TM-03817A-35/2 *(Nonregistered)*

W/CHANGE 1

MAINTENANCE AND OVERHAUL MANUAL

for

RADIO SET AN/PRC-47 AND ACCESSORIES

UNITED STATES MARINE CORPS

Approved by U. S. Marine Corps:

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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page	Ch. 1	6-18A to 6-18D	Ch. 1
ii	Ch. 1	6-19 to 6-20	Ch. 1
iii to iv	Orig	6-21 to 6-22	Orig
v to xi	Ch. 1	6-23 to 6-24	Ch. 1
1-0	Orig	6-25	Orig
1-1 to 1-2	Ch. 1	6-26 to 6-29	Ch. 1
1-3	Orig	6-30	Orig
1-4 to 1-8	Ch. 1	6-31 to 6-32	Ch. 1
1-9 to 1-10	Orig	6-33	Orig
2-1	Orig	6-34 to 6-35	Ch. 1
3-0	Orig	6-36	Orig
4-1 to 4-10	Ch. 1	6-37 to 6-38A	Ch. 1
4-11 to 4-12	Orig	6-39 to 6-40	Orig
4-13	Ch. 1	6-41 to 6-42A	Ch. 1
4-14 to 4-16	Orig	6-43	Orig
4-17 to 4-20	Ch. 1	6-44 to 6-44B	Ch. 1
4-21 to 4-22	Orig	6-45 to 6-46	Orig
4-22A	Ch. 1	6-47 to 6-48	Ch. 1
4-23 to 4-27	Orig	6-49 to 6-50	Orig
5-0 to 5-3	Orig	6-51 to 6-52A	Ch. 1
5-3 to 5-5	Ch. 1	6-53	Orig
5-6	Orig	6-54	Ch. 1
5-7 to 5-12	Ch. 1	6-55 to 6-57	Orig
5-13 to 5-16	Orig	6-58 to 6-59	Ch. 1
5-17 to 5-20A	Ch. 1	6-60 to 6-66	Orig
5-21 to 5-33	Orig	6-67 to 6-82	Ch. 1
6-0 to 6-14	Orig	i-1 to i-2	Ch. 1
6-15 to 6-18	Ch. 1		

LIST OF PAGES FOR PEN-AND-INK CORRECTIONS

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
1-9	Ch. 1	5-21	Ch. 1
1-10	Ch. 1	5-22	Ch. 1
4-11	Ch. 1	5-23	Ch. 1
4-12	Ch. 1	6-1	Ch. 1
4-16	Ch. 1	6-6	Ch. 1
4-21	Ch. 1	6-7	Ch. 1
4-22	Ch. 1	6-21	Ch. 1
4-24	Ch. 1	6-29	Ch. 1
5-1	Ch. 1		

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1. This publication, TM-03817A-35/2, is effective upon receipt and includes current information as of 1 February 1963.

2. This Manual is published for the information and guidance of all concerned with Radio Set AN/PRC-47.

3. Notice of any discrepancies and suggested changes to this publication should be directed to the Commandant of the Marine Corps (Code CSY).

By direction of the Commandant of the Marine Corps

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1	12 July 1963		[illegible] Murphy

TABLE OF CONTENTS

SECTION 1 - GENERAL INFORMATION

SECTION 2 - PREPARATION FOR USE AND STOWAGE

SECTION 3 - OPERATOR'S SECTION

SECTION 4 - PRINCIPLES OF OPERATION

SECTION 4 - PRINCIPLES OF OPERATION (Cont)

SECTION 5 - TROUBLE SHOOTING

TABLE OF CONTENTS (Cont)

SECTION 5 - TROUBLE SHOOTING (Cont)

SECTION 6 - SERVICE AND REPAIR

SUBSECTION 6-1 - PREVENTIVE MAINTENANCE

SUBSECTION 6-2 - MAINTENANCE STANDARDS

SUBSECTION 6-3 - REPAIR

SECTION 6 - SERVICE AND REPAIR (Cont)

TABLE OF CONTENTS (Cont)

SECTION 6 - SERVICE AND REPAIR (Cont)

LIST OF ILLUSTRATIONS

SECTION 1 - GENERAL INFORMATION

SECTION 4 - PRINCIPLES OF OPERATION

LIST OF ILLUSTRATIONS (Cont)

SECTION 4 - PRINCIPLES OF OPERATION (CONT)

SECTION 5 - TROUBLE SHOOTING

SECTION 6 - SERVICE AND REPAIR

SUBSECTION 6-2 - MAINTENANCE STANDARDS

SUBSECTION 6-3 - REPAIR

SECTION 6 - SERVICE AND REPAIR (Cont)

LIST OF ILLUSTRATIONS (Cont)

SECTION 6 - SERVICE AND REPAIR (Cont)

SECTION 6 - SERVICE AND REPAIR (Cont)

LIST OF ILLUSTRATIONS (Cont)

SECTION 6 - SERVICE AND REPAIR (Cont)

LIST OF TABLES

SECTION 1 - GENERAL INFORMATION

SECTION 4 - PRINCIPLES OF OPERATION

SECTION 5 - TROUBLE SHOOTING

LIST OF TABLES (Cont)

SECTION 5 - TROUBLE-SHOOTING (Cont)

SECTION 6 - SERVICE AND REPAIR

SUBSECTION 6-2 - MAINTENANCE STANDARDS

SUBSECTION 6-3 - REPAIR

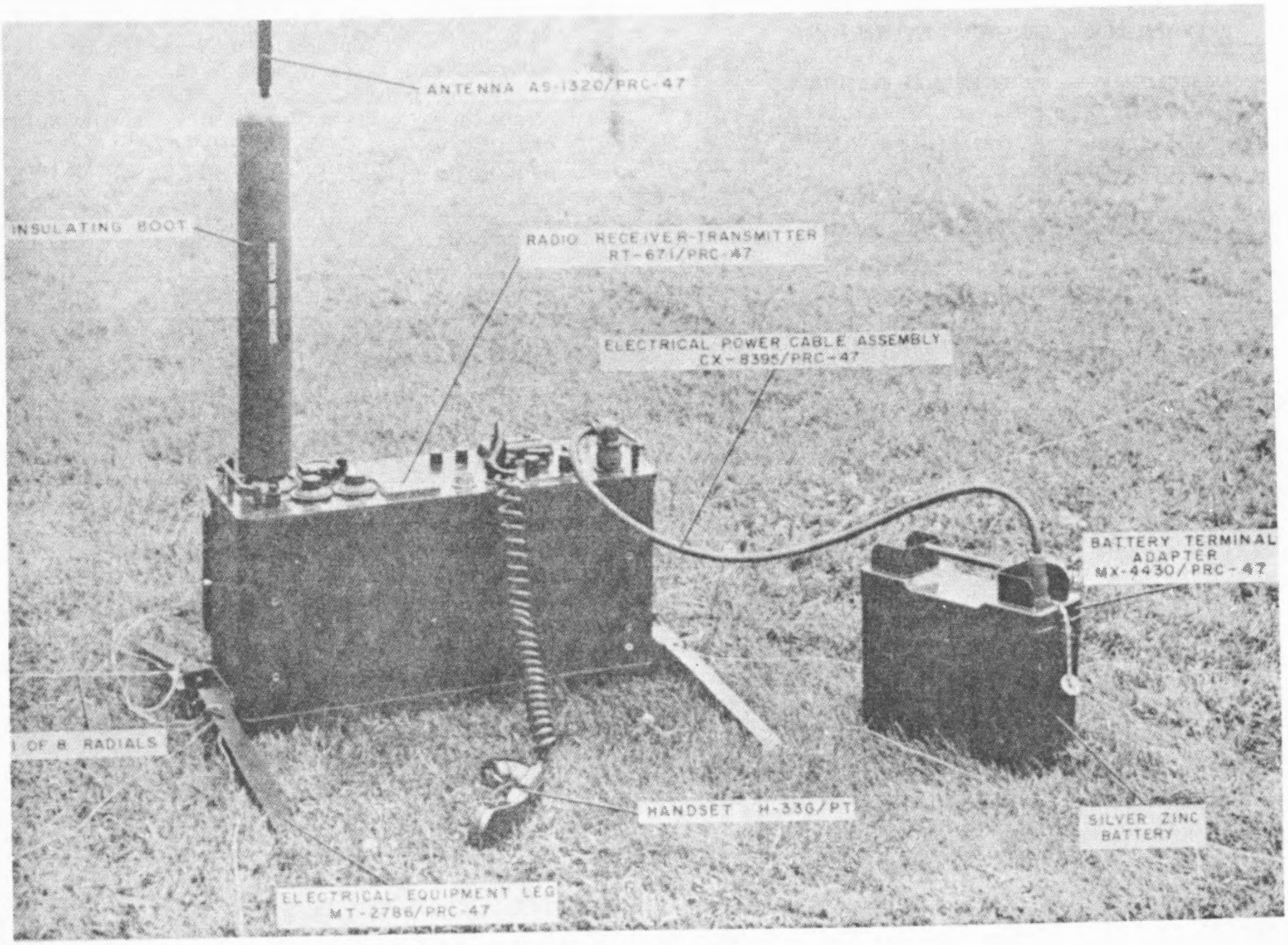


Figure 1-1. Radio Set AN/PRC-47 Operating Setup

SECTION 1
GENERAL INFORMATION

1-1. GENERAL.

This manual contains equipment description and instructions for; preparation for use and stowage, operation, principles of operation, trouble shooting, and repair for Radio Set AN/PRC-47 (figure 1-1).

1-2. FUNCTIONAL DESCRIPTION.

a. PURPOSE OF EQUIPMENT. - Radio Set AN/PRC-47 (hereinafter referred to as the radio set) is a complete portable high-frequency communications system including antenna and accessories. The radio set provides continuous wave (CW) and upper sideband (USB) voice transmission and reception in 1-kilocycle increments over the frequency range of 2 to 11.999 megacycles. The equipment is also capable of frequency shift keying (FSK) communication when operated in conjunction with a frequency shift keying converter. The radio set may be operated at its own control panel or from a remote control panel.

b. EQUIPMENT APPLICATIONS. - The radio set may be used in portable, vehicle, and fixed station applications. In the portable application, the complete equipment can be packed by two men. For this application, the radio set is powered by a 24-volt battery which is part of the equipment. For mobile application, the equipment is mounted in a suitable vehicle (for example; truck, 1/4-ton 4 x 4 M38A1) and is powered by the vehicle's 26.5-volt d-c generator. For fixed station application, the equipment may be powered by a 115-volt, single-phase, 400-cps power supply. Figure 1-1 shows a field setup of Radio Set AN/PRC-47, and figure 1-2 shows placement of radial wires.

For high-power voice or CW operation (extended time) the radio set duty cycle is 1 minute (maximum) of transmission for every 9 minutes (minimum) of reception. For low-power extended time operation, the duty cycle for voice or CW operation is 2 minutes transmit for 9 minutes receive time.

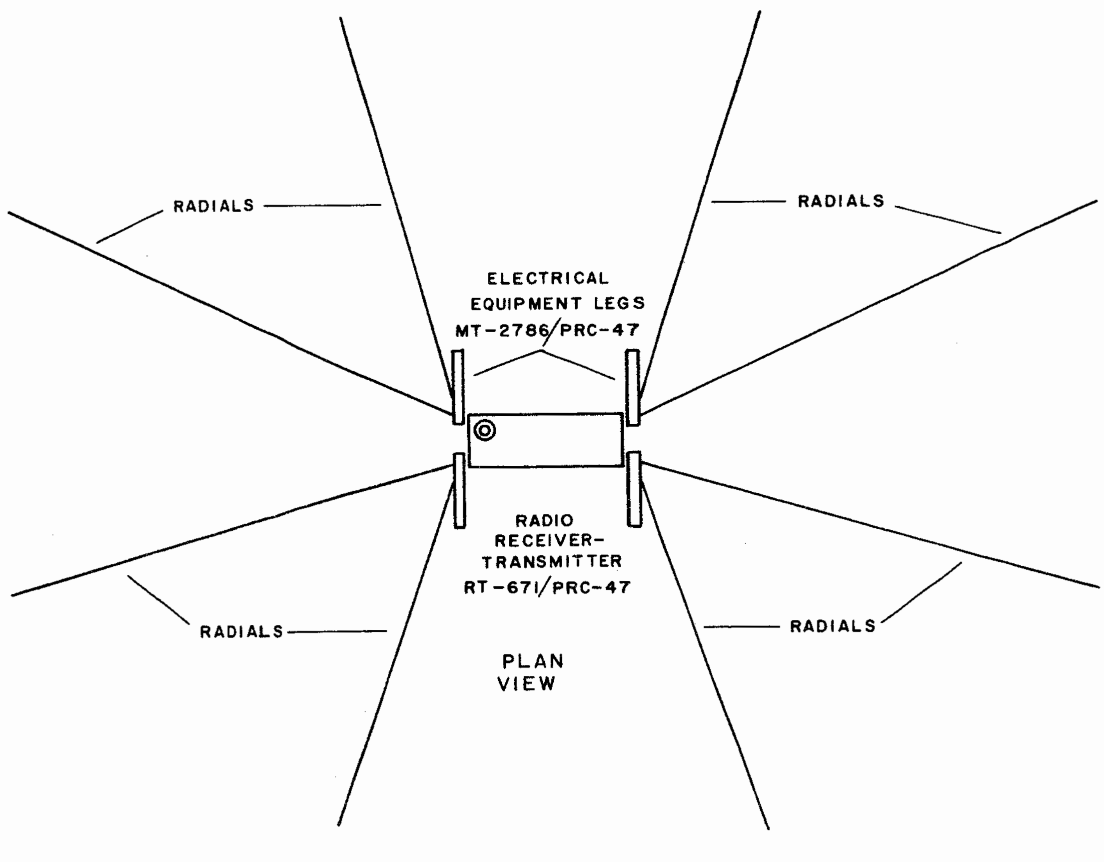


Figure 1-2. Radio Set AN/PRC-47 Field Setup, Plan View, Radial Placement

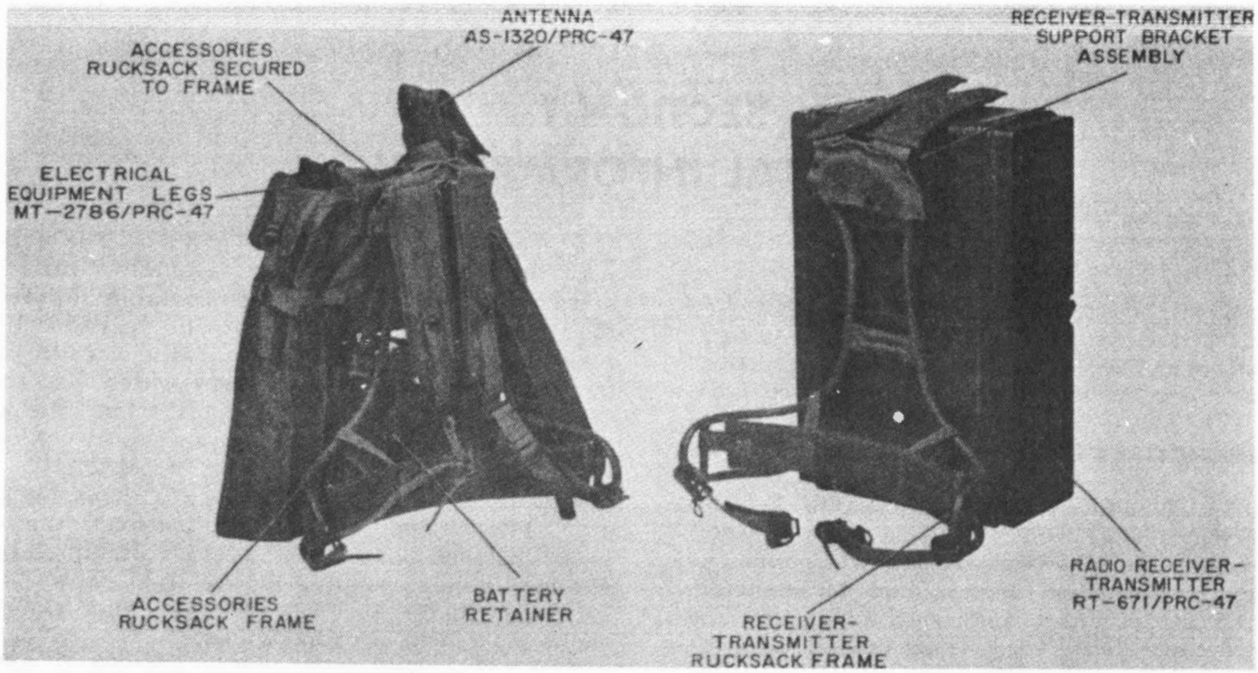


Figure 1-3. Rucksack Frames Packed with Radio Set AN/PRC-47

Limited low-power cycle is 10 minutes transmit for 5 minutes receive operation not to exceed 1 hour total. For normal voice communication, with 1 minute transmission and 9 minutes reception, one battery charge will last approximately 12 operating hours.

1-3. DESCRIPTION OF EQUIPMENT.

a. RADIO SET. - The radio set consists of seven major units and a number of accessories which are required for operation. The seven major units are a receiver-transmitter; three silver-zinc batteries; separate power cables for a-c, battery, and d-c operation; a whip antenna; and a radio set case. The accessories are listed in table 1-3.

The radio set is divided into two parts for portage. Each part is man packed on a separate rucksack frame (see figure 1-3). One part consists of the receiver-transmitter. The other part consists of the silver-zinc battery, the associated power cable, the whip antenna, and accessory equipment required for portable operation.

When it is desired to store the equipment or transport it by vehicle, the equipment is placed in the radio set case. This case is waterproof and holds the complete equipment (see figure 1-4). Three identical silver-zinc batteries are included in the radio set case. Separate compartments are provided in the radio set case for the various components and accessories of the radio set.

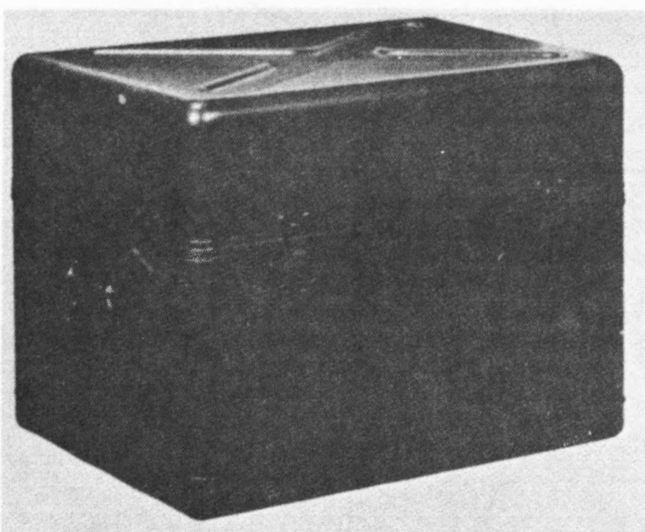


Figure 1-4. Radio Set Case CY-3700/PRC-47

b. RECEIVER-TRANSMITTER. - The receiver-transmitter contains the major electronic circuits and controls of the radio set. The receiver-transmitter is normally housed in its own case (see figure 1-3). When the cover of this case is closed, it is completely watertight. The case is mounted on the rucksack frame as shown in figure 1-3 and also in figure 2-2 of Operator's Manual for Radio Set AN/PRC-47 and Accessories (TM-03817A-12/1).

In normal operation, the cover of the receiver-transmitter case is removed to reveal the control panel of the receiver-transmitter and is secured to

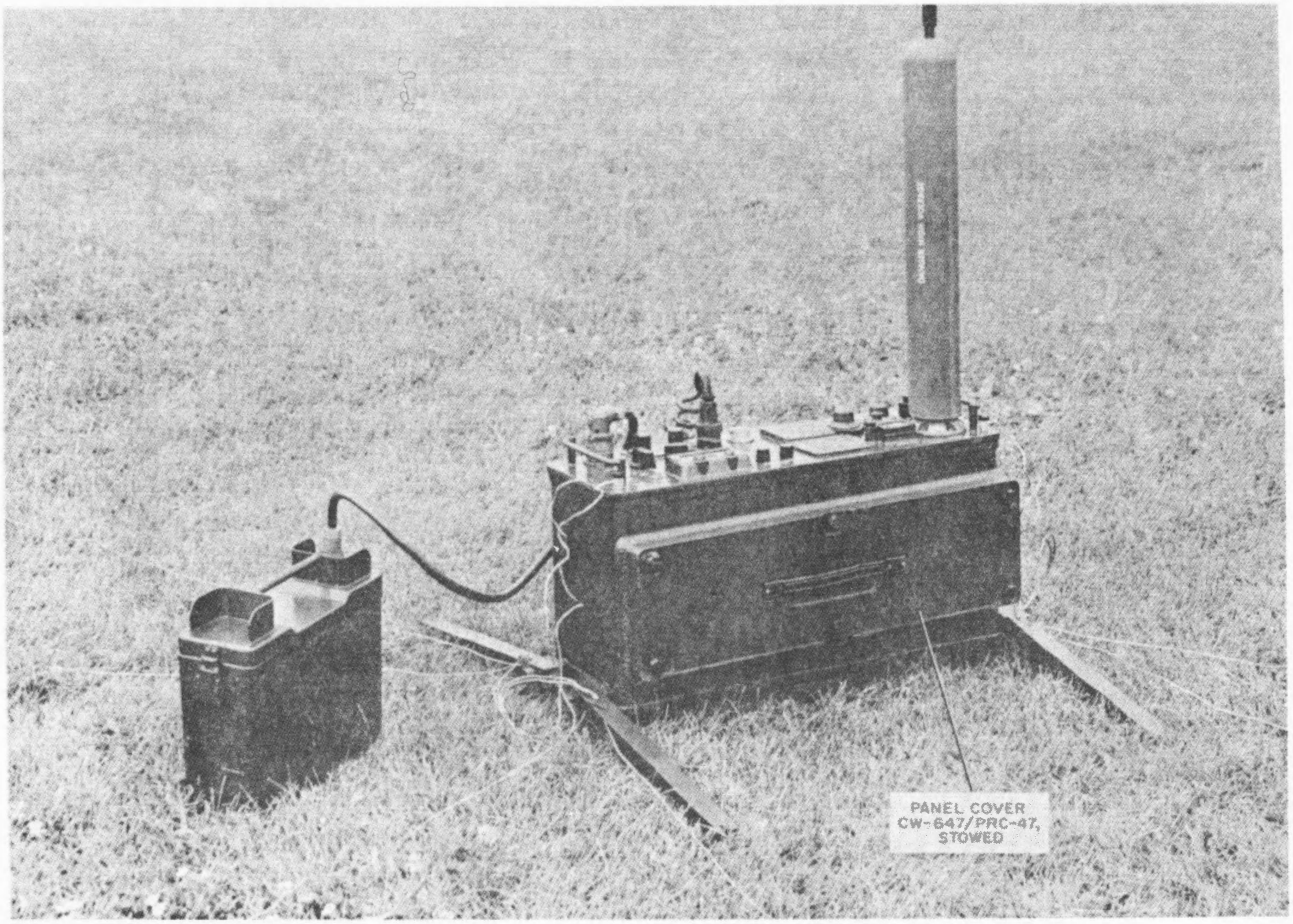


Figure 1-5. Operating Setup, Showing Panel Cover CW-647/PRC-47 Stowed

the side of the receiver-transmitter case. Refer to figure 1-5. All controls and connections necessary for operation and tuning of the receiver-transmitter are located on the control panel.

Removal of the receiver-transmitter case provides access to six plug-in modules which contain the major electronic circuits of the radio set. A gear train that provides a mechanical connection from the control panel to the modules is provided at the back of the control panel. Figure 1-6 shows the location of the modules. Test points are located on top of the modules for adjustment, alignment, and trouble shooting.

c. SILVER-ZINC BATTERY.

(1) GENERAL. - The silver-zinc battery is a 24-volt (nominal), 25-ampere hour (nominal) rechargeable storage battery which is used in portable application of Radio Set AN/PRC-47 where no other suitable power source is available. The battery is nomenclatured Battery, Storage BB-451/U. Three batteries are supplied with each radio set. The same battery is used with Radio Sets AN/PRC-41 and AN/PRC-38. Battery Terminal Adapter MX-4430/PRC-47 is provided as a carrying handle and as a plug terminal adapter for cable connection. The battery is watertight when connected to the radio set with Cable Assembly CX-8395/PRC-47. To avoid a long formation and activation period, the BB-451/U is supplied in a dry charged condition.

(2) CONSTRUCTION. - The battery is contained in a watertight fiber glass case with a stainless steel cover plate. After removing the cover plate, the cells may be removed in groups of four using only ordinary hand tools. A plastic sheet for recording charging history is bonded to the under side of the cover plate.

(3) CELLS. - The battery consists of 16 series connected silver-zinc cells constructed in blocks of four cells each. Nominal open circuit voltage of a

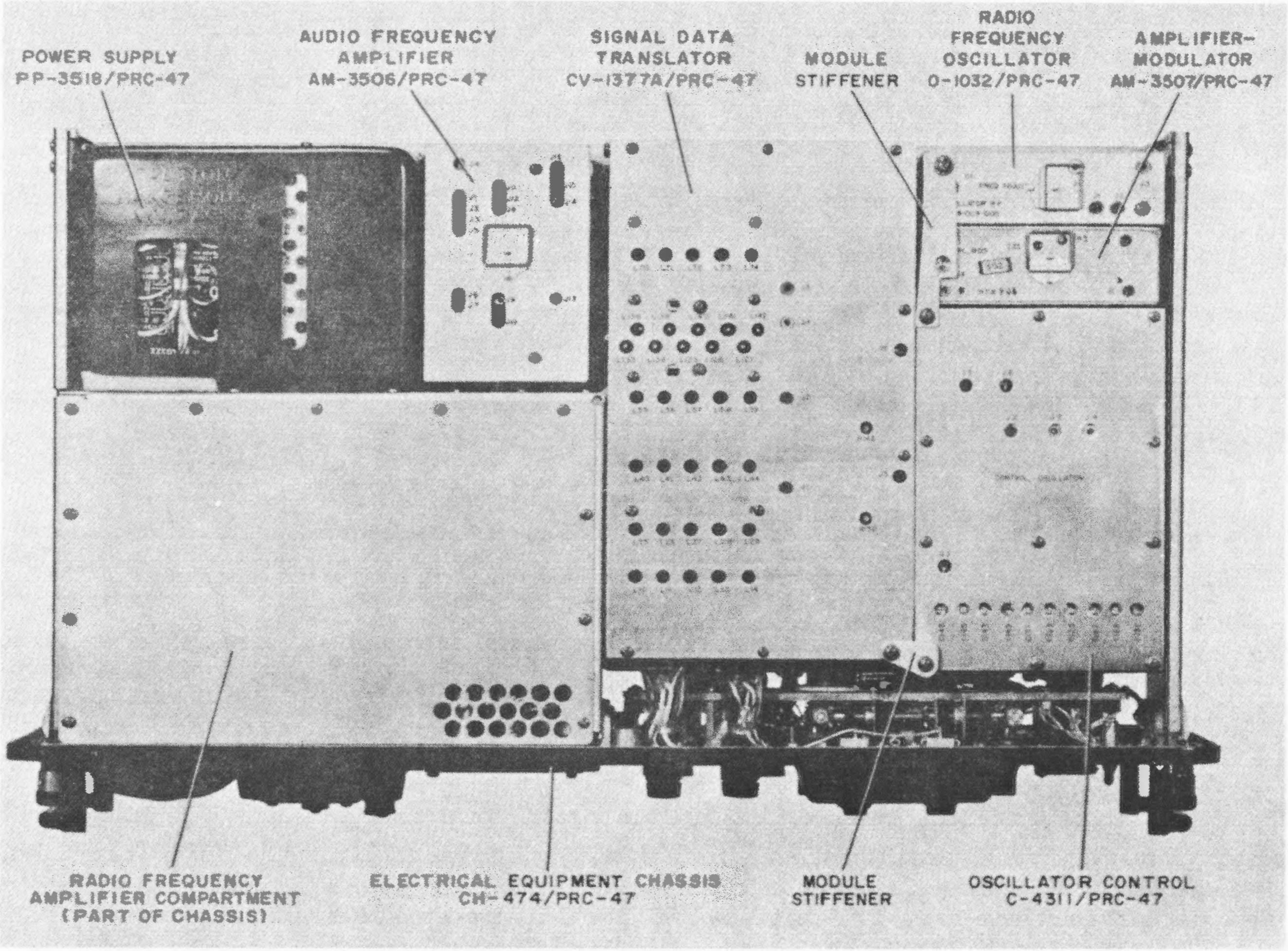


Figure 1-6. Radio Receiver-Transmitter RT-671/PRC-47, Case Removed

fully charged cell is 1.86 volts per cell. The minimum voltage per cell under specified load is 1.375 volts at -11°C (+12°F), and above, and 1.250 volts from -10°C to -25°C (+14° to -13°F). All cells will provide the minimum performance shown in table 1-1.

(4) CHARGE RETENTION (DRY). - Charge retention of a dry, charged cell over the specified periods will be in accordance with the minimum values indicated below:

(a) 2 years at +30°C (+86°F) and below - 98% (19.6 ampere-hours).

(b) 1 year at +50°C (+122°F) and below - 80% (16 ampere-hours)

(c) 3 months at +65°C (+149°F) and below - 50% (10 ampere-hours)

(5) ACTIVATION. - The cells of the silver-zinc battery will deliver the specified ampere-hour capacity after a 24-hour "soak" in the electrolyte, a 40-percent solution of potassium hydroxide and other additives furnished by the manufacturer. A booster charge is permissible if the temperature and storage limits of paragraph (4) above have been exceeded.

WARNING

The basic potassium hydroxide electrolyte in the battery is corrosive to aluminum and other metals. DO NOT add acid to this battery. If acid is added to the electrolyte, a violent reaction will occur. This reaction will be dangerous to personnel and will also damage the battery.

(6) CHARGE ACCEPTANCE. - The battery cells will perform according to specifications after charging at a modified constant current of 2.5 amperes average with voltage cutoff at 2.03 volts. Emergency charging of the cells is possible by charging at a constant potential of 2.03 volts per cell with charge

TABLE 1-1. BATTERY CELL PERFORMANCE (WET)

TEMPERATURE		CAPACITY (amp-hr)	RECHARGE CYCLES	WET LIFE (months)	CHARGE RETENTION (percentage)
(deg C)	(deg F)				
-25	-13	15	15	6	80% for 6 months
-18	0	20	20	6	80% for 6 months
0	+32	20	25	12	80% for 6 months
+5	+41	20	50	18	80% for 6 months
+30	+86	20	50	18	80% for 6 months
+38	+100	20	25	12	70% for 3 months
+50	+122	20	15	2	50% for 1 month
+60	+140	20	10	1	50% for 2 days

acceptance as follows: a 0.5-hour charge period replaces 50 percent of the capacity removed on previous discharge; a 4-hour charge period replaces 60 percent of the capacity removed on the previous discharge. All recharging must be with Battery Charger PP-3240/U or its exact replacement. Curves for battery charging are shown in figure 2-1 of Operator's Manual for Radio Set AN/PRC-47 and Accessories (TM-03817A-12/1).

(7) STORAGE. - Dry, charged cells are filled with an inert gas by the manufacturer and may be stored under the following conditions:

temperature range	-65°C to +65°C (-85°F to +149°F)
relative humidity	100 percent
attitude	any
altitude	40,000 ft.

Wet, charged cells should be stored in an upright position and will perform as per table 1-1.

d. POWER CABLES. - Three separate power cables are provided with the equipment for the three applications described in paragraph 1-2*a* (see figure 1-7). Electrical Power Cable Assembly CX-8395/PRC-47 is used in the portable application to connect the battery power supply to Radio Receiver-Transmitter RT-671/PRC-47. Electrical Power Cable Assembly CX-8394/PRC-47 is used in the mobile application to connect a 26.5-volt d-c system to RT-671/PRC-47. Electrical Power Cable Assembly CX-8393/PRC-47 is used in the fixed site application to connect a 115-volt, single-phase, 400-cps source to RT-671/PRC-47.

e. ANTENNAS. - The radio set includes Antenna AS-1320/PRC-47 (a 15-foot whip) and Antenna AS-1321/PRC-47 (a long-wire antenna) either of which may be connected to the receiver-transmitter. Both antennas connect directly to the control panel of the RT-671/PRC-47.

Antenna AS-1320/PRC-47 consists of nine sections which can be assembled quickly by hand (see figure 1-7). Antenna AS-1321/PRC-47 (see figure 1-7) is a 45-foot antenna with insulators at 15 feet and 25 feet. Jumpers with alligator clips are permanently attached near the insulators so that the correct antenna length for the operating frequency may be chosen by shorting out the insulators as required.

For the mobile application, the radio set is used with a vehicular whip antenna. For the fixed site application, any suitable antenna may be used. In the mobile and fixed site application, the antenna terminal adapter is taken off the long-wire antenna and used with the antenna lead wire to connect the antenna to the receiver-transmitter control panel.

f. ELECTRICAL EQUIPMENT LEGS MT-2786/PRC-47. - Electrical Equipment Legs MT-2786/PRC-47 (see figure 1-1) are included with the radio set to support the receiver-transmitter or to prevent tipping when Antenna AS-1320/PRC-47 is used in high winds. The electrical equipment legs attach to each end of the receiver-transmitter, as shown in figure 1-1, and are adjustable to compensate for uneven ground conditions.

g. ANTENNA GROUND PLANE. - The antenna ground plane for the portable application consists of eight wires permanently attached to Electrical Equipment Legs MT-2786/PRC-47. When radio set is set up for transmission, the eight ground plane wires are

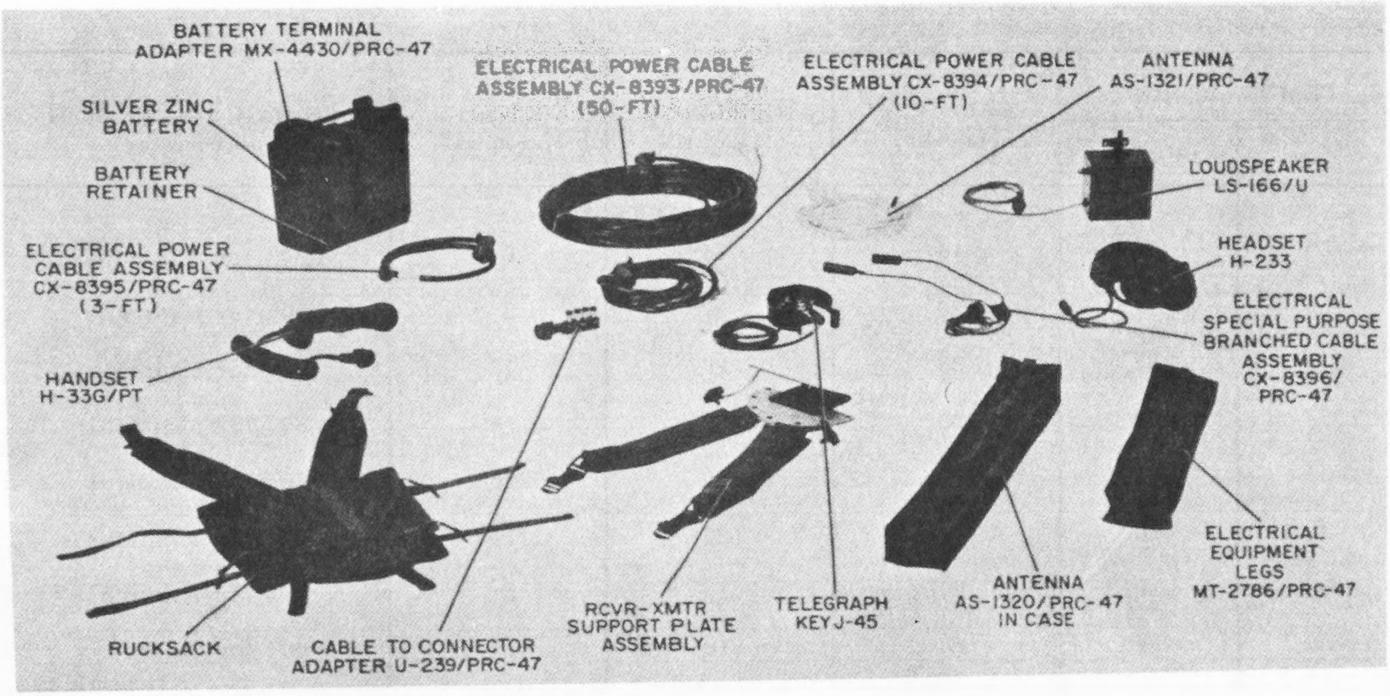


Figure 1-7. Radio Set AN/PRC-47, Accessories

unwound and spread out in a radial pattern. Also, a short wire with a pin terminal is connected to the ground plane wires wound on each MT-2786/PRC-47. Each pin is inserted into a spring-loaded grounding terminal at each end of the control panel, connecting all ground plane radials to the panel. Refer to figure 1-2 for positioning of ground plane radials.

h. AUDIO ACCESSORIES. - Voice operation of the radio set is accomplished with Handset H-33E/PT. This handset is connected directly to the control panel of the receiver-transmitter (see figure 1-7). Two audio receptacles are provided on the control panel so that two handsets may be connected.

For CW operation, Headset H-233 and Telegraph Key J-45 are used (see figure 1-7). They are connected through Electrical Special Purpose Branched Cable Assembly CX-8396/PRC-47 to one of the audio receptacles on the control panel.

The radio set may be operated remotely by Control Group AN/GRA-6 which is connected to one of the audio receptacles on the front panel of RT-671/PRC-47. Control Group AN/GRA-6 provides on-off and push-to-talk functions and audio connections. The control group is not part of the radio set.

For frequency shift keying operation (FSK), Cable to Connector Adapter U-239/PRC-47, which is supplied as part of the radio set, is connected to one of the audio receptacles on the control panel of the receiver-transmitter. Also, an FSK converter, such as CV-786/TRC-75, must be used. During FSK operation, the specified duty cycle must not be exceeded.

Loudspeaker operation of the radio set is possible with Loudspeaker LS-166/U. It is connected to one of the audio receptacles on the receiver-transmitter control panel.

i. RUCKSACK. - One rucksack and two canvas cases are provided for portage. The rucksack is provided to pack Electrical Power Cable Assembly CX-8395/PRC-47 and the various accessories required for portable operation: Antenna AS-1321/PRC-47, Handset H-33E/PT, Headset H-223, Telegraph Key J-45, and Electrical Special Purpose Branched Cable Assembly CX-8396/PRC-47. One canvas case is used to pack Electrical Equipment Legs MT-2786/PRC-47, and the other canvas case is used to pack Antenna AS-1320/PRC-47. The rucksack, the canvas cases, and Storage Battery BB-451/U are packed on one rucksack frame. The receiver-transmitter is packed on the other rucksack frame.

j. ACCESSORIES CASE CY-3657/PRC-47. - Accessories Case CY-3657/PRC-47, shown in figure 1-8, is a special carrying case for transport and storage of spare modules for Radio Set AN/PRC-47. The accessories case is provided with shaped lining and necessary trays to provide protection for the modules against transport and storage damage. Allowances for this item are included in appropriate Maintenance Float directives.

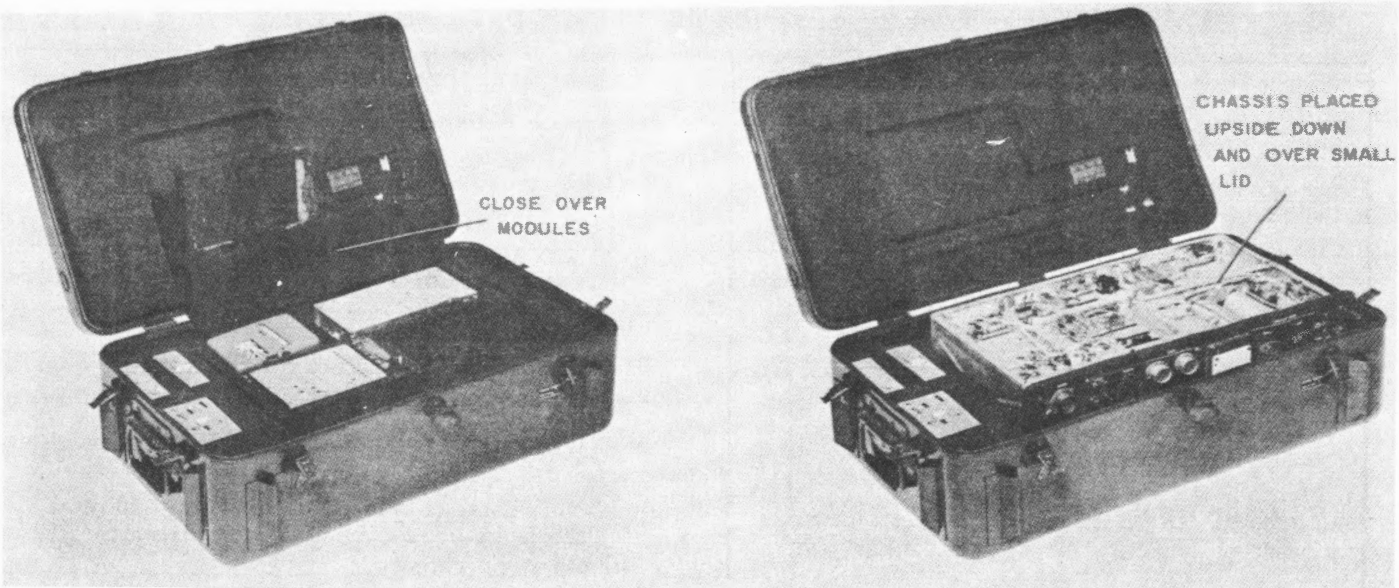


Figure 1-8. Accessories Case CY-3657/PRC-47

1-4. QUICK REFERENCE DATA.

Quick reference data for the radio set is provided in table 1-2.

