

★

UNCLASSIFIED

TECHNICAL MANUAL

for

COMMUNICATIONS RECEIVER
MODEL GPR-90RXD



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, CANADA

★

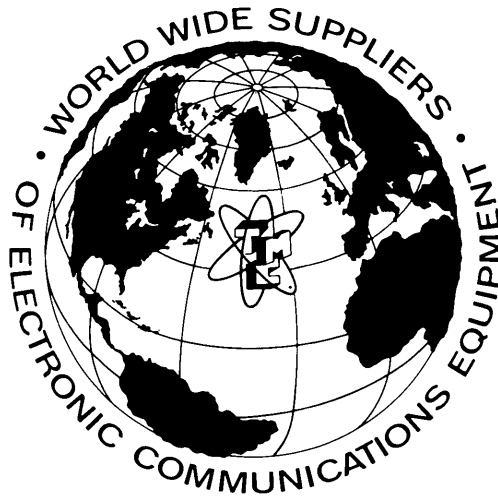
★

UNCLASSIFIED

TECHNICAL MANUAL

for

COMMUNICATIONS RECEIVER
MODEL GPR-90RXD



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, CANADA



THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes, fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

TABLE OF CONTENTS

Paragraph	Page	Paragraph	Page
SECTION 1—GENERAL DESCRIPTION		SECTION 5—TROUBLESHOOTING	
1-1	Introduction 1-1	5-1	General 5-0
1-2	Technical Specifications 1-1	5-2	Troubleshooting Techniques 5-0
SECTION 2—INSTALLATION		5-3	Servicing Techniques 5-0
2-1	Initial Inspection 2-0	5-4	Communications Receiver GPR-90RXD 5-1
2-2	Mechanical Installation 2-0	SECTION 6—MAINTENANCE	
2-3	Electrical Installation 2-0	6-1	General 6-1
2-4	Initial Adjustment 2-0	6-2	Communications Receiver GPR-90RXD 6-1
SECTION 3—OPERATOR'S SECTION		SECTION 7—PARTS LIST	
3-1	Communications Receiver GPR-90RXD 3-0	7-1	Parts List 7-0
3-2	Operator's Maintenance 3-2	SECTION 8—SCHEMATIC DIAGRAMS	
SECTION 4—PRINCIPLES OF OPERATION		8-1	Schematic Diagrams 8-1/8-2
4-1	General 4-0		
4-2	Communications Receiver GPR-90RXD 4-0		

LIST OF ILLUSTRATIONS

Figure		Page	Figure		Page
SECTION 1—GENERAL DESCRIPTION			SECTION 4—PRINCIPLES OF OPERATION (CONT'D)		
1-1	Communications Receiver GPR-90RXD	iv	4-5	Schematic Diagram, GPR-90RXD, First and Second Converters	4-11/4-12
SECTION 2—INSTALLATION			4-6	Schematic Diagram, IF Amplifiers and AVC Detector	4-13/4-14
2-1	Power Supply Changeover Connections	2-0	4-7	Schematic Diagram, GPR-90RXD, BFO	4-15
2-2	Outline Dimensional Drawing, Model GPR- 90RXD	2-2	4-8	Schematic Diagram, GPR- 90RXD, Detector and Noise Limiter	4-16
2-3	GPR-90RXD Showing Rear Panel Controls and Con- nections	2-2	4-9	Schematic Diagram, GPR- 90RXD, Audio Amplifier	4-17
2-4	Typical Packaging Diagram	2-3	SECTION 5—TROUBLESHOOTING		
SECTION 3—OPERATOR'S SECTION			5-1	Voltage and Resistance Dia- gram, GPR-90RXD	5-3/5-4
3-1	GPR-90RXD Operating Controls	3-2	5-2	Location of Major Electronic Components, GPR-90RXD, Top View	5-5
SECTION 4—PRINCIPLES OF OPERATION			5-3	Location of Major Electronic Components, GPR-90RXD, Bottom View	5-6
4-1	Block Diagram, GPR-90RXD	4-3/4-4	SECTION 8—SCHEMATIC DIAGRAMS		
4-2	Schematic Diagram, GPR-90RXD, RF Amplifiers	4-5/4-6	8-1	Schematic Diagram, Com- munications Receiver GPR- 90RXD (Sheet 1 of 2)	8-3/8-4
4-3	Schematic Diagram, GPR-90RXD, HFO	4-7/4-8	8-1	Schematic Diagram, Com- munications Receiver GPR- 90RXD (Sheet 2 of 2)	8-5/8-6
4-4	Schematic Diagram, GPR-90RXD, Crystal Oscillator/Amplifier	4-9/4-10			

LIST OF TABLES

Table		Page	Table		Page
SECTION 1—GENERAL DESCRIPTION			SECTION 3—OPERATOR'S SECTION		
1-1	Electron Tube Complement	1-2	3-1	Operation Chart	3-0
1-2	Front Panel Controls of the GPR-90RXD	1-2	3-2	Table of Equivalent Control Designations	3-3
SECTION 2—INSTALLATION			SECTION 5—TROUBLESHOOTING		
2-1	Rear Panel Controls and Con- nections of GPR-90RXD	2-1	5-1	Troubleshooting Chart, Communications Receiver GPR-90RXD	5-1
			SECTION 6—MAINTENANCE		
			6-1	Alignment Data, GPR-90RXD	6-3



Figure 1-1. Communications Receiver GPR-90RXD

SECTION 1 GENERAL DESCRIPTION

1-1. INTRODUCTION.

The COMMUNICATIONS RECEIVER GRP-90RXD (figure 1-1) is a general coverage communications receiver with a frequency range of 0.54 to 31.5 mc, distributed over six bands, and is capable of receiving AM, CW, MCW, FS, and SSB signals. Tuning is provided with full electrical bandspread, and a 100-kc crystal-controlled calibrator provides 100-kc markers throughout the tuning range.

The 17-tube circuit of the GPR-90RXD provides a sensitivity that averages better than one microvolt for a 10-db signal-to-noise ratio. Dual conversion is employed in bands, 4, 5, and 6 for improved image rejection. The input provides for a 75-ohm unbalanced antenna and the output may be terminated in 4-, 8-, 16-, or 600-ohm voice coils or headphones. A front panel S-meter indicates relative signal strength and also permits accurate tuning.

The RF SELECTIVITY switch provides six steps of IF selectivity: 0.25 to 2 kc on crystal filter, and 7 kc at 6 db down in noncrystal operation. Audio selectivity is controlled by a 3-position (NORMAL, LOW-PASS, and 1200 ~ PEAK) switch. When set to 1200 ~ PEAK, the audio bandwidth at 10 db down from the peak can be varied from 600 to 1600 cps by means of the AUDIO SPREAD control.

In addition to the normal local oscillator, the GPR-90RXD permits the use of 10 precisely adjustable crystal positions available from the front panel plus a rear deck input for an external high stability control oscillator or synthesizer. A series type noise limiter is employed to effectively reduce ignition or other pulse type noise. The limiter can be turned on by a front panel limiter switch.

1-2. TECHNICAL SPECIFICATIONS.

Frequency range	0.54 to 31.5 mc in six bands.
Type of reception	AM, CW, MCW, FS, and SSB.
Tuning system	Accurately calibrated main tuning dial plus full electrical bandspread.
Input impedance	75 ohms unbalanced.
Output impedance	4, 8, 16, and 600 ohms plus headphones.
Output level	2-watt high quality audio output.
Sensitivity	Better than 1 microvolt for 10 db signal-to-noise ratio.
Noise figure	Better than 6 db.
Image ratio	Averages 85 db.
Selectivity	Variable in six steps from 250 cps to 5 kc, 5 crystal and 1 noncrystal position.
AVC characteristic	With an 80-db change in the input signal, the output remains constant within 12 db.
Audio selectivity	Specially designed audio selectivity control with variable bandwidth.
Noise limiter	A highly effective series type noise limiter is provided.
Metering	Calibrated S-meter.
VFO stability	Better than 0.002 percent on first three bands and 0.003 percent on three bands.
Crystal stability	Dependent upon crystal being used.
Crystal calibrator	Provides 100-kc markers throughout tuning range.
BFO circuit	Variable frequency BFO.
Hum level	Better than 60 db.
Primary power	115 or 230 volts, 50 or 60 cycles, approximately 90 watts.

The frequency of the beat frequency oscillator is controlled by the BFO PITCH control which varies the audio beat note on CW signals from zero to ± 3 kc. The high stability of this BFO makes it possible to receive SSB signals.

Table 1-1 is a list of the electron tube complement of the GPR-90RXD. Table 1-2 lists the GPR-90RXD front panel controls.

The receiver operates on 115- and 230-volt, 60-cycle AC power although provision is made for operation from an external power supply or batteries for emergency service in areas where AC power is not available.

TABLE 1-1. ELECTRON TUBE COMPLEMENT

REF SYM	TUBE TYPE	FUNCTION
V1	6DC6	1st RF Amplifier
V2	6BA6	2nd RF Amplifier
V3	6AU6	1st Converter
V4	6BE6	2nd Converter and Oscillator

TABLE 1-1. ELECTRON TUBE COMPLEMENT (CONT'D)

REF SYM	TUBE TYPE	FUNCTION
V5	6BA6	Buffer
V6	6BA6	1st IF Amplifier
V7	6BA6	2nd IF Amplifier
V8	6BA6	3rd IF Amplifier
V9	6AL5	Noise Limiter
V10	12AX7	Audio Amplifier
V11	6V6	2nd Audio Amplifier
V12	6AG5	Oscillator
V13	6AG5	BFO
V14	5U4G	Rectifier
V15	OA2	Voltage Regulator
V16	6CB6	100 kc Oscillator
V17	6AG5	Xtal. Osc. Amplifier

TABLE 1-2. FRONT PANEL CONTROLS OF THE GPR-90RXD

CONTROL	FUNCTION
HFO switch	Selects local oscillator mode.
XTAL PHASE control	Adjusts center frequency of crystal filter.
RF SELECTIVITY switch	Adjusts bandpass width of crystal filter.
AUDIO GAIN control	Adjusts audio output level.
CAL switch	Applies power to 100-kc oscillator.
MAIN TUNING control	Tunes receiver to desired frequencies.
SEND-REC switch	Applies B+ to receiver circuits.
MANUAL-AVC switch	Permits application of AVC voltage to appropriate circuits.
ANT. TUNE control	Tunes receiver input to antenna.
RANGE SELECTOR switch	Selects tuning range.
LIMITER switch	Permits reduction of impulse-type noise.
BFO switch	Applies power to beat frequency oscillator.
BAND SPREAD control	Permits fine tuning of receiver.
AUDIO SPREAD control	Adjusts audio bandwidth when AUDIO SELECTOR switch is in 1200 PEAK position.
RF GAIN control	Adjusts gain of RF and IF amplifiers.

TABLE 1-2. FRONT PANEL CONTROLS OF THE GPR-90RXD (CONT'D)

CONTROL	FUNCTION
Power switch (part of RF GAIN control)	Applies primary power to receiver.
BFO PITCH control	Varies frequency of beat frequency oscillator.
AUDIO SELECTOR switch	Adjusts audio bandwidth.
XTAL ADJ. control	Adjusts crystal frequencies in local crystal oscillator.
S-meter	Indicates relative signal strength of carrier signals.
PHONES jack	Permits headphone monitoring of audio signal.

SECTION 2 INSTALLATION

2-1. INITIAL INSPECTION.

Each GPR-90RXD has been calibrated and tested at the factory before shipment. Upon arrival at the operating site, inspect the packing case and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as "loose items".

With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

The equipment is shipped with all tubes and other plug-in components installed. Check that all such components are properly seated in their sockets.

A TYPICAL PACKAGING DIAGRAM, figure 2-4, has been included to assist in the unpacking and repackaging of the GPR-90RXD.

2-2. MECHANICAL INSTALLATION.

The GPR-90RXD is equipped with a standard 19 inch rack panel, which can be mounted in any stand-

ard equipment rack. Provision has been made for mounting of chassis slides if desired. Refer to figure 2-2 for the GPR-90RXD outline dimensions.

2-3. ELECTRICAL INSTALLATION.

Power is applied to the GPR-90RXD immediately upon connection of the power cord to any suitable power source and setting the front panel POWER switch to the ON position. The GPR-90RXD is factory wired for 115 volt operation. For conversion to 230 volt operation, refer to figure 2-1.

Table 2-1, used in conjunction with figure 2-3, indicates the interconnections, input connections and output connections for the GPR-90RXD.

2-4. INITIAL ADJUSTMENT.

Before any GPR-90RXD unit is shipped, it is aligned and thoroughly checked against the manufacturer's specifications. Therefore, no initial adjustments are necessary other than the connection to a suitable antenna, connection to a speaker and connection to a suitable primary power source.

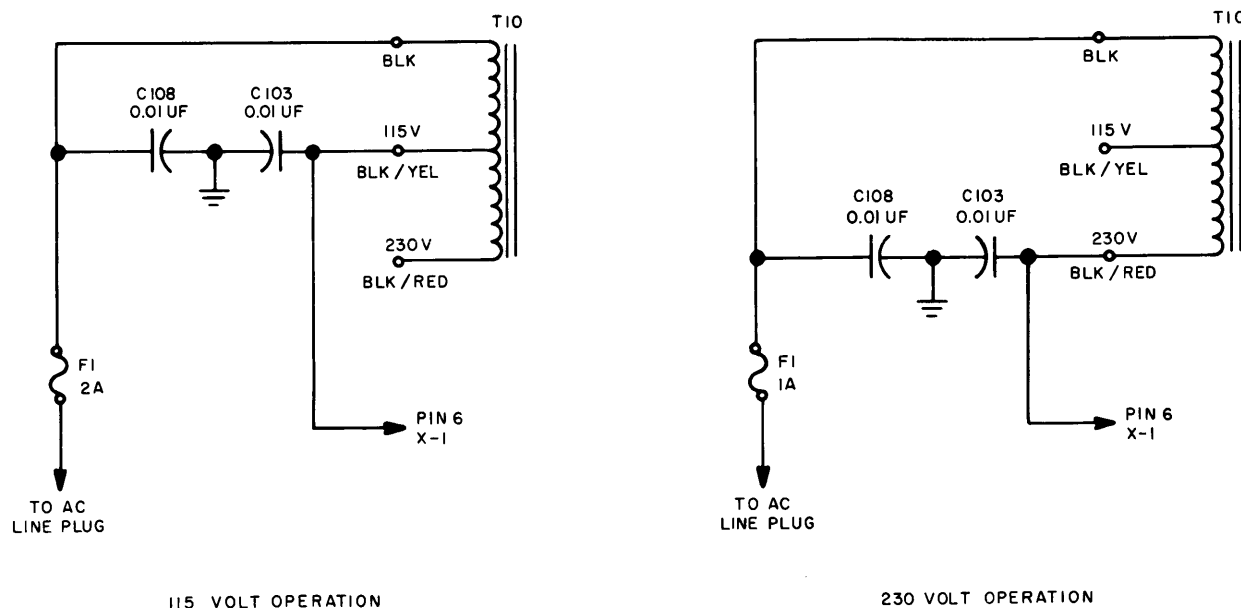


Figure 2-1. Power Supply Changeover Connections

TABLE 2-1. REAR PANEL CONTROLS AND CONNECTIONS OF GPR-90RXD

ITEM	FUNCTION
LINE CORD, 2 conductor power cable.	W1 - Connects the required AC operating voltage (Ref. Table 1-1) from the external power source to the GPR-90RXD.
AC LINE, power receptacle.	J3 - Convenience outlet providing AC line voltage.
FUSE, 2A	F1 - 2 amp cartridge line fuse.
E1, 4 connector terminal board.	Connector 1 } - For external AVC, remove Connector 2 } - jumper wire Connector 3 - No connection Connector 4 - Ground connection
RELAY, 2 prong, polarized connector receptacle.	J4 - Connects to transmitter enabling the receiver to be disabled by the transmitter when keying.
AUXILIARY POWER IN, 8 pin socket.	X1 - Accepts power from external power supply or batteries. When the GPR-90RXD receives normal power at plug P2, the AC plug PL1 must be placed in AUXILIARY POWER socket X1.
ANT 75Ω, connector receptacle, BNC type.	J6 - Antenna input connector, 75 ohms.
S METER ADJ, potentiometer screw-driver adjust control.	R50 - Signal strength meter (M1) adjustment control.
ACCESSORY POWER OUT, 8 pin socket.	X2 - Accessory outlet providing DC filament and B+ voltages.
EXT, connector receptacle BNC type.	J5 - External synthesizer input connector.
BFO IN, connector receptacle, BNC type.	J7 - External Beat Frequency Oscillator input connector.
E2, 5 connector terminal board.	Audio output speaker connections.
E3, 4 connector terminal board.	Connector 1 } - Diode load connections Connector 2 } - For external AVC, remove jumper wires Connector 3 - Ground Connector 4 - External AVC input connection and AVC output connection.
IFO IN, connector receptacle, BNC type.	J8 - External IFO input connector.
IF GAIN, potentiometer screwdriver adjust control.	R106 - IF gain control.
IF OUT, dual contact phono type connector.	J1A - IF output jack.
PHONO, dual contact phono type connector.	J1B - Phono input jack.
RADIO-PHONO, slide switch.	S6 - Radio or phono operation selector switch.
SSB, slide switch.	S7 - Single Sideband ON-OFF selector switch.

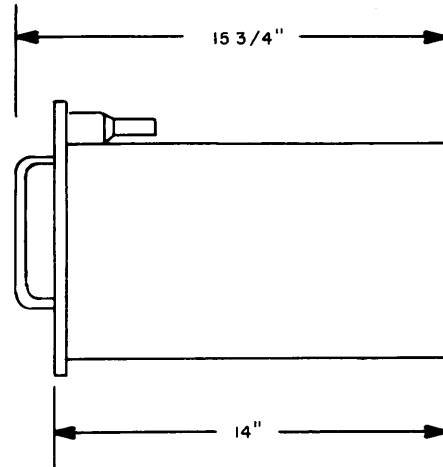
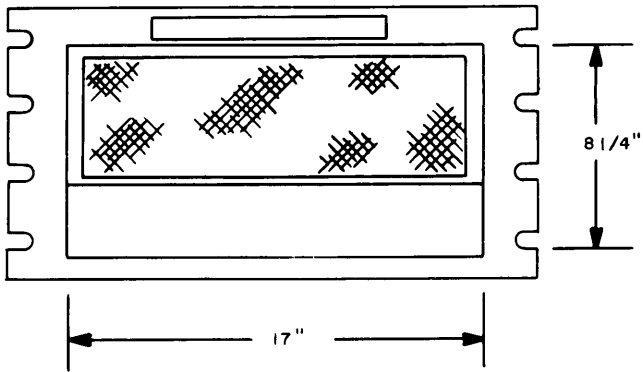
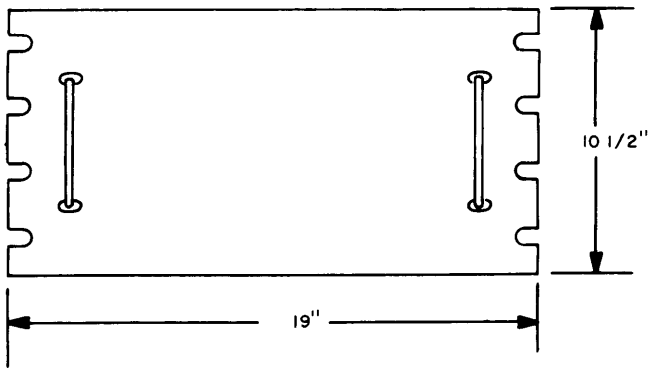


Figure 2-2. Outline Dimensional Drawing, Model GPR-90RXD

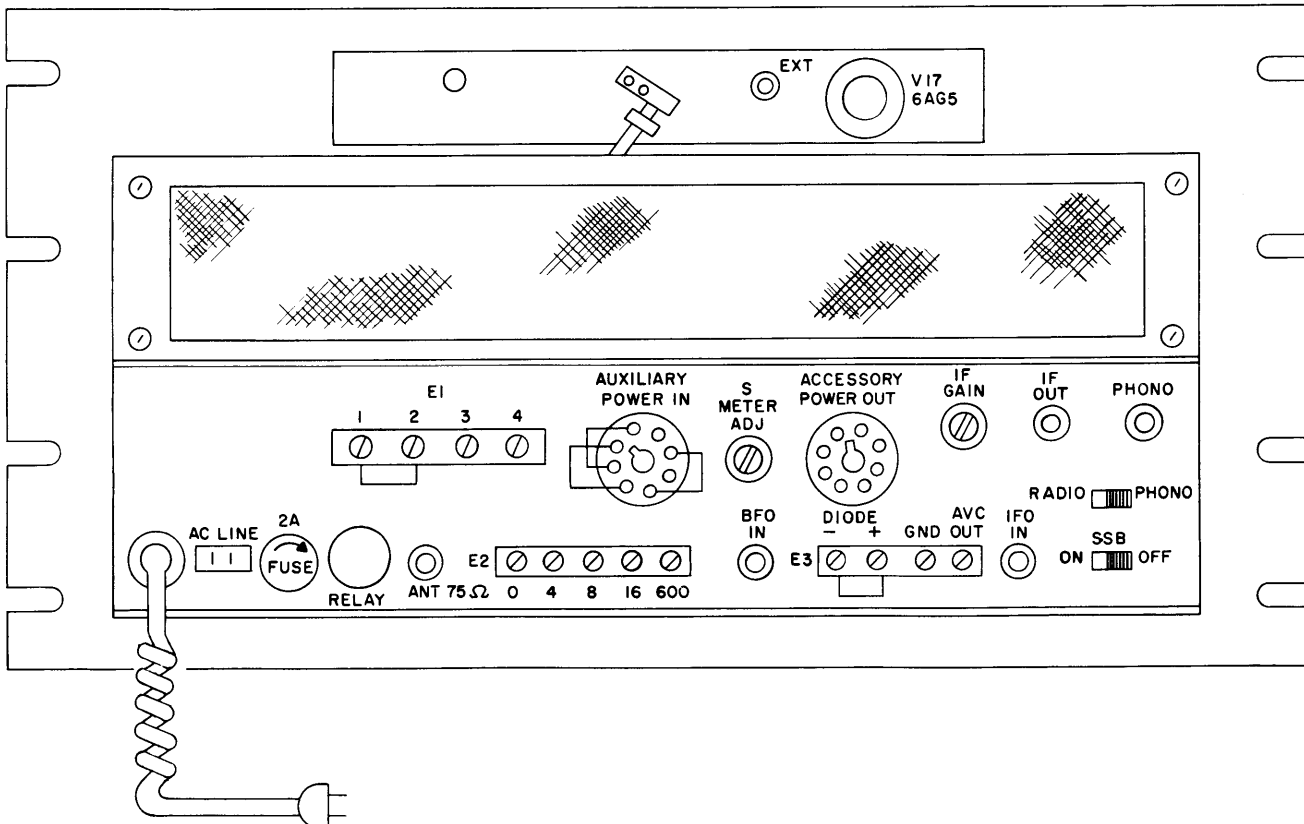


Figure 2-3. GPR-90RXD Showing Rear Panel Controls and Connections

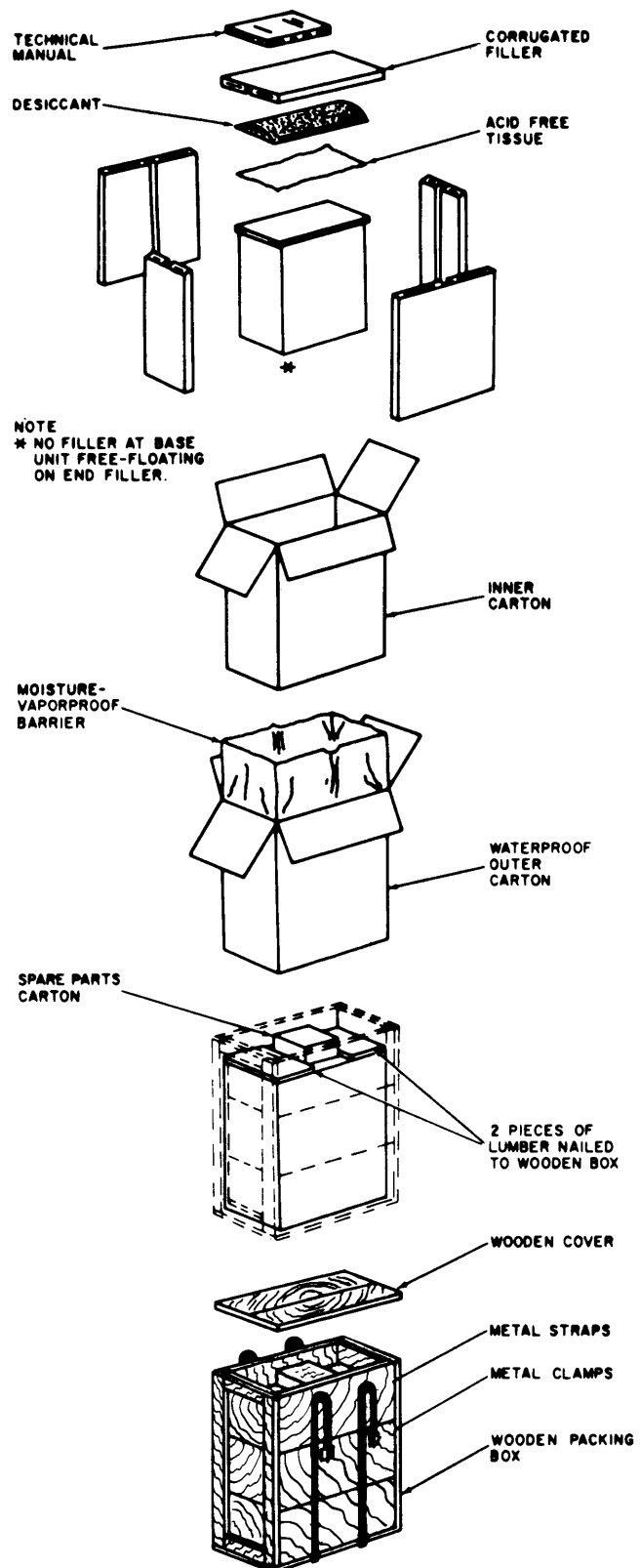


Figure 2-4. Typical Packaging Diagram

SECTION 3

OPERATOR'S SECTION

3-1. COMMUNICATIONS RECEIVER GPR-90RXD.

a. **AM RECEPTION.** - When the received signal is accompanied by excessive background noise (other than ignition or pulse type), increasing the RF selectivity of the GPR-90RXD will improve the signal-to-noise ratio. The selectivity should be increased up to the point where a phone signal becomes unintelligible. An almost obliterated signal can sometimes be pulled through the noise hash and received perfectly by the combined use of the RF and audio selectivity controls.

