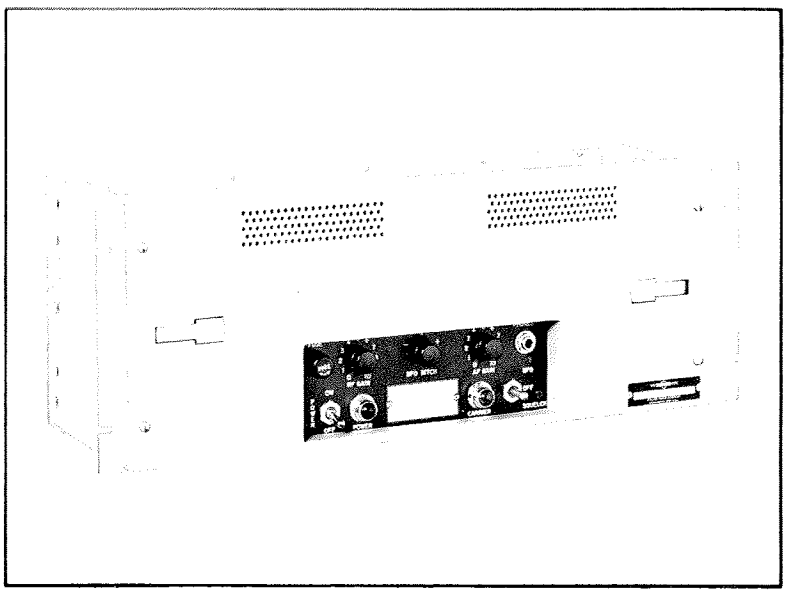
Collins

INSTRUCTION BOOK

H-F FIXED TUNED RECEIVER

51N-7



COLLINS RADIO COMPANY

H-F FIXED TUNED RECEIVER

51N-7

INSTRUCTION BOOK

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont)

LIST OF TABLES

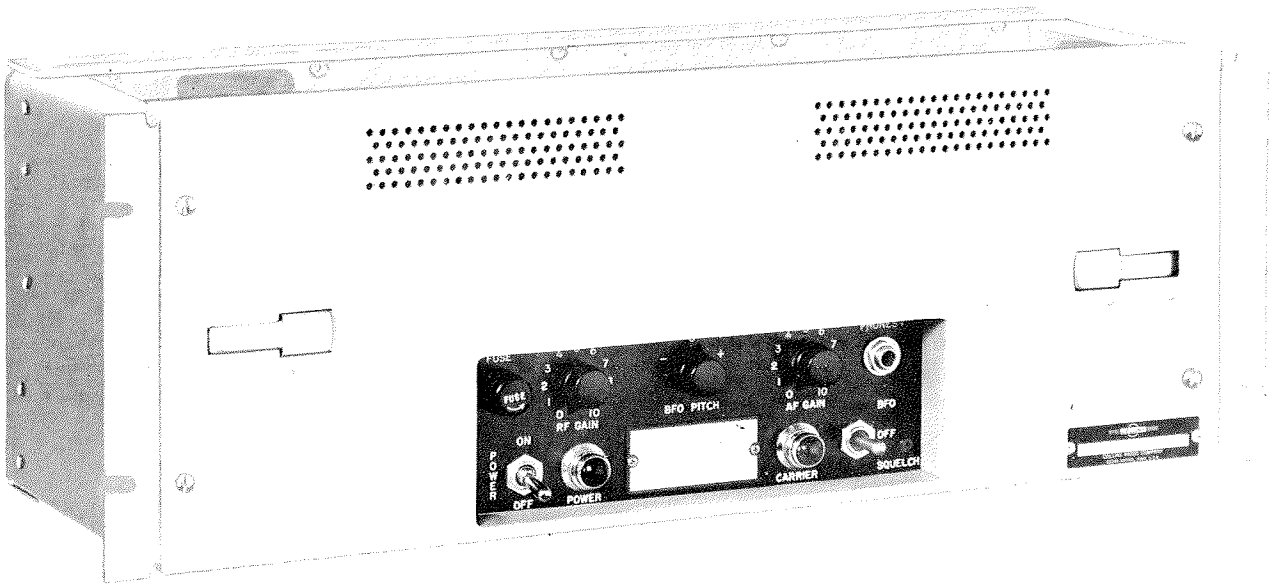


Figure 1-1. 51N-7F Radio Receiver

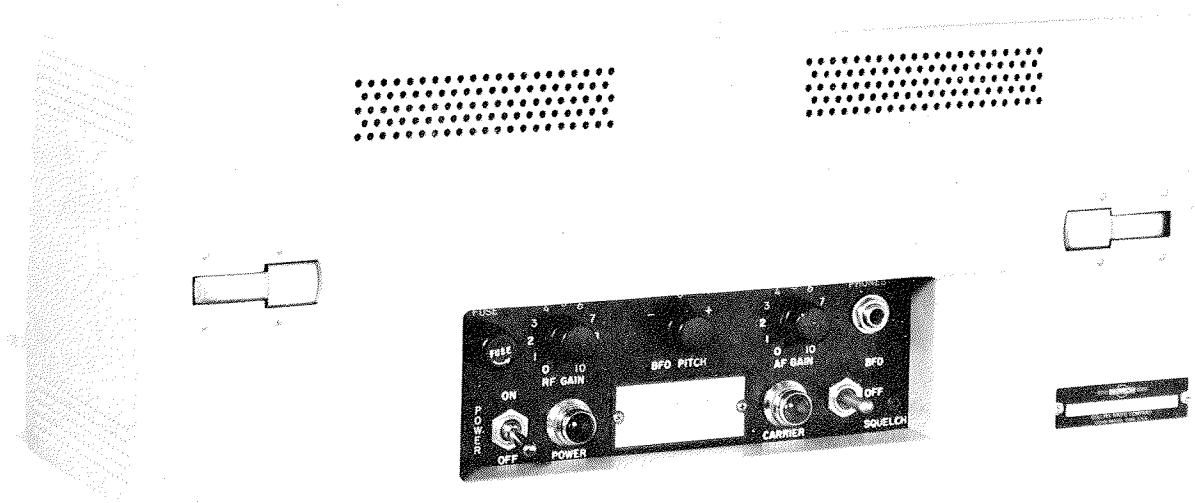


Figure 1-2. 51N-7R Radio Receiver

SECTION I
GENERAL DESCRIPTION

1.1 PURPOSE OF HANDBOOK.

This instruction book contains information necessary for the installation and maintenance of the 51N-7 Radio Receiver. It includes a description of the receiver, installation procedures, operating information, preventive and corrective maintenance information, and diagrams.

1.2 PURPOSE OF EQUIPMENT.

The 51N-7 Radio Receiver is a fixed tuned h-f receiver designed for use in fixed ground stations for air to ground or point to point communications systems. It is capable of receiving AM, radiotelephone, or continuous wave radiotelegraphy on any single fixed frequency between 2 and 24 megacycles.

The receiver is constructed on a chassis designed to fit any standard 19-inch relay rack. It requires approximately 7 inches of vertical mounting space. The receiver weighs approximately 17.8 pounds.

The receiver may be ordered in three models which differ only in their style of mounting. The 51N-7F is designed for front panel flush mounting. See figure 1-1. The dust cover on this model may be removed by loosening the four Dzus fasteners located on its face. The 51N-7R differs in that its mounting is located on the rear of the chassis, although it is of the same type. See figure 1-2. Its dust cover is attached by means of two snap fasteners. The 51N-7H has a hinge on the left side of the receiver. See figure 1-3. This hinge permits the receiver to be maintained while still in the rack. The exterior design of the receiver makes it readily adaptable to any of these types of mounting. Modification kits for these changes are listed in table 1-3. The 51N-7 Radio Receiver is an 11 tube, single conversion superheterodyne receiver. The mixer stage injection is furnished by a crystal controlled oscillator. The

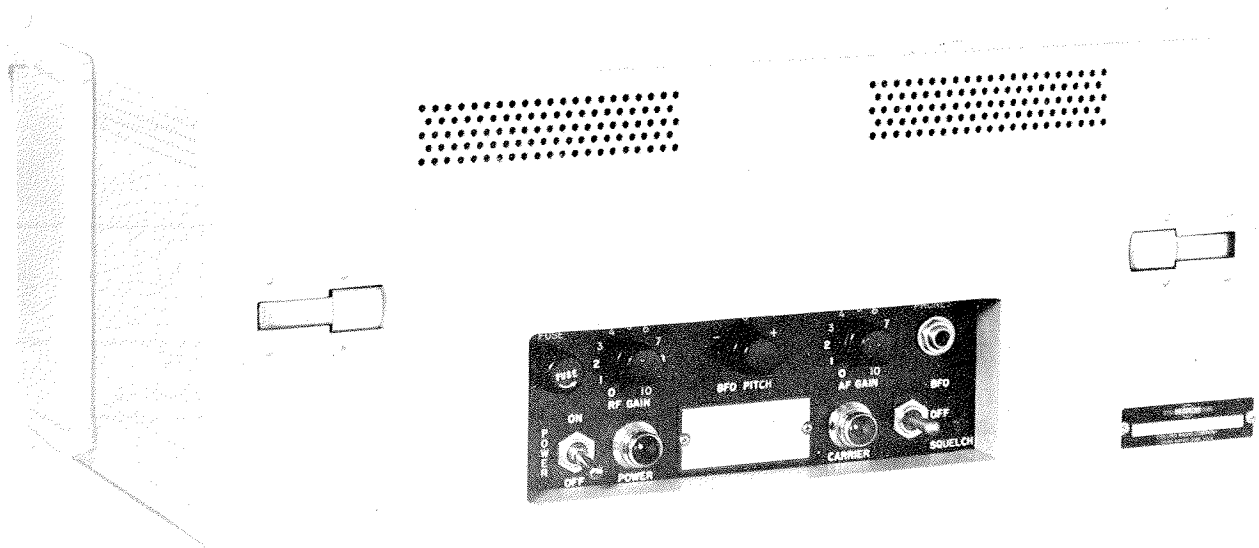


Figure 1-3. 51N-7H Radio Receiver

receiver utilizes a Collins mechanical filter as the selective element. The mechanical filter, type F455K40, provides improved selectivity in the receiver as well as reduced maintenance. A noise limiter is used in the receiver to minimize interference from ignition systems, or other pulse type interference. The receiver is designed for operation on either 115 or 230 volts, single phase a-c, 50/60 cps.

TABLE 1-1. EQUIPMENT SUPPLIED

QUANTITY	DESCRIPTION	COLLINS PART NUMBER
1	51N-7F Radio Receiver, flush mounting	522-0469-005
	or	
	51N-7R Radio Receiver, recessed mounting	522-0470-005
	or	
	51N-7H Radio Receiver, hinge mounting	522-0471-005
	and	
1	Instruction book	520-5436-00
1	RF connector, type UG-102/U	357-9009-00
1	RF connector, type UG-103/U	357-9010-00
1	15-pin connector	372-1118-00

TABLE 1-2. EQUIPMENT REQUIRED, BUT NOT SUPPLIED

QUANTITY	DESCRIPTION
1	HF antenna
	RG-22B/U 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

DESCRIPTION	COLLINS PART NUMBER
Conversion kit; converts 51N-7 hinge style to flush style	541-0189-00
Conversion kit; converts 51N-7 flush style to hinge style	541-0190-00
Conversion kit; converts 51N-7 flush style to recessed style	541-0191-00

TABLE 1-3. ACCESSORY EQUIPMENT (Cont.)

DESCRIPTION	COLLINS PART NUMBER
Conversion kit; converts 51N-7 hinge style to recessed style	541-0192-00
Conversion kit; converts 51N-7 recessed style to flush style	541-0193-00
Conversion kit; converts 51N-7 recessed style to hinge style	541-1470-00
Remote control kit; provides operation of receiver by a 48-volt power control relay	541-0020-00
Remote control kit; provides operation of receiver by a 12-volt power control relay	541-0021-00
Audio attenuation kit; attenuates audio output approximately 15 db when working into a low-level transmission or phone line	541-0022-00
6-foot power cable including male plug-in connector	426-1003-00

TABLE 1-4. ELECTRON TUBE COMPLEMENT

REFERENCE SYMBOL	TUBE TYPE	FUNCTION
V1	6DC6	RF amplifier
V2	6BA7	Mixer
V3	6AK5/5654	High-frequency oscillator
V4	6BA6/5749	AGC amplifier
V5	6AK5/5654	BFO
V6	6BA6/5749	1st i-f
V7	6BA6/5749	2nd i-f
V8	6BA6/5749	3rd i-f
V9	12AU7/5814	Relay amplifier
V10	12AU7/5814	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	17.8 lb approximately.
Finish	Anodized aluminum cover. Black enamel control panel.
Frequency	Any fixed frequency in the range of 2 mc to 24 mc.
Frequency control	Crystal oscillator.
Type of receiver	Superheterodyne, with an automatic noise limiter, and a carrier operated squelch circuit.
Intermediate frequency	455 kc, bandwidth, 4 kc.
Receiver output	500 mw audio output with a 600-ohm or a 4-ohm line.
Type of reception	Amplitude modulated radiotelephony, CW or FSK.
Frequency stability	0.001 per cent over temperature range.
Receiver sensitivity	RF GAIN control set at maximum. A 2.9-uv signal at 30 per cent, 400-cycle modulation will produce not less than 10 db signal to noise ratio.
Squelch circuits	Squelch circuit will open at 2.5 uv. Drop in to drop out ratio is 1.4 to 1. Squelch threshold adjustable with RF GAIN control.
Antenna type	100-ohm input, balanced or unbalanced.
Receiver selectivity	The bandwidth at 6 db is 4 kc ±10%.
AVC characteristics	Audio output constant within 5 db from signal input of 5 uv to 200,000 uv.
Power dissipation	45 watts.
Power requirements	115 or 230 volt single phase a-c, 50/60 cps.
Ambient temperature range	0 degree C (32°F) to 55 degree C (99°F) operating range.
Relative humidity	Up to 95 per cent.
Maximum altitude for satisfactory operation	Up to 10,000 feet.

1.4 FREQUENCY CHANGING DATA.

In order to change the frequency of the 51N-7, it is necessary to replace the r-f coils (T101, L101, L102, L103, and L104) and to install the correct crystal (Y1). Coil sets are available as follows: (See table 1-5.)

TABLE 1-5

R-F COIL SETS

Band	Frequency (mc)	Collins Part Number
1	2-4	541-7576-004
2	4-8	541-7577-004
3	8-16	541-7578-004
4	16-24	541-7579-004

In order to determine the correct crystal to use for a given frequency, use the following formulas: F = Xtal frequency, Fc = Channel frequency.

Channels under 14.5 mc, lower sideband reception.

$F = Fc + 453.675$

Channels under 14.5 mc, upper sideband reception.

$F = Fc + 456.325$

Channels above 14.5 mc, lower sideband reception.

$$F = \frac{Fc + 453.675}{2}$$

Channels above 14.5 mc, upper sideband reception.

$$F = \frac{Fc + 456.325}{2}$$

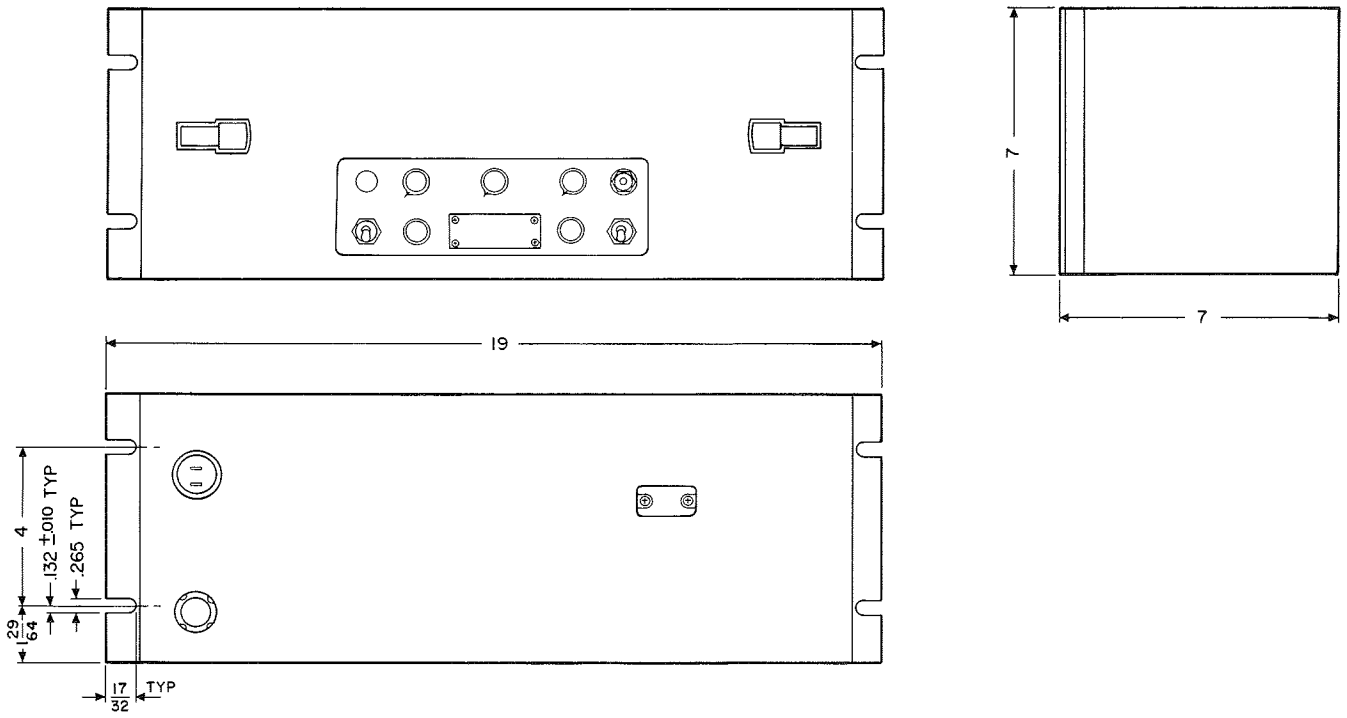


Figure 2-1. Outline and Mounting Dimensions, 51N-7F, Front Panel Flush Mounting

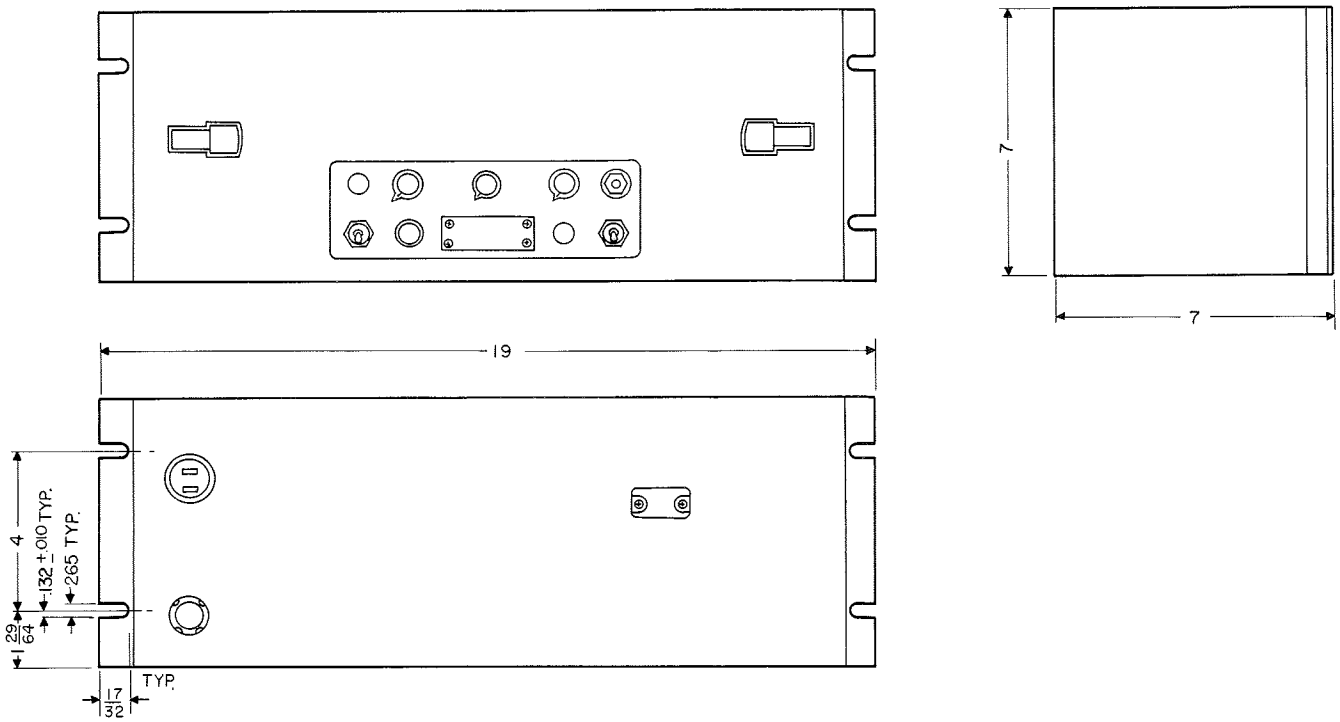


Figure 2-2. Outline and Mounting Dimensions, 51N-7R, Recessed Mounting

SECTION II
INSTALLATION

2.1 UNPACKING.

All equipment supplied with the 51N-7 Radio Receiver is shipped in a single container. The receiver is shipped with all tubes and connectors in place unless instructions to the contrary are received.