TABLE 1-2. QUICK REFERENCE DATA (Sheet 1 of 3)

CONDITIONS	SPECIFICATIONS
Ambient Temperature Range	-40°C (-40°F) to +60°C (+140°F).
Ambient Humidity Range	0 tp 100 percent relative.
Altitude Range	Sea level to 12,000 feet.
Power Source	With d-c power supplies: 24-volt d-c silver-zinc battery; 26.5-volt d-c vehicular supply. With a-c power supplies: 115 volts, single phase, 400 cps.
Power Consumption	Transmit: not more than 320 watts. (Normal voltage, average power, voice operation.) Receive: not more than 21 watts (at maximum battery voltage and with lights on).
Duty Cycle	High Power: 1 minute transmit 9 minutes receive Low Power: 2 minutes transmit 9 minutes receive or 10 minutes transmit 5 minutes receive

TABLE 1-2. QUICK REFERENCE DATA (Sheet 2 of 3)

CONDITIONS	SPECIFICATIONS
Modes of Operation	USB only; Voice, FSK, or CW (f_o +800 cps)
Frequency Range	2 to 11.999 mc in 1-kc increments.
Number of Channels	10,000
Transmit Power Output (nominal into 50-ohm load)	20 watts peak envelope power (low power). 100 watts peak envelope power (high power).
Receive Sensitivity	Signal-plus-noise to noise ratio of at least 10 db with 2.0 microvolts r-f input and 50 milliwatts minimum audio output.
Receive Selectivity	Response to signals from 300 to 3000 cps above selected channel frequency not more than ±6 db from response to signal 1700 cps above selected channel frequency; response at least -60 db at 4600 cps above and 1000 cps below selected channel frequency.
Receive I-F Rejection	At least 80 db down.
Receive Image Rejection	With reference to 5-microvolt input signals; 80 db from 2.000 to 5.999 mc, 60 db from 6.000 to 9.999 mc, 50 db from 10.000 to 11.999 mc.
Receive Agc Characteristics	Maximum variation of 10 db for input signals of 5 to 100,000 microvolts.
Receive Audio Output	At least 500 milliwatts for 1000-microvolt input.
Receive Audio Distortion	Does not exceed 15 percent for 1000-microvolt r-f input signal and 500-milliwatt output signal.
Receive Over-all Audio Response	Within ±6 db from 300 to 3000 cps with reference to 1700 cps.
Undesired Sideband Rejection	At least 60 db.
Third Order Intermodulation Products	At least 30 db down.
Transmit Carrier Suppression	At least 40 db down.
Harmonic Spurious Emission	Second harmonic at least 35 db down from transmission; all others at least 50 db down from transmission output.
Frequency Stability	±25 cps for 60 days.
Battery Service Conditions	
Ambient Temperature	-25°C to +60°C (-13°F to +140°F).

TABLE 1-2. QUICK REFERENCE DATA (Sheet 3 of 3)

CONDITIONS	SPECIFICATIONS
Shock, Vibration, Inclination	Per MIL-E-16400 except vibration range shall extend to 55 cps.
Humidity	Up to 100 percent, relative.
Altitude	Up to 15,000 feet.
Attitude	Any position.

1-5. EQUIPMENT LISTS.

Table 1-3 lists the equipment supplied as part of the radio set. Table 1-4 lists optional equipment.

TABLE 1-3. EQUIPMENT SUPPLIED (Sheet 1 of 2)

QUANTITY PER EQUIPMENT	NOMENCLATURE		*OVER-ALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	H	W	D		
1	Radio Receiver-Transmitter	RT-671/PRC-47	13-13/32	21-5/32	6-29/32	1.25	40.8
3	Storage Battery	BB-451/U	7-27/32	11-5/8	4-1/8	0.25	17.0
1	Antenna	AS-1320/PRC-47	180 (long)				4.0
	(packed in carrier)		2-1/2	4	24-1/2		
1	Radio Set Case	CY-3700/PRC-47	17	28	20-3/4		65
1	Electrical Power Cable Assembly	CX-8393/PRC-47	50 ft long				6.68
1	Electrical Power Cable Assembly	CX-8395/PRC	3 ft long				0.5
1	Electrical Power Cable Assembly	CX-8394/PRC-47	10 ft long				1.5
1	Battery Terminal Adapter	MX-4430/PRC-47	2-3/4	10-27/32	4-3/32		1.8
1	Set, Frame Accessories						1.25
1	Handset	H-33E/PT					1.0
1	Headset	~~H-70C~~ H-233 (modified)					1.12

TABLE 1-3. EQUIPMENT SUPPLIED (Sheet 2 of 2)

QUANTITY PER EQUIPMENT	NOMENCLATURE		*OVER-ALL DIMENSIONS			*VOLUME	*WEIGHT
	NAME	DESIGNATION	H	W	D		
1	Telegraph Key	J-45					0.88
1	Cable to Connector Adapter	U-239/PRC-47					0.4
1	Loudspeaker	LS-166/U					3.875
1	Antenna	AS-1321/PRC-47	45 ft long				2.5
1	Electrical Special Purpose Branched Cable Assembly	CX-8396/PRC-47					0.38
2	(sets) Electrical Equipment Leg	MT-2786 PRC-47	2-1/2	3-7/8	18.0		5.48
1	Rucksack						1.31
2	Rucksack Frames						

*Unless otherwise stated, dimensions are in inches, volume in cubic feet, weight in pounds.

TABLE 1-4. OPTIONAL EQUIPMENT (NOT SUPPLIED)

QUANTITY PER EQUIPMENT	NOMENCLATURE	OVER-ALL DIMENSIONS
~~1~~	~~Vehicle Mounting Kit (includes)~~	
	~~Mounting Brackets and Back-up Plate~~	
	~~Antenna Lead Wire~~	~~3 feet long~~
	~~Antenna Mounting Bracket~~	
~~1~~	~~Blower Kit (includes)~~	
	~~Blower and motor~~	
	~~Connecting hoses~~	
	~~Port adapters~~	
1	Accessories Case CY-3657/PRC-47	10 x 28-7/16 x 16-7/16 inches volume is 2.6 cu. ft.

SECTION 2
PREPARATION FOR USE AND STOWAGE

Complete instructions for setting up the equipment, stowing the equipment in portable packs, and stowing the equipment in Radio Set Case CY-3700/PRC-47 are given in section 2 of Operator's Manual for Radio Set AN/PRC-47 and Accessories (TM-03817A-12/1). Refer to section 2 of TM-03817A-12/1.

SECTION 3
OPERATOR'S SECTION

An operator's functional description of the equipment and a description of all controls as well as operating procedures and operator's maintenance instructions are given in section 3 of Operator's Manual for Radio Set AN/PRC-47 and Accessories (TM-03817A-12/1). Refer to section 3 of TM-03817A-12/1.

SECTION 4
PRINCIPLES OF OPERATION

4-1. OVER-ALL FUNCTIONAL DESCRIPTION.

All major functional circuits of Radio Set AN/PRC-47 are contained in Radio Receiver-Transmitter RT-671/PRC-47. This unit consists of three functional groups of circuits which are shown in figure 4-1: transmit-receive circuits, frequency control circuits, and power supply circuits. Radio Receiver-Transmitter RT-671/PRC-47 consists of the following nomenclatured subassemblies:

Audio Frequency Amplifier AM-3506/PRC-47 (module A1)
Amplifier-Modulator AM-3507/PRC-47 (module A2)
Radio Frequency Oscillator O-1032/PRC-47 (module A6)
Oscillator Control C-4311/PRC-47 (module A7)
Power Supply PP-3518/PRC-47 (module A5)
Signal Data Translator CV-1377( )/PRC-47 (module A3)
Electrical Equipment Chassis CH-474/PRC-47
Panel Cover CW-647/PRC-47

The transmit-receive circuits provide voice communication (USB only), CW communication, or frequency shift keying (FSK) communication. The operating frequency may be selected in 1-kilocycle increments within the frequency range of 2.0 to 11.999 megacycles. During transmission, either a microphone audio signal from Handset H-33E/PT or an FSK audio signal from an external FSK unit, such as CV-786/TRC-75, may be applied to the audio input

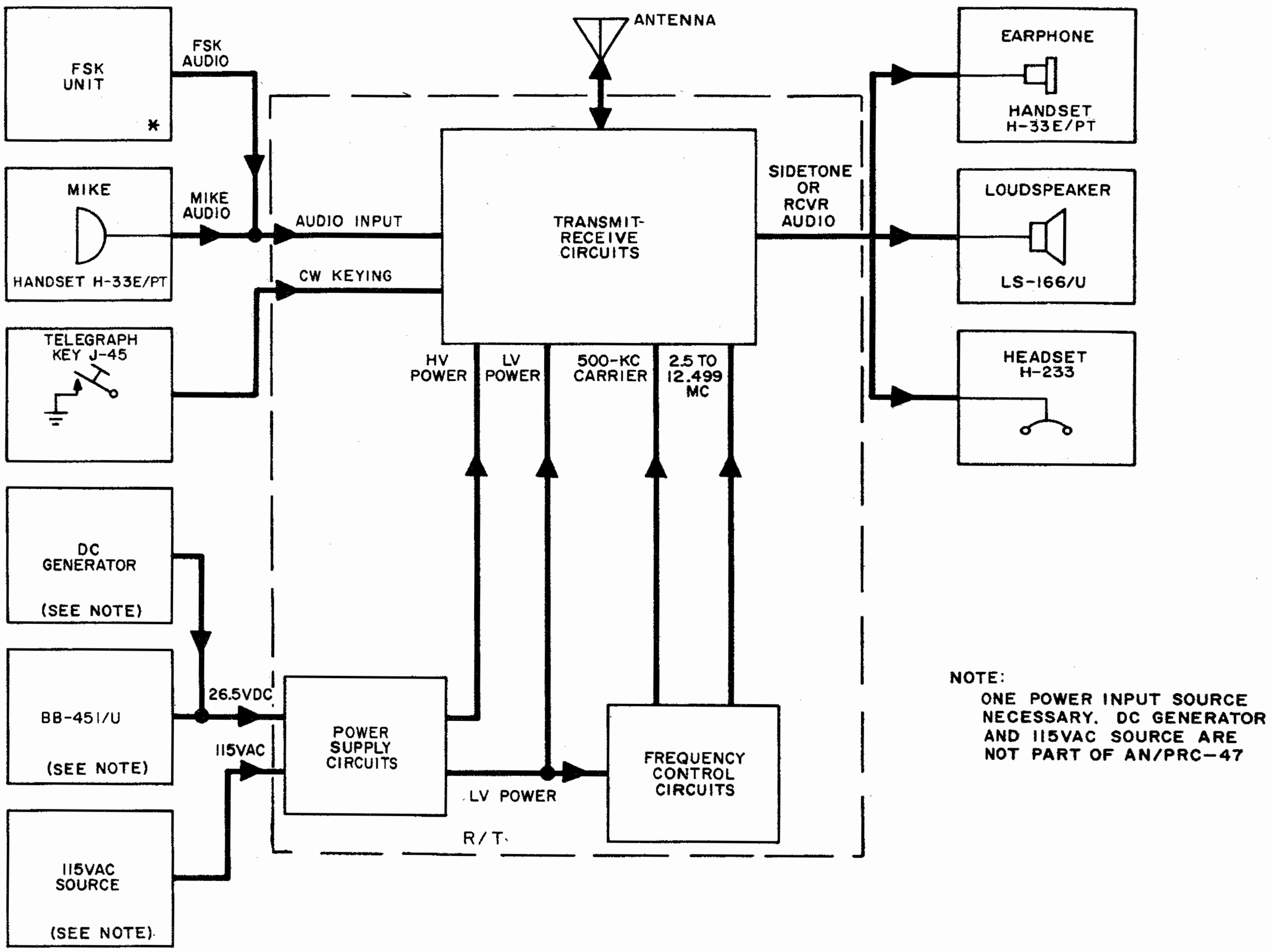


Figure 4-1. Over-all Functional Block Diagram

of the transmit-receive circuits. The audio output from the CV-786/TRC-75 is 1.5 volts at 150 ohms and 3.0 volts at 600 ohms. This is more than adequate input for the transmit audio input circuits, but no adjustment is required as audio limiter and alc circuits in the transmitter compensate for levels. The input requirements for the CV-786/TRC-75 are 100 millivolts to 4.0 volts at 600 to 1000 ohms; receiver audio output is more than adequate for this requirement. The RT-671/PRC-47 VOLUME control may be adjusted as necessary for proper level to the CV-786/TRC-75. For CW operation, a keying signal from Telegraph Key J-45 is applied to the transmit-receive circuits to control an internally generated 800-cps audio signal. The transmit-receive circuits use the modulating audio signal and a 500-kc carrier signal from the frequency control circuits to produce a double-sideband, suppressed-carrier signal. With the undesired sideband and the 500-kc carrier suppressed, this nominal 500-kc signal is frequency-converted to the desired communications frequency by mixing it with a local oscillator signal from the frequency control circuits. The local oscillator signal can be selected in 1-kc steps within the range from 2.5 to 12.499 mc to produce a transmission frequency output from 2.0 to 11.999 mc. This output is supplied to the antenna. If the transmission is at a satisfactory power level, a portion of the transmitted audio is applied to the selected audio device as a sidetone. The sidetone may be heard either at Handset H-33E/PT, Headset H-233, or Loudspeaker LS-166/U.

During reception, the transmit-receive circuits reverse the transmission sequence, using many of the stages that were used for transmission. Thus, the r-f signal from the antenna is mixed with the selected local oscillator frequency from 2.5 to 12.499 mc which is supplied by the frequency control circuits. This converts the selected communications channel from 2.0 to 11.999 mc to the i-f frequency of 500 kc. This is converted to audio by mixing it with the 500-kc carrier from the frequency control circuits. The resulting audio is supplied to the audio component being used.

The power supply circuits provide all supply voltages required by the radio set. The supply voltages may be derived from a +26.5-volt d-c input or a 115-volt a-c input. For the +26.5-volt d-c input, either Storage Battery BB-451/U or a d-c generator may be used. The power supply circuits produce two sets of supply voltages. When transmission is not required, only a set of low-voltage outputs is used. The low-voltage outputs provide the necessary power for the operation of all stages in the transmit-receive circuits which are used for reception and for the operation of the frequency control circuits. A separate set of high-voltage outputs are turned on only when transmission is required. These outputs provide the additional power to supply the high power r-f output stages in the transmit-receive circuits.

4-2. TRANSMIT-RECEIVE CIRCUITS.

a. GENERAL DESCRIPTION. (See figure 4-2.)

(1) TRANSMISSION. - For voice transmission, audio signals are supplied from the microphone to a microphone audio amplifier circuit in audio frequency amplifier module A1. This circuit amplifies the audio and compresses it to provide a reasonably steady audio level regardless of variations in the microphone input. A portion of the amplified audio is used as a sidetone signal and is applied through an audio output amplifier in Audio Frequency Amplifier AM-3506/PRC-47 to the headphones for monitoring. Another portion of the amplified audio is applied to a vox (voice-operated transmitter) circuit in Audio Frequency Amplifier AM-3506/PRC-47. Whenever the audio signals exceed a minimum threshold level, the vox circuit supplies a vox switching signal to various circuits in the radio set. This signal switches the radio set from its normal receive condition to the transmit condition. For CW transmission or during tuning, a ground potential switching signal turns on an 800-cps oscillator in the audio frequency amplifier module. The oscillator provides a continuous audio tone to replace the microphone input.

The portion of the amplified audio signal used to modulate the transmitter is fed to a balanced modulator in Amplifier-Modulator AM-3507/PRC-47. Here the audio signal is mixed with a 500-kc carrier signal from Radio Frequency Oscillator O-1032/PRC-47 in the frequency control circuits. The balanced modulator produces upper and lower sidebands but suppresses the 500-kc carrier. The sideband signal is then applied to an amplifier and filter circuit for amplification and suppression of the upper sideband (USB). The remaining lower sideband (LSB) signal is routed to a transmitter mixer circuit in Signal Data Translator CV-1377( )/PRC-47. Here the signal is converted from the LSB 500-kc frequency to any desired transmission frequency from 2.0 to 11.999 mc in 1-kc steps. The transmission frequency is controlled by a master local oscillator in the frequency control circuits. This oscillator is adjusted to supply a frequency from 2.5 to 12.499 mc in 1-kc steps to the transmitter mixer. The transmission frequency is the difference between the LSB 500-kc frequency and the selected local oscillator frequency. Since the transmitter LSB 500-kc frequency is subtracted from the local oscillator frequency, a sideband inversion occurs in the transmitted signal and the intelligence appears at the mixer output as the upper sideband of the selected transmission frequency.

The transmitter r-f signal produced by the transmitter mixer is amplified by tuned r-f amplifier stages in Signal Data Translator CV-1377( )/PRC-47. Tuning is controlled directly by gearing from the frequency controls on the front panel. The output r-f drive signal is supplied to the power amplifier compartment of Electrical Equipment Chassis CH-474/PRC-47. The power amplifier in this compartment is tuned

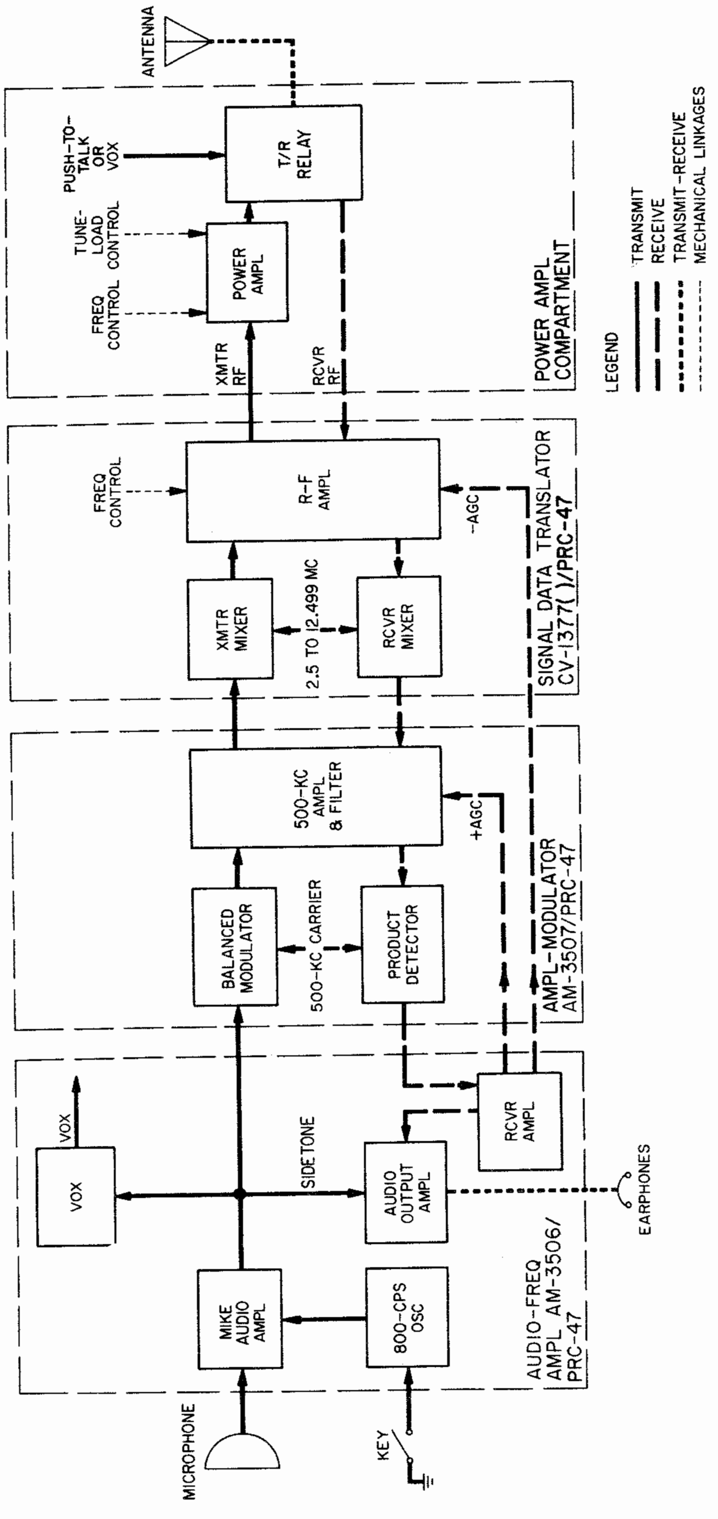


Figure 4-2. Transmit-Receive Circuits, Functional Block Diagram

and loaded to the selected transmittion frequency by the POWER AMPLIFIER TUNE and LOAD controls. The transmitter r-f signal is routed through the transmit-receive (TR) relay in the power amplifier compartment to the antenna. The TR relay is energized by the vox signal from the vox circuit in Audio Frequency Amplifier AM-3506/PRC-47.

(2) RECEPTION. - During reception, the r-f signal from the antenna is connected through the normally closed contacts of the TR relay in the power amplifier compartment. The TR relay is in the de-energized (receive) condition as long as the vox signal from audio frequency amplifier module A1 is not present. The r-f antenna signal is initially

amplified by the same tuned r-f amplifier stages (in Signal Data Translator CV-1377 ( )/PRC-47) that are used for transmission. Thus, only r-f signals in the frequency channel selected for transmission are amplified; all others are rejected by the tuned circuits in the r-f amplifier.

The r-f amplifier output is applied to a receiver mixer where it is mixed with the same local oscillator frequency (from 2.5 to 12.499 mc) that is supplied to the transmitter mixer. The receiver mixer output is tuned to a nominal difference frequency of 500 kc. Thus, the receiver mixer selects the communications channel which is 500 kc below the local oscillator frequency. This is the same channel that is used for transmission. (Image frequencies are attenuated in the r-f amplifier tuned circuits.)

The receiver r-f signal at the input to the receiver mixer is actually the upper sideband of the selected transmission frequency. Since the receiver r-f signal is subtracted from the local oscillator frequency in the receiver mixer, a sideband inversion occurs, and the desired mixer output is the lower sideband of 500 kc.

The LSB receiver 500-kc signal is applied to the same 500-kc amplifier and filter circuit in Amplifier-Modulator AM-3507/PRC-47 that is used for transmission. Here the signal is amplified and information from adjacent communications channels is rejected. The LBS receiver 500-kc signal is then applied to a product detector where it is mixed with the 500-kc carrier frequency from Radio Frequency Oscillator O-1032/PRC-47 in the frequency control circuit. The product detector output frequency is the difference between the 500-kc carrier and the LBS receiver 500-kc signal. This difference frequency is the audio modulation of the received r-f signal. The audio signal produced by the product detector is amplified by a receiver audio amplifier in Audio Frequency Amplifier AM-3506/PRC-47 and supplied through the audio output amplifier to the headphones. The receiver audio amplifier also includes an automatic gain control (agc) circuit. This circuit produces a positive agc bias voltage which controls the gain of the 500-kc amplifiers in Amplifier-Modulator AM-3507/PRC-47, and a negative agc bias voltage which controls the gain of the r-f amplifiers in Signal Data Translator CV-1377 ( )/PRC-47. The agc voltage thus provides a relatively steady audio volume level at the earphones during reception.

NOTE

On the top three channels of each band (that is, X.997, X.998, X.999) proper reception may be hampered due to spurious responses (birdies). This is a normal operating characteristic of the radio.

b. TRANSMIT-RECEIVE CIRCUITS, DETAILED DESCRIPTION. (See figure 4-3.)

(1) TRANSMISSION.

(a) AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47. (See figure 6-71.) - The audio input from the microphone is amplified by microphone amplifier Q1. Part of the Q1 output is applied to compressor amplifier Q2 which amplifies the audio sufficiently to drive compressor rectifier CR1 through CR4. The rectifier produces a floating d-c output which is filtered by capacitors C3 and C4. The positive and negative sides of the d-c output control compressor CR17 which acts as a variable input impedance for the audio input to Q1. This restricts the range of the output signal from Q1 and causes the Q1 output to be reasonably constant regardless of the strength of the microphone input.

Compressor CR17 is a diode bridge connected between the Q1 input signal path and ground (see figure 4-4). The bridge provides two separate variable resistance paths to ground. The diodes in each resistance path are forward-biased by the positive and negative side of the floating d-c output from compressor rectifier CR1 through CR4. The flow of d-c forward-bias current is shown in figure 4-4. For low audio signal levels, the d-c forward-bias voltage is small and the diodes operate with a high forward resistance. As the audio signal monitored at the output of Q1 increases, the bias voltage increases proportionately and the diode resistance is reduced. This reduces input impedance for the audio input to Q1 and thereby reduces audio signal level.

For CW keying and for tuning the radio set, oscillator Q5 is turned on by a ground potential switching signal. Oscillator Q5 produces an 800-cps signal which is used as the audio input for transmission instead of the microphone signal. During tuning, OPR-TUNE switch S102 on the front panel is set to TUNE. This connects a ground signal from the normally closed contacts of overtemperature cutout relay K103 to the CW key input, and then to oscillator Q5. OPR-TUNE switch S102 also supplies a push-to-talk ground signal to the power supply circuits during tuning. This turns on the high-voltage power supply (refer to paragraph 4-4*b*).

The CW keying line connects inductor L2 to ground to complete the collector d-c bias path for Q5. The 800-cps oscillation frequency is controlled by the emitter-to-collector tank circuit consisting of cwpacitors C19 and C20 and inductor L2.

The outputs of microphone amplifier Q1 and oscillator Q5 are applied to the input of microphone amplifier Q3. Excessive peaks in the amplified output of Q3 are clipped by CR5 and CR6. The signal is then amplified by microphone output amplifier Q4 and transformer-coupled to amplifier-modulator module A2.

The audio signal produced by microphone output amplifier Q4 is also fed to sidetone gate CR10.

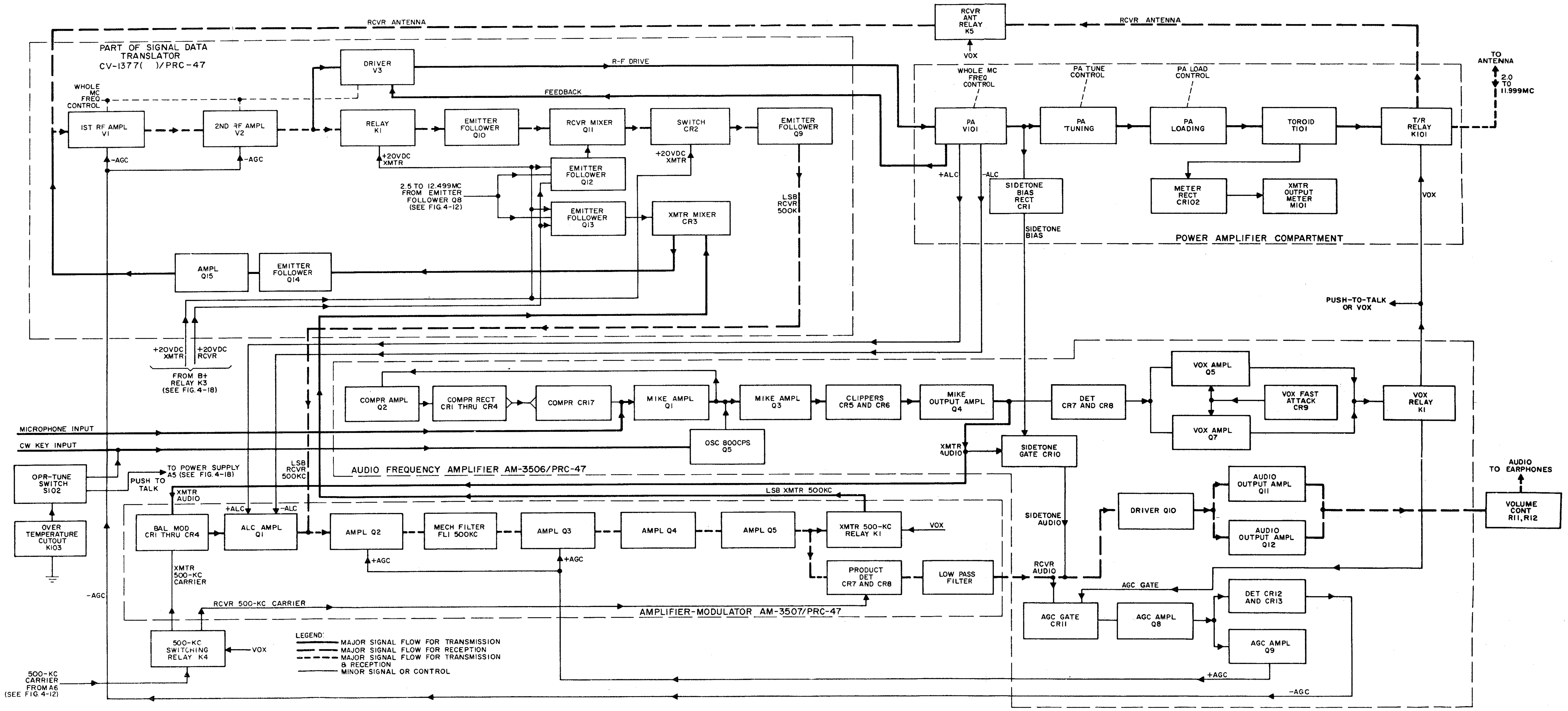


Figure 4-3. Transmit-Receive Circuits, Detailed Block Diagram

Sidetone gate CR10 acts as a switch for the sidetone audio signal. When the radio set is transmitting, a negative d-c sidetone bias signal is fed from the power amplifier compartment to forward-bias sidetone gate CR10. The sidetone audio passing through CR10 is amplified by driver Q10 and push-pull audio output amplifiers Q11 and Q12 to produce the sidetone for the earphones. The output audio level is adjusted by VOLUME control potentiometers R11 and R12 on the front panel (see figure 6-77, sheet 1).

The audio signal produced by microphone output amplifier Q4 is also applied to detector CR7 and CR8. Detector CR7 and CR8 produces a positive d-c signal which is fed to vox (voice-operated transmitter) amplifiers Q6 and Q7. These amplifiers operate together as a relay driver to energize vox relay K1 when the audio level exceeds a threshold minimum. Diode CR9 operates in conjunction with Q6 and Q7 to provide a fast attack time (the initial time during which the threshold audio level must be present to energize K1) and a slow release time (the time that the audio level must be below the threshold for relay K1 to release).

A simplified schematic diagram of the vox relay driver circuits is provided in figure 4-5. The collectors of Q6 and Q7 are returned to the +26.5-volt supply through the coil of K1. Initially, when the radio set is first turned on and with the audio signal below the vox threshold, C26 charges through Q6 and R42. Almost the full +26.5 volts appears across C26 when it is charged. This leaves the base of Q6 close to ground potential and cuts off Q6. If the audio level suddenly exceeds the threshold, a positive d-c step appears at the base of Q7 and drives Q7 into partial conduction. Conduction of Q7 is limited by negative feedback of the inverted step from the Q7 collector through capacitor C26 and transistor Q6 to the base of Q7. However, the negative step at the base of Q6 deteriorates quickly as capacitor C26 discharges through the low forward resistance of CR9. Thus, Q6 is cut off quickly, and the negative feedback is disabled. This permits Q7 to switch into full conduction, shorting one side of the K1 coil to ground, and energizing K1. Capacitor C26 is now discharged and both sides approach ground potential.

If the audio level suddenly drops below the threshold, a negative-going step suddenly appears at the base of Q7 and drives Q7 toward cutoff. Immediate cutoff of Q7 is prevented by negative feedback of the positive step from the collector of Q7 through capacitor C26 and transistor Q6 to the base of Q7. The positive step at the base of Q6 deteriorates slowly as capacitor C26 is charged through Q6 and R42. Ultimately, the base of Q6 returns toward ground potential and the negative feedback is disabled. Transistor Q7 goes into cutoff and vox relay K1 is released.

The later model Audio Frequency Amplifier AM-3506/PRC-47 modules are being produced with microphone push-to-talk circuits. This disables the vox circuit and allows the operator to physically energize vox relay K1 by actuating the microphone

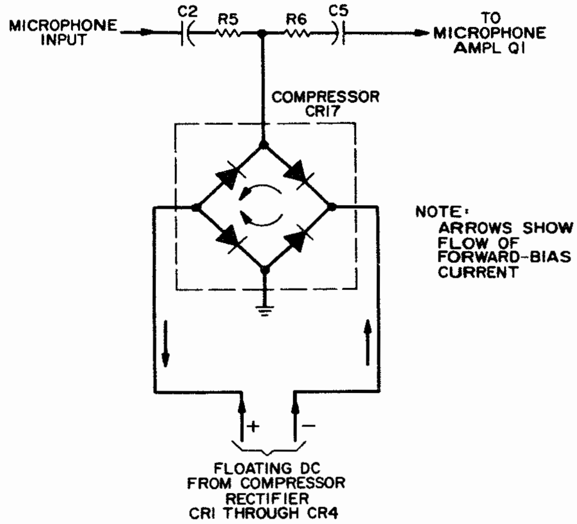


Figure 4-4. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Microphone Compressor Circuit, Simplified Schematic Diagram

push-to-talk switch. If normal vox operation is desired, remove the push-to-talk line from the cold side of vox relay K1.

Vox relay K1 transfers the radio set from its normal receive condition to the transmit condition. This is accomplished by a +26.5-volt vox switching signal which is routed from the contacts of K1 to the coils of relays in amplifier-modulator module A2, power supply module A5, and the chassis. The vox switching signal is also applied to agc gate CR11 in module A1 to disable agc operation during transmission (refer to paragraph 4-2*b*(2) *(d)*).

(b) AMPLIFIER-MODULATOR AM-3507/PRC-47. (See figure 6-72.) - During transmission, the transmitter audio signal from Audio Frequency Amplifier AM-3506/PRC-47 is applied to balanced modulator CR1 through CR4 in Amplifier-Modulator AM-3507/PRC-47. Here, the transmitter audio signal is combined with the transmitter 500-kc carrier from r-f oscillator module A6. The transmitter 500-kc carrier is routed through the contacts of energized 500-kc switching relay K4 on the chassis. This relay

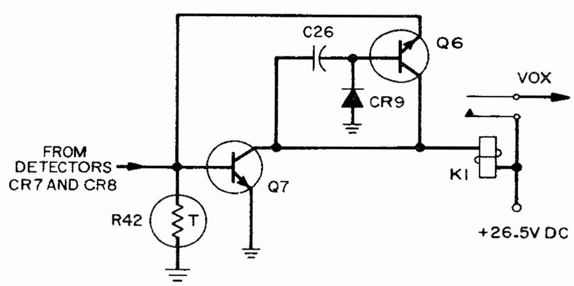


Figure 4-5. Audio Frequency Amplifier AM-3506/PRC-47 VOX Circuit, Simplified Schematic Diagram

is energized by the vox signal from the audio amplifier module. The output of balanced modulator CR1 through CR4 consists of a series of pulses whose polarity and repetition rate are determined by the phase and frequency of the 500-kc signal and whose amplitude is proportional to the instantaneous amplitude of the input audio signal. In terms of frequency analysis, the balanced modulator output contains the upper and lower audio sidebands displaced from the 500-kc reference frequency by the instantaneous audio frequency.

Operation of balanced modulator CR1 through CR4 is shown in figure 4-6 which shows the basic features of the circuit. This balanced modulator uses a ring modulator configuration to provide a push-pull output. The diodes are alternately switched on and off in pairs by the transmitter 500-kc carrier which is symmetrically fed through a balanced capacitor input circuit. Thus, the audio input signal is chopped into alternate positive and negative 500-kc pulses as shown in figure 4-6. Output of the balanced modulator is a double sideband suppressed carrier signal.

The upper and lower sideband signal is passed through alc amplifier Q1. This stage receives plus and minus alc bias voltages from the power amplifier compartment. The alc voltages adjust signal level of the sidebands so that the power amplifier tube is not driven into excessive grid current by high level signals. Both the plus and minus alc voltages are actually negative voltages. The plus alc voltage is fixed at -110 volts dc and serves as a reference for the minus alc voltage. As long as the power amplifier does not draw grid current, the minus alc voltage is also -110 volts dc. When grid current is drawn, the minus alc voltage goes more negative. This reduces the gain of alc amplifier Q1 to prevent excessive power amplifier grid current.

The plus alc voltage is applied to the emitter circuit of alc amplifier Q1 while the minus alc voltage is applied to the base circuit. Transistor Q1 is connected as a common base amplifier which is self-biased. As the signal level increases, the minus alc voltage at the base reduces the forward bias and thereby reduces the gain.

The signal from alc amplifier Q1 is further amplified by common base amplifier Q2, and then applied to mechanical filter FL1 which is tuned to pass only the lower sideband of the suppressed carrier. The filtered lower sideband signal is amplified by common base amplifier Q3 and common emitter amplifiers Q4 and Q5. The signal is then fed through the contacts of energized transmitter 500-kc relay K1 to signal data translator module A3. Relay K1 is energized during transmission by the vox signal from audio frequency amplifier module A1.

(c) SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47. (See figure 6-73, sheet 3.) - During transmission, the LSB transmitter 500-kc signal is applied to transmitter mixer CR3A and CR3B. Here, the signal is mixed with a local oscillator signal, selected in 1-kc steps at any frequency from 2.5 to 12.499 mc and supplied from the frequency control circuits through emitter follower Q13. The difference frequency is the desired output and falls in the frequency range of 2.0 to 11.999 mc depending upon the local oscillator frequency selected. Subtracting the LSB transmitter 500-kc signal from the local oscillator frequency inverts the sideband so that an LSB transmitter 500-kc signal becomes a USB signal at the desired r-f frequency.

Q13 is supplied collector power during transmission by a +20-volt d-c transmitter supply voltage from power supply module A5. During reception, the +20-volt d-c transmitter supply is disconnected and a +20-volt d-c receiver supply voltage is turned on. This voltage disables the output of emitter follower Q13 by forward-biasing switching diode CR6.

The transmitter mixer is a balanced mixer using two diodes (see figures 4-7 and 6-73, sheet 3). Diodes CR3A and CR3B are alternately switched into conduction and cutoff by the 2.5- to 12.499-mc local oscillator frequency. The LSB transmitter 500-kc signal is injected at the junction of R58 and R59 and is mixed with the local oscillator frequency. The resulting waveform consists of pulses whose repetition rate and polarity are determined by the local oscillator signal and whose amplitude is determined by the 500-kc signal. The difference frequency is used as output and all other mixing products are attenuated in later tuned stages.

Potentiometer R150 is used to balance the transmitter mixer circuit to obtain maximum suppression of the local oscillator frequency in the circuit output. Potentiometer R148 is a gain control used to adjust the output of the mixer circuit to the desired level.

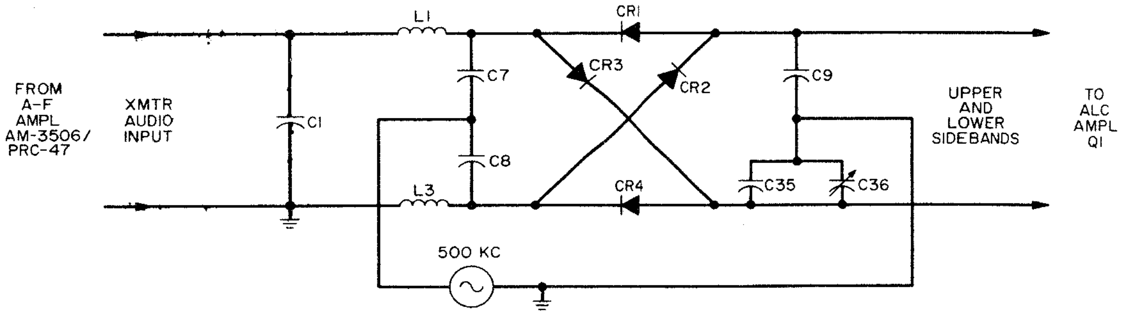


Figure 4-6. Amplifier-Modulator AM-3507/PRC-47 (A2), Balanced Modulator, Simplified Schematic Diagram

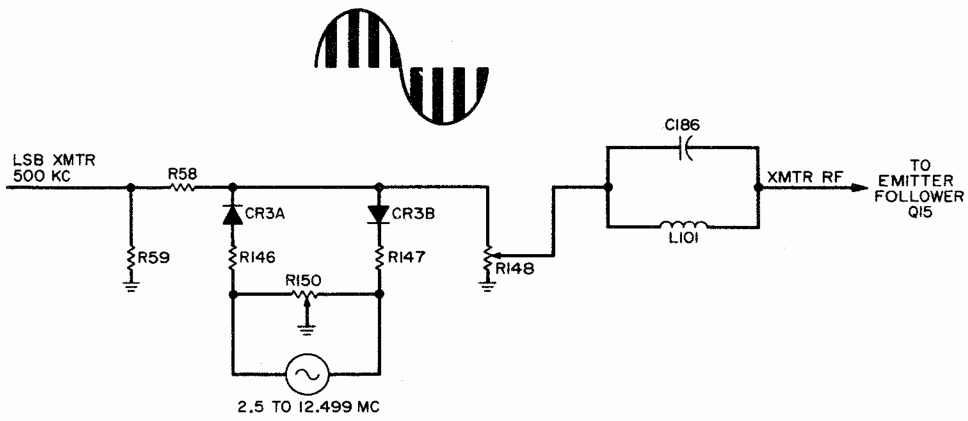


Figure 4-7. Signal Data Translator CV-1377( )/PRC-47 (A3), Transmitter Mixer, Simplified Schematic Diagram

Capacitor C186 and inductor L101 form a filter trap to attenuate any 500-kc signal leaving the mixer.

The 2.0- to 11.999-mc signal produced by the transmitter mixer is coupled through emitter follower Q14 and amplifier Q15 to be amplified by first and second r-f amplifiers V1 and V2. The signal is then applied to driver V3 which drives the power amplifier tube in the power amplifier compartment of the chassis. The input circuit to V1 as well as the output circuits of V1, V2, and V3 are tuned to the selected whole megacycle frequency band by LC combination switches S3, S4, S5, and S8, respectively. Fine tuning in the selected band is provided by variable inductors L2, L3, L4, and L5. The switches and variable inductors are operated by gearing from the frequency controls on the front panel. A simplified schematic diagram of the V1 input circuit for the 2-mc selection is provided in figure 4-8. This figure also shows the tuning performed by switches S1 and S2 for a separate input during reception (refer to paragraph 4-2*b*(2)*(b)*).

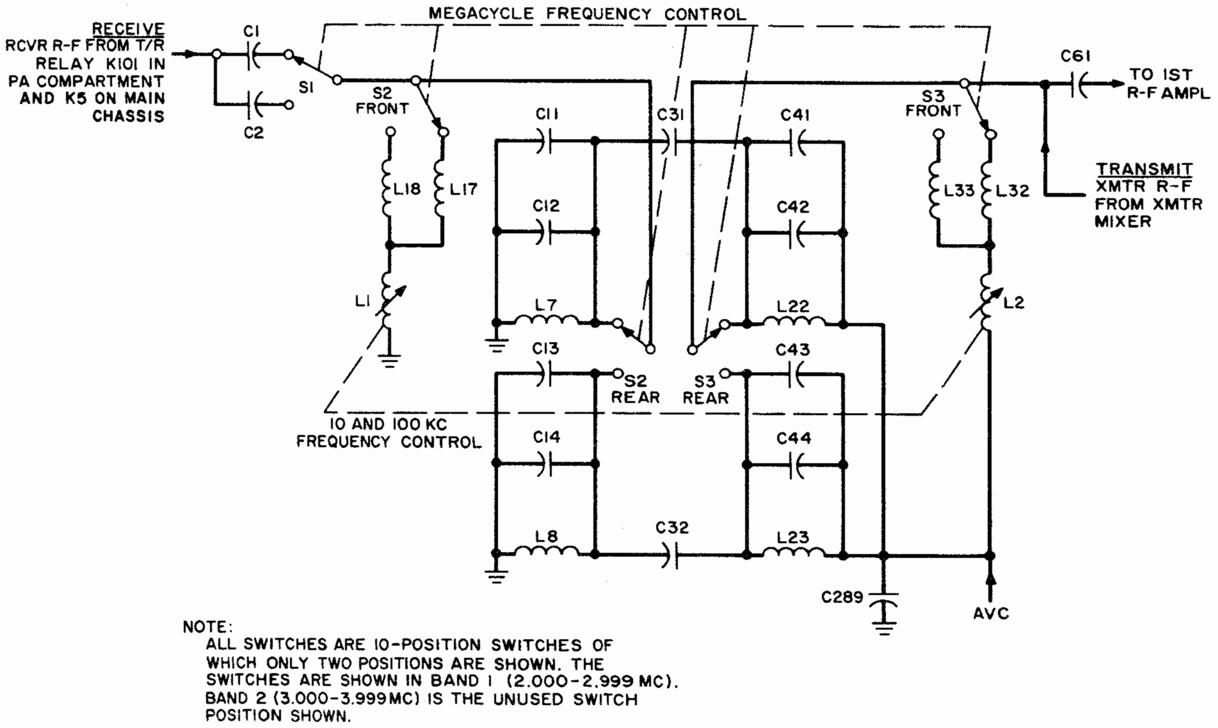


Figure 4-8. Signal Data Translator CV-1377( )/PRC-47 (A3), Input Circuit to First R-F Amplifier V1, Simplified Schematic Diagram

(d) POWER AMPLIFIER COMPARTMENT. (See figure 6-77, sheet 2.) - During transmission, the r-f drive signal from Signal Data Translator CV-1337( )/PRC-47 is applied to power amplifier V101. Automatic level control (alc) is provided for this stage to prevent excessive grid current; this permits the power amplifier to operate near its maximum capability without being overloaded when high signal levels appear. The automatic level control is provided by plus alc and minus alc outputs which are applied to alc amplifier Q1 in Amplifier-Modulator AM3507/PRC-47 to reduce the signal level when excessive grid current is drawn.