If the signal being received is interfered with or heterodynes with an adjacent carrier, adjust XTAL PHASE control 1 to reduce the interference.

Turning HFO switch 2 in any of the 10 crystal positions permits the GPR-90RXD to receive 10 channels, utilizing a crystal-controlled local oscillator to produce the intermediate frequency. If it is desired to obtain reception on frequencies not covered by the 10 crystals, turn HFO switch 2 to EXT and connect an external synthesizer to EXT jack J5.

b. **CW RECEPTION.** - To place the GPR-90RXD in operation for the reception of CW signals, the controls and switches are set to the same positions as those outlined in paragraph 3-1a for AM reception except that BFO switch 14 is set to ON.

After turning on the BFO, tune in a CW signal. Adjust the BFO PITCH control 18 for a pleasing tone.

NOTE

CW reception may be accomplished with the AVC switch in the ON or OFF positions. However, best reception is usually obtained by turning the AVC off, retarding the RF gain and increasing the audio gain.

c. **SSB RECEPTION.** - To place the GPR-90RXD in operation for the reception of single-sideband signals, the controls and switches are set to the same positions as those outlined in table 3-1 for AM reception except that BFO switch 14 and SINGLE SIDEBAND switch S9 (on rear apron) are each set to the ON position.

TABLE 3-1. OPERATION CHART

STEP	OPERATION	PURPOSE
1	Set SEND-REC switch 10 to REC.	Applies B+ power to unit.
2	Set RF SELECTIVITY switch 6 to NON XTAL.	Selects widest IF response.
3	Set MANUAL-AVC switch 11 to AVC.	Permits AVC operation.
4	Set BFO switch 14 to OFF.	Disables BFO.
5	Set CAL switch 8 to OFF.	Disables 100-kc oscillator.
6	Set RANGE SELECTOR switch 12 to desired band.	Selects appropriate tuning range.
7	Set HFO switch 2 to VAR.	Selects local oscillator, within the unit, to beat against the incoming RF to produce the IF.
8	Adjust RF GAIN control 17 fully clockwise.	Applies primary power to the unit and adjusts RF gain to maximum.
9	Set RADIO-PHONO switch (on the rear apron) to RADIO.	Connects audio amplifier to detector.
10	Set SSB switch (on the rear apron) to OFF.	Permits normal operation of detector.

Single sideband signals are characterized by the lack of a carrier, unintelligibility, and fluctuations of the S-meter. To obtain proper reception, the carrier must be reinserted by turning on the BFO.

Tune in the single sideband signal for maximum S-meter deflection. Turn the RF GAIN control down until the signal is barely audible. Turn on the BFO and tune the BFO PITCH control very slowly until the reception becomes intelligible. If intelligibility cannot be attained, rotate the BFO PITCH control in the opposite direction. The direction of rotation is dependent upon which sideband the transmitting station is utilizing. In all cases, the BFO PITCH control should be turned very slowly.

NOTE

Because of the slow tuning rate on the BAND SPREAD dial, it is often possible to tune SSB signals by retarding the RF gain, boosting the audio and setting the BFO pitch to zero. Rotating the BAND SPREAD dial slowly will then bring in the station.

d. S-METER. - The S-meter performs a dual function; it provides a visual means of accurately tuning the GPR-90RXD to the incoming signal, and it indicates the relative strength. The AVC switch must be in the ON position for the S-meter to operate correctly.

e. EXTERNAL OPERATION. - A stable external oscillator of 75 ohms output impedance with a minimum of 1 volt output is connected through a cable (consisting of RG-59/U with a RG-260/U connector) to J5, located adjacent to V17 on the amplifier crystal oscillator chassis.

The frequency of the external oscillator is determined as follows:

(1) Where the signal frequency lies between .54 Mc and 5.6 Mc.

The external oscillator frequency is:

$$F_o = F_s + 0.455 \text{ Mc}$$

where: F_o = Oscillator frequency

F_s = Signal frequency

Example: For a 1 Mc signal the oscillator frequency would be:

$$F_o = 1.000 + 0.455 \text{ Mc} = 1.455 \text{ Mc}$$

(2) Where the signal frequency lies between 5.6 Mc and 31.5 Mc.

The external oscillator frequency is:

$$F_o = F_s + 3.955 \text{ Mc}$$

Example: For a 25 Mc signal the oscillator frequency would be:

$$F_o = 25.000 + 3.955 = 28.955$$

NOTE

The external oscillator should be turned "OFF" or disconnected from the receiver when not in external operation.

f. XTAL OPERATION. - No special connections are required for this mode of operation.

The frequency of the crystals required for use in this operation is determined as follows:

F_o = Internal oscillator frequency

F_x = Crystal frequency

F_s = Signal frequency

(1) Where the signal frequency lies between 5.4 Mc and 5.6 Mc.

The oscillator frequency is:

$$F_o = F_s + 0.455 \text{ Mc}$$

The crystal frequency required is:

$$F_x = 1.00005 \times F_o$$

Example: For a 1 Mc signal the oscillator frequency would be:

$$F_o = 1.000 + 0.455 \text{ Mc} = 1.455 \text{ Mc}$$

The crystal frequency is:

$$F_x = 1.00005 \times 1.45500 \text{ Mc}$$

$$F_x = 1.45507 \text{ Mc}$$

(2) Where the signal frequency lies between 5.4 Mc and 16.0 Mc.

The oscillator frequency is:

$$F_o = F_x + 3.955 \text{ Mc}$$

The crystal frequency required is:

$$F_x = 1.00005 \text{ Mc} \times F_o$$

Example: For a 10 Mc signal the oscillator frequency would be:

$$F_o = 10.000 \text{ Mc} + 3.955 \text{ Mc} = 13.955 \text{ Mc}$$

The crystal frequency is:

$$F_x = 1.00005 \times 13.955 \text{ Mc}$$

$$F_x = 13.95569 \text{ Mc}$$

(3) Where the signal frequency lies between 16.0 Mc and 31.5 Mc.

The oscillator frequency is:

$$F_o = F_s + 3.955 \text{ Mc}$$

The crystal frequency required is:

$$F_x = 1.00005 \times \frac{F_o}{2}$$

Example: For a 25 Mc signal the oscillator frequency would be:

$$F_o = 25.000 + 3.955 = 28.955 \text{ Mc}$$

The crystal frequency is:

$$F_x = 1.00005 \times \frac{28.955 \text{ Mc}}{2}$$

$$F_x = 1.00005 \times 14.4775 \text{ Mc}$$

$$F_x = 14.47822 \text{ Mc}$$

NOTE

To minimize confusion between the crystal frequency and the signal frequency it is suggested that the signal frequency be noted on the identification plate adjacent to the number identifying the crystal position.

3-2. OPERATOR'S MAINTENANCE.

a. COMMUNICATIONS RECEIVER GPR-90RXD. -

There are several maintenance operations which can be performed on the GPR-90RXD by the operator when trouble is encountered. If normal operating procedures produce unsatisfactory results, the operator should proceed as follows:

(1) Check the power supply by noting whether dial lamp is on, indicating whether power is being applied to the GPR-90RXD.

CAUTION

Never replace a fuse with one of higher rating. If a fuse burns out immediately after replacement. DO NOT replace it a second time until the cause has been corrected.

(2) If no power is evident, check fuse on rear apron. Replace blown fuse with fuse of equal value.

(3) Check the tubes since the most common cause of operational failure is usually tube failure. Checking the tubes will often save many hours of unnecessary troubleshooting. The location of tubes in the GPR-90RXD is shown in figure 5-1.

Table 3-2 lists the equivalent control designations to be used in conjunction with figure 3-1.

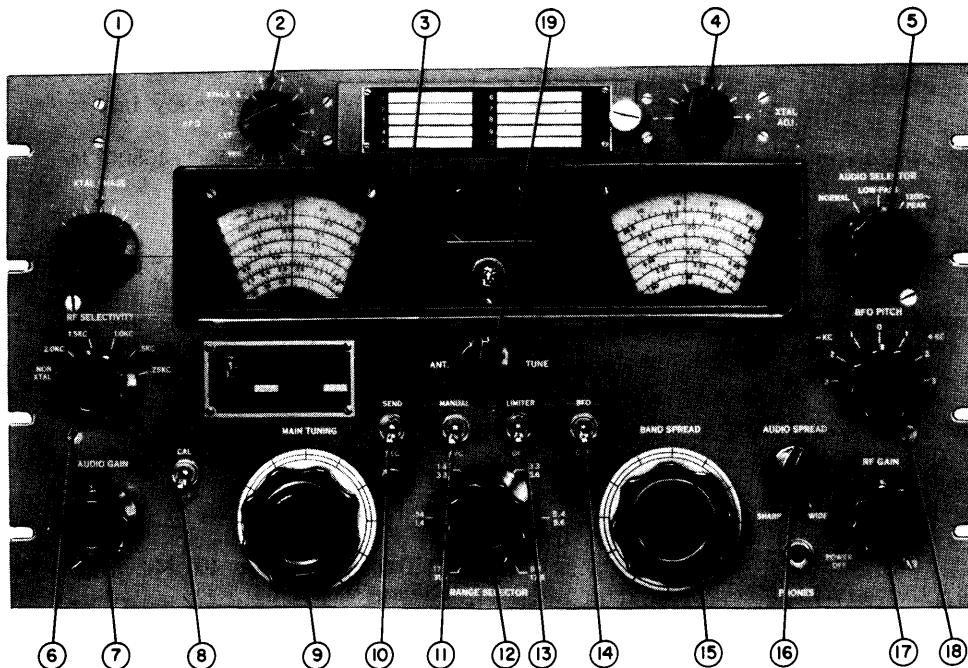


Figure 3-1. GPR-90RXD Operating Controls

TABLE 3-2. TABLE OF EQUIVALENT CONTROL DESIGNATIONS

SERIAL DESIGNATION (SEE FIGURE 3-1)	PANEL DESIGNATION (SEE FIGURE 3-1)	COMPONENT DESIGNATION ON OVERALL SCHEMATIC DIAGRAM
COMMUNICATIONS RECEIVER GPR-90RXD		
1	XTAL PHASE	Knob capacitor C42
2	HFO	Knob (12-position) selector switch S12)
3	S-meter (No designation)	Meter M1
4	XTAL ADJ.	Knob capacitor C149
5	AUDIO SELECTOR	Knob (3-position) selector switch S5
6	RF SELECTIVITY	Knob (6-position) selector switch S2
7	AUDIO GAIN	Knob potentiometer R68
8	CAL	Toggle switch S11
9	MAIN TUNING	Knob capacitor C9
10	SEND-REC	Toggle switch S9
11	MANUAL-AVC	Toggle switch S3
12	RANGE SELECTOR	Knob (6-position) selector switch S1
13	LIMITER	Toggle switch S4
14	BFO	Toggle switch S8
15	BAND SPREAD	Knob capacitor C8
16	AUDIO SPREAD	Knob variable resistor R71
17	RF GAIN	Knob potentiometer R81
18	BFO PITCH	Knob capacitor C99
19	ANT. TUNE	Knob capacitor C140

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL .

This section covers the principles of operation of the GPR-90RXD Communications Receiver. Although the GPR-90RXD has many inherent features, its operation and versatility can be enhanced by combining it with any of TMC's accessory units such as TMC's models MSR-6 Single Sideband Converter, AFC-1, Automatic Frequency Control Unit and the VOX-5, Variable Frequency Oscillator. A description of such combinations is further explained in the system operating manuals when applicable.

The following text explains the principles of operation of the GPR-90RXD supported by a block diagram and simplified schematic diagrams.

4-2. COMMUNICATIONS RECEIVER GPR-90RXD.

a. INTRODUCTION. - (See figure 4-1.) - The GPR-90RXD is capable of receiving AM, CW, MCW, FS, and SSB signals over a 0.54- to 31.5-mc range in six bands. The RF signal, derived from either a 75-ohm unbalanced antenna or an antenna coupler, is applied to two-stage RF amplifier V1 and V2. The RF gain of these stages is controlled by the setting of RF GAIN control R81, the cathode bias resistor for IF amplifier V6. Thereafter, the amplified RF signal is converted by V3 and V4 to a 455-kc intermediate frequency. For improved image rejection, double conversion is used on the upper three bands.

Three methods of producing the intermediate frequency are available. Local oscillator V12 may be used in conventional fashion. Second, 10 channels may be received with 10 precisely adjustable crystals controlling a second local oscillator, V17. Finally, provision is made for the use of an external high stability control oscillator, or synthesizer.

The 455-kc IF signal developed as a result of either single or double conversion passes through an IF crystal filter which permits variation of the bandwidth from 250 cps to 5 kc. XTAL PHASE control C42, used in conjunction with this circuits, reduces heterodyne and interfering signals.

The IF output of amplifier V8 is applied to diode detector V9A in the GPR-90RXD where it is demodulated. Diode V9B, a series noise limiter, effectively reduces impulse type noise.

A Hartley-type BFO, V13, is used for detection of CW signals; its output is injected into the detector plate circuit. Provision is made in the GPR-90RXD for an externally generated BFO signal.

The detector output is amplified by an audio amplifier consisting of voltage amplifier V10B and power amplifier V11. The audio output circuit provides the means for matching voice coil impedances of 4, 8, 16, and 600 ohms, as well as headphones. The AUDIO SELECTOR and AUDIO SPREAD controls provide variation of the audio response of the audio amplifier. The response may be varied between one which is essentially flat to one whose bandwidth is 1200 cps at a center frequency of approximately 1100 cps.

For calibrating the GPR-90RXD, the output of 100-kc calibration oscillator V16 is injected at the GPR-90RXD input. The harmonic output of the oscillator permits calibration of the GPR-90RXD throughout its frequency bands.

The power supply consists of a full-wave rectifier, the output of which is heavily filtered by a pi-type filter for effective hum reduction. Hum produced by the filament supply is minimized by a hum balancing potentiometer. Voltage regulator V15 provides 150-volt regulated DC power.

b. RF AMPLIFIERS. (See figure 4-2.) - The RF voltage delivered by the antenna is inductively coupled to first RF amplifier V1 via RF transformers L28 through L33 and wafers S1_{AA} and S1_A of the RANGE SELECTOR switch. ANT. TUNE control C140 peaks the RF input circuit to the particular antenna used with the GPR-90RXD. The RF output of V1 is coupled to V2 via separate coupling networks (depending on the band selected) and wafers S1_B and S1_C of the RANGE SELECTOR switch. Inductive coupling is used in bands 1 through 3; RC coupling is used for bands 4 through 6. The amplified output of V2 is applied through coupling networks and wafers S1_D and S1_E of the RANGE SELECTOR switch to first converter V3.

The gain of both RF stages is controlled by RF GAIN control R81 in the common cathode return circuit. The RF amplifiers are tuned by MAIN TUNING capacitor C9, sections of which are connected across the selected tuned circuits by the RANGE SELECTOR switch. BAND SPREAD control C8 provides electrical bandspread for the RF circuits.

c. HIGH FREQUENCY OSCILLATOR. - Oscillator V12 is a Hartley type which provides an RF signal 455 kc above that of the incoming signal. (See figure 4-3A.) When switch S13 is turned to position 4 and HFO switch S12 is turned to VAR, oscillator V12 receives 150-volt plate voltage and is tuned by two sections of MAIN TUNING capacitor C9. The tank circuits for the oscillator are selected by

RANGE SELECTOR switch S1. This is accomplished simultaneously with the selection of the coupling circuits used in the RF amplifiers. Figure 4-3A is a simplified schematic diagram which shows the HFO circuit elements arranged for band 1 operation. As shown in this figure, the bandspread feature of the GPR-90RXD is not used in band 1 operation. The HFO circuit elements in figure 4-3B are arranged for band 2 operation and typify the circuit arrangement for the next four bands: 3, 4, 5, and 6. The circuit and its function is identical with band 2 operation except for the addition of BAND SPREAD capacitor C8, component values, and contact position of RANGE SELECTOR switch S1.

Crystal oscillator/amplifier V17 is used when the GPR-90RXD is tuned for operation in 1 of the 10 crystal-controlled channels or when an external synthesizer supplies the HFO input. (See figure 4-4.)

When operating with a crystal-controlled channel, switch S13 is also turned to position 4 while HFO switch S12 is turned to the desired crystal position. The frequency generated by the selected crystal can be slightly adjusted by rotating XTAL ADJ. control C149.

d. FIRST AND SECOND CONVERTERS. (See figure 4-5.) - The signal output from RF amplifier V2 is applied to the control grid of first converter V3, and the output of the local oscillator in use (V12 or V17) is applied to the cathode of V3. These signals mix to produce an IF signal, the frequency of which is dependent upon the band in use. When operating in bands 1, 2, or 3, and IF signal is 455 kc. This signal is applied through buffer IF amplifier V5 and IF transformer T5 to IF amplifier V6 through a crystal filter. When the GPR-90RXD is operated in these bands, single conversion is used. The gain is extremely high at this time since second converter V4 is not used. (Second converter V4 is a pentagrid converter, the gain of which is usually less than unity.) Since the attenuating property of the second converter is not available during single conversion, the gain of the first converter is substantially reduced by injecting a positive voltage into the cathode circuit of V3. In this way, the gain of the GPR-90RXD is kept fairly constant on all bands and stability is assured on the lower three bands.

In the three higher bands, double conversion is used. In this case, the frequency of the IF produced in first converter V3 is 3.955 mc. First converter V3 is permitted to operate at high gain for operation in these bands. The output of V3 is mixed with a 3.5-mc voltage developed in second converter oscillator V4. The oscillator portion of V4 is crystal controlled. The output of this tube is a 455-kc voltage which is applied to first IF transformer T5.

When the GPR-90RXD is used as a dual-diversity receiver (as in the DDR-6E), an external oscillator is connected to EXTERNAL IFO INPUT jack J8. This action ensures that the oscillator portions of the second converters and oscillators of both GPR-90RXD's are synchronized at 3.5 mc. At this time the crystal oscillator portion of V4 is disabled by

permitting diode CR1 in the cathode circuit of V4 to conduct

e. IF AMPLIFIERS. (See figure 4-6.) - The output of first IF transformer T5 is applied to a crystal filter. RF SELECTIVITY switch S2 determines the selectivity of the IF amplifier. In the NON XTAL position, crystal Y1 is shorted out. In the remaining positions, crystal Y1 is utilized. As RF SELECTIVITY switch S2 is rotated clockwise, more and more resistance is put in series with the crystal bridge circuit. This action effectively raises the Q of the circuit, producing a more selective filter response. XTAL PHASE control C42 is used to eliminate or reduce the effects of heterodyne or interfering signals.

The IF amplifier consists of three transformer coupled stages: V6, V7, and V8. The gain of the amplifier may be varied by two controls; IF GAIN control R106 and RF GAIN control R81. When RF GAIN control R81 is varied, the RF amplifier is also affected. IF GAIN control R106 is left undisturbed after the desired IF gain is achieved.

S-meter M1 is connected in the screen grid circuit of the second IF amplifier. This meter responds to changes in signal level, as controlled by the AVC input to IF amplifier V6. The meter may be adjusted by varying S-METER ADJ control R50.

f. AUTOMATIC VOLUME CONTROL. - The AVC detector is a triode connected in the diode configuration. (See figure 4-6.) The IF output at the plate of the third IF amplifier V8 is coupled to the plate of AVC detector V10A. The intermediate frequency is rectified and the resulting DC voltage, which is proportional to the signal strength, is the AVC signal. This signal is fed back to the grids of the RF and IF amplifiers. Variations in signal strength thus cause the gain of these stages to vary, stabilizing the output of the GPR-90RXD.

g. BEAT FREQUENCY OSCILLATOR. (See figure 4-7.) - The BFO, which is centered at 455 kc, is injected at the detector plate. The BFO stage, V13, is made operable by applying 150 volts to the plate end screen circuits with BFO switch S8 in the ON position. The output frequency may be varied ± 3 kc by adjusting BFO PITCH control C99.

An external BFO may be inserted at EXTERNAL BFO INPUT jack J7.

h. DETECTOR AND NOISE LIMITER. (See figure 4-8.) - The output of the third IF transformer is coupled through IF transformer T8 to detector V9A. The IF signal is demodulated and filtered; the remaining audio information is applied to audio amplifier V10B.

When LIMITER switch S4 is set to the ON position, series noise limiter V9B is inserted across the detected output. The noise limiter effectively reduces impulse type noise. With LIMITER switch S4 set to the OFF position, the noise limiter diode is short circuited and becomes inoperative.

i. **AUDIO AMPLIFIERS.** (See figure 4-9.) - Triode V10B is the first audio amplifier. Three inputs may be applied to the grid of this amplifier. With RADIO-PHONO switch S6 in the PHONO position, the output of a high impedance phonograph cartridge may be connected to PHONO INPUT jack J1 and the audio amplifier may be utilized. (See figure 4-8.) For full output, 0.15 volt is required. When RADIO-PHONO switch S6 is set to the RADIO position, the GPR-90RXD will operate normally. When SSB switch S7 is set to the ON position, the audio output of the detector is shorted to ground. (For SSB operation, audio signals can be supplied by a TMC Model MSR-6, Single Sideband Converter.)

By means of AUDIO SELECTOR switch S5 and AUDIO SPREAD control R71, the response of the audio amplifier may be controlled from an essentially flat response to a 1200-cps wide response (at -10 db) at a center frequency of approximately 1100 cps. (See figure 4-9.)