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

2.2 MOUNTING. (See figure 2-1.)

The 51N-7 is designed for mounting in a standard 19-inch relay-type rack or cabinet. Several means of attachment of the 51N-7 to the rack are available depending upon the specification of the order. Each particular type of mounting may be changed by use of the accessory mounting kits listed in section I of this manual. In all cases, the 51N-7 requires 7 inches of vertical mounting space. The depth required by the 51N-7 will vary from 2 to 7 inches depending on the type of mounting used. 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.

2.3 ANTENNA CONNECTION.

Antenna connection is made at the rear of the receiver at J1 using the UG-102/U connector which

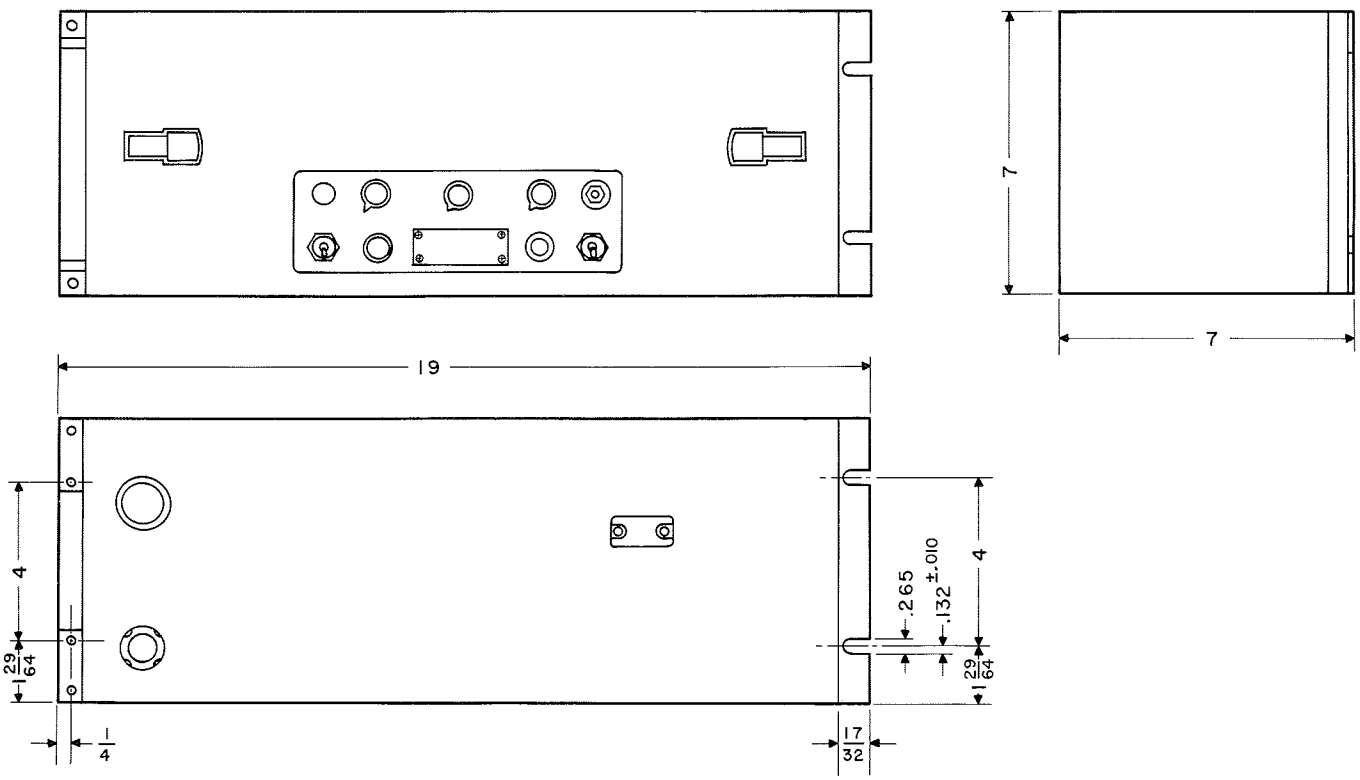
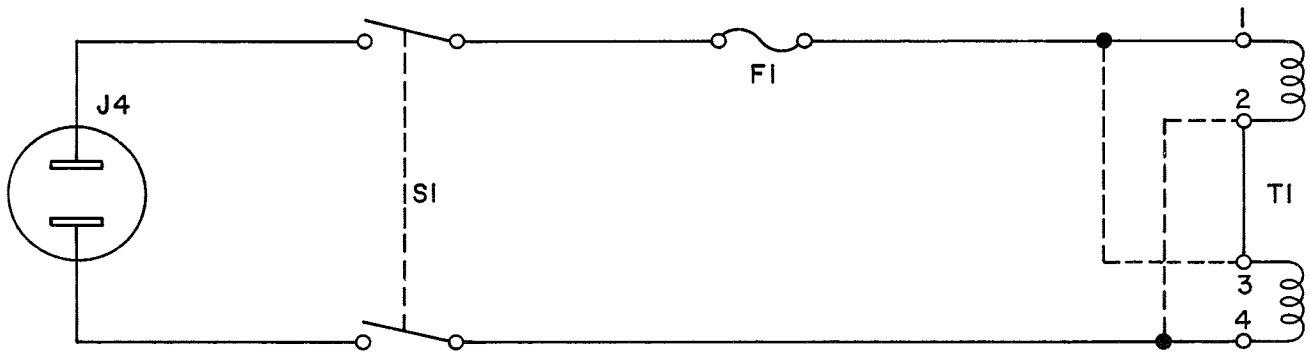


Figure 2-3. Outline and Mounting Dimensions, 51N-7H, Hinge Mounting



CONECTIONS ARE SHOWN FOR 230 V AC SINGLE PHASE OPERATION. 115 V AC CONNECTIONS SHOWN IN DOTTED LINES. VALUE OF F1 SHOULD BE .5 AMPERE FOR 230 V AC. WIRE BETWEEN PINS 2 AND 3 SHOULD BE REMOVED FOR 115V AC OPERATION.

Figure 2-4. Connections for 230 Volt A-C Operation

is provided. The receiver is wired for a 100-ohm balanced line input. If a single wire, unbalanced type of antenna is desired, it will be necessary to ground either side of the input from J1 to T101, at T101, and to change the type of input connector used.

2.4 POWER CONNECTIONS.

The 51N-7 is normally connected for 115 v a-c, 50/60 cps. Provisions are made for operation at 230 v a-c, single phase, 50/60 cps through a reconnection of T1. See figure 2-4.

The steps required for this change are as follows:

a. Unsolder and remove jumper wire between terminals 1 and 3 of T1.

b. Unsolder and remove jumper wire between terminals 2 and 4 of T1.

c. Secure and solder a jumper between terminals 2 and 3 of T1.

d. Replace F1 with a 0.5 ampere slow-blow fuse.

e. Change line cord as needed.

Remote application of power may be made by using either the 48-volt remote relay kit, Collins part number 541-0020-00 as shown in figure 2-5, or the 12-volt relay kit, Collins part number 541-0021-00. Both are wired the same although the power supply suggested in figure 2-5 will have to be reworked for 12-volt operation. Either of these power control relays, K2, may be placed on the mounting holes provided on the chassis under the control panel. Relay control wires are provided in the cable terminating at terminals 14 and 15 of J3. The loose ends have been brought to the vicinity of the remote relay standoffs under the control panel, tagged and taped. The primary power wires are brought to the two standoffs under S2 and the carrier lamp I2 to facilitate connection to the appropriate relay terminal.

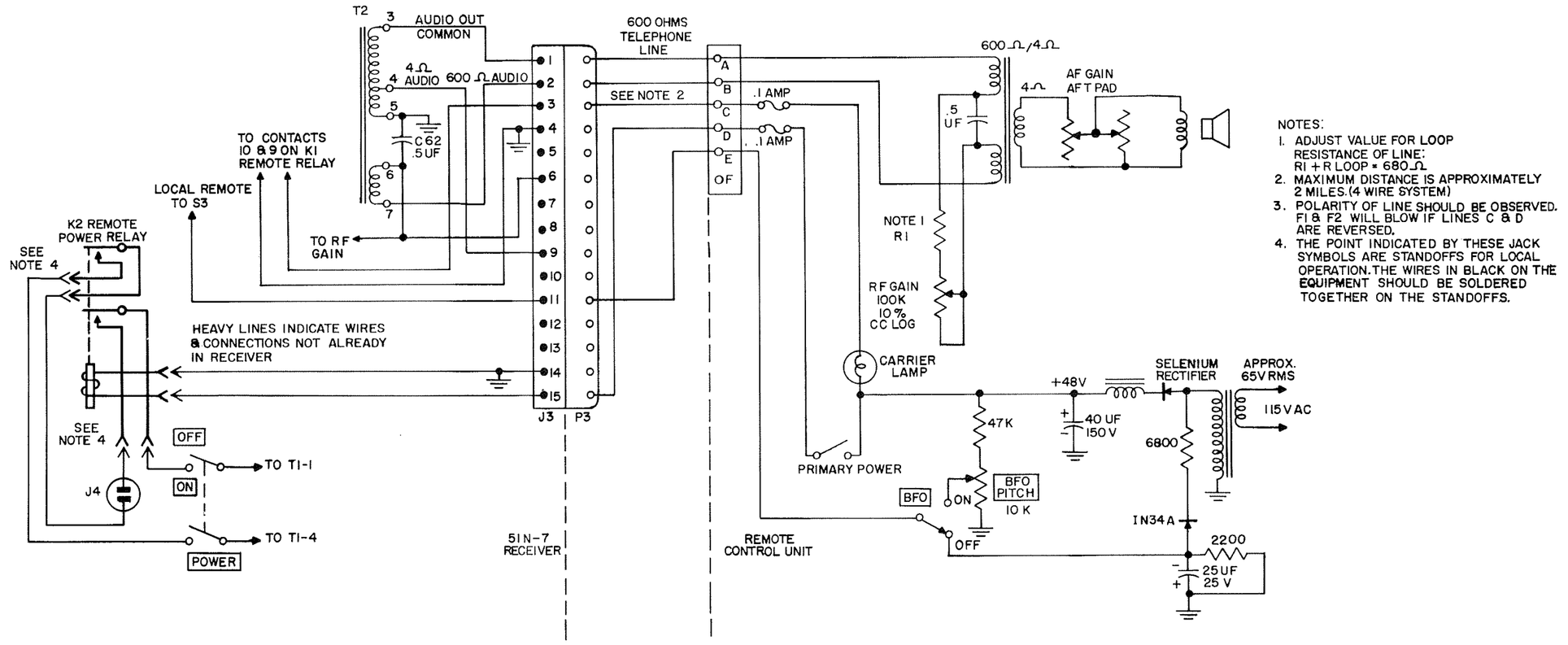
2.5 REMOTE CONTROL OPERATION. (See figure 2-5.)

The 51N-7 has been specifically designed for use in remote installations where there is no need for the operator to have direct access to the equipment, or where operational requirements dictate this type of operation.

Figure 2-5 is a schematic diagram showing a suggested layout for the complete remoting of the receiver. It may be used either partially or in its entirety. As shown, this remote installation will permit operation to approximately 2 miles from the receiver. General instructions for making remote operation follow.

2.5.1 REMOTE AUDIO CONNECTIONS.

Audio output may be remoted by tapping from terminals 1 and 2 of J3 for 600-ohm output or terminals 1 and 9 for 4-ohm output. The a-f gain is then controlled by an a-f T pad as shown in figure 2-5.



NOTES:

1. ADJUST VALUE FOR LOOP RESISTANCE OF LINE: R1 + R LOOP = 680Ω
2. MAXIMUM DISTANCE IS APPROXIMATELY 2 MILES. (4 WIRE SYSTEM)
3. POLARITY OF LINE SHOULD BE OBSERVED. F1 & F2 WILL BLOW IF LINES C & D ARE REVERSED.
4. THE POINT INDICATED BY THESE JACK SYMBOLS ARE STANDOFFS FOR LOCAL OPERATION. THE WIRES IN BLACK ON THE EQUIPMENT SHOULD BE SOLDERED TOGETHER ON THE STANDOFFS.

Figure 2-5. Suggested Remote Control Wiring Diagram

2.5.2 REMOTE CARRIER INDICATOR.

Provisions have been made for the operation of a remote carrier indicator lamp which will light whenever the squelch unit of the receiver is opened. This may be done as shown in figure 2-5 or by connecting directly between terminals 5 and 7 of J3. The remote indicator lamp should be a 6-8 volt, 0.15 ampere pilot lamp equivalent to a Mazda type No. 47.

2.5.3 REMOTE RF GAIN CONTROLS.

The r-f gain of the receiver may be remoted by connecting a 100K ohm potentiometer between pins 6 and 7 of J3. The potentiometer should be connected so that minimum resistance is obtained in the maximum clockwise position of the control. The R-F GAIN control on the 51N-7 control panel should be set at minimum gain when this connection is made.

An alternate method of remoting the r-f gain is shown in figure 2-5 and is recommended when the entire set is to be remoted. This method will permit the use of less connecting wiring between the receiver and the remote control unit. If this method is used, the front panel RF GAIN control should be disconnected.

2.5.4 REMOTE BFO OPERATION.

The bfo circuits of the 51N-7 have been designed to permit remote operation with a minimum of modification. The only adjustment necessary on the receiver itself is to turn the BFO PITCH control fully counterclockwise, thereby activating S3 to the REMOTE position. S3 is attached to the rear of R131, BFO PITCH. The suggested method of remoting this function is shown in figure 2-5.

2.6 INITIAL ADJUSTMENTS.

Prior to placing the equipment into service, certain tests should be performed to determine whether or not the equipment is operating properly. The 51N-7 is normally supplied with the correct crystal and is tuned to the desired frequency. It is, however, desirable to check the equipment prior to placing it into service.

TABLE 2-1. RECOMMENDED TEST EQUIPMENT

EQUIPMENT	EXAMPLE	REMARKS
VTVM	Heathkit V-6	Any equivalent type.
Signal generator	Measurements 65B	Should cover from 400 kc to 24 mc, tone modulated.
Oscilloscope	Heathkit O-9	Any equivalent type.
Audio oscillator	Hewlett-Packard 200AB	Should cover at least from 100 to 400 cps.
Audio output meter	General Radio 583A	Any equivalent type.

2.6.1 RECEIVER TUNING.

Complete tuning procedures are included herein to permit maintenance personnel to change the 51N-7 frequency as well as to make the necessary pre-installation check.

2.6.1.1 MECHANICAL OPERATIONS. Other than removing the dust cover, these operations need not be performed unless it is necessary to change the frequency.

a. Remove the dust cover. On the 51N-7R and H models, it is held in with two snap fasteners. On the 51N-7F, the cover is secured with four Dzus fasteners.

b. Remove the slug rack by loosening the Dzus fasteners at each end of the rack. Lift the rack straight out.

CAUTION

USE EXTREME CARE WHEN HANDLING THE SLUG RACK TO AVOID INJURING SLUGS.

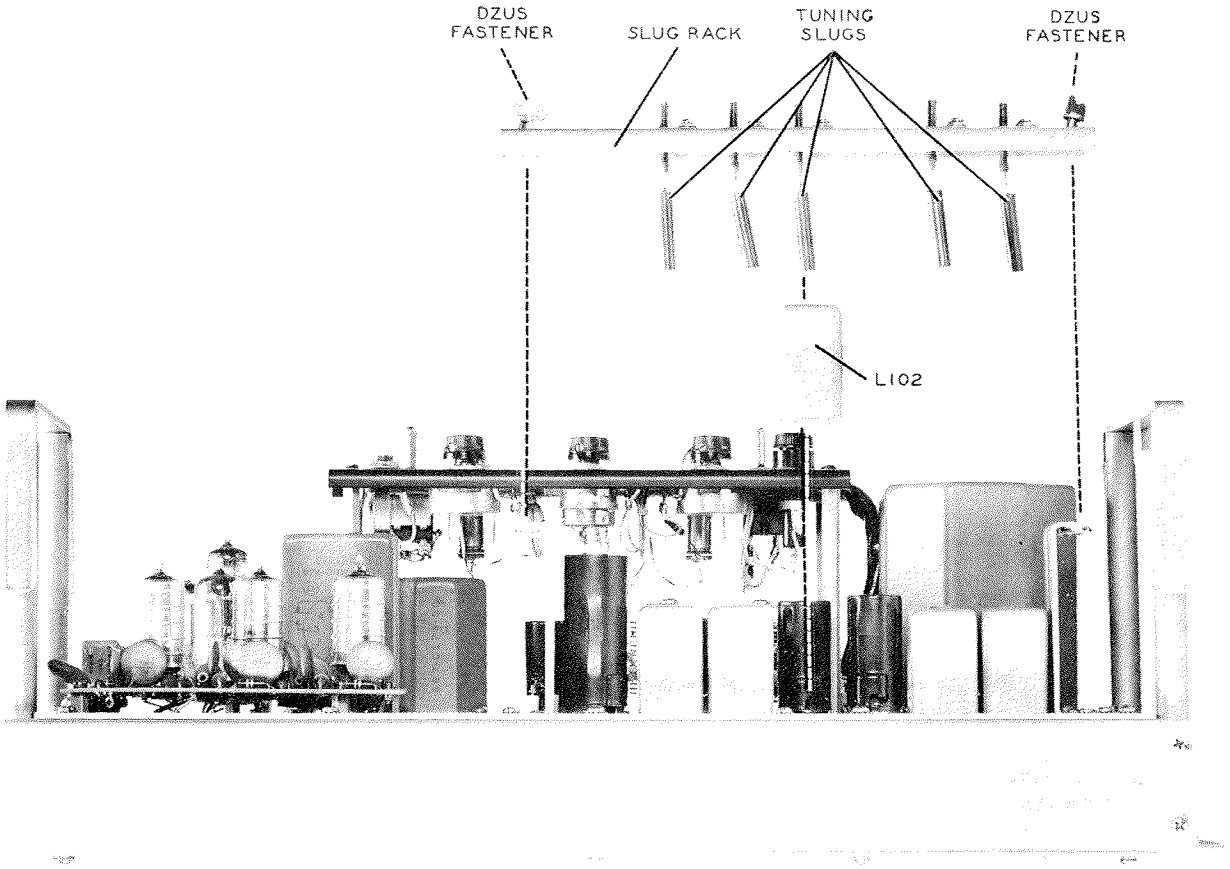


Figure 2-6. Slug Rack Disassembly Details

c. The coils are now removed by loosening the Phillips no. 4 screw at the base of each coil form. This screw may be reached by inserting the screwdriver into the hole provided for the slug.

d. Replace the coils with the correct set for the frequency desired. These coils are listed in section I, table 1-5.