The grid of power amplifier V101 is normally at -110 volts dc as long as the tube does not draw grid current. When the signal level exceeds a peak value of 110 volts, V101 draws grid current which flows through R119, R104, and L102 to the -110-volt supply (see figure 4-9). The voltage drop across R104, due to this grid current, is used to bias alc amplifier Q1 in Amplifier-Modulator AM-3507/PRC-47 to reduce its gain. This is the minus alc output. The plus alc output is always at -110 volts and provides a reference for the minus alc output. This method of gain control keeps the signal at the grid of V101 at a fairly constant level of 110 volts peak.

Negative feedback is provided from the plate of V101 to the filament center tap of driver V3 in Signal Data Translator CV-1377( )/PRC-47. This arrangement improves linearity and allows the power amplifier to be operated at optimum power level with minimum distortion of the output signal.

The signal from power amplifier V101 is fed through a power amplifier tuning circuit and a power

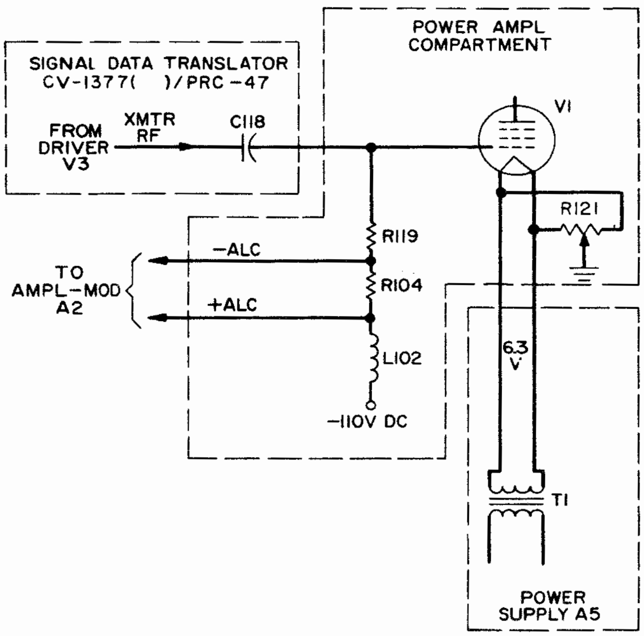


Figure 4-9. Power Amplifier Compartment, Amplifier Grid Bias Circuit, Simplified Schematic Diagram

amplifier loading circuit. The power amplifier tuning circuit consists of a pi network that matches the plate impedance of the tube to the resistance of the antenna. The power amplifier loading circuit provides series inductive reactance to cancel the capacitance reactance of the antenna. These circuits are adjusted by the POWER AMPLIFIER TUNE and LOAD controls on the receiver-transmitter front panel to provide fine tuning and loading. Variable inductor L109 in the tuning circuit is adjusted by the TUNE control and variable inductors L110, L111, and L112 in the loading circuit are adjusted by the LOAD control. Coarse tuning is provided by band switch wafers S101A and S101B. This switch is geared to the whole megacycle frequency control on the front panel.

The transmitter signal from the pi-L network is fed through toroid T101 and the contacts of energized TR (transmit-receive) relay K101 to the antenna. Relay K101 is energized during transmission by the vox signal from Audio Frequency Amplifier AM-3506/PRC-47. Toroid T101 passes a sample of the output r-f signal to meter circuit rectifier CR102 and the associated filter circuit. This provides a d-c output proportional to the r-f transmission level which is used to operate XMTR OUTPUT meter M101 on the front panel. The meter indicates relative power output to the antenna and is necessary in tuning the power amplifier. Meter sensitivity can be adjusted by means of M ADJ control R117 on the front panel.

XMTR OUTPUT meter M101 is connected into the circuit through contacts of BATTERY TEST switch S3 on the front panel when this switch is released (refer to paragraph 4-4*b*(3)). Diode CR103 is connected across meter M101 to protect the meter from excessive current. The diode acts as a forward limiter for current levels which exceed the capability of the meter. Meter M101 is operated at a reduced sensitivity range when XMTR PWR switch S103 on the front panel is at HI. This minimizes the amount of adjustment required with M ADJ control R117 when the transmission is switched from a low power level to a high power level.

A portion of the signal from power amplifier V101 is fed through sidetone bias rectifier CR101 to produce a d-c sidetone bias signal which is proportional to the transmission power level. This signal is supplied to sidetone gate CR10 in Audio Frequency Amplifier AM-3506/PRC-47 to switch on the sidetone signal at the headphones (or loudspeaker) whenever the transmission level exceeds a threshold minimum.

(2) RECEPTION.

(a) POWER AMPLIFIER COMPARTMENT. (See figure 6-77, Sheet 2.) - The received r-f signal is routed from the antenna through TR relay K101 in the power amplifier compartment. Relay K101 is normally in the receive position and permits the signal to be fed to signal data translator module A3 through de-energized antenna relay K5 in the chassis. During

transmission, K5 is energized by the vox signal from Audio Frequency Amplifier AM-3506/PRC-47, thereby connecting the receiver antenna line to ground.

(b) SIGNAL DATA TRANSLATOR CV-1377/PRC-47. (See figure 6-73.) - During reception, the receiver antenna signal is fed to first and second r-f amplifiers V1 and V2 in Signal Data Translator CV-1377/PRC-47. The input to V1 is coarse-tuned to the selected whole megacycle frequency band by inductor-capacitor combinations on switches S1, S2, and S3, and fine-tuned by variable inductors L1 and L2 (see figure 4-8). The outputs of V1 and V2 are tuned by inductor-capacitor combinations on switches S4 and S5, and by variable inductors L3 and L4. Automatic gain control (agc) is applied to the grids of V1 and V2 from audio frequency amplifier module A1.

The amplified receiver r-f signal is fed from second r-f amplifier V2 through the normally closed contacts of relay K1. During transmission, relay K1 is energized by a +20-volt d-c transmitter power supply voltage from main chassis relay K3. During reception, K1 is de-energized and passes the receiver r-f signal to switch CR1. This switch is back-biased during transmission by the +20-volt d-c transmitter power supply voltage.

During reception, switch CR1 passes the receiver r-f signal through impedance matching emitter follower Q10 to receiver mixer Q11. Here the r-f signal is mixed with a local oscillator signal which is selected in 1-kc steps at any frequency from 2.5 to 12.499 mc and is supplied from the frequency control circuits through emitter follower Q12. Emitter follower Q12 is enabled during reception by a +20-volt d-c receiver supply voltage from main chassis relay K3. This voltage provides the B+ supply for Q12. During transmission, the +20-volt d-c receiver power supply is disconnected and the +20-volt transmitter power supply voltage is turned on (refer to paragraph 4-4*b*(3)). This voltage disables the output of emitter follower Q12 by forward-biasing switching diode CR5.

The output of receiver mixer Q11 is tuned to the difference frequency of 500 kc. Thus, the mixer selects the receiver r-f channel which is 500 kc below the selected local oscillator frequency. The receiver r-f signal at the input to mixer Q11 is the upper sideband of the selected communications frequency. This frequency is subtracted from the local oscillator frequency to produce the receiver 500-kc output. Because of the resulting sideband inversion, the receiver 500-kc output is actually the lower sideband of a suppressed 500-kc carrier.

The LSB receiver 500-kc signal produced by receiver mixer Q11 is fed to switch CR2. This switch is forward-biased during reception allowing the signal to be coupled through impedance matching emitter follower Q9 to Amplifier-Modulator AM-3507/PRC-47. During transmission, a +20-volt d-c transmitter power supply voltage blocks CR2.

(c) AMPLIFIER-MODULATOR AM-3507/PRC-47. (See figure 6-72.) - The LSB receiver 500-kc signal from signal data translator module A3 is applied to common base amplifier Q2 in Amplifier-Modulator AM-3507/PRC-47. Amplifier Q2 feeds the signal into mechanical filter FL1 to reject signals from adjacent communications channels which may have been passed by receiver-mixer Q11 in module A3. FL1 is adjusted to pass only signals which appear in the frequency range of the lower sideband of 500 kc. The filtered signal is successively amplified by common base amplifier Q3, and common emitter amplifiers Q4 and Q5. Automatic gain control is provided for amplifiers Q2 and Q3 by a plus agc voltage from audio frequency amplifier module A1.

The amplified LSB receiver 500-kc signal is injected into product detector CR7 and CR8 together with a receiver 500-kc carrier signal to produce an audio output signal. The receiver 500-kc carrier is supplied during reception from the frequency control circuits through the normally closed contacts of 500-kc switching relay K4 (refer to paragraph 4-3*b*(1)*(b)*). During transmission, relay K4 is energized by a vox signal from Audio Frequency Amplifier AM-3506/PRC-47. This switches the 500-kc carrier to transmitter operation (refer to paragraph 4-2*b*(1)*(b)*). The audio output of CR7 and CR8 is fed through a low pass filter which bypasses the 500-kc components in the signal and passes the audio components. The audio signal is routed to Audio Frequency Amplifier AM-3506/PRC-47.

Product detector CR7 and CR8 (see figure 4-10) consists of two diode mixer circuits connected in a

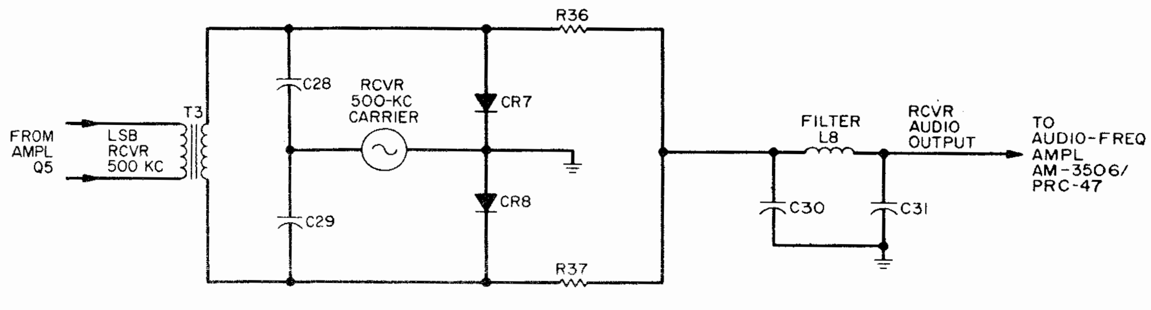


Figure 4-10. Amplifier-Modulator AM-3507/PRC-47 (A2), Product Detector, Simplified Schematic Diagram

push-pull arrangement to provide maximum audio output voltage. The two diode mixer circuits in the product detector use the receiver 500-kc carrier signal to switch diodes CR7 and CR8 alternately on and off at a 500-kc rate. The frequency of the receiver 500-kc signal differs from the receiver 500-kc carrier by the audio frequency so that the instantaneous amplitude of the output signal varies from zero to maximum at the audio rate.

(d) AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47. (See figure 6-71.) - The receiver audio signal from Amplifier-Modulator AM-3507/PRC-47 is fed to driver Q10 in Audio Frequency Amplifier AM-3506/PRC-47. Driver Q10 amplifies the signal and applies it to audio output amplifiers Q11 and Q12. Audio output amplifiers Q11 and Q12 are connected in push-pull and provide the last stage of receiver audio amplification. The output of Q11 and Q12 is fed through VOLUME control potentiometers R11 and R12 on the chassis to the headphones.

Part of the audio signal input to Audio Frequency Amplifier AM-3506/PRC-47 is fed to automatic gain control (agc) gate CR11. This gate is back-biased during transmission by the vox signal from vox relay K1. This prevents sidetone audio signals from initiating automatic gain control.

During reception, the audio signals are fed through CR11 to agc amplifier Q8. Part of the amplified signal from Q8 is applied to agc amplifier-Q9 for conversion into a plus agc voltage for amplifiers Q2 and Q3 in Amplifier-Modulator AM-3507/PRC-47. Agc amplifier Q9 is biased in its nonlinear region and, therefore, operates as a common emitter detector. The collector of Q9 is returned to ground through the biasing circuits for Q2 and Q3 in module A2. The output of Q9 is a positive d-c voltage whose level varies slowly with the average audio level. Audio components are removed from the signal by filtering capacitor C42.

The other portion of the amplified audio signals from Q8 is converted to a minus agc voltage by detectors CR12 and CR13. Diode CR14 and its bias network operates as an agc delay gate. This disables the minus agc output for weak signals. The minus agc voltage provides automatic gain control to first and second r-f amplifiers V1 and V2 in signal data translator module A3.

4-3. FREQUENCY CONTROL CIRCUITS.

a. GENERAL DESCRIPTION. (See figure 4-11.)

(1) MASTER OSCILLATOR. - The basic local oscillator frequency for both receiver and transmitter operation is 2.5 to 12.499 mc in 1-kc steps. This frequency is generated by a master oscillator in Signal Data Translator CV-1377/PRC-47. The master oscillator is coarse-tuned in ten 1-mc steps by the whole megacycle frequency control on the front panel (refer to table 4-1). Fine tuning of the master oscillator to a specific 1-kc channel is accomplished by adjustment of variable inductor L6 and by d-c error signals from a discriminator in oscillator control module A7. The discriminator is part of a closed frequency control loop which compares the master oscillator output with crystal-controlled reference frequencies and automatically adjusts the master oscillator frequency to a selected combination of crystal-controlled frequencies. The crystal-controlled frequencies are selected in four steps; whole megacycle selection, 100-kc selection, 10-kc selection, and 1-kc selection.

TABLE 4-1
MASTER OSCILLATOR FREQUENCIES

WHOLE MC BAND NO.	CHANNEL FREQ (mc)	MASTER OSCILLATOR FREQ (mc)
1	2 - 2.999	2.5 - 3.499
2	3 - 3.999	3.5 - 4.499
3	4 - 4.999	4.5 - 5.499
4	5 - 5.999	5.5 - 6.499
5	6 - 6.999	6.5 - 7.499
6	7 - 7.999	7.5 - 8.499
7	8 - 8.999	8.5 - 9.499
8	9 - 9.999	9.5 - 10.499
9	10 - 10.999	10.5 - 11.499
10	11 - 11.999	11.5 - 12.499

(2) WHOLE MEGACYCLE AND 100-KC FREQUENCY SELECTION. - The frequencies for whole megacycle and 100-kc selection are both derived from the output of an extremely stable crystal oscillator in radio frequency oscillator module A6. This crystal oscillator produces a fixed 3-mc output which is frequency-divided by 6 in a 500-kc divider circuit. The resulting 500-kc signal is supplied to the receive-transmit circuits as the 500-kc carrier frequency.

The 500-kc signal is also supplied from module A6 to a 1-mc pulse generator in Oscillator Control C-4311/PRC-47. The 1-mc pulse generator multiplies the frequency of the 500-kc input by 2 and converts the resulting 1-mc signal into a 1-mc pulse train. The 1-mc pulses are applied to a 5-14 mc ringer and amplifier in Signal Data Translator CV-1377/PRC-47. The 5-14 mc ringer uses the 1-mc pulses to generate one of ten output sine-wave

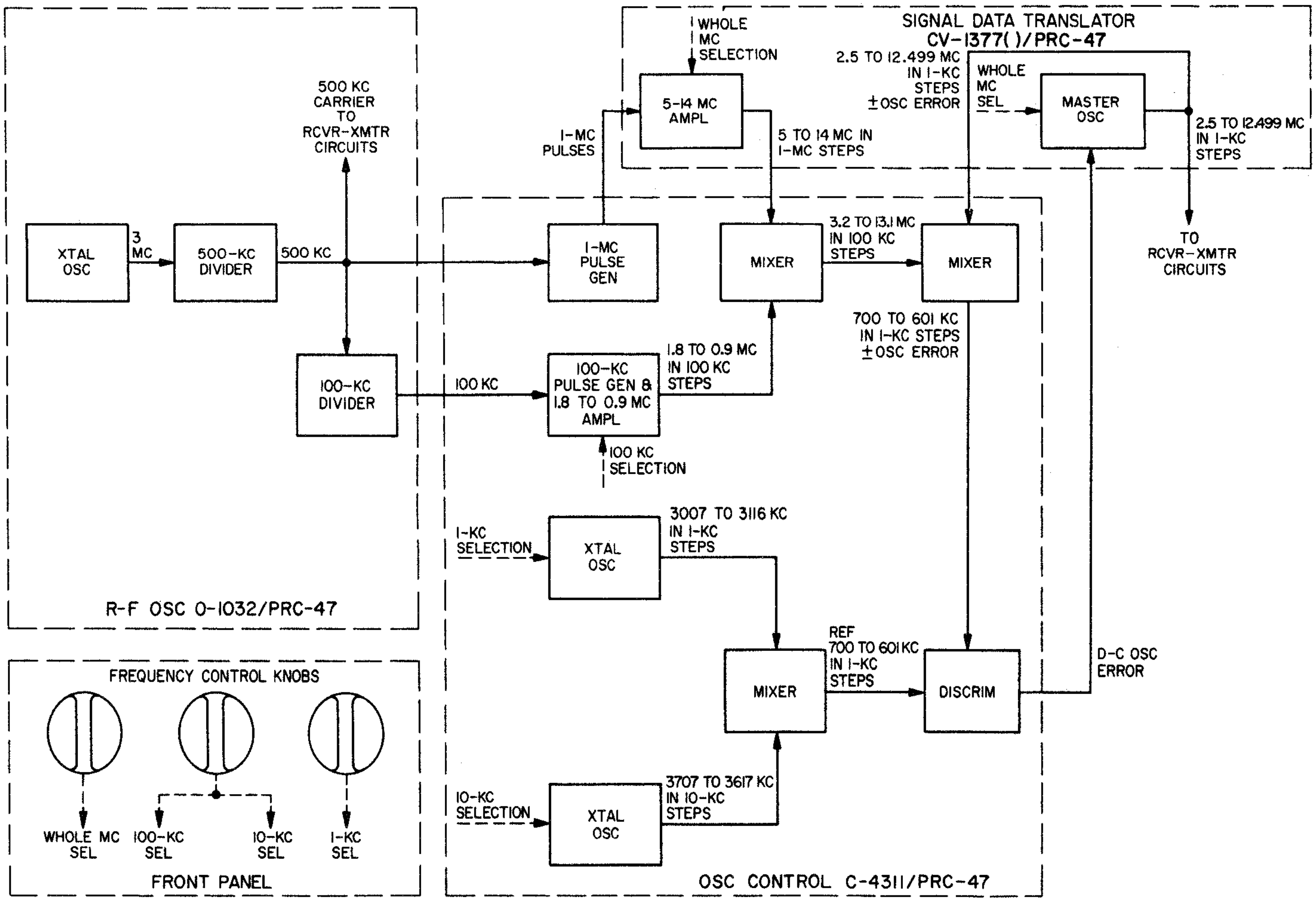


Figure 4-11. Frequency Control Circuits, Functional Block Diagram

frequencies. The frequencies are selected from 5 to 14 mc in 1-mc steps by the whole megacycle frequency control on the front panel (refer to table 4-2).

TABLE 4-2
WHOLE MEGACYCLE SELECTION FREQUENCIES (5 TO 14 MC)

WHOLE MC BAND NO.	CHANNEL FREQ (mc)	WHOLE MC SELECTION FREQ (mc)
1	2.000 - 2.999	5
2	3.000 - 3.999	6
3	4.000 - 4.999	7
4	5.000 - 5.999	8
5	6.000 - 6.999	9
6	7.000 - 7.999	10
7	8.000 - 8.999	11
8	9.000 - 9.999	12
9	10.000 - 10.999	13
10	11.000 - 11.999	14

The 500-kc signal at the output of the 500-kc frequency divider in Radio Frequency Oscillator O-1032/PRC-47 is also applied to a 100-kc divider which divides the frequency by a factor of 5. The resulting 100-kc signal is applied to a 100-kc pulse generator and 1.8- to 0.9-mc ringer and amplifier in Oscillator Control C-4311/PRC-47. This circuit produces a 100-kc pulse train which is used to generate 1 of 10 output sine wave frequencies. These frequencies are selected from 1.8 to 0.9 mc in 100-kc steps by the middle frequency control on the front panel (refer to table 4-3).

The selected 5- to 14-mc whole megacycle selection frequency is beat with the selected 1.8- to 0.9-mc 100-kc selection frequency in a mixer in Oscillator Control C-4311/PRC-41. The mixer output can thus be any of 100 frequencies from 3.2 to 13.1 mc in 100-kc steps. This is indicated in table 4-4 which shows a few sample frequencies. The selected 3.2- to 13.1-mc frequency is applied to a second mixer where it is beat with the output of the master oscillator. Now, if the radio set operator selects his 1-kc communication channel on an even 100 kc, such as 2.000, 2.100, 2.200 mc, etc, the master oscillator frequencies should be 2.500, 2.600,

TABLE 4-3
100-KC SELECTION FREQUENCIES
(0.9 TO 1.8 MC)

100 KC BAND NO.	CHANNEL FREQ (mc)	100-KC SELECTION FREQ (mc)
1	X.000 - X.099	1.8
2	X.100 - X.199	1.7
3	X.200 - X.299	1.6
4	X.300 - X.399	1.5
5	X.400 - X.499	1.4
6	X.500 - X.599	1.3
7	X.600 - X.699	1.2
8	X.700 - X.799	1.1
9	X.800 - X.899	1.0
10	X.900 - X.999	0.9

2.700, etc, respectively, to 12.400 mc for a channel selection of 11.900 mc. Thus, the master oscillator frequency should always be exactly 700 kc below the 3.2- to 13.1-mc mixer input frequency. Any variation of the mixer output from 700 kc represents a frequency error in the master oscillator.

Now, assume that the radio set operator selects from 1 to 99 kc above the full 100-kc selection. For this case, the master oscillator output must be from 1 to 99 kc above its previous value (for example, 2.501 to 2.599 mc for the first 100-kc selection). However, the output of the first mixer will still remain fixed at its previous value (for example, 3.2 mc for the first 100-kc selection). Thus, the difference output will be less than 700 kc by an amount from 1 to 99 kc depending on the specific channel selected (refer to table 4-5). Any variation from the correct value represents an oscillator error. Thus, the 700- to 601-kc output of the second mixer is applied to the discriminator where it is compared with a 700- to 601-kc reference signal. The discriminator produces a d-c error voltage which automatically adjusts the master oscillator until the oscillator is operating at the specific 1-kc channel selected by the reference signal. The 700- to 601-kc reference signal is selected by the 10-kc and 1-kc frequency selections.

(3) 10-KC AND 1-KC FREQUENCY SELECTIONS. - The frequency for the 10-kc selection frequency is generated by a crystal oscillator in Oscillator Control C-4311/PRC-47 which can be operated at any of 10 frequencies from 3707 to 3617 kc in 10-kc steps (refer to table 4-6). The 10-kc selection is controlled by gearing from the middle frequency control.

TABLE 4-4. MIXED WHOLE MEGACYCLE AND 100-KC SELECTION FREQUENCIES (3.2 TO 13.1 MC)

WHOLE MC BAND NO.	100-KC BAND NO.	CHANNEL FREQ (kc)	MIXED SELECTION FREQ (mc)
1	1	2.0 - 2.099	3.2
1	2	2.1 - 2.199	3.3
1	3	2.2 - 2.299	3.4
1	4	2.3 - 2.399	3.5
.	.	.	.
.	.	.	.
2	1	3.0 - 3.099	4.2
2	2	3.1 - 3.199	4.3
2	3	3.2 - 3.299	4.4
.	.	.	.
.	.	.	.
.	.	.	.
10	8	11.7 - 11.799	12.9
10	9	11.8 - 11.899	13.0
10	10	11.9 - 11.999	13.1

TABLE 4-5. MIXED 10-KC AND 1-KC SELECTION FREQUENCIES (700 TO 601 KC)

CHANNEL FREQ (mc)	MIXED SELECTION FREQ (kc)
X.X00	700
X.X01	699
X.X02	698
X.X03	697
.	.
.	.
X.X10	690
X.X11	689

CHANNEL FREQ (mc)	MIXED SELECTION FREQ (kc)
X.X12	688
.	.
.	.
.	.
X.X97	603
X.X98	602
X.X99	601

TABLE 4-6
10-KC SELECTION FREQUENCIES
(3707 TO 3617 KC)

10-KC BAND NO.	CHANNEL FREQ (mc)	10-KC SELECTION FREQ (kc)
1	X.X00 - X.X09	3707
2	X.X10 - X.X19	3697
3	X.X20 - X.X29	3687
4	X.X30 - X.X39	3677
5	X.X40 - X.X49	3667
6	X.X50 - X.X59	3657
7	X.X60 - X.X69	3647
8	X.X70 - X.X79	3637
9	X.X80 - X.X89	3627
10	X.X90 - X.X99	3617

The 1-kc selection frequency is generated by a crystal oscillator in module A7 which can be operated at any of 10 frequencies from 3007 to 3016 kc in 1-kc steps (refer to table 4-7). The 1-kc selection is controlled by gearing from the front panel which is driven by the 1-kc frequency control.

TABLE 4-7
1-KC SELECTION FREQUENCIES
(3007 TO 3016 KC)

1-KC CHANNEL	1-KC SELECTION FREQUENCY (kc)
1	3007
2	3008
3	3009
4	3010
5	3011
6	3012
7	3013
8	3014
9	3015
10	3016

The selected 3707- to 3617-kc frequency is beat with the selected 3007- to 3016-kc frequency in a mixer which produces a difference frequency from 700 to 601 kc in 1-kc steps. The difference frequency provides the frequency reference to the discriminator for the 10-kc and 1-kc selections.

b. FREQUENCY CONTROL CIRCUITS, DETAILED DESCRIPTION. (See figure 4-12.)

(1) RADIO FREQUENCY OSCILLATOR O-1032/PRC-47. (See figure 6-75.)

(a) CRYSTAL OSCILLATOR. - Temperature compensated crystal oscillator E2 is an extremely accurate stabilized master oscillator that generates a basic frequency of 3 mc (see figure 4-13). It consists of Q1 operating by selection of inductor L1. Frequency adjustment necessary for crystal aging is provided by capacitor C1 with a range of ±4 ppm. Normally, the crystal does not drift more than 35 ppm over the temperature range of -40° (-40°F) to +85°C (+185°F). Crystal drive is kept to approximately 10 microwatts for two reasons; first, to ensure long term stability, and second, to keep the self-rectified voltage on the Varicap, C12, to a value below the minimum voltage required for compensation over the operating temperature range. The correction voltage supplied to the Varicap is derived from a temperature-sensitive network designed to provide an output that matches the input required to hold the frequency relatively constant over the temperature range. To minimize the effects of rapid temperature changes, the crystal and compensating network are encapsulated together, and the entire oscillator circuit is encased in a polyurethane foam insulating block. Q2 and Q3 serve only as isolating amplifiers.

NOTE

Since the entire oscillator is temperature compensated, the oscillator board is designed as a replaceable item and no attempt should be made at field repairs.

(b) 500-KC DIVIDER. - The 3-mc signal from E2 is frequency-divided by locked oscillator Q4 to produce an output frequency of 500 kc. The 500-kc signal is applied to emitter follower Q7 in the 100-kc divider circuit and is also coupled through 500-kc amplifier Q5 to Oscillator Control C-4311/PRC-47. The output of Q5 is also coupled through 500-kc amplifier Q6 to 500-kc switching relay K4 in the main chassis. Both Q5 and Q6 are isolation amplifiers. Relay K4 supplies the 500-kc signal to the transmit-receive circuits to serve as the 500-kc carrier for transmission and reception. In its normal receive condition, relay K4 feeds the 500-kc signal to product detector CR7 and CR8 in Amplifier-Modulator AM-3507/PRC-47. For transmission, K4 is energized by the vox signal from vox relay K1 in Audio Frequency Amplifier AM-3506/PRC-47. In this

Figure 4-12. Frequency Control Circuits, Detailed Block Diagram

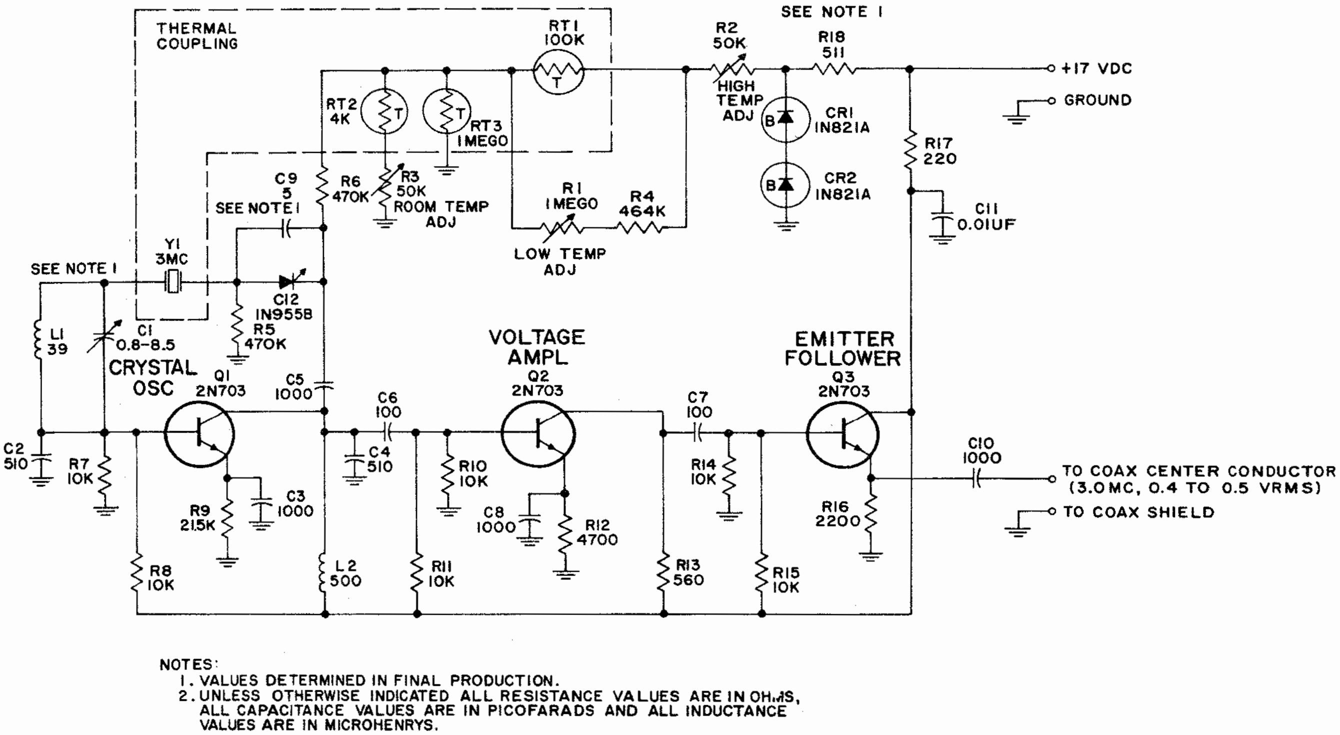


Figure 4-13. Radio Frequency Oscillator O-1032/PRC-47 (A6), Crystal Oscillator, Simplified Schematic Diagram

case, K4 feeds the 500-kc signal to balanced modulator CR1 through CR4 in module A2.

Locked oscillator Q4 is basically a Colpitts oscillator which is tuned to 500 kc, 1/6 the input frequency. The 3-mc input signal serves as a synchronizing signal to force the 500-kc oscillator output to run synchronously with the 3-mc frequency. Thus, the approximate frequency of the Q4 output is determined by the Q4 tuned circuit at about 500 kc and is locked at 500 kc by the 3-mc synchronizing signal.

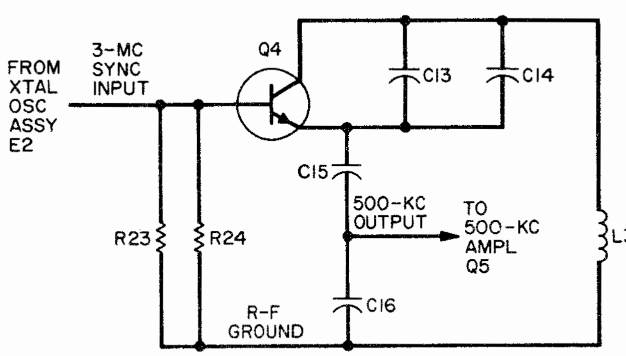


Figure 4-14. Radio Frequency Oscillator O-1032/PRC-47 (A6), Locked Oscillator Q4, Simplified Schematic Diagram

A simplified schematic diagram of locked oscillator Q4 is provided in figure 4-14. The 500-kc natural oscillation frequency is determined primarily by capacitors C13, C14, C15, and C16 and inductor L3. Positive feedback to sustain oscillation is routed from the junction of C13, C14, and C15 back to the emitter of Q4. Capacitors C15 and C16 form a voltage divider to supply a portion of the 500-kc oscillation voltage to 500-kc amplifier Q5.

(c) 100-KC DIVIDER. - The 500-kc signal produced by locked oscillator Q4 in the 500-kc divider is coupled through emitter follower Q7 divider to locked oscillator Q8. This circuit is a Colpitts oscillator similar to locked oscillator Q4. Locked oscillator Q8 is tuned to 100 kc, 1/5 the input frequency. Thus, 500-kc input signal serves as a synchronizing signal to force the 100-kc oscillator output to run synchronously with the 500-kc frequency.

The 100-kc output of locked oscillator Q8 is coupled through 100-kc output amplifier Q9 to Oscillator Control C-4311/PRC-47. Amplifier Q9 provides isolation to protect locked oscillator Q8 from load changes.

(2) OSCILLATOR CONTROL C-4311/PRC-47. (See figure 6-76.)

(a) 1-MC PULSE GENERATOR - The 500-kc signal from the Radio Frequency Oscillator

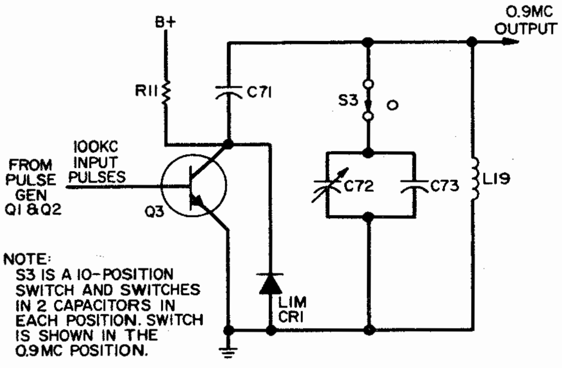


Figure 4-15. Oscillator Control C-4311/PRC-47 (A7), Pulse Amplifier Q3 (Ringing Circuit), Simplified Schematic Diagram

PRC-47 is fed to doubler Q4 in Oscillator Control C-4311/PRC-47 to produce a 1-mc output. Doubler Q4 operates in the nonlinear region to produce the various harmonics of the 500-kc input. The output circuit of Q4 is tuned to the second harmonic to produce the 1-mc output.

The 1-mc sinusiodal signal from doubler Q4 is converted into a 1-mc pulse train by pulse generator Q5 and Q6. Pulse generator Q5 and Q6 is basically a Schmitt trigger circuit using inductor L2 for the common emitter load. The inductor operates as a constant current device at the 1-mc operating frequency. Thus, the inductor maintains a constant d-c emitter supply current (common mode current) which flows alternately through each of the two transistors as they are switched at the 1-mc rate. The 1-mc pulse output of pulse generator Q5 and Q6 is amplified by amplifier Q7 and routed to Signal Data Translator CV-1377( )/PRC-47 (refer to paragraph 4-3*b*(3)*(a)*). In the signal data translator, the 1-mc pulse frequency is multiplied up to one of 10 even megacycle frequencies from 50 to 14 mc, depending on the whole megacycle band selected. This results in a sinusoidal signal at one of the 10 frequencies from 5 to 14 mc. The 5-to 14-mc signal is returned from the signal data translator and mixed with any one of 10 frequencies from 1.8 to 0.9 mc depending on which 100-kc band is selected within the selected whole megacycle band. The 1.8-to 0.9-mc signal is derived from the 100-kc input supplied by Radio Frequency Oscillator O-1032/PRC-47. This is described in the following paragraph.

(b) 100-KC PULSE GENERATOR. - The 100-kc signal from Radio Frequency Oscillator O-1032/PRC-47 is converted into a 100-kc pulse train by pulse generator Q1 and Q2. Pulse generator Q1 and Q2 is a standard Schmitt trigger circuit. This circuit is triggered by the 100-kc sine wave input. The output signal at the collector of transistor Q2 is a square wave at the 100-kc frequency. The coupling circuit from the collector of transistor Q2 to the base of pulse amplifier Q3 differentiates the square wave and produces positive and negative going pulses. Diode CR1 conducts when the negative pulses are present, thereby shorting them out. The positive pulses are fed to a parallel-tuned circuit and ring this circuit at its resonant frequency. The circuit consists of inductor L19 and a capacitor network switched in parallel with L19 by switch S3. Switch S3 is controlled by the middle frequency control on the front panel and is used to pick one of 10 possible frequencies in 100-kc increments from 1.8 to 0.9 mc. A simplified schematic diagram of pulse amplifier Q3 and the tuned circuit arrangement is shown in figure 4-15.

The sinusoidal ringing signal from pulse amplifier Q3 is amplified and clipped by limiters Q17, Q18, and Q19. Clipping all oscillations to the same level compensates for the decay of the ringing oscillations. Spurious frequencies introduced by the clipping action are removed by a 0.9- to 1.8-mc filter network. The signal is then applied to mixer Q14.

(c) MIXERS. - Mixer CR10 is a balanced mixer which beats the 5- to 14-mc signal from Signal Data Translator CV-1377( )/PRC-47 with the 1.8-to 0.9-mc signal. Since each of the two inputs can be selected at any one of 10 frequencies, the mixer output is any of 100 frequencies from 3.2 to 13.1 mc in 100-kc increments.

The 3.2-to 13.1-mc signal is applied to mixer CR11 where it is mixed with a 2.5- to 12.499-mc signal (in 1-kc increments) from the signal data translator. The 2.5- to 12.499-mc signal from the signal data translator is always lower in frequency than the 3.2- to 13.1-mc signal by an amount from 601 to 700 kc plus or minus a small frequency error. The difference frequency is fed through a filter and then through forward-limiting clippers CR8 and CR9. The resulting square wave is coupled through emitter follower Q16 to the discriminator where it is compared with a 601- to 700-kc reference frequency. The reference frequency is generated in the crystal oscillator and mixer circuits.

(d) CRYSTAL OSCILLATOR AND MIXER CIRCUITS. - The 10-kc selection shaft from the middle frequency control on the front panel sets oscillator Q21 at any one of 10 crystal-controlled frequencies from 3617 to 3707 kc. The 1-kc selection shaft from the 1-kc frequency control sets oscillator Q20 at any one of 10 crystal-controlled frequencies from 3007 to 3016 kc. The signals from oscillators Q20 and Q21 are beat together in mixer Q22 to provide any frequency from 601 to 700 kc in 1-kc steps. The output signal is passed through a band-pass filter and then clipped by clippers CR7 and CR8. The resulting square wave signal is coupled through emitter follower Q23 to the discriminator circuits. Oscillators Q20 and Q21 are designed to operate together to provide cancellation of frequency drifts. Similar circuit configurations are used for the two oscillators and the crystals are cut in a similar manner for both. Thus, a temperature change affects the output frequency of both oscillators in the same direction (up

or down). Since the difference frequency is used at the output of mixer Q22, the two frequency drifts cancel each other.

(e) DISCRIMINATOR. - The discriminator has two modes of operation. First, it operates in the frequency control mode and compares the frequency of the 601- to 700-kc reference signal from emitter follower Q23 with the frequency of the 601- to 700-kc master oscillator mixed signal from emitter follower Q16. The discriminator produces d-c output voltages which adjust the operating frequency of the master oscillator in Signal Data Translator CV-1377/PRC-47 to reduce the frequency difference. The frequency difference must initially be less than 50 kc for the master oscillator frequency to be captured. After the frequency difference has been reduced to about 5 kc, the discriminator goes into the phase control mode. In this mode, the discriminator monitors the changing phase difference between the two input signals. The output d-c control voltages adjust the frequency of the master oscillator until the phase difference stops changing. When this happens, the frequencies are identical.

To ensure that both signals applied to the discriminator are of the same amplitude, the signals are clipped by identical diode clipper circuits at the inputs to emitter followers Q16 and Q23. The outputs of Q16 and Q23 are summed at the inputs to two discriminator channels. However, the reference signal from Q23 is phase-shifted by capacitor C21 and resistor R34 before being fed to the upper channel. Discriminator amplifiers Q8 and Q11 serve as the input stages to the two discriminator channels. These amplifiers use matched transistors and amplify the two summed signals equally. Since each of the summed signals is the sum of two CW signals, the summed signals appear approximately as shown in A of figure 4-16. These are similar to the double sideband (DSB) signals which appear at the output of a balanced modulator. The repetition rate of the sine-wave envelope is equal to the difference between the two CW frequencies and is, therefore, equal to the frequency error of the master oscillator. The sine-wave envelopes are slightly out of phase because of the phase shift applied to the reference 601- to 700-kc signal at the input to the upper channel. Either the upper or lower channel sine-wave envelope will lead depending on whether the reference frequency is higher or lower than the master oscillator mixed signal.