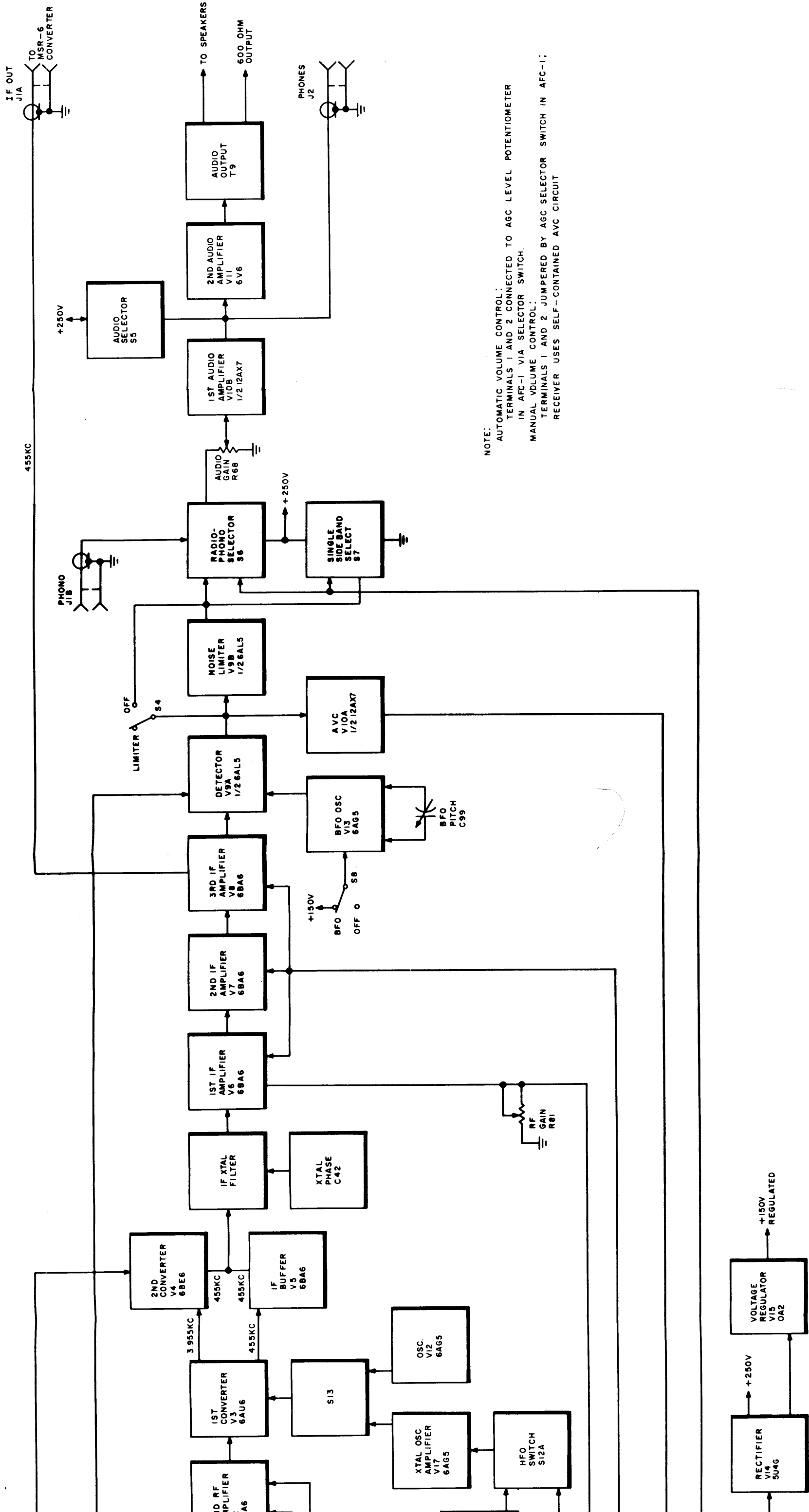
Volume is controlled by rotating AUDIO GAIN control R68. The output of V10B is applied to second audio amplifier V11, a power pentode. This amplifier is capable of delivering 2 watts of audio to 4-, 8-, 16-, or 600-ohm voice coils. Provision is also made for the use of headphones at PHONES jack J2. When headphones are used, the speaker is disabled.

j. **100-KC CALIBRATOR.** (See figure 8-1.) - The GPR-90RXD may be calibrated with the crystal-controlled 100-kc oscillator V16. When CAL switch S11 is set to ON, power is applied to the oscillator. At this time, the oscillator output applies 100-kc harmonics to the GPR-90RXD input. The output of the oscillator is of sufficient amplitude to provide 100-kc markers throughout the entire tuning range of the GPR-90RXD.

k. **POWER SUPPLY.** (See figure 8-1.) - The power supply is a heavily filtered full-wave rectifier which supplies 250 volts of unregulated power and 150 volts of regulated power to the various GPR-90RXD circuits. The 150-volt regulator, V15, is a gas tube.

Provision is made for the use of external DC power by placing a battery plug (with the connections shown in figure 8-1) into AUXILIARY POWER socket X1. When the GPR-90RXD is to be used with the normal 115-volt, 60-cps power at plug P2, AC plug P11 must be placed in AUXILIARY POWER socket X1.

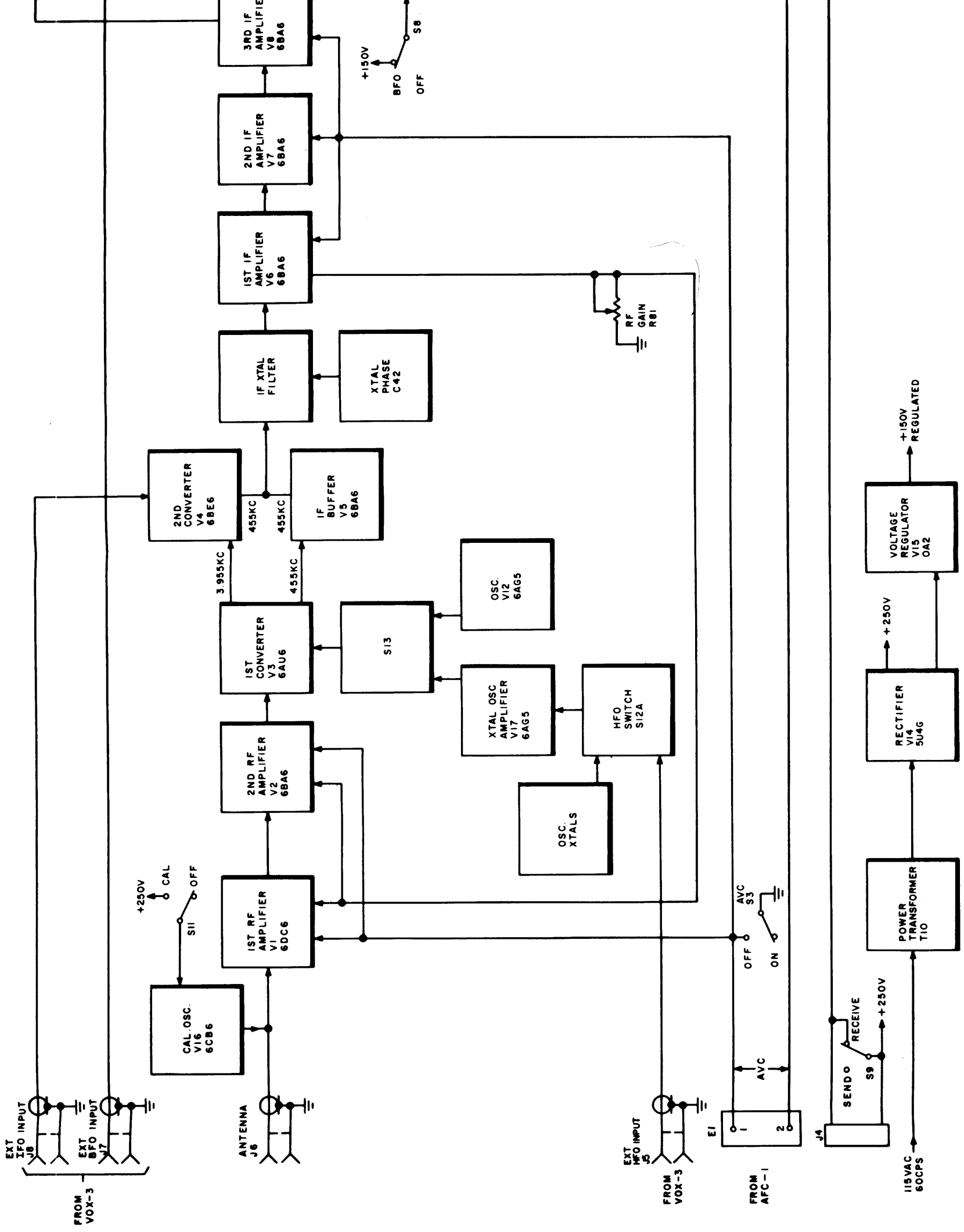
When external DC power is used, the requirements are 180 to 300 volts DC at 100 milliamperes and 6 volts at 5 amperes. Power for external accessories is available at ACCESSORY POWER SOCKET X2 (250 volts DC at 10 milliamperes and 6.3 volts AC at 0.6 ampere).

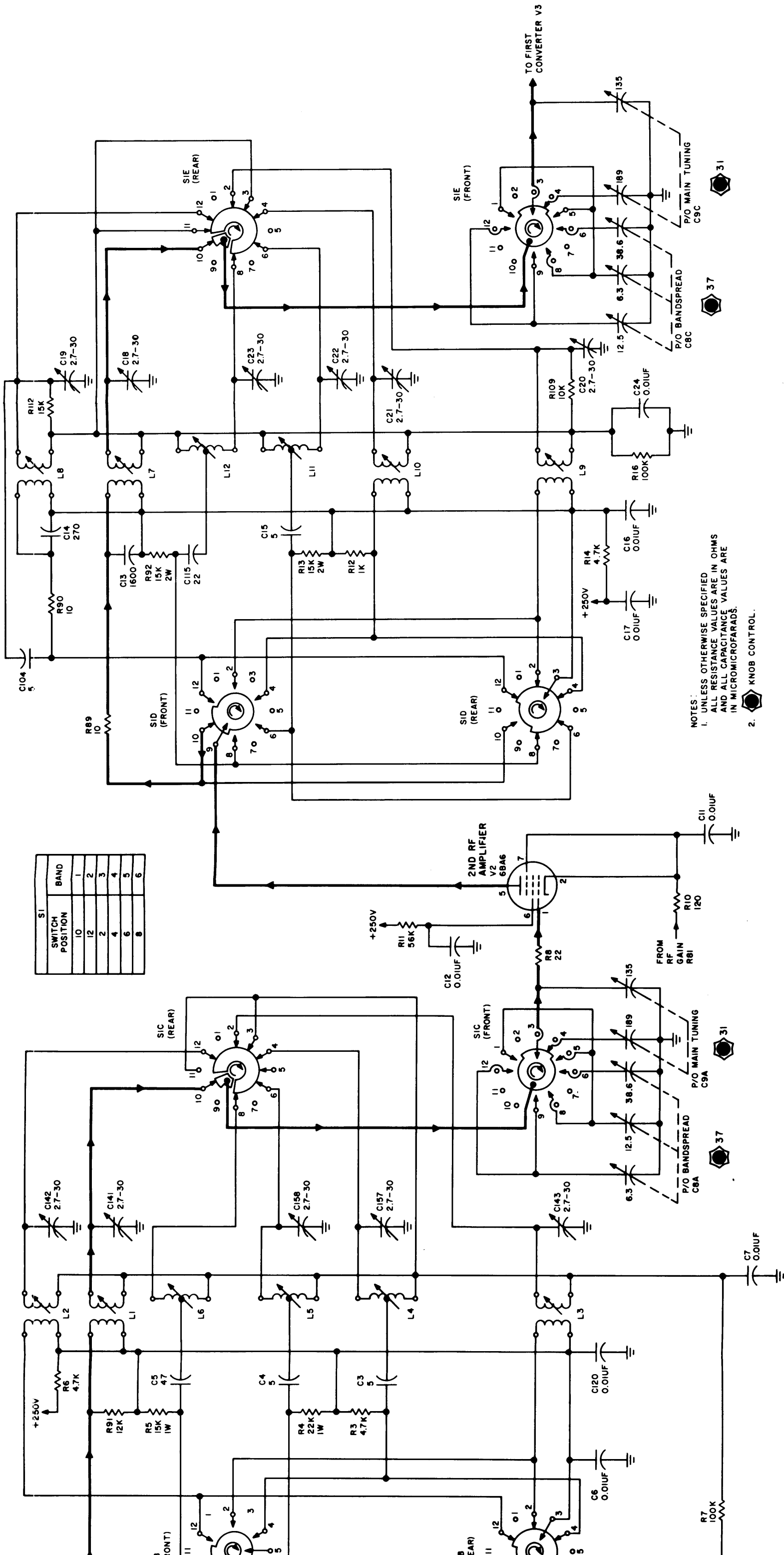


NOTE:
 AUTOMATIC VOLUME CONTROL:
 TERMINALS 1 AND 2 CONNECTED TO AGC LEVEL POTENTIOMETER
 IN AFC-1 VIA SELECTOR SWITCH.
 MANUAL VOLUME CONTROL:
 TERMINALS 1 AND 2 JUMPED BY AGC SELECTOR SWITCH IN AFC-1;
 RECEIVER USES SELF-CONTAINED AVC CIRCUIT.

Figure 4-1. Block Diagram, GPR-90RXD
 4-3/4-4

004633005






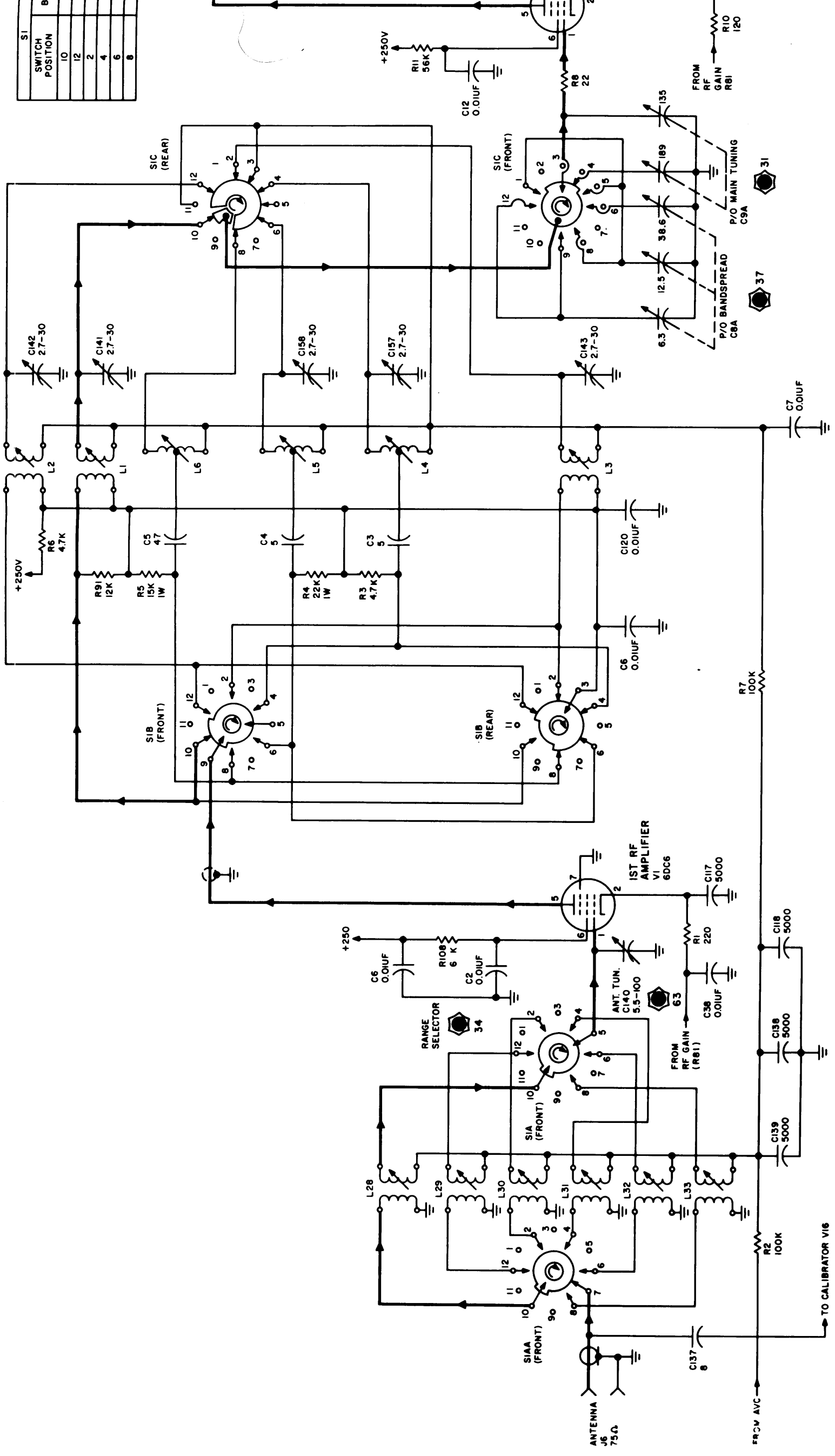
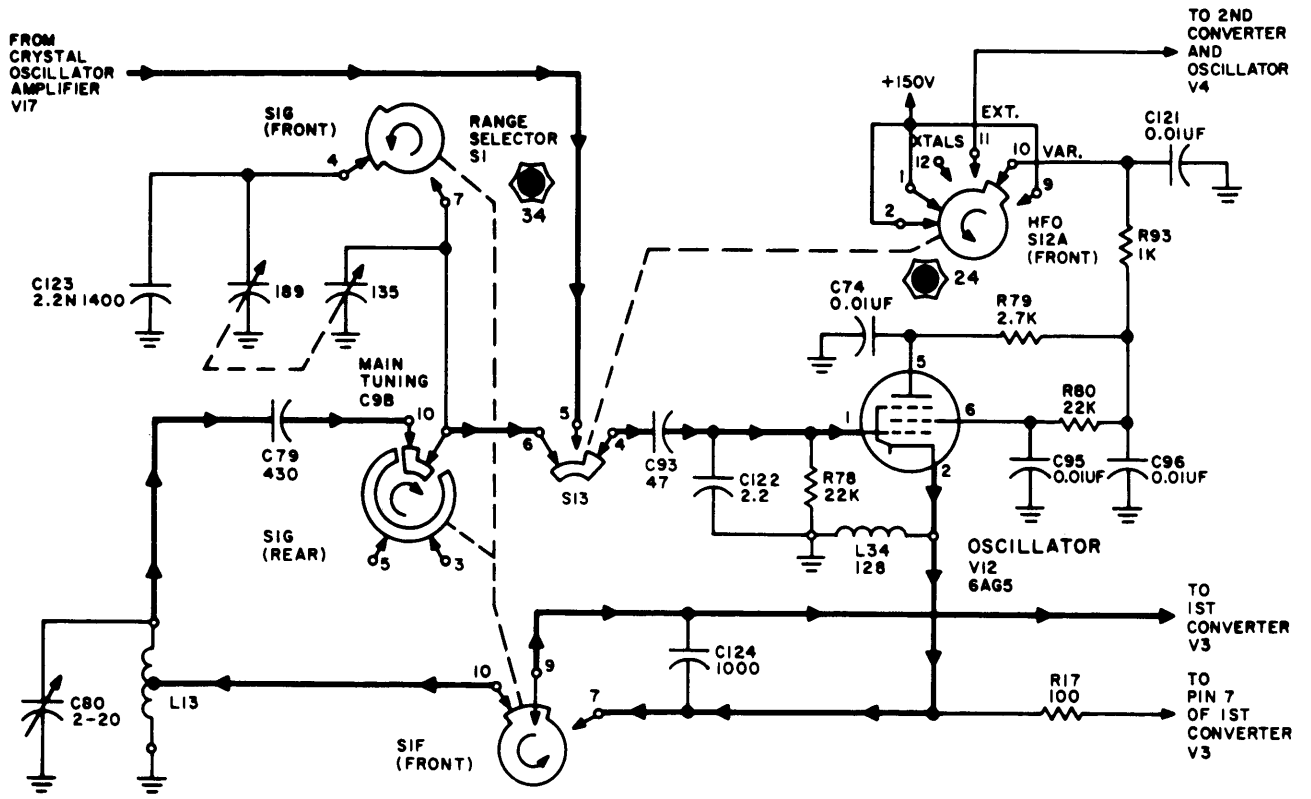
NOTES:
 1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
 2.  KNOB CONTROL.

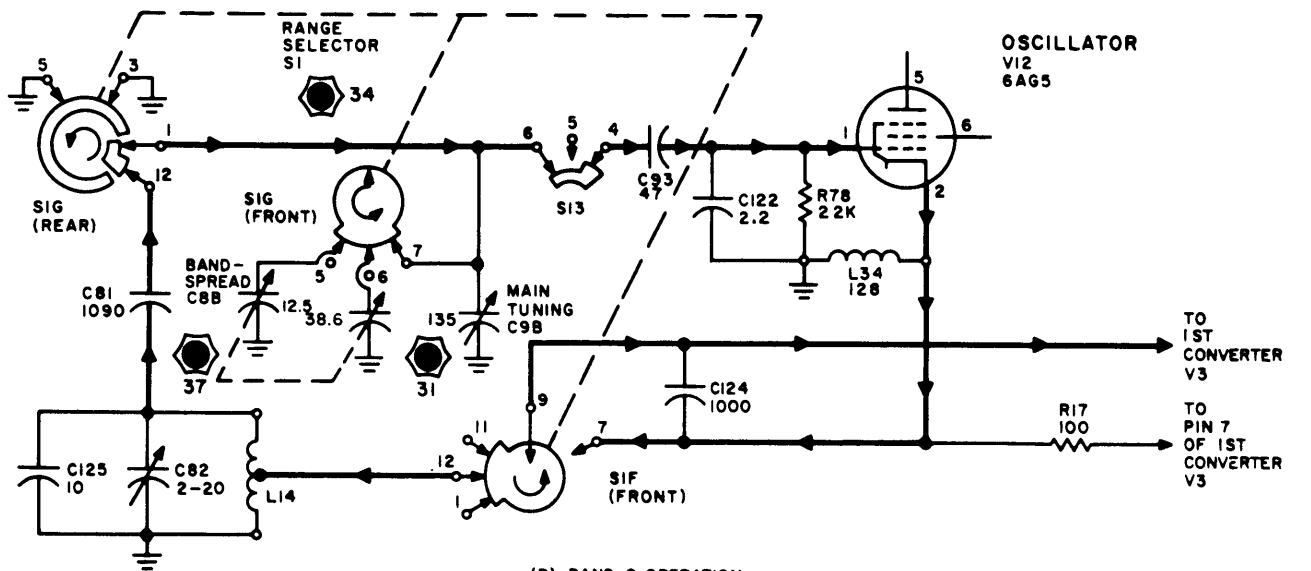
Figure 4-2. Schematic Diagram, GPR-90RXD, RF Amplifiers

S1	SWITCH POSITION
10	10
2	2
4	4
6	6
8	8





(A) BAND 1 OPERATION



(B) BAND 2 OPERATION


- NOTES:
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS; ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS; ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
 2. SWITCH S13
 - A. S13 IS IN POSITION 4 WHEN HFO SWITCH S12 IS IN POSITION VAR.
 - B. S13 IS IN POSITION 5 WHEN HFO SWITCH S12 IS IN POSITION EXT. AND XTALS.
 3.  KNOB CONTROL.