CAUTION

WHEN REPLACING THE SLUG RACK, USE CARE IN INSERTING SLUGS INTO THE COILS.

e. Replace the crystal, Y1, with the correct crystal for the frequency desired. This may be determined by consulting the formulas listed in section I.

f. If the frequency desired is below 14.5 mc, connect the jumper plug shown in figure 2-7 between terminals B and C. If the frequency desired is above 14.5 mc, connect the jumper between terminals A and B.

2.6.1.2 ELECTRICAL OPERATIONS.

a. Apply power to the 51N-7 and allow to warm up for approximately five minutes.

b. Connect a vtvm to the AGC test jack and connect a 600-ohm load between terminals 1 and 2 of J3.

c. Connect the signal generator between the terminals of antenna jack J1 with a matching resistor in series with the hot side of the generator which will make its output 100 ohms. The value of this resistor may be determined by measuring the output impedance of the signal generator and adding a series resistor to make the output impedance equal 100 ohms. Ground the other side of the antenna terminal to the chassis.

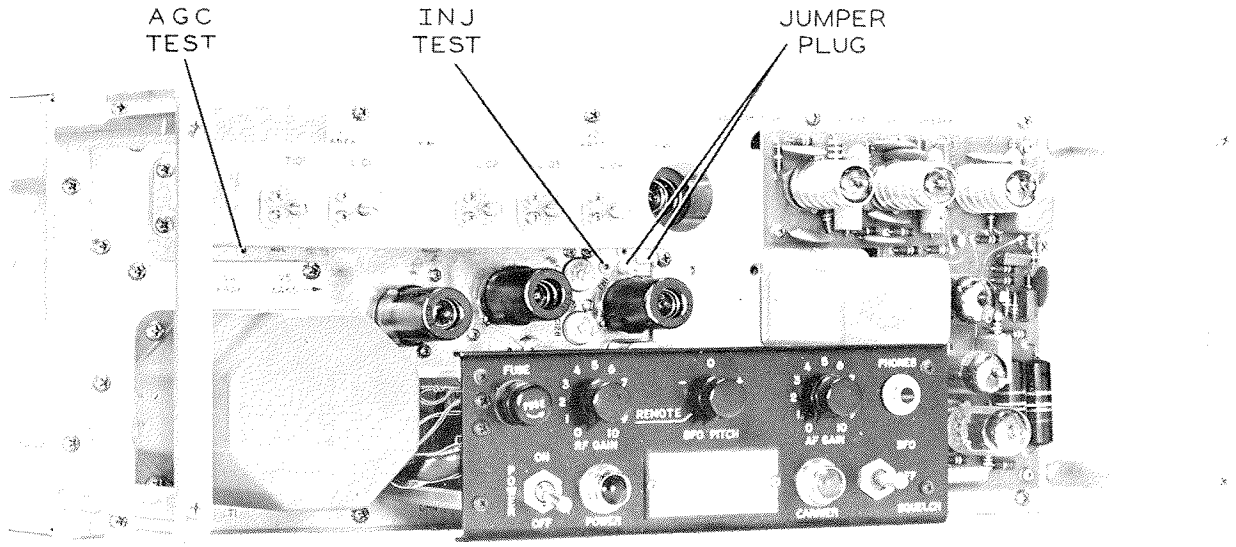


Figure 2-7. Location of Test Jacks and Jumper Plug on 51N-7

d. Set the BFO switch to OFF, BFO PITCH to 0, and the RF GAIN to fully clockwise. If the channel frequency selected is above 14.5 megacycles, tune C-127 for maximum injection voltage as measured at the INJ test jack. No adjustment is required at frequencies below 14.5 megacycles.

NOTE

When tuning the 51N-7 to frequencies above 14.5 mc, caution should be observed to avoid tuning to the third harmonic of the crystal frequency.

e. Rock the signal generator until a signal is heard, tuning the converter grid circuit, L102, L103, and L104, if necessary.

f. Rough tune T101, L101, L102, L103, and L104 for maximum signal at the AGC test jack. Starting the tuning with L104 and working toward T101 is the suggested order for this operation.

g. Leaving the vtvm connected to the AGC test jack, readjust the slugs for maximum indication. Keep reducing the output voltage of the signal generator to maintain the agc test voltage below 2.7 volts d-c. It will be necessary to recheck the alignment of T101, L101, L102, L103, and L104 as the input level is reduced.

2.6.2 AGC CHARACTERISTICS.

This test is used to determine whether or not the 51N-7 is correctly aligned as well as to check its agc characteristics.

a. Leaving the signal generator connected as before, connect the audio output meter across terminals 2 and 3 of J3. Set the audio output meter for a 600-ohm input.

b. Adjust the output of the signal generator to 5 uv, modulated 30 per cent at 1000 cps. Adjust the AF GAIN control for an audio output of approximately 100 mw.

c. Increase the signal generator output to 200,000 uv, and record the rise in audio output. It should not exceed 4.5 db from 5 to 200,000 uv input. Again increase the signal generator output to 1.0 volt. The output should remain at 4.5 db for inputs of from 0.2 v to 1.0 v.

2.6.3 RECEIVER SENSITIVITY.

Upon determining that the receiver is on the correct frequency and correctly aligned, the sensitivity should be checked using the following procedure.

a. Connect the audio output meter across terminals 1 and 2 of J3.

b. Set the output level of the signal generator to 2.9 uv, modulated 30 per cent at 1000 cps, and adjust the AF GAIN for an output of approximately 100 mw.

c. Remove the modulation, and record the drop in audio output. It should be no less than 10 db.

2.6.4 RECEIVER SELECTIVITY.

The following procedures are used to determine the over-all selectivity of the 51N-7.

a. Remove L104 as described in 2.2.1.1 and connect the signal generator to pin 7 of V2, see main schematic, figure 8-7. Connect the d-c vtvm to the agc test jack.

b. Adjust the output of the signal generator until the agc voltage just begins to rise. Note the signal generator and the agc voltage.

c. Increase the signal generator output 2 times, 6 db, and tune the signal generator below 455 kc until the same agc voltage is obtained as in b. Determine the frequency difference between the signal generator frequency and 455 kc. Tune the signal generator above 455 kc until the same agc is obtained as in b. Again determine the difference between the signal generator frequency and 455 kc. The difference should be no more than 4.5 kc and no less than 3.5 kc

d. Repeat c. for inputs of 1000 times, 60 db, and 10,000 times, 80 db. The differences should be no more than 10 kc at 60 db and 20 kc at 80 db.

SECTION III
OPERATION

3.1 OPERATING CONTROLS.

All controls necessary for operation are located on the front panel of the 51N-7. Removal of the dust cover will reveal those additional adjustments needed to align and change frequency of the 51N-7. Once these internal controls have been set, they need not be a concern to operating personnel. The following controls are available to adjust the receiver for use.

3.1.1 POWER ON-OFF (S1).

A double-pole, single-throw switch controlling the application of a-c power to the 51N-7.

3.1.2 POWER LAMP (I1).

Power Lamp I1 lights when power is applied to the 51N-7.

3.1.3 RF GAIN (R6).

A continuously variable control which regulates the amount of r-f gain, thereby controlling the squelch operating level. It is also used to regulate the receiver sensitivity during CW operation.

3.1.4 AF GAIN (R62).

R62 is a continuously variable control which regulates the audio output level of the receiver. Maximum output is obtained in the maximum clockwise position.

3.1.5 CARRIER INDICATOR (I2).

Carrier Indicator I2 lights when the squelch circuit opens and remains lit in the BFO or OFF position of BFO-OFF-SQUELCH (S2). Its principal function is to indicate which frequency is being called when several similar receivers are being operated simultaneously.

3.1.6 BFO-OFF-SQUELCH (S2).

This switch places the bfo in operation for CW recep tion in the BFO position. By placing the switch in th OFF position, the squelch circuit remains open, the bfo off, and permits continuous audio output whether a carrier is present or not. In the SQUELCH position, the squelch circuit operates normally denying audio output unless a signal is present. The CARRIE light (I2) remains lit when the switch is either in the BFO or OFF position.

3.1.7 BFO PITCH (R131).

A continuously variable control permits the adjustment of the bfo to the desired point. A switch, S3, is incorporated in this control and should be at remote (fully counterclockwise) when the receiver is being operated from a remote position.

3.2 OPERATING PROCEDURE.

Since the 51N-7 is a fixed frequency receiver, the only operations required of the operator is to turn the receiver on and adjust the above listed controls to suit his individual listening requirements.

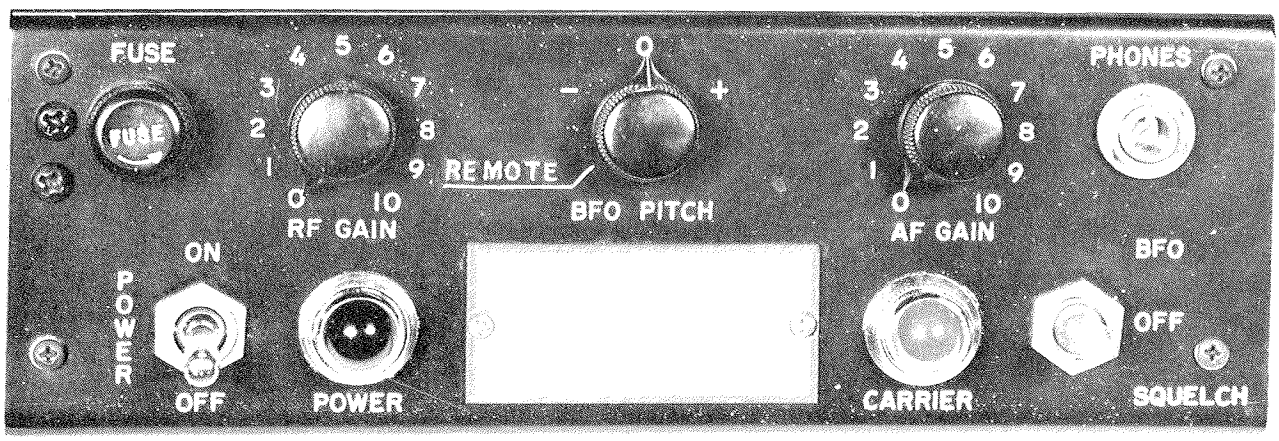


Figure 3-1. 51N-7 Radio Receiver Control Panel

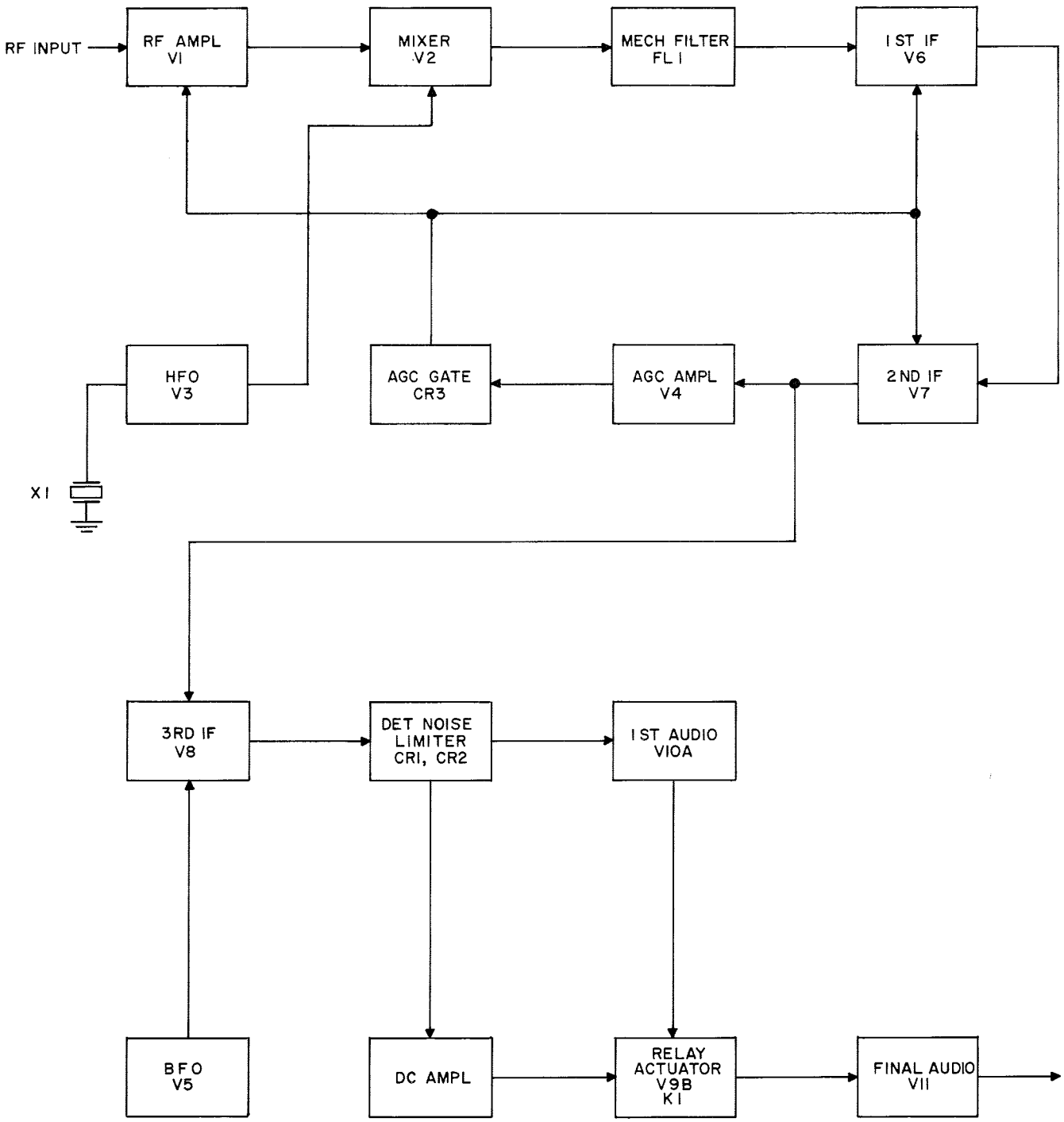


Figure 4-1. Functional Block Diagram, 51N-7 Radio Receiver

SECTION IV
PRINCIPLES OF OPERATION

4.1 GENERAL.

The 51N-7 Radio Receiver is a high frequency, 11 tube, superheterodyne receiver which operates on any single, fixed frequency within a range of from 2 to 24 megacycles. The receiver is designed to receive AM. radiotelephone, CW or FSK signals. The signal-to-noise ratio of the receiver is improved by the use of a crystal controlled local oscillator which allows emphasis of either the upper or lower sideband of the incoming signal. Selection of the sideband to be emphasized is determined during the initial adjustment of the receiver. The frequency itself is controlled by the choice of the appropriate crystal and set of tuning coils. Data for this selection is included in section I. The three i-f stages operate at 455 kc with the Collins Mechanical Filter F455K40 being used as the selective device. Additionally, the circuitry includes a noise detector, automatic gain control, beat-frequency oscillator, a squelch unit, and two stages of audio amplification.

Figure 4-1 is a simplified block diagram of the 51N-7. The incoming signal is partially selected by passing through several tuned circuits, T101, L101, and applied to the r-f amplifier V1. From V1 the amplified signal is narrowed further by several more tuned circuits and passed into the mixer, V2, where it is beat with the output of V3, the high-frequency oscillator. The resultant 455-kc signal is passed through the mechanical filter where it is brought down to a 4-kc bandwidth and then amplified in the three i-f stages. The signal is next detected and limited by detector CR1 and limiter CR2, both of which are silicon diodes. The resulting d-c signal is amplified by the audio amplifiers V10A and V11 and is taken off T5, the audio transformer.

The agc action is used on V1, V6, and V7. The agc signal is tapped from between the second and third i-f amplifiers and amplified in V4. The regulating signal is then applied to the r-f amplifier, V1; the first i-f, V6; and the second i-f, V7, through agc gate, CR3, in order to maintain a more closely regulated output from the receiver.

Squelch circuitry is also incorporated in the 51N-7. The control voltage is tapped from the detector circuit and applied to the squelch amplifier, V10B, which is used to operate V9B, the relay actuator, which prevents the audio amplifier from conducting unless a signal is present. This is done by keeping relay K1 open which denies the noise from the grid of V11, the final audio amplifier. The power supply consists of a full-wave bridge rectifier which supplies bias voltage as well as B plus and other necessary operating voltages.

4.2 DETAILED PRINCIPLES OF OPERATION.

The following test describes circuits used in the 51N-7 in greater detail and special circuitry is given full attention.

4.2.1 R-F AMPLIFIER.

As shown in figure 4-2, the r-f amplifier of this receiver employs a 6DC6 pentode for amplification. Input from the 100-ohm balanced antenna is preselected in T101, the antenna transformer and passed through to L101, a tuned circuit, in the grid circuit of V1. Here it is further preselected and has the agc voltage added through R101 to the grid of V1. Upon being amplified in V1, the signal is sent through L102, L103, and L104 which are three parallel tuned circuits on the plate of V1 where the amplified signal is narrowed further before being applied to the mixer stage.

4.2.2 MIXER.

The mixer stage, V2, a 6BA7 converter, mixes the signal from L104 with the output of the high-frequency oscillator and passes the resultant 455-kc i-f signal on to the mechanical filter.

4.2.3 HIGH-FREQUENCY OSCILLATOR.

The high-frequency oscillator of the 51N-7 shown in figure 4-4 is a crystal controlled oscillator using a 6AK5 pentode for V3. An additional tank circuit is incorporated in the plate circuit of V3 to permit the oscillator to operate on second harmonics for frequencies above 14.5 mc. When operating on frequencies below 14.5 mc, the tank is removed. Changeover from one type of operation to the other is accomplished by means of a jumper plug.

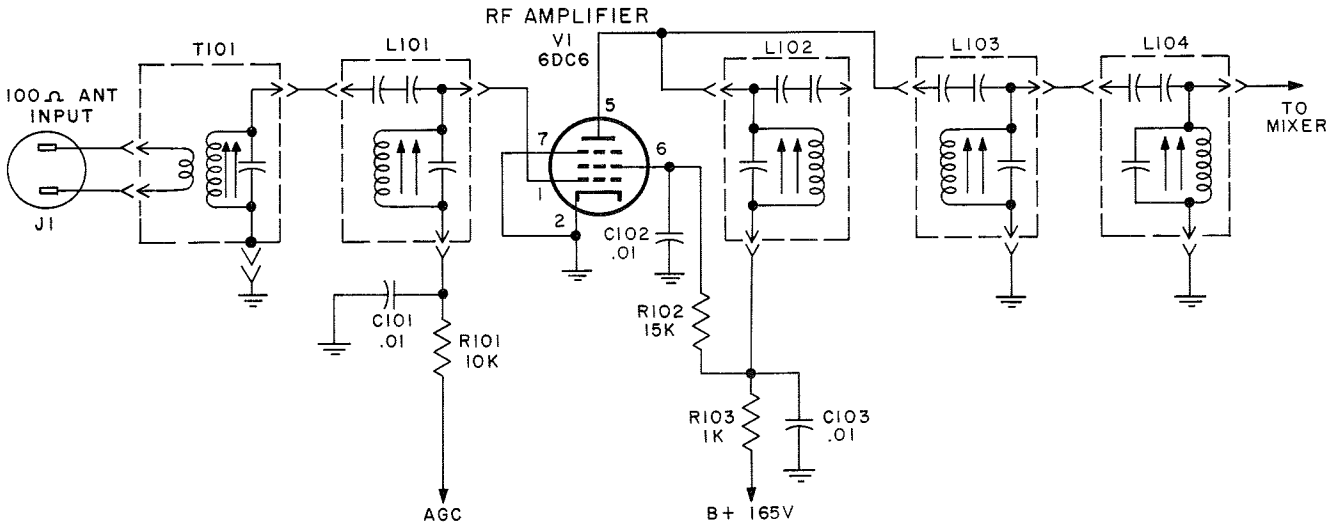


Figure 4-2. Simplified Schematic Diagram, R-F Amplifier

4.2.4 MECHANICAL FILTER.

The mechanical filter, FL1, used on the 51N-7 is a type F455K40. As used in this circuit, it is the selective device for the i-f strip and will pass only a 455-kc signal and has a band pass of 4 kc. Through the use of this filter the usual arrangement of i-f transformers has been eliminated.