The outputs of discriminator amplifiers Q8 and Q11 are further amplified by discriminator amplifiers Q9 and Q12 (also a matched pair) and are then detected by diodes CR3 and CR4. The leading edges of the envelope peaks are used to trigger transistors Q10 and Q13 (matched pair) into alternate conduction. The two transistors operate as a bistable multivibrator whose switching rate is the same as the repetition rate of the sine-wave envelope. The collectors of transistors Q10 and Q13 are supplied by

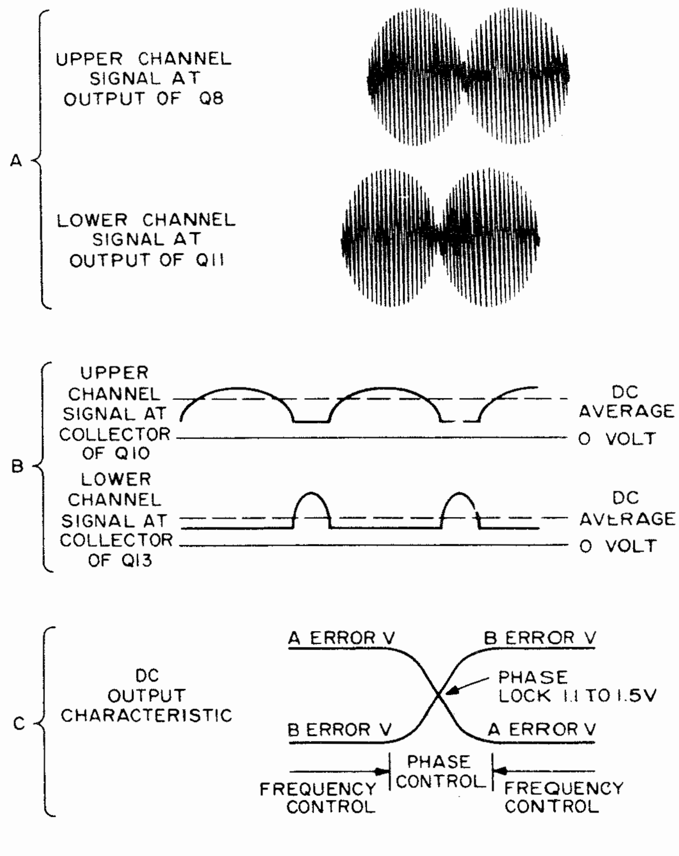


Figure 4-16. Oscillator Control C-4311/PRC-47 (A7), Discriminator Waveforms

the clipped envelope. This results in pulses at the collectors of Q10 and Q13 as shown in B of figure 4-16. The Q10 pulses may be positive going and Q11 pulses negative going or vice-versa depending on whether the upper channel envelope is leading the lower channel envelope (as shown in B) or vice-versa. This is determined by whether the reference frequency is higher or lower than the master oscillator mixed frequency as stated in the previous paragraph.

Integrator circuits in Q10 and Q13 output lines (R104, C93 in the upper channel; R103, C92 in the lower channel) change the pulse outputs to d-c levels known as the A and B error voltages. Either A is high and B is low, or vice-versa, depending on whether the reference frequency is higher or lower than the master oscillator mixed frequency. However, the A and B levels are not otherwise significantly variable during the frequency control mode. This is illustrated by the frequency control characteristic in C of figure 4-16.

The A and B error voltages are fed to Varicaps in the tank circuit of master oscillator Q1 in Signal Data Translator CV-1377/PRC-47. This tunes the oscillator by changing the effective capacity of the Varicaps in the direction to reduce the frequency error. The A and B voltage levels are large enough to overcorrect for the frequency error and cause a

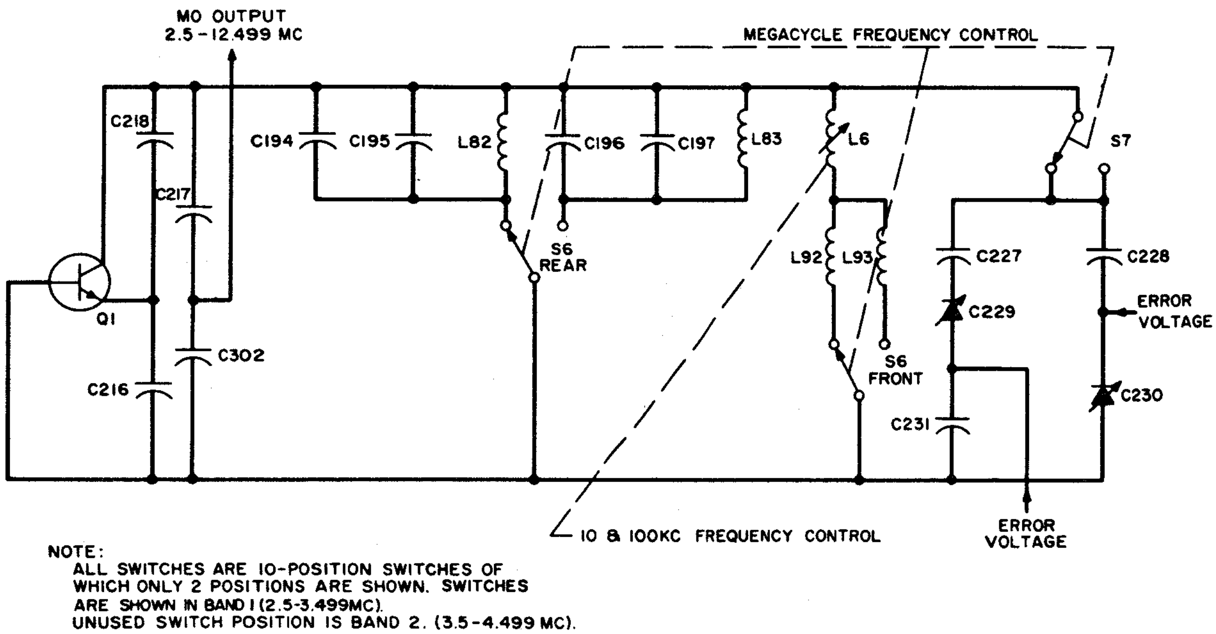


Figure 4-17. Signal Data Translator CV-1377/PRC-47 (A3), Master Oscillator, Simplified Schematic Diagram

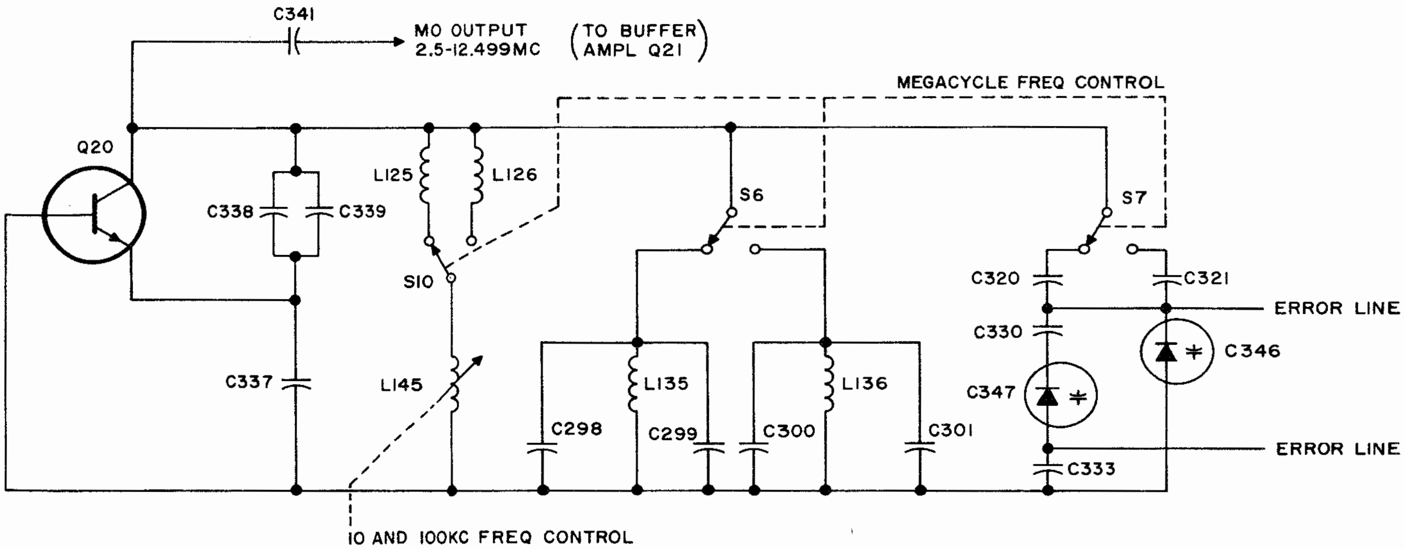
frequency error in the reverse direction. However, there is a time lag in changing the effective capacity of the Varicaps. During this time lag, the frequency error is being continuously monitored by the discriminator. The phase control mode begins when the envelope frequency is pulled close to zero. At this time the switching transistors stop switching. The A and B error voltages are then equal to the d-c envelope voltages. The A and B error voltage levels vary with the phase difference between the input frequencies to the two channels. In the upper channel, this phase difference includes the additional phase difference contributed by phase shift network C21 and R34. The output A and B error voltages adjust the master oscillator frequency until the varying phase difference between the master oscillator and the reference signals becomes constant. This occurs when the varying phase difference is equal to the fixed phase difference introduced by phase shift network C21 and R34. At this time, the upper and lower channel signals become CW and of the same amplitude (see B of figure 4-16). The output A and B error voltages are now equal at approximately 1.5 volts as shown in C of figure 4-16. These waveforms shown in figure 4-16 cannot be observed with an oscilloscope during normal circuit operation since the waveforms are present only instantaneously during channel changing.

(f) AUTOMATIC OSCILLATOR CAPTURE CIRCUIT. - In some instances, during turn-on or channel change, transients may cause the oscillator control to lose capture of the variable frequency oscillator (MO) located in Signal Data Translator CV-1377/PRC-47. The automatic oscillator capture circuit detects the absence of a heterodyned vfo signal through the filter network between Q26 and Q27. When signal is present at the emitter of Q27, relay K6, antilockout relay on the chassis, is not energized. When this signal is absent at Q27 emitter, transistor Q29 conducts to energize K6. Closing of K6 introduces +1.0 volt dc on each of error lines A and B. Since the vfo is initially tracked with these fixed error line voltages, their application from K6 pulls the oscillator into capture range. At capture, relay K6 is again de-energized and all error line control voltages are normally derived.

(3) SIGNAL DATA TRANSLATOR CV-1377/PRC-47.

(a) 5- TO 14-MC AMPLIFIERS. - The 1-mc pulse input from Oscillator Control C-4311/PRC-47 is fed to pulse amplifier Q19 in signal data translator module A3 for frequency multiplication. Pulse amplifier Q19 is a ringing circuit similar to pulse amplifier Q3 in the oscillator control module (refer to paragraph 4-3b(2)*(b)*). The natural ringing frequency of Q19 is selected by switch S9 at one of 10 frequencies from 5 to 14 mc in 1-mc increments. The selection is controlled by gearing from whole megacycle frequency control on the front panel. The selected ringing frequency is synchronized to the 1-mc input pulses by Q19. The 5- to 14-mc ringing signal is clipped to a constant level by limiters Q16 and Q17. The signal is then coupled through emitter follower Q18 to Oscillator Control C-4311/PRC-47.

~~*(b)* MASTER OSCILLATOR. - The A and B d-c error voltages from the discriminator in the oscillator control are fed to the Varicap control circuit in Signal Data Translator CV-1377/PRC-47.~~



NOTE:
ALL SWITCHES ARE 10 POSITION SWITCHES OF WHICH ONLY 2 POSITIONS ARE SHOWN
SWITCHES ARE SHOWN IN BAND 1 POSITION (2.5-3.499MC).
UNUSED SWITCH POSITION IS (3.5-4.499MC)

Figure 4-17A. Signal Data Translator CV-1377A/PRC-47 (A3), Master Oscillator, Simplified Diagram

(b) MASTER OSCILLATOR (applicable to CV-1377A/PRC-47 only). - The A and B d-c error voltages from the discriminator in the oscillator control are fed to the Varicap control circuit in Signal Data Translator CV-1377A/PRC-47. Here the error voltages are used to adjust the effective capacity of a pair of Varicaps to provide fine tuning of master oscillator Q20 for any frequency deviation from the selected 1-kc channel.

Master oscillator Q20 is basically a Colpitts oscillator. This is shown in the a-c equivalent circuits of figure 4-17A. Master oscillator Q20 is coarse-tuned in whole megacycle increments by switches S6, S7, and S10. Figure 4-17A shows the equivalent circuit for the 2-mc selection.

The 2.5- to 12.499-mc output of master oscillator Q20 is coupled through buffer amplifier Q21, emitter follower Q2, amplifiers Q3 and Q4, and emitter follower Q5 to module A7 as a feedback signal for frequency correction. A 2.5- to 12.499-mc signal from emitter follower Q2 is also fed through amplifiers Q6 and Q7, and emitter follower Q8 to emitter followers Q12 and Q13 in the transmit-receive circuits. Refer to paragraphs 4-2*b*(1)*(c)* and 4-2*b*(3)*(b)*.

(c) MASTER OSCILLATOR (applicable to CV-1377/PRC-47 only). - The A and B d-c error voltages from the discriminator in the oscillator control are fed to the Varicap control circuit in Signal Data Translator CV-1377/PRC-47.

Here, the error voltages are used to adjust the effective capacity of three pairs of Varicaps. Depending on the whole megacycle band selection, one of the three pairs of Varicaps is selected by switch S7 to provide fine tuning of master oscillator Q1. The Varicap control corrects Q1 for any frequency deviation from the selected 1-kc channel.

Master oscillator Q1 is basically a Colpitts oscillator with additional capacitors connected across the collector-to-emitter circuit. This is shown in the a-c equivalent circuit of figure 4-17. Master oscillator Q1 is coarse-tuned in whole megacycle increments by the front and rear decks of switch S6. Figure 4-17 shows the equivalent circuit for the 2-mc selection.

The 2.5- to 12.499-mc output of master oscillator Q1 is coupled through emitter follower Q2, amplifiers Q3 and Q4, and emitter follower Q5 to module A7 as a feedback signal for frequency correction. A 2.5- to 12.499-mc signal from emitter follower Q2 is also fed through amplifiers Q6 and Q7, and emitter follower Q8 to emitter followers Q12 and Q13 in the transmit-receive circuits (refer to paragraphs 4-2b(1)*(c)* and 4-2b(2)*(b)*).

4-4. POWER SUPPLY CIRCUITS.

a. GENERAL DESCRIPTION. (See figure 4-18.) - The power supply circuits operate either from a 115-volt, 400-cps source or a +26.5-volt d-c source. The a-c or d-c power is switched into the power supply circuits by an associated a-c or d-c power control relay when the POWER-LIGHTS switch on the front panel is set to POWER ON or when a power-on switch signal is received from a remote control panel.

During receiver operation, all necessary B+ and filament supply voltages for tube and transistor operation are provided by a low-voltage power supply circuit in Power Supply PP-3518/PRC-47. This power supply circuit operates from a 26.5-volt d-c input which is supplied directly by the primary power when a +26.5-volt power source is used. When a 115-volt a-c power source is used, a portion of the input power is applied to a rectifier circuit in module A5 to produce the +26.5-volt d-c input for the low-voltage power supply.

During transmission, a high-voltage power supply in the power supply is turned on to provide B+ and filament power for the high power r-f vacuum tubes in the radio set. The high-voltage power supply can be turned on either by operating the push-to-talk switch on the operator's handset, by setting CW-FSK/VOICE switch to CW-FSK or by setting the OPR-TUNE switch to TUNE. The high-voltage power supply contains a large power transformer which operates from an a-c input. When a 115-volt a-c source is used, the primary power is supplied directly to the

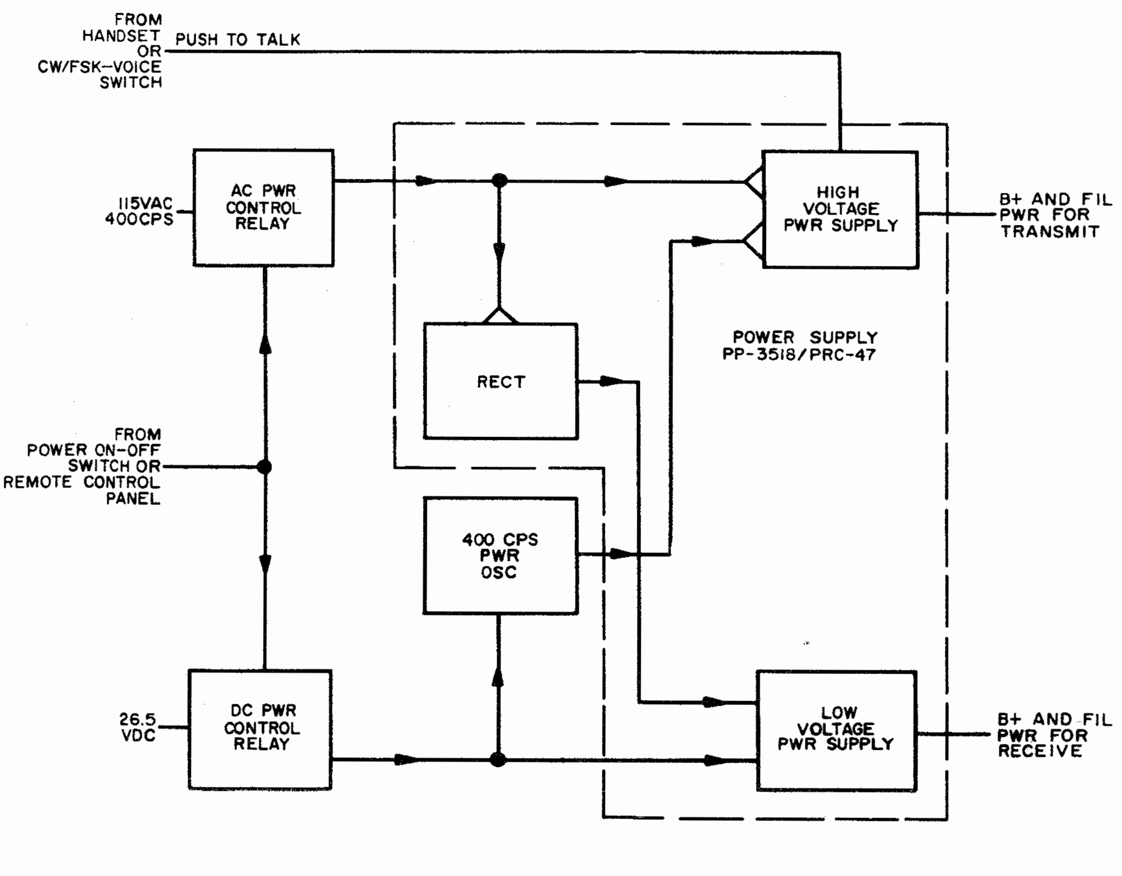


Figure 4-18. Power Supply Circuits, Functional Block Diagram

high-voltage power supply. When a +26.5-volt d-c source is used, a portion of the primary power is applied to a 400-cps power oscillator in the chassis to produce a 26.5-volt peak square wave. This square wave provides the a-c input to the high-voltage power supply.

b. POWER SUPPLY CIRCUITS, DETAILED DESCRIPTION. (See figure 4-19.)

(1) 115-VOLT A-C POWER INPUT. - When 115-volt a-c, 400-cps power is used, the power is fed through fuse F2 and transformer T2, to rectifier CR3 through CR6 in Electrical Equipment Chassis CH-474/PRC-47. The rectifier output is +26.5-volt d-c power which arms a-c power control relay K2. Relay K2 is energized from front panel POWER-LIGHTS switch S1 or from a remote on-off switch. When K2 is energized, 115-volt a-c power from the primary of T2 is fed through the K2 contacts and the contacts of de-energized d-c power control relay K1 to the high-voltage power supply circuits in Power Supply PP-3518/PRC-47. The 115-volt a-c power at the input to the transmitter-receiver is also routed through fuse F2 to step-down transformer T2 in Power Supply PP-3518/PRC-47. Transformer T2 drives rectifier CR26 through CR29 to produce +26.5-volt d-c power. This power is used to feed the low-voltage power supply circuits for reception.

The +26.5-volt d-c power also arms push-to-talk relay K1. Relay K1 is energized by a ground signal which may be supplied by the push-to-talk switch on the operator's handset, by CW-FSK/VOICE switch S2 (for CW or FSK transmission) or by OPR-TUNE switch S102 (for tuning) (refer to paragraph 4-2*b*(1)*(a)*). For the 115-volt a-c input, the contacts of push-to-talk relay K1 pass the 115-volt a-c power to transformer T1 which drives the high voltage power supply circuits.

(2) +26.5-VOLT D-C POWER INPUT. - When +26.5-volt d-c power is used, the power is fed through fuse F1 to arm d-c power control relay K1. Relay K1 is energized when a ground is supplied from front panel POWER-LIGHTS switch S1 or a remote on-off switch. When K1 is energized, 26.5-volt d-c power is fed through the K1 contacts to the low-voltage power supply circuits in power supply module A5.

The +26.5-volt d-c power is also supplied to 400-cps power oscillator Q1 and Q2. This circuit produces a 26.5-volt square wave which is applied to transformer T1 in power supply module A5 to drive the high-voltage power supply circuits.

The high-voltage power supply circuits are turned on by push-to-talk relay K1. This relay coil is connected to the +26.5-volt d-c power and is energized by a ground signal from either the operator's push-to-talk switch, CW-FSK/VOICE switch S2 (for CW or FSK operation), or by OPR-TUNE switch S102 (for tuning). The contacts of relay K1 connect the input +26.5-volt d-c power to the primary winding of transformer T1. This completes the B+ supply path to 400-cps power oscillator Q1, Q2 as shown in figure 4-20. Thus, transformer T1 receives the 26.5-volt square wave power only when relay K1 is energized.

The operation of 400-cps power oscillator Q1, Q2 is similar to that of a standard saturation oscillator with the saturable reactor connected as an autotransformer. When power is initially turned on, d-c power control relay is energized. This applies +26.5 volts dc to capacitor C1 and back-biases diodes CR1 and CR2. Now, if the push-to-talk switch is pressed the +26.5 volts dc is routed through push-to-talk relay K1 and the primary windings of transformer T1 in module A5 to transistors Q1 and Q2. This drives both transistors into saturation (one at a time). Any difference in operation level of the two transistors results in a voltage difference between the two emitters. This is coupled through saturable reactor to the bases of the two transistors by autotransformer action. Thus, if Q1 is conducting more heavily than Q2, the emitter of Q2 will be more positive than the emitter of Q1. This voltage is coupled through T1 to drive Q1 toward cutoff and Q2 toward saturation. The regenerative action continues until the core of T1 saturates and the flux change stops. This removes the base biasing voltages to Q1 and Q2, thereby permitting the magnetic flux to decay and start regenerative action in the reverse direction. As the emitters of Q1 and Q2 are alternately grounded, they induce 26.5 volts dc across in the primary windings of transformer T1 in Power Supply PP-3518/PRC-47. This results in 26.5-volt peak square wave which repeats at 400 cps as controlled by the characteristics of saturable reactor T1. Diodes CR1 and CR2 prevent the voltage at either side of the transformer T1 primary from rising above +26.5 volts.

(3) LOW-VOLTAGE POWER SUPPLY. - For both a-c and d-c operation, +26.5 volts dc is supplied to vox relay K1 in Audio Frequency Amplifier AM-3506/PRC-47, to the filaments of first and second r-f amplifiers V1 and V2 in Signal Data Translator CV-1377/PRC-47, and to the front panel lamps. For a-c operation, this power is derived from rectifier CR26 through CR29 in Power Supply PP-3518/PRC-47. For d-c operation, the +26.5-volt d-c input is used. In addition, for both a-c and d-c operation when BATTERY TEST switch S3 on the front panel is pressed, the available +26.5 volts dc is supplied to XMTR OUTPUT meter on the front panel for power monitoring.

The +26.5-volt d-c power is also fed through a filter in Power Supply PP-3518/PRC-47 which drops 2.5 volts to result in a filtered +24-volt input. This output is supplied directly to audio output amplifier Q11 and Q12 in Audio Frequency Amplifier AM-3506/PRC-47 and is also fed through the normally de-energized contacts of B+ relay K3 to provide the B+ supply for the first and second r-f amplifiers in Signal Data Translator CV-1377/PRC-47. During transmission, B+ relay K3 is energized by a vox

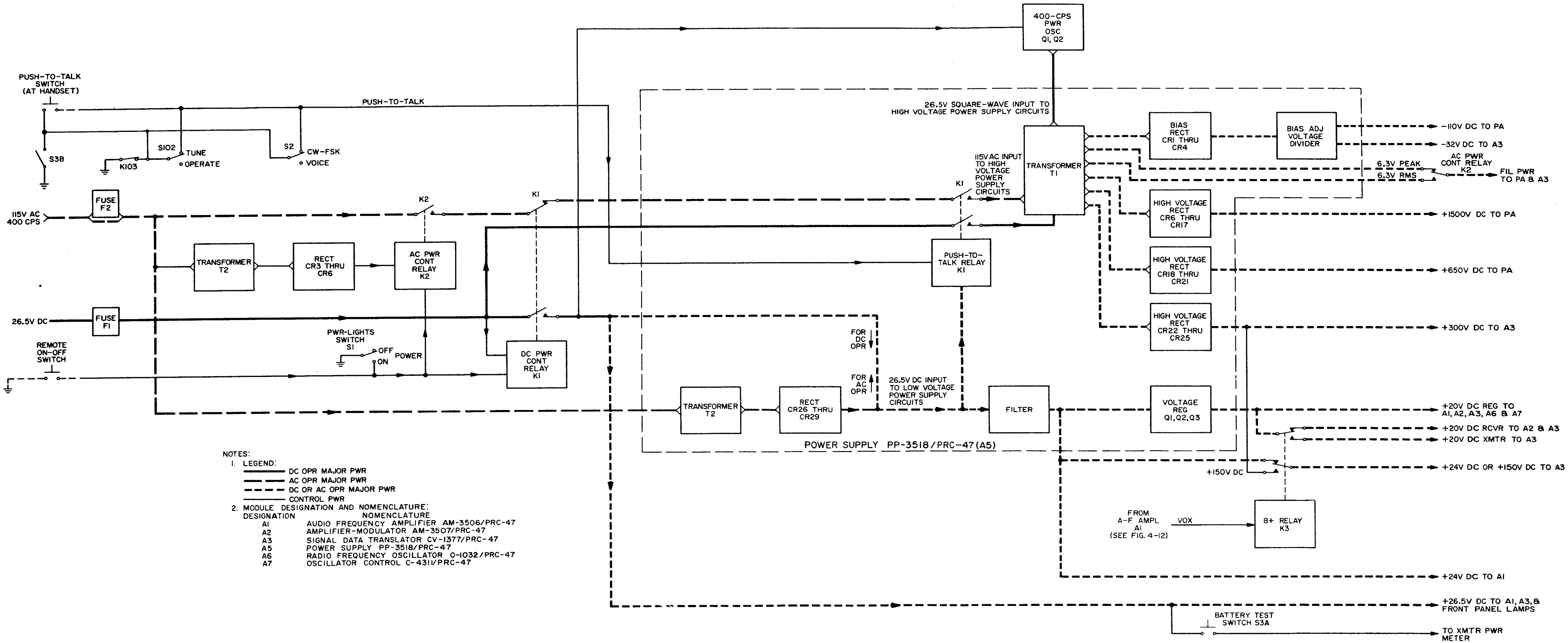


Figure 4-19. Power Supply Circuits, Detailed Block Diagram

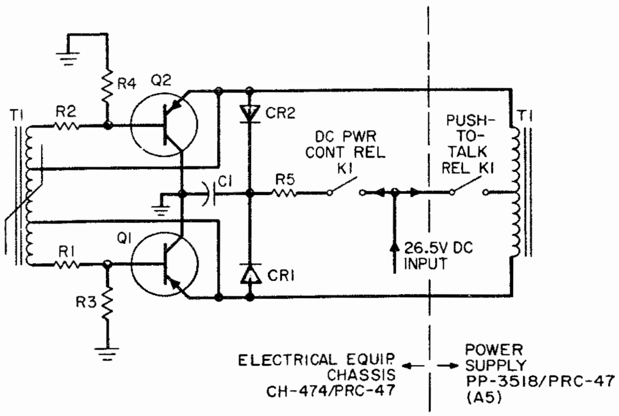


Figure 4-20. Power Oscillator,
Simplified Schematic Diagram

signal from vox relay K1 in Audio Frequency Amplifier AM-3506/PRC-47. Relay K3 then replaces the +24 volts dc with +150 volts which is derived from the +300-volt d-c output of the high-voltage power supply circuits. The +150 volts dc causes the first and second r-f amplifiers to operate at a much higher power level for transmission than for reception.

The filtered +24 volts dc is also applied to a voltage regulator consisting of Q1, Q2, and Q3 with their associated reference diode CR31 and filter capacitors. Zener diode CR31 and resistor R20 set a fixed reference voltage at the emitter of Q2. The base of Q2 samples variations in the output voltage of the regulator at the slider of potentiometer R22. Transistors Q2 and Q1 perform d-c amplification functions to control the base of series regulator Q3. When the +20-volt d-c output tends to rise, current through Q2 base-emitter circuit is increased. The resulting increased collector current of Q2 increases the voltage drop across R19 and lowers the base potential of Q1. Current through the Q1 collector-emitter circuit and Q3 base-emitter circuit decrease and Q3 conduction is decreased. This action makes Q3 collector-emitter circuit appear as a larger series resistor in the +20-volt d-c regulated line and holds the regulated output at +20 volts. Exact value of the regulated output voltage may adjusted within small limits by setting R22.

(4) HIGH-VOLTAGE POWER SUPPLY. - For both a-c and d-c operation, transformer T1 supplies a-c power to high-voltage rectifiers CR6 through CR17, CR18 through CR21, and CR22 through CR25 which produce +1500-, +650-, and +300-volt d-c outputs respectively. The +300-volt output is measured with respect to ground. The +650-volt output is actually +350 volts measured from the +300-volt level and the +1500-volt output is actually +850 volts measured from the +650-volt level. The +1500- and +650-volt outputs are used as supply voltages for power amplifier tube V101 in the chassis. The +300-volt output is used for driver V3 in Signal Data Translator CV-1377/PRC-47. Also, during transmission, this voltage is dropped to +150 volts dc and is routed through the contacts of energized B+ relay K3 to supply first and second r-f amplifiers V1 and V2 in A3.

The a-c output of transformer T1 also drives bias rectifier CR1 through CR4 to produce a negative d-c bias voltage which is adjusted in two voltage dividers to produce -110- and -32-volt d-c regulated outputs. The -110-volt d-c output supplies grid bias for power amplifier V101 in the chassis while the -32-volt d-c output supplies grid bias for driver V3 in Signal Data Translator CV-1377/PRC-47.

Transformer T1 also produces two filament power outputs, one at 6.3 volts rms, and the other at 6.3 volts peak. These outputs are supplied to a-c power control relay K2 which selects the 6.3-volt rms sine-wave output during a-c operation and the 6.3-volt peak-to-peak square wave output during d-c operation. This is done to provide the same average power to the tube filaments on a-c operation (sine wave) as on d-c operation (square wave). Thus, a lower-voltage square wave (6.3 volts peak) provides the same average filament power as a higher-voltage sine wave (6.3 volts rms). The selected 6.3-volt filament power output supplies the filament of power amplifier V101 in the chassis as well as the filament of driver V3 in Signal Data Translator CV-1377/PRC-47.

SECTION 5
TROUBLE SHOOTING

5-1. GENERAL.

NOTE

The greatest advantage in the performance of effective trouble shooting is a complete knowledge of the system and how it works. This knowledge will enable maintenance personnel to isolate a malfunction by logic instead of by trial and error and thus eliminate large areas of the system as sources of trouble before any actual work is done. It is important that the following general information be read thoroughly before any attempt is made to perform the trouble shooting described in this section.

a. This section describes the trouble-shooting methods necessary to isolate trouble in the equipment to a functional section, a module, or a particular stage in the module. Servicing block diagrams are provided to enable the technician to identify each module, the stages within the module, and the various signal and supply voltages necessary for proper operation.

b. Test point jacks are shown on the servicing block and schematic diagrams. These test points must be used only under the conditions specified in the text and in the notes on the servicing block diagrams. Certain test points are used to check the performance of a functional section or major group of circuits. Use of such test points may or may not isolate trouble to a particular module. For example, where the test point represents an evaluation of a single module, that particular module can be suspected; where the test point represents an evaluation of several modules, then further checks are required (as described in the trouble-shooting text for particular functional sections). Other test points are used to isolate trouble within a module; these test points should be used to perform stage-by-stage signal tracing wherever possible.

c. In addition to regular test point information, tables are provided for checking voltages and waveforms through a series of circuits. Such tables may be used to further isolate trouble by signal tracing if regular test points do not.

d. Supply voltages are given on the servicing block diagrams for each module in the equipment. These voltages, as well as all signals to and from the modules, are identified by the plugs, jacks, and pin numbers through which parts they are carried. The supply voltages may be checked before or after test point or waveform checks, depending on the nature of the trouble. For example, if a functional section of major group does not perform its function as evidenced by an erroneous voltage or waveform reading at a significant point, it may be advantageous to first check supply voltages before proceeding with more detailed checks.

TABLE 5-1. TEST EQUIPMENT REQUIRED FOR PRELIMINARY TROUBLE SHOOTING

NOMENCLATURE	TYPE	DESCRIPTION
Signal Generator	AN/URM-25D	10 kc to 50 mc in eight bands, 400 and 1000 cps modulation.
Frequency Meter	AN/URM-32 or AN/USM-122	Measures frequency from 125 kc to 1000 mc. (Note: Use Hewlett-Packard Model 525A to extend range.)
Signal Generator	TS-382F/U	20 cps to 200 kc in four bands, output 100 mv into 1000 ohms.
Vacuum-Tube Voltmeter	TS-505D/U	0 to 1000 volts dc in nine steps, 0 to 200 volts ac in seven steps, 0 to 1000 megohms in seven steps.
Output Meter	TS-585D/U	Power range 0 to 5000 mw in 4 ranges, impedance 2.5 to 20,000 ohms in 40 discrete steps.

5-2. TEST EQUIPMENT AND SPECIAL TOOLS.

a. Test equipment required for preliminary trouble shooting is listed in table 5-1. Test equipment required for more detailed trouble shooting is listed in table 5-2. Special tools are included in Cable Assembly Set AN/PRA-4 and listed in table 5-3 and illustrated in figure 5-1.

TABLE 5-2. TEST EQUIPMENT REQUIRED FOR DETAILED TROUBLE SHOOTING

NOMENCLATURE	TYPE	DESCRIPTION
Vacuum-Tube Voltmeter	TS-505D/U	0 to 1000 volts dc in nine steps, 0 to 200 volts ac in seven steps, 0 to 1000 megohms in seven steps.
Signal Generator	AN/URM-25D	10 kc to 50 mc in eight bands, 400 and 1000 cps modulation.
Frequency Meter	AN/URM-32 or AN/USM-122	Measures frequency from 125 kc to 1000 mc. (Note: Use Hewlett-Packard model 525A to extend range.)
Output Meter	TS-585D/U	
Oscilloscope	AN/USM-137	Sweep range; 0.02 usec/cm to 15 sec/cm. Horizontal amplifier: 200 mv/cm to 5 v/cm. Vertical amplifier: dc to 10 mc.
Wide-Band Amplifier	HP-525A (Hewlett-Packard)	Used in conjunction with AN/USM-137 and AN/USM-122.
Probe	AC-21A/C	Used in conjunction with AN/USM-137.

TABLE 5-3. SPECIAL TOOLS (CABLE ASSEMBLY SET AN/PRA-4, FSN 5995-973-3686) (Sheet 1 of 2)

QTY.	NOMENCLATURE	MANUFACTURER'S PART NUMBER	USE
1	Special Extender Cable No. 1	549-6255-00	Extending Power Supply PP-3518/PRC-47.
1	Special Extender Cable No. 2	549-6256-00	Extending Audio Frequency Amplifier AM-3506/PRC-47.
1	Special Extender Cable No. 3	549-6257-00	Extending Oscillator Control C-4311/PRC-47.
4	Special Extender Cable No. 4	549-6258-00	Extending Signal Data Translator CV-1377/PRC-47, Oscillator Control C-4311/PRC-47, and Amplifier-Modulator AM-3507/PRC-47. All four required for CV-1377/PRC-47. One required for each of remaining modules (C-4311/PRC-47 and AM-3507/PRC-47).
1	Special Extender Cable No. 5	549-6259-00	Extending Amplifier-Modulator AM-3507/PRC-47 or Radio Frequency Oscillator O-1032/PRC-47.
1	Front Panel Test Lead	549-6260-00	Extending front panel audio receptacles for ease of connection to test microphone and loudspeaker.

TABLE 5-3. SPECIAL TOOLS (CABLE ASSEMBLY SET AN/PRA-4, FSN 5995-973-3686) (Sheet 2 of 2)

QTY.	NOMENCLATURE	MANUFACTURER'S PART NUMBER	USE
1	Test-Antenna Lead	549-6261-00	Connection to a 50-ohm, 100-watt, noninductive load.
1	3-Foot RG-58/U Coaxial Cable	553-9759-002	Connect antenna simulator to 50-ohm load.
1	5-Foot RG-58/U Coaxial Cable	553-9760-002	Connect antenna simulator to any desired test equipment such as oscilloscope, frequency meter, or distortion analyzer.
1	BNC to Type N Adapter	357-9291-00	To adapt type N connector of 50-ohm dummy load to BNC connector of RG-58/U cable.
1	Antenna Simulator	553-9758-005	Simulates a 15-foot whip antenna for bench measurement purposes when used with a 50-ohm load. 12-position switch allows testing AN/PRC-47 at 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 11.999 mc.
1	Canvas Carrying Case	553-9764-003	Storage and transportation of Cable Assembly Set AN/PRA-4.

5-3. OVER-ALL TROUBLE SHOOTING.

a. PRELIMINARY CHECKS. - Preliminary checks are intended to avoid necessary work on a more detailed level by revealing over-all discrepancies in cable connections, power source conditions, and control settings. First, check all cable connections: power source and signal inputs and outputs. Second, check the condition of the power source by depressing the BATTERY TEST switch and checking that the XMTR OUTPUT meter indicates in the banded area. Third, check the operating control settings (refer to section 3).

b. ISOLATION TO A FUNCTIONAL SECTION. - In all probability, trouble will lie in a particular stage of a particular module. For the purpose of grouping the modules in terms of related functions, the over-all equipment is divided into three functional sections: power supply circuits, frequency generation circuits, and transmit-receive circuits. Simplified block diagrams designed for preliminary trouble shooting are shown in figures 5-2, 5-3, 5-4, and 5-5. Over-all servicing block diagrams of the three functional sections are shown in figures 5-7, 5-8, and 5-9. Some of the test points shown on the diagrams and illustrated in figures 5-10 and 5-11 are intended to check the over-all performance of functional sections. If the preliminary checks of paragraph 5-3*a* do not isolate the trouble to a particular functional section, then the specific evaluation of each functional section must be performed as described in paragraphs 5-4 through 5-6. Since the increasing order of complexity of functional sections is first, power supply, second, frequency generation circuits, and third, transmit-receive circuits, functional sections should be checked in that order. The power supply affects the entire equipment and should therefore be checked first. The frequency generation circuits generally affect both the transmitter and the receiver and are in use at all times while the equipment is energized, and should therefore be checked second. The transmit-receive circuits alternate in use and some circuits are shared by both functions. Also, this functional section involves more modules than other sections. For these reasons it should be checked last.

NOTE

If existing symptoms indicate a particular functional section, the preceding sequence of checks may be disregarded and the suspected section checked immediately.

(1) POWER SUPPLY. - Refer to figure 5-2. With power on and the equipment set up for normal CW operation (section 3), measure the voltages shown on the diagram. Use a TS-505D/U vtvm. Close the CW key only long enough to obtain measurements. The test points shown are identified in figures 5-10 and 5-11. All voltages are measured with reference to chassis ground. Do not measure high-voltage output anywhere in the power supply module. High voltage is measured across a portion of a bleeder network in the power amplifier compartment at test point J101. If these measurements are

Figure 5-1. Special Tools

not satisfactory, proceed as described in paragraph 5-4.

(2) FREQUENCY GENERATION. - Refer to figure 5-3. Test points are identified in figure 5-10. With power on, set up the equipment for normal CW operation (section 3). Leave the key line open. Connect a TS-505D/U vtvm (with r-f probe attached) between A3J5 and chassis ground. The voltage indicated must be approximately 1.75 volts ac. Disconnect the vtvm and connect a frequency meter, AN/URM-32 or AN/USM-122, to A3J5. The frequency indicated must be 500 kc higher than the channel frequency shown on the frequency indicator. If these voltage and frequency measurements are satisfactory, the frequency stabilizing circuits are operating satisfactorily. If these measurements are not satisfactory, measure the voltages at A6J1 and A6J4. If these latter measurements are not satisfactory, substitute known good modules for Signal Data Translator CV-1377( )/PRC-47 and Radio Frequency Oscillator O-1032/PRC-47 or proceed as described in paragraph 5-5.