Figure 4-3. Schematic Diagram, GPR-90RXD, HFO

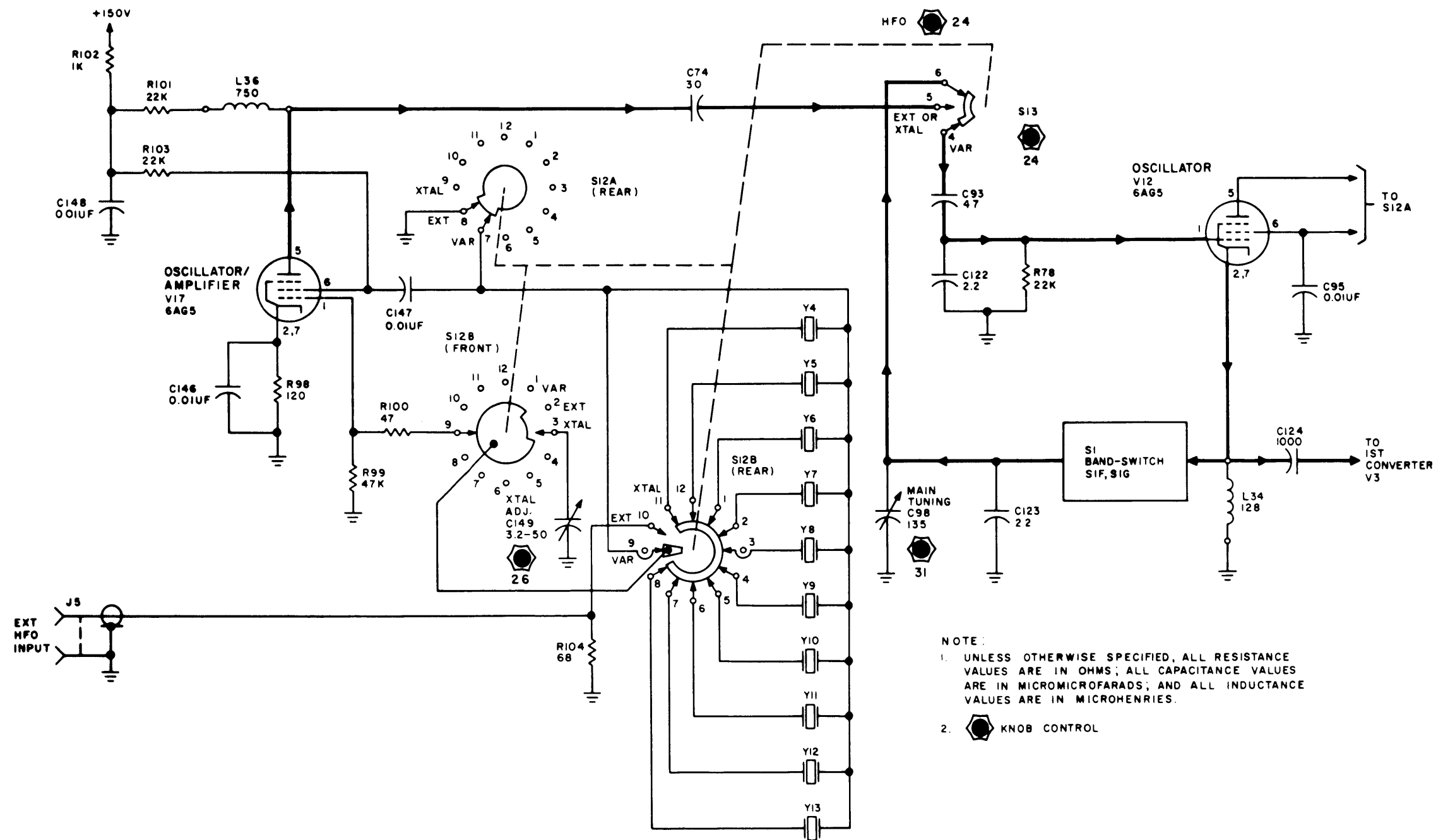


Figure 4-4. Schematic Diagram, GPR-90RXD, Crystal Oscillator/Amplifier

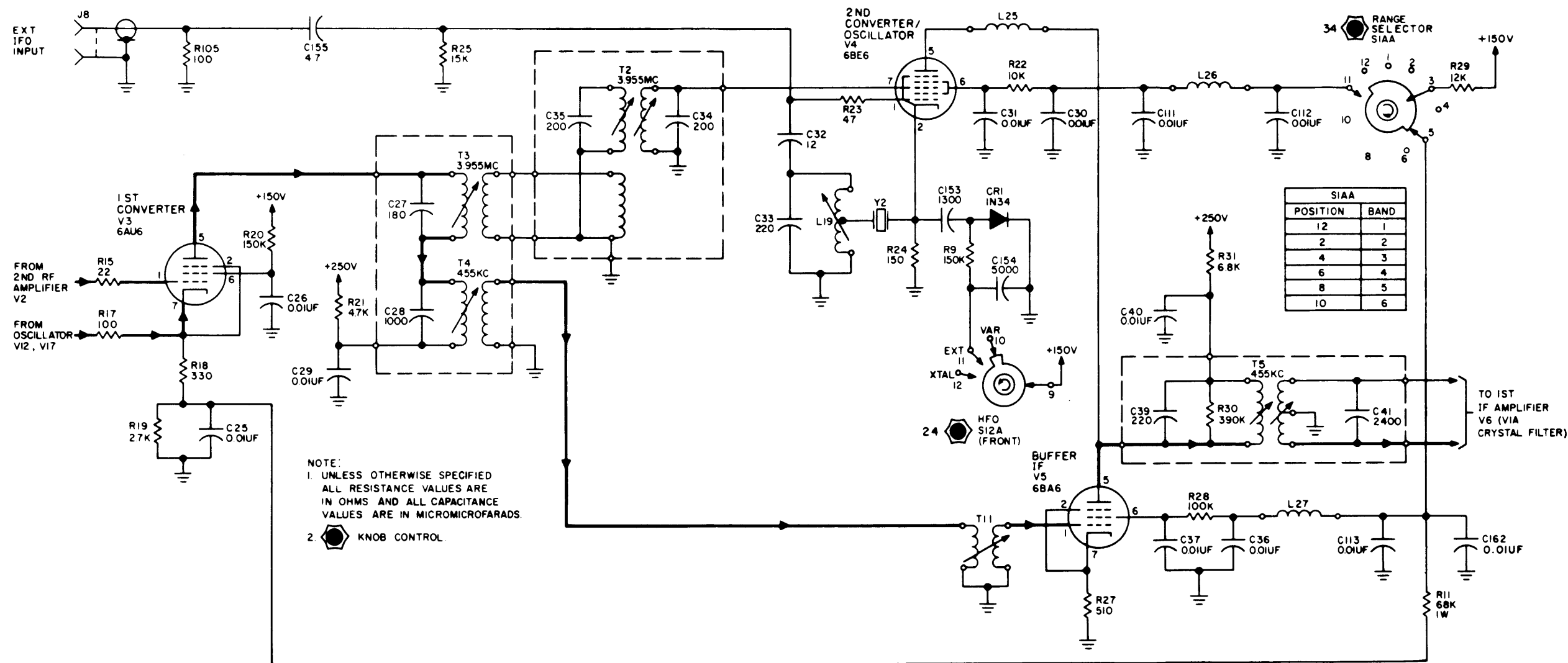
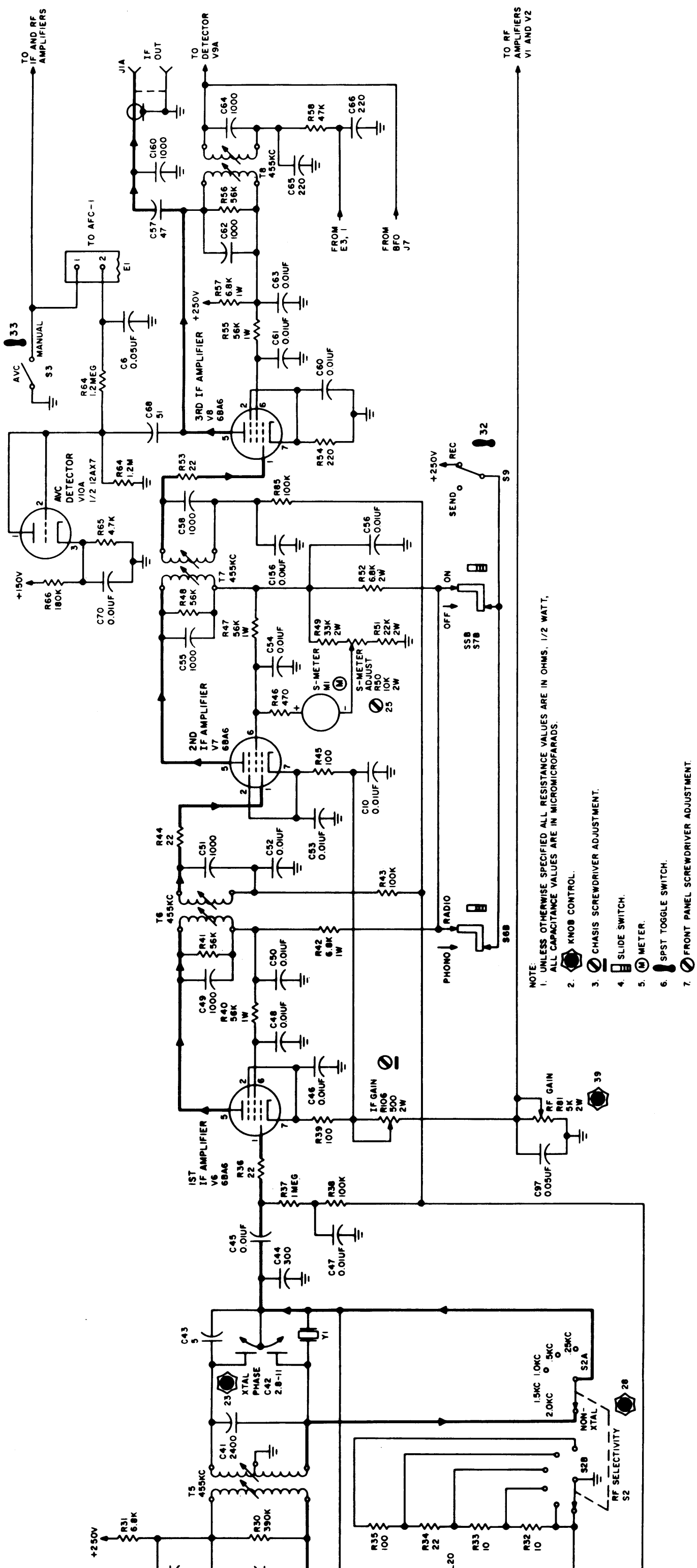
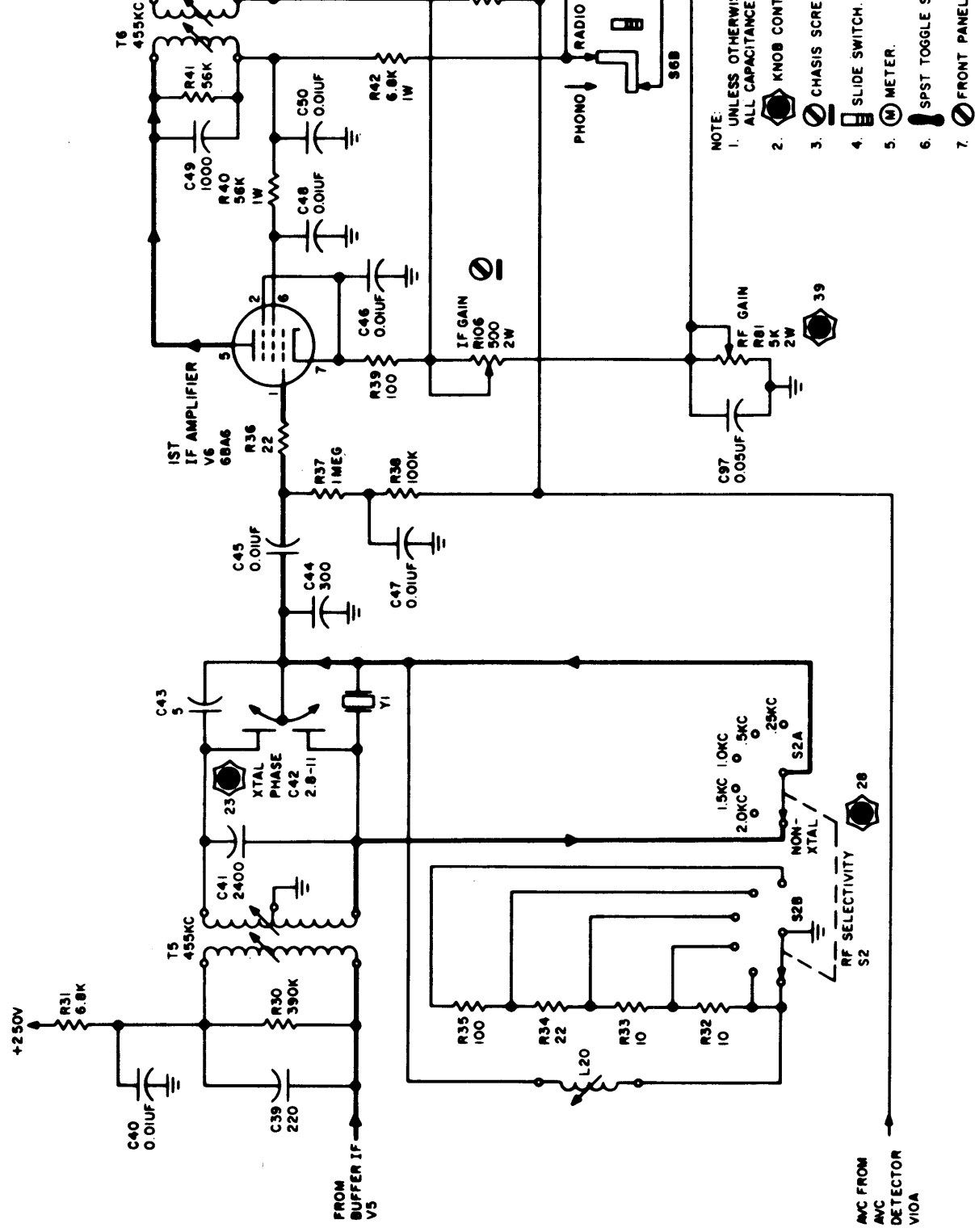


Figure 4-5. Schematic Diagram, GPR-90RXD, First and Second Converters



- NOTE:
 1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS, 1/2 WATT,
 ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS.
 2. KNOB CONTROL.
 3. CHASSIS SCREWDRIVER ADJUSTMENT.
 4. SLIDE SWITCH.
 5. METER.
 6. SPST TOGGLE SWITCH.
 7. FRONT PANEL SCREWDRIVER ADJUSTMENT.

Figure 4-6. Schematic Diagram, IF Amplifiers and AVC Detector



NOTE:
1. UNLESS OTHERWISE SPECIFIED,
ALL CAPACITANCE IN MICROFARADS.
2. KNOB CONT.
3. CHASIS SCRE.
4. SLIDE SWITCH.
5. METER.
6. SPST TOGGLE SWITCH.
7. FRONT PANEL.

AVC FROM
AVC
DETECTOR
V10A

RF SELECTIVITY
S2

PHONO
RADIO

S6B

S2A


28

39

NOTE:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCE VALUES ARE IN OHMS, ALL INDUCTANCE VALUES ARE IN MICROHENRIES AND ALL CAPACITANCES ARE IN MICROMICROFARADS.

2.  KNOB CONTROL.

3.  SPST TOGGLE SWITCH.

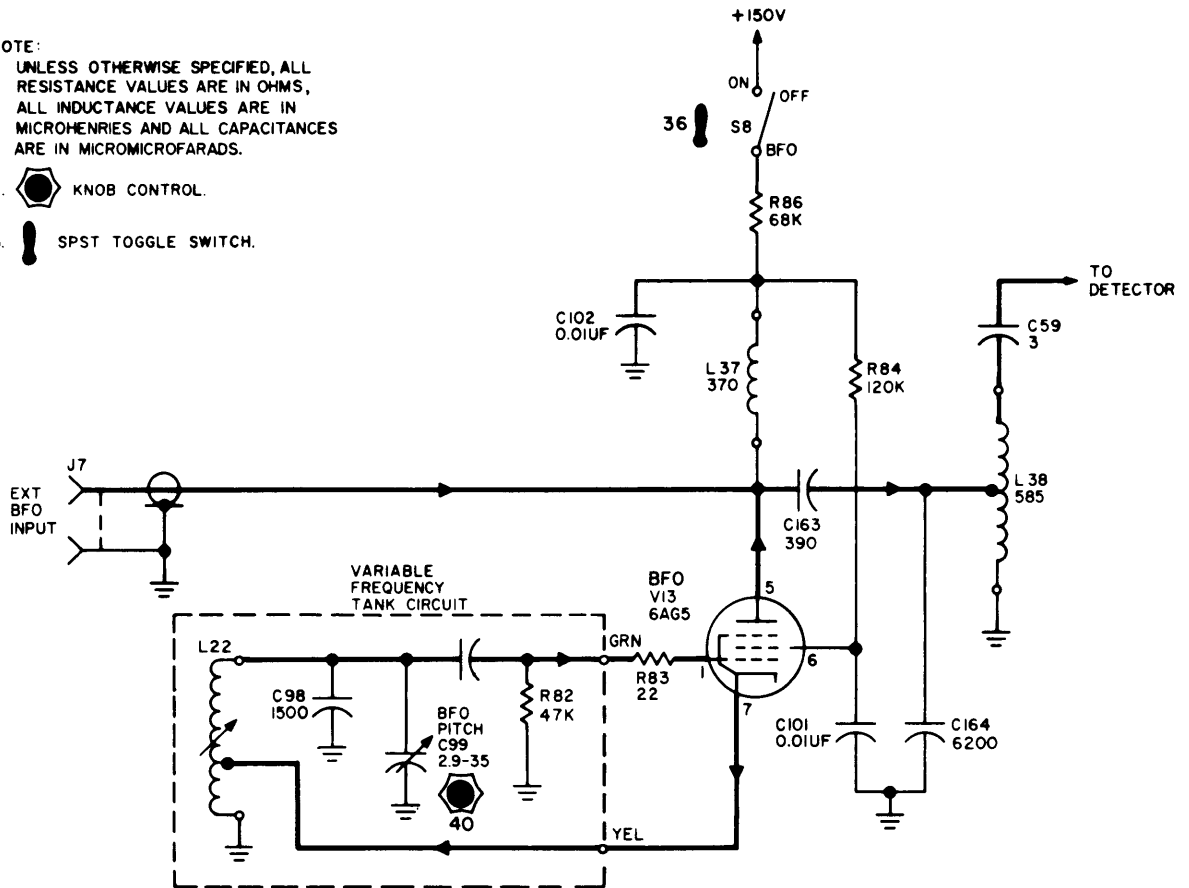


Figure 4-7. Schematic Diagram, GPR-90RXD, BFO

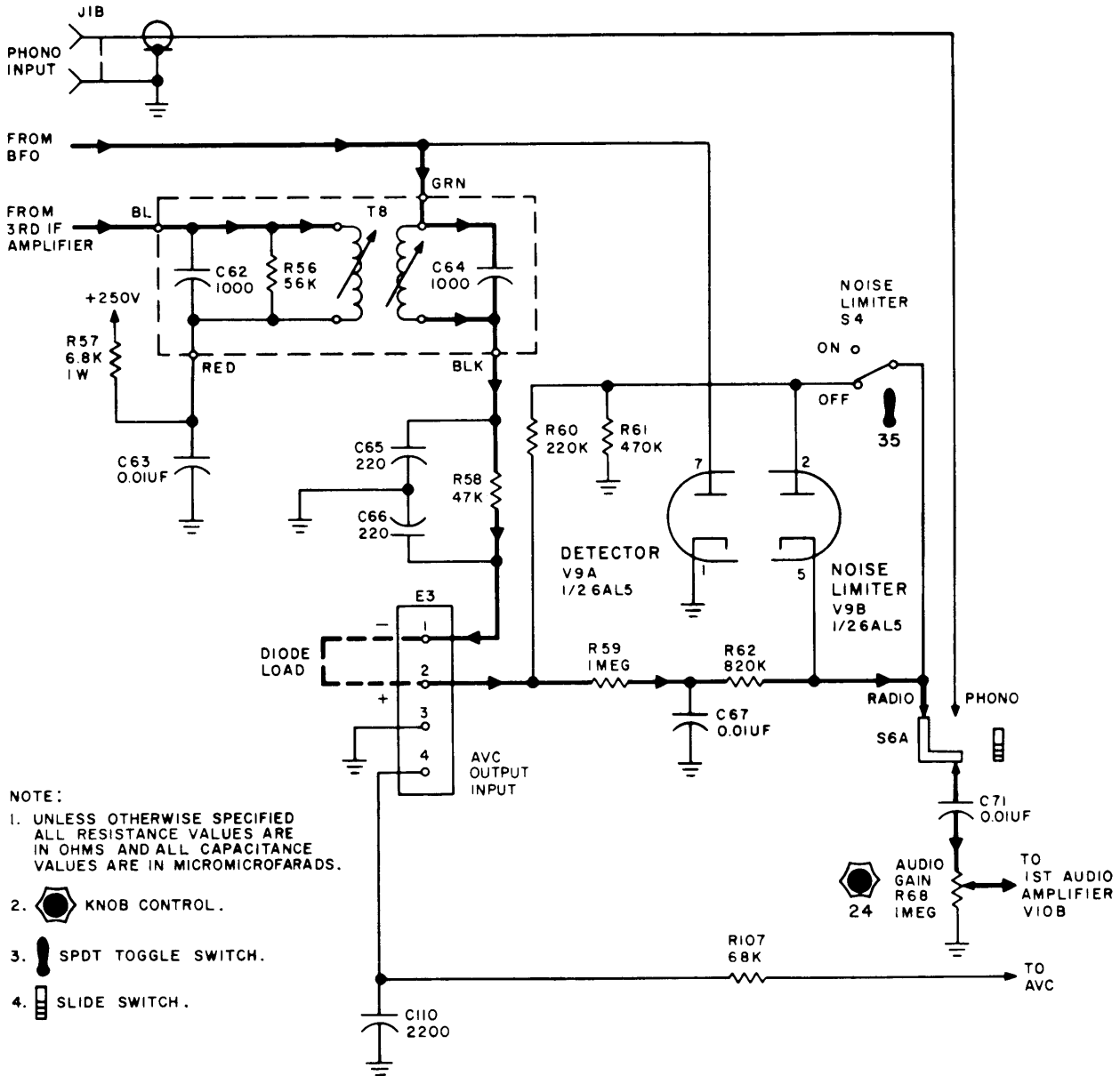


Figure 4-8. Schematic Diagram, GPR-90RXD, Detector and Noise Limiter

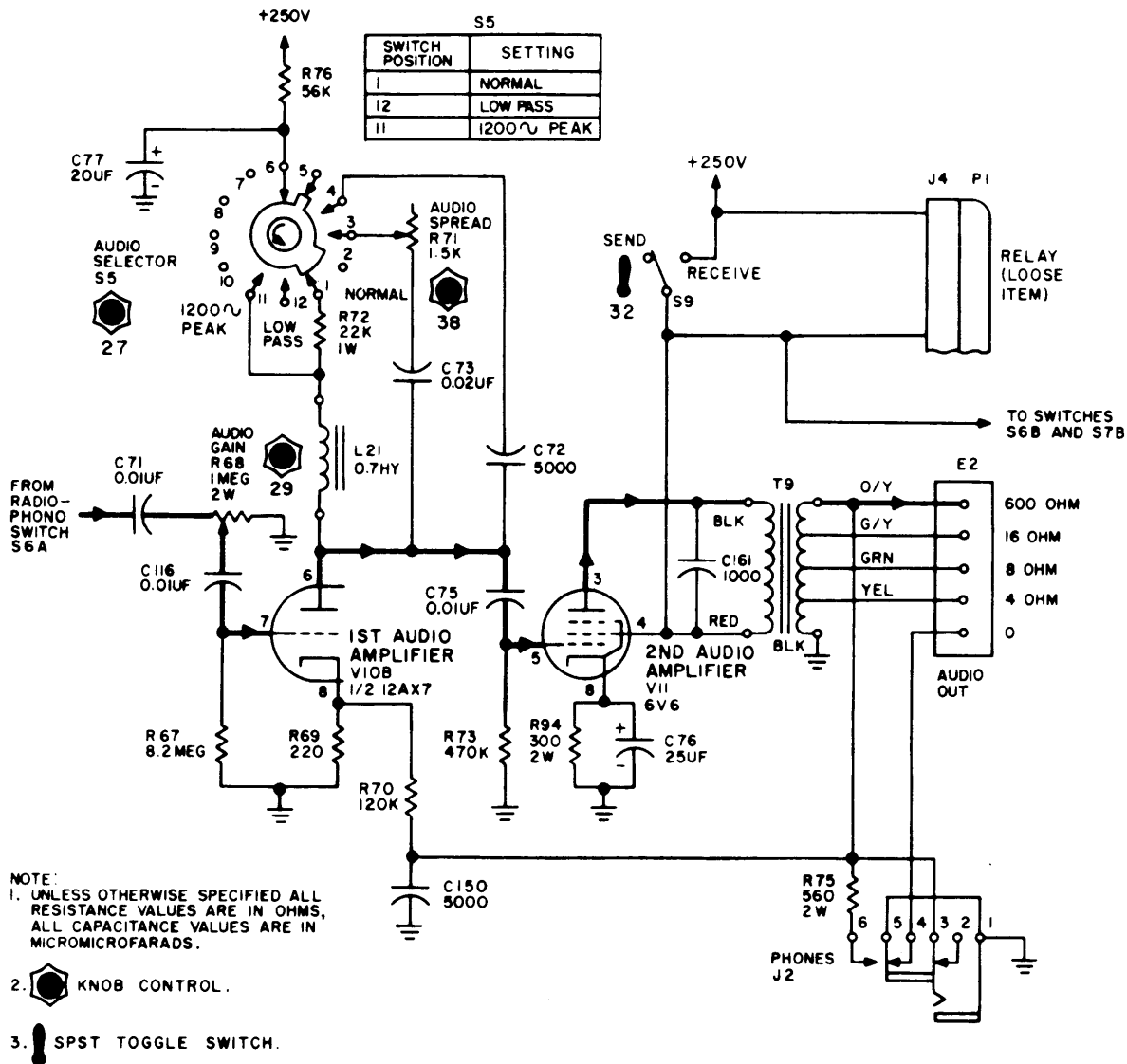


Figure 4-9. Schematic Diagram, GPR-90RXD, Audio Amplifier

SECTION 5 TROUBLESHOOTING

5-1. GENERAL.

Troubleshooting is the method of locating and diagnosing equipment troubles and maladjustments; the information necessary to remedy the equipment troubles and maladjustments is reserved for Section 6 of the manual under the heading "Maintenance."

Troubleshooting tools may, for convenience, be divided into the following six categories:

- a. Accurate schematic diagrams.
- b. Tables of voltage and resistance; waveform data.
- c. Location data (photographs with callouts of the major electronic equipment elements).
- d. Troubleshooting techniques.
- e. Troubleshooting charts based on operating procedures.
- f. Troubleshooting procedures based on circuit sectionalization.

Troubleshooting techniques are about the same for all types of electronic equipment and are covered briefly in the following paragraph.

5-2. TROUBLESHOOTING TECHNIQUES.

a. GENERAL CONSIDERATIONS. - When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In this case, it is unnecessary to follow a lengthy and orderly course of troubleshooting in order to localize and isolate the faulty part.

A second shortcut in troubleshooting is to ascertain that all tubes and fuses are in proper working order and that the equipment receives proper supply voltages. Many times this method will eliminate further investigation.

A third shortcut is to examine the equipment, section by section, for burned out elements, charring, corrosion, arcing, excessive heat, dirt, dampness, etc.

It is important to recognize that defective elements may have become defective due to their own weakness or to some contributing cause beyond their control.

b. TROUBLESHOOTING CHARTS BASED ON OPERATING PROCEDURES. - The general purpose of these charts is to narrow the area of trouble to one or more sections of the equipment in order to minimize the labor of locating the source of trouble. These charts present a prescribed order "to turn on" the equipment, indicate what to expect as each step is taken, and give clues as to possible "troubled areas" when some expectation is not realized.

c. TABLES OF VOLTAGE AND RESISTANCE; WAVEFORM DATA. - These tables give nominal values of voltage-to-frame and resistance-to-frame, generally at tube elements and sometimes at connectors and terminal board elements. Large deviations from the nominal values should be carefully investigated. During this process, accurate schematic diagrams and location data are highly essential. Schematic diagrams of the equipment covered in this manual are contained in Section 8.