The mechanical filter achieves its selectivity through the use of electrical and mechanical components. The filter is composed of three general units: the input transducer, the resonant section, and the output transducer. The input and output sections being identical.

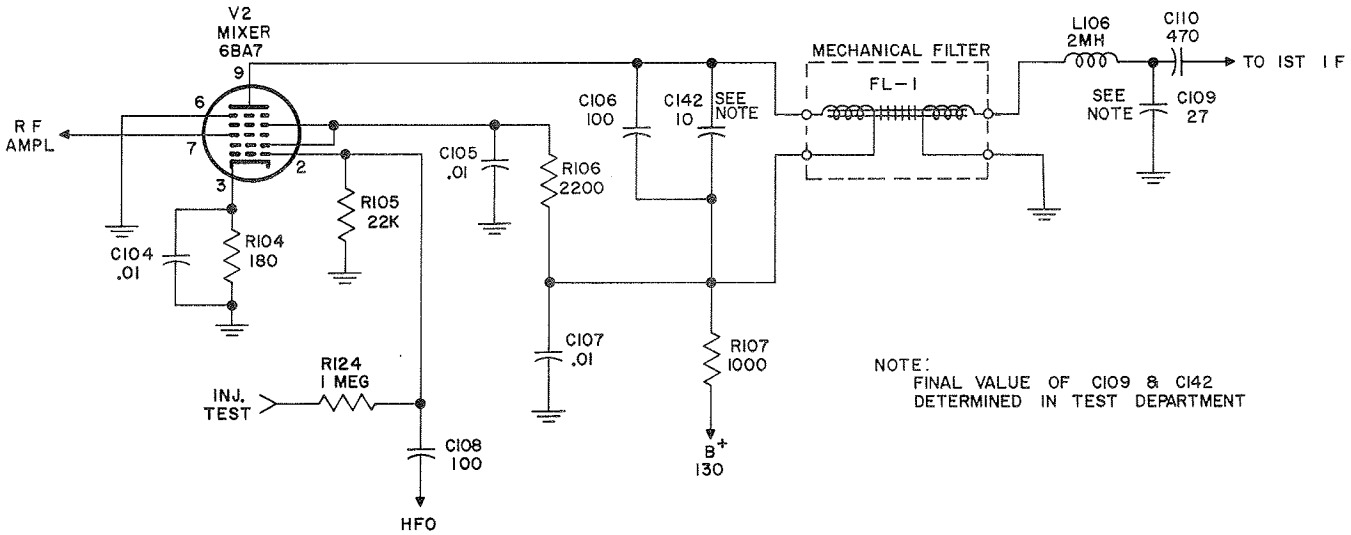


Figure 4-3. Simplified Schematic Diagram, Mixer and Mechanical Filter

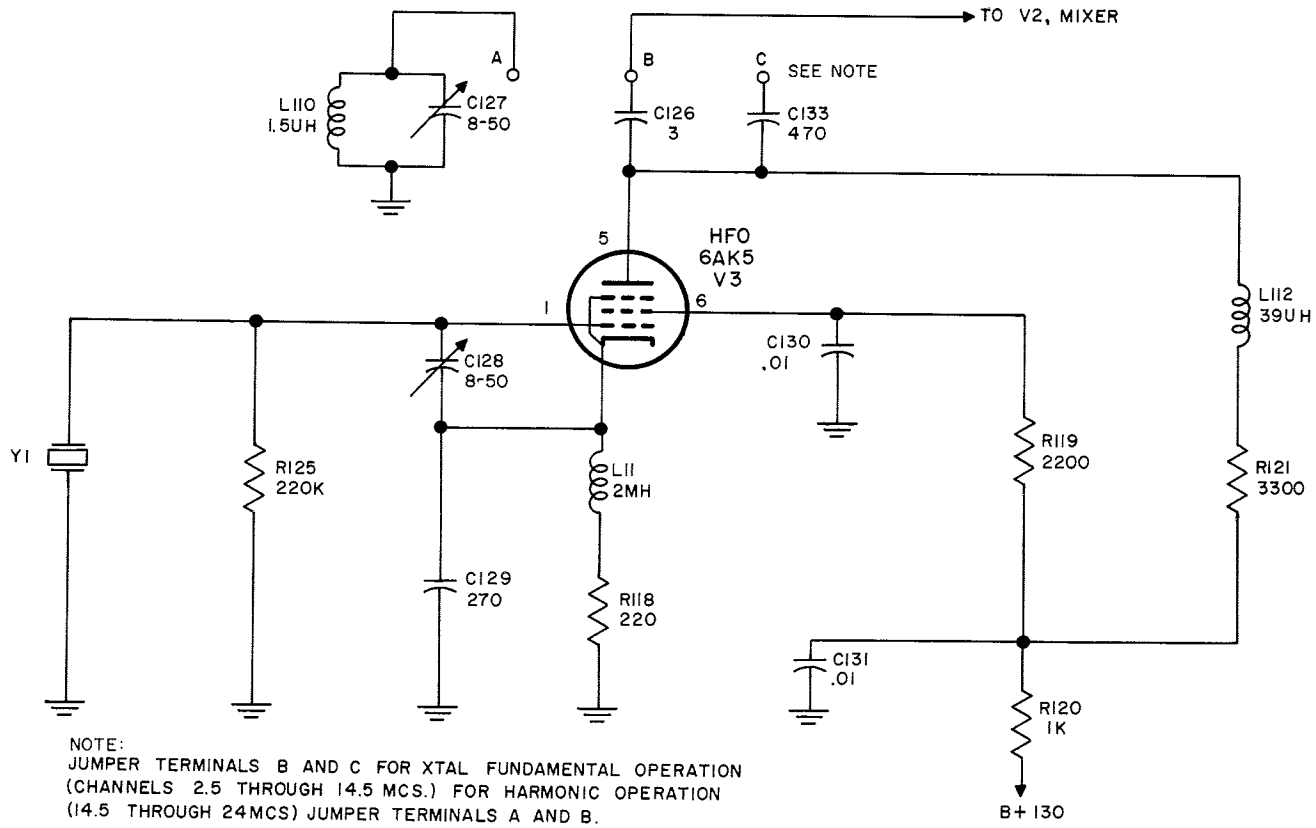


Figure 4-4. Simplified Schematic Diagram, High-Frequency Oscillator

The input signal is impressed on a small coil which surrounds a nickel wire. By means of magnetostriction the magnetic field variations of the coil 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. These disks are sharply resonant and have excellent frequency stability. The vibrations of this first disk is coupled to the other disks by means of wires welded to their edges. The output end of the filter is identical to the input. Here the last disk causes the nickel wire to vibrate, and the magnetostriction of the nickel wire causes a varying magnetic field which is intercepted by the coil which induces the output voltage.

4.2.5 I-F AMPLIFIERS.

The i-f stages of the 51N-7 accept the 455-kc signal from the mechanical filter, FL1, and amplify it three times in V6, V7, and V8, all 6BA's. The need for the usual i-f transformers has been eliminated because of the nature of the input to this stage from the mechanical filter. T5 is added at the end of the i-f stages to couple this stage to the diode detector, CR1. See figure 4-5.

4.2.6 DETECTOR LIMITER CIRCUITS.

The i-f signal from the secondary of T5, the diode coupling transformer, is rectified in the detector CR1. The diode load for this detector circuit is provided by R36, R37, and R38. Filtering is provided by detector bypass capacitors, C47 and C48. The audio output is taken from between R37 and R38 and applied to the anode of CR2 which works in conjunction with R42, R43, and R44, the limiter diode loads. R128, from B plus is led to the anode of CR2 to prevent the input from becoming zero potential at any time as the diode cuts off prior to reaching this level. This is done to permit weak signals to pass through the limiter. C49 and R39 are provided in this stage and serve to bias the d-c amplifier V10B.

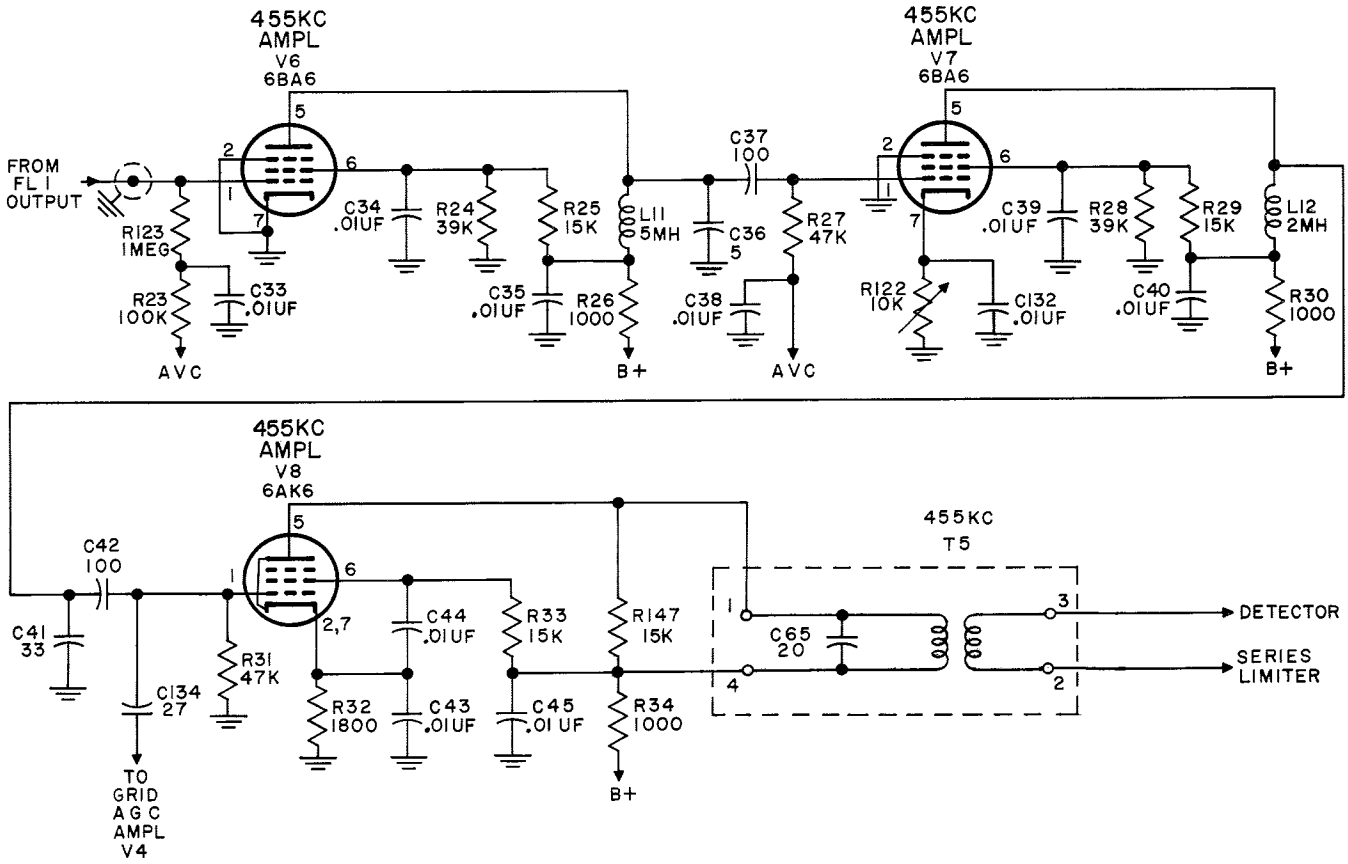


Figure 4-5. Simplified Schematic Diagram, 455 kc I-F Amplifier

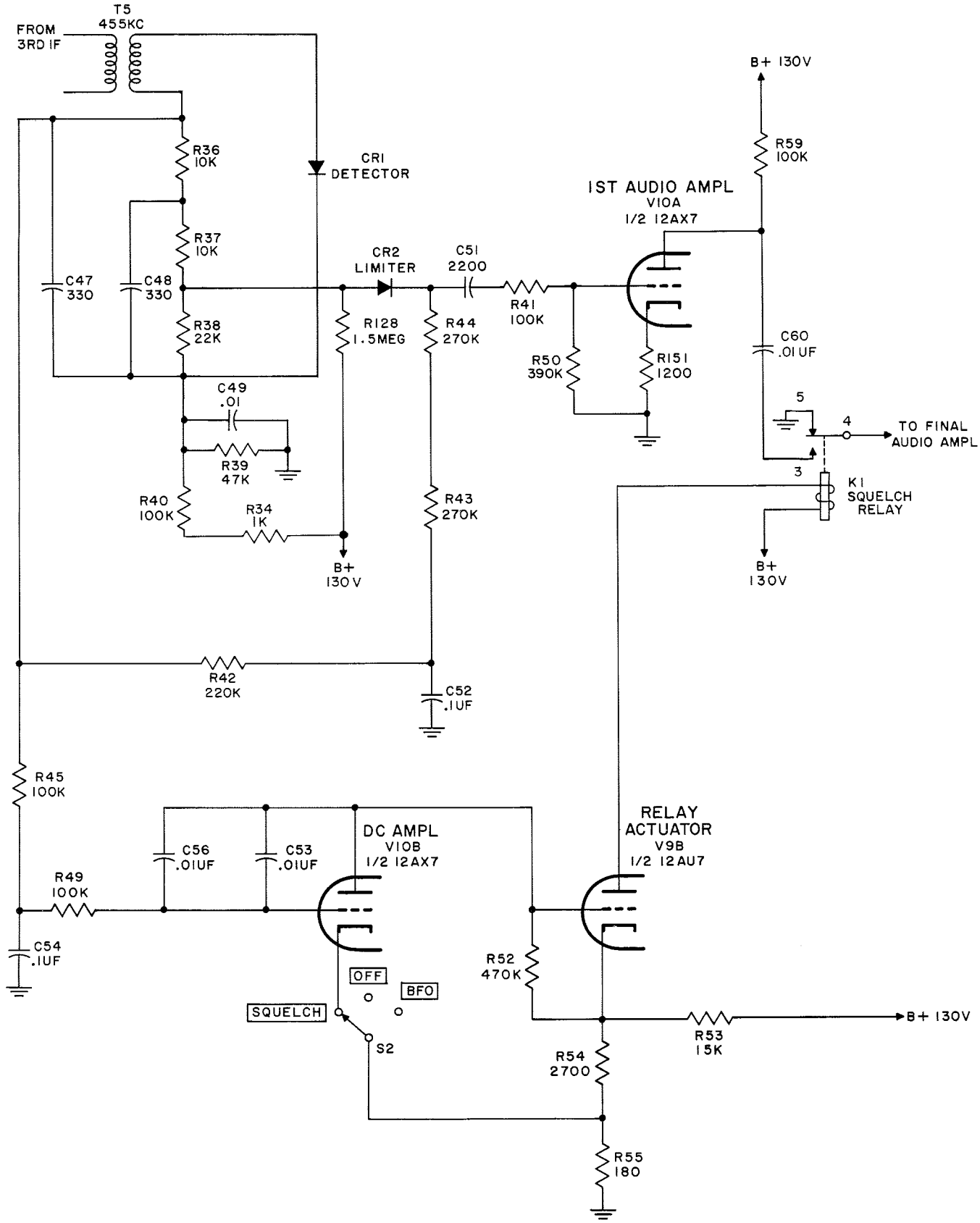


Figure 4-6. Simplified Schematic Diagram, Detector Limiter, First Audio Amplifier and Squelch Circuit

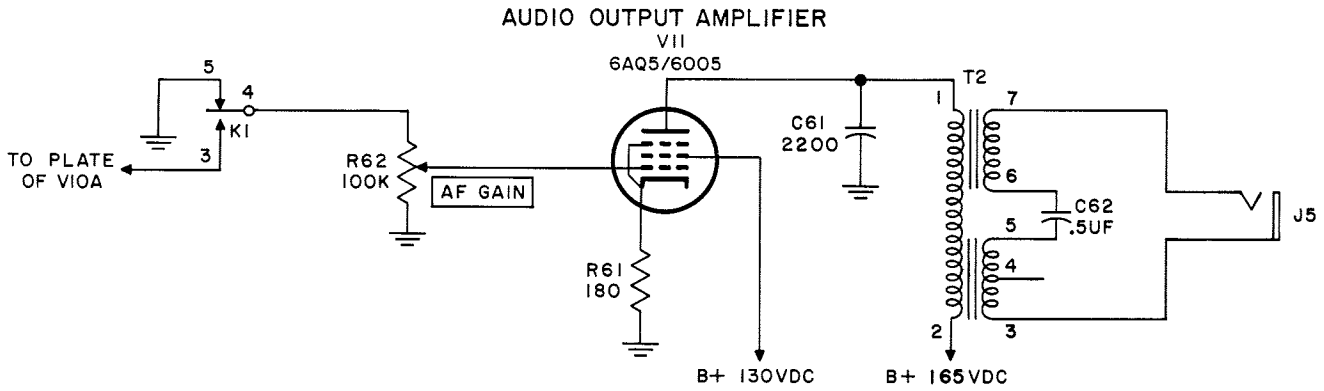


Figure 4-7. Simplified Schematic Diagram, Final Audio Amplifier

4.2.7 AUDIO AMPLIFIERS. (See figures 4-6 and 4-7.)

The detected and limited signal is applied to the grid of V10A, the first audio amplifier. See figure 4-6. The amplified signal is taken from the plate and coupled through C60 to V11, the final audio amplifier. The AF GAIN control, R62, is located in the grid of V11. T2, the audio transformer is prcvided with taps led to the output jack, J3, to permit either 4-ohm or 600-ohm output. The 600 ohm is taken across pins 1 and 2 and the 4 ohm across pins 3 and 4.

4.2.8 SQUELCH UNIT. (See figure 4-6.)

With S2 in the squelch position, V10B, the d-c amplifier and V9B, the relay actuator, are brought into the circuit. V10B is a d-c amplifier receiving its control voltage from the audio signal. Plate voltage is applied through R52 from the voltage divider 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. Thus, any voltage drop across R52 acts as bias for V9B.

The operation of the circuit is best explained by assuming that the RF GAIN is reduced to prevent the squelch circuit from opening on noise and that an r-f signal is applied to the receiver. This signal is demodulated, limited, and filtered in the detector limiter stages, and a negative portion of this signal is taken from between R36 and T5. This is applied to the grid of V10B, the d-c amplifier, which, in conjunction with the positive bias applied through S2, cuts the tube off. No current flows through R52 from V10B and V9B conducts energizing K1. The normally closed contacts of K1 are ungrounded, and the signal from the first audio amplifier, V10A, is applied to the grid of V11, as well as lighting L2, the carrier lamp. Positive feedback is applied to the cathode of V10B by the cathode current of V9B through R55 to reduce relay chatter. C56 and C53 also serve to lessen chatter by reducing the effects of instantaneous signals in V10B. When S2 is placed in either the BFO or OFF positions, V9B conducts continuously. When the incoming r-f signal is cut off, bias is reduced on V10B and it conducts. Current flows through R52 cutting off V9B. This causes K1 to open which grounds out the audio signal from the detector.

