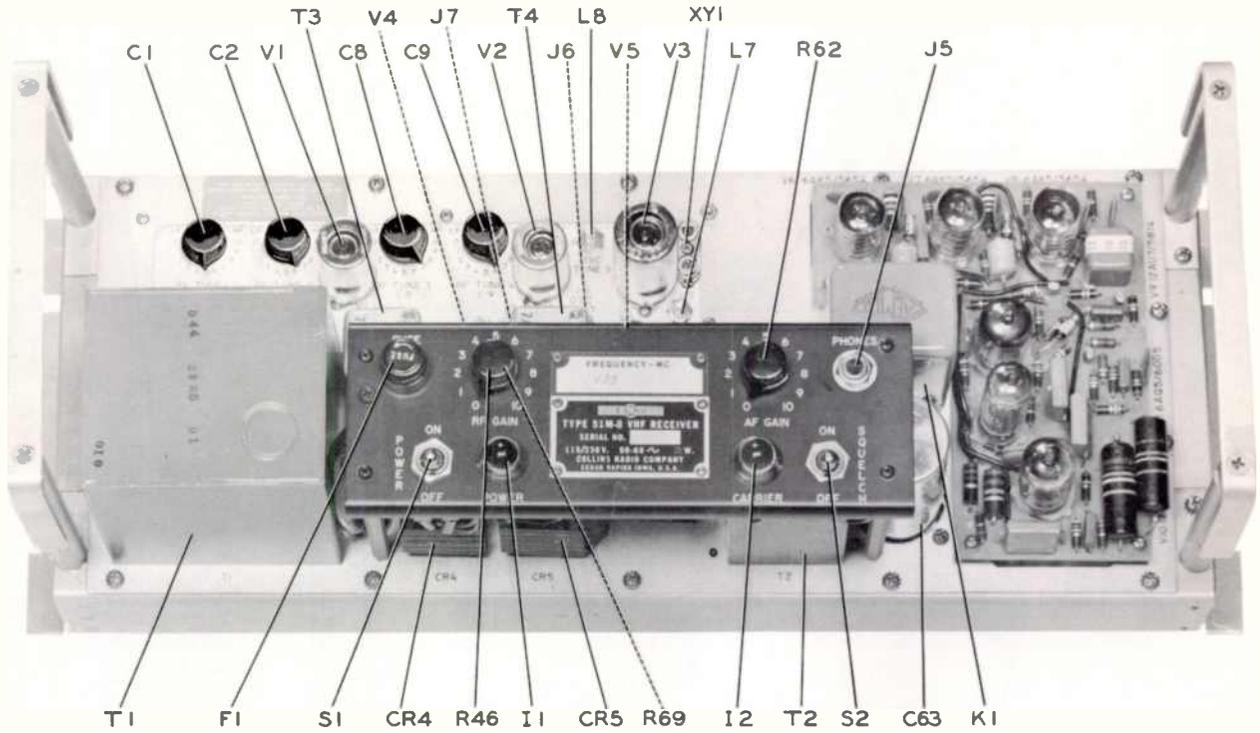


Figure 8-1. 51M-8 Radio Receiver, Top Front View

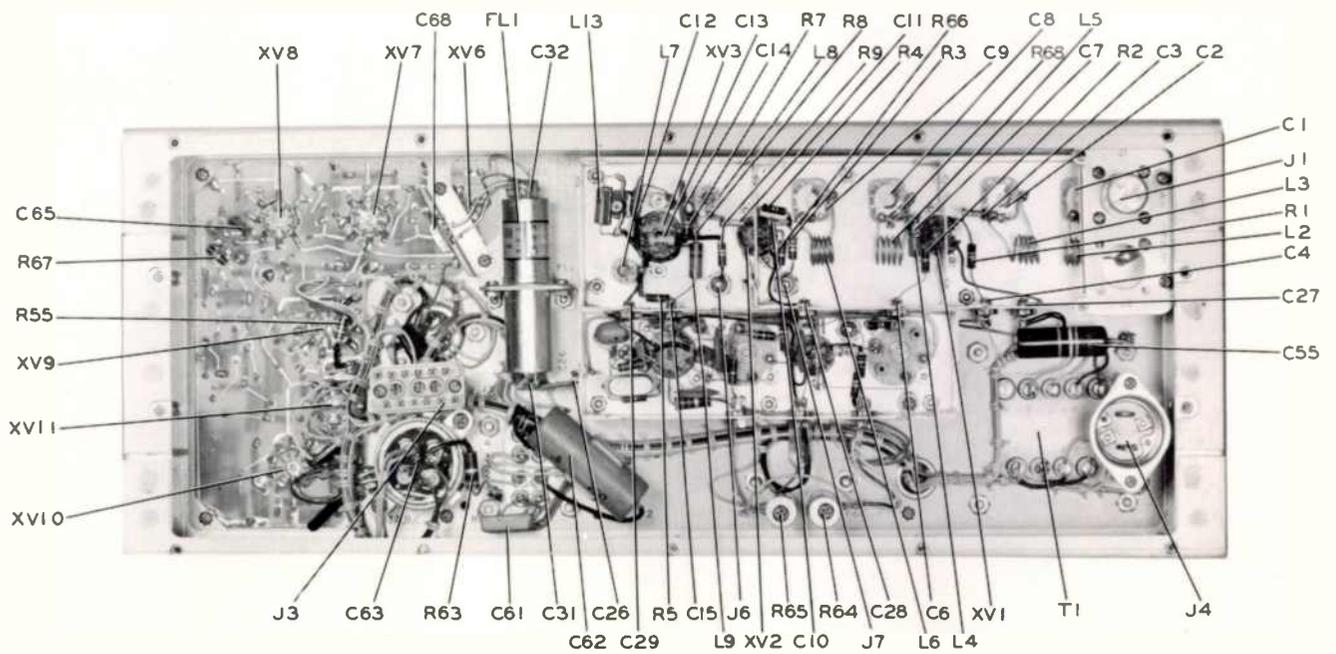


Figure 8-2. 51M-8 Radio Receiver. Bottom View

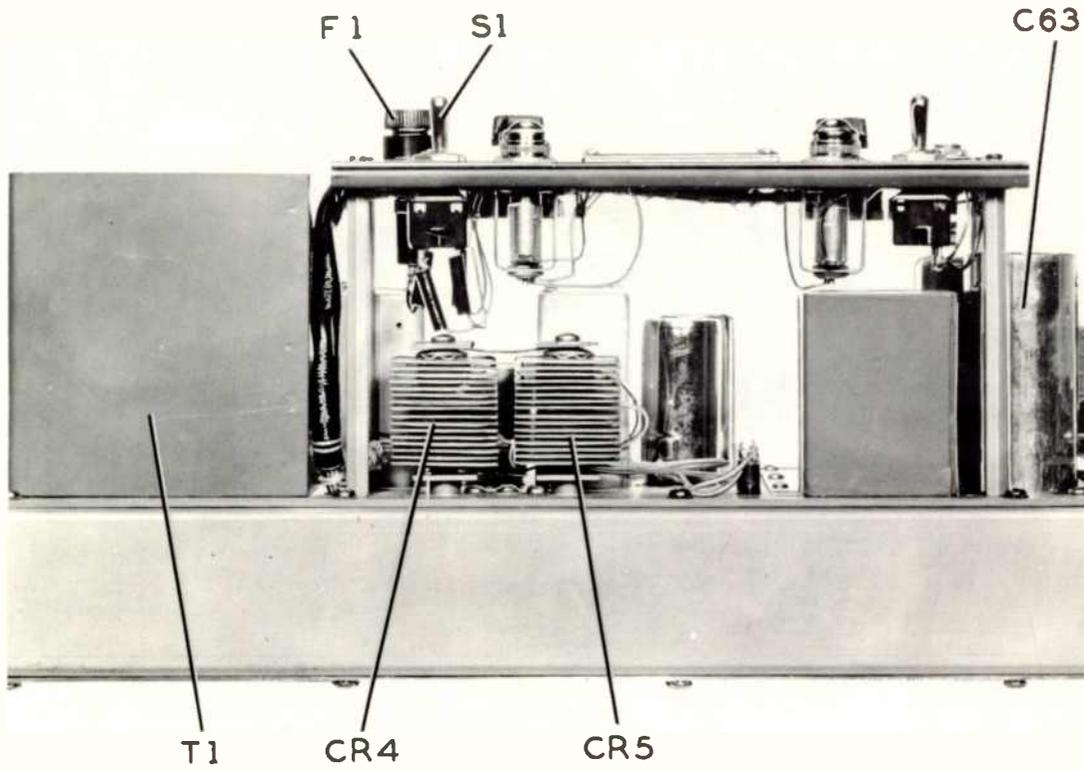


Figure 8-3. 51M-8 Radio Receiver, Power Supply Close Up

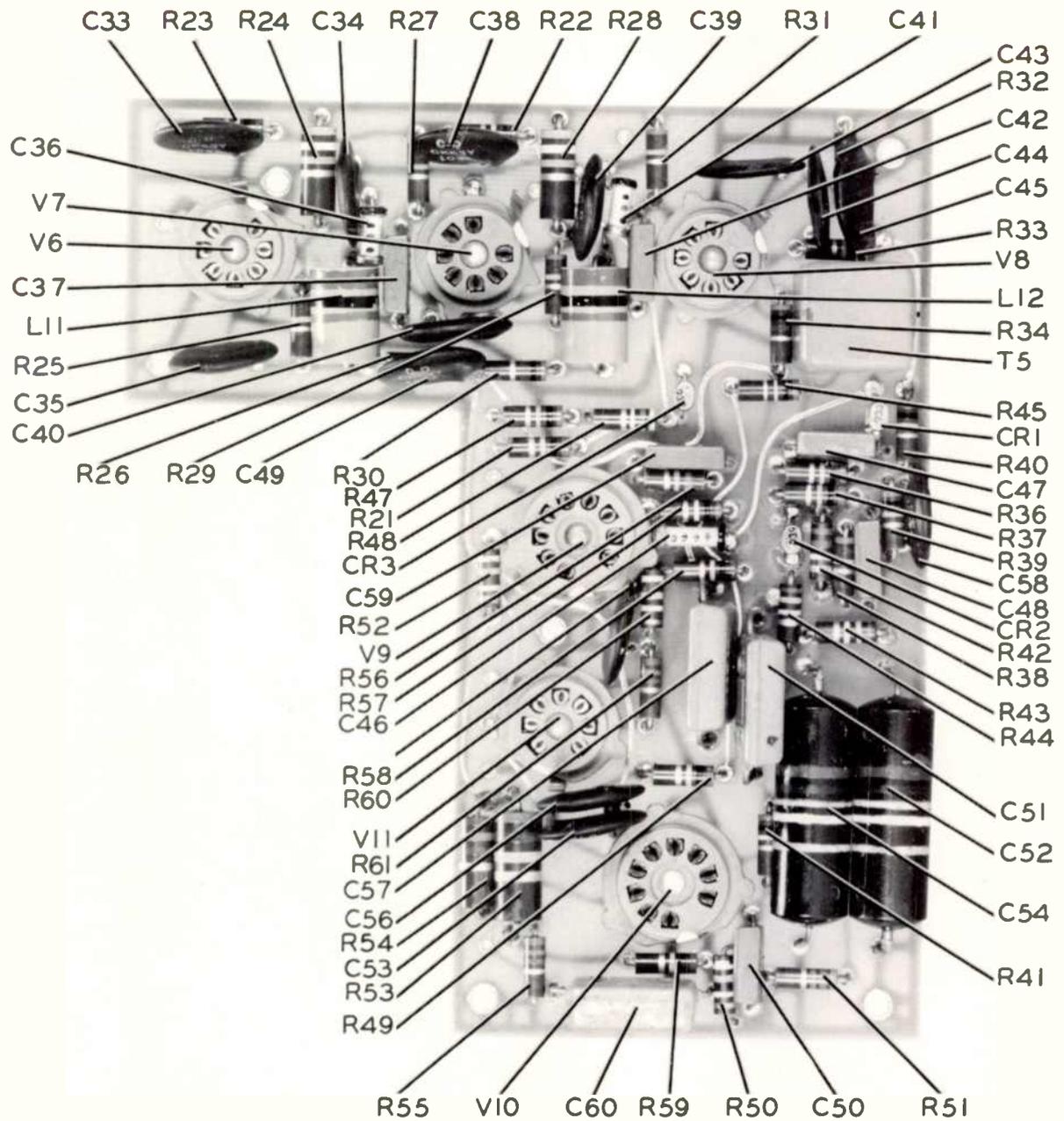


Figure 8-4. 51M-8 Radio Receiver Printed Circuit Board



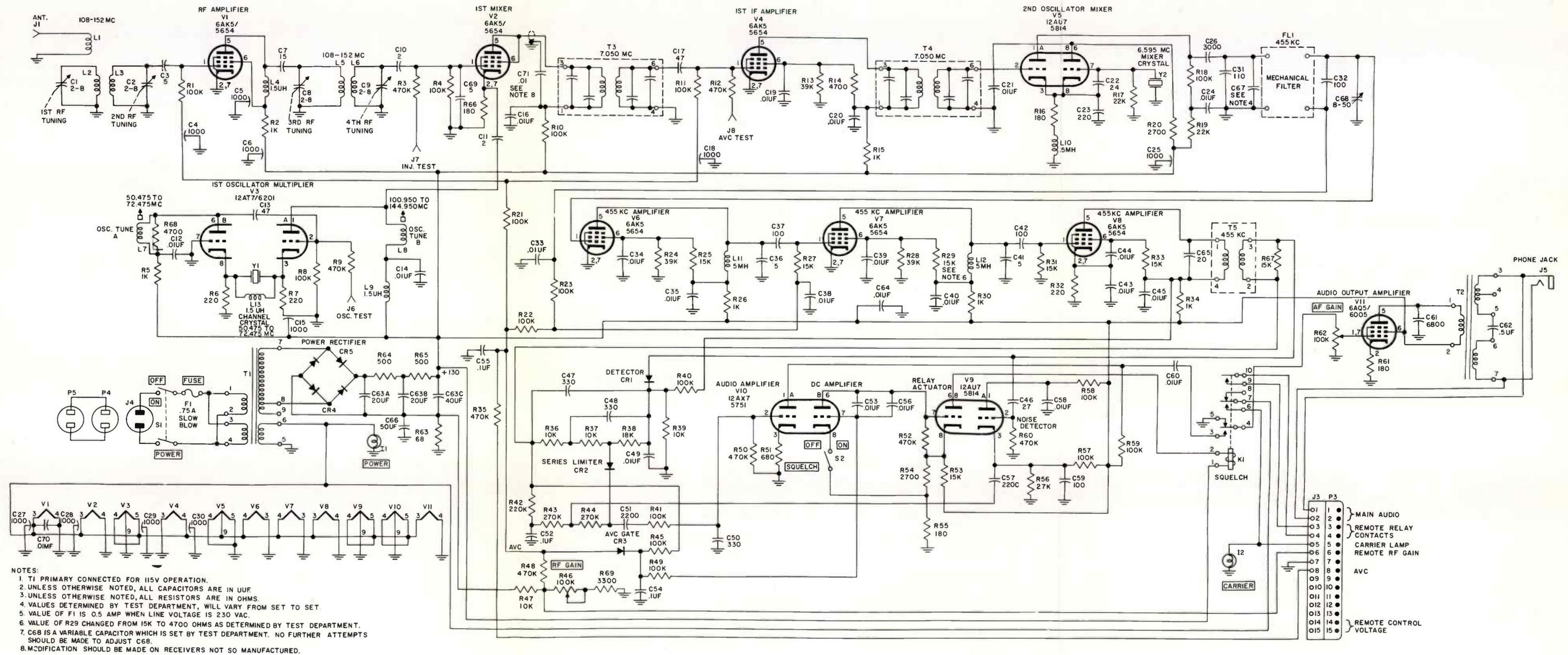


Figure 8-5. 51M-8 Radio Receiver, Main Schematic Diagram