A good oscilloscope is a good troubleshooting tool. It may be connected to a number of critical points along a circuit to detect extraneous voltages, distorted waveforms, and other symptoms of trouble.

d. TROUBLESHOOTING PROCEDURES BASED ON CIRCUIT SECTIONALIZATION. - Equipments usually consist of a number of subassemblies or sections. It is frequently helpful to treat these subassemblies or sections as independent entities. In so doing, however, they must be properly powered. Observations may then be made with VTVMs, CROs, or other test equipment at selected points under given types and magnitudes of injection voltages. Again, the subassemblies or sections may be examined for rated performance, according to specification, for the presence of extraneous grounds, for opens, or unusual voltages.

5-3. SERVICING TECHNIQUES.

WARNING

Extreme care should be exercised when measuring voltages. Voltages as high as 250 volts are present in the unit.

a. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before a part is unsoldered, note the positions of the leads. If the part, such as a transformer or switch, has a number of connections, tag each of the leads.

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

(3) Do not allow drops of solder to fall into the set. They may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

5-4. COMMUNICATIONS RECEIVER GPR-90RXD.

a. VOLTAGE AND RESISTANCE DIAGRAMS. - Figure 5-1 shows the voltage-to-chassis and resistance-to-chassis measurements at the vacuum tube pins in the GPR-90RXD under the conditions stated.

b. LOCATION DATA. - Figures 5-2 and 5-3 locate the major electronic elements of the GPR-90RXD.

c. TROUBLESHOOTING CHART BASED ON OPERATING PROCEDURES. - Refer to table 3-1 for interpretation of control designations. Refer to table 5-1.

d. TROUBLESHOOTING PROCEDURES BASED ON CIRCUIT SECTIONALIZATION. - The following paragraphs present troubleshooting procedures which are keyed to functional sections of the GPR-90RXD.

(1) **POWER SUPPLY.** - If the dial lamp fails to go on with power switch S10 (mounted on RF GAIN control R81) in the on position, check fuse F1. If no DC power appears in the chassis, check rectifier V14, power supply filter network (C104 and L23), and SEND-REC switch S9. Inspect the power supply for any signs of discoloration due to arcing and loose connections. Any one of the above symptoms mentioned could cause the GPR-90RXD to be inoperative. (See figure 5-1.) Check the tube pin socket voltages with a reliable 20,000 ohms-per-voltmeter.

Check the voltage across voltage regulator V15 for 150 volts. V15 could short and prevent the chassis from receiving full voltage output. A faulty voltage regulator would cause the various oscillators to malfunction.

(2) **CHASSIS.** - If, after the power supply has been checked out the GPR-90RXD still does not operate correctly, inspect all the tubes and see that the filaments are glowing, replacing any tubes as necessary. If the filaments are good, note the operation of the S-meter. If the S-meter operates correctly, the fault is probably in V8, V9, V10, or V11. If not, check the RF and IF circuits first. The quickest method of locating the trouble is to utilize the voltage and resistance diagram, figure 5-1.

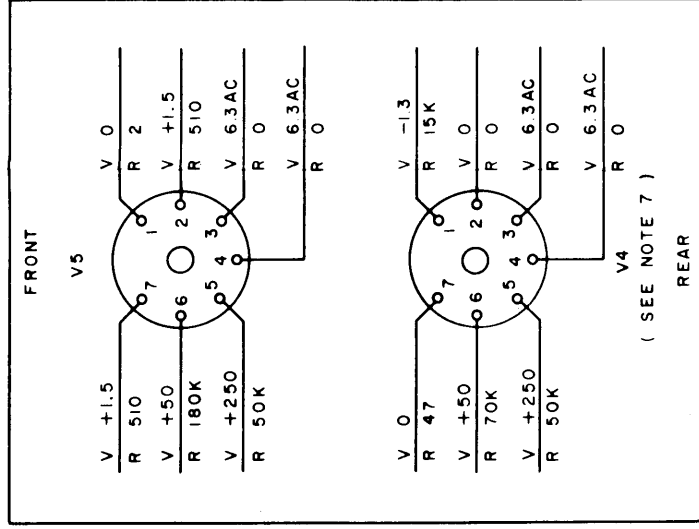
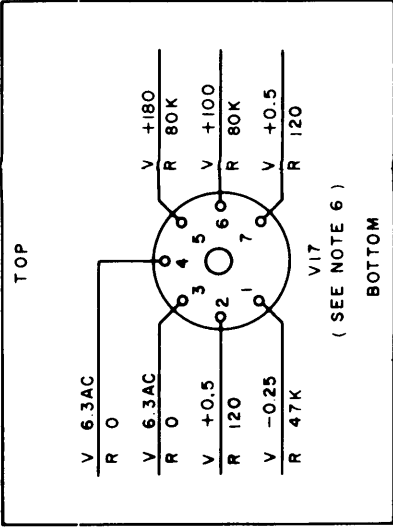
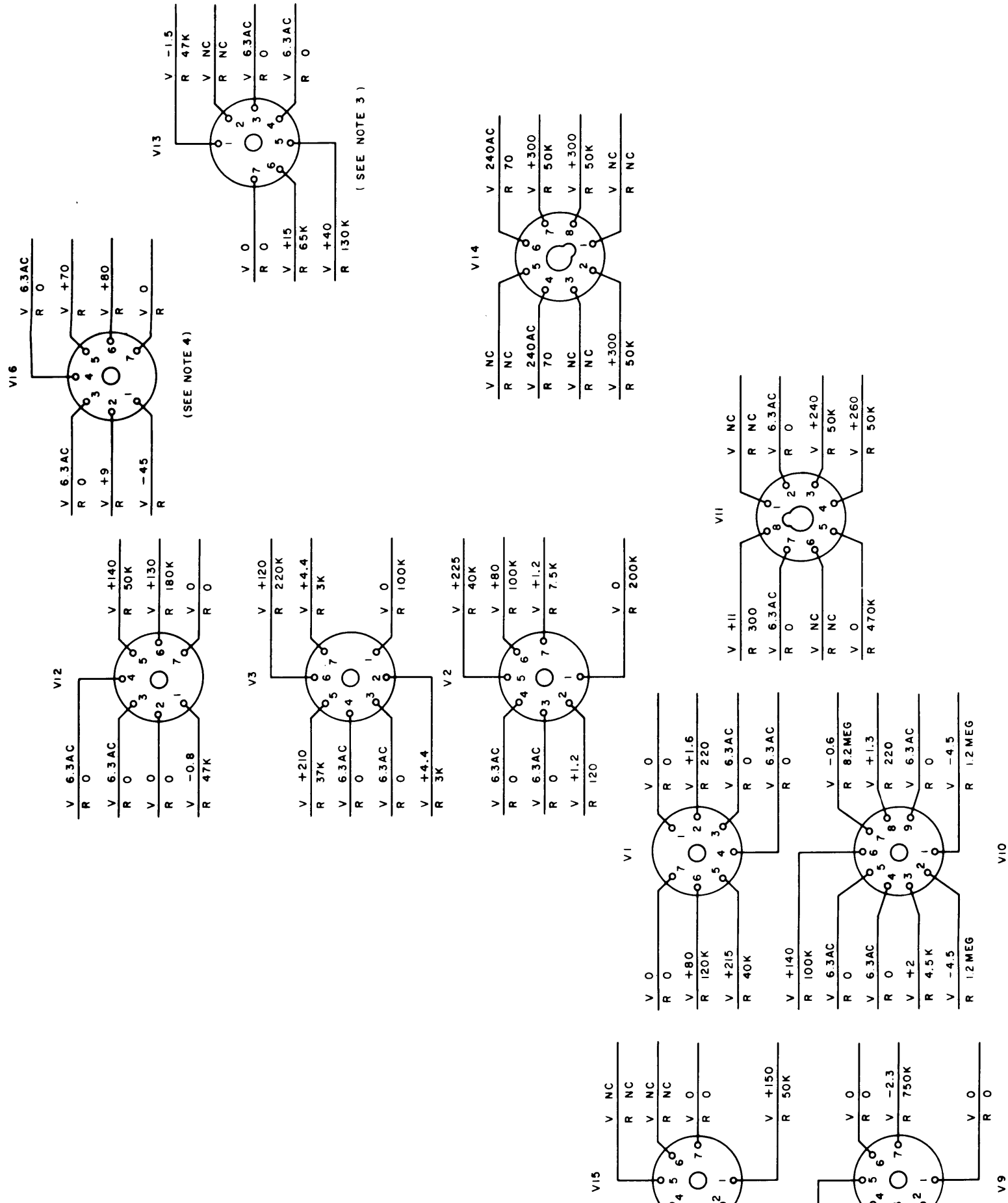
TABLE 5-1. TROUBLESHOOTING CHART, COMMUNICATIONS RECEIVER GPR-90RXD

STEP	CONTROL OPERATED	NORMAL INDICATION	REMEDY
1	Set GPR-90RXD controls and switches for AM reception. RF GAIN control R81 should be adjusted fully clockwise. After a 1-minute warm-up period, tune the GPR-90RXD through band 2, observe the S-meter, and listen to the audio, adjusting AUDIO GAIN control R68 as required.	S-meter M1 should deflect each time a station is tuned as indicated by the audio output. Front panel lamps glow.	<p>If none of the normal indications are present, check fuse F1 and replace if necessary. Repeat step 1. If the fuse opens, check tubes V14 and V15 and their associated circuits.</p> <p>If S-meter M1 fluctuates as the GPR-90RXD is tuned and no audio is heard, check tubes V11, V10, V9, and V8 in that order.</p> <p>If S-meter M1 fluctuates very weakly, check tubes V7, V6, V5, and V3.</p> <p>If S-meter M1 does not deflect at all, check tubes V12, V7, V6, V5, V3, V2, and V1.</p>
2	Turn RANGE SELECTOR switch S1 to 9.4-17.8.	S-meter M1 should deflect each time a station is tuned.	If S-meter M1 fluctuates very weakly or not at all, check tube V4.
3	Set CAL switch S11 to the ON position.	S-meter M1 should deflect at 100-kc intervals.	Check tube V16 and its associated circuit.

TABLE 5-1. TROUBLESHOOTING CHART, COMMUNICATIONS RECEIVER GPR-90RXD (CONT'D)

STEP	CONTROL OPERATED	NORMAL INDICATION	REMEDY
4	Set GPR-90RXD controls and switches for CW reception. Tune the GPR-90RXD over any band.	Audio beats should be heard each time a carrier is tuned.	Check tube V13 and its associated circuit.
5	Set GPR-90RXD controls and switches for SSB reception. Tune in an SSB station.	Nondistorted audio should be heard.	Check tube V13 and its associated circuit.
6	Set GPR-90RXD controls for AM reception; turn HFO switch S12 to any of the 10 crystal positions and switch S13 to position 5. Tune in the particular channel as determined by the crystal chosen.	Normal AM reception should be heard.	Tune to a different channel. Check tube V17 and switches S12 and S13.

FRONT



CONDITIONS:

VOLTAGE MEASUREMENTS

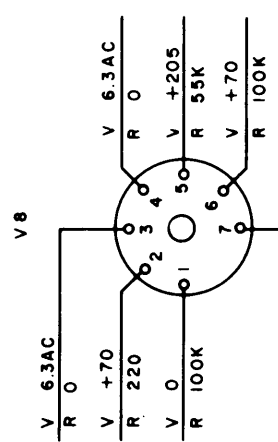
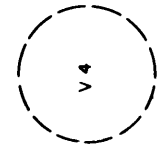
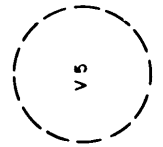
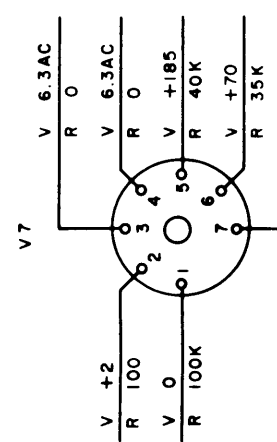
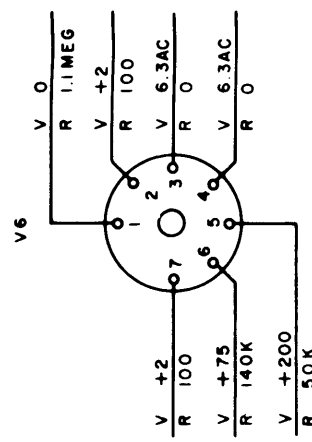
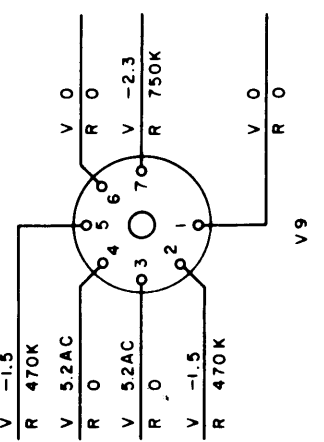
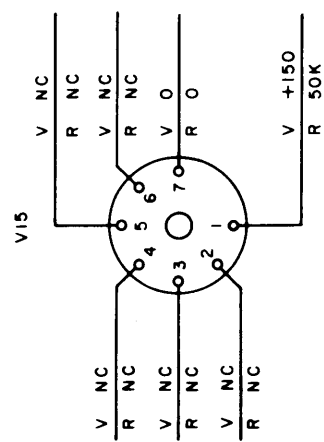
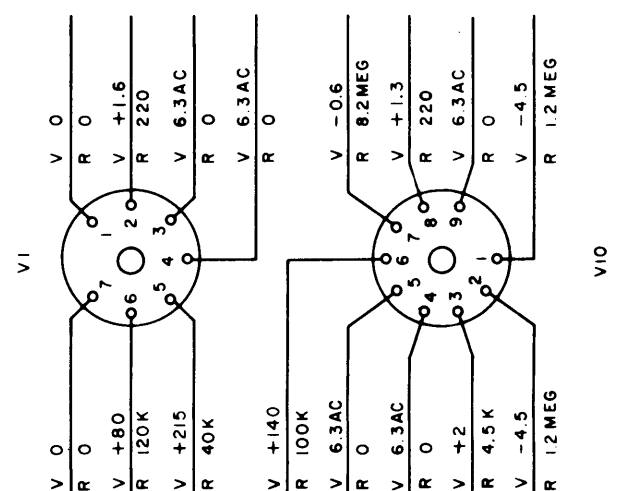
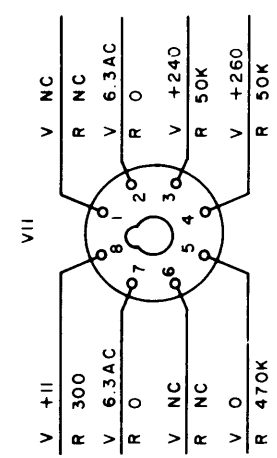
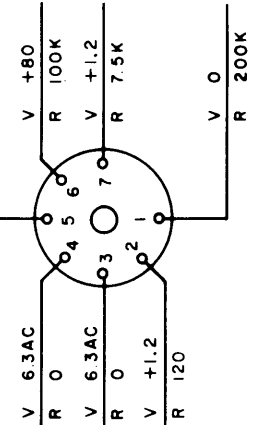
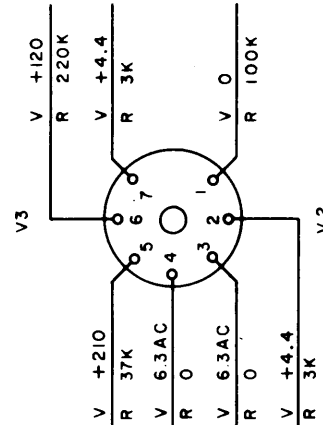
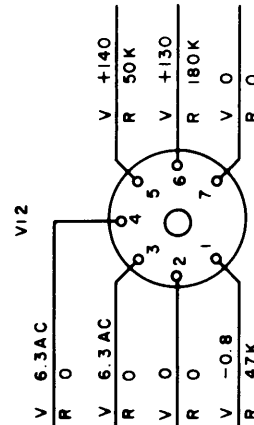
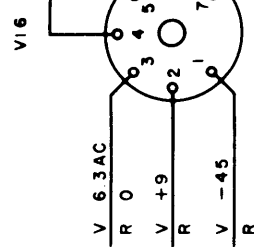
- ALL MEASUREMENTS MADE TO CHASSIS GROUND, EXCEPT FILAMENT VOLTAGES WHICH ARE MEASURED ACROSS THE FILAMENTS.
- RANGE SELECTOR 1.4-3.3 FULLY COUNTERCLOCKWISE
AUDIO GAIN REC
SEND/REC UP POSITION
MANUAL/AVC OFF
LIMITER/OFF OFF
BFO/OFF OFF
CAL/OFF OFF
- V13 MEASUREMENTS MADE WITH BFO/OFF SWITCH IN UP POSITION.
- V16 MEASUREMENTS MADE WITH CAL/OFF SWITCH IN UP POSITION.
- V12 MEASUREMENTS MADE WITH HFO SWITCH IN VAR POSITION
- V17 MEASUREMENTS MADE WITH HFO SWITCH IN EXT. POSITION.
- V4 MEASUREMENTS MADE WITH RANGE SELECTOR SWITCH IN 9.4-17.8 POSITION.
- MEASUREMENTS MADE WITH VTVM.

RESISTANCE MEASUREMENTS

- PRIMARY POWER REMOVED.
- UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS.
- ALL MEASUREMENTS MADE TO CHASSIS GROUND EXCEPT FILAMENT RESISTANCES WHICH ARE MEASURED ACROSS THE FILAMENTS.
- SEE NOTE 3 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 4 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 5 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 6 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 7 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 2 OF VOLTAGE MEASUREMENTS.
- SEE NOTE 8 OF VOLTAGE MEASUREMENTS.

Figure 5-1. Voltage and Resistance Diagram, GPR-90RXD

FRONT



V NC
R NC
V 240A
R 70
V NC
R NC
V +300
R 50K

(SEE NOTE 4)

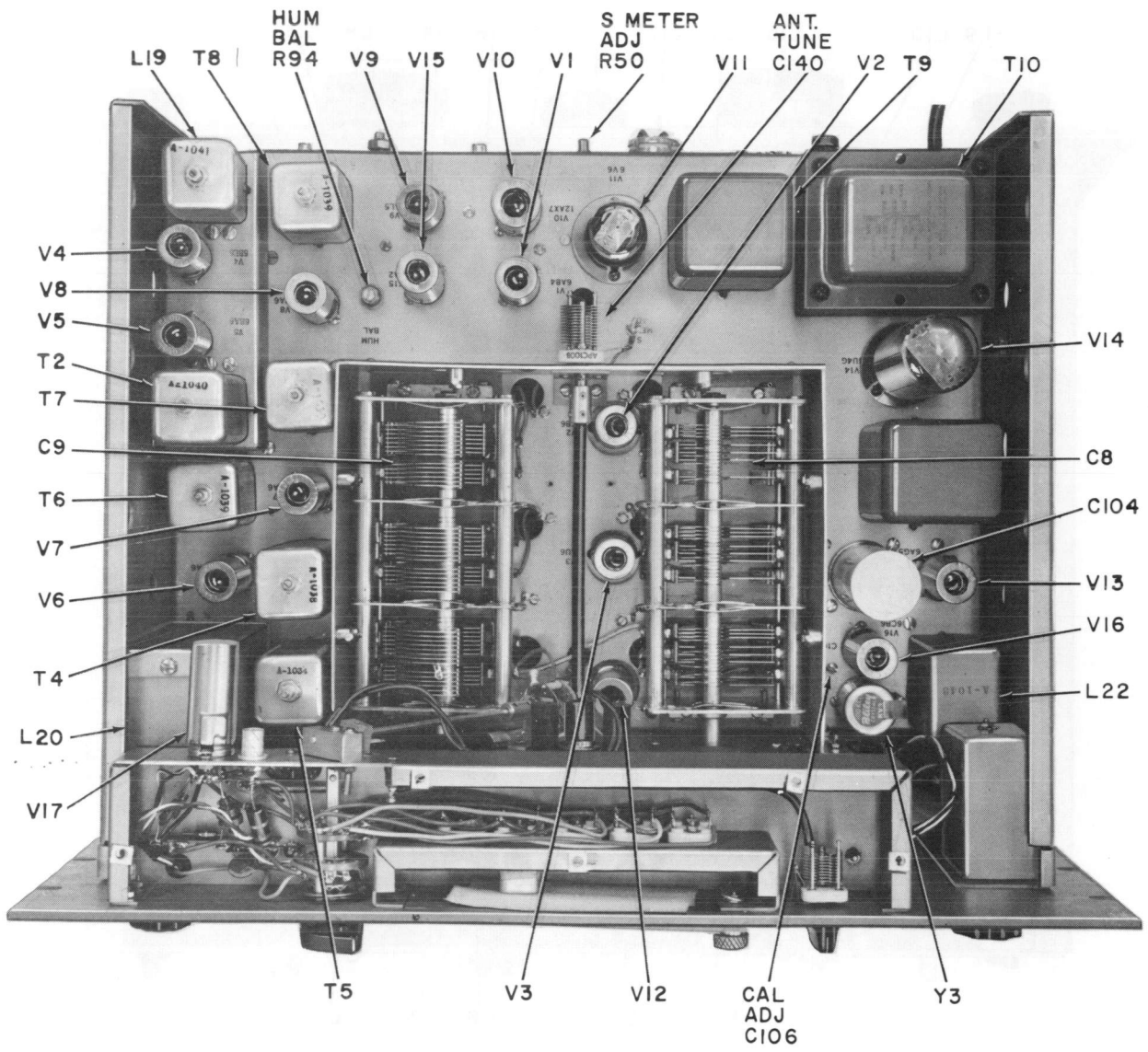


Figure 5-2. Location of Major Electronic Components, GPR-90RXD, Top View

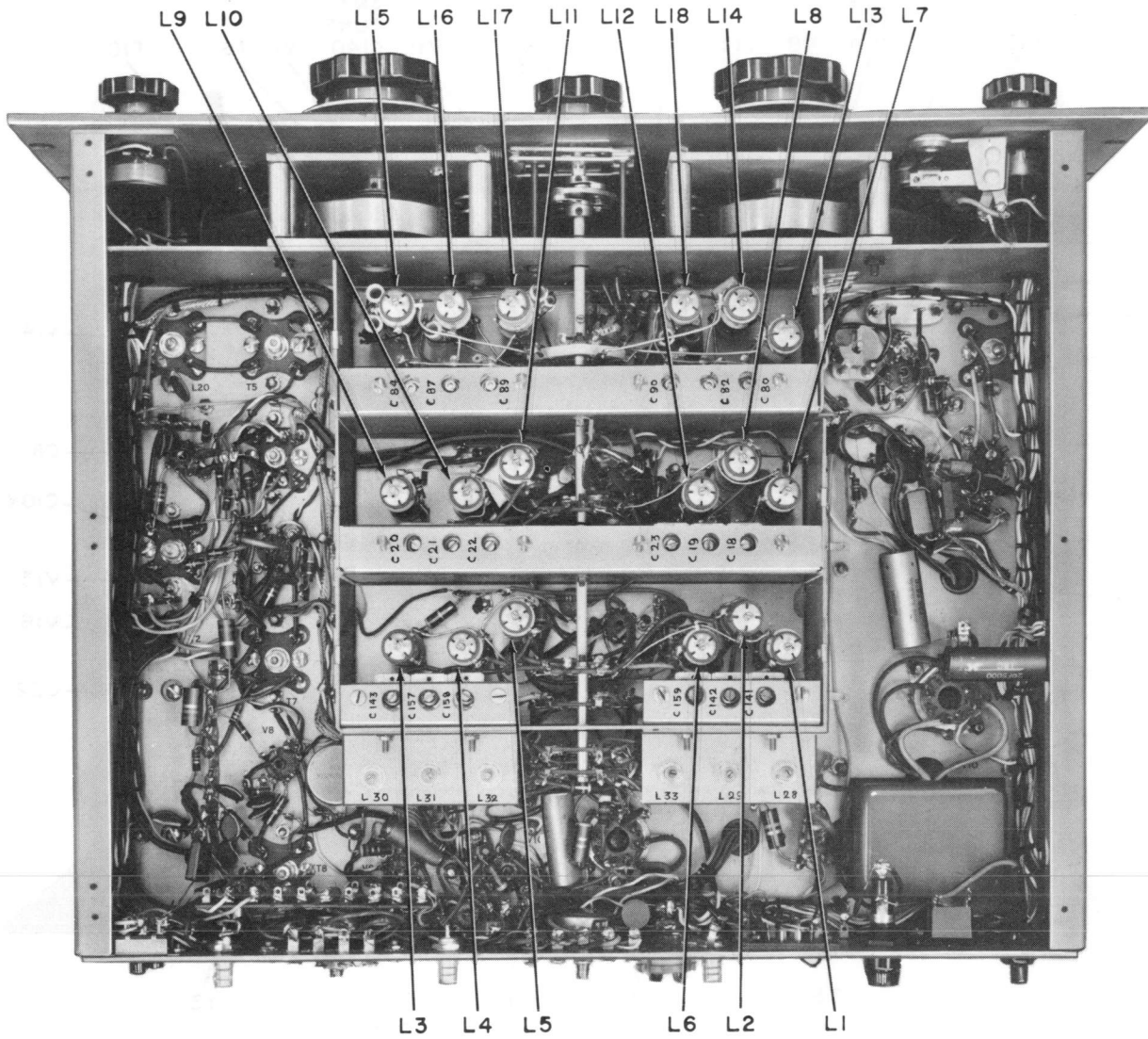


Figure 5-3. Location of Major Electronic Components, GPR-90RXD, Bottom View

SECTION 6 MAINTENANCE

6-1. GENERAL.