(3) RECEIVER. - Refer to figure 5-4. Test points are identified in figure 5-10. With power on, set up the equipment for normal reception (section 3). The receiver test consists of introducing a 2-microvolt signal at the antenna and measuring a 50-milliwatt output at the headset terminals. Note that the signal generator is set 1 kc higher than the frequency shown on the frequency indicator and that a standard 50-ohm load (or 47-ohm resistor) is connected from the antenna to chassis ground. Other test point values

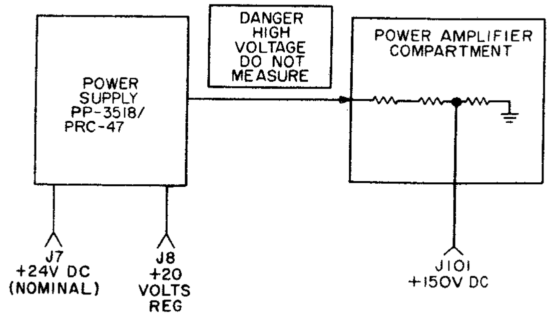


Figure 5-2. Power Supply, Simplified Block Diagram for Preliminary Trouble Shooting

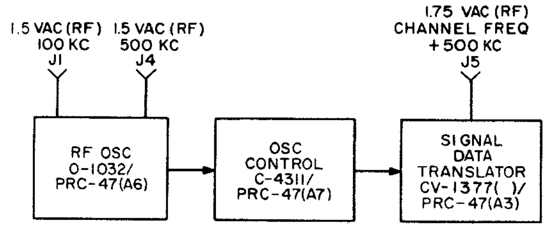
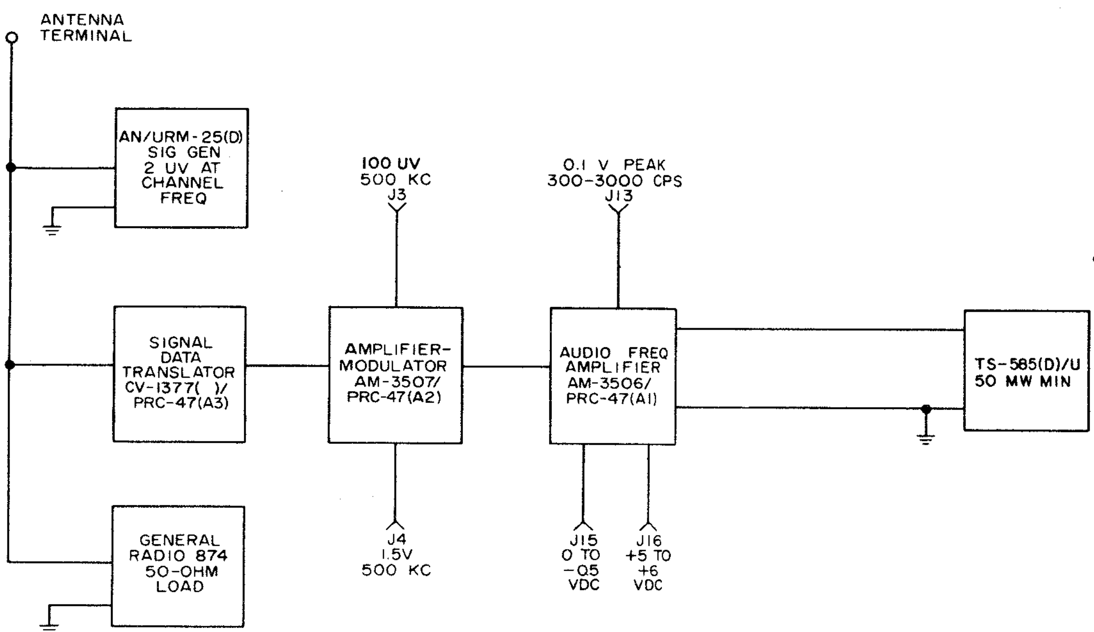
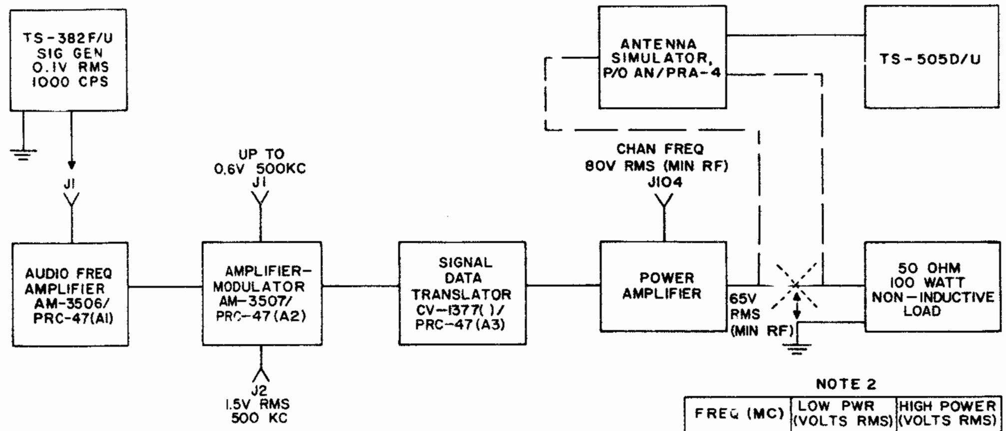


Figure 5-3. Frequency Generation, Simplified Block Diagram for Preliminary Trouble Shooting



NOTES:
1. USE TS-505/U VTVM TO MEASURE VOLTAGES EXCEPT J3 USE SIGNAL GENERATOR INPUT
2. OUTPUT METER SETUP FOR 300 OHMS

Figure 5-4. Receiver, Simplified Block Diagram for Preliminary Trouble Shooting



NOTES:
1. USE TS-505/U VTVM TO MEASURE VOLTAGES EXCEPT AT A2J1 USE OSCILLOSCOPE
2. RF VOLTS READ ON TS-505D/U WHEN USING ANTENNA SIMULATOR.

NOTE 2

FREQ (MC)	LOW PWR (VOLTS RMS)	HIGH POWER (VOLTS RMS)
2.0	14.1	31.6
4.0	17.3	40.0
6.0	21.2	49.0
8.0	24.5	54.9
10.0	26.4	59.0
119.99	27.3	60.6

Figure 5-5. Transmitter, Simplified Block Diagram for Preliminary Trouble Shooting

are given in the signal path shown on the diagram. These values are nominal and intended only as guides. If the receiver test is not satisfactory, proceed as described in paragraph 5-6.

(4) TRANSMITTER. - Refer to figure 5-5. Connect test equipment as shown in the block diagram. With power on, set up the equipment for normal voice operation (section 3). Then set the OPR-TUNE switch to TUNE and the XMTR PWR switch to HI. Test points are identified in figures 5-10 and 5-11. Set the voltage and frequency output from the signal generator as specified in figure 5-5. Note that the antenna load may be either a standard 50-ohm load or a 100-watt, noninductive 47-ohm resistor. Using a TS-505D/U vtvm with r-f probe attached, measure the a-c voltages at J104 and across the antenna load. Then reset the vtvm for d-c voltage and measure the negative voltage at J104. Other test point values are given in the signal path shown on the diagram. These values are nominal and intended only as guides. If the transmitter test is not satisfactory, proceed as described in paragraph 5-6.

NOTE

The following procedures refer to voltage tables and schematic diagrams which in turn refer to specific pins on transistors. Figure 5-6 shows the base diagrams for all transistors used in the equipment.

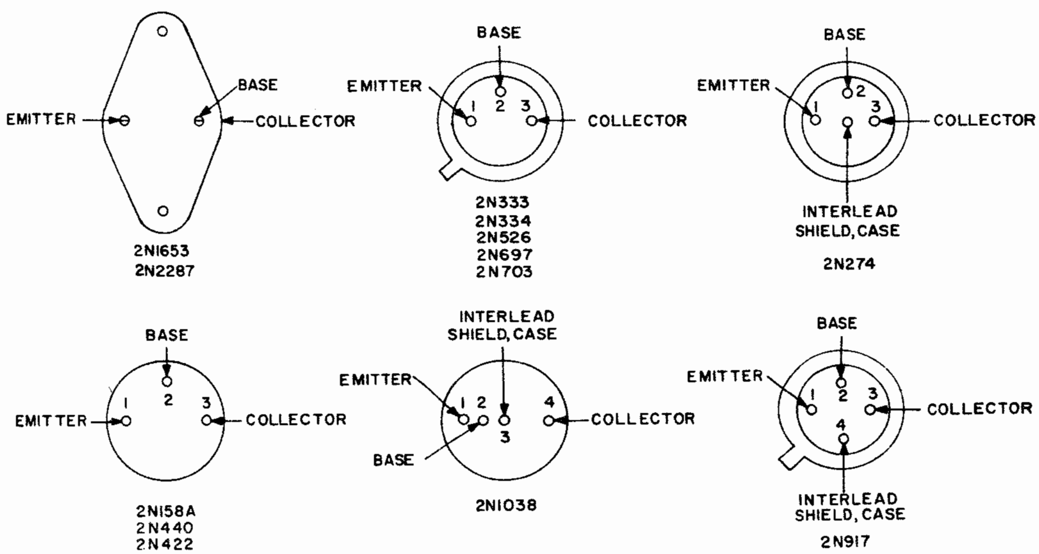


Figure 5-6. Transistor Base Diagrams

5-4. POWER SUPPLY TROUBLE SHOOTING.

a. ISOLATION TO POWER SUPPLY MAIN CIRCUITS. - Portions of the power supply section are modularized and portions are mounted on the chassis. Figure 5-7 shows the locations of these portions. It also shows the test points needed to evaluate satisfactory performance of the power supply. Test points are identified in figure 5-10. It is important that the test point measurements be made only under the conditions specified in the notes on the servicing block diagram. Do not attempt to measure the high-voltage rectifier output in any part of the power supply section; instead, measure it at J101 in the power amplifier compartment (see figure 5-11). Note that voltage values across J3 and J4 are different when the power source (ac or dc) is different. Note also that voltage values across J10 and J11 are different when the power source (ac or dc) is different. These differences are explained in the notes on figure 5-7. When the power source is 115 volts ac, measure this value across pins 3 and 18 of connector J1 on the chassis; this voltage is the a-c input to the low-voltage power supply.

WARNING

Dangerous voltages exist at pins A1 and A2 of connector J1 on the under side of the chassis (see figure 5-11). If power is turned off and detail checks are to be made, be sure to discharge these two pins by shorting to chassis ground with a screwdriver.

b. ISOLATION TO PARTICULAR CIRCUITS OR PARTS. - Once trouble is isolated to a particular main circuit of the power supply section, refer to the schematic diagrams of the power supply, figure 6-74, and the chassis, figure 6-77, and perform point-to-point checks of detail circuits and parts. Table 5-10 is a chart of relay closures versus sources of applied relay coil energy.

5-5. FREQUENCY GENERATION TROUBLE SHOOTING.

a. ISOLATION TO SPECIFIC MODULE. - If the preliminary trouble-shooting procedures of paragraph 5-3 provide unsatisfactory results, refer to figure 5-8. Set up the equipment for normal voice operation (section 3) and set the frequency indicator for 3002 kc. All voltages and waveforms shown on figure 5-8 must be checked in order to isolate trouble to a particular module. Test points are identified in figure 5-10. First, measure all supply voltages at the multipin jack for each module from the under side of the chassis. If the supply voltages are satisfactory, measure the voltage or waveform at each test point as specified on figure 5-8. Values given are closely approximate and may vary slightly. Determine continuity of signal flow in isolating trouble to a particular module or portion of a module.

b. ISOLATION TO SPECIFIC STAGE. - Once trouble is isolated to a particular module or group of circuits within a module, refer to the voltage tables (5-4 through 5-9) to further isolate trouble to the particular stage. Values given in these tables are nominal and intended only as guides. Then refer to figures 6-73 through 6-77, and perform point-to-point checks of detail circuits and parts.

5-6. TRANSMIT-RECEIVE TROUBLE SHOOTING.

a. ISOLATION TO SPECIFIC MODULE. - It must be established that all other functional sections of the equipment are performing properly before further tests are to be performed on the transmit-receive section. If the preliminary trouble-shooting procedures of paragraph 5-3 provide unsatisfactory results, refer to figure 5-9. Set up the equipment for normal voice operation (section 3) and set the frequency indicator for 3002 kc. All voltages and waveforms on figure 5-9 must be checked in order to isolate trouble to a particular module. Test points are identified in figures 5-10 and 5-11. First, measure all supply voltages at the multipin jack for each module from the under side of the chassis. If the supply voltages are satisfactory, proceed as follows: Connect a dummy load between the antenna terminal and chassis ground; the load may be a dummy load or a 47-ohm 100-watt, noninductive resistor. For transmitter tests, connect a TS-382F/U signal generator between A1J1 and chassis ground and adjust its output for 0.25 volt at 1000 cps. Check each of the voltages and waveforms as specified on figure 5-9 for transmit or transmit-receive conditions (see legend). Values given are approximate and may vary ±20 percent except for gain measurements. For receiver tests, disconnect the signal generator from A1J1 and connect an AN/URM-25D signal generator across the antenna dummy load; adjust its output for 2 microvolts at 3003 kc. Check each of the voltages and waveforms as specified on figure 5-9 for receive or transmit-receive conditions (see legend). Values on the diagrams are approximate and may vary slightly. Determine continuity of signal flow in isolating trouble to a particular module or portion of a module.

b. ISOLATION TO SPECIFIC STAGE. - The test point and intermodular connections shown on figure 5-9 provide facilities for isolation of trouble to a module, and in some cases, particularly Audio Frequency Amplifier AM-3506/PRC-47 (A1), to a particular stage. Where necessary, refer to the voltage tables (5-4 through 5-9) to further isolate trouble to the particular stage. Values given in these tables are nominal and intended only as guides. Then refer to figures 6-71, 6-72, 6-73, and 6-77 and perform point-to-point checks of detail circuits and parts. Note that when vox relay A1K1 is energized as a result of microphone or CW key input, it supplies a 26.5-volt d-c excitation voltage to TR relay K101, receiver antenna relay K5, transmitter 500-kc relay A2K1, and 500-kc switching relay K4. If there is evidence of any of these relays not actuating, trace the d-c excitation voltage paths by referring to figure 6-77.

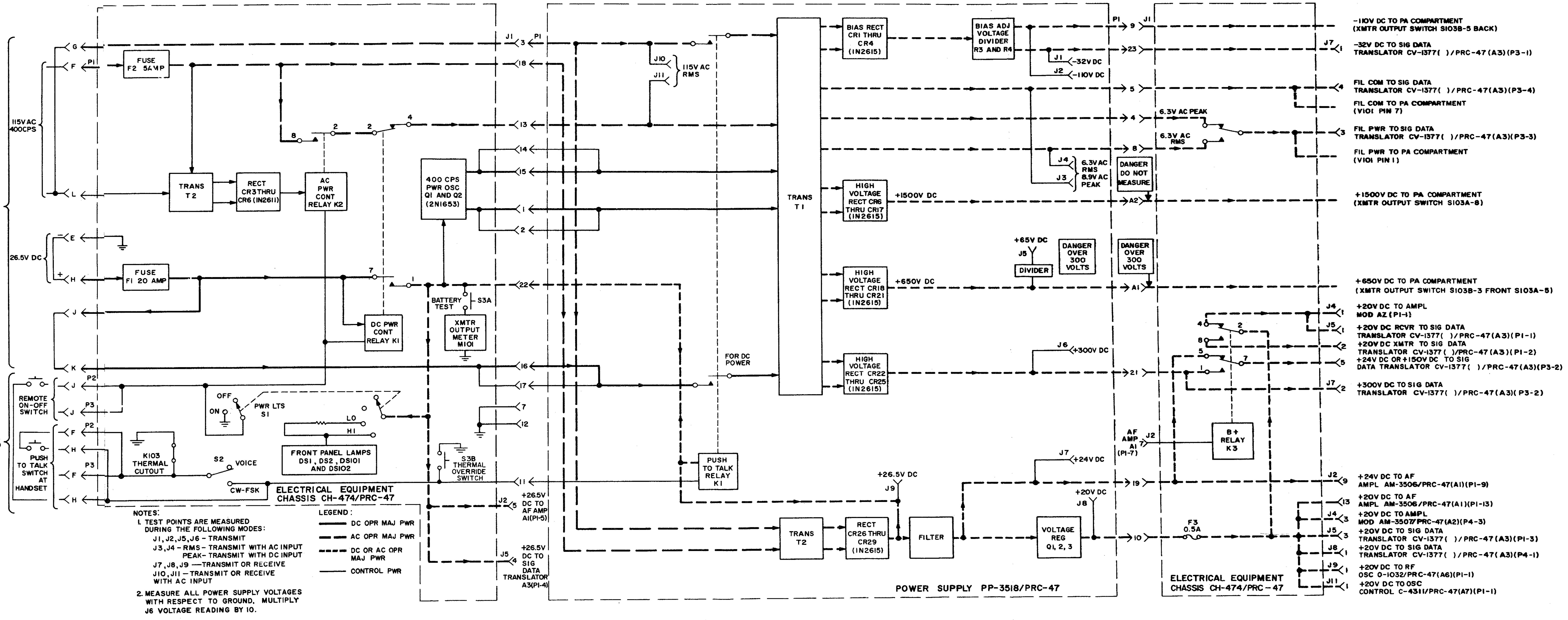
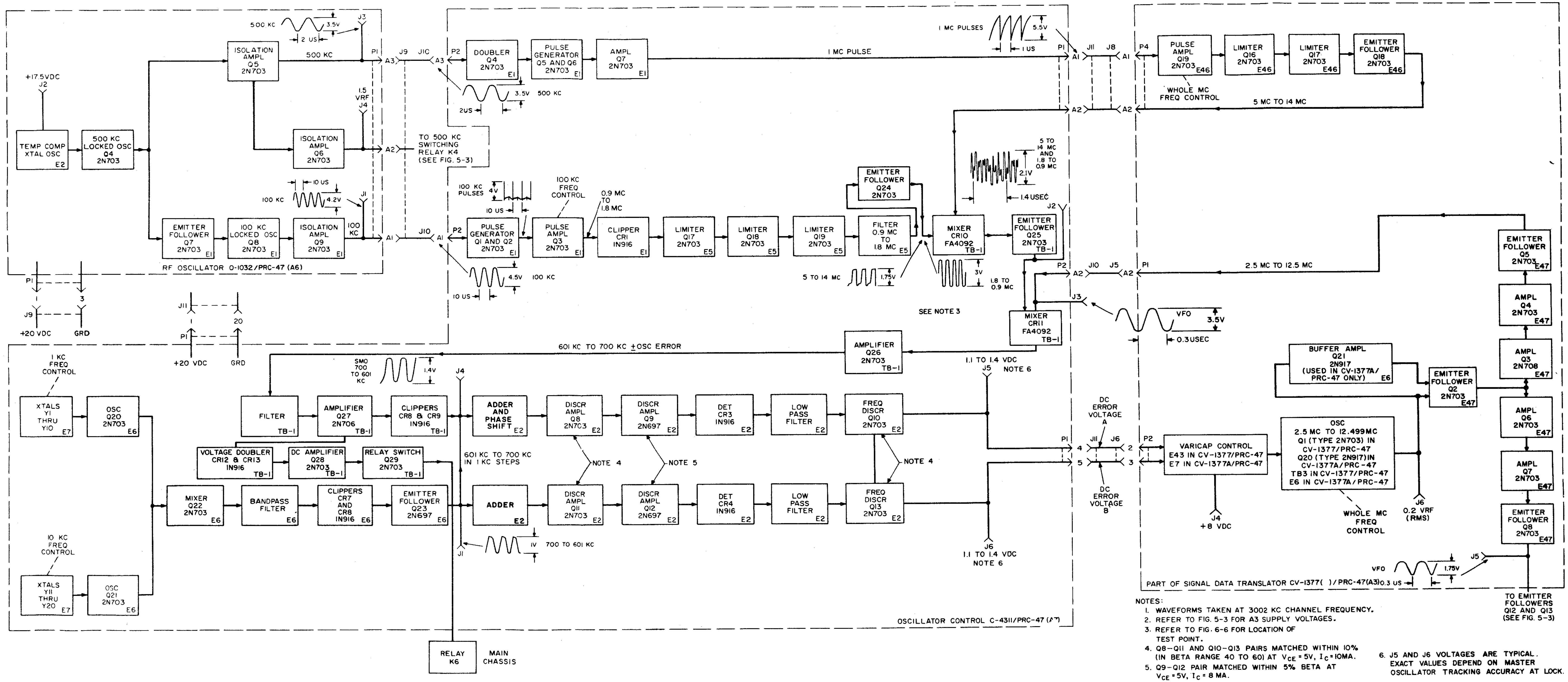


Figure 5-7. Power Supply Circuits, Servicing Block Diagram



NOTES:

1. WAVEFORMS TAKEN AT 3002 KC CHANNEL FREQUENCY.
2. REFER TO FIG. 5-3 FOR A3 SUPPLY VOLTAGES.
3. REFER TO FIG. 6-6 FOR LOCATION OF TEST POINT.
4. Q8-Q11 AND Q10-Q13 PAIRS MATCHED WITHIN 10% (IN BETA RANGE 40 TO 60) AT V_{CE} = 5V, I_C = 10MA.
5. Q9-Q12 PAIR MATCHED WITHIN 5% BETA AT V_{CE} = 5V, I_C = 8 MA.
6. J5 AND J6 VOLTAGES ARE TYPICAL. EXACT VALUES DEPEND ON MASTER OSCILLATOR TRACKING ACCURACY AT LOCK.

Figure 5-8. Frequency Generation Circuits, Servicing Block Diagram

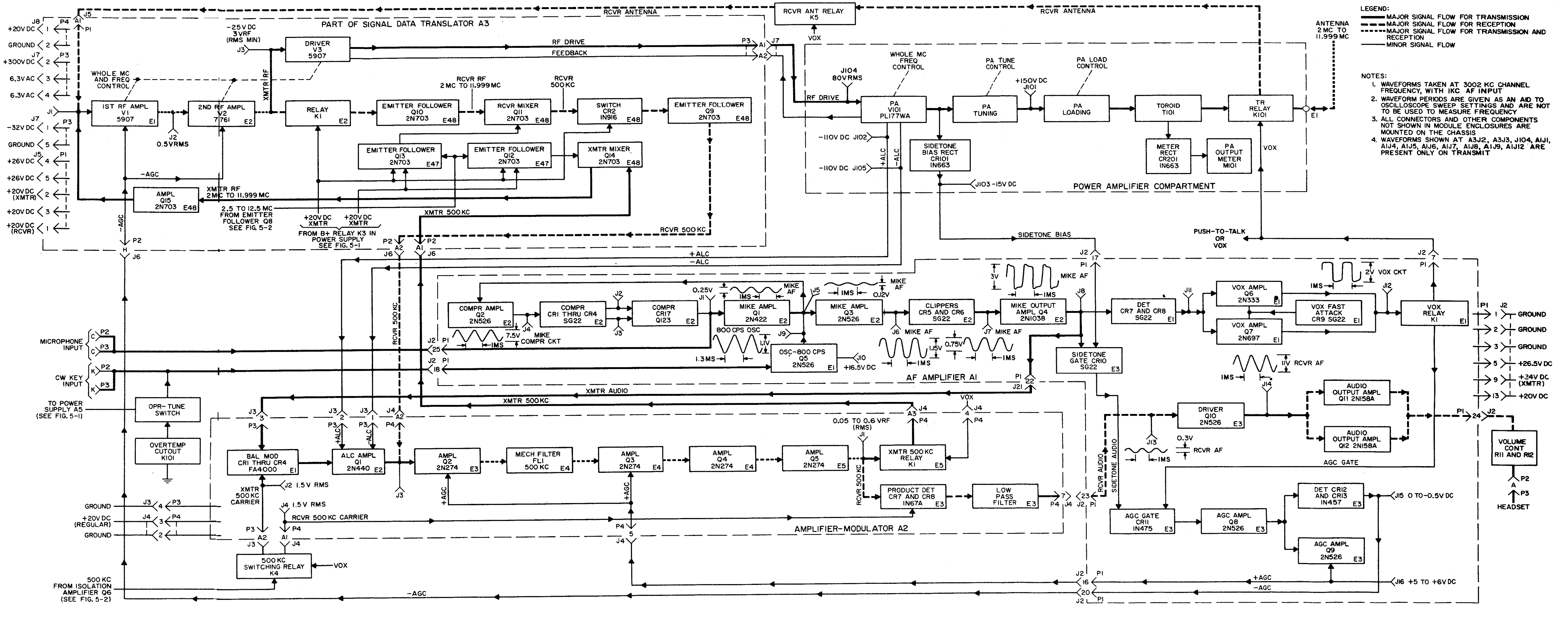


Figure 5-9. Transmit-Receive Circuits, Servicing Block Diagram

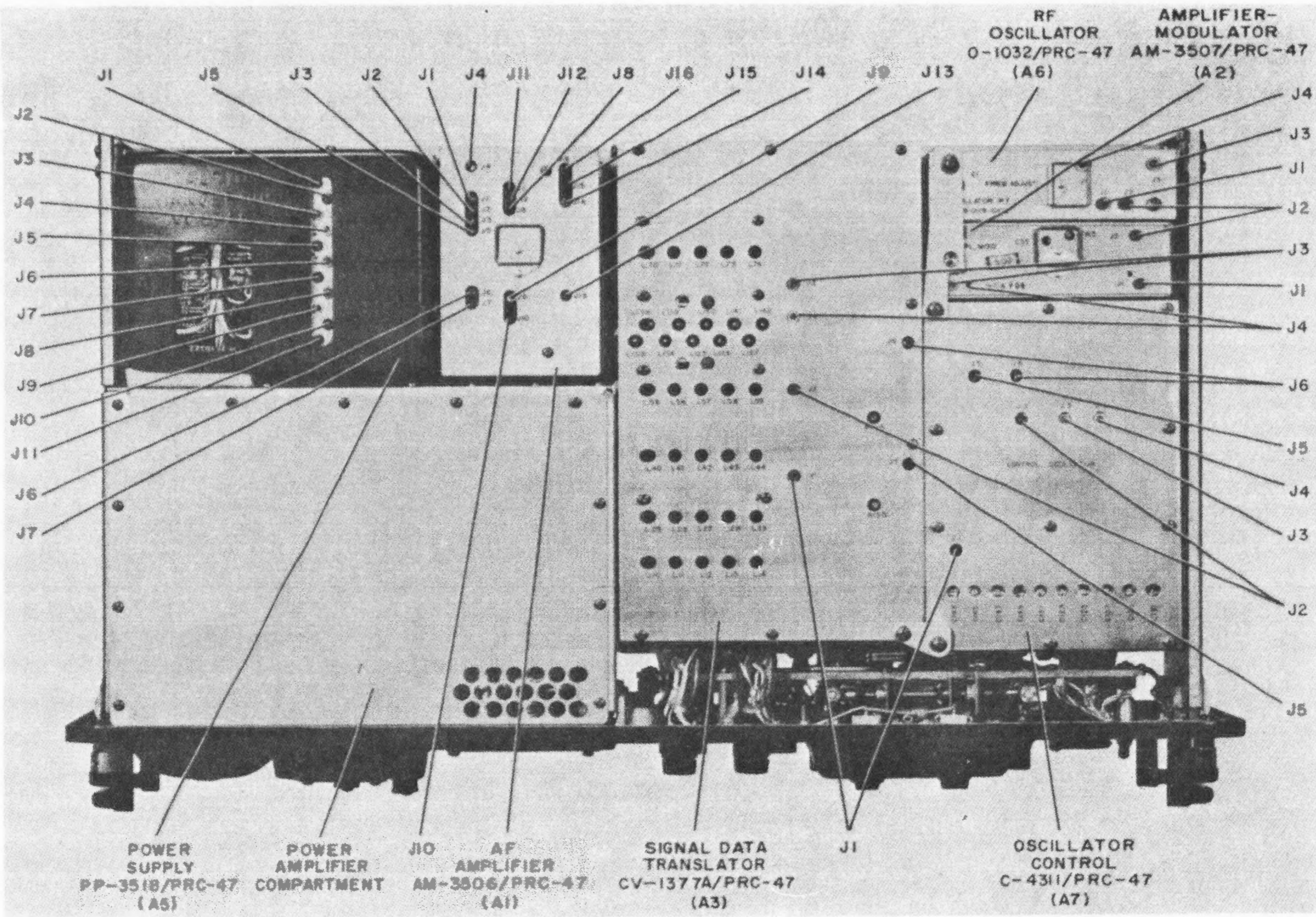


Figure 5-10. Radio Receiver-Transmitter RT-671/PRC-47, Test Point Locations, Top View

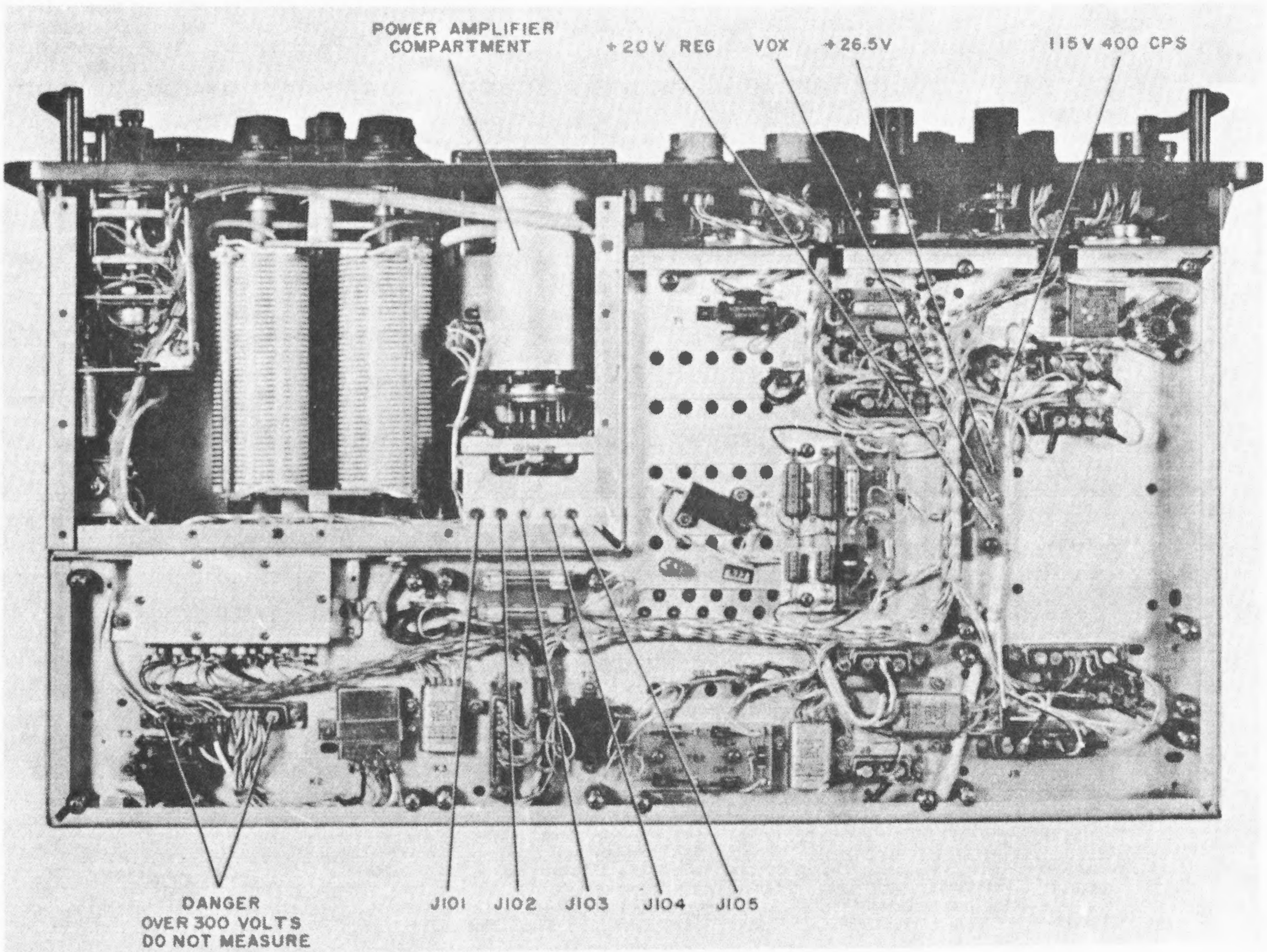


Figure 5-11. Radio Receiver-Transmitter RT-671/PRC-47, Test Point Locations, Bottom View

TABLE 5-4. VOLTAGE MEASUREMENTS, AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1)
(Sheet 1 of 3)

NOTE

E stands for emitter, B for base, and C for collector.
Refer to figure 5-6 for transistor base diagrams.
All values are nominal and intended only as guides.

STAGE	POINT OF TEST	VOLTAGE (volts)
D-C Measurements on Receive with No A-C Input Except as Noted		
Q1	E	+14.1
	B	+13.9
	C	+4.7
Q2	E	+9.9
	B	+9.7
	C	+2.1
Q3	E	+13.5
	B	+13.3
	C	+5.9
Q4	E	+11.6
	B	+11.4
	C	+1.5
Q5	E	+14.8 (CW key closed)
	E	+15.3 (CW key open)
	B	+15.1 (CW key closed)
	B	+15.2 (CW key open)
	C	0 (CW key closed)
	C	+15.3 (CW key open)
Q6	E	0 (no input)
	E	+0.7 (0.1 volt rms mike input)
	B	+0.26 (no input)

TABLE 5-4. VOLTAGE MEASUREMENTS, AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1)
(Sheet 2 of 3)

STAGE	POINT OF TEST	VOLTAGE (volts)
D-C Measurements on Receive with No A-C Input Except as Noted (Cont)		
Q6 (Cont)	B	+0.43 (0.1 volt rms mike input)
	C	+24 (no input)
	C	+1.2 (0.1 volt rms mike input)
Q7	E	0 (no input)
	E	0 (0.1 volt rms mike input)
	B	0 (no input)
	B	+0.7 (0.1 volt rms mike input)
	C	+24 (no input)
	C	+1.2 (0.1 volt rms mike input)
Q8	E	+9.3
	B	+9.2
	C	+1.5
Q9	E	+17.5
	B	+19.2
	C	+6.0
Q10	E	+8.3
	B	+8.1
	C	+1.6
Q11	E	+22.8
	B	+22.8
	C	+0.08

TABLE 5-4. VOLTAGE MEASUREMENTS, AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1)
(Sheet 3 of 3)

STAGE	POINT OF TEST	VOLTAGE (volts)
D-C Measurements on Receive with No A-C Input Except as Noted (Cont)		
Q12	E	+22.8
	B	+22.8
	C	+0.08
Signal Measurements with 0.1-Volt RMS Microphone Input		
Q1	B	Not readable
	C	0.2 peak
Q2	B	0.1 peak
	C	8.0 peak
Q3	B	0.1 peak
	C	1.2 peak
Q4	B	0.7 peak
	C	13.0 peak
Signal Measurements with 50-MW Audio Output		
Q8	B	0.1 peak
	C	1.6 peak
Q9	B	1.6 peak
	C	0
Q10	B	0.1 peak
	C	4.0 peak
Q11/12	B	0.8 peak
	C	11.0 peak

TABLE 5-5. VOLTAGE MEASUREMENTS, AMPLIFIER-MODULATOR AM-3507/PRC-47 (A2)
(Sheet 1 of 2)

NOTE

E stands for emitter, B for base, and C for collector.
Refer to figure 5-6 for transistor base diagrams.
All values are nominal and intended only as guides.

STAGE	POINT OF TEST	VOLTAGE (volts)
D-C Measurements During Transmit		
Q1	E	-110
	B	-110
	C	-109
D-C Measurements During Transmit or Receive		
Q2	E	+6.9
	B	+6.6
	C	0
Q3	E	+9.3
	B	+9.4
	C	0
Q4	E	+6.5
	B	+6.3
	C	0
Q5	E	+7.4
	B	+7.2
	C	0
Signal Tracing with Fixed Output and Varied Inputs*		
Q5	B	16 mv
	C	1.2

*Conditions: AN/URM-25D signal generator and applicable termination through 0.05-uf capacitor to point of test. Input as required for 0.1-volt rms output at A1J13 as monitored on TS-505D/U.

TABLE 5-5. VOLTAGE MEASUREMENTS, AMPLIFIER-MODULATOR AM-3507/PRC-47 (A2)
(Sheet 2 of 2)

STAGE	POINT OF TEST	VOLTAGE (volts)
Signal Tracing with Fixed Output and Varied Inputs* (Cont)		
Q4	B	250 uv
	C	29 mv
Q3	E	72 uv
	C	2 mv
Q2	E	12 uv
	C	3 mv
	J3	120 uv
*Conditions: AN/URM-25D signal generator and applicable termination through 0.05-uf capacitor to point of test. Input as required for 0.1-volt rms output at A1J13 as monitored on TS-505D/U.		

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47 (A3)
(2-MC CHANNEL FREQUENCY) (Sheet 1 of 8)

NOTE

E stands for emitter, B for base, and C for collector.
Refer to figure 5-6 for transistor base diagrams.
All values are nominal and intended only as guides.

STAGE	POINT OF TEST	VOLTAGE (d-c volts)		VOLTAGE (a-c peak to peak)		MODE
		CV-1377	CV-1377A	CV-1377	CV-1377A	
Isolation Amplifier Board A3E47						
Q2	E	+6.8	+6.8	0.35	0.5	Transmit or receive
	B	+7.5	+7.5	0.35	0.4	Transmit or receive
	C	+15.0	+15.0	0	0	Transmit or receive
Q3	E	+1.7	+1.7	0.3	0	Transmit or receive
	B	+2.4	+2.4	0.3	0.5	Transmit or receive
	C	+7.7	+7.7	1	1.5	Transmit or receive

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47 (A3) (2-MC CHANNEL FREQUENCY) (Sheet 2 of 8)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)		VOLTAGE (a-c peak to peak)		MODE
		CV-1377	CV-1377A	CV-1377	CV-1377A	
Isolation Amplifier Board A3E47 (Cont)						
Q4	E	+2.4	+2.4	1.0	0	Transmit or receive
	B	+3.2	+3.2	1.0	1.4	Transmit or receive
	C	+9.0	+9.0	3.5	6.0	Transmit or receive
Q5	E	+9.2	+9.2	3.5	6.4	Transmit or receive
	B	+9.9	+9.9	3.5	5.8	Transmit or receive
	C	+14.5	+14.5	0	0	Transmit or receive
Q6	E	+6.1	+6.1	0	0	Transmit or receive
	B	+6.8	+6.8	0.3	0.3	Transmit or receive
	C	+9.0	+9.0	4.5	4.5	Transmit or receive
Q7	E	+5.5	+5.5	0	0	Transmit or receive
	B	+4.8	+4.8	4.0	4.0	Transmit or receive
	C	+10.5	+10.5	9.0	9.0	Transmit or receive
Q8	E	+6.6	+6.6	8.0	8.0	Transmit or receive
	B	+6.7	+6.7	9.0	9.0	Transmit or receive
	C	+11.5	+11.5	0	0	Transmit or receive
Q12	E	+6.8	+6.8	7.0	7.0	Receive
	B	+7.5	+7.5	5.0	5.0	Receive
	C	+12.5	+12.5	0	0	Receive
Q12	E	+0.4	+0.4	0.25	0.25	Transmit
	B	-0.1	-0.1	3.0	3.0	Transmit
	C	+0.5	+0.5	0	0	Transmit
Q13	E	+0.2	+0.2	0.2	0.2	Receive
	B	-2.2	-2.2	8.0	8.0	Receive
	C	+0.34	+0.34	0	0	Receive

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47 (A3) (2-MC CHANNEL FREQUENCY) (Sheet 3 of 8)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c peak to peak)	MODE
Isolation Amplifier Board A3E47 (Cont)				
Q13	E	+4.1	6.0 peak	Transmit
	B	+3.1	7.5 peak	Transmit
	C	+7.0	0	Transmit
Transmit Mixer Board A3E48				
Q9	E	+6.8	*130 uv, 500 kc	Receive
	B	+7.4	*100 uv, 500 kc	Receive
	C	+10.5		Receive
Q10	E	+6.6	*25 uv, 2 mc	Receive
	B	+7.2	*17 uv, 2 mc	Receive
	C	+9.8		Receive
Q11	E	+0.46		Receive
	B	+1.0	*10 uv, 2 mc	Receive
	C	+13.0	*180 uv, 500 kc	Receive
Q14	E	+7.3		Transmit
	B	+7.9		Transmit
	C	+12.5		Transmit
Q15	E	+6.3		Transmit
	B	+6.9		Transmit
	C	+10.0		Transmit

*Signal injected with AN/URM-25D and applicable termination 0.05-uf capacitor to point of test. Input as required for 0.1-volt rms at A1J13.

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47 (A3)
(2-MC CHANNEL FREQUENCY) (Sheet 4 of 8)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c peak to peak)	MODE
Oscillator Board TB3				
Q1	E	+5.9	1.0 (osc freq)	Transmit or receive
	B	+6.2		Transmit or receive
	C	+7.0	3.0 (osc freq)	Transmit or receive
Oscillator Subassembly A3E6 and A3E7				
Q20	E	+2.0	0.3	Transmit or receive
	B	+2.5	0	Transmit or receive
	C	+3.6	0.6	Transmit or receive
Q21	E	+8.0	0	Transmit or receive
	B	+8.5	0.1	Transmit or receive
	C	+18.0	0.8	Transmit or receive
Amplifier Board A3E46				
Q16	E	+4.8	3.9	Transmit or receive
	B	+5.3	3.0 (ringer freq)	Transmit or receive
	C	+11.0	8.0 (ringer freq)	Transmit or receive
Q17	E	+4.1	4.4 (ringer freq)	Transmit or receive
	B	+3.1	7.0 (ringer freq)	Transmit or receive
	C	+12.0	6.5 (ringer freq)	Transmit or receive
Q18	E	+3.9	3.0 (ringer freq)	Transmit or receive
	B	+3.8	5.8 (ringer freq)	Transmit or receive
	C	+5.8	0	Transmit or receive

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377( )/PRC-47 (A3) (2-MC CHANNEL FREQUENCY) (Sheet 5 of 8) (Cont)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c peak to peak)	MODE
		Amplifier Board A3E46 (Cont)		
Q19	E	+0.5	2.2, 1-mc pulse	Transmit or receive
	B	0		Transmit or receive
	C	+20.0	3.8 (ringer freq)	Transmit or receive
		Data Translator Tubes		
V1 (A3TB1)	1	-0.16		Receive
	2	+0.10		Receive

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377/PRC-47 (A3) (2-MC CHANNEL FREQUENCY) (Sheet 6 of 7)

6 of 8

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts) peak to peak	MODE
Data Translator Tubes (Cont)				
V1 (A3TB1) (Cont)	3	0		Receive
	4	+0.10		Receive
	5	+15.0		Receive
	6	+24.0		Receive
	7	+15.0		Receive
	8	+0.10		Receive
V2 (A3TB2)	1	-0.12		Receive
	2	+0.08		Receive
	3	0		Receive
	4	+0.08		Receive
	5	+23.5		Receive
	6	+24.0		Receive
	7	+22.2		Receive
	8	+0.08		Receive
V1 (A3TB1)	1	-1.3		Transmit
	2	+0.36		Transmit
	3	0		Transmit
	4	+0.36		Transmit
	5	+41.0		Transmit
	6	+24.0		Transmit
	7	+44.0		Transmit
	8	+0.36		Transmit
V2 (A3TB2)	1	-0.9		Transmit
	2	+2.2		Transmit
	3	0		Transmit

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377/PRC-47 (A3)
(2-MC CHANNEL FREQUENCY) (Sheet 6 of 7)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)	MODE
Data Translator Tubes (Cont)				
V2 (A3TB2) (Cont)	4	+2.2		Transmit
	5	+145		Transmit
	6	+24.0		Transmit
	7	+105		Transmit
	8	+2.2		Transmit
V3	1	+2.9		Transmit
	2	-22.0		Transmit
	3	+290		Transmit
	4	+2.9		Transmit
	5	+2.9		Transmit
	6	+290		Transmit
	7	0		Transmit
	8	+290		Transmit
	9	+2.9		Transmit
	1-9	6.3 (a-c rms or peak square wave)		Transmit
Translator Gain				
Conditions: TS-382F/U (1 kc at 0.1 volt at microphone input or J1 of audio frequency amplifier module A1).				
	J1		0.1 peak	Transmit
	J2		0.15 rms	Transmit
	J3		2.6 rms	Transmit
	J104 (PA comp)		89 rms	Transmit

TABLE 5-6. VOLTAGE MEASUREMENTS, SIGNAL DATA TRANSLATOR CV-1377/PRC-47 (A3)
(2-MC CHANNEL FREQUENCY) (Sheet ~~7~~ 8 of ~~7~~ 8)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c ~~volts~~) peak to peak	MODE
Translator Gain				
Conditions: AN/URM-25D and applicable termination through 0.05-uf capacitor to point of test. TS-585D/U output meter across audio connector and VOLUME control fully clockwise (must indicate 50 mw). TS-585D/U meter set to 300 ohms.				
	Antenna		1.7 uv	Receive
	J1		15 uv	Receive
	J2		68 uv	Receive
	J3		280 uv	Receive

TABLE 5-7. VOLTAGE MEASUREMENTS, RADIO FREQUENCY OSCILLATOR O-1032/PRC-47 (A6)
(Sheet 1 of 2)

NOTE

E stands for emitter, B for base, and C for collector.
Refer to figure 5-6 for transistor base diagrams.
All values are nominal and intended only as guides.