4.2.9 BEAT-FREQUENCY OSCILLATOR. (See figure 4-8.)

The BFO employed in the 51N-7 is a tuned grid, tuned plate oscillator using two germanium diodes, CR102 and CR103, in its input circuit. CR102 functions as a variable impedance in conjunction with R131, BFO PITCH, in order to vary the frequency of the BFO. CR103 is used to bias the BFO to cut off when S3 is placed in the REMOTE position. The output of the BFO is injected into the detector circuits at the output of the i-f stages at T5, the diode coupling transformer.

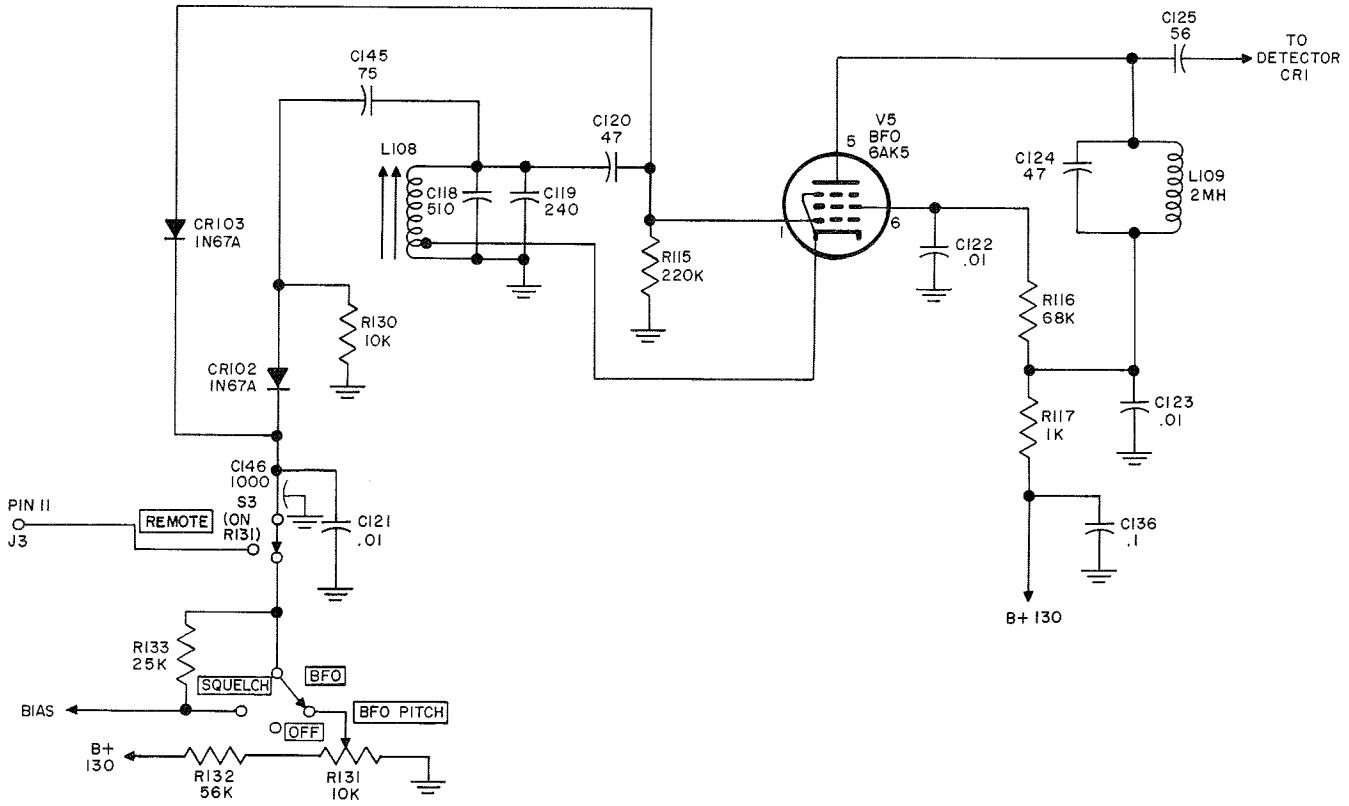


Figure 4-8. Simplified Schematic Diagram, Beat-Frequency Oscillator

4.2.10 AGC AMPLIFIER CIRCUITS. (See figure 4-9.)

The agc control signal is taken from the grid of the third i-f amplifier and this 455-kc signal is amplified in V4, the agc amplifier. The amplified signal is then taken from the plate of V4 and rectified in CR101. The tank circuit is composed of L107 and C113 serving as an impedance in the plate circuit of V4. R111 is the diode load. The resultant control signal is applied through CR3, the agc gate, to the r-f amplifier, V1, and the first and second i-f amplifiers, V6 and V7. CR3 serves to control the level at which agc action is applied to these circuits. The RF GAIN potentiometer is located in this stage as it controls the level of bias applied to the agc controlled stages manually, and thereby controls the sensitivity of the receiver.

4.2.11 POWER AND BIAS SUPPLY.

The power and bias supply of the 51N-7 receiver is composed of a full-wave rectifier circuit made up of metallic rectifiers CR4 and CR5. These rectifiers, in conjunction with the output filter network, provide B plus voltages of 130 volts d-c and 165 volts d-c as well as the bias voltage. The power transformer, T1, is designed for either 115 or 230 volt operation and may be reconnected for either type of operation. This may be done as shown in section II, paragraph 2-4.

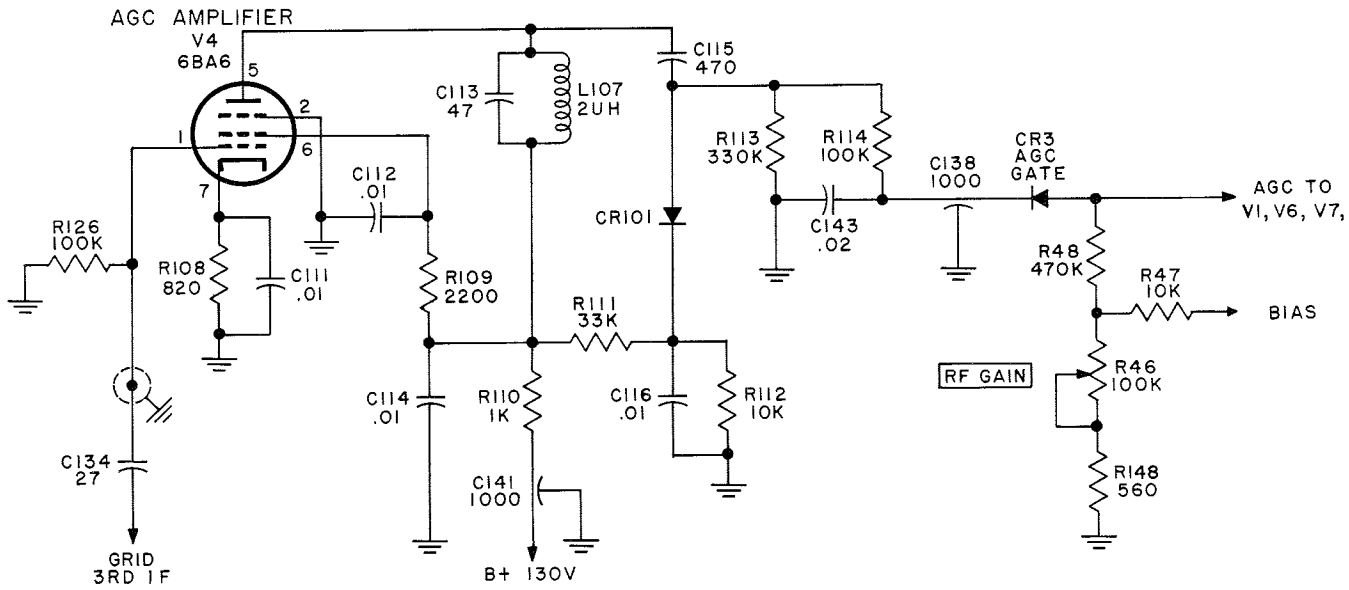


Figure 4-9. Simplified Schematic Diagram, AGC Amplifier Circuits

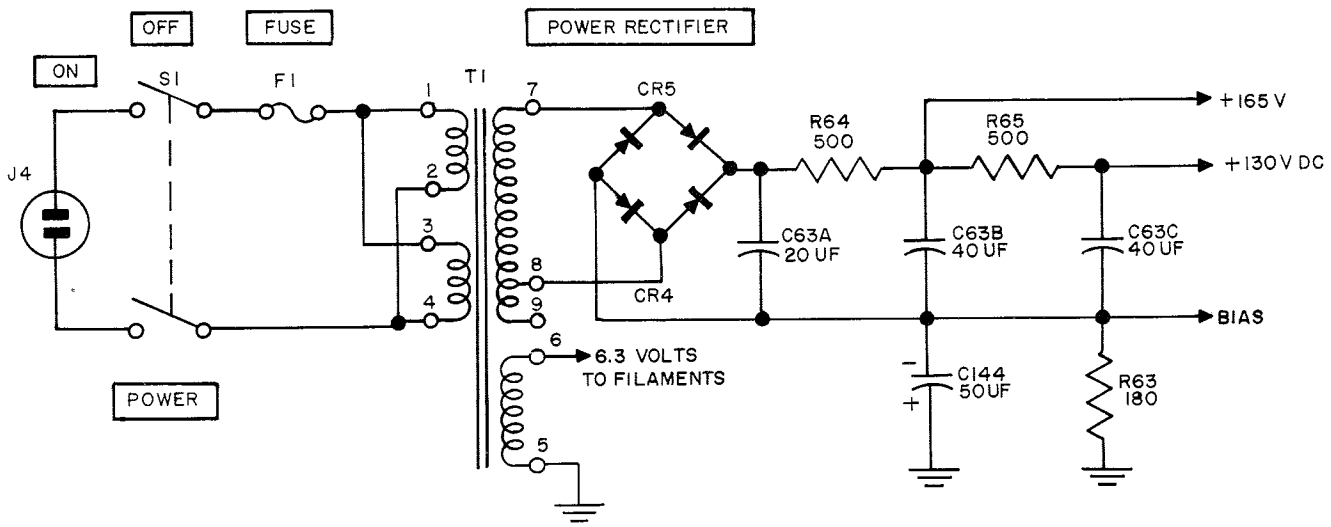


Figure 4-10. Simplified Schematic Diagram, Power and Bias Supply

SECTION V
INSPECTION AND PREVENTIVE MAINTENANCE

5.1 GENERAL.

The 51N-7 Radio Receiver is not equipped with any mechanical devices which require maintenance at specific periods. It is recommended, however, that the following performance tests be performed periodically in order to determine if the equipment is performing to its standards. The test equipment listed in table 5-1 is recommended for these tests.

TABLE 5-1. RECOMMENDED TEST EQUIPMENT

TEST EQUIPMENT	SUGGESTED TYPE
Signal generator	Measurements 65B or equivalent
Vacuum-tube voltmeter	Heathkit V6 or equivalent
Audio oscillator	Hewlett-Packard 330B or equivalent
Audio output meter	General Radio 583A or equivalent

5.2 RECEIVER SENSITIVITY.

a. Connect a 600-ohm audio output meter across the receiver audio output, pins 1 and 2 of J3.

b. Connect the signal generator to the antenna jack, J1, as described in section II, paragraph 2.6.1.2, step c. Adjust to the frequency recorded on the control panel.

c. Set the output of the signal generator to 2.9 uv, modulated 30 per cent at 1000 cps and adjust the RF GAIN on the receiver for an output of approximately 100 mw as read on the audio output meter.

d. Remove the modulation and note the drop in audio output. It should be no less than 10 db.

5.3 SELECTIVITY.

a. Remove L104 and connect the signal generator to pin 7 of V2, mixer. Connect a d-c vtvm to AGC test.

b. Adjust the output of the signal generator to 455 kc and increase its output until the agc voltage just begins to rise. Note the signal generator output and the agc voltage.

c. Increase the signal generator output 2 times (6 db) and tune the signal generator below 455 kc until the same agc voltage noted in b. is obtained. Determine the frequency difference between the signal generator frequency and 455 kc. It should be no less than 3.5 kc. Tune the signal generator above 455 kc until the agc voltage obtained in b. is again obtained. The difference frequency should be no more than 4.5 kc.

d. Repeat c. for input of 1000 times, 60 db, and 100,000 times, 80 db. The differences should be approximately 10 kc at 60 db and 20 kc at 80 db.

5.4 AGC CHARACTERISTICS.

a. Replace L104 and connect the signal generator to the antenna terminals as shown in section II, paragraph 2.6.1.2, step c. Connect the audio output meter across the output terminals of the receive

b. Set the signal generator to the receiver frequer with its output at 5 uv, modulated 30 percent at 1000 cps. Adjust the AF GAIN control for an audio output of approximately 100 mw.

Increase the signal generator output to 200,000 uv and record the rise in audio output. It should not exceed 4.5 db anywhere from 5 to 200,000 uv. Again increase the signal generator output to 1.0 volt. The output should be no more than 4.5 db from 0.2 volt to 1.0 volt.

5.5 RECEIVER GAIN.

a. Set the signal generator to the frequency of the receiver and apply 30 per cent modulation at 1000 cps.

b. With the AF GAIN and the RF GAIN set to maximum, increase the output of the signal generator until 500 mw is obtained at the audio output. No more than 3 uv input should be required.

5.6 SQUELCH OPERATION.

a. Connect the signal generator to the antenna jack and adjust to the receiver frequency.

b. Set the BFO-OFF-SQUELCH switch to the SQUELCH position.

c. Increase the output level of the signal generator until the squelch circuit opens (CARRIER light on), and record the signal generator output level. It should not exceed 2.5 uv.

d. Decrease the signal generator output level until the squelch drops out (CARRIER light goes out), and calculate the ratio between squelch pull-in and dropout. It should be not more than 1.4 to 1.

SECTION VI
CORRECTIVE MAINTENANCE

6.1 GENERAL.

This section includes necessary information for trouble shooting inoperative equipment and correcting defects.

Before any attempt is made to repair this receiver, the mechanic should familiarize himself with this book. Test equipment recommended to trouble shoo this equipment is listed in table 6-1.

TABLE 6-1. RECOMMENDED TEST EQUIPMENT

TEST EQUIPMENT	SUGGESTED TYPE
Signal generator	Measurements 65 B or equivalent
Vacuum-tube voltmeter	Heathkit V-6 or equivalent
Oscilloscope	Heathkit 0-9 or equivalent
Audio oscillator	Hewlett-Packard 330B or equivalent
Audio output meter	General Radio 583A or equivalent

6.2 TROUBLE SHOOTING.

TABLE 6-2. PRIMARY VOLTAGE TEST CHART

VOLTAGE SOURCE	TYPICAL VALUE	TEST POINT
Main supply	130 v d-c	Bottom end of R65
	165 v d-c	Junction of R64 and R65
Filament supply	6.3 v a-c	Pin 6, T1
Bias	*-5 v d-c	R63

*Obtained with R-F GAIN at maximum.

6.2.1 POWER SUPPLY.

Since all of the circuits in the receiver are dependent upon the proper supply voltages, these should be checked as follows using a vacuum-tube voltmeter.

6.2.2 TROUBLE LOCATION CHECK.

In order to determine whether the trouble lies in the r-f or audio section of the receiver, a modulated r-f signal of approximately 100 uv amplitude should be

applied to the antenna connector. 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 amplitude is varied, it is an indication of proper agc action. Therefore, the existing trouble in the receiver is evidently in the noise limiter or audio amplifier circuits. In order to locate these troubles, an oscilloscope should be used for tracing the audio signal from the detector through the various audio circuits. The following table is provided to indicate the test points to be checked.

TABLE 6-3

CIRCUIT LOCATION	CHECK POINT
Detector output	Junction of CR1, R37 and R38
Noise limiter output	Junction of C51, R44
Audio driver grid	V10A, pin 2
Audio driver plate	V10A, pin 1
AF GAIN control	R62, V11, pins 1 and 7
Audio amplifier grid	V11, pin 1 and 7
Audio amplifier plate	V11, pin 5

6.3 TROUBLE TRACING DIAGRAMS.

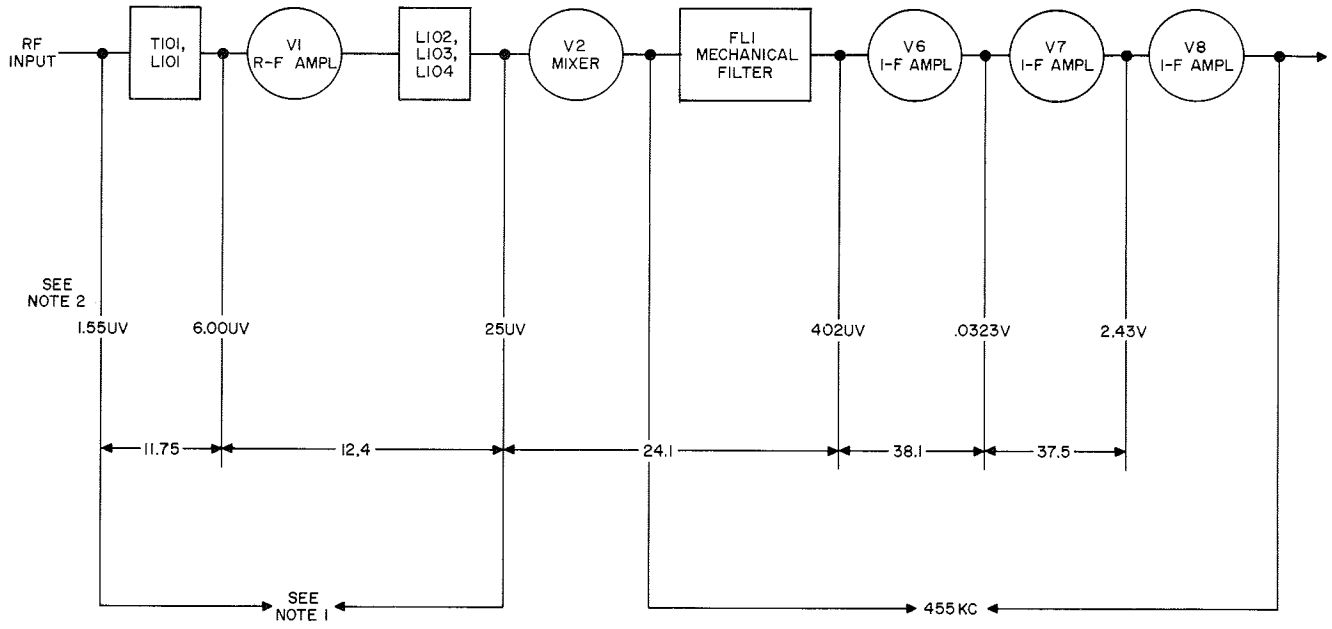
Figure 6-2 comprises a combination voltage, resistance, and signal flow diagram. It will be of use to determine the location of trouble in equipment which is malfunctioning. The gain per stage diagram, figure 6-1, will be a definite aid in locating defective stages. It should be understood that the values on both of these diagrams are approximate. The conditions under which the readings were taken are listed on each diagram.

6.4 TROUBLE SHOOTING PROCEDURES.

In the event that the 51N-7 does not meet the standards established in section II and V and the trouble is not immediately apparent, the following should be of assistance.

TABLE 6-4. HFO, R-F, AND MIXER TROUBLE ISOLATION CHART

SYMPTOMS	PROBABLE CAUSE	REMEDY
1. Defective HFO	1. Misplaced jumper plug	1. See par. 2.6.1.1, procedure f.
	2. Incorrect crystal	2. See par. 2.6.1.1, procedure e.
	3. Detail components	3. Test by measurement and substitution.
2. Defective r-f amplifier output	1. Improperly tuned	1. See par. 2.6.1
	2. Wrong coil set installed	2. See table 1-5.
	3. Detail components	3. Test by measurement and substitution.
3. Improper mixer action	1. Detail components in V3, mixer, circuits	1. Test by measurement and substitution.