# ELECTRICAL WIRE CODE

## EXAMPLES

UNSHIELDED WIRE, MIL TYPE B #22 AWG, WHITE WITH RED AND GREEN TRACERS:

D	A	9	25	4-1/4
Type of Wire	Size of Wire	Color of Body	Color of Tracers	Length of Wire in Inches (Includes Stripping & Tinning)

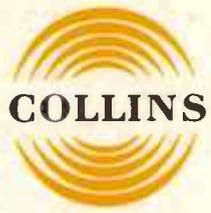
SHIELDED WIRE (SINGLE), MIL TYPE C, #15 AWG, WHITE WITH RED AND GREEN TRACERS:

R	D	S	9	25	4-1/4
Type of Wire	Size of Wire	Shielded	Color of Body	Color of Tracers	Length of Wire in Inches (Includes Stripping & Tinning)

SHIELDED WIRE (MULTIPLE), MIL TYPE B, #22 AWG, WHITE, AND WHITE WITH RED TRACER:

D	A	S	(9)	(92)	4-1/4
Type of Wire	Size of Wire	Shielded	First Conductor	Second Conductor	Length of Wire in Inches (Includes Stripping & Tinning)

TYPE OF WIRE CODE			SIZE OF WIRE CODE		COLOR CODE	
LETTER	TYPE OF WIRE	FAMILY USUALLY FOUND IN	LETTER	SIZE	NUMBER OR LETTER	COLOR
A	Cotton Braid Over Plastic (Formerly AN-J-C-48)	440 Plain 443 Shielded	A	#22 AWG	0	Black