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Q4	E	+11.0	2.0 peak, 500 kc
	B	+10.5	1.5 peak, 3 mc
	C	+16.3	12.0 peak, 500 kc
Q5	E	+4.5	0.5 peak, 500 kc
	B	+5.1	0.3 peak, 500 kc
	C	+16.2	20 peak, 500 kc
Q6	E	+7.3	0.5 peak, 500 kc
	B	+7.8	0.5 peak, 500 kc
	C	+16.2	15 peak, 500 kc

TABLE 5-7. VOLTAGE MEASUREMENTS, RADIO FREQUENCY OSCILLATOR O-1032/PRC-47 (A6)
(Sheet 2 of 2)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Q7	E	+7.4	0.4 peak, 500 kc
	B	+8.0	0.4 peak, 500 kc
	C	+16.7	0
Q8	E	11.2	2.0 peak, 100 kc
	B	11.2	0.7 peak, 500 and 100 kc
	C	17.0	22 peak, 100 kc
Q9	E	+7.6	17 peak, 100 kc
	B	+8.2	0.4 peak, 100 kc
	C	+16.9	0.4 peak, 100 kc

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 1 of 9)

NOTE

E stands for emitter, B for base, and C for collector.
Refer to figure 5-6 for transistor base diagrams.
All values are nominal and intended only as guides.

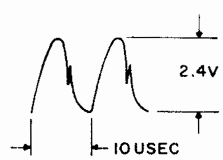
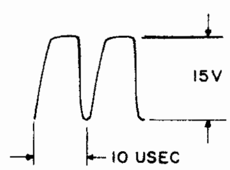
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Pulse Generator Board A7E1			
Q1	E	+1.3	
	B	+1.0	5.5 peak, 100 kc sine wave
	C	+12.5	

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 2 of 9)

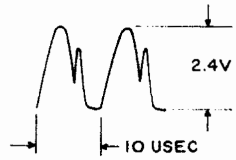
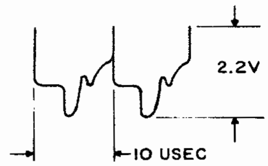
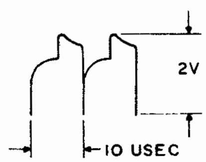
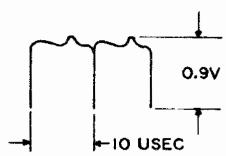
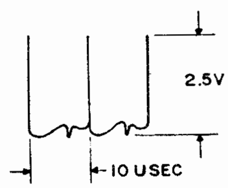
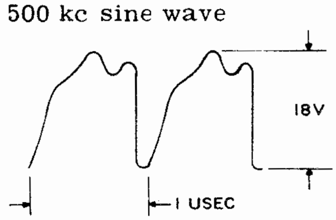
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
		Pulse Generator Board A7E1 (Cont)	
Q2	E	+1.3	
	B	+1.1	
	C	+17.2	
Q3	E	+0.7	
	B	+1.4	
	C	+10.0	
Q4	E	+1.6	0.2 peak, 500 kc ripple
	B	+0.9	3 peak, 500 kc sine wave
	C	+14.0	

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 3 of 9)

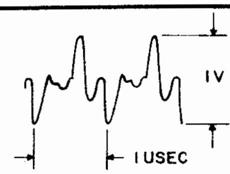
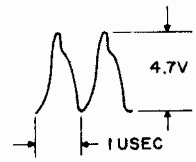
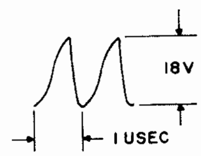
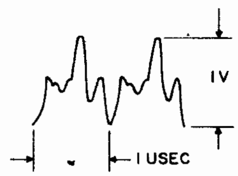
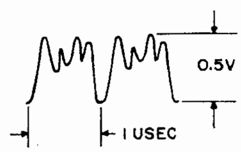
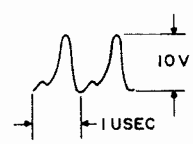
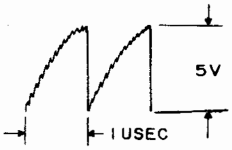
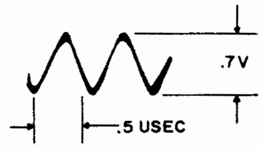
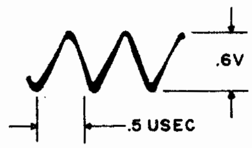
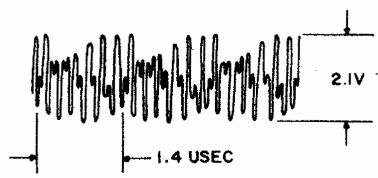
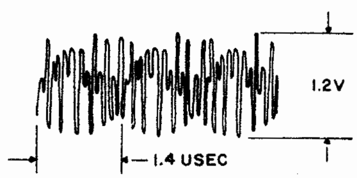
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
		Pulse Generator Board A7E1 (Cont)	
Q5	E	0	
	B	-1.6	
	C	+10.0	
Q6	E	0	
	B	+0.64	
	C	+3.3	

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 4 of 9)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Pulse Generator Board A7E1 (Cont)			
Q7	E	+1.2	0.1 peak, 1 mc ripple
	B	+1.6	
	C	+16.0	
Discriminator Board A7E2			
Q8	E	+2.2	
	B	+2.8	
	C	+7.0	
Q9	E	+3.5	
	B	+4.1	
	C	+14.5	
Q10	E	0	
	B	*+0.3	
	C	*+1.3	
Q11	E	+2.1	
	B	+2.7	
	C	+7.7	
Q12	E	+3.5	
	B	+4.1	
	C	+14.5	

*Varies depending on lock.

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 5 of 9)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
		Discriminator Board A7E2 (Cont)	
Q13	E	0	
	B	*+0.3	
	C	*+1.3	
		Mixer Board A7TB1	
Q24	E	+5.9	
	B	+6.5	
	C	+17.5	
Q25	E	+7.5	
	B	+8.2	

*Varies depending on lock.

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 6 of 9)

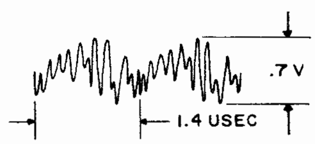
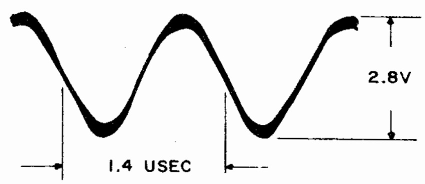
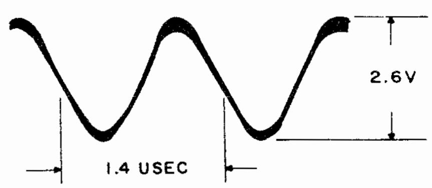
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Mixer Board A7TB1 (Cont)			
Q25 (Cont)	C	+17.5	
Q26	E	+7.0	
	B	+7.7	
	C	+16.5	
Q27	E	+3.5	
	B	+4.1	

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 7 of 9)

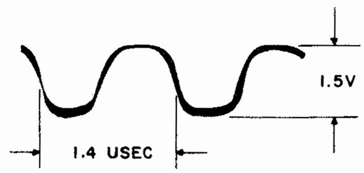
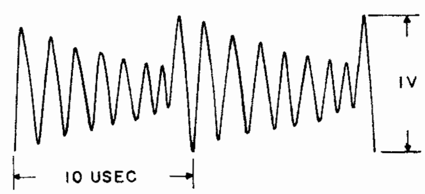
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
		Mixer Board A7TB1 (Cont)	
Q27 (Cont)	C	+9.5	
Q28	E	Locked In / No Sig. to Discr.	
		+.64 / 0	
	B	+1.35 / 0	
	C	+.72 / +7.2	
Q29	E	0 / 0	
	B	0 / +0.8	
	C	+24.0 / +0.5	
		Amplifier-Limiter Board A7E4	
Q17	E	+0.8	
	B	+1.4	
	C	+10.5	
Q18	E	+0.55	

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 8 of 9)

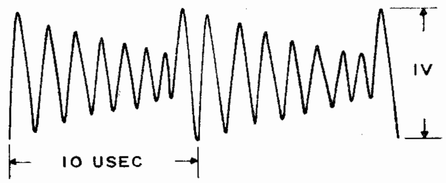
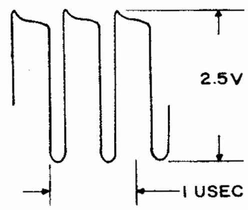
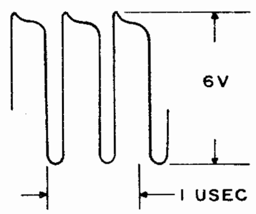
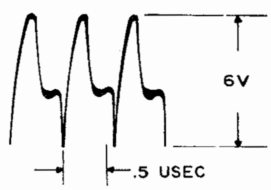
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
		Amplifier-Limiter Board A7E4 (Cont)	
Q18 (Cont)	B	+1.0	
	C	+4.8	
Q19	E	+1.0	
	B	+0.15	
	C	+2.3	
		Oscillator Control Board A7E6	
Q20	E	+9.0	
	B	+8.7	
	C	+17.5	5.2 peak (sine wave)
Q21	E	+8.8	
	B	+8.8	
	C	+17.5	3.6 peak (sine wave)

TABLE 5-8. VOLTAGE MEASUREMENTS, OSCILLATOR CONTROL C-4311/PRC-47 (A7)
(CHANNEL FREQUENCY 3000 KC) (Sheet 9 of 9)

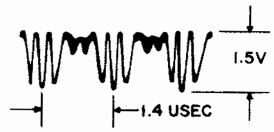
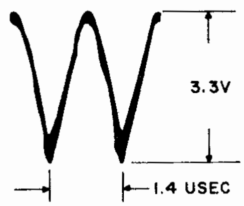
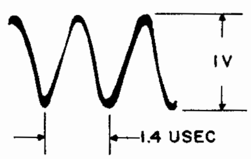
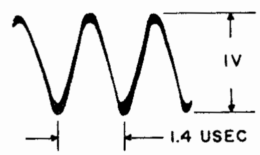
STAGE	POINT OF TEST	VOLTAGE (d-c volts)	VOLTAGE (a-c volts)
Oscillator Control Board A7E6 (Cont)			
Q22	E	+4.5	0.2 peak, ripple
	B	+4.4	
	C	+17.8	
Q23	E	+8.6	
	B	+9.2	
	C	+17.8	0.2 peak, 601-700 kc ripple

TABLE 5-9. VOLTAGE MEASUREMENTS, POWER SUPPLY PP-3518/PRC-47 (A5) (Sheet 1 of 2)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)
Q1	E	+21.0
	B	+21.5
	C	+22.5
Q2	E	+9.0
	B	+9.8

TABLE 5-9. VOLTAGE MEASUREMENTS, POWER SUPPLY PP-3518/PRC-47 (A5)
(Sheet 2 of 2)

STAGE	POINT OF TEST	VOLTAGE (d-c volts)
Q2 (Cont)	C	+21.5
Q3	E	+20
	B	+20.8
	C	+22.3
Conditions of measurement: 24.0-volt d-c input; 20-volt regulated output at A5J8.		

TABLE 5-10. RELAY CLOSURES VERSUS SOURCES OF APPLIED ENERGY

RELAY	LOCATION	SOURCES OF APPLIED ENERGY	
		CONTROL	CONNECTION OPPOSITE END OF COIL
K1	Chassis	POWER-LIGHTS switch	+26.5 volts dc from power supply
K2	Chassis	POWER-LIGHTS switch	Rectified power from T-2 and CR1-CR4 on chassis (a-c input only)
K3	Chassis	Vox relay A1K1-4	+26.5 volts dc from power supply
K4	Chassis	Vox relay A1K1-4	+26.5 volts dc from power supply
K5	Chassis	Vox relay A1K1-4	+26.5 volts dc from power supply
K101	Chassis	Vox relay A1K1-4	+26.5 volts dc from power supply
K102	Chassis	Vox relay A1K1-4	+26.5 volts dc from power supply
K6	Chassis	A7TB1-Q29	+26.5 volts dc from power supply
A1K1	AM-3506/PRC-47	Current through Q6 and Q7 (vox ampls)	+26.5 volts dc from power supply
A2K1	AM-3507/PRC-47	Vox relay A1K1-4	Ground
A3K1	CV-1377/PRC-47	+20 volts (K3-3) transmit only	Ground
A5K1	PP-3518/PRC-47	Ground on the push-to-talk line	+26.5 volts dc from power supply

SECTION 6
SERVICE AND REPAIR

SUBSECTION 6-1
PREVENTIVE MAINTENANCE

6-1. GENERAL.

This subsection provides preventive maintenance procedures for the radio set. The performance of these procedures is necessary to maintain efficient and dependable operation of the equipment and to minimize the chances of equipment failure during operation. These procedures consist of general care and cleaning practices, and visual inspections to be performed periodically or wherever applicable.

6-2. MAINTENANCE PROCEDURES.

a. PREVENTIVE MAINTENANCE TECHNIQUES. - Use the following maintenance techniques when performing preventive maintenance.

(1) Use No. 000 sandpaper to remove rust and corrosion.

(2) Use an approved finish to touch up damaged surface areas.

(3) Use clean, dry, lint-free cloth or a dry brush for cleaning.

(4) If necessary, use trichloroethane (inhibited methyl chloroform) for cleaning; then wipe the parts dry with a dry cloth. This cleaning solvent may be obtained in 1-gallon quantities under FSN 6810-664-0387 or in 5-gallon quantities under FSN 6810-664-0388.

(5) If dry compressed air of moderate pressure is available, it may be used to remove dust from inaccessible plates.

b. EXTERNAL PREVENTIVE MAINTENANCE. - Perform the following routine maintenance procedures on the external parts of the radio set components.

(1) Check for completeness and satisfactory condition and appearance of the various radio set components.

(2) Remove dirt and moisture from jacks, plugs, front panels, etc.

(3) Inspect controls for positive action and for binding, scraping, excessive looseness, worn or chipped gears, and misalignment.

(4) Inspect components for damaged finish, and exposed metal surfaces for corrosion and moisture.

(5) Inspect cabling and wiring for mildew, tears, and fraying.

(6) Inspect switches and knobs for looseness.

(7) Clean name plates, dial and meter windows, and indicator lamp jewel (plastic) assemblies.

(8) Check the antenna connector bowl insulator for signs of cracking.

(9) Connect the battery pack to the POWER receptacle on the receiver-transmitter front panel. Set the XMTR PWR switch to OFF and the POWER-LIGHTS switch to POWER-ON. Press the BATTERY TEST switch and observe that the XMTR OUTPUT meter indicates in the white band.

(10) Turn the POWER-LIGHTS switch through LIGHTS-OFF, -LO, and -HI positions, and observe that the front panel lamps operate corresponding to the POWER-LIGHTS switch positions.

c. INTERNAL PREVENTIVE MAINTENANCE. - Remove the receiver-transmitter from its case (refer to paragraph 6-12) and remove the modules from the main chassis, as necessary, to perform the following preventive maintenance procedures on the internal parts of the receiver-transmitter.

(1) Inspect capacitors for leaks, bulges, or discoloration.

(2) Inspect resistors, transistors, diodes, wiring and insulation for cracks, chipping, blistering, discoloration, moisture and signs of overheating.

(3) Clean interior of main chassis and modules and tighten all interior fastenings.

(4) Tighten connections and mountings of transformers, capacitors, relays, terminal boards, and component mounting boards.

(5) Clean exposed electrical contacts with clean, dry, lint-free cloth.

(6) If the load and tune coils and roller contacts in the power amplifier compartment show signs of corrosion, clean the coils with a wooden burnishing rod.

CAUTION

Do not lubricate coils or roller contacts.

(7) In both Oscillator Control C-4311/PRC-47 and Signal Data Translator CV-1377/PRC-47, the printed circuit switches may become corroded or soiled resulting in poor contact. Clean the contacts with a good solvent such as FSN 6810-664-0387.

CAUTION

Do not lubricate switch contacts.

SUBSECTION 6-2
MAINTENANCE STANDARDS

6-3. GENERAL.

This subsection contains instructions for performing an over-all functional test on the receiver-transmitter. The successful completion of this test simultaneously establishes the performance standards and operational capability of the equipment. If any of the tests cannot be completed successfully, refer to section 5 to determine the cause of trouble.

a. ATMOSPHERIC CONDITIONS. - All testing should be performed at an atmospheric pressure of approximately 29.92 inches of mercury, a room temperature of approximately 72°F (22°C) and a maximum of 50 percent relative humidity.

b. POWER REQUIREMENTS. - For the purposes of the performance standard tests, both sources of primary power, 24.0 volts dc and 115 volts ac, single phase, at 400 cps ±5 percent, are required.

6-4. REQUIRED TEST EQUIPMENT.

The following test equipment, or equivalents, are required to perform the performance standard tests:

Equipment	AN No. or Manufacturer's Name and Model No.
Signal generator	AN/URM-25D
Vacuum-tube voltmeter (vtvm)	TS-505D/U
Antenna load (50 ohms)	
Frequency counter	AN/USM-122
Audio power output meter	TS-585D/U
Audio oscillator	TS-382F/U
Oscilloscope	AN/USM-137
Transmitter output attenuator	See figure 6-1
Dummy whip antenna	See figure 6-2

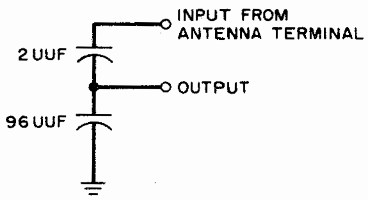
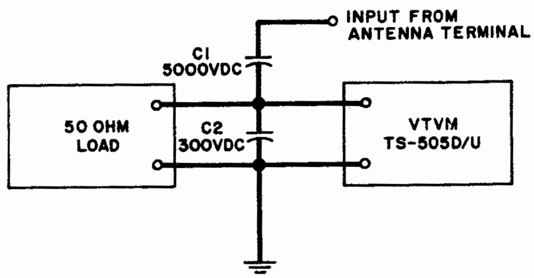


Figure 6-1. Test Connection and Requirements for Output Attenuator



FREQUENCY (MC)	C1 (UUF)	C2 (UUF)
2.0	75	5380
3.0	75	3520
4.0	75	2420
5.0	87	1830
6.0	100	1360
7.0	100	1000
8.0	120	770
9.0	120	645
10.0	125	520
11.0	150	370
11.999	175	330

Figure 6-2. Test Connection and Requirements for Dummy Whip Antenna

6-5. TEST PROCEDURES.

The following test procedures are divided into two major sections: receiver sensitivity test and transmitter tests. Both major groups are subdivided further into tests which check specific functions of either the receiver section or transmitter section. Perform all tests in the sequence given.

a. RECEIVER SENSITIVITY TEST.

(1) Connect test equipment and receiver-transmitter as shown in figure 6-3.

(2) Set switches and controls on receiver-transmitter to positions as follows:

Switch or Control	Position
Frequncy controls	2225 kc
CW-FSK/VOICE	VOICE
OPR-TUNE	OPR
VOLUME	Maximum clockwise
POWER-LIGHTS	POWER-ON

(3) Adjust signal generator for a 2.0-microvolt output at 2226 kc.

(4) Observe and record audio output level. Output should be 50 mw minimum.

(5) Remove signal generator input.

(6) Observe and record audio output level. The difference between this output and the output recorded in step (4) (signal-to-noise ratio) should be 10 db minimum.

(7) Set frequency controls to frequencies (kc) listed below. For each frequency, repeat steps (3) through (6). Always set signal generator frequency 1 kc above channel frequency listed below:

2775	6225	9225
3225	6775	9775
3775	7225	10225
4225	7775	10775
4775	8225	11225
5225	8775	11775
5775		

(8) Repeat steps (3) through (6) using the 115-volt a-c power source.

b. TRANSMITTER TESTS.

(1) POWER OUTPUT.

(a) Connect test equipment and receiver-transmitter as shown in figure 6-4.

(b) Set switches and controls on receiver-transmitter to positions as follows:

Switch or Control	Position
Frequency controls	2000 kc
CW-FSK/VOICE	VOICE
XMTR PWR	LO
OPR-TUNE	TUNE
POWER-LIGHTS	POWER-ON

(c) Place the stud of the antenna simulator in the antenna bowl of RT-671/PRC-47 and screw in until the lower bracket lines up with the hole in the handle on the front panel. Secure with rod screwed through the two brackets on the simulator and into the hole in the receiver-transmitter handle.

(d) Connect the ground wire from the second lower tab on the simulator to the ground wire connection on the panel near the handle.

(e) Connect the 3-foot coaxial cable from the jack marked 50Ω on the simulator to the 50-ohm, 100-watt, noninductive load, using the adapter (and a T-connector, if desired). The T-connector may be used for connection of a vtvm such as TS-505D/U to measure r-f voltage across the load, or the vtvm may be connected to the VTVM jack.

(f) The INSTRUMENT connector may be used with the 5-foot coaxial cable to connect any desired test equipment to monitor the r-f signal. Such equipment may be a distortion analyzer, an oscilloscope, or a frequncy meter. This connector is connected inside the simulator through a small capacitor to the capacitor network and provides approximately one volt rms r-f signal for monitoring.

(g) With the antenna simulator and 50-ohm load connected as shown in figure 6-4, a 15-foot whip antenna is simulated. The switch on top of the simulator is set to the test frequency and the RT-671/PRC-47 is tuned and loaded as in the Operator's Manual for Radio Set AN/PRC-47 and Accessories, TM-03817A-12/1. Table 6-1 lists r-f power and voltages for frequencies at 2.0, 4.0, 6.0, 8.0, 10.0, and 11.999 mc. If tests are desired at other frequencies (odd megacycle points) the values given in the table may be interpolated as half way between values given. Any frequency in the 11-11.999 mc range may be measured with the antenna simulator switch at 11.

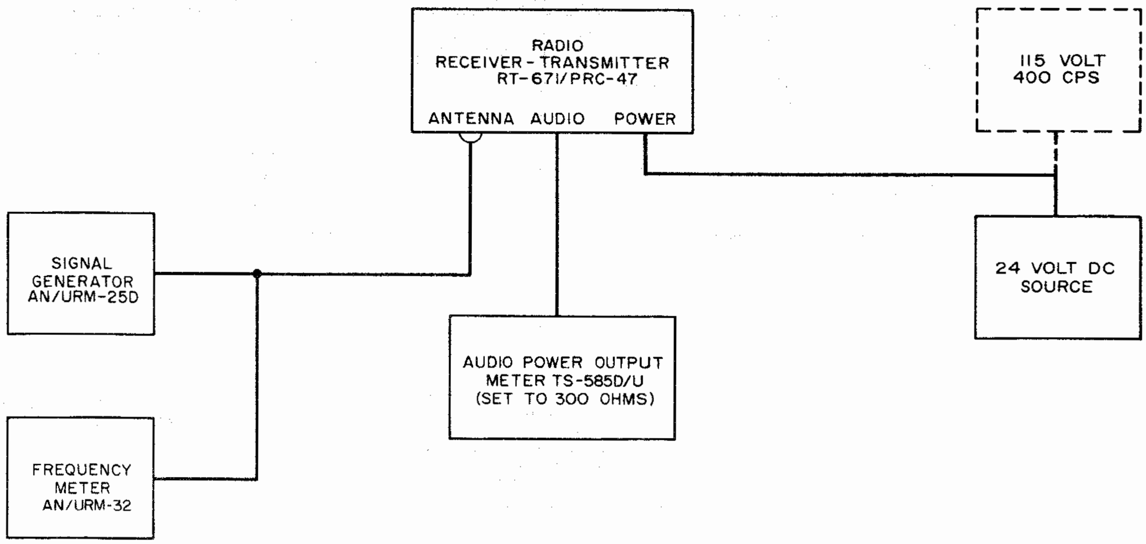


Figure 6-3. Receiver Test Setup

TABLE 6-1. POWER DELIVERED TO A 15-FOOT WHIP (SIMULATED)

CHANNEL FREQUNCY (mc)	LOW POWER		HIGH POWER	
	(watts min)	(volts rf)	(watts min)	(volts rf)
2.0	4	14.1	20	31.6
4.0	6	17.3	32	40.0
6.0	9	21.2	48	49.0
8.0	12	24.5	60	54.9
10.0	14	26.4	70	59.0
11.999	15	27.3	76	60.6

NOTE

Make all tests at frequencies near whole megacycle numbers. Voltages (and the power they represent) read at the 50-ohm load do not represent power output total as delivered to a 50-ohm load without the antenna simulator, but more nearly that which would be present in a 15-foot whip antenna.

(h) Adjust POWER AMPLIFIER TUNE and LOAD controls on receiver-transmitter for maximum output as indicated on receiver-transmitter XMTR OUTPUT meter.

(i) Observe and record transmitter output voltage on vtvm. Compute transmitter output power. Transmitter output power should be 4 watts minimum, or 14.1 volts rf.

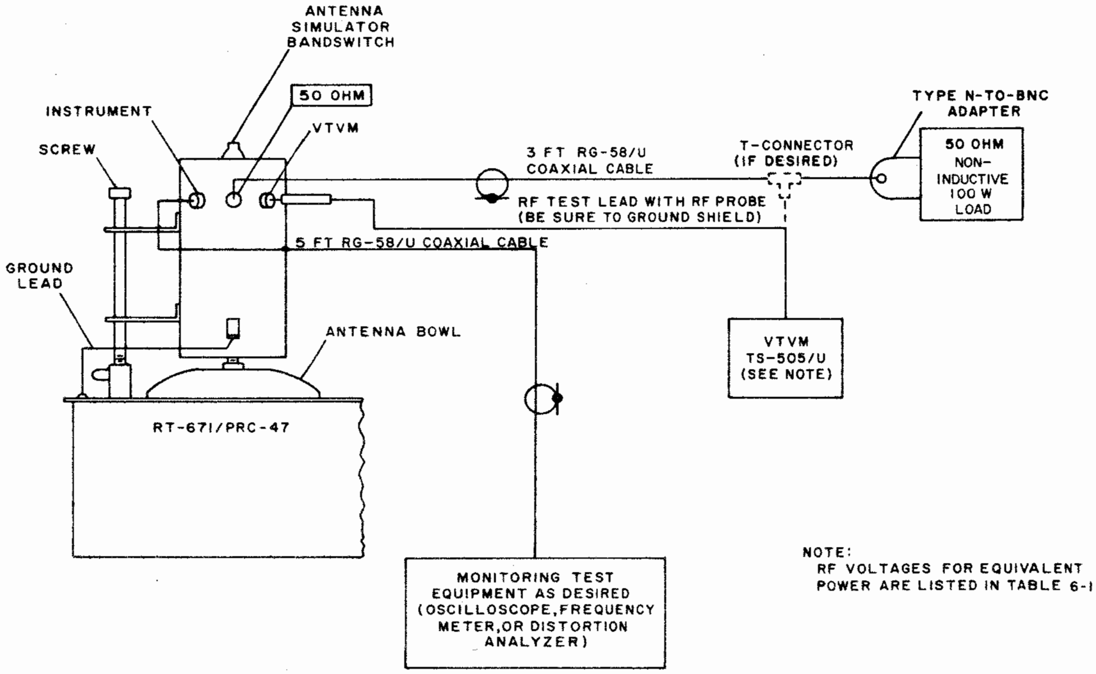


Figure 6-4. Transmitter Power Output Test Setup

(j) Set XMTR PWR switch to HI. Readjust POWER AMPLIFIER TUNE and LOAD controls for maximum output as indicated on XMTR OUTPUT meter.

(k) Observe and record transmitter output voltage on vtvm. Compute transmitter output power. Transmitter output power should be 20 watts minimum, or 31.6 volts rf.

(l) Repeat steps (a) through (k) for channel frequencies listed below. Observe that receiver-transmitter low and high power outputs for each corresponding channel frequency are as specified below.

(m) Repeat step (a) through (k) using the 115-volt a-c power source instead of 24.0 volts dc.

(2) FREQUENCY STABILITY.

(a) Connect test equipment and receiver-transmitter as shown in figure 6-5.

(b) Set switches and controls on receiver-transmitter to positions as follows:

Switch or Control	Position
Frequency controls	9900 kc
CW-FSK/VOICE	VOICE
OPR-TUNE	TUNE
XMTR PWR	LO
POWER-LIGHTS	POWER-ON

(c) Adjust POWER AMPLIFIER TUNE and LOAD controls on receiver-transmitter for maximum output as indicated on receiver-transmitter XMTR OUTPUT meter.

(d) Set OPR-TUNE switch to OPR.

(e) Adjust audio oscillator for a 0.1-volt output at 2000 cps.

(f) Set CW-FSK/VOICE switch to CW-FSK. Observe and record transmitter output frequency indicated on frequency counter. Transmitter output frequency should be 9902 kc ±12 cps.

(g) Repeat steps (a) through (f) for channel frequencies listed below. Observe that transmitter output frequency for each corresponding channel is as specified below:

Channel Frequency (kc)	Transmitter Output Frequency (kc ±12 cps)
9911	9913
9922	9924
9933	9935
9944	9946
9955	9957
9966	9968
9977	9979
9988	9990
9999	10,001

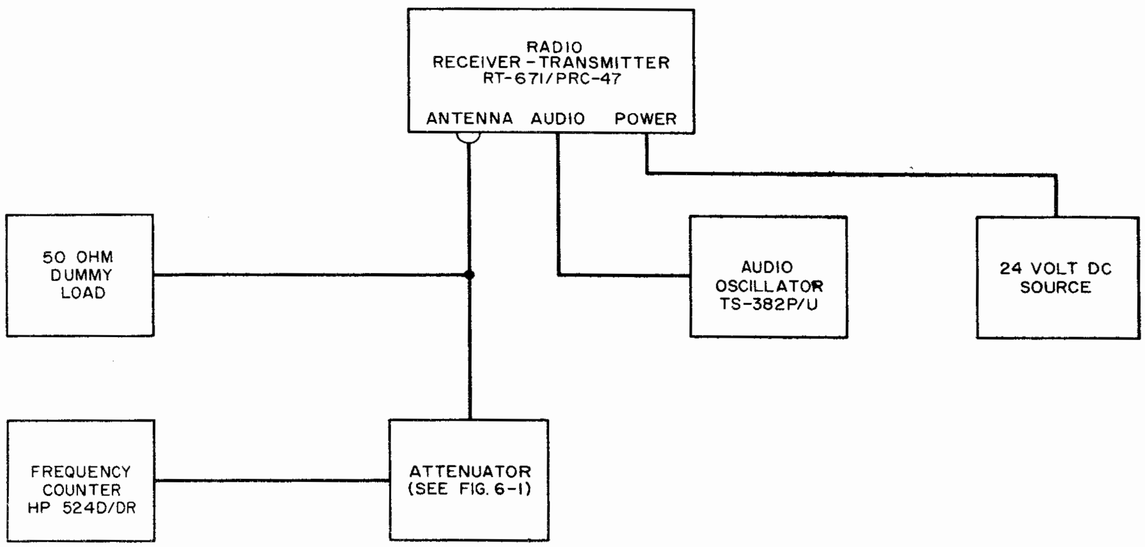


Figure 6-5. Transmitter Frequency Stability Test Setup

SUBSECTION 6-3
REPAIR

6-6. FAILURE REPORT.

Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Marine Corps Supply Activity, Philadelphia 46, Pennsylvania. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember--there are two sides to the failure report--

YOUR SIDE	HEADQUARTERS SIDE
Every FAILURE REPORT is a boost for you:	Headquarters uses the information to:
1. It shows that you are doing your job.	1. Evaluate present equipment.
2. It helps make your job easier.	2. Improve future equipment.
3. It ensures available replacements	3. Order replacements for stock.
4. It gives you a chance to pass your knowledge to every man on the team.	4. Prepare field changes.
	5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest Forms and Publications Supply Point.

6-7. GENERAL.

This subsection provides information necessary to enable maintenance technicians to repair defects found when trouble-shooting the equipment as described in section 5 or while performing the preventive maintenance as described in subsection 6-1. This information consists of procedures for removing modules and major components from the main chassis and instructions for the disassembly, repair, and reassembly of these modules and major components. Illustrations showing the location of circuit elements and mechanical parts, and schematic diagrams are provided to aid maintenance technicians in repairing the equipment. Procedures for tuning and adjusting the receiver-transmitter are also provided.

6-8. ALIGNMENT AND ADJUSTMENT.

a. GENERAL - The following paragraphs describe procedures for aligning and adjusting Radio Receiver-Transmitter RT-671/PRC-47. The performance of these procedures will ensure optimum performance of the equipment. The alignment and adjustment is performed with the receiver-transmitter removed from its case. To remove the case, place the receiver-transmitter with its front panel down. Loosen the six screws located at the bottom of the case; then lift the case off the equipment. Connect the primary power source to the POWER receptacle on the front panel. Make certain that the POWER-LIGHTS switch is set to POWER-OFF. Set XMTR PWR switch to OFF and the CW-FSK/VOICE switch to VOICE. No input cables should be connected to either of the AUDIO receptacles.

WARNING

Extreme care should be exercised by personnel performing the alignment and adjustment procedures on the receiver-transmitter. High-voltage circuits, particularly in Power Supply PP-3518/PRC-47 (A5) and in the power amplifier compartment, are dangerous and may be fatal.

NOTE

In performing the alignment and adjustment procedures, if it is necessary to remove Signal Data Translator CV-1377/PRC-47 (A3) or Oscillator Control C-4311/PRC-47 (A7), make certain that the front panel frequency controls are set at 2000 kc. This aligns the switch couplers on the front panel and on the two modules in a vertical position so that the modules can be removed. For the same reason, the frequency controls should be set to 2000 kc when these modules are reinstalled.

b. TEST EQUIPMENT. - The following is a list of test equipment required to perform the alignment and adjustment procedures:

Equipment	AN and Federal Stock No. or Manufacturer's Name and Model No.
Output meter	TS-585D/U
Electronic counter	AN/USM-122
Receiver	AN/URR-23A (5820-642-6855)
Audio oscillator	TS-382F/U (6625-519-3815)
Oscilloscope	AN/USM-137
Signal generator	AN/URM-25D (6625-309-5381)
Multimeter (vtvm)	TS-505D/U
Dummy load (50 ohms)	
Module extension cables (7)	

c. USE OF SPECIAL TOOLS. - Refer to figure 5-1. The cables numbered 1 through 5 are used to extend the modules from Electrical Equipment Chassis CH-474/PRC-47 so the modules may be accessible from all sides for adjustment, trouble shooting, and testing. Refer to paragraph 6-13 for removal and replacement of modules. Observe all notes, cautions, and warnings. Cables of Cable Assembly Set AN/PRC-4 are not furnished in sufficient number to extend all modules at one time, nor is this necessary. Refer to the USE column of table 5-3 and note which cables are necessary for each module. The module under test may be removed from the chassis and plugged into the proper chassis receptacle through the cables as indicated. Cable No. 1 is used to extend Power Supply PP-3518/PRC-47. Cable No. 2 is used to extend Audio Frequency Amplifier AM-3506/PRC-47. Cable No. 3 and one of Cables No. 4 are used to extend Oscillator Control C-4311/PRC-47. All four of Cables No. 4 are required to extend Signal Data Translator CV-1377/PRC-47. Cable No. 5 and one of Cables No. 4 are used to extend Amplifier-Modulator AM-3507/PRC-47. Cable No. 5 is used to extend Radio Frequency Oscillator O-1032/PRC-47. The test-antenna lead may be used to connect the antenna terminal to a 50-ohm load when the antenna simulator is not used. The Front Panel Test Lead may be used to connect test microphone and loudspeaker to one of the front panel AUDIO receptacles. When this connection is made, use the blue lead and the associated black lead (connected to the shield on the blue wire) to connect the test microphone and the red lead with its associated black lead (connected to shield on red wire) to connect the test loudspeaker.

The antenna simulator, adapter and coaxial cables, are used as shown in figure 6-4 for testing power output of Radio Receiver-Transmitter RT-671/PRC-47 into a 15-foot whip antenna.

d. SERVICING TRANSISTORIZED EQUIPMENT. - U.S. Marine Corps Technical Instruction TI-5960-25/1 is reproduced here for convenience. Observe all precautions included in this Instruction.

NORMAL

TI-5960-25/1

U. S. MARINE CORPS TECHNICAL INSTRUCTION

SERVICING

TRANSISTORIZED EQUIPMENT

HEADQUARTERS U. S. MARINE CORPS, WASH. 25, D. C.
17 May 1962

1. Purpose. To provide instructions for special precautions to be observed when servicing transistorized equipment. Information contained herein supersedes instructions formerly contained in MCO 2005.2 SUP 8.

2. General. Although transistors are expected to operate indefinitely, they are subject to abuse and unless special maintenance techniques are used, they will be ruined.

a. Background. Surface barrier and drift transistors which can operate at high frequencies are becoming widely used in the Marine Corps and are especially sensitive to certain kinds of overload during routine servicing. Transistors are like semiconductor diodes in this respect, except that the circuitry is more complex, and because of the interaction between circuits even more understanding is required. Parts can be burned out when measuring resistances with a multimeter even when the power supply is turned off. This means that personnel must not indiscriminately measure parts values, as has been a practice with electron tube circuits. An additional complexity results because the circuits normally use bypass and coupling capacitors designed for the lower voltages and they may also be damaged by the usual multimeter.

b. Special Limitations. Because a simple slip can ruin many costly transistors, all personnel using or servicing transistorized equipment should know the transistor's limitations. Before applying any test signal (even a multimeter) to a transistor circuit, the technician should check the maximum allowable current, voltage, and power dissipation ratings of each transistor. Since the resistance of a transistor changes with the magnitude and polarity of applied voltages, it is sometimes useful to consider the transistor as a simple switch or matched impedance when computing an ultra safe maximum signal which may be applied to a particular element. The effect on associated circuits should be considered.

c. Precautions. Special instructions for each equipment should be followed since transistors and circuits are not all alike. Table 1, although necessarily general, will, in most cases, provide adequate information for the technician who services transistorized equipment.

Table 1. How to Avoid Damage to Transistors While Servicing Circuits

a. Basic Failure Voltage Breakdown or "Punch Through"

NOTE: Voltage breakdown is especially critical in surface barrier types of transistors.

Cause: Safe voltage is exceeded in the nonconducting direction. Allowable values for surface barrier transistors are on the order of 15 volts from collector to emitter and 0.5 volt from base to emitter. Sometimes 0.1 volt can be excessive.

TI-5960-25/1

Source of Abuse	Suggestions
Short circuiting series parts, such as the load resistor, with test prods, screwdriver, or soldering iron--thus permitting the voltage on the transistor to rise.	Do not short parts with voltages present. Use very small test prods. Insulate prods to the tips. If a screwdriver is used near active transistor circuits, it should be small and well insulated. Turn off power to transistors before using soldering iron or uninsulated tools. Keep transistor away from high voltage circuits.
Using multimeter on high resistance measuring range (22.5 volts of multimeter AN/PSM-4, for instance, is far too high for surface barrier transistors).	Avoid use of resistance measuring circuits unless safe. Remove batteries from multimeter or use series and parallel resistors to limit current and voltages to safe values.
Using soldering iron which connects AC from line by leakage, or capacitance.	Use 6-volt iron or isolation transformer. Always turn transistor circuits off and, observing safety precautions, connect a common ground before soldering.
Connecting leads from ungrounded test set to transistor, causing RF filter to connect voltage to transistor	Ground all cases together using short ground connections. Use all safety precautions necessary.
Using transformerless AC sets or test sets.	Not recommended. However, if necessary to use them, connect an electrostatically shielded isolation transformer (1:1 ratio) in the power line of the transformerless set for safety, and use common ground. Check voltages before connecting test leads between equipments to assure safe values.
Using equipment with faulty power supply.	Repair power supply.
Accidentally connecting other voltages to transistor.	Keep "haywire" away. Check for test lead voltage that might damage transistor, and if evident, eliminate it before connecting. Ground and short probes and test leads to discharge any test set capacitors before connecting, when applicable.

b. Basic Failure-Burnout or "Runaway"

Cause: Allowable power dissipation is exceeded in any part of the transistor.

Source of Abuse	Suggestions
Shorting out, shunting, or grounding the transistor input resistor with power applied, causing inadequate bias.	Use extreme care to avoid shorts or shunts. Insulate test prods to the tip. Do not connect test leads to transistor if ends of leads are free to short circuit. Use only insulated prods or the power off. Include DC isolation (suitable capacitor) between signal source and transistor.
Connecting the collector voltage without the proper emitter to base bias voltage.	Avoid connecting transistors or plugging them into sockets unless the power supply voltages are off.
Using multimeter (battery) on the "low" resistance range.	Check on allowable currents and voltages for transistor elements. Restrict resistance measuring ranges to safe ones or use limiting resistances (series and parallel as necessary).

Source of Abuse	Suggestions
Shorting any parts that cause excessive power to be applied to the transistor.	Do not use a voltmeter of low resistance or other device that will radically affect circuit resistance or voltages, in either the base or collector circuits.
Using an ungrounded soldering iron, thus connecting leakage current into the transistor circuit.	(1) Do not solder, connect, or disconnect with voltages on transistor. (2) Ground iron tip (through shank) to transistor circuit ground, in a safe manner; use isolation (1:1) transformer, or use 6-volt iron. (3) Disconnect heated iron before touching it to circuit if iron is large enough to hold necessary heat.
Inadvertently connecting voltages or currents (such as radio interference filter current, or leakage from the power line, RF pickup, external batteries, power supply voltages, or test oscillator voltages).	Ground chassis or cases using all necessary safety precautions. Reduce stray fields (use insulated shield, if necessary). Before connecting, check test lead voltage compared to that of transistor circuit with electronic multimeter ME-25/U to assure low enough voltage. Do not connect low impedance device across equipment voltage or current supplies or loads.
Inducing current by magnetic field of a soldering gun (such as the transformer type).	Do not use high-current-carrying conductor or soldering device near wiring.
Subjecting transistor to power line transients.	Use a suitable supply and power source.

3. Reserve Applicability. This Instruction is applicable to the Marine Corps Reserve.

By direction of the Commandant of the Marine Corps

Chester R. Allen
CHESTER R. ALLEN
Major General, U. S. Marine Corps
Quartermaster General of the Marine Corps

NOTE

Oscillator Control C-4311/PRC-47 contains three matched transistor pairs identified in figure 6-76. In any case where these particular transistors are replaced, make sure the replacement is a matched pair; the equal gain in each half of the matched pair is important to the operation of the equipment. DO NOT replace one half only of a matched pair. Included in notes on figure 6-76 are parameters for matching.