The maintenance data contained in this section falls into two categories: preventive maintenance and corrective maintenance. The purpose of preventive maintenance is to minimize equipment breakdown by performing periodic checks and those procedures which tend to maintain normal operation. Corrective maintenance may be considered as consisting of information useful in locating and diagnosing equipment troubles and maladjustments. The diagnostic type of information is presented under troubleshooting (Section 5); remedial type of information is presented in this section.

6-2. COMMUNICATIONS RECEIVER GPR-90RXD.

a. PREVENTIVE MAINTENANCE.

(1) In order to prevent actual failure of the GPR-90RXD's it is suggested that a schedule of preventive maintenance be set up and adhered to.

(2) At periodic intervals (at least every six months) the GPR-90RXD should be removed from the cabinet for cleaning and inspection. The chassis wiring should be inspected for dirt, corrosion, charring, discoloring or grease; in particular, the tube socket should be carefully inspected for evidence of deterioration. Dust may be removed with a soft brush or a vacuum cleaner if one is available. Remove dirt or grease from electrical parts with trichlorethylene or ethylenedichloride. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

Carbon tetrachloride (CCl₄) may be used only if great care is exercised because it is a toxic substance. Do not inhale its fumes. Avoid contact with skin.

(3) Test each tube, one at a time, in a reliable tube tester, replacing tube in socket from which it was removed if its measured characteristics are within the manufacturer's tolerances (usually ± 20 percent from tube manual values). Replace only those tubes which are found to be below par; recommended procedure is once every three months.

(4) When replacing the GPR-90RXD in the cabinet, ensure that all terminal screw connections at the rear of the GPR-90RXD are tight.

b. CORRECTIVE MAINTENANCE.

(1) GENERAL. - Corrective maintenance of the GPR-90RXD's is limited to alignment of their tank circuits, S-meters, and hum balance adjustments. The circuits of the GPR-90RXD have been carefully aligned by factory personnel. Realignment of the GPR-90RXD should not be attempted until all other causes of faulty operation have been investigated. Alignment should not be required unless the GPR-90RXD has been tampered with or some component part replaced in the stages containing tuned circuits. Alignment should be made only by personnel familiar with GPR-90RXD's and experienced with their alignment.

(2) IF ALIGNMENT. - The low frequency should be aligned first. Remove the dust cover over the tuning capacitor shield compartment by removing the knurled nuts. Couple the signal generator to the lug of the middle section of the main tuning capacitor. (See figure 5-2.) Connect the oscillator return to ground by means of a short wire with alligator clips on each end. Connect the 600-ohm, 10-watt load and the AC voltmeter across the 600-ohm speaker terminals. Set the following controls and switches as follows:

RANGE SELECTOR switch	.54- 1.4
AVC switch	MANUAL
LIMITER switch	OFF
BFO switch	OFF
SEND-REC switch	REC
AUDIO SELECTOR switch	NORMAL
RF GAIN control	Fully clockwise
AUDIO GAIN control	Fully clockwise
MAIN TUNING control	Half capacity
XTAL PHASE control	0

(3) 455 KC. - Turn the RF SELECTIVITY to the NON XTAL position and the signal generator frequency to 455 kc, modulated 30 percent at 400 cycles. A pair of headphones may be used for monitoring purposes. Adjust the signal generator output until some deflection is noted on the output meter. Peak IF transformers T8, T7, T6, T5 (top and bottom), and T4 (top) for maximum output. (See figures 5-2 and 5-3 for the location of these adjustments. During

alignment, the signal generator output should be progressively reduced to prevent GPR-90RXD overload. Turn the RF SELECTIVITY control to the 2.0 KC position and adjust the signal generator frequency for maximum meter deflection. In this way the signal generator frequency is made to coincide with the 455-kc crystal frequency in the GPR-90RXD IF. The frequency of the generator should not be disturbed for the remainder of the 455-kc IF and BFO alignment. Again peak transformers T8, T7, T6, and T5 (top and bottom), T4 (top), and coil L20 for maximum output.

(4) BFO. - Turn off the signal generator modulation and set the BFO PITCH control to zero. Turn the BFO switch to the on position and adjust coil L22 for a zero beat.

(5) 3.955 MC. - Turn the RANGE SELECTOR switch to the 5.4- 9.6 position. Set the signal generator to 3.955 mc, modulated 30 percent at 400 cycles. Adjust second converter coil, L19, until an output is indicated. Since adjustment of L19 permits the 3.5-mc crystal-controlled oscillator to operate over a small frequency range, it must be set approximately in the middle of this range for stable operation. To determine stable oscillator operation, momentarily turn the GPR-90RXD off and on. If the GPR-90RXD continues to operate after interruption, L19 is set correctly. When the oscillator coil is adjusted to 3.5 mc, adjust transformers T3 (bottom) and T2 (top and bottom) for maximum output.

During this test, use sufficient generator output, but not enough to overload the GPR-90RXD. This completes the IF alignment. Remove the signal generator leads from the tuning capacitor and the oscillator ground. Replace the dust cover over the tuning capacitor compartment.

(6) RF ALIGNMENT. - The frequencies for the RF alignment and the location of these adjustments are shown in figure 5-3. The lowest frequency band is aligned first, followed by the next higher band. The alignment procedure for the broadcast band will be described so that the remaining bands can be aligned in a similar manner. The signal generator is coupled to the antenna jack.

NOTE

The generator output impedance should be subtracted from 75 ohms to obtain the proper antenna dummy resistor. The same GPR-90RXD control settings should be used as in the case of IF alignment, except that the RF SELECTIVITY control is set to the NON XTAL position and the BAND SPREAD dial is locked to 100 on the logging calibration.

Set the MAIN TUNING dial and the signal generator frequency to 0.56 mc. The signal generator should be modulated 30 percent at 400 cycles and the output meter connected across the output terminals. Adjust oscillator slug L13 first, using sufficient signal generator output to obtain meter deflection, followed by coils L7 and L1 to obtain maximum output. The signal generator output should be progressively decreased as GPR-90RXD sensitivity increases with each tuned circuit. Set the GPR-90RXD and signal generator dials to 1.4 mc and adjust capacitors C80 and C18 in that order for maximum output. Repeat the above procedure very carefully and until there is no further improvement in sensitivity and frequency calibration. The remaining stages are aligned in a similar manner and are listed in table 6-1. The image frequency listed for each signal frequency should be checked to ascertain that the oscillator, V12, is operating above the signal frequency.

(7) S-METER CALIBRATION. - Turn the RANGE SELECTOR switch to 5.4 - 9.6, AVC switch to on, RF SELECTIVITY switch to NON XTAL, RF GAIN control to maximum, signal generator and GPR-90RXD MAIN TUNING control to 14 mc. Apply 50 microvolts to the GPR-90RXD antenna terminals; tune the GPR-90RXD to the signal; and adjust resistor R50, R106, and the ANT. TUNE control for an S-9 reading on the S-meter.

(8) HUM BALANCE ADJUSTMENT. - Connect a high impedance AC voltmeter with a 3-millivolt range or a sensitive oscilloscope across the 600-ohms audio output load. Ground the GPR-90RXD to an external ground. Adjust the RF GAIN and AUDIO GAIN controls to their maximum settings. Adjust hum balance control R94 for minimum meter or oscilloscope deflection.

TABLE 6-1. ALIGNMENT DATA, GPR-90RXD

BAND	SIGNAL GENERATOR AND RECEIVER DIAL SETTING	ADJUST FOR MAXIMUM OUT- PUT IN ORDER GIVEN			IMAGE FREQUENCY APPEARS ON SIGNAL GENERATOR DIAL*
		OSC	MIXER	RF	
1	.56 mc	L13	L7	L1	1.47 mc
	1.4 mc	C80	C18	Ant. Tune	2.31 mc
2	1.5 mc	L14	L8	L2	2.41 mc
	3.2 mc	C82	C19	Ant. Tune	4.11 mc
3	3.3 mc	L15	L9	L3	4.21 mc
	5.5 mc	C84	C20	Ant. Tune	6.41 mc
4	5.6 mc	L16	L10	L4	13.51 mc
	9.5 mc	C87	C21	Ant. Tune	17.41 mc
5	9.8 mc	L17	L11	L5	17.71 mc
	17.5 mc	C89	C22	Ant. Tune	25.41 mc
6	18.0 mc	L18	L12	L6	25.91 mc
	31.0 mc	C90	C23	Ant. Tune	38.91 mc

*Use sufficient signal generator output.

SECTION 7 PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C1	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%; 500 wvdc.	Decoupling	CC-100-16
C2	Same as C1	Bypass V1	CC-100-16
C3	CAPACITOR, fixed: ceramic; 5 uuf, ±0.25 uufd; 500 wvdc.	Coupling L4	CC21SL050C
C4	Same as C3	Coupling L5	CC21SL050C
C5	CAPACITOR, fixed: ceramic; 47 uuf, ±10%, 500 wvdc.	Coupling L6	CC21SL470K
C6	Same as C1	RF Bypass	CC-100-16
C7	Same as C1	Bypass	CC-100-16
C8A,B, & C	CAPACITOR, variable: air tuning; bandspread, 3 sections; I A) 6.6 - 6.8 mmf, B) 7.4 - 12.8 mmf, C) 6.9 - 38.5 mmf, II A) 5.9 - 6.2 mmf, B) 7.3 - 12.8 mmf, C) 7.0 - 38.6 mmf, III A) 5.9 - 6.3 mmf, B) 7.4 - 12.7 mmf, C) 7.1 - 38.6 mmf, ±0.5 uuf.	Bandspread	CB-131
C9A,B, & C	CAPACITOR, variable: air dielectric; three main sections; six subsections; three with 11 plates; three with 15 plates; 8.5 - 135 uufd. each 11 plate sect. 10.5 - 189 uuf. ea. 15 plate sect.	Main Tuning	CB-130
C10	CAPACITOR, fixed: ceramic; .1 uf, ±80 -20%; 500 wvdc.	Bypass V6	CC-100-28
C11	Same as C1	Bypass V2	CC-100-16
C12	Same as C1	Bypass V2	CC-100-16
C13	CAPACITOR, fixed: mica; 1600 uuf, char. D; 500 wvdc.	Plate V2	CM20D162F
C14	CAPACITOR, fixed: mica; 270 uuf, ±2%, char, C; 300 wvdc.	Plate V2	CM15C271G
C15	Same as C3	Coupling L11	CC21SL050C
C16	Same as C1	B+ Bypass	CC-100-16
C17	Same as C1	B+ Bypass	CC-100-16
C18	CAPACITOR, variable: mica; 3 sections (Section 1); 27 - 30 uuf, each section.	Mixer Trimmer	CX-101
C19	Section 2 of C18	Mixer Trimmer	P/O CX-101

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C20	Section 3 of C18	Mixer Trimmer	P/O CX-101
C21	Same as C18 (Section 1)	Mixer Trimmer	CX-101
C22	Section 2 of C21	Mixer Trimmer	P/O CX-101
C23	Section 3 of C21	Mixer Trimmer	P/O CX-101
C24	Same as C1	Grid Return	CC-100-16
C25	Same as C1	Bypass V3	CC-100-16
C26	Same as C1	Screen Bypass V3	CC-100-16
C27	CAPACITOR, fixed: mica; 180 uuf, ±2%; char. D; 500 wvdc.	IF Tank P/O T3	CM20D181G
C28	CAPACITOR, fixed: mica; 1,000 uuf, ±2%; char. D; 500 wvdc.	IF Tank P/O T4	CM20D102G
C29	Same as C1	Bypass T4	CC-100-16
C30	Same as C1	Bypass V4	CC-100-16
C31	Same as C1	Bypass V4	CC-100-16
C32	CAPACITOR, fixed; ceramic; 120 uuf, ±20%; 500 wvdc.	Coupling V4	CC-101-4
C33	CAPACITOR, fixed: mica; 220 uuf, ±2%; char. D; 500 wvdc.	OSC Tank P/O L19	CM20D221G
C34	CAPACITOR, fixed: mica; 200 uuf, ±2%; char. D; 500 wvdc.	IF Tank P/O T2	CM20D201G
C35	Same as C34	IF Tank P/O T2	CM20D201G
C36	Same as C1	Bypass V5	CC-100-16
C37	Same as C1	Bypass V5	CC-100-16
C38	Same as C1	RF Bypass	CC-100-16
C39	Same as C33	IF Tank P/O T5	CM20D221G
C40	Same as C1	Bypass T5	CC-100-16
C41	CAPACITOR, fixed: mica; 2400 uuf, ±2%; char. D; 500 wvdc.	IF Tank P/O T5	CM20D242G
C42	CAPACITOR, variable; air dielectric; 1 section 3 plates; 2.8 - 11 uuf.	XTAL Phasing	CT-105-1
C43	CAPACITOR, fixed: mica; 5 uuf, ±20%; char. C; 300 wvdc.	XTAL Filter Y1	CM15C050M
C44	CAPACITOR, fixed: mica; 300 uuf, ±2%; char. D; 500 wvdc.	XTAL Filter Y1	CM20D301G
C45	Same as C1	Coupling V6	CC-100-16
C46	Same as C1	Bypass V6	CC-100-16

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C47	Same as C1	AVC Return	CC-100-16
C48	Same as C1	Screen Bypass V6	CC-100-16
C49	Same as C28	IF Tank P/O T6	CM20D102G
C50	Same as C1	Bypass T6	CC-100-16
C51	Same as C28	IF Tank P/O T6	CM20D102G
C52	Same as C1	AVC Bypass	CC-100-16
C53	Same as C1	Cathode Bypass V7	CC-100-16
C54	Same as C1	Screen Bypass V7	CC-100-16
C55	Same as C28	IF Tank P/O T7	CM20D102G
C56	Same as C1	Bypass T7	CC-100-16
C57	Same as C5	IF Output	CC21SL470K
C58	Same as C28	IF Tank P/O T7	CM20D102G
C59	CAPACITOR, fixed: ceramic; 3 uuf, ±0.25 uufd; char. SL; 500 wvdc.	BFO Injection T7	CC21SL030C
C60	Same as C1	Cathode Bypass V8	CC-100-16
C61	Same as C1	Screen Bypass V8	CC-100-16
C62	Same as C28	IF Tank P/O T8	CM20D102G
C63	Same as C1	Bypass T8	CC-100-16
C64	Same as C28	IF Tank P/O T8	CM20D102G
C65	CAPACITOR, fixed: ceramic; 220 uufd, ±10%; 500 wvdc.	RF Filter T8	CC-101-3
C66	Same as C65	RF Filter T8	CC-101-3
C67	Same as C1	Bypass V9	CC-100-16
C68	CAPACITOR, fixed: ceramic; 51 uuf, ±2%; 500 wvdc.	Coupling V9	CC21SL510G
C69	CAPACITOR, fixed: paper; .05 uf, +40% -20%; 400 wvdc.	Time Constant	CN-100-3
C70	Same as C1	Bypass V10	CC-100-16
C71	Same as C1	Coupling V10	CC-100-16
C72	CAPACITOR, fixed: ceramic; .005 uf, GMV; 500 wvdc.; disc type.	Low Pass Filter	CC-100-15
C73	CAPACITOR, fixed: ceramic; .02 uf, ±80% -20%; 500 wvdc.; disc type.	Audio Filter	CC-100-24
C74	CAPACITOR, fixed: ceramic; dielectric; 30 uuf, ±5%; 500 wvdc.	OSC Injection S13	CC26CH300J

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C75	Same as C1	Coupling V11	CC-100-16
C76	CAPACITOR, fixed: electrolytic; 25 uf, ±10%; 150 wvdc.	Bypass V11	CE-100
C77	CAPACITOR, fixed: electrolytic; 20 uf, 250 wvdc.	Bypass V11	CE-103-5
C78	CAPACITOR, fixed: ceramic; dielectric; 47 uuf, ±5%; 500 wvdc.	OSC Injection HFO, S1F	CC21SL470J
C79	CAPACITOR, fixed: mica; 430 uuf, char. D; 500 wvdc.	Padder L13	CM20D431F
C80	CAPACITOR, variable: air dielectric; one section, 21 plates; 2.7 - 19.6 uuf.	OSC Trimmer L13	CB-122-4
C81	CAPACITOR, fixed: mica; .01 uf, char. D; 500 wvdc.	Padder L14	CM20D1091F
C82	Same as C80	Trimmer L14	CB-122-4
C83	CAPACITOR, fixed: ceramic; 750 uuf, ±5%; 500 wvdc.	Padder L15	CC45UJ751J
C84	Same as C80	Trimmer L15	CB-122-4
C85	CAPACITOR, fixed: ceramic; 91 uuf, ±5%; 500 wvdc.	Padder L16	CC35CG910J
C86	CAPACITOR, fixed: ceramic; 4.7 uuf, ±25%; 500 wvdc.	Tank L16	CC20UJ4R7C
C87	Same as C80	Trimmer L16	CB-122-4
C88	CAPACITOR, fixed: ceramic; 330 uuf, ±5%; 500 wvdc.	Padder L17	CC45SH331J
C89	Same as C80	Trimmer L17	CB-122-4
C90	Same as C80	Trimmer L18	CB-122-4
C91	Same as C86	Tank L18	CC20UJ4R7C
C92	CAPACITOR, fixed: ceramic; 390 uuf, ±5%; 500 wvdc.	Padder L18	CC45SH391J
C93	Same as C78	Coupling V12	CC21SL470J
C94	Same as C1	Plate Return V12	CC-100-16
C95	Same as C1	Bypass V12	CC-100-16
C96	Same as C1	Bypass V12	CC-100-16
C97	Same as C69	Bypass R81	CN-100-3
C98	CAPACITOR, fixed: mica; 1500 uuf, ±2%; char. D; 500 wvdc.	BFO Tank P/O L22	CM20D152G

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C99	CAPACITOR, variable: air dielectric; 1 section, 14 plates; 2.9 - 35 uuf, 500 wvdc.	BFO Pitch P/O L22	CT-104-4
C100	Same as C65	Grid Coupling P/O L22	CC-101-3
C101	Same as C1	Screen Bypass V13	CC-100-16
C102	Same as C1	Bypass V13	CC-100-16
C103	Same as C1	AC Line Bypass	CC-100-16
C104 A & B	CAPACITOR, fixed: electrolytic; dual unit; 40 uf; each section, 450 wvdc.	B+ Filter V14	CE-102-1
C105 A & B	CAPACITOR, fixed: ceramic; two sections; .01 uf, 500 wvdc; ea., disc type.	Fil. Bypass V6	CC-100-23
C106	CAPACITOR, variable: air dielectric; 1 section, 19 plates; 3.2 - 50 uuf, 500 wvdc.	Cal Adjust V16	CT-104-3
C107	Same as C73	Bypass	CC-100-24
C108	Same as C1	AC Line Bypass	CC-100-16
C109	Same as C3	Coupling L12	CC21SL050L
C110	CAPACITOR, fixed: ceramic; .002 uf, GMV, 500 wvdc, disc type.	Decoupling	CC-100-11
C111	Same as C1	B+ Bypass	CC-100-16
C112	Same as C1	B+ Bypass	CC-100-16
C113	Same as C1	B+ Bypass	CC-100-16
C114	CAPACITOR, fixed: ceramic; 6.8 uuf, $\pm .5\%$; 500 wvdc.	Tank L15	CC20UJ6R8D
C115	CAPACITOR, fixed: ceramic; 22 uuf, $\pm 10\%$; 500 wvdc.	Coupling L12	CC21SL220K
C116	Same as C1	Grid Bias V10	CC-100-16
C117	Same as C72	Cathode Bias V1	CC-100-15
C118	Same as C72	Series Tank	CC-100-15
C119	Same as C73	Bypass	CC-100-24
C102	Same as C1	Series Tank	CC-100-16
C121	Same as C1	B+ Bypass V12	CC-100-16
C122	CAPACITOR, fixed: ceramic; 2.2 uuf, $\pm .5\%$ uuf; 500 wvdc.	Temp Comp. V12	CC-101-9
C123	Same as C122	Temp Comp. SIG	CC-101-9

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C124	CAPACITOR, fixed: mica; .001 uf, ±10%; char. B; 500 wvdc.	DC Blocking	CM20B102K
C125	CAPACITOR, fixed: ceramic; 10 uuf, ±5%; 500 wvdc.	Tank L14	CC20UJ100J
C126	CAPACITOR, fixed: ceramic; 4.7 uuf, ±.25 uufd; 500 wvdc.	Tank L17	CC20RH4R7C
C127	Same as C83	Padder L15	CC45UJ751J
C128	CAPACITOR, fixed: ceramic; 180 uuf, ±5%; 500 wvdc.	Padder L15	CC35UJ181J
C129	CAPACITOR, fixed: ceramic; 220 uuf, ±5%; 500 wvdc.	Padder L16	CC45SH221J
C130	CAPACITOR, fixed: ceramic; 100 uuf, ±5%; 500 wvdc.	Padder L17	CC32SH101J
C131	CAPACITOR, fixed: ceramic; 390 uuf, ±5%; 500 wvdc.	Padder L18	CC45TH391J
C132	Same as C10	Bypass	CC-100-28
C133	Same as C10	Bypass	CC-100-28
C134	Same as C1	Cathode Bypass V16	CC-100-16
C135	Same as C1	Feedback V16	CC-100-16
C136	CAPACITOR, fixed: ceramic; 150 uuf, ±10%; 500 wvdc.	Screen Bypass V16	CC-101-2
C137	CAPACITOR, fixed: ceramic; 8 uuf, ±2%; 500 wvdc.	Coupling	CC21SL080G
C138	Same as C72	Series Tank	CC-100-15
C139	Same as C72	Series Tank	CC-100-15
C140	CAPACITOR, variable: air tuning; 100 uuf, 27 plates; air gap = 0.015 nominal; 600V RMS.	Bypass V1	CB-132-100B
C141	Same as C18 (Section 1)	Series Tank	CX-101
C142	Same as C18 (Section 2)	Series Tank	P/O CX-101
C143	Same as C18 (Section 3)	Series Tank	P/O CX-101
C144	Same as C1	Fil. Bypass V4	CC-100-16
C145	Same as C1	Fil. Bypass V4	CC-100-16
C146	Same as C1	Cathode Bypass V17	CC-100-16
C147	Same as C1	Screen Bypass V17	CC-100-16
C148	Same as C1	B+ Bypass V17	CC-100-16

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C149	CAPACITOR, variable: air dielectric: 1 section, 19 plates; 3.2 - 50 uuf, 500 wvdc.	Freq. Adjust	CT-104-1
C150	Same as C72	Bypass J2	CC-100-15
C151	Same as C1	Fil. Bypass V8	CC-100-16
C152	Same as C1	Fil. Bypass V8	CC-100-16
C153	CAPACITOR, fixed: mica; .0013 uf, $\pm 2\%$; char. B; 500 wvdc.	Coupling V4	CM20B132G
C154	Same as C72	RF Bypass V4	CC-100-15
C155	Same as C86	IFO Input	CC20UJ4R7C
C156	Same as C1	AVC Bypass T7	CC-100-16
C157	Same as C18 (Section 1)	Series Tank	CX-101
C158	Same as C18 (Section 2)	Series Tank	P/O CX-101
C159	Same as C18 (Section 3)	Series Tank	P/O CX-101
C160	Same as C124	Bypass V8	CM20B102K
C161	CAPACITOR, fixed: paper; .001 uf, +60 -20%; 600 wvdc; plastic tubular case.	Decoupling V11	CN-100-9
C162	Same as C1	Decoupling V5	CC-100-16
C163	CAPACITOR, fixed: mica; 390 uuf, $\pm 10\%$; char. B; 500 wvdc.	Coupling V13	CM20B391K
C164	CAPACITOR, fixed: mica; .006 uf, $\pm 10\%$; char. B; 500 wvdc.	B+ Bypass V13	CM20B622K
C165	Same as C10	Filter X2	CC-100-28
C166	Same as C10	Filter X2	CC-100-28
CR1	DIODE, XTAL.	Electronic Sw.	1N34A
E1	STRIP, terminal: feedthrough; four 6-32 binder lead screws with solder lugs.	AVC External Terminal Conn.	TM-116-4
E2	STRIP, terminal; feedthrough; five 6-32 binder head screws with solder lugs, Phenolic body.	Audio Output	TM-116-5
E3	Same as E1	Terminal Conn.	TM-116-4
F1	FUSE, cartridge: 2 amp.	AC Line Fuse	FU-100-2
I1	LAMP, incandescent: miniature; 6-8 volts; 250 ma dc; T-3-1/4 frosted bulb; bayonet base.	Dial Light	BI-101-44(AF)
I2	Same as I1	Dial Light	BI-101-44(AF)