NOTES:

1. FREQUENCY SELECTED BY COIL SET AND CRYSTAL USED.
2. SIGNAL (IN MICROVOLTS) INDICATED AT EACH POINT IS THAT REQUIRED TO GIVE OV AT THE DIODE LOAD.

Figure 6-1. Gain per Stage Diagram

TABLE 6-5. I-F, DETECTOR, AND AUDIO TROUBLE ISOLATION CHART

SYMPTOMS	PROBABLE CAUSE	REMEDY
1. I-f action defective	1. Mechanical Filter, FL1 defective	1. Replace FL1.
	2. Detail components	2. Test by measurement and substitution.
2. Incorrect detector action	1. Detail components	1. Test by measurement and substitution.
3. Noise limiter not passing weak signals	1. R-28 defective	1. Replace.
4. First audio defective	1. Detail components	1. Test by measurement and replacement.

TABLE 6-6. SQUELCH CIRCUITS

SYMPTOMS	PROBABLE CAUSE	SUGGESTED REMEDY
1. Improper squelch action		
a. No audio	1. S2 not closing	1. Replace S2.
	2. K1 open	2. Replace K1.
b. No squelch	1. K1 jammed closed	1. Replace K1.
	2. C53 or C56 shorted	2. Replace C53 or C56.
2. Carrier lamp out	1. L2 burned out	1. Replace L2.
	2. Carrier contacts on K1 jammed	2. Replace K1.
3. No audio present, L2 lit.	1. K2 defective	1. Replace K2.

TABLE 6-7. BEAT-FREQUENCY OSCILLATOR

SYMPTOMS	PROBABLE CAUSE	SUGGESTED REMEDY
1. BFO pitch bad	1. BFO out of alignment	1. Correct by adjusting L108.
2. No remote operation	1. S3 open in REMOTE position	1. Replace S3.
	2. CR103 short	2. Replace CR103.
3. No operation	1. Detail components	1. Test by measurement and replacement.

TABLE 6-8. AGC CIRCUITS

SYMPTOMS	PROBABLE CAUSE	SUGGESTED REMEDY
1. No agc action	1. AGC gate, CR3 open	1. Replace CR3.
	2. CR101 open or short	2. Replace CR101.
	3. Detail components defective	3. Test by measurement and substitution.

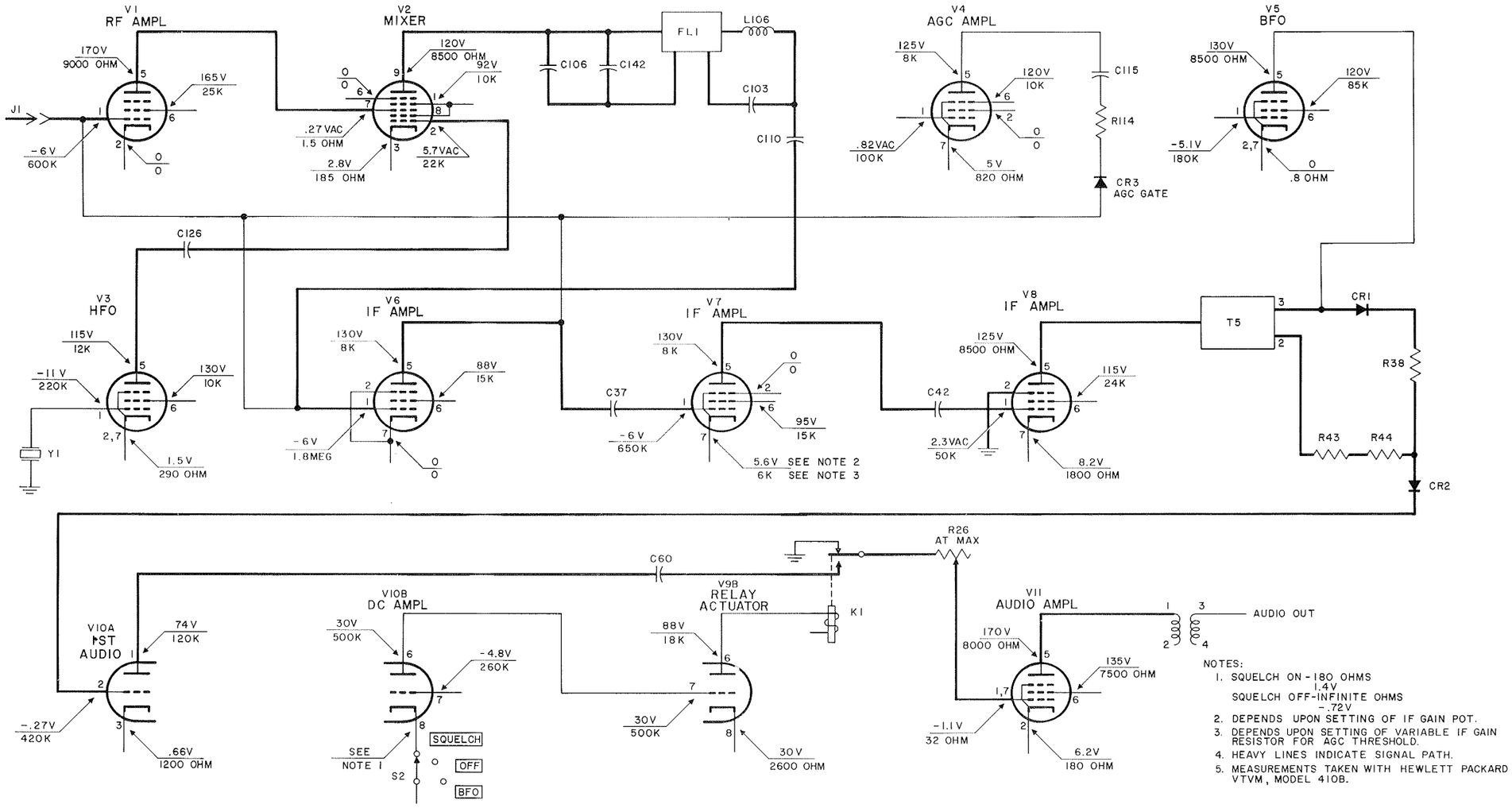


Figure 6-2. Voltage and Resistance Schematic Diagram

SECTION VII
PARTS LIST

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C33	Decoupling	CAPACITOR: ceramic dielectric, 10,000 uuf guaranteed min, h-k dielectric 500 vdcw	913-1188-00
C34	Screen bypass	CAPACITOR: Same as C33	913-1188-00
C35	Decoupling	CAPACITOR: same as C33	913-1188-00
C36	455 kc tank	CAPACITOR: ceramic dielectric, 5 uuf ±1/2 uuf, 500 vdcw	916-0118-00
C37	Coupling	CAPACITOR: mica, 100 uuf ±2%, 500 vdcw	912-0493-00
C38	Decoupling	CAPACITOR: same as C33	913-1188-00
C39	Screen bypass	CAPACITOR: same as C33	913-1188-00
C40	Decoupling	CAPACITOR: same as C33	913-1188-00
C41	455 kc tank	CAPACITOR: tubular ceramic, 33 uuf ±1% 500 vdcw; positive tolerance 60 PPM/°C	916-4010-00
C42	Coupling	CAPACITOR: same as C37	912-0493-00
C43	Cathode bypass	CAPACITOR: same as C33	913-1188-00
C44	Screen bypass	CAPACITOR: same as C33	913-1188-00
C45	Decoupling	CAPACITOR: same as C33	913-1188-00
C46		Not used	
C47	Detector bypass	CAPACITOR: mica, 300 uuf ±2%, 500 vdcw	912-0529-00
C48	Detector bypass	CAPACITOR: same as C47	912-0529-00
C49	Decoupling	CAPACITOR: same as C33	913-1188-00
C50		Not used	
C51	Coupling	CAPACITOR: mica, 2200 uuf ±10%, 500 vdcw	935-4067-00
C52	Decoupling	CAPACITOR: paper dielectric, 100,000 uuf ±10%, 400 vdcw	931-0299-00
C53	Decoupling	CAPACITOR: same as C33	913-1188-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C54	Filter	CAPACITOR: same as C52	931-0299-10
C55	AGC bypass	CAPACITOR: same as C52	931-0299-00
C56	Chatter reduction in K1	CAPACITOR: same as C33	913-1188-00
C57		Not used	
C58		Not used	
C59		Not used	
C60	Coupling	CAPACITOR: mica, 10,000 uuf ±10%; 300 vdcw	935-2117-00
C61	Decoupling	CAPACITOR: mica, 6,800 uuf ±10%; 300 vdcw	935-2110-00
C62	Tuning	CAPACITOR: paper, 0.5 uf ±20% -10%, 200 vdcw	931-0169-00
C63 A, B, C	Filtering	CAPACITOR: dry electrolytic, triple section, first section 20 uf -10% to +40% at 25°C, 400 vdcw; second section 40 uf -10% to +40% at 25°C, 350 vdcw; third section 40 uf -10% to +40% at 25°C, 350 vdcw	183-1126-00
C64	B+ bypass	CAPACITOR: same as C33	913-1188-00
C65	455 kc tank	CAPACITOR: ceramic dielectric, 20 uuf ±2%, neg temp coef 0 (tolerance +60 uuf/uf/°C), 500 vdcw	916-4187-00
C101	AGC filter	CAPACITOR: same as C33	913-1188-00
C102	Screen bypass	CAPACITOR: same as C33	913-1188-00
C103	B+ filter	CAPACITOR: same as C33	913-1188-00
C104	V2 cathode bypass	CAPACITOR: same as C33	913-1188-00
C105	B+ filter	CAPACITOR: same as C33	913-1188-00
C106	Decoupling	CAPACITOR: same as C37	912-0493-00
C107	B+ filter	CAPACITOR: same as C33	913-1188-00
C108	HFO coupling	CAPACITOR: mica, 100 uuf ±10%, 500 vdcw	912-0495-00
**C109	Tuning	CAPACITOR: mica, 27 uuf ±2%, 500 vdcw	912-0451-00
C110	Coupling	CAPACITOR: mica, 470 uuf ±10%, 300 vdcw	912-0543-00

** Final values determined in test dept

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C111	Cathode bypass	CAPACITOR: same as C33	913-1188-00
C112	Screen bypass	CAPACITOR: same as C33	913-1188-00
C113	Filter	CAPACITOR: mica, 47 uuf ±2%; 500 vdcw	912-0469-00
C114	Decoupling	CAPACITOR: same as C33	913-1188-00
C115	Coupling	CAPACITOR: same as C110	912-0543-00
C116	Filtering	CAPACITOR: ceramic dielectric, 10,000 uuf guaranteed min; h-k dielectric 500 vdcw	913-1188-00
C117		Not used	
C118	Oscillator tuning	CAPACITOR: mica, 510 uuf ±2%; 300 vdcw	912-0544-00
C119	Oscillator tuning	CAPACITOR: mica, 240 uuf ±2%; 500 vdcw	912-0520-00
C120	Coupling	CAPACITOR: same as C113	912-0469-00
C121	Decoupling	CAPACITOR: same as C33	913-1188-00
C122	Screen bypass	CAPACITOR: same as C33	913-1188-00
C123	Decoupling	CAPACITOR: same as C33	913-1188-00
C124	Tuning	CAPACITOR: same as C113	912-0469-00
C125	Coupling	CAPACITOR: tubular ceramic, 56 uuf ±10%, 500 vdcw; temp coef 330 PPM/°C positive tolerance 180 PPM/°C	916-4945-00
C126	High freq coupling	CAPACITOR: ceramic, 3.0 uuf ±1/4 uuf, 500 vdcw	916-0144-00
C127	High-pass filter tank	CAPACITOR: ceramic, rotary type, single section; 8.0 to 75.0 uuf, 350 vdcw	917-1075-00
C128	Cathode-grid feedback	CAPACITOR: same as C127	917-1075-00
C129	Cathode-phase shift	CAPACITOR: mica dielectric, 270 uuf ±5%, 500 vdcw, temp coef PPM/°C	912-0524-00
C130	B+ bypass	CAPACITOR: same as C33	913-1188-00
C131	B+ bypass	CAPACITOR: same as C33	913-1188-00
C132	Cathode bypass	CAPACITOR: same as C33	913-1188-00
C133	Low-frequency coupling	CAPACITOR: same as C110	912-0543-00
C134	Coupling	CAPACITOR: mica, 27 uuf ±10%, 500 vdcw	912-0453-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
C135		NOT USED	
C136	B+ bypass	CAPACITOR: paper dielectric, 100,000 uuf ±10%, 400 vdcw	931-0299-00
C137	B+ line filter	CAPACITOR: ceramic dielectric, 1000 uuf ±20%, 500 vdcw	913-0371-00
C138	AGC line filter	CAPACITOR: same as C137	913-0371-00
C139	Filament line filter	CAPACITOR: same as C137	913-0371-00
C140	Filament line filter	CAPACITOR: same as C137	913-0371-00
C141	B+ line filter	CAPACITOR: same as C137	913-0371-00
**C142	Tuning	CAPACITOR: mica, 20 uuf ±5%, 500 vdcw	912-0443-00
**C142	Tuning	CAPACITOR: mica, 15 uuf ±5%, 500 vdcw	912-0437-00
**C142	Tuning	CAPACITOR: mica, 24 uuf ±5%, 500 vdcw	912-0449-00
**C142	Tuning	CAPACITOR: mica, 10 uuf ±5%, 500 vdcw	912-0431-00
C143	Decoupling	CAPACITOR: ceramic dielectric, 2000 uuf +100% -20%, 500 vdcw	913-2142-00
C144	Filtering	CAPACITOR: aluminum electrolytic, 50 uf -15%, +100%, measured at 25°C and 120 cps; 25 vdcw	183-1158-00
C145	Coupling	CAPACITOR: mica; 75 uuf ±2%, 500 vdcw	912-0484-00
C146	BFO line filter	CAPACITOR: ceramic dielectric, 1000 uuf ±20%, 500 vdcw	913-0371-00
CR1	Detector	SEMICONDUCTOR DEVICE, DIODE: silicon, 0.132 in. thk by 0.200 w by 0.200 lg	353-0170-00
CR2	Series limiter	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-0170-00
CR3	AGC gate	SEMICONDUCTOR DEVICE, DIODE: same as CR1	353-0170-00
CR4	Power rectifier	RECTIFIER, METALLIC: selenium full wave, single phase, center tap; 175 v input rating; 100 ma dc current output rating; 2 stacks; hole mounting	373-0179-00
CR5	Power rectifier	RECTIFIER, METALLIC: same as CR4	353-0179-00

**Final values determined in test dept

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
CR101	AGC rectifier	SEMICONDUCTOR DEVICE, DIODE: silicon; 0.130 in. dia by 0.265 in. lg; wire lead type hermetically sealed	353-0205-00
CR102	BFO frequency control	SEMICONDUCTOR DEVICE, DIODE: germanium	353-0147-00
CR103	BFO biasing	SEMICONDUCTOR DEVICE, DIODE: same as C102	353-0147-00
E1		SHIELD, ELECTRON TUBE: 7 pin miniature, cylindrical, brass, cadmium plated, 0.930 in. dia by 0.810 in. by 1-3/4 in.	541-6551-003
E2		SHIELD, ELECTRON TUBE: 9 pin noval; cylindrical w/flared end; brass; 0.950 in. by 1.065 in. by 2-3/8 in.; mounts directly on the tube; incl copper insert	541-6555-003
E3		SHIELD, ELECTRON TUBE: 7 miniature cylindrical w/flared end; closed top; brass; 0.810 in. by 0.930 in. by 1-3/8 in.; mounts directly on tube; incl copper insert	541-6550-003
E4		SHIELD, ELECTRON TUBE: same as E1	541-6551-003
E5		SHIELD, ELECTRON TUBE SOCKET: aluminum, for 7 pin miniature printed circuit tube socket	141-0332-00
E6		SHIELD, ELECTRON TUBE SOCKET: aluminum, for 7 pin miniature printed circuit tube socket	141-0332-00
E7		SHIELD, ELECTRON TUBE SOCKET: same as E6	141-0332-00
E8		SHIELD, ELECTRON TUBE SOCKET: same as E6	141-0332-00
E9	Lens cap	LIGHT INDICATOR: for use with T-3-1/4 miniature bayonet base bulb, amber lens	262-0095-00
E10	Lens cap	LIGHT INDICATOR: for use with T-3-1/4 miniature bayonet base bulb, green lens	262-0096-00
F1	Power fuse	FUSE, CARTRIDGE: cylindrical, glass body, brass, nickel or bright alloy plated 0.750 amp	264-4270-00
FL1	Mechanical filter	FILTER, MECHANICAL: 455 kc center frequency, bandwidth 4.0 kc at 6 db, 8.5 kc at 60 db, terminal impedance 17,000 ohms, resonating capacity 130 uuf	526-9303-00

SECTION VII
Parts List

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
I1	Power indicator	LAMP, incandescent: 6.3 v, 0.15 amp; bulb T-3-1/4 clear; miniature bayonet base; tungsten filament, burn any position	262-3240-00
I2	Carrier indicator	LAMP: same as I1	262-3240-00
J1	Antenna connector	CONNECTOR, receptacle: 2 round female contacts; straight	357-9010-00
J3	Audio and remote control jack	CONNECTOR, receptacle: 15 polarized female contact; straight	372-1081-00
J4	Power input	CONNECTOR, receptacle: 2 rectangular male nonpolarized contacts, straight	368-3700-00
J5	Phone jack	JACK, telephone: for 2 conductor plug 1/4 in. dia barrel	358-1080-00
K1	Cut-out relay	RELAY, armature: contact arrangement 2C, 1A; contact rating 1A-115 v at 1 amp dc 2C-audio; audio gold alloy; single winding, 60 v dc m pull-in v 4.0 ma dc, drop out v 1.0 ma dc, 6.6 ma dc max 10,000 ohms ±10%; insulator coil, solder type terminal	974-0011-00
L11	Impedance coupling	COIL, RADIO FREQUENCY: universal wound, 3 or 4 pi; 5.0 uh; no.40 AWG SSE insulated copper wire; carbonyl form	240-0312-00
L12	Impedance coupling	COIL, RADIO FREQUENCY: three sections, universal wound, approx 225 turns per section; no.40 AWG SSE copper wire; 2 mh ±2% at 350 kc, 100 megohm	240-0516-00
*L101, L102, L103, and L104	Band selection	COIL KIT, plug-in, selects Band 1, 2 to 4 mc or COIL KIT, plug-in, selects Band 2, 4 to 8 mc or COIL KIT, plug-in, selects Band 3, 8 to 16 mc or COIL KIT, plug-in, selects Band 4, 16 to 24 mc	541-7576-004 541-7577-004 541-7578-004 541-7579-004
L106	455 kc tank	COIL, RADIO FREQUENCY: three sections, universal wound, approx 225 turns per section; no. 40 AWG SSE copper wire; 2 mh ±2% at 350 kc, 100 megohms	240-0516-00
L107	AGC amp. plate tank	COIL, RADIO FREQUENCY: same as L106	240-0516-00

* These items vary according to the coil kits listed.