6-9. ALIGNMENT AND ADJUSTMENT OF STABILIZING CIRCUIT FOR VFO.

a. OSCILLATOR CONTROL C-4311/PRC-47 (A7).

(1) PULSE GENERATOR.

(a) Set the frequency selector control switches on receiver-transmitter front panel to 2000 kc. Loosen four screws securing Oscillator Control C-4311/PRC-47 (A7) to main chassis (figure 6-22) and remove the module. Using module A7 extension cables, reconnect the module to its receptacles on the main chassis.

(b) Loosen fastening screws which hold top and bottom covers to module, and remove the covers.

(c) Set POWER-LIGHTS switch to POWER-ON.

(d) With the oscilloscope, observe the output of the 1-mc pulse generator (figure 6-6).

(e) Adjust capacitor C15, accessible through rear of module A7 (figure 6-7), for a minimum 500-kc amplitude modulation on the waveform.

(2) 0.9- TO 1.8-MC RINGING CIRCUIT ALIGNMENT.

(a) Rotate switch S2 (figure 6-8) to extreme counterclockwise position.

(b) Place the oscilloscope probe on the 0.9- to 1.8-mc input to mixer board TB1 (figure 6-6).

(c) Set the oscilloscope sweep to 1 usec/cm and adjust capacitor C90 (figure 6-9) for 1.8 mc.

(d) Adjust the oscilloscope sweep to 10 usec/cm and make a slight adjustment of capacitor C90 to minimize the 100-kc modulation on the 1.8-mc signal.

(e) Rotate switch S2, one revolution at a time, clockwise. For each revolution, repeat steps *(b)*, *(c)*, and *(d)*, adjusting the capacitors listed below to the corresponding frequency:

Switch S2 Revolutions (from full counterclockwise)	Adjust Capacitor (see figures 6-9 and 6-10)	Frequency (mc)
1	C88	1.7
2	C86	1.6
3	C84	1.5
4	C82	1.4
5	C80	1.3
6	C78	1.2
7	C76	1.1
8	C74	1.0
9	C72	0.9

(3) 601- TO 700-KC CRYSTAL ALIGNMENT.

(a) Insert an insulator (small tuning wand or wooden match stick) between pickup arm and pad of S1 to disconnect that bank of crystals from the circuit.

(b) Connect the electronic counter through a 33-uuf capacitor to the junction of capacitors C100 and C101 (figure 6-69). The coaxial cable used should be kept as short as possible.

(c) Adjust capacitor C133 (figure 6-11) for 3707.000 kc ±1 cps with switch S2 (figure 6-8) set to 0.

(d) Remove the electronic counter from the junction of capacitor C100 and C101 and connect it to jack J1 (figure 6-6). Remove from S1 the insulator inserted in step *(a)*.

(e) Set switches S1 and S2 to their 0 positions. Adjust capacitor C113 (figure 6-11) for 700.000 kc ±1 cps on the electronic counter.

(f) Rotate switch S1 to the 1 position. Adjust capacitor C115 (figure 6-11) for an output of 699.000 kc ±1 cps.

(g) Rotate switch S1 to the 2 position and adjust capacitor C117 (figure 6-11) for output of 698.000 kc ±1 cps.

(h) Continue with the adjustments as follows:

Switch S1 Position	Adjust Capacitor (see figures 6-6 and 6-11)	Frequency (kc)
3	C119	697.000 ±1 cps
4	C121	696.000 ±1 cps
5	C123	695.000 ±1 cps
6	C125	694.000 ±1 cps
7	C127	693.000 ±1 cps
8	C129	692.000 ±1 cps
9	C131	691.000 ±1 cps

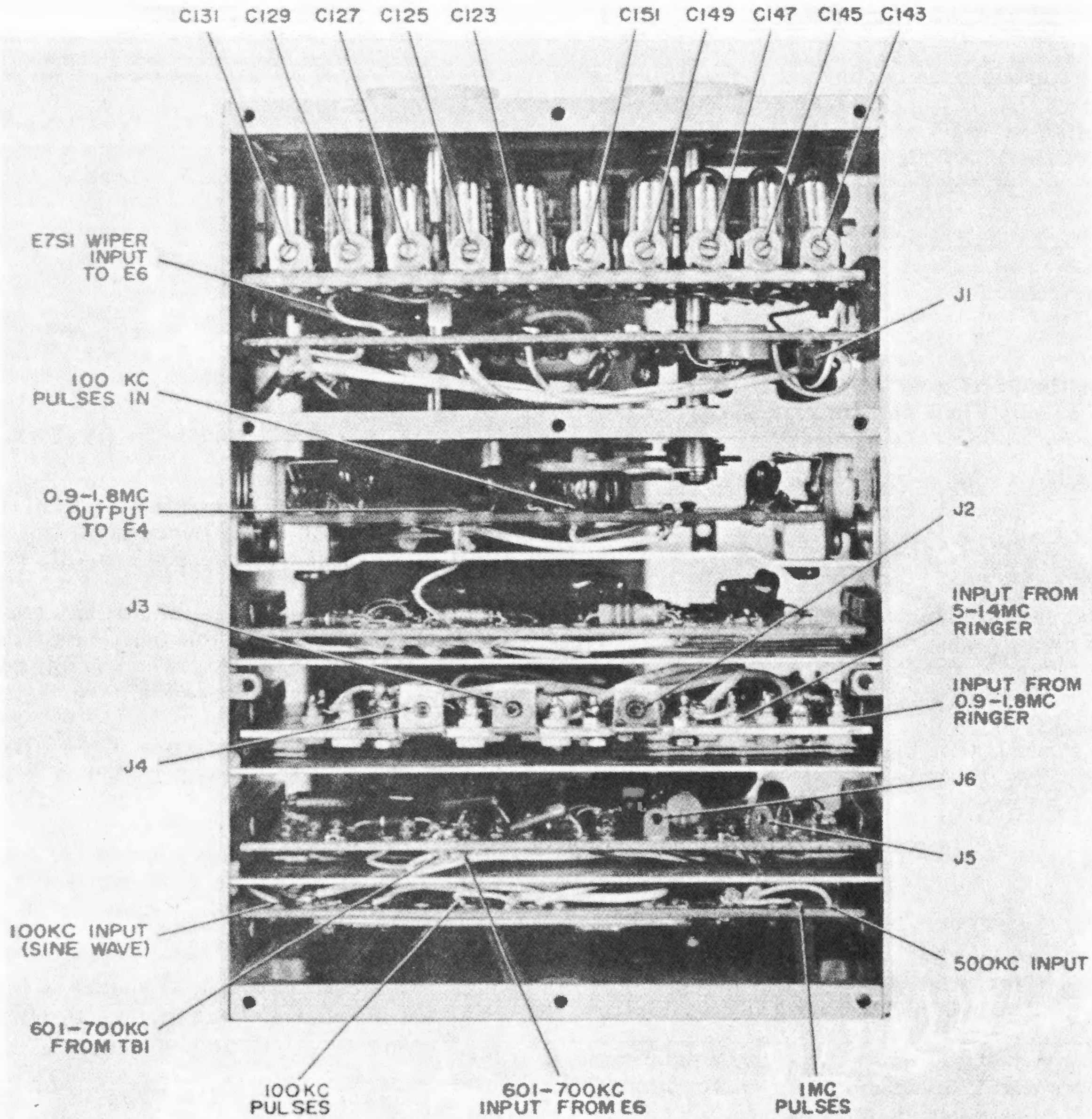


Figure 6-6. Oscillator Control C-4311/PRC-47(A7), Top View, Location of Test Points and Adjustments

(i) With switch S1 set to 0, rotate switch S2 to the 1 position. Adjust capacitor C135 (figure 6-11) for an output frequency of 690.000 kc ±1 cps.

(j) Rotate switch S2 to the 2 position and adjust capacitor C137 (figure 6-11) for 680.000 kc ±1 cps.

(k) Continue with the adjustments as follows:

Switch S2 Position	Adjust Capacitor (see figures 6-6 and 6-11)	Frequency (kc)
3	C139	670.000 ±1 cps
4	C141	660.000 ±1 cps
5	C143	650.000 ±1 cps
6	C145	640.000 ±1 cps
7	C147	630.000 ±1 cps
8	C149	620.000 ±1 cps
9	C151	610.000 ±1 cps

(l) Set POWER-LIGHTS switch to POWER-OFF.

(m) Remove module extension cables, reset all switches to 0, replace the top and bottom covers, and reinstall module A7 on the main chassis.

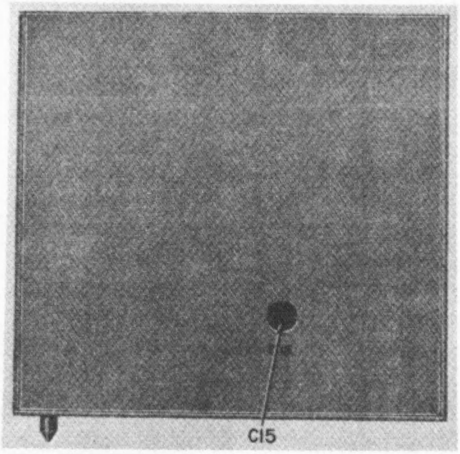


Figure 6-7. Oscillator Control C-4311/PRC-47 (A7), Rear View, Location of Capacitor C15

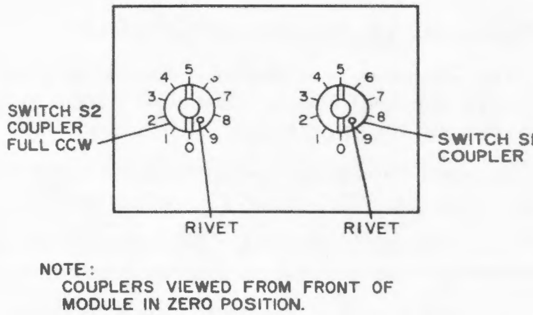


Figure 6-8. Oscillator Control C-4311/PRC-47 (A7), Front View, Coupler Positioning

(4) 601- TO 700-KC CRYSTAL OSCILLATOR, CAPACITOR SELECTION. - If crystals or capacitors have been replaced and the trimmer capacitors on board assembly E7-E8 are run into their stops during the alignments of paragraph 6-9a(3), make the following capacitor replacement in the defective circuits.

(a) If the trimmer adjustment is bringing the output frequency toward the desired frequency with counterclockwise rotation of the lead-screw when the stop is reached, the circuit has too much capacitance and the next smaller standard value must be selected. The capacitors are standard value 2 percent Duramica types. Remove the assembly of E7 and E8, replace the capacitor in question with the next smaller type and replace the assembly in C-4311/PRC-47. Replace O-4311/PRC-47 on the chassis and continue the subject frequency adjustment.

(b) If the trimmer adjustment reaches the clockwise stop before the frequency is satisfactory, proceed as in *(a)* except replace the fixed capacitor with the next larger standard value.

CAUTION

Do not force the trimmers against their stops or they will be damaged.

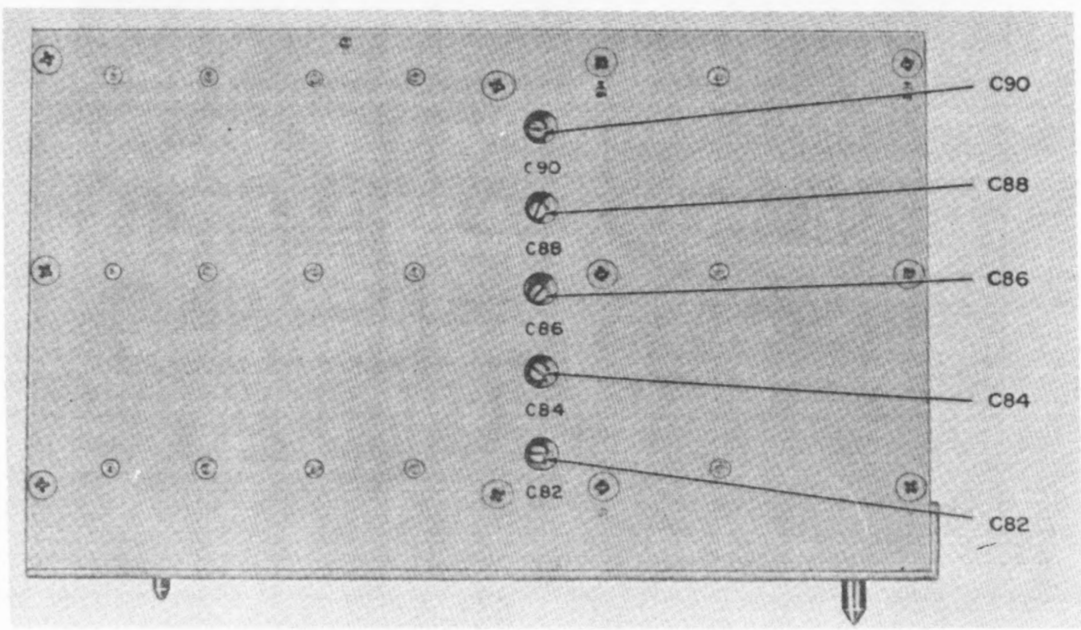


Figure 6-9. Oscillator Control C-4311/PRC-47 (A7), Left Side, Location of Adjustments

(5) 5- TO 14-MC RINGING CIRCUIT.

(a) Remove oscillator control module A7 top cover and connect the oscilloscope probe to the 5- to 14-mc ringer input on board E3 (figure 6-6).

(b) Set the front panel frequency controls to 2000 kc. Set the POWER-LIGHTS switch to POWER-ON.

(c) Adjust capacitor C248 (figure 6-12) for a 5.0-mc output as viewed on the oscilloscope.

(d) Set the oscilloscope sweep to 1 usec/cm and readjust capacitor C248 slightly for minimum 1-mc amplitude modulation on the waveform.

(e) Set the frequency controls to 3000 kc and adjust capacitor C250 (figure 6-12) for a 6.0-mc output, readjusting for a minimum 1.0-mc ripple. Continue adjustments as follows:

Frequency Control Setting (kc)	Trimmer Capacitor (see figure 6-12)	Required Frequency (mc)
4000	C252	7.0
5000	C254	8.0

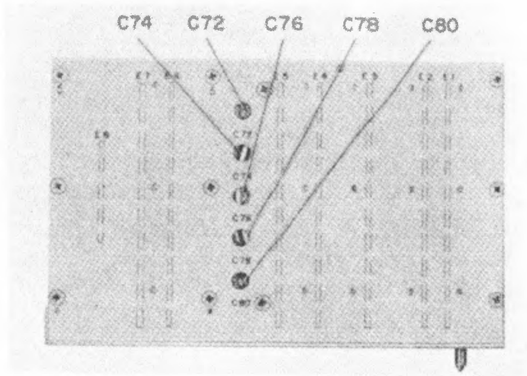


Figure 6-10. Oscillator Control C-4311/PRC-47 (A7), Right Side, Location of Adjustments

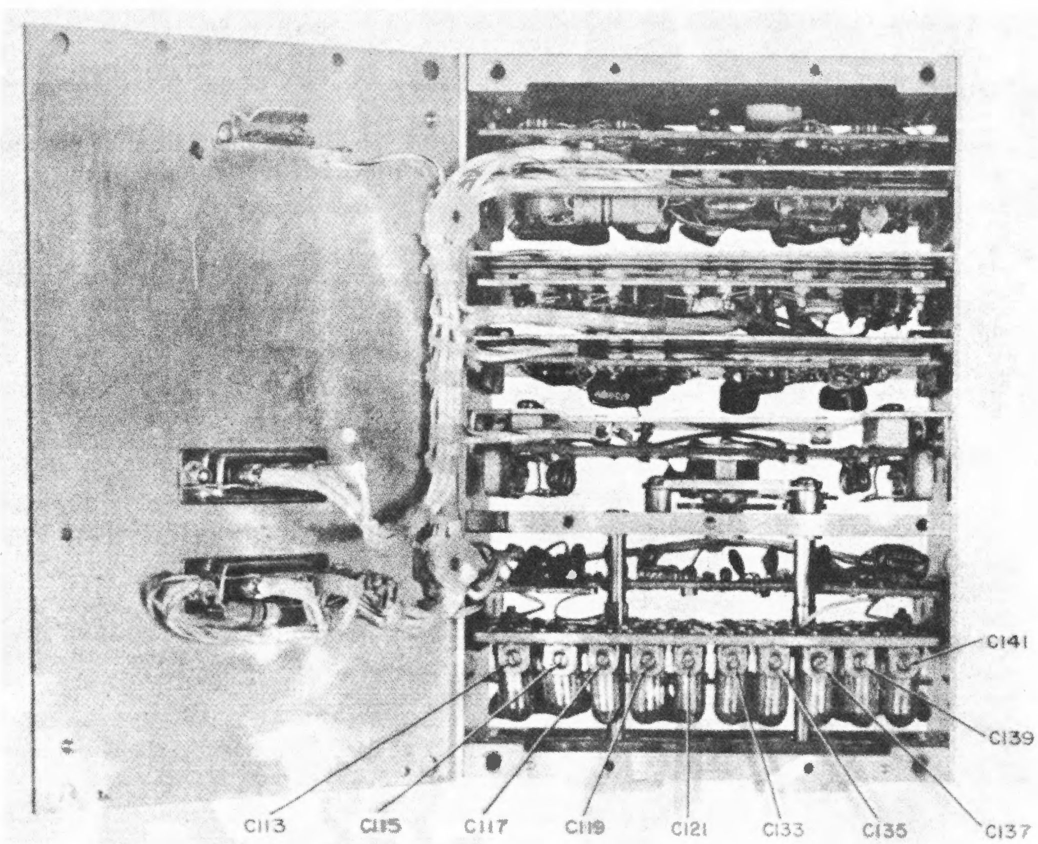


Figure 6-11. Oscillator Control C-4311/PRC-47 (A7), Bottom View, Location of Adjustments

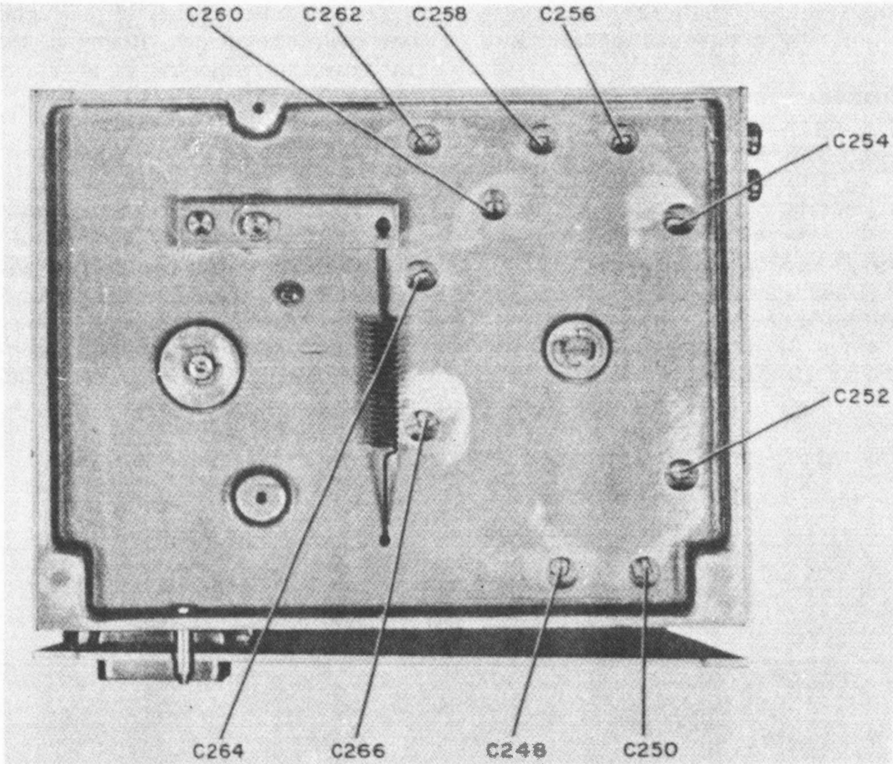


Figure 6-12. Signal Data Translator CV-1377( )/PRC-47 (A3), Rear View, Location of Adjustments

Frequency Control Setting (kc)	Trimmer Capacitor (see figure 6-12)	Required Frequency (mc)
6000	C256	9.0
7000	C258	10.0
8000	C260	11.0
9000	C262	12.0
10, 000	C264	13.0
11, 000	C266	14.0

b. SIGNAL DATA TRANSLATOR CV-1377( )/ PRC-47 (A3).

(1) VARIABLE FREQUENCY OSCILLATOR (VFO) TRACKING ACCURACY TEST.

(a) Set the frequency controls of the receiver-transmitter front panel for 2000 kc and the POWER-LIGHTS switch to the POWER-ON position.

(b) Using a vacuum-tube voltmeter, monitor the d-c voltages at jacks J5 and J6 (the vfo error lines) on oscillator control module A7. The d-c voltages at J5 and J6 should be balanced (the vfo error lines are considered balanced when the d-c voltage difference between J5 and J6 is less than 0.2 volt dc). If the vfo error lines are unbalanced, a tracking adjustment is necessary. See paragraph 6-9*b*(2).

(c) Check the vfo error line voltages on all bands (except at 2000 kc which was checked in steps *(a)* and *(b)* above) as follows:

1. Measure and record the error line voltages at the lowest frequency of the band (not applicable to the 2-mc band).

2. Measure and record the error line voltages at the middle frequency of the band.

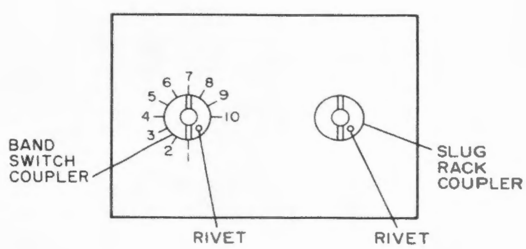


Figure 6-13. Signal Data Translator CV-1377( )/PRC-47 (A3), Front View, Coupler Positioning

3. Measure and record the error line voltages 10 kc below the highest frequency of the band.

Example: Measure and record the error line voltages on the 3-mc band at 3000 kc, 3500 kc, and 3990 kc.

NOTE

When checking the 3-mc band, measure and record the error line voltages at 2500 and 2990 kc only. Do not check at 2000 kc as this was already done in steps *(a)* and *(b)* above.

Record the ratios of the highest error line voltage at each frequency. If any of these ratios exceed 3, a tracking adjustment is necessary on that band. See paragraph 6-9*b*(2).

NOTE

If the VFO tracking error exceeds 60 to 80 kc, lockout relay K6 will automatically disable the oscillator control circuitry, and place 1.0 volt dc on each error line. When checking the tracking accuracy by monitoring the error line balance, make sure the oscillator control circuitry is not disabled. This can be done by

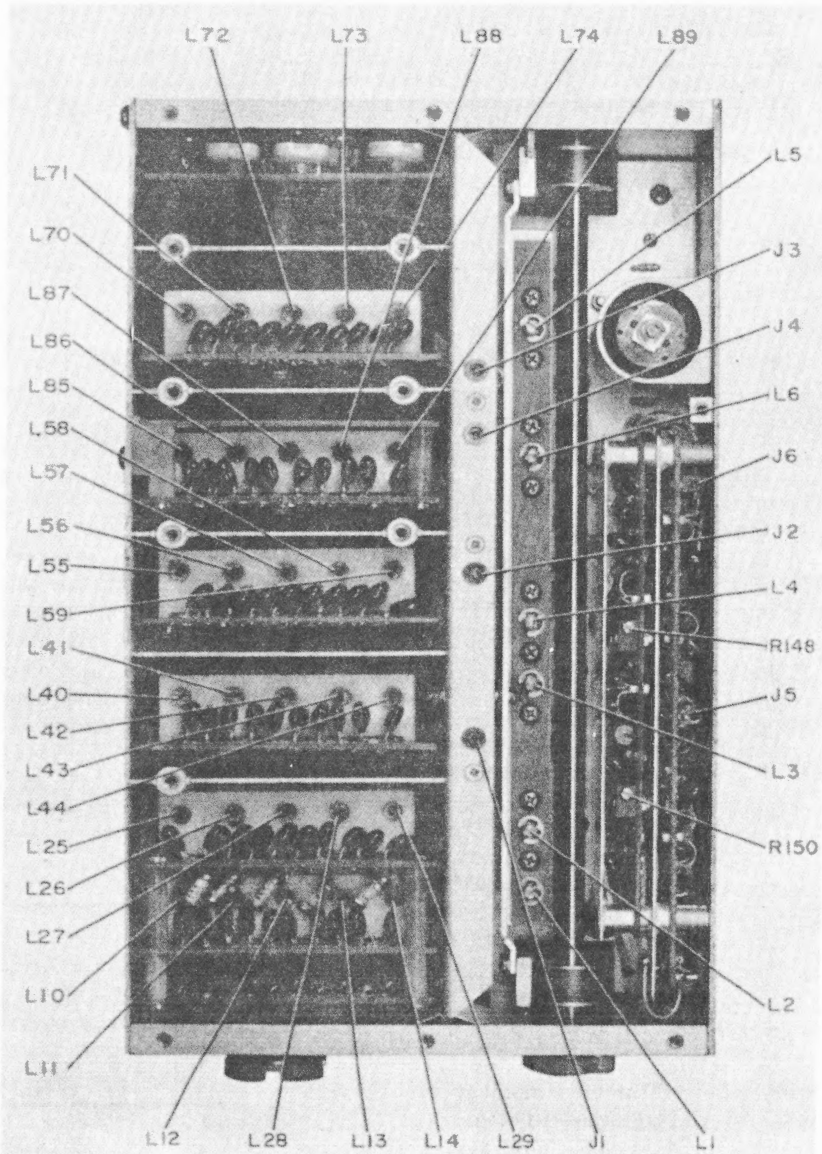


Figure 6-14. Signal Data Translator CV-1377/PRC-47 (A3), Top View, Location of Test Points and Adjustments

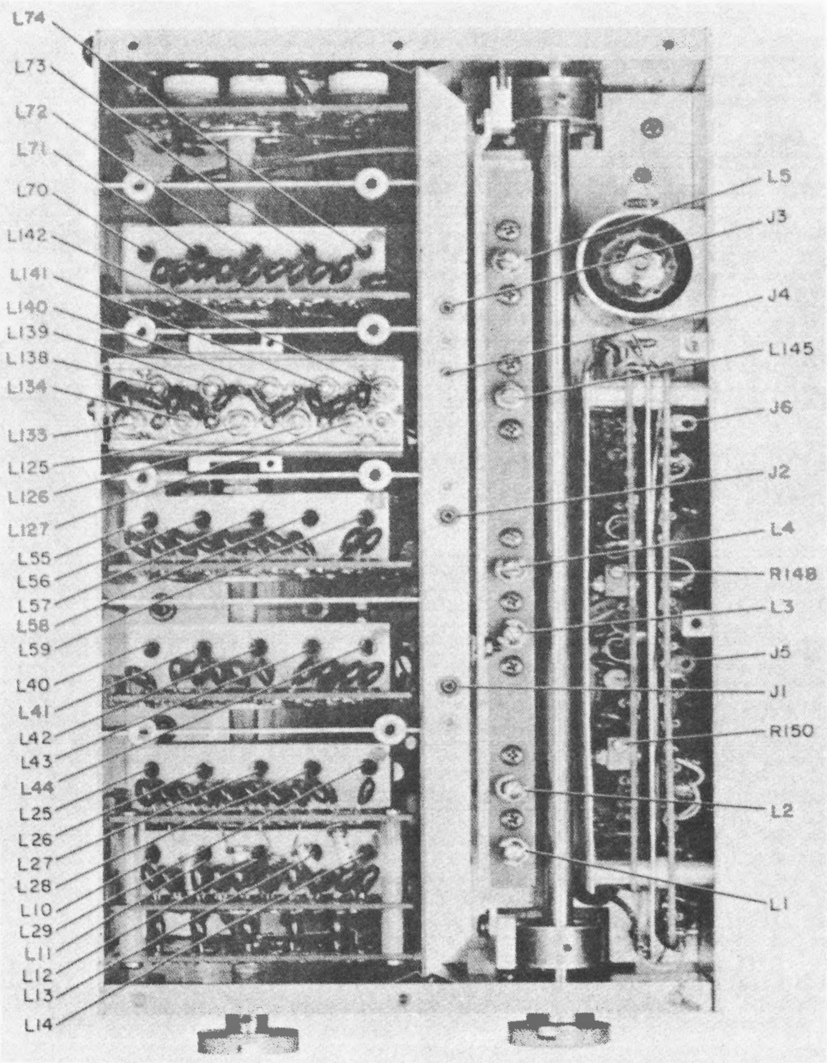


Figure 6-14A. Signal Data Translator CV-1377A/PRC-47 (A3), Top View, Location of Test Point and Adjustments

measuring the d-c voltage at pin 5 (the pin with the blue wire connection) on lockout relay K6. In normal operation, approximately 26 volts dc will be present; however, if the oscillator control circuitry is locked out, the voltage at pin 5 will drop to approximately 1.0 volt.

(2) VARIABLE FREQUENCY OSCILLATOR (VFO) TRACKING ADJUSTMENT (applicable to CV-1377/PRC-47 only).

(a) Set frequency controls on receiver-transmitter front panel for 2000 kc. Set POWER-LIGHTS SWITCH to the POWER-OFF position.

(b) Loosen the five screws securing module A3 to the main chassis (figure 6-22 and remove the module. Loosen the fastening screws which hold the bottom cover to the module, and remove the module. Remove the copper vfo shield from the bottom of the vfo subassembly.

(c) Check the distance from the bottom of the powdered iron core in coil L6 (figure 6-14) to the bottom of the coil form. With the slug rack coupler positioned as shown in figure 6-13, this distance should be 0.250 ±0.010 inch and can be adjusted with a screwdriver from the top of the module with the top cover removed.

NOTE

The slot in the slug rack coupler must be vertical during measurement.

(d) Replace the vfo shield and bottom cover plate. Reinstall the module in the main chassis.

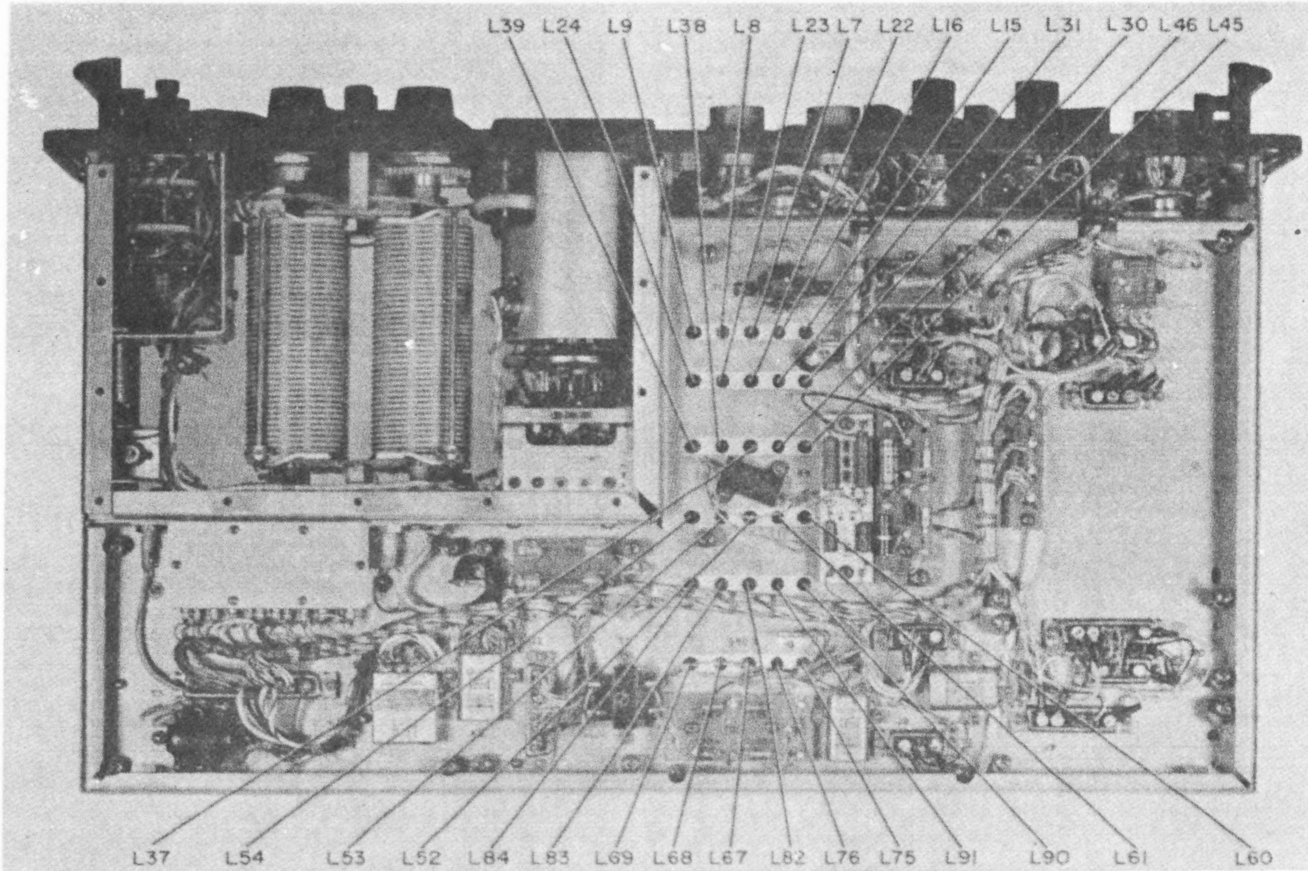


Figure 6-15. Radio Receiver-Transmitter RT-671/PRC-47, Bottom View, Location of Signal Data Translator CV-1377/PRC-47 Adjustments

(e) With the receiver-transmitter removed from its case, apply power and set up for normal high frequency operation.

(f) Ground pin 5 on lockout relay K6. This is the pin with the blue wire connection. Grounding this point disables the oscillator control circuitry and places 1.0 volt dc on each of the two error lines in the oscillator.

(g) Monitor the oscillator frequency at A3J5 using a calibrated communications receiver lightly coupled to the jack.

(h) Set the receiver-transmitter front panel frequency controls to 200 kc. If the frequency indicated on the monitor is not 2500 ±1 kc, adjust L82 until the monitored frequency is 2500 ±1 kc. (See figure 6-15.)

(i) Check the oscillator frequency at the lower band edge, midband, and upper band edge minus 10 kc. For example, check the 2-mc band at 2000, 2500, and 2990 kc on the KILOCYCLES indicator. Monitored oscillator frequencies must be dial reading plus 500 ±20 kc.

(j) If the 2-, 3-, 4-, 5-, and 6-mc bands track high at the 900-kc point, remove the capacitor from across the appropriate shunt coil, replace with a larger value (see table 6-2), and adjust the appropriate shunt coil at the low end of the band. Increase the capacitor value at the rate of 3 uuf per kc excess error. The shunt coils for the low frequency bands are L82, L83, L84, L85, and L86 respectively. If the 7-, 8-, 9-, 10-, and 11-mc bands track high at the 990-kc frequency, add capacity at the rate of 2 uuf per 1 kc excess error across shunt coils L87, L88, L89, L90, and L91 respectively. Select these capacitors from the 2 percent duramica capacitors ranging in values from 5 to 100 uuf. Use the selected capacitor to replace the one connected in parallel with the appropriate shunt coil for the band having excess tracking error. If tracking frequencies check low, subtract capacity at the same rate as above, repeak the appropriate shunt coil at the low end of the band, and recheck tracking.

(k) If a tracking error correction was needed on the 2-mc band, repeat step *(h)*.

(l) Recheck all bands 3 mc and above at the 000-, 500-, and 990-kc points (last three digits in

TABLE 6-2. CAPACITOR SELECTIONS FOR MASTER OSCILLATOR
(APPLICABLE TO CV-1377/PRC-47 ONLY)

MANUFACTURER'S PART NO.	UUF	MIL DESIGNATION	MIL SPEC
912-2750-00	5		
912-2753-00	10		
912-2756-00	12		
912-2759-00	15		
912-2762-00	18		
912-2765-00	20	CM05E200J03	MIL-C-5
912-2768-00	22	CM05E220J03	MIL-C-5
912-2771-00	24	CM05E240J03	MIL-C-5
912-2773-00	27	CM05E270G03	MIL-C-5
912-2776-00	30	CM05E300G03	MIL-C-5
912-2779-00	33	CM05E330G03	MIL-C-5
912-2782-00	36	CM05E360G03	MIL-C-5
912-2785-00	39	CM05E390G03	MIL-C-5
912-2788-00	43	CM05E430G03	MIL-C-5
912-2791-00	47	CM05E470G03	MIL-C-5
912-2794-00	51	CM05E510G03	MIL-C-5
912-2797-00	56	CM05E560G03	MIL-C-5
912-2800-00	62	CM05E620G03	MIL-C-5
912-2803-00	68	CM05E680G03	MIL-C-5
912-2806-00	75	CM05E750G03	MIL-C-5
912-2809-00	82	CM05E820G03	MIL-C-5
912-2812-00	91	CM05F910G03	MIL-C-5
912-2815-00	100	CM05F101G03	MIL-C-5

dials). If the 500-kc point is still too high (that is, more than 520 kc), go back to the lower end of the band and adjust the appropriate shunt coil for a frequency 10 to 20 kc less than the dial reading plus 500 kc. For example, the 5-mc band oscillator frequency may read 5500, 6032, and 6495 kc at the three frequency check points. With the frequency controls set to 5000 kc, adjust the slug of L85 for a monitored frequency of 5488 kc. This will lower the entire curve approximately 12 kc and the three monitored frequencies will be approximately 5488, 6020, and 6483 kc. All three new frequencies will be within 20 kc of 5500, 6000, and 6500 kc respectively.

(m) In any case, recheck the tracking for three points on any band which has been affected by repairs or adjustments.

(n) Remove the ground from pin 5 on lockout relay K6. Set the receiver-transmitter front panel

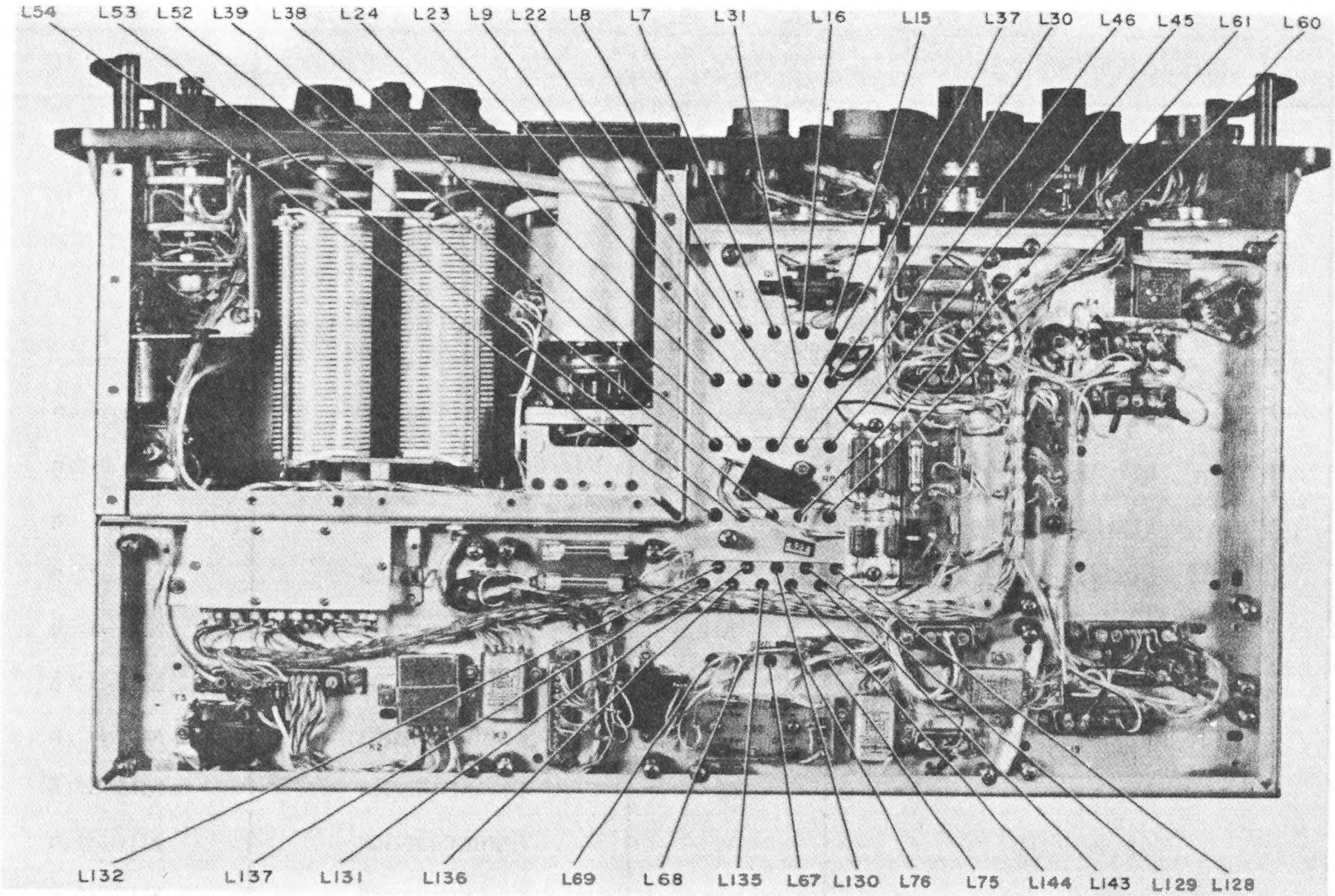


Figure 6-15A. Radio Receiver-Transmitter RT-571/PRC-47, Bottom View, Location of Signal Data Translator CV-1377A/PRC-47 Adjustments

frequency controls to 2000 kc. Using a vacuum-tube voltmeter, monitor the d-c voltages at jacks J5 and J6 on oscillator control module A7 (figure 6-6). Adjust the core in coil L6 until these voltages are within 0.2 volt of each other.

(3) VARIABLE FREQUENCY OSCILLATOR (VFO) TRACKING ADJUSTMENT FOR CV-1377A/PRC-47.

(a) Set frequency controls on receiver-transmitter front panel for 2000 kc. Set POWER-LIGHTS switch to the POWER-OFF position.

(b) Loosen the five screws securing module A3 to the main chassis (figure 6-22) and remove the module. Loosen the fastening screws which hold the bottom cover to the module and remove the cover. Remove the copper vfo shield from the bottom of the vfo subunit.

(c) Check the distance from the bottom of the powdered iron core in coil L145 (figure 6-14a) to the bottom of the coil form. With the slug rack coupler positioned as shown in figure 6-13, this distance should be 0.312 ±0.010 inch and can be adjusted with a screwdriver from the top of the module with the top cover removed.