B	Busbar, Round Tinned	421	B	#20	1	Brown
C	MIL-W-16878 Type B (#20 and Larger) (600 Volts)	439	C	#18	2	Red
D	Miniature Wire, MIL-W-16878 Type B (#22 & Smaller)	439-7000 Series	D	#16	3	Orange
E	Extra Flexible Varnished Cambric	423	E	#14	4	Yellow
F	Kel-F (Monochlorotrifluoroethylene)	422	F	#12	5	Green
G	Neon Sign Cable (15,000 Volts)	423 0004 00	G	#10	6	Blue
H	Silicone	425 0942 00	H	#8	7	Violet
J	Single Conductor Stranded (Not Rubber Covered)	422	J	#6	8	Gray (Slate)
K	Single Conductor Stranded (Rubber Covered)	423	K	#4	9	White
L	MIL-W-16878 Type C (1000 Volts)	439 1000 Series	L	#2	a	Clear
M	Teflon, MIL-W-16878 Type E (600 Volts)	439 4000 Series	M	#1	b	Tan
N	MIL-W-16878 Type D (3000 Volts)	439 3000 Series	N	#0	c	Pink
P	Teflon, MIL-W-16878 Type EE (1000 Volts)	439 0000 Series	P	#00	d	Maroon
Q	Acetate Yarn Telephone Type	428	Q	#000	e	Light Green
R			R	#0000	f	Light Blue
T			T	#28		
V			V	#26		
W			W	#24		
X			X	#19		
Y			Y	#30		
Z			Z			



**COLLINS RADIO COMPANY**