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
L108	Oscillator tuning	COIL, RADIO FREQUENCY: 136 turns tapped at 35 turns from start, 14.0 ft of 9 x 41 SSE LITZ wire, 0.3 ft of No. 18 wire, resonate after plating at 455 kc ceramic powder filled core	541-7587-002
L109	V5 plate tank	COIL, RADIO FREQUENCY: same as L106	240-0516-00
L110	High-pass filter tank	COIL, RADIO FREQUENCY: single layer wound; enamel or formvar insulation, 1.5 inductance, 800 ma max current, mineral filled phenolic coil form	240-0063-00
L111	V3 cathode choke	COIL, RADIO FREQUENCY: choke; single wound, 3 pie universal wound, unshielded; 2.0 mh ±10% at 350 kc; ea pie 225 turns of No. 40 AWG copper wire	240-0084-00
L112	B+ filter	COIL, RADIO FREQUENCY: single wound, single layer solenoid, insulated copper wire, 39 uh ±10%, 500 ma dc, 2 ohm dc resistance, powered iron form	240-0171-00
P1	Antenna connector	CONNECTOR PLUG: two rd male contacts; one mating end, for use with cable	357-9009-00
P3	Output and remote operation	CONNECTOR, PLUG: 15 prong male connector; three 0.093 in. dia brass contacts, 12 0.040 in. dia brass contacts wall or cable mounting	372-1079-00
P4	Power connector	CONNECTOR, PLUG: two rectangular female polarized contacts	372-9001-00
R21	AGC filter decoupling	RESISTOR: comp, 0.10 megohm ±10%, 1/2 watt	745-1436-00
R22	AGC filter decoupling	RESISTOR: same as R21	745-1436-00
R23	Grid return	RESISTOR: same as R21	745-1436-00
R24	V6 screen	RESISTOR: comp, 15,000 ohms ±10%, 1/2 watt	745-1401-00
R25	V6 screen	RESISTOR: comp, 39,000 ohms ±10%, 1 watt	745-3419-00
R26	B+ dropping	RESISTOR: comp, 1000 ohms ±10%, 1/2 w	745-1352-00
R27	AGC dropping	RESISTOR: comp, 47,000 ohms ±10% 1/2 watt	745-1422-00
R28	V7 screen	RESISTOR: same as R25	745-3419-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R29	V7 screen	RESISTOR: same as R24	745-1401-00
R30	B+ dropping	RESISTOR: same as R26	745-1352-00
R31	V8 to R10	RESISTOR: same as R27	745-1422-00
R32	V8 cathode	RESISTOR: comp, 1800 ohms ±10% 1/2 watt	745-1363-00
R33	V8 screen	RESISTOR: same as R24	745-1401-00
R34	B+ dropping	RESISTOR: same as R26	745-1352-00
R35	AGC decoupling	RESISTOR: comp, 0.47 megohm ±10%, 1/2 watt	745-1464-00
R36	Diode load	RESISTOR: comp, 10,000 ohms ±10%, 1/2 watt	745-1394-00
R37	Diode load	RESISTOR: same as R36	745-1394-00
R38	Diode load	RESISTOR: comp, 22,000 ohms ±10%, 1/2 watt	745-1408-00
R39	Biasing	RESISTOR: comp, 4700 ohms ±10% 1/2 watt	745-1380-00
R40	Biasing	RESISTOR: same as R21	745-1436-00
R41	Coupling	RESISTOR: same as R21	745-1436-00
R42	Diode load	RESISTOR: comp, 0.22 megohm ±10%, 1/2 w	745-1450-00
R43	Diode load	RESISTOR: comp, 0.27 megohm ±10%, 1/2 w	745-1454-00
R44	Diode load	RESISTOR: same as R43	745-1454-00
R45	Coupling	RESISTOR: same as R21	745-1436-00
R46	RF gain	RESISTOR: variable, 0.10 megohm ±20%, 1/2 watt	376-4010-00
R47	Voltage divider	RESISTOR: same as R36	745-1394-00
R48	Voltage divider	RESISTOR: same as R35	745-1464-00
R49	V10 grid	RESISTOR: same as R21	745-1436-00
R50	V10A grid	RESISTOR: comp, 0.39 megohm ±10%, 1/2 watt	745-1461-00
R51	V10A cathode	RESISTOR: comp, 1200 ohms ±10%, 1/2 watt	745-1356-00
R52	V9B grid	RESISTOR: same as R35	745-1464-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R53	B+ dropping	RESISTOR: comp, 15,000 ohm ±10%, 2 watts	745-5701-00
R54	Voltage divider	RESISTOR: comp, 2700 ohms ±10%	745-3370-00
R55	Voltage divider	RESISTOR: comp, 180 ohms ±10%, 1/2 watt	745-1321-00
R56		Not used	
R57		Not used	
R58		Not used	
R59	B+ dropping	RESISTOR: same as R21	745-1436-00
R60		Not used	
R61	V11 cathode	RESISTOR: same as R55	745-1321-00
R62	AF gain	RESISTOR: variable comp, 0.10 megohm ±20%, 1/2 watt	376-3010-00
R63	Voltage divider	RESISTOR: comp, 180 ohms ±10%, 2 watts	745-5321-00
R64	Voltage divider	RESISTOR: wire wound, 500 ohms ±5%, 10 watts	747-0537-00
R65	Voltage divider	RESISTOR: same as R64	747-0537-00
R101	Decoupling	RESISTOR: same as R36	745-1394-00
R102	V1 screen	RESISTOR: same as R24	745-1401-00
R103	B+ dropping	RESISTOR: same as R26	745-1352-00
R104	V2 cathode	RESISTOR: same as R55	745-1321-00
R105	V2 grid	RESISTOR: same as R38	745-1408-00
R106	B+ dropping	RESISTOR: comp, 2200 ohms ±10%, 1/2 watt	745-1366-00
R107	B+ dropping	RESISTOR: same as R26	745-1352-00
R108	Cathode bias	RESISTOR: comp, 820 ohms ±10%, 1/4 watt	745-0349-00
R109	B+ dropping	RESISTOR: same as R106	745-1366-00
R110	B+ dropping	RESISTOR: same as R26	745-1352-00
R111	Diode load	RESISTOR: comp, 33000 ohms ±10%, 1/2 watt	745-1415-00
R112	Decoupling	RESISTOR: same as R36	745-1394-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R113	Plate load	RESISTOR: comp, 0.33 megohm ±10%, 1/2 watt	745-1457-00
R114	Diode load	RESISTOR: same as R21	745-1436-00
R115	V5 grid	RESISTOR: same as R42	745-1450-00
R116	B+ dropping	RESISTOR: comp, 68,000 ohms ±10%, 1/2 watt	745-1429-00
R117	B+ dropping	RESISTOR: same as R26	745-1352-00
R118	V3 cathode	RESISTOR: comp, 220 ohm ±10%, 1/2 watt	745-1324-00
R119	Screen dropping	RESISTOR: same as R106	745-1366-00
R120	Dropping	RESISTOR: same as R26	745-1352-00
R121	Plate dropping	RESISTOR: comp, 3300 ohms ±10%, 1/2 watt	745-1373-00
R122	IF gain	RESISTOR: variable, 10,000 ohms ±20%, 1/2 watt	380-6277-00
R123	RF isolation	RESISTOR: comp, 1.0 megohm ±10%, 1/2 watt	745-1478-00
R124	RF isolation	RESISTOR: same as R123	745-1478-00
R125	V3 grid load	RESISTOR: same as R42	745-1450-00
R126	Grid load	RESISTOR: same as R21	745-1436-00
R127		Not used	
R128	B+ dropping	RESISTOR: comp, 1.5 megohm ±10%, 1/2 watt	745-1485-00
R129		Not used	
R130	Diode load	RESISTOR: same as R36	745-1394-00
R131	BFO pitch control	RESISTOR: variable, 10,000 ohms ±20%, 2 watts; includes (S-3-spdt switch)	380-0468-00
R132	Voltage dropping	RESISTOR: comp; 56000 ohms ±10%, 1 watt	745-3426-00
R133	Voltage dropping	RESISTOR: same as R38	745-1408-00
R147	Plate load	RESISTOR: same as R24	745-1401-00
R148	Minimum bias	RESISTOR: comp, 560 ohms ±10%, 1/2 watt	745-1342-00
S1	Power switch	SWITCH, toggle: dpst; resistive load 5 amps at 125 v, 2 amp at 250 v, inductive load ea pole 3 amps at 125 v, 1.5 amp at 250 v; metal case	266-3043-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S2	BFO-OFF-SQUELCH	SWITCH, toggle: dpdt; 30 amp continuous current corring capacity; metal case	266-3061-00
S3	Remote BFO switch	SWITCH: spdt part of resistor R131	380-0468-00
T1	Power transformer	TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: steel case, hermetically sealed, fully enclosed frame; two primaries 115 v, connected in series 230 v input; 50 to 60 cycles; single phase; secondaries 205 v, 185 v, 6.3 v; compound filled; 3-7/8 in. h. 3-9/16 in. lg by 3-1/16 in. w; solder lug terminals; stud or flange mounted	667-0177-00
T2	Audio transformer	TRANSFORMER, AUDIO FREQUENCY: plate coupling type; primary impedance, No. one 600 ohms, secondary impedance No. two 4.0 ohms; current rating 35 ma primary, 0 secondary; fully enclosed frame, steel case, hermetically sealed; 2-7/16 in. h, 1-15/16 in. lg, 1-13/16 in. w; stud or flange mounted	667-0178-00
T5	Interstage coupling	TRANSFORMER, INTERMEDIATE FREQUENCY: 455 kc frequency interstage, unshielded; 23/32 in. lg, 23/32 in. w, 7/8 in. h, stud mounted by two 2-56NC-2A studs spaced 0.687 in. c to c diagonally 4 terminals pin type	678-0816-00
T101	Antenna coil	PART OF L101, L102, L103, and L104 coil kits	
V1	RF amplifier	TUBE, electron: 6DC6	255-0226-00
V2	Mixer	TUBE, electron: 6BA7	255-0209-00
V3	High-frequency oscillator	TUBE, electron: 6AK5	257-0040-00
V4	AGC amplifier	TUBE, electron: 6BA6	255-0185-00
V5	Beat-frequency oscillator	TUBE, electron: 6AK5	257-0040-00
V6	IF amplifier	TUBE, electron: 6BA6	255-0185-00
V7	IF amplifier	TUBE, electron: 6BA6	255-0185-00
V8	IF amplifier	TUBE, electron: 6AK6	257-0041-00
V9	Relay actuator	TUBE, electron: 12AU7	255-0199-00
V10	Audio and d-c amplifier	TUBE, electron: 12AX7	255-0201-00
V11	Audio amplifier	TUBE, electron: 6AQ5	255-0195-00
XF1	Primary fuse holder	FUSE, HOLDER: for 3 AG fuses, 1-1/4 by 1/4 in; bakelite, 1/16 in. locking slug included	265-1002-00

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
XI1	Indicator light socket	LIGHT, indicator: w/o lens; for miniature bayonet base, T3-1/4 bulb; 6 to 8 v; open shell; cadmium plated metal shell	262-1260-00
XI2	Indicator light socket	LIGHT: same as XI-1	262-1260-00
XV1	V1 socket	SOCKET, ELECTRON TUBE: 7 pin miniature tube socket; bayonet type mtg	220-1111-00
XV2	V2 socket	SOCKET, ELECTRON TUBE: 9 contact miniature tube socket; bayonet type mtg	220-1103-00
XV3	V3 socket	SOCKET, ELECTRON TUBE: same as XV1	220-1111-00
XV4	V4 socket	SOCKET, ELECTRON TUBE: same as XV1	220-1111-00
XV5	V5 socket	SOCKET, ELECTRON TUBE: same as XV1	220-1111-00
XV6	V6 socket	SOCKET, ELECTRON TUBE: 7 pins miniature printed circuit type; clinch type mtg	220-0935-00
XV7	V7 socket	SOCKET, ELECTRON TUBE: 7 pin miniature printed circuit type; clinch type mtg	220-0937-00
XV8	V8 socket	SOCKET, ELECTRON TUBE: 7 pin miniature printed circuit type; clinch type mtg	220-0934-00
XV9	V9 socket	SOCKET, ELECTRON TUBE: 9 pin miniature printed circuit clinch type mtg	220-0919-00
XV10	V10 socket	SOCKET, ELECTRON TUBE: same as XV9	220-0919-00
XV11	V11 socket	SOCKET, ELECTRON TUBE: same as XV8	220-0934-00
XY1	Crystal Y1 socket	SOCKET, CRYSTAL: 2 regularly spaced contact positions, 0.486 in. c to c each contact, 0.243 in. from center; cadmium plated phosphor bronze or beryllium	292-0082-00