NOTE

The slot in the slug rack coupler must be vertical during measurement.

(d) Replace the vfo shield and bottom cover plate. Reinstall the module in the main chassis.

(e) Apply power to the system and set up the receiver-transmitter as in normal high frequency operation.

(f) Ground pin 5 on lockout relay K6. This is the pin with the blue wire connection. Grounding this point disables the oscillator control circuitry and places 1.0 volt d-c on each of the two error lines in the oscillator.

(g) Loosely couple a calibrated communications receiver to oscillator frequency monitor jack A7J3.

(h) Set the receiver-transmitter front panel frequency controls to the band which needs alignment (as determined by paragraph 6-9*b*(1) above) and proceed as follows:

NOTE

Refer to table 6-3 to obtain the LOW FREQUENCY CONTROL SETTINGS, HIGH FREQUENCY CONTROL SETTINGS, ADJUSTMENT COILS, MIDBAND FREQUENCIES, and OSCILLATOR FREQUENCIES used in the following alignment procedure.

1. Set the receiver-transmitter front panel frequency controls to the LOW FREQUENCY CONTROL SETTING. Adjust the associated adjustment coil until the monitor at A7J3 indicates the respective OSCILLATOR FREQUENCY within ±1 kc. (See table 6-3.)

2. Set the receiver-transmitter front panel frequency controls to the HIGH FREQUENCY CONTROL SETTING. Adjust the associated adjustment coil until the monitor at A7J3 indicates the respective OSCILLATOR FREQUENCY within ±1 kc. (See table 6-3.)

3. Repeat steps 1. and 2. until both OSCILLATOR FREQUENCIES are within ±1 kc of the desired frequencies.

4. Set the receiver-transmitter front panel frequency controls to the MIDBAND FREQUENCY. A signal should be monitored at A7J3 equal to the MIDBAND FREQUENCY pulse 500 ±8 kc.

(i) If the frequency error in the center of the band exceeds 8 kc but is not more than 16 kc, it

TABLE 6-3. VARIABLE FREQUENCY OSCILLATOR TRACKING ADJUSTMENT CHART FOR CV-1377A/PRC-47

BAND	LOW FREQUENCY CONTROL SETTING (kc)	HIGH FREQUENCY CONTROL SETTING (kc)	OSCILLATOR FREQUENCY (kc)	MIDBAND FREQUENCY SETTING (kc)	ADJUSTMENT COIL
1	2000	2990	2500 3490	2500 2500	L135 L125
2	3000	3990	3500 4490	3500 3500	L136 L126
3	4000	4990	4500 5490	4500 4500	L137 L127
4	5000	5990	5500 6490	5500 5500	L138 L128
5	6000	6990	6500 7490	6500 6500	L139 L129
6	7000	7990	7500 8490	7500 7500	L140 L130
7	8000	8990	8500 9490	8500 8500	L141 L131
8	9000	9990	9500 10, 490	9500 9500	L142 L132
9	10, 000	10, 990	10, 500 11, 490	10, 500 10, 500	L143 L133
10	11, 000	11, 990	11, 500 12, 990	11, 500 11, 500	L144 L134

will be possible to reduce the maximum frequency deviation to less than 8 kc by setting the band ends up or down.

CAUTION

This should be done only on the 3-mc and higher bands. Do not attempt to change the 2-mc band edges. If the 2-mc midband frequency is more than 8 kc high or low, capacitor changes must be made.

For example, if the signal monitored in step *(h)*4, is 12 kc high with the band edges tracked as outlined above, the band may be tracked by setting the frequency about 6 kc low at both ends. When this is done, the center frequency will be about 6 kc high (well within the 8-kc limit). If the center frequency is more than 16 kc high or low with the end points tracked as outlined above, it will be necessary to change the selected capacitor on that band. The selected capacitors corresponding to the various bands are listed in table 6-4. If the midband frequency is too low, change the selected capacitor to the next lower value listed in table 6-5; if the midband frequency is too high, change the selected capacitor to the next higher value listed in table 6-5. After changing capacitors it will be necessary to repeat step *(h)* above.

(j) After tracking the master oscillator, remove the ground from pin 5 on lockout relay K6. Set the receiver-transmitter front panel frequency controls to 2000 kc. Using a vacuum-tube voltmeter, monitor the d-c voltages at jacks J5 and J6 on oscillator control module A7. Adjust the core in coil L145 until these voltages are equal within 0.2 volt dc.

TABLE 6-4. CAPACITOR SYMBOL NUMBERS USED ON BANDS 1 THROUGH 10 (APPLICABLE TO CV-1377A/PRC-47 ONLY) (See figures 6-56A and 6-56B for location of capacitors.)

BAND	SELECTED CAPACITOR
1	C299
2	C301
3	C303
4	C305
5	C307
6	C309
7	C311
8	C313
9	C315
10	C317

TABLE 6-5. CAPACITOR SELECTIONS FOR MASTER OSCILLATOR (APPLICABLE TO CV-1377A/PRC-47 ONLY)

MANUFACTURER'S PART NO.	UUF	MIL DESIGNATION	MIL SPEC
912-3834-00	2		
912-3836-00	5		
912-3838-00	12		
912-3839-00	15		
912-3841-00	20		
912-3842-00	22		
912-3843-00	24		
912-3845-00	27		
912-3853-00	39		
912-3860-00	51		
912-3866-00	62		
912-3875-00	82		
912-3878-00	91		
912-3881-00	100		
912-3884-00	110		
912-3890-00	130		
912-3893-00	150		

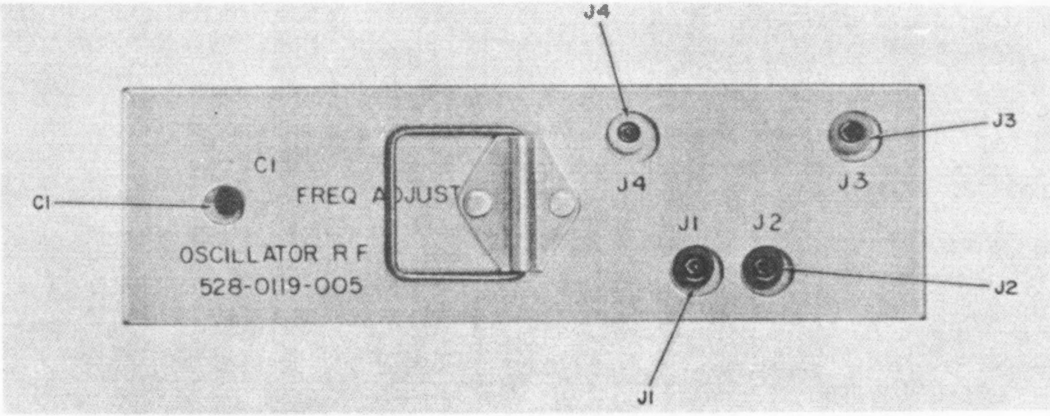


Figure 6-16. Radio Frequency Oscillator O-1032/PRC-47 (A6), Top View, Location of Test Points and Adjustments

c. RADIO FREQUENCY OSCILLATOR CV-1377( )/ PRC-47 (A6) FREQUENCY ADJUSTMENT.

(1) Connect the electronic counter to jack J4 (figure 6-16).

(2) Adjust capacitor C1 until the electronic counter reads 500,000.0 cps.

(3) Disconnect all test equipment.

6-10. RECEIVER CIRCUITS.

a. AMPLIFIER-MODULATOR AM-3507/PRC-47 (A2) TUNED CIRCUITS.

(1) Set the POWER-LIGHTS switch to POWER-OFF. Remove the two screws securing the upper module stiffener and remove stiffener. Loosen two screws securing module A2 to the main chassis (figure 6-22) and remove the module. Using the module A2 extension cable, reconnect the module to its receptacle on the main chassis.

(2) Set the POWER-LIGHTS switch to POWER-ON.

(3) Connect the d-c probe of the vtvm to jack J16 (figure 5-4) on audio frequency amplifier module A1.

(4) Using the signal generator, apply an input signal of 498 kc to jack J3 (figure 6-17) on module A2.

(5) Adjust the level of the 498-kc signal so that the vtvm reads slightly higher than it would without the signal.

(6) On module A2, adjust capacitors C15 and C17, coils L6 and L7, and variable transformer T3 (figure 6-18) for a maximum reading on the vtvm.

b. SIGNAL DATA TRANSLATOR CV-1377( )/ PRC-47 (A3) TUNED CIRCUITS.

(1) Set frequency controls to 2000 kc. Set POWER-LIGHTS switch to POWER-OFF.

(2) Loosen five screws securing module A3 to main chassis (figure 6-22) and remove the module. Loosen the fastening screws which hold the bottom cover to the module and remove the cover.

(3) Set the slug rack coupler to the position shown in figure 6-13 (the slot vertical as shown).

(4) Check the distance from the bottom of the powdered iron core to the bottom of the coil form on coils L1, L2, L3, and L4 (figure 6-14). This distance should be 1/4 inch and can be adjusted with a screwdriver from the top of the module with the top cover removed.

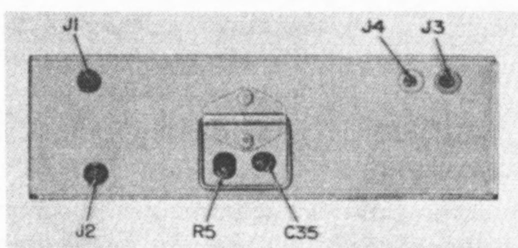


Figure 6-17. Amplifier-Modulator AM-3507/PRC-47 (A2), Top View, Location of Test Points and Adjustments

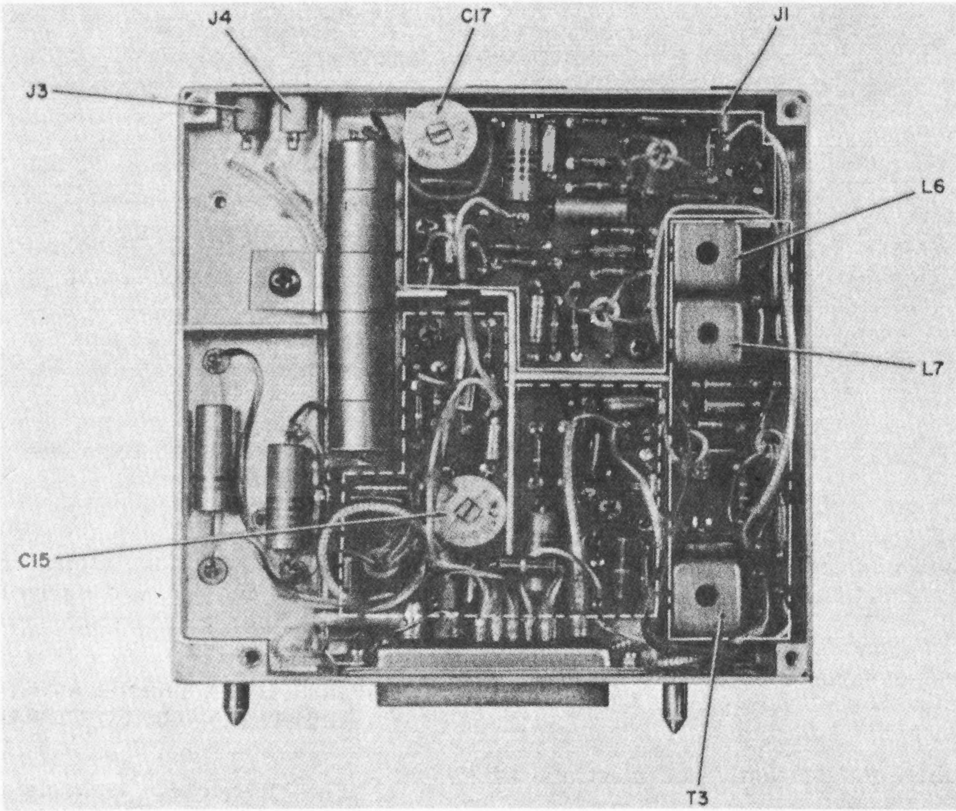


Figure 6-18. Amplifier-Modulator AM-3507/PRC-47 (A2), Side View (Card Assemblies E3, E4, and E5), Location of Test Points and Adjustments

(5) Replace the bottom cover plate and reinstall the module on the main chassis.

(6) Connect the signal generator to the front panel ANTENNA connector.

WARNING

Make certain that the XMTR PWR switch is set to OFF, the CW-FSK/VOICE switch is set to VOICE, and no audio input devices are connected to the AUDIO receptacles. Also check that OPR-TUNE switch is set to OPR.

(7) Connect the d-c probe of the vtvm to jack J16 on Audio Frequency Amplifier AM-3506/PRC-47 (A1) (figure 5-4).

(8) Adjust the front panel frequency controls for a frequency of 2000 kc. Set the POWER-LIGHTS switch to POWER-ON.

(9) Adjust the signal generator frequency for 2001 kc with an output level sufficient to increase the vtvm reading slightly.

(10) Adjust coils L7, L22, and L37 on module A3 (figure 6-15) for a maximum reading on the vtvm.

(11) Adjust the front panel controls for a frequency of 2990 kc.

(12) Adjust the signal generator frequency for 2991 kc.

(13) Adjust L52 on module A3 for a maximum reading on the vtvm.

(14) Repeat steps (9) and (10) setting the frequency controls, in sequence, to the positions indicated below. For each setting, set the frequency of the signal generator to the corresponding setting (1 kc above) and adjust the associated coils for a maximum vtvm reading.

Frequency Controls Setting (kc)	Signal Generator Frequency (kc)	Adjust Coils (see figures 6-14 and 6-15)
3000	3001	L8, L23, L38, L53
4000	4001	L9, L24, L39, L54
5000	5001	L10, L25, L40, L55
6000	6001	L11, L26, L41, L56
7000	7001	L12, L27, L42, L57
8000	8001	L13, L28, L43, L58
9000	9001	L14, L29, L44, L59
10, 000	10,001	L15, L30, L45, L60
11, 000	11,001	L16, L31, L46, L61

(~~12~~) 15 If parts are replaced in the tuned collector circuit of receive mixer Q11 (A3E8Q11), resonate L100 to the i-f frequency by selecting C168 as follows:

(~~13~~) 16 Connect a signal generator through a 0.05-uf blocking capacitor to the base of Q11. Set signal generator output to 8000 microvolts and 500 kc.

(~~14~~) 17 Connect the r-f probe of TS-505D/U to Q11 collector and set to lowest scale.

(~~15~~) 18 Rock the signal generator frequency back and forth across 500 kc and observe the vtvm for peak voltage reading (approximately 0.7 volt).

(~~16~~) 19 If the resonance indication occurs at a frequency less than 490 kc. replace C168 with the next smaller standard capacitance value. If resonance occurs higher than 510 kc, replace C168 with the next larger standard capacitance value.

(~~17~~) 20 If the value of C168 is indeterminable, start with a value of 140 uuf. Select from 2 percent Duramica type capacitors.

c. AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1).

(1) AGC CIRCUIT.

(a) Adjust the front panel frequency controls for a frequency of 2000 kc.

(b) With the signal generator still connected to the front panel ANTENNA connector, adjust the signal generator for a ~~4~~ 0.4-microvolt output at 2001 kc.

(c) Connect the d-c probe of the vtvm to jack J16 on audio frequency amplifier module A1 (figure 5-4).

(d) Adjust variable resistor R52 in module A1 (figure 6-19) to the threshold point where clockwise rotation causes the vtvm indication to increase and counterclockwise rotation has no effect on the vtvm indication.

(2) AUDIO OUTPUT.

(a) With the front panel frequency controls still set for a frequency of 2000 kc and the signal generator still connected to the front panel ANTENNA connector, adjust the signal generator for a 1000-microvolt output at 2001 kc.

(b) Connect Output Meter TS-585D/U between pins L (high) and B (low) of the unused AUDIO receptacle. Adjust TS-585D/U for 300 ohms.

(c) Adjust front panel VOLUME control to the maximum clockwise position.

(d) Adjust variable resistor R54 in module A1 (figure 6-19) for an audio output of ~~750 milliwatts~~ 1 watt as indicated on the output meter.

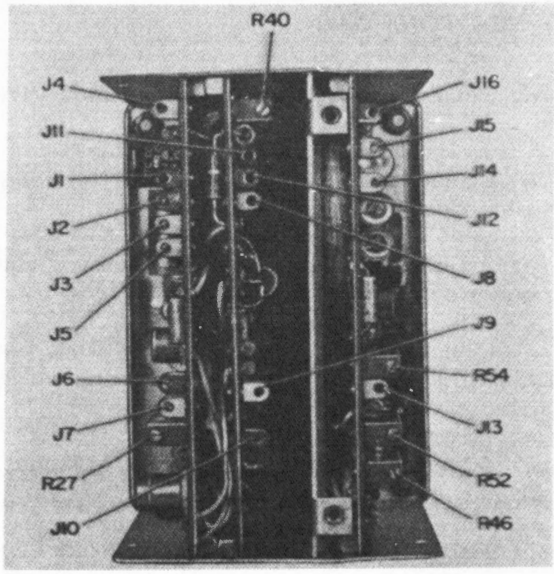


Figure 6-19. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Top View, Location of Test Points and Adjustments

(e) Disconnect all test equipment.

6-11. TRANSMITTER CIRCUITS.

a. AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1).

(1) MICROPHONE AMPLIFIER GAIN.

(a) Adjust the front panel frequency controls for a frequency of 2000 kc.

(b) Connect an audio oscillator to the microphone input, pins C (high) and E (low) on one of the front panel AUDIO receptacles.

(c) Set the audio oscillator output for 0.1 volt at 1000 cps.

(d) Connect the oscilloscope probe to A2P3-3 (or J3-3 on CH-474/PRC-47, figure 6-29), and adjust variable resistor R27 (figure 6-19) on module A1 for a peak-to-peak waveform amplitude of 3.0 volts.

(2) VOX GAIN. (not applicable to radios wired for push-to-talk operation)

(a) Repeat steps *(a)*, *(b)*, and *(c)* in paragraph 6-11*a*(1) above, except in step *(c)* set the audio oscillator output to 0.01 volt instead of 0.1 volt.

(b) Adjust variable resistor R40 on module A1 (figure 6-19) so that the vox relay is energized at this voltage. Vox relay energizing can be determined by observing the waveform at jack J2 on amplifier modulator module A2 (figure 5-4). No signal will be observed at jack J2 until the vox relay is energized.

(3) SIDETONE GAIN.

(a) Set the POWER-LIGHTS switch to POWER-OFF.

(b) Connect the front panel ANTENNA connector to a 50-ohm dummy load.

(c) Adjust the front panel frequency controls for a frequency of 2000 kc.

(d) Connect Output Meter TS-585D/U between pins L (high) and B (low) of the unused AUDIO receptacle.

(e) Adjust the front panel VOLUME control to the maximum clockwise position.

(f) Set the POWER-LIGHTS switch to POWER-ON.

(g) Set the front panel OPR-TUNE switch to TUNE and the XMTR POWER switch to LO. Adjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(h) Set the XMTR PWR switch to HI and readjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(i) Adjust variable resistor R46 on audio frequency amplifier module A1 (figure 6-19) for an audio output of 100 milliwatts as indicated on the output meter.

b. AMPLIFIER-MODULATOR AM-3507/PRC-47 (A2).

(1) TRANSMITTER 500-KC ALIGNMENT.

(a) Set POWER-LIGHTS switch to POWER-OFF.

(b) Loosen two screws securing amplifier-modulator module A2 to main chassis (figure 6-22) and remove the module. Using the module A2 extension cables, reconnect the module to its receptacles on the main chassis.

(c) Connect the a-c probe of the vtvm to jack J104 (figure 5-5).

(d) Connect the front panel ANTENNA connector to the 50-ohm dummy load.

(e) Adjust the front panel frequency controls to 2000 kc.

(f) Set the POWER-LIGHTS switch to POWER-ON.

(g) Set the front panel OPR-TUNE switch to TUNE and the XMTR PWR switch to LO. Adjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(h) Set the XMTR PWR switch to HI and readjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(i) Adjust variable transformer T2 on module A2 (figure 6-20) for a maximum indication on the vtvm.

(j) Set POWER-LIGHTS switch to POWER-OFF.

(k) Remove the module extension cables and reinstall the module in the main chassis.

(2) BALANCED MODULATOR ADJUSTMENT.

(a) Set the front panel OPR-TUNE switch to OPR. Make certain that the POWER-LIGHTS switch is set to POWER-OFF.

(b) Connect the front panel ANTENNA connector to the 50-ohm dummy load.

(c) Adjust the front panel frequency controls to 2000 kc.

(d) Connect the audio oscillator to the microphone input, pins C (high) and E (low) on one of the front panel AUDIO receptacles.

(e) Adjust the oscillator for an output of 0.1 volt at 5000 cps.

(f) Set the POWER-LIGHTS switch to POWER-ON. Set the CW-FSK/VOICE switch to CW-FSK.

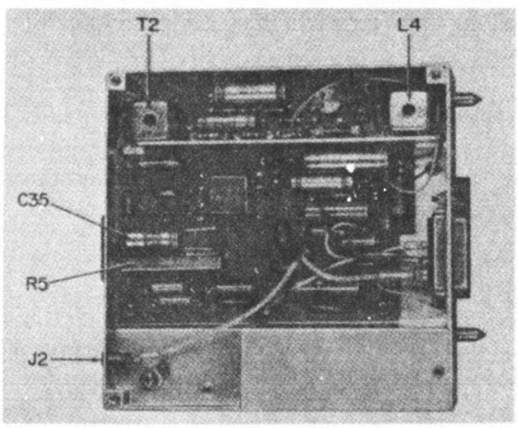


Figure 6-20. Amplifier-Modulator AM-3507/PRC-47 (A2), Side View (Card Assemblies E1 and E2), Location of Test Points and Adjustments

(g) Connect the oscilloscope probe to jack J3 on Signal Data Translator CV-1377( )/PRC-47 (A3) (figure 5-4) and adjust capacitor C35 and variable resistor R5 on module A2 (figure 6-17) for a minimum indication on the oscilloscope. Since these two controls are interactive, adjust first one and then the other until neither produces an appreciable decrease in oscilloscope indication.

c. SIGNAL DATA TRANSLATOR CV-1377( )/ PRC-47 (A3).

(1) TUNED CIRCUITS.

(a) Set the frequency controls to 2000 kc. Set the POWER-LIGHTS switch to POWER-OFF.

(b) Loosen five screws securing Signal Data Translator CV-1377( )/PRC-47 (A3) to main chassis (figure 6-22), and remove the module. Loosen the fastening screws which hold the bottom cover to the module and remove the cover.

(c) Set the slug rack coupler to the position shown in figure 6-13 (the slot vertical as shown).

(d) Check the distance from the bottom of the powdered iron core to the bottom of the coil form on coil L5 (figure 6-14). If a red dot appears on the top of the coil form (as viewed from the bottom of the translator) adjust the core to a depth of 9/32 inch. If no red dot is visible adjust the core to a depth of 1/4 inch. This can be adjusted with a screwdriver from the top of the module with the top cover removed.

(e) Replace the bottom cover plate and reinstall the module in the main chassis.

(f) Connect the front panel ANTENNA connector to the 50-ohm dummy load.

(g) Connect the a-c probe of the vtvm to jack J104 (figure 5-5).

(h) Set frequency controls to 2990 kc.

(i) Set the front panel OPR-TUNE switch to TUNE and set XMTR PWR switch to HI.

(j) Set POWER-LIGHTS switch to POWER-ON.

(k) Adjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(l) Adjust coil L67 on Signal Data Translator CV-1377( )/PRC-47 (A3) (figure 6-15) for a maximum output indication on the vtvm.

(m) Adjust, in sequence, coils L68 through L76 (figures 6-14 and 6-15). For each adjustment, set the frequency controls to the frequency specified below and adjust the associated coil for a maximum output indication on the vtvm.

Frequency Control Setting (kc)	Adjust Coil
3000	L68
4000	L69
5000	L70
6000	L71
7000	L72
8000	L73
9000	L74
10, 000	L75
11, 000	L76

(2) TRANSMIT MIXER BALANCE.

(a) Set the POWER-LIGHTS switch to POWER-OFF.

(b) Set the frequency controls to 11000 kc.

(c) Connect the front panel ANTENNA connector to the 50-ohm dummy load.

(d) Set the OPR-TUNE switch to TUNE.

(e) Set the POWER-LIGHTS switch to POWER-ON.

(f) Adjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on XMTR OUTPUT meter.

(g) Connect the AN/URR-23A receiver antenna to jack J1 on module A3 (figure 6-14) and tune the receiver to 11500 kc.

(h) Adjust variable resistor R150 on module A3 (figure 6-14) for a minimum indication on the receiver.

(3) TRANSMIT GAIN CONTROL.

(a) Set the POWER-LIGHTS switch to POWER-OFF.

(b) Set the frequency controls to 11000 kc.

(c) Connect the front panel ANTENNA connector to the 50-ohm dummy load.

(d) Connect the a-c probe of the VTVM to V104 (located on the bottom side of the manuscript.

(e) Set the OPR TUNE switch to TUNE and the XMTR PWR switch to No. 1.

(f) Turn the equipment on, and adjust the POWER AMPLIFIER TUNE and LOAD controls to maximum power output.

(g) Adjust R148 on module A3 (figures 6-14 and 6-14A) clockwise as long as the VTVM indication continues to increase. Stop at the point where further adjustment makes no difference.

d. POWER SUPPLY PP-3518/PRC-47 (A5).

(1) POWER AMPLIFIER BIAS.

(a) Set the XMTR PWR switch to OFF and set the POWER-LIGHTS switch to POWER-ON.

(b) Connect the d-c probe of the vtvm to jack J2 on Power Supply PP-3518/PRC-47 (A5) (figure 6-21).

(c) Set the front panel CW-FSK/VOICE switch to CW-FSK and adjust variable resistor R3 on Power Supply PP-3518/PRC-47 (A5) (figure 6-21) until the vtvm reads -110 volts.

(2) DRIVER BIAS.

(a) Set the XMTR PWR switch to OFF and set the POWER-LIGHTS switch to POWER-ON.

(b) Connect the d-c probe of the vtvm to jack J1 on Power Supply PP-3518/PRC-47 (A5) (figure 6-21).

(c) Set the front panel CW-FSK/VOICE switch to CW-FSK and adjust variable resistor R4 on module A5 (figure 6-21) until the vtvm reads -32 volts.

(3) REGULATED +20-VOLT D-C ADJUSTMENT.

(a) Set the XMTR PWR switch to OFF and set the POWER-LIGHTS switch to POWER-ON.

(b) Connect the d-c probe of the vtvm to A5J8 on the power supply. Refer to figure 6-21.

(c) Adjust R22 for +20-volt indication on the vtvm.

e. MAIN CHASSIS, HUM BALANCE.

(1) Set the POWER-LIGHTS switch to POWER-OFF.

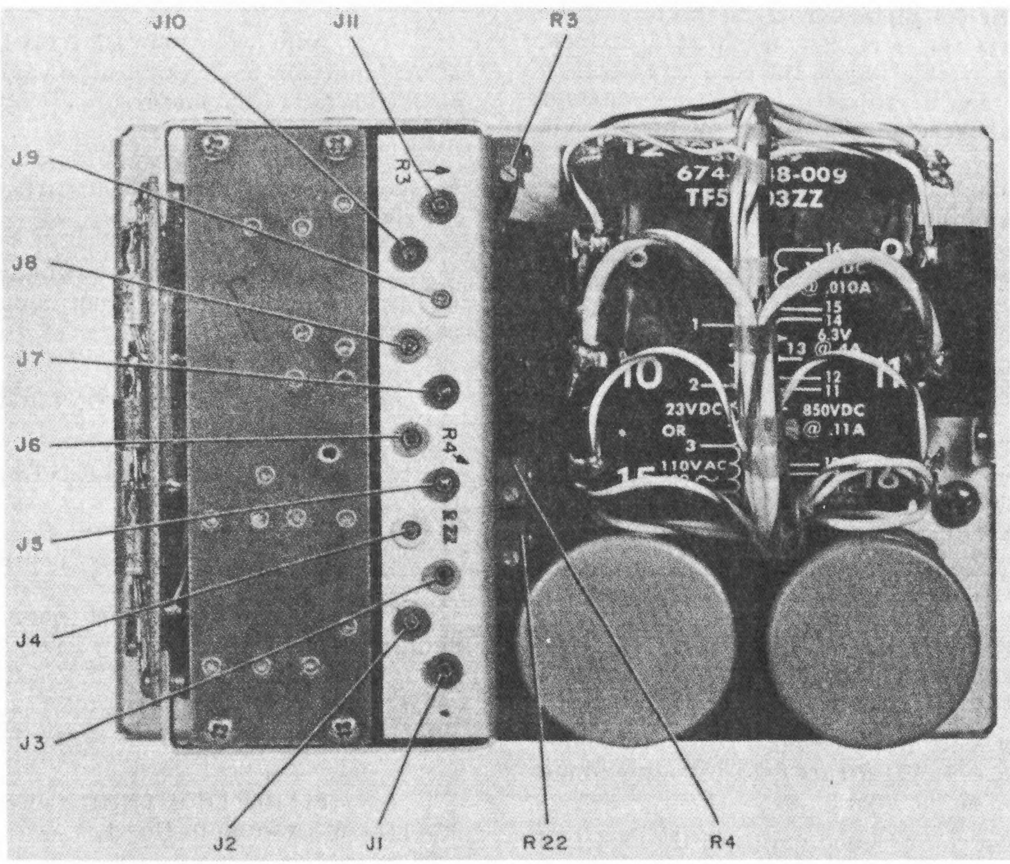


Figure 6-21. Power Supply PP-3518/PRC-47 (A5), Top View, Location of Test Points and Adjustments

(2) Set the frequency controls to 2000 kc.

(3) Connect the front panel ANTENNA connector to the 50-ohm dummy load. Connect the oscilloscope to the ANTENNA connector.

(4) Connect the audio oscillator to the microphone input, pins C (high) and E (low) on one of the front panel AUDIO receptacles.

(5) Adjust the audio oscillator for an output of 0.1 volt at 2000 cps.

(6) Set the OPR-TUNE switch to OPR and set the XMTR PWR switch to HI.

(7) Set the CW-FSK/VOICE switch to CW-FSK.

(8) Set the POWER-LIGHTS switch to POWER-ON.

(9) Adjust the POWER AMPLIFIER TUNE and LOAD controls for maximum power output as indicated on the XMTR OUTPUT meter.

(10) Adjust variable resistor R121, located at bottom of power amplifier compartment (figure 6-30) for a minimum modulation indication on the oscilloscope.

6-12. REMOVAL OF MODULES.

WARNING

The receiver-transmitter contains high voltage circuits which are dangerous and may be fatal if contacted by operating personnel. Before attempting to remove any components from the receiver-transmitter, disconnect all power input cables and set all power switches to off.

Access to internal components of Radio Receiver-Transmitter RT-671/PRC-47 requires removing the main chassis from its case. Loosen the six screws which secure the receiver-transmitter cover to the case and remove the cover. Set the receiver-transmitter upside down on the handles and loosen the six screws on the bottom of the case and remove the case from the main chassis. All chassis components are now accessible for removal.

WARNING

Extreme care should be exercised by personnel working on Radio Receiver-Transmitter RT-671/PRC-47. High-voltage circuits, particularly in Power Supply PP-3518/PRC-47 and in the power amplifier compartment, are dangerous and may be fatal if contacted. Before attempting any work on the receiver-transmitter, refer to figure 6-22 and short circuit to ground the two high-voltage power supply terminals (CH-474/PRC-47, J1-A1 and J1-A2) to discharge any high-voltage capacitors in Power Supply PP-3518/PRC-47 (A5) or the power amplifier compartment.

Figure 6-22 is a bottom view of Electrical Equipment Chassis CH-474/PRC-47, showing the location of the module captive retaining screws. Before removing any modules except the power supply, the appropriate upper module stiffener(s) must be removed. To release a module, loosen the associated captive screws shown in figure 6-22 and lift the module, slowly but firmly from the top side of the chassis. These procedures are identical for all modules except signal data translator module A3 and oscillator control module A7. Before removing these modules, set the frequency controls on the receiver-transmitter front panel so that the KILOCYCLES indicator reads 2000. This aligns the couplings on the frequency controls and on modules A3 and A7 in a vertical position so that these modules can be lifted from the chassis.

6-13. DISASSEMBLY, ADJUSTMENT, REPAIR, AND REASSEMBLY.

a. GENERAL. - The following paragraphs describe disassembly, adjustment, repair, and reassembly procedures for the modules and other major components comprising the receiver-transmitter. Disassembly should be performed only to the extent necessary to accomplish a repair or adjustment. Parts location diagrams, exploded views, and schematics are provided to aid maintenance technicians in performing the repair procedures. Replace any component that is found defective and cannot be repaired. Refer to the parts list for the correct stock number of replacement parts.

(1) SOLDERING REQUIREMENTS. - When repairing or replacing wiring on electronic components, special care should be taken to maintain high quality workmanship, paying particular attention to soldering, Military Specification MIL-S-6872. Use rosin-core wire solder containing 60 percent tin and 40 percent lead. This solder wire is 1/16 inch in diameter and furnished in 1-pound quantities under FSN 3439-753-1874. After soldering, clean the joints with denatured alcohol, FSN 6810-222-2373 (5 gallons), to remove traces of rosin or other foreign matter.

Replacement wiring should be of the same length and gage as the defective wiring being replaced. Care should also be taken in properly dressing replacement wiring to prevent signal pickup and cross-coupling which can occur at the high frequencies at which the receiver-transmitter operates.

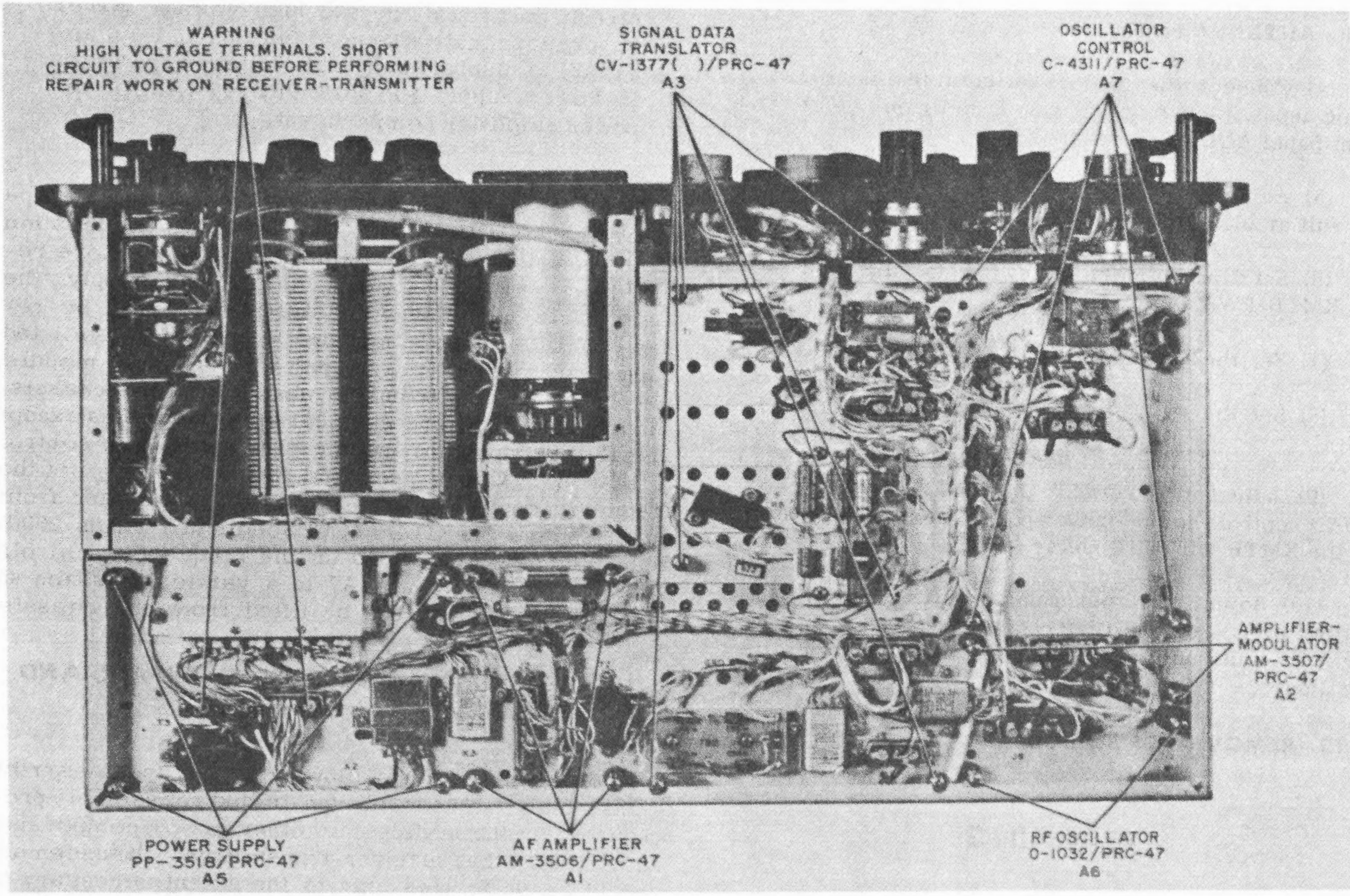


Figure 6-22. Receiver-Transmitter, Bottom View, Location of Module Retaining Screws

CAUTION

When soldering heat sensitive components such as transistors, thermistors, and diodes, use a pair of long-nose pliers as a heat sink and a low-voltage pencil-type iron to prevent these components from being damaged by excessive amounts of heat.

(2) REPLACING COMPONENT PARTS ON PRINTED CIRCUIT BOARDS.

(a) Clip the leads of the defective component being replaced close to the terminal holes.

(b) Place the soldering iron tip against the connection on the solder side of the board. When sufficient heat has melted the solder area, push the component lead through the board with the aid of a small pick and clear the opening to accommodate the replacement parts.

(c) Insert the leads of the replacement part in the terminal holes and push the leads through.

(d) Place the soldering iron tip on the lead coming through the hole, from the opposite side of the board, and apply solder to the terminal. Remove the iron as soon as solder flows freely.

(e) Clip the leads as short as possible.

CAUTION

Use extreme care when soldering leads of component parts on printed circuit boards. The printed circuit is fused to the insulated board by a bonding material which, under extreme heat conditions, will lose its effectiveness, permitting the printed circuit to raise and separate from the panel.

(3) REPAIR OF PRINTED CIRCUIT BOARDS. - Repair of printed circuit boards is not recommended unless repair requirements are minor. It is usually more economical to replace the printed circuit board (less the mounted components). Repairs can be made, however, using the following procedures.

(a) Eliminate the progression of a crack in the board by drilling a stop hole (No. 65 drill) at the end of the crack.

(b) If a crack extends under or through the printed circuit, a suitable conventional wire may be soldered to the printed circuit to bridge the area of the crack. Standoff terminals or eyelets may be added to facilitate attachment of component leads or hook-up wire, provided the electrical circuit is not altered.

(c) If an area of the printed circuit has lifted from the board without cracking, and for a length of no more than 1 inch, the printed circuit can be fastened to the board as follows. Clean the raised portion of the printed circuit with technical acetone, FSN 6810-184-4795 (1 gallon). Prepare a bonding material of sealing compound (epoxy) FSN 8030-589-8477, and hardener, sealing compound, FSN 8030-543-2587. Both these stock numbers are supplied in 1/2-pint quantities; mix only enough to do the job. Press down on the raised printed circuit to flatten it and apply the bonding material in such a manner that it extends at least 1/6 inch past the ends and edges of the raised area. Allow the bonding material to air-dry for 24 hours.

b. AUDIO FREQUENCY AMPLIFIER AM-3506/PRC-47 (A1).

(1) DISASSEMBLY. - Remove cover of Audio Frequency Amplifier AM-3506/PRC-47 (A1) by pulling up on the cover handle while holding the base of the module. Figure 6-32 shows the location of the module card assemblies. To remove the card assemblies, remove the two fastening screws on each side of the module and slide the card assemblies straight up out of the module. Card E3 may be removed independently, while card E1 and E2 must be removed simultaneously since they are interconnected by wiring. If wiring between cards E1 and E2, or wiring between any of the cards and the module connector must be removed, tag the disconnected wire so that it can be identified and reconnected correctly during reassembly.

(2) REPAIR. - Replace any component parts which are defective. Figures 6-33, 6-34, and 6-35 show the location of component parts on the three card assemblies. Also refer to paragraphs 6-13*a* (1) through (3).

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install the card assemblies in their respective slots as shown in figure 6-32 and secure in place with the two fastening screws on each side of the module. Replace the module cover, making certain that the cover is held firmly in place by the retaining clips in the module.

c. AMPLIFIER-MODULATOR AM-3507/PRC-47 (A2).

(1) DISASSEMBLY. - Remove the screws which fasten the two side covers to amplifier-modulator module A2 and remove covers. All component parts mounted on module card assemblies are now accessible. Figures 6-36 and 6-37 show the location of the module card assemblies. If necessary to remove a card assembly, loosen the screws which fasten card assembly to the module and remove card. Also unsolder any interconnecting wiring if required. Tag all disconnected wire so they can be identified and reconnected correctly during reassembly.

(2) REPAIR. - Replace any component parts found defective. Figures 6-36 and 6-37 show the location of component parts on the five card assemblies. Also refer to paragraphs 6-13a(1) through (3).

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install card assemblies in respective slots as shown in figures 6-36 and 6-37 and secure in place with fastening screws. Replace the two side cover. Secure covers in place with fastening screws.

d. SIGNAL DATA TRANSLATOR CV-1377( )/ PRC-47 (A3).

(1) DISASSEMBLY. - Remove the screws which fasten the top and bottom covers to signal data translator module A3 and remove the covers. Figures 6-38 and 6-39 show the location of the module card assemblies. To remove cards E47 and E48, remove the four fastening screws from the side of the module and slide the cards out from the top of the module. To remove cards TB1, TB2, E43, E44, and E46, remove one or two fastening screws, as applicable, and slide the cards out from the bottom of the module.

In order to remove any of the switch cards, it is necessary to first remove the frequency range switch shaft. Align the switch coupler as shown in figure 6-13 so that the groove in the coupler is vertical and the rivet on the coupler is at the lower right. The coupler should normally be in this position in order to remove (or install) module A3 from the main chassis. With the coupler in the position described, remove the C-shaped retaining ring from the rear of the switch shaft which extends through the switch cards to the rear of the module (figure 6-23). The shaft may now be withdrawn from the front of the module. Slide out the switch cards, being careful not to disturb the switch positions on the cards. Some of the card assemblies in the signal data translator assembly are fastened together, making it necessary to remove these card assemblies simultaneously. The assemblies that must be removed simultaneously are listed below:

CV-1377/PRC-47	CV-1377A/PRC-47
Card assemblies S1, S2, S3	Card assemblies S1, S2, S3
Card assemblies S6 and S7	

Once they are removed from the module, they may be separated from each other by removing the attaching screws.