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
I3	LAMP, incandescent: 6-8V; 250 ma; T-3-1/4 clear bulb; bayonet base.	Meter Light	BI-101-44
J1A	JACK, tip: electrical; dual contact; phono type.	IF Output	JJ-144
J1B	Same as J1A	Phone Input	JJ-144
J2	JACK, telephone: normally closed.	Phones	JJ-132
J3	CONNECTOR, receptacle: electrical; female; 2 prong; 10 amps 250V, 15 amps 125V.	AC Line	JJ-145
J4	CONNECTOR, receptacle: electrical; female; 2 prong; polarized; one 5/32" dia pin hole, one 1/8" dia pin hole.	Relay Input	JJ-146
J5	CONNECTOR, receptacle: electrical; 1 female contact; 52 ohms; BNC type.	External	UG-625/U
J6	Same as J5	Antenna	UG-625/U
J7	Same as J5	BFO Input	UG-625/U
J8	Same as J5	IF Input	UG-625/U
L1	TRANSFORMER, RF: tuned; Q-pri = 45, sec = 60; L(uh) pri = 138, sec = 195; freq pri = 790 kc, sec = 790 kc.	2nd RF Band 1	TT-101
L2	TRANSFORMER, RF: tuned; 1.43-3.3 mc; primary, 32.5 uh \pm 1.6 uh, Q = 40, secondary, 27.5 uh \pm 1.4 uh, Q = 90.	2nd RF Band 2	A-897
L3	TRANSFORMER, RF: tuned; 3.2-5.6 mc; primary, 190 uh \pm 9.5 uh, Q = 50, secondary, 9.7 uh \pm .048 uh, Q = 85.	2nd RF Band 3	A-898
L4	COIL, RF: tuned; 5.4-9.6 mc; 3.4 uh \pm 5%, Q = 120.	2nd RF Band 4	A-901
L5	COIL, RF: tuned; 9.4-17.8 mc; 1.1 uh \pm 5%, Q = 110.	2nd RF Band 5	A-900
L6	TRANSFORMER, RF: tuned; 17.3-31.5 mc; .3 uh, Q = 115.	2nd RF Band 6	A-905
L7	TRANSFORMER, RF: tuned; 535-1.45 mc; primary, 280 uh \pm 14 uh, Q = 50, secondary, 195 uh \pm 10 uh, Q = 60.	3rd RF Band 1	A-961
L8	TRANSFORMER, RF: tuned; Q-pri = 40, sec = 90; L(uh) pri = 94, sec = 27.5; freq(mc) pri = .790, sec = 2.5.	3rd RF Band 2	TT-109
L9	TRANSFORMER, RF: tuned; Q-pri = 55, sec = 85; L(uh) pri = 9.0, sec = 9.7; freq(mc) pri = 7.9, sec = 2.5.	3rd RF Band 3	TT-108

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L10	TRANSFORMER, RF: tuned; 5.4-9.6 mc; primary, 5 uh \pm 25 uh, Q = 78, secondary, 3.4 uh \pm .2 uh, Q = 120.	3rd RF Band 4	A-964
L11	COIL, RF: tuned; 9.4-17.8 mc; 1.1 uh \pm .05 uh, Q = 115.	3rd RF Band 5	A-965
L12	TRANSFORMER, RF: tuned; 17.3-31.5 mc; .3 uh, Q = 115.	3rd RF Band 6	A-966
L13	TRANSFORMER, RF: tuned; .990-1.905 mc; 111 uh \pm 5 uh, Q = 95; tapped @ 71 uh \pm 4 uh, Q = 85; +13.6 uh \pm .6 uh, Q = 55.	OSC Band 1	A-894
L14	TRANSFORMER, RF: tuned; 1.885-3.755 mc; 20.5 uh \pm 1 uh, Q = 100 \pm 5; tapped @ 13.5 uh \pm .6 uh, Q = 90 \pm 5.	OSC Band 2	A-896
L15	TRANSFORMER, RF: tuned; 3.655-6.055 mc; 8.2 uh \pm .4 uh, Q = 100; tapped @ 5.5 uh \pm .25 uh, Q = 85 \pm 6.	OSC Band 3	A-899
L16	TRANSFORMER, RF: tuned; 9.355-13.555 mc; 1.66 uh \pm .08 uh, Q = 80; tapped @ 1.12 uh \pm .05 uh, Q = 75.	OSC Band 4	A-903
L17	TRANSFORMER, RF: tuned; 9.355-13.555 mc; 0.76 uh, 10.08 uh, Q = 225; tapped @ 0.05 uh, 10.05 uh.	OSC Band 5	A-1356
L18	TRANSFORMER, RF: tuned; 21.255-34.455 mc; 0.25 uh, 10.03 uh, Q = 145; tapped @ 1-1/4 turns.	Oscillator	A-1355
L19	TRANSFORMER, RF: tuned; 7.2 uh \pm 5%; Q = 110.	2nd Converter	A-1041
L20	COIL, RF: tuned; 250 uh \pm 10 uh; Q = 80.	XTAL Filter Load	A-944
L21	COIL, peaking; 700 millihenries; \pm 5%; Q = 55 \pm 10%; DC resistance, 60-75 ohms.	Audio Filter	CL-117
L22	TRANSFORMER, RF: tuned; 75 uh \pm 4 uh, Q = 80; tapped @ 33 uh \pm 1.5 uh.	BFO OSC	A-1043
L23	REACTOR, filter: 11.4 henries; 125 ma max. current; 250 ohms, insulated for 2500 volts, RMS.	RF Choke	TF-158
L24	COIL, RF: fixed; 11.0 uh.	P/O Low Pass Filter	CL-134-3
L25	COIL, RF: 200 uh, wound on resistor, RC30GF822K	RF Choke V4	CL-108-6
L26	COIL, RF: 128 uh.	B+ Choke	CL-177
L27	Same as L26	B+ Choke	CL-177

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L28	TRANSFORMER, RF: tuned; Q-pri = 8, sec = 50; L(uh) pri = 10, sec = 340; freq(mc) pri = 25, sec = .790.	1st RF Band 1	TT-102
L29	TRANSFORMER, RF: tuned; Q-pri = 45, sec = 85; L(uh) pri = 1.4 sec = 75; freq(mc) pri = 2.5 sec = .790.	1st RF Band 2	TT-103
L30	TRANSFORMER, RF: tuned; Q-pri = 20, sec = 75; L(uh) pri = .32, sec = 19.0; freq(mc) pri = 25, sec = 2.5.	1st RF Band 3	TT-104
L31	TRANSFORMER, RF: tuned; Q-pri = 90, sec = 100; L(uh) pri = 42, sec = 7.0; freq(mc) pri = 25, sec = 7.9.	1st RF Band 4	TT-105
L32	TRANSFORMER, RF: tuned; Q-pri = 120, sec = 100; L(uh) pri = .3 sec = 2.5; freq(mc) pri = 25, sec = 7.9.	1st RF Band 5	TT-106
L33	TRANSFORMER, RF: tuned; Q-pri = 100, sec = 155; L(uh) pri = .15 ±5%, sec = .8 ±5%; freq(mc) pri = 25, sec = 25.	1st RF Band 6	TT-107
L34	Same as L26	Cathode Choke V12	CL-177
L35	Same as L24	P/O Low Pass Filter	CL-134-3
L36	COIL, RF: 750 uh; ±20% 100 ma max. current; 17 ohms; bakelite body.	Plate Choke V17	CL-100-5
L37	COIL, RF: fixed; 370 uh; Q = 70, freq = 790 kc; wire - #36, double silk Litz.	BFO Plate	CL-230
L38	COIL, RF: fixed; 585 uh; Q = 80, freq = 790 kc; wire - #36, double silk Litz.	BFO Output	CL-231
M1	METER "S" type: white and red; illuminated dial, w/a 6.3 VAC pilot light.	Sensitivity Meter	MR-107
P1	CONNECTOR, plug: electrical; male; two prong; polarized; one 5/32" dia pin hole, one 1/8" dia pin hole.	Relay Plug	PL-123
P2	P/O W1	Power Input	P/O W1
PL1	CONNECTOR, plug: electrical; 8 prong, octal; polarized; w/associated wiring.	AC Oper Plug	A-1021
R1	RESISTOR, fixed: comp.; 220 ohms ±10%; 1/2 watt.	Cathode Bias V1	RC20GF221K
R2	RESISTOR, fixed: comp.; 100K ohms ±10%; 1/2 watt.	AVC Bias V1	RC20GF104K
R3	RESISTOR, fixed: comp.; 4700 ohms ±5%; 1/2 watt.	Plate Load L4	RC20GF472J
R4	RESISTOR, fixed: comp.; 22K ohms ±5%; 1 watt.	Plate Load L5	RC32GF223J

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R5	RESISTOR, fixed: comp.; 15K ohms ±5%; 1 watt.	Plate Load L6	RC32GF153J
R6	RESISTOR, fixed: comp.; 47000 ohms ±10%; 1 watt.	B+ Decoupling	RC32GF472K
R7	Same as R2.	AVC Bias	RC20GF104K
R8	RESISTOR, fixed: comp.; 22 ohms ±10%; 1/2 watt.	Suppressor V2	RC20GF220K
R9	RESISTOR, fixed: comp.; 150K ohms ±10%; 1/2 watt.	Degeneration V4	RC20GF154K
R10	RESISTOR, fixed: comp.; 120 ohms ±10%; 1/2 watt.	Cathode Bias V2	RC20GF121K
R11	RESISTOR, fixed: comp.; 56K ohms ±10%; 1/2 watt.	Screen Load V2	RC20GF563K
R12	RESISTOR, fixed: comp.; 1K ohm ±10%; 1/2 watt.	Load L10	RC20GF102K
R13	RESISTOR, fixed: comp.; 15K ohms ±5%; 2 watt.	Plate Load L11	RC42GF153J
R14	RESISTOR, fixed: comp.; 4700 ohms ±10%; 1/2 watt.	B+ Bypass	RC20GF472K
R15	Same as R8	Suppressor V3	RC20GF220K
R16	Same as R2	Grid Bias L12	RC20GF104K
R17	RESISTOR, fixed: comp.; 100 ohms ±5%; 1/2 watt.	OSC Injector V9	RC20GF101J
R18	RESISTOR, fixed: comp.; 330 ohms ±10%; 1/2 watt.	Degeneration V3	RC20GF331K
R19	RESISTOR, fixed: comp.; 2700 ohms ±10%; 1/2 watt.	Cathode Bias V3	RC20GF272K
R20	Same as R9	Screen Load V3	RC20GF154K
R21	Same as R14	B+ Decoupling T4	RC20GF472K
R22	RESISTOR, fixed: comp.; 10K ohms ±10%; 1/2 watt.	Screen Load V4	RC20GF103K
R23	RESISTOR, fixed: comp.; 47 ohms ±10%; 1/2 watt.	Suppressor V4	RC20GF470K
R24	RESISTOR, fixed: comp.; 150 ohms ±10%; 1/2 watt.	Cathode Bias V4	RC20GF151K
R25	RESISTOR, fixed: comp.; 15K ohms ±5%; 1/2 watt.	Grid Leak P/O L19	RC20GF153J
R26	Same as R23	Suppressor V4	RC20GF470K
R27	RESISTOR, fixed: comp.; 510 ohms ±5%; 1/2 watt.	Cathode V5	RC20GF511J

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R28	Same as R2	Screen Load V5	RC20GF104K
R29	RESISTOR, fixed: comp.; 12K ohms ±10%; 1 watt.	B+ Decoupling	RC32GF123K
R30	RESISTOR, fixed: comp.; 390K ohms ±10%; 1/2 watt.	Shunting, P/O T5	RC20GF394K
R31	RESISTOR, fixed: comp.; 6800 ohms ±10%; 1/2 watt.	B+ Decoupling	RC20GF682K
R32	RESISTOR, fixed: comp.; 10 ohms ±5%; 1/2 watt.	XTAL Filter Y1	RC20GF100J
R33	Same as R32	XTAL Filter Y1	RC20GF100J
R34	RESISTOR, fixed: comp.; 22 ohms ±5%; 1/2 watt.	XTAL Filter Y1	RC20GF220J
R35	Same as R17	XTAL Filter Y1	RC20GF101J
R36	Same as R8	Limiter V6	RC20GF220K
R37	RESISTOR, fixed: comp.; 1 meg ±10% 1/2 watt	Isolation V6	RC20GF105K
R38	Same as R2	AVC Bias	RC20GF104K
R39	Same as R17	Cathode Bias V6	RC20GF101J
R40	RESISTOR, fixed: comp.; 56K ohms ±10%; 1 watt.	Screen Load V6	RC32GF563K
R41	Same as R11	Shunt, P/O T6	RC20GF563K
R42	RESISTOR, fixed: comp.; 6800 ohms ±10%; 1 watt.	B+ Decoupling	RC32GF682K
R43	Same as R2	AVC Bias T2	RC20GF104K
R44	Same as R8	Suppressor V7	RC20GF220K
R45	Same as R17	Cathode Bias V7	RC20GF101J
R46	RESISTOR, fixed: comp.; 470 ohms ±10%; 1 watt.	Meter Bridge	RC20GF471K
R47	Same as R40	Screen Load V7	RC32GF563K
R48	Same as R11	Shunt, P/O T7	RC20GF563K
R49	RESISTOR, fixed: comp.; 27K ohms ±10%; 2 watts.	Meter Bridge	RC42GF273K
R50	RESISTOR, variable: comp.; 10K ohms ±20%; linear, 2 watts.	Meter Adj.	RV4ATSA103B
R51	RESISTOR, fixed: comp.; 22K ohms ±5%; 2 watts.	Meter Bridge	RC42GF223J
R52	RESISTOR, fixed: comp.; 6800 ohms ±10%; 2 watts.	B+ Decoupling T7	RC42GF682K

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R53	Same as R8	Suppressor V8	RC20GF220K
R54	Same as R1	Cathode Bias V8	RC20GF221K
R55	Same as R40	Screen Load V8	RC32GF563K
R56	Same as R11	Shunt P/O T8	RC20GF563K
R57	Same as R42	B+ Decoupling T8	RC32GF682K
R58	RESISTOR, fixed: comp.; 47K ohms ±10%; 1/2 watt.	Load V9	RC20GF473K
R59	Same as R37	Noise Limiter V9	RC20GF105K
R60	RESISTOR, fixed: comp.; 220K ohms ±10%; 1/2 watt.	Load V9	RC20GF224K
R61	RESISTOR, fixed: comp.; 470K ohms ±10%; 1/2 watt.	Load V9	RC20GF474K
R62	RESISTOR, fixed: comp.; 820K ohms ±10%; 1/2 watt.	Noise Limiter V9	RC20GF824K
R63	RESISTOR, fixed: comp.; 1.2 megs ±10%; 1/2 watt.	AVC V10	RC20GF125K
R64	Same as R63	Volt. Divider V10	RC20GF125K
R65	Same as R14	Cathode Bias V10	RC20GF472K
R66	RESISTOR, fixed: comp.; 180K ohms ±10%; 1/2 watt.	Volt. Divider V10	RC20GF184K
R67	RESISTOR, fixed: comp.; 8.2 megs ±10%; 1/2 watt.	Grid Leak V10	RC20GF825K
R68	RESISTOR, variable: comp.; 1 meg ±10%; linear, 2 watts.	Audio Gain	RV4ATRD105D
R69	Same as R1	Cathode Bias V10	RC20GF221K
R70	RESISTOR, fixed: comp.; 120K ohms ±10%; 1/2 watt.	Feedback V10	RC20GF124K

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R71	RESISTOR, variable: comp.; 1500 ohms $\pm 10\%$; linear, 2 watts.	Audio Spread	RV4ATSC152B
R72	Same as R4	Plate Load	RC32GF223J
R73	Same as R61	Grid Leak V11	RC20GF474K
R74	RESISTOR, fixed: comp.; 300 ohms $\pm 5\%$; 2 watts.	Cathode Bias V11	RC42GF301J
R75	RESISTOR, fixed: comp.; 560 ohms $\pm 10\%$; 2 watts.	Phase Shunt J2	RC42GF561K
R76	Same as R11	B+ Decoupling	RC20GF563K
R77	RESISTOR, fixed: comp.; 680K ohms $\pm 10\%$; 1/2 watt.	Plate Load V16	RC20GF684K
R78	RESISTOR, fixed: comp.; 22K ohms $\pm 10\%$; 1/2 watt.	Grid Leak V12	RC20GF223K
R79	Same as R19	Plate Load V12	RC20GF272K
R80	Same as R78	Screen Load V12	RC20GF223K
R81	RESISTOR, variable: comp.; 5K ohms $\pm 10\%$; 2 watts.	RF Gain	RV4BTRD502E
R82	Same as R58	Grid Leak V13	RC20GF473K
R83	Same as R8	Suppressor V13	RC20GF220K
R84	Same as R70	Screen Load V13	RC20GF124K
R85	Same as R2	AVC Bias	RC20GF104K
R86	RESISTOR, fixed: comp.; 68K ohms $\pm 10\%$; 1/2 watt.	Volt. Divider V13	RC20GF683K
R87	RESISTOR, fixed: wire-wound; 5000 ohms $\pm 10\%$; 20 watts.	Bleeder V14	RW-110-30
R88	RESISTOR, fixed: comp.; 4.7 ohms $\pm 5\%$; 1 watt.	Volt. Divider V9	RC32GF4R7J
R89	RESISTOR, fixed: comp.; 10 ohms $\pm 10\%$; 1/2 watt.	Suppressor L7	RC20GF100K
R90	Same as R89	Suppressor L8	RC20GF100K
R91	RESISTOR, fixed: comp.; 12K ohms $\pm 5\%$; 1/2 watt.	Suppressor V1	RC20GF123J

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R92	Same as R13	Load L12	RC42GF153J
R93	RESISTOR, fixed: comp. ; 1000 ohms ±5%; 1/2 watt.	Decoupling V12	RC20GF102J
R94	RESISTOR, variable: wire-wound; 250 ohms ±10%; 2 watts; linear taper.	Hum Balance	RA101ASSA- 251A
R95	RESISTOR, fixed: comp. ; 270K ohms ±10%; 1/2 watt.	Screen V16	RC20GF274K
R96	Same as R31	Cathode Bias V16	RC20GF682K
R97	Same as R61	Grid V16	RC20GF474K
R98	Same as R10	Cathode Bias V17	RC20GF121K
R99	Same as R58	Grid Leak V17	RC20GF473K
R100	Same as R23	Volt. Dropping	RC20GF470K
R101	RESISTOR, fixed: comp. ; 22K ohms ±10%; 1 watt.	Plate Load V17	RC32GF223K
R102	Same as R12	Plate Load V17	RC20GF102K
R103	Same as R78	Screen Load V17	RC20GF223K
R104	RESISTOR, fixed: comp. ; 68 ohms ±10%; 2 watts.	Terminating J5	RC42GF680K
R105	Same as R17	Terminating J8	RC20GF101J
R106	RESISTOR, variable: comp. ; 500 ohms ±20%; linear, 2 watts.	IF Gain	RV4ATXA501B
R107	Same as R86	Volt. Dropping	RC20GF683K
R108	Same as R86	Screen Load V1	RC20GF683K
R109	Same as R22	Load L9	RC20GF103K
R110	Same as R11	Load L28	RC20GF563K
R111	RESISTOR, fixed: comp. ; 68K ohms ±10%; 1 watt.	Volt. Dropping	RC32GF683K
R112	Same as R25	Load L8	RC20GF153J
S1AA	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 6 contacts (1 common), rear 3 contacts (1 common), bakelite ins.	Bandswitch	WS-118
S1A	WAFER, switch: (P/O A-1899) shorting rotary type; front section, 6 contacts (1 common), rear 6 contacts (1 common), bakelite ins.	Bandswitch	WS-117

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S1B	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 7 contacts (1 common), rear 7 contacts (1 common), bakelite ins.	Bandswitch	WS-100-6
S1C	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 8 contacts (1 common), rear section, 8 contacts; bakelite ins; brass terminals; silver plated.	Bandswitch	WS-100-3
S1D	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 7 contacts (1 common), rear section, 7 contacts (1 common), bakelite ins; brass terminals, S. P.	Bandswitch	WS-100-2
S1E	Same as S1C	Bandswitch	WS-100-3
S1F	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 7 contacts (1 common), rear section, 7 contacts (1 common), bakelite ins; brass terminals, S. P.	Bandswitch	WS-100-4
S1G	WAFER, switch: (P/O A-1899) shorting, rotary type; front section, 8 contacts (1 common), rear section, 8 contacts, bakelite ins; brass terminals; silver plated.	Bandswitch	WS-100-5
S2A, B	SWITCH, rotary: non-shorting; one section; S. P. ; six positions, bakelite ins; brass terminals; S. P., 1/4" dia shaft, 2-7/8" long.	RF Selectivity	SW-147
S3	SWITCH, toggle: SPST; 3 amps @250 volts, 6 amps @125 volts, battery type.	AVC	ST-103-1-62
S4	Same as S3	Noise Limiter	ST-103-1-62
S5	SWITCH, rotary: non-shorting; 2 sections, S. P. ; 3 positions, bakelite ins; brass contacts and wipers, silver plated; 1/4" dia shaft, 7/8" long.	Audio Selectivity	SW-156
S6A, B	SWITCH, sliding: DPDT; 5 amps @ 125 volts.	Radio Phono	SW-163
S7A, B	Same as S6A, B	Radio Phono	SW-163
S8	Same as S3	BFO	ST-103-1-62
S9	Same as S3	Send, Receive	ST-103-1-62
S10	P/O R81	Power ON-OFF	P/O R81
S11	Same as S3	Calibrate	ST-103-1-62

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S12A, B	SWITCH, 12 position: shorting rotary type; front section, 5 contacts (1 common), rear section, 1 contact (1 common), bakelite ins.	HFO	SW-273
S13	SWITCH, rotary: non-shorting; one section., S. P.; 2 positions 30° of throw; glass melamine ins., silver alloy contact and wipers, 1/8" dia shaft, 1-9/32" long.	HFO	SW-203
T1	NOT USED		
T2	TRANSFORMER, RF: tuned; primary, 6.2 uh ±5%, Q = 110; secondary #1, 6.2 uh ±5%, Q = 110; secondary #2, 2 turns.	2nd Converter	A-1040
T3	TRANSFORMER, assy RF: tuned; winding #1, 95 uh, Q = 82; winding #2 6.2 uh, Q = 110.	Comp. IF	A-1038
T4	Same as T3	Comp. IF	P/O T3
T5	TRANSFORMER, RF: tuned; primary 415 uh, ±5%, Q = 90; secondary, 40 uh, ±5%, Q = 65.	Crystal Filter	A-1034
T6	TRANSFORMER, RF: tuned; 455 kc; primary, 95 uh ±5 uh, Q = 75; secondary, 95 uh ±5 uh, Q = 75.	1st IF	A-1039
T7	Same as T6	2nd IF	A-1039
T8	Same as T6	3rd IF	A-1039
T9	TRANSFORMER, RF: output; 100 - 10,000 cps ±3 db; primary, 5000 ohms, 55 ma max.; secondary, 600 Ω, tapped at 16.8 and 4 Ω, 4 and 10 watts max. output, insulated for 1000 volts.	Output	TF-159
T10	TRANSFORMER, power: primary, 115/230V, 50/60 cps; secondary #1, 5V @3A; secondary #2, 270-0-275V @ 110 ma; secondary #3, 6.3V @ 5.65A; insulated for 1000 volts.	Power	TF-169
T11	AUTOTRANSFORMER: 128 uh ±5%, Q = 100.	2nd Converter	A-989
V1	TUBE, electron: semiremote - cutoff pentode; 7 pin miniature.	1st RF Amp.	6DC6
V2	TUBE, electron: remote cutoff pentode; 7 pin miniature.	2nd RF Amp.	6BA6
V3	TUBE, electron: sharp cutoff pentode; 7 pin miniature.	1st Converter	6AU6