SECTION VIII
ILLUSTRATIONS

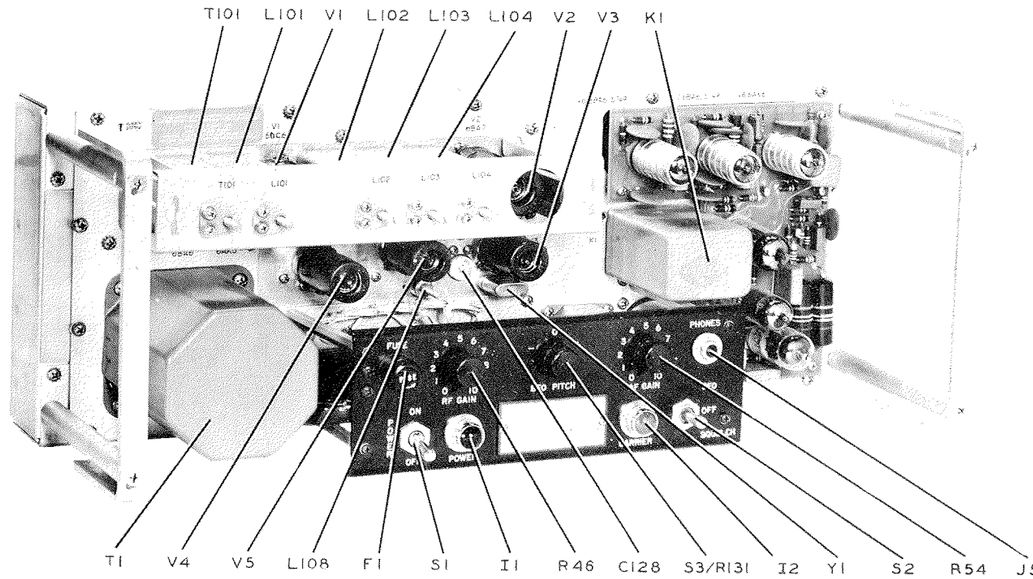


Figure 8-1. 51N-7 Radio Receiver, Cover Removed

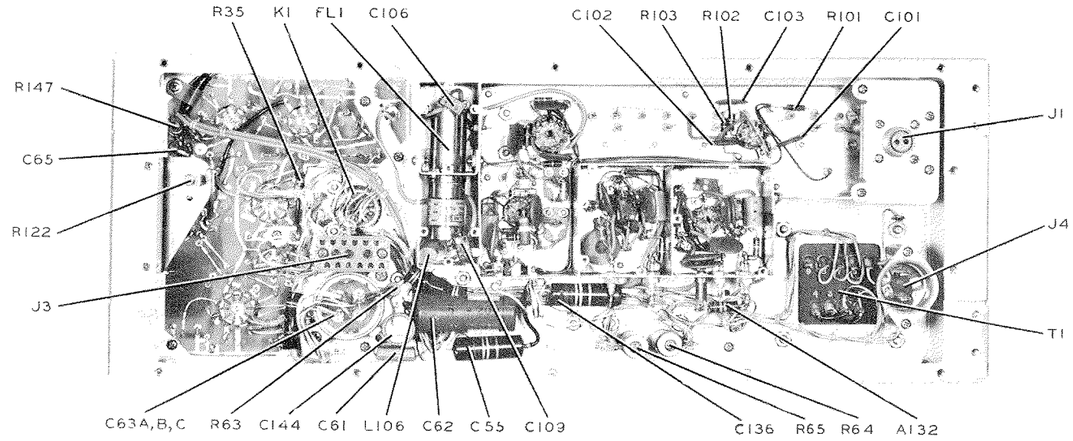


Figure 8-2. 51N-7 Radio Receiver, Bottom View, Covers Removed

SECTION VIII
Illustrations

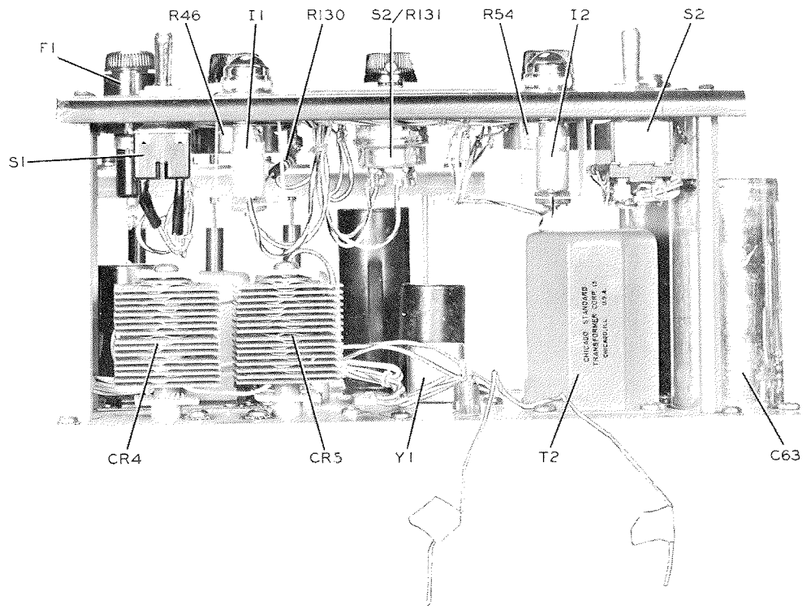


Figure 8-3. 51N-7 Radio Receiver Control Panel, Bottom View

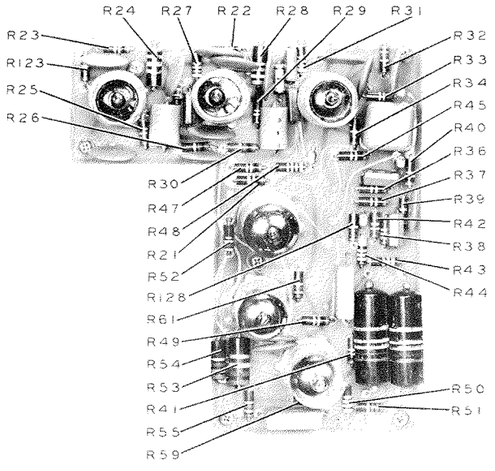


Figure 8-4. Printed Circuit Board, Resistor Location

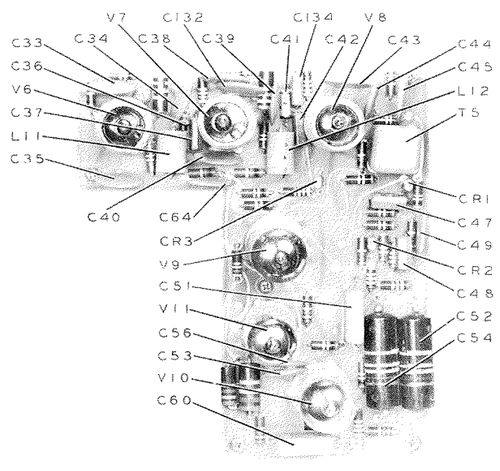


Figure 8-5. Printed Circuit Board, Component Location

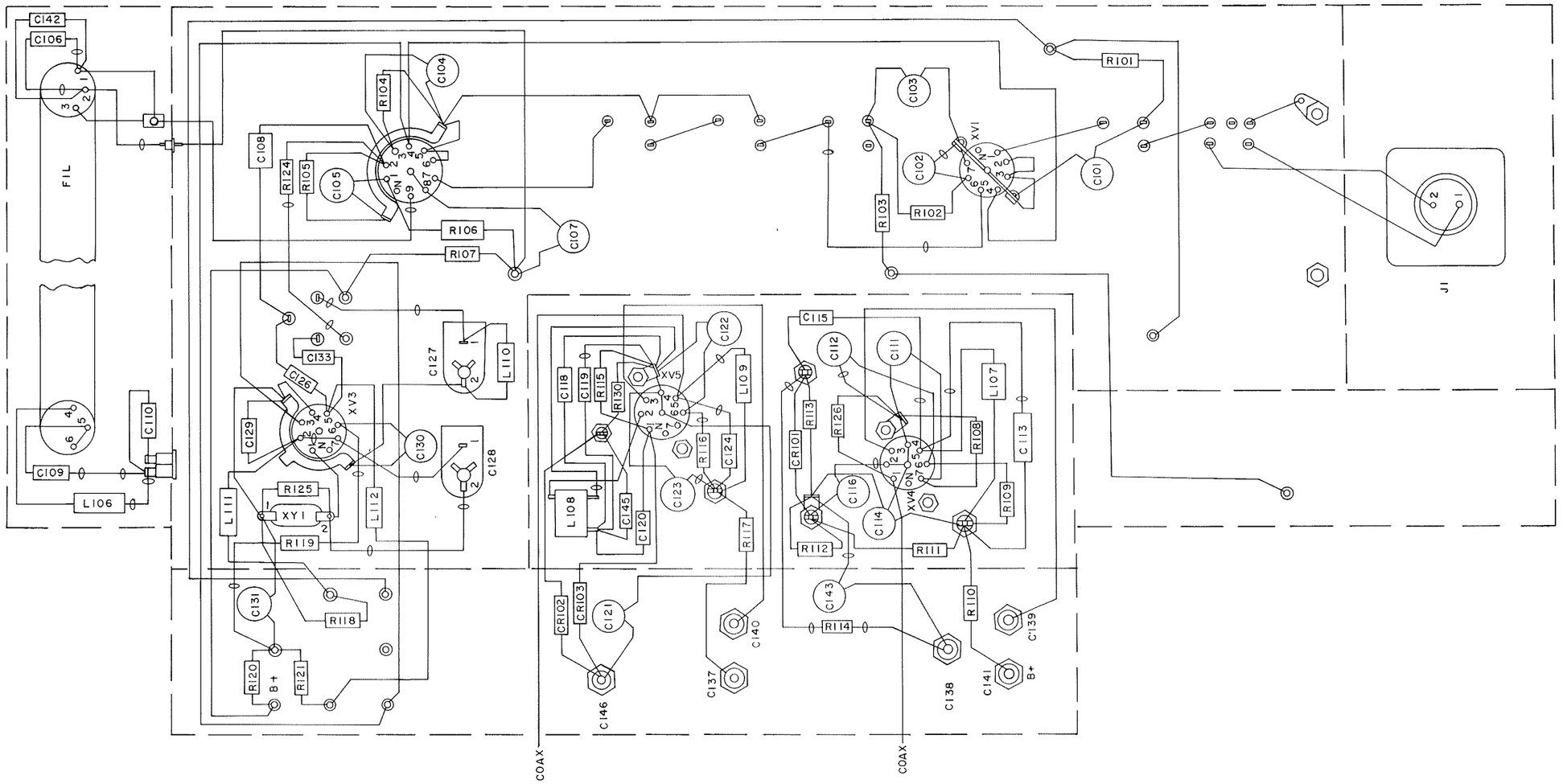
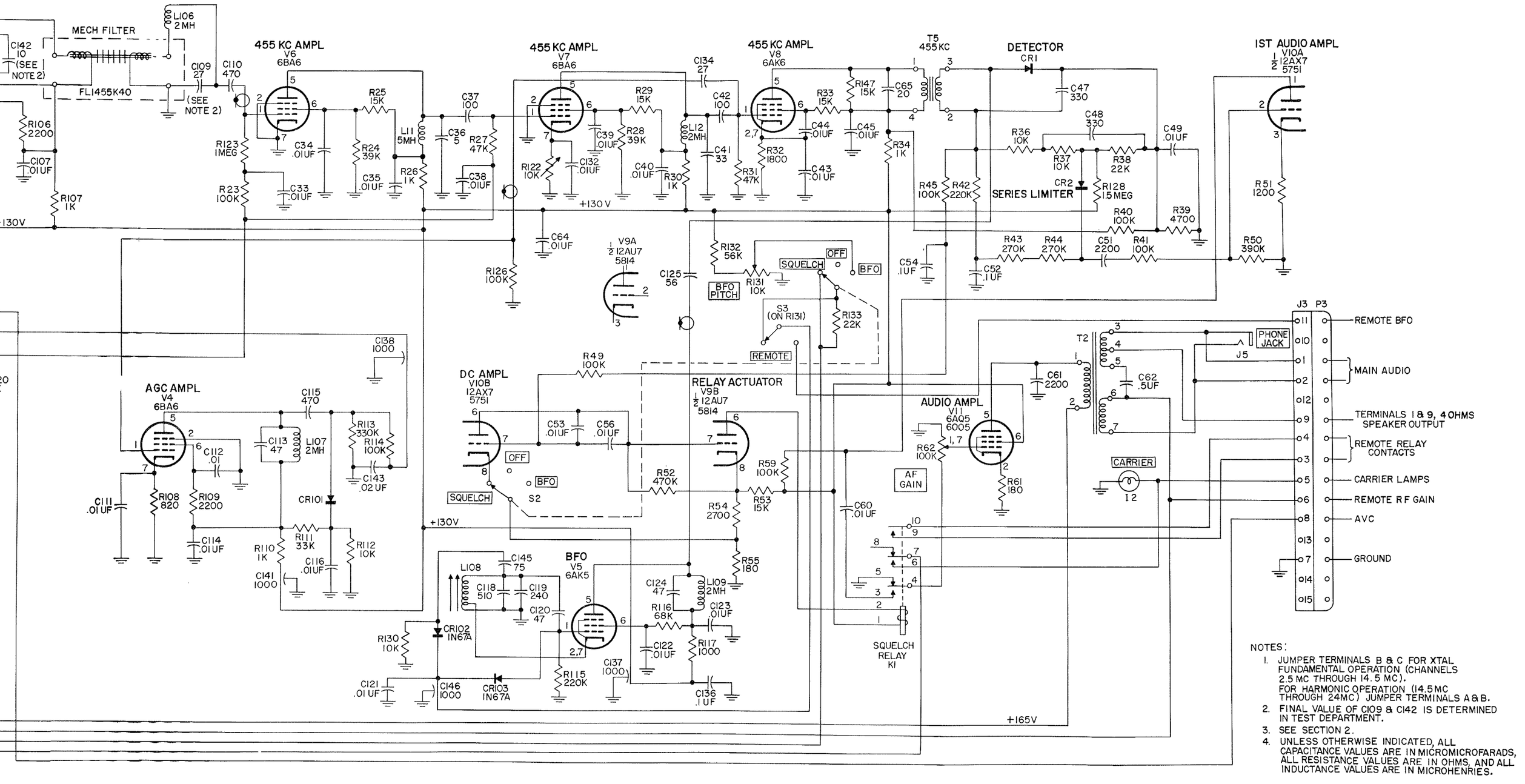


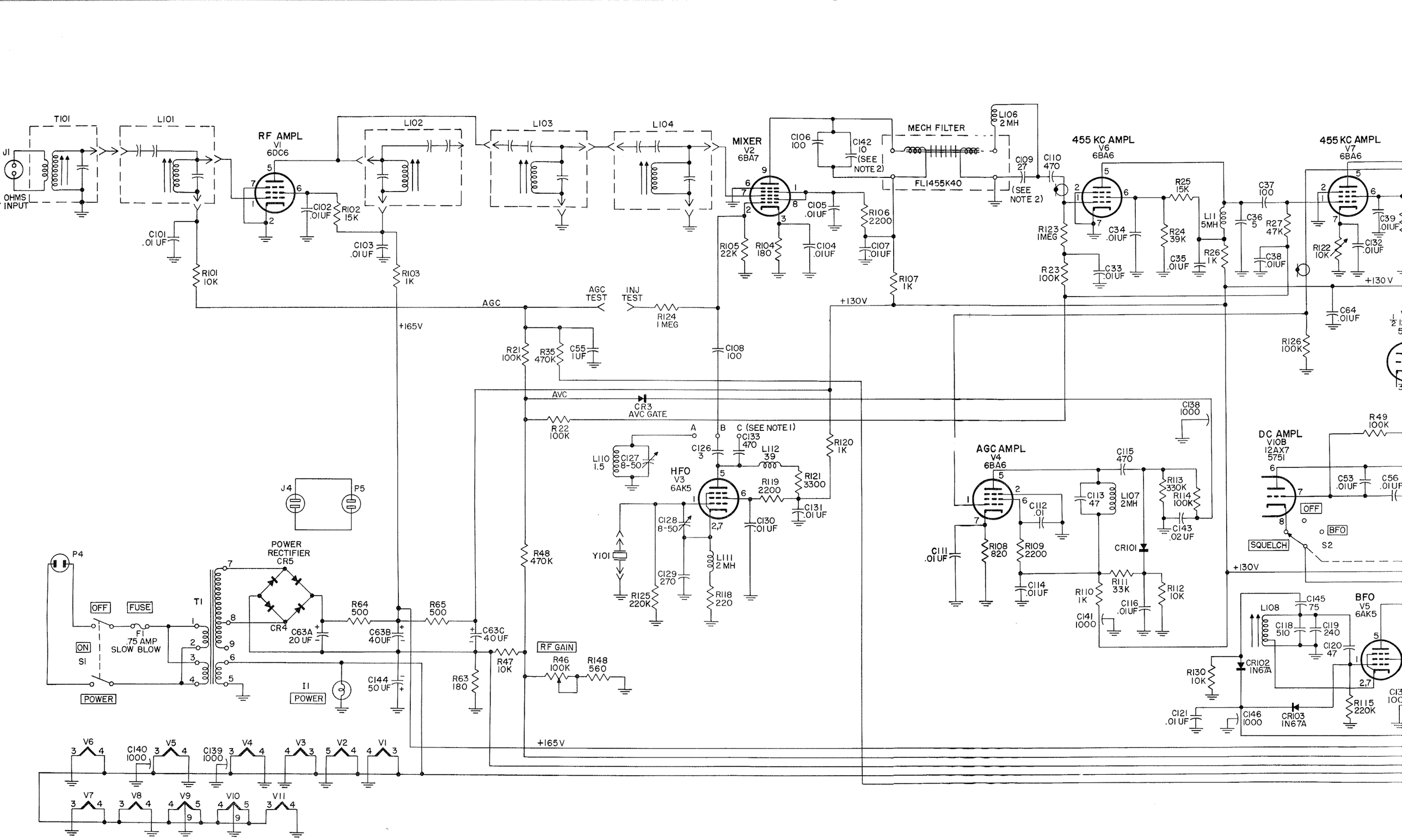
Figure 8-6. R-F Chassis, Component Location Diagram

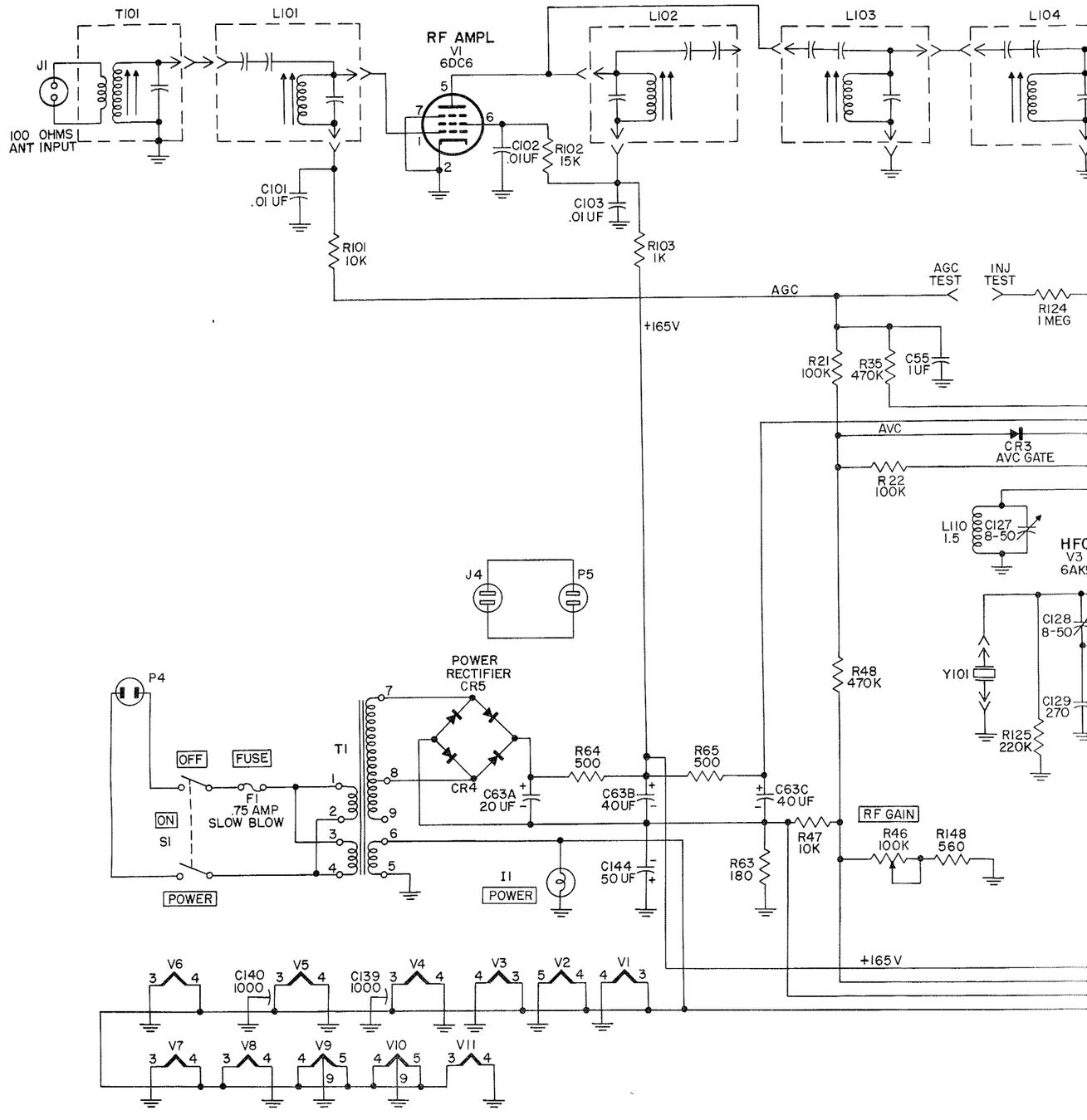


NOTES:

1. JUMPER TERMINALS B & C FOR XTAL FUNDAMENTAL OPERATION (CHANNELS 2.5 MC THROUGH 14.5 MC).
   FOR HARMONIC OPERATION (14.5 MC THROUGH 24MC) JUMPER TERMINALS A & B.
2. FINAL VALUE OF C109 & C142 IS DETERMINED IN TEST DEPARTMENT.
3. SEE SECTION 2.
4. UNLESS OTHERWISE INDICATED, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ALL RESISTANCE VALUES ARE IN OHMS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

Figure 8-7. 51N-7 Radio Receiver, Over-all Schematic Diagram


T101
L101
L102
L103
L104
J1
OHMS INPUT
RF AMPL
V1
6DC6
C101 .01 UF
R101 10K
C102 .01UF
R102 15K
C103 .01UF
R103 1K
MIXER
V2
6BA7
C106 100
C142 10 (SEE NOTE 2)
MECH FILTER
L106 2 MH
FL1455K40
C109 27
C110 470
(SEE NOTE 2)
C105 .01UF
R106 2200
R105 22K
R104 180
C104 .01UF
C107 .01UF
R107 1K
455 KC AMPL
V6
6BA6
R123 1MEG
R23 100K
C34 .01UF
C33 .01UF
R25 15K
R24 39K
C35 .01UF
L11 5MH
R26 1K
C36 5
C37 100
R27 47K
C38 .01UF
455 KC AMPL
V7
6BA6
C39 .01UF
R22 10K
C132 .01UF
+130 V
C64 .01UF
R126 100K
AGC
AGC TEST
INJ TEST
R124 1 MEG
+165V
+130V
R21 100K
R35 470K
C55 1UF
C108 100
AVC
CR3
AVC GATE
R22 100K
A
B
C (SEE NOTE 1)
C133 470
C126 3
L112 39
R120 1K
L110 1.5
C127 8-50
HFO
V3
6AK5
R119 2200
R121 3300
C131 .01UF
C128 8-50
C130 .01UF
2,7
L111 2 MH
C129 270
R125 220K
R118 220
Y101
R48 470K
C138 1000
AGC AMPL
V4
6BA6
C115 470
C113 47
L107 2MH
R113 330K
R114 100K
C143 .02 UF
C112 .01
C111 .01UF
R108 820
R109 2200
C114 .01UF
CR101
R111 33K
R110 1K
C116 .01UF
C141 1000
R112 10K
DC AMPL
V10B
12AX7
5751
R49 100K
C53 .01UF
C56 .01UF
OFF
BFO
SQUELCH
S2
+130V
BFO
V5
6AK5
L108
C145 75
C118 510
C119 240
C120 47
CR102 1N67A
R130 10K
C121 .01 UF
C146 1000
CR103 1N67A
R115 220K
J4
P5
POWER
P4
OFF
FUSE
F1 .75 AMP SLOW BLOW
ON
S1
POWER
T1
POWER RECTIFIER CR5
CR4
C63A 20 UF
C63B 40UF
C63C 40 UF
R64 500
R65 500
R63 180
R47 10K
RF GAIN
R46 100K
R148 560
I1
POWER
C144 50 UF
+165V
V6
V5
V4
V3
V2
V1
C140 1000
C139 1000
V7
V8
V9
V10
V11


T101
L101
L102
L103
L104
J1
100 OHMS
ANT INPUT
RF AMPL
V1
6DC6
C101
.01 UF
R101
10K
C102
.01UF
R102
15K
C103
.01 UF
R103
1K
AGC
AGC TEST
INJ TEST
R124
1 MEG
+165V
R21
100K
R35
470K
C55
1UF
AVC
CR3
AVC GATE
R22
100K
L110
1.5
C127
8-50
C128
8-50
C129
270
R125
220K
Y101
R48
470K
J4
P5
P4
POWER
RECTIFIER
CR5
CR4
T1
OFF
FUSE
F1
.75 AMP
SLOW BLOW
ON
S1
POWER
I1
POWER
C63A
20 UF
R64
500
R65
500
C63B
40UF
C63C
40 UF
C144
50 UF
R63
180
R47
10K
RF GAIN
R46
100K
R148
560
+165 V
V6
C140
1000
V5
C139
1000
V4
V3
V2
V1
V7
V8
V9
V10
V11

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		
LETTER	TYPE OF WIRE	FAMILY USUALLY FOUND IN
A	Cotton Braid Over Plastic (Formerly AN-J-C-48)	440 Plain 443 Shielded
B	Busbar, Round Tinned	421
C	MIL-W-16878 Type B (#20 and Larger) (600 Volts)	439
D	Miniature Wire, MIL-W-16878 Type B (#22 & Smaller)	439-7000 Series
E		
F	Extra Flexible Varnished Cambric	423
G		
H	Kel-F (Monochloro-trifluoroethylene)	422
J		
K	Neon Sign Cable (15,000 Volts)	423 0004 00
L	Silicone	425 0942 00
M		
N	Single Conductor Stranded (Not Rubber Covered)	422
P	Single Conductor Stranded (Rubber Covered)	423
Q		
R	MIL-W-16878 Type C (1000 Volts)	439 1000 Series
T	Teflon, MIL-W-16878 Type E (600 Volts)	439 4000 Series
V	MIL-W-16878 Type D (3000 Volts)	439 3000 Series
W	Teflon, MIL-W-16878 Type EE (1000 Volts)	439 0000 Series
X		
Y		
Z	Acetate Yarn Telephone Type	428

SIZE OF WIRE CODE	
LETTER	SIZE
A	#22 AWG
B	#20
C	#18
D	#16
E	#14
F	#12
G	#10
H	#8
J	#6
K	#4
L	#2
M	#1
N	#0
P	#00
Q	#000
R	#0000
T	#28
V	#26
W	#24
X	#19
Y	#30
Z	

COLOR CODE	
NUMBER OR LETTER	COLOR
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray (Slate)
9	White
a	Clear
b	Tan
c	Pink
d	Maroon
e	Light Green
f	Light Blue