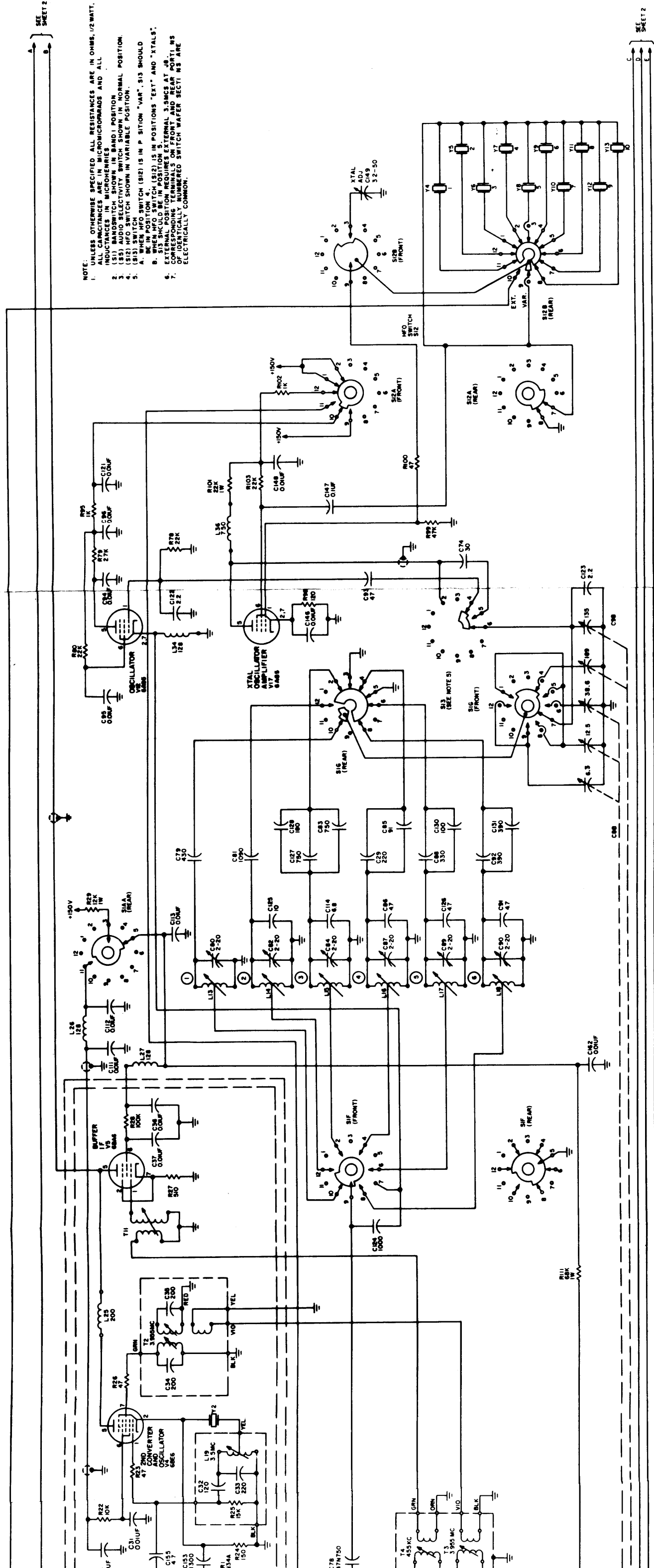
PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
V4	TUBE, electron: pentagrid converter; 7 pin miniature.	2nd Converter and OSC	6BE6
V5	Same as V2	Buffer	6BA6
V6	Same as V2	1st IF Amp.	6BA6
V7	Same as V2	2nd IF Amp.	6BA6
V8	Same as V2	3rd IF Amp.	6BA6
V9	TUBE, electron: duo diode; 7 pin miniature.	Noise Limiter	6AL5
V10	TUBE, electron: high Mu twin triode; 9 pin miniature.	Audio Amp.	12AX7
V11	TUBE, electron: beam power tube; 8 pin octal metal type.	2nd Audio Amp.	6V6
V12	TUBE, electron: sharp cutoff pentode; 7 pin miniature.	Oscillator	6AG5
V13	Same as V12	BFO	6AG5
V14	TUBE, electron: full wave vacuum rectifier; 8 pin glass octal.	Rectifier	5U4G
V15	TUBE, electron: voltage regulator; 7 pin miniature.	Volt. Regulator	0A2
V16	TUBE, electron: sharp cutoff pentode; 7 pin miniature.	100 kc OSC	6CB6
V17	Same as V12	XTAL OSC Amp.	6AG5
W1	CABLE ASSEMBLY, power: electrical; 2 cond., 6 ft. 3 in. long; w/integral male plug one end.	Line Cord	CA-102-2
X1	SOCKET, electron tube: detail.	Power Socket	TS-101P01
X2	Same as X1	Accessory Socket	TS-101P01
XF1	FUSEHOLDER, extractor post type: 250V 15 amp.	F1 Socket	FH-100-2
XI1	SOCKET, bracket: for miniature, bayonet base; T3-1/4 bulb; rt. angled, down turned.	I1 Socket	TS-107-2
XI2	Same as XI1	I2 Socket	TS-107-2
XI3	SOCKET, lamp: for miniature bayonet base; T3-1-1/4 bulb; 10 in. leads for insertion into rear of meter.	I3 Socket	TS-127
XV1	SOCKET, electron tube: 7 pin miniature.	V1 Socket	TS-102P01
XV2	Same as XV1	V2 Socket	TS-102P01

PARTS LIST (CONT'D)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
XV3	Same as XV1	V3 Socket	TS-102P01
XV4	Same as XV1	V4 Socket	TS-102P01
XV5	Same as XV1	V5 Socket	TS-102P01
XV6	Same as XV1	V6 Socket	TS-102P01
XV7	Same as XV1	V7 Socket	TS-102P01
XV8	Same as XV1	V8 Socket	TS-102P01
XV9	Same as XV1	V9 Socket	TS-102P01
XV10	SOCKET, electron tube: 9 pin miniature.	V10 Socket	TS-103P01
XV11	Same as X1	V11 Socket	TS-101P01
XV12	SOCKET, electron tube: ceramic; 7 pin miniature.	V12 Socket	TS-102C01
XV13	Same as XV1	V13 Socket	TS-102P01
XV14	Same as X1	V14 Socket	TS-101P01
XV15	Same as XV1	V15 Socket	TS-102P01
XV16	Same as XV1	V16 Socket	TS-102P01
XV17	Same as XV1	V17 Socket	TS-102P01
XY3	SOCKET, Xtal.	Y3 Socket	TS-105
XY4	SOCKET, Xtal: .486 in. spacing for .050 in. pin dia.	Y4 Socket	TS-104-1
XY5	Same as XY4	Y5 Socket	TS-104-1
XY6	Same as XY4	Y6 Socket	TS-104-1
XY7	Same as XY4	Y7 Socket	TS-104-1
XY8	Same as XY4	Y8 Socket	TS-104-1
XY9	Same as XY4	Y9 Socket	TS-104-1
XY10	Same as XY4	Y10 Socket	TS-104-1
XY11	Same as XY4	Y11 Socket	TS-104-1
XY12	Same as XY4	Y12 Socket	TS-104-1
XY13	Same as XY4	Y13 Socket	TS-104-1
Y1	CRYSTAL UNIT, quartz: 455 kc, \pm .02%; 2 in. solder leads.	XTAL Filter	CR-102
Y2	CRYSTAL UNIT, quartz: 3.5 mcs.	OSC V4	CR-103
Y3	CRYSTAL UNIT, quartz: 100 kc	100 kc OSC	CR-100

SECTION 8
SCHEMATIC DIAGRAMS



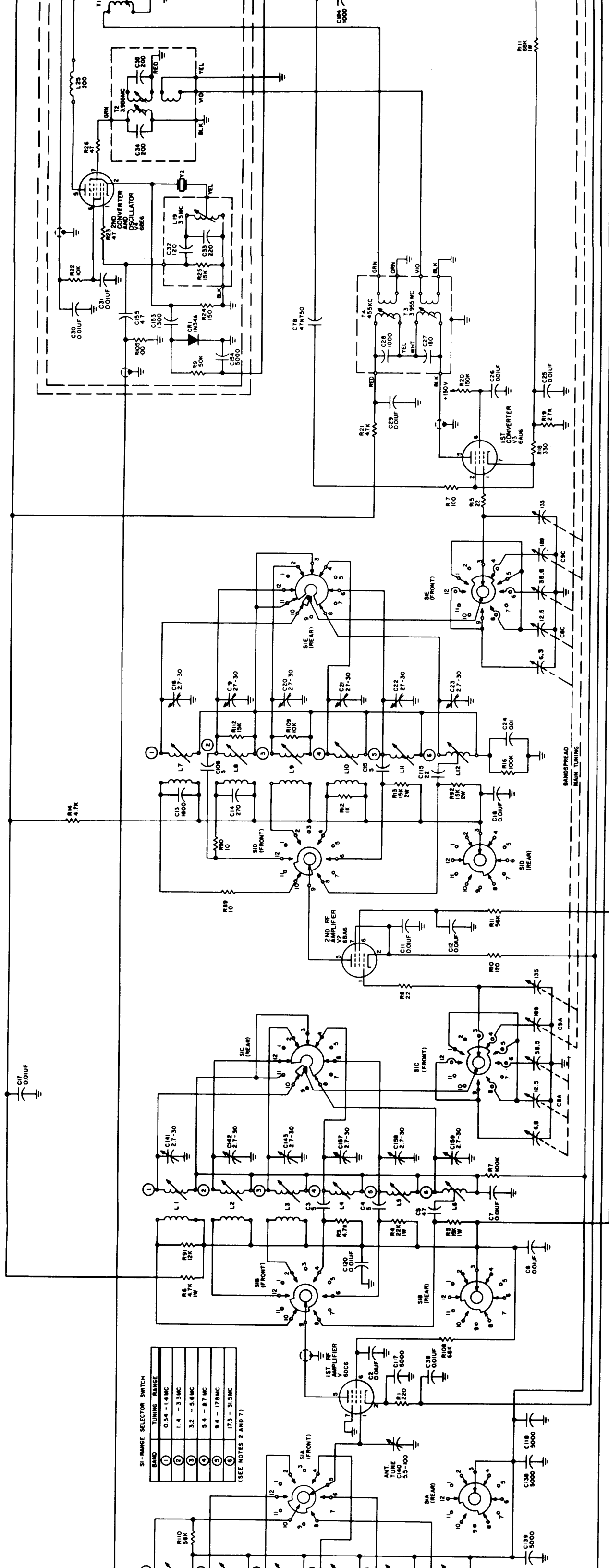
NOTE: UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS, 1/2 WATT. INDUCTANCES ARE IN MICROMHMS AND ALL CAPACITANCES ARE IN MICROFARADS AND ALL SWITCHES ARE IN NORMAL POSITION.

- (S1) BANDSWITCH SHOWN IN BAND 1 POSITION
- (S2) AUDIO SELECTIVITY SWITCH SHOWN IN NORMAL POSITION.
- (S3) HFO SWITCH SHOWN IN VARIABLE POSITION.
- WHEN HFO SWITCH (S12) IS IN POSITION "VAR", S13 SHOULD BE IN POSITION 4.
- WHEN HFO SWITCH (S12) IS IN POSITION "EXT" AND "XTALS", S13 SHOULD BE IN POSITION 5.
- EXTERNAL POSITION REQUIRES EXTERNAL 3.5MCS AT J8.
- CORRESPONDING TERMINALS ON FRONT AND REAR PORTS ARE ELECTRICALLY COMMON.

Figure 8-1. Schematic Diagram, Communications Receiver GPR-90RXD (Sheet 1 of 2)

8-3/8-4

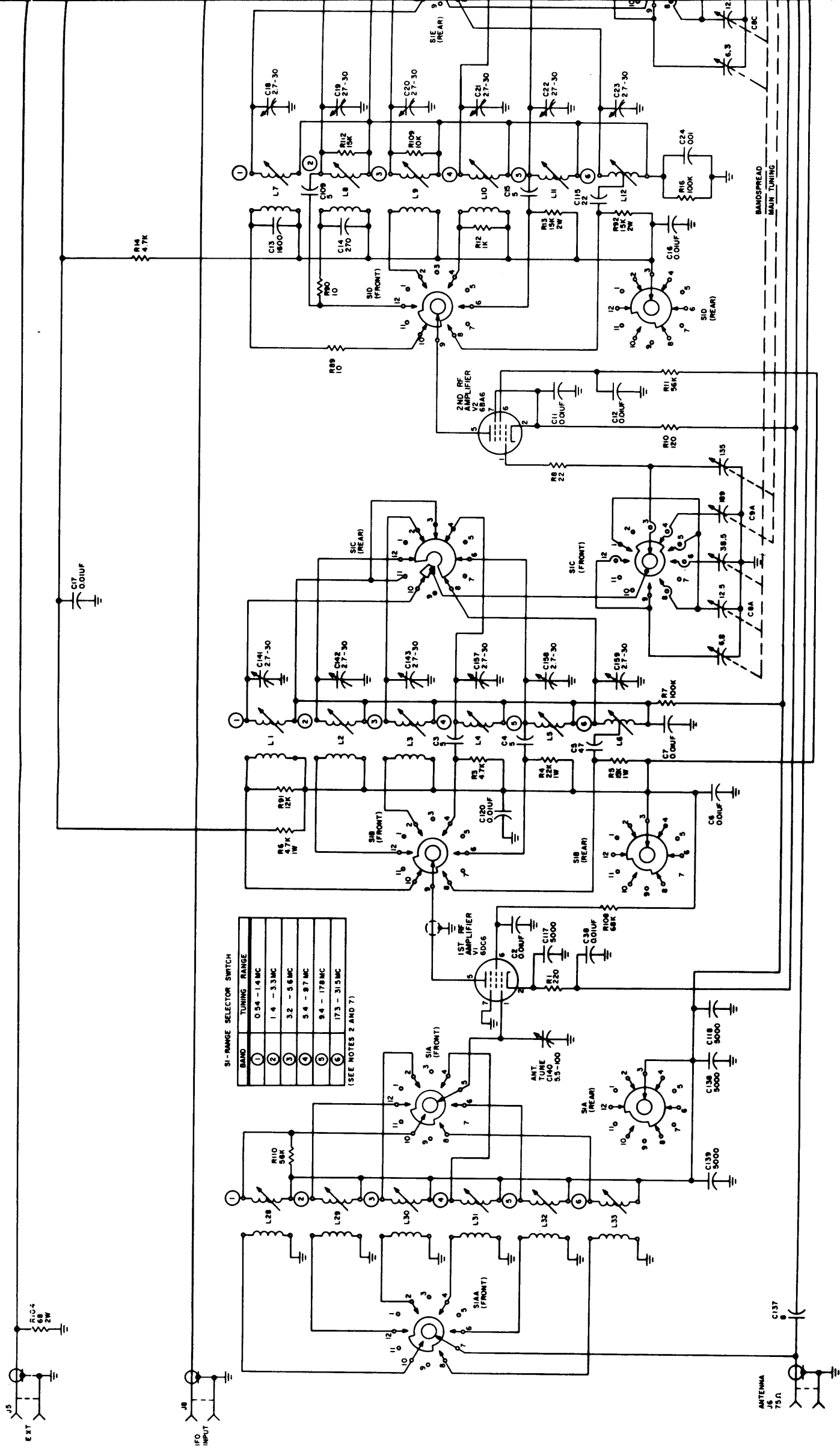
004633005

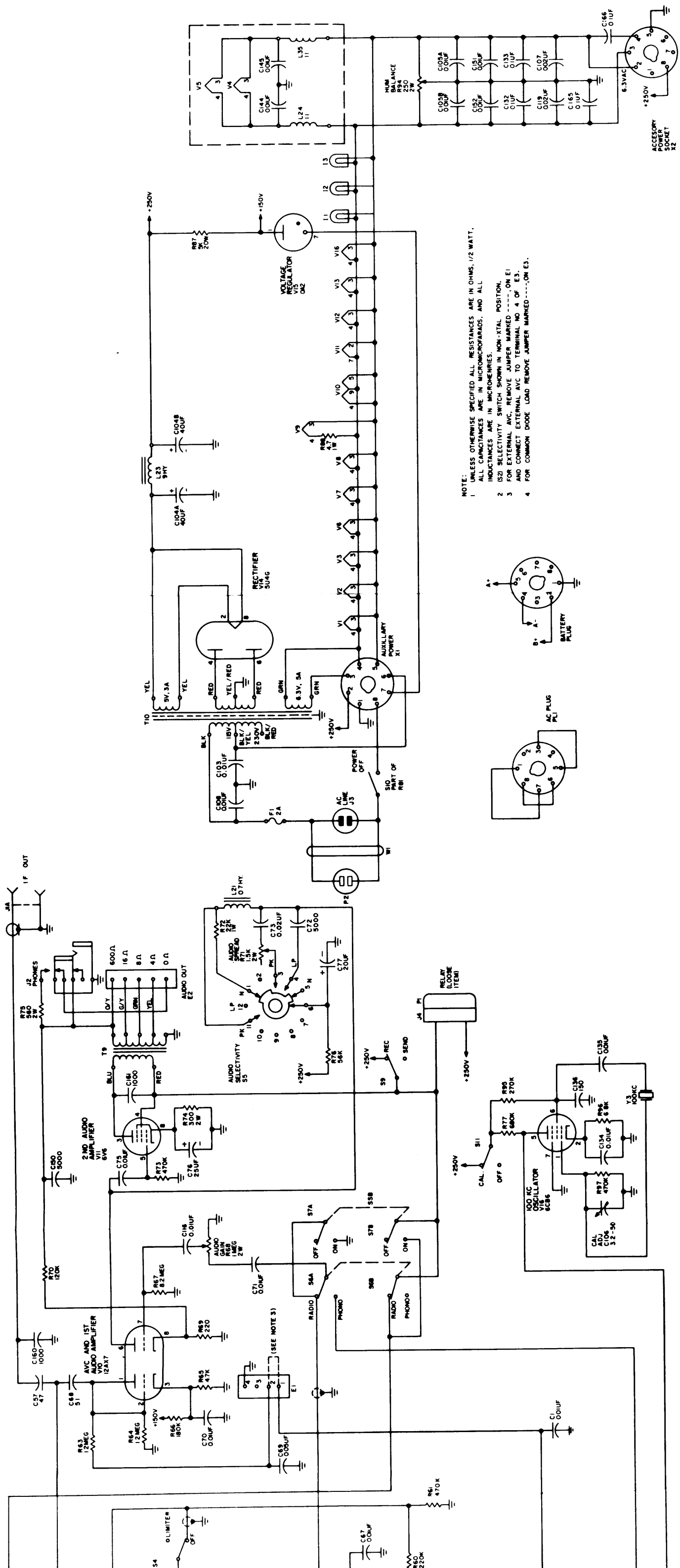


S1-RANGE SELECTOR SWITCH

BAND	TUNING RANGE
1	0.54 - 1.4 MC
2	1.4 - 3.3 MC
3	3.2 - 5.8 MC
4	5.4 - 8.7 MC
5	9.4 - 17.8 MC
6	17.3 - 31.5 MC

(SEE NOTES 2 AND 7)





NOTE:
 1 UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS, 1/2 WATT.
 ALL CAPACITANCES ARE IN MICROMICROFARADS, AND ALL
 INDUCTANCES ARE IN MICRORHENRIES.
 2 IS2 SELECTIVITY SWITCH SHOWN IN NON-XTAL POSITION.
 3 FOR EXTERNAL AVC, REMOVE JUMPER MARKED -----, ON E1
 AND CONNECT EXTERNAL AVC TO TERMINAL NO. 4 OF E3.
 4 FOR COMMON DIODE LOAD REMOVE JUMPER MARKED -----, ON E3.

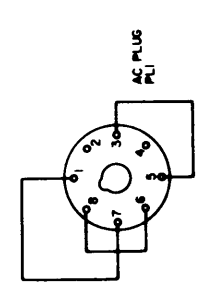
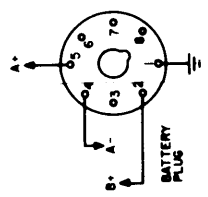
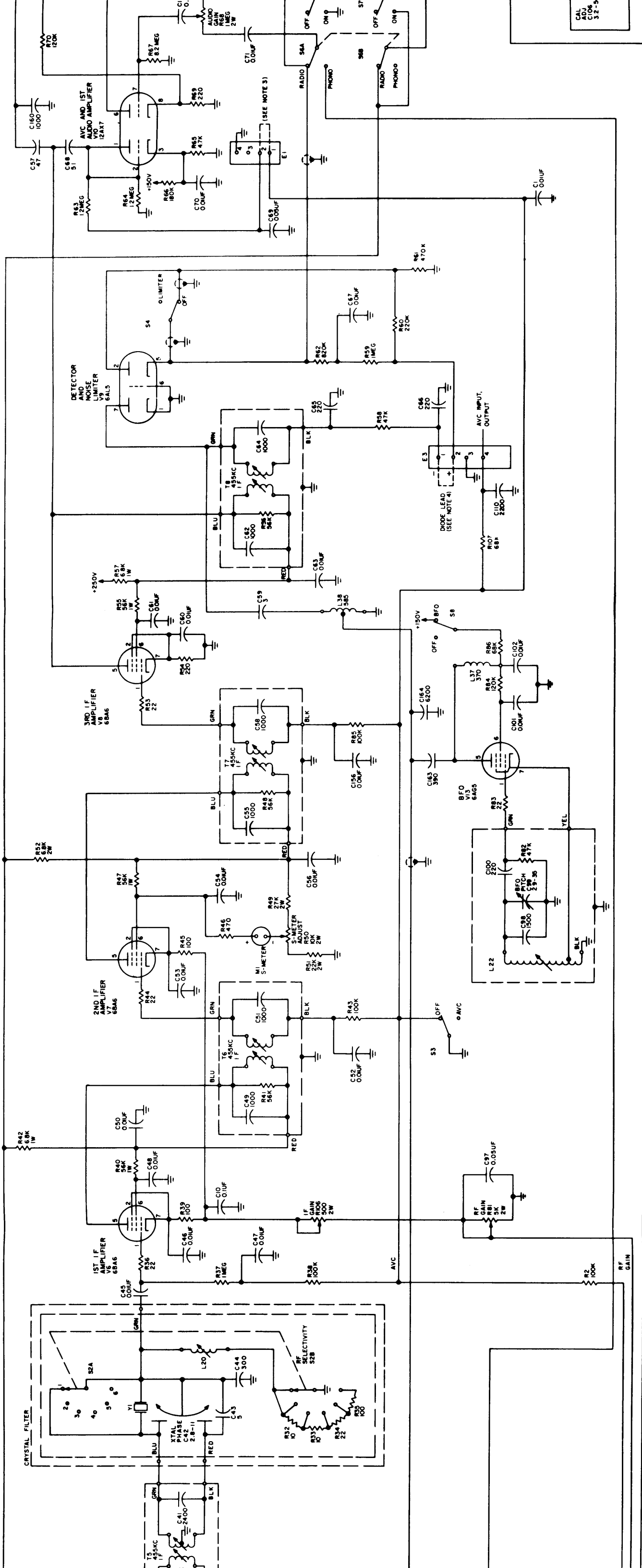
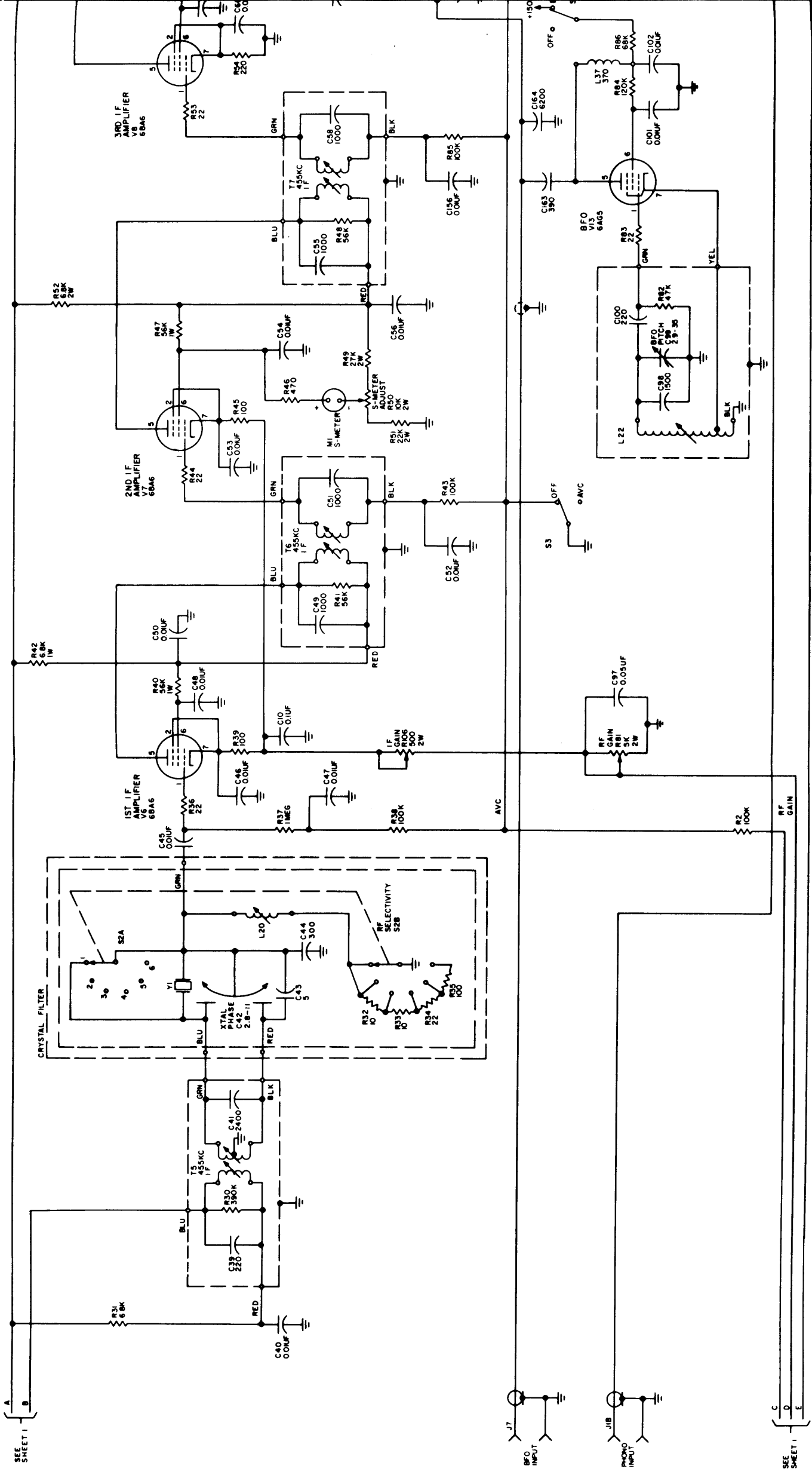


Figure 8-1. Schematic Diagram, Communications Receiver GPR-90RXD (Sheet 2 of 2)





SEE SHEET 1

SEE SHEET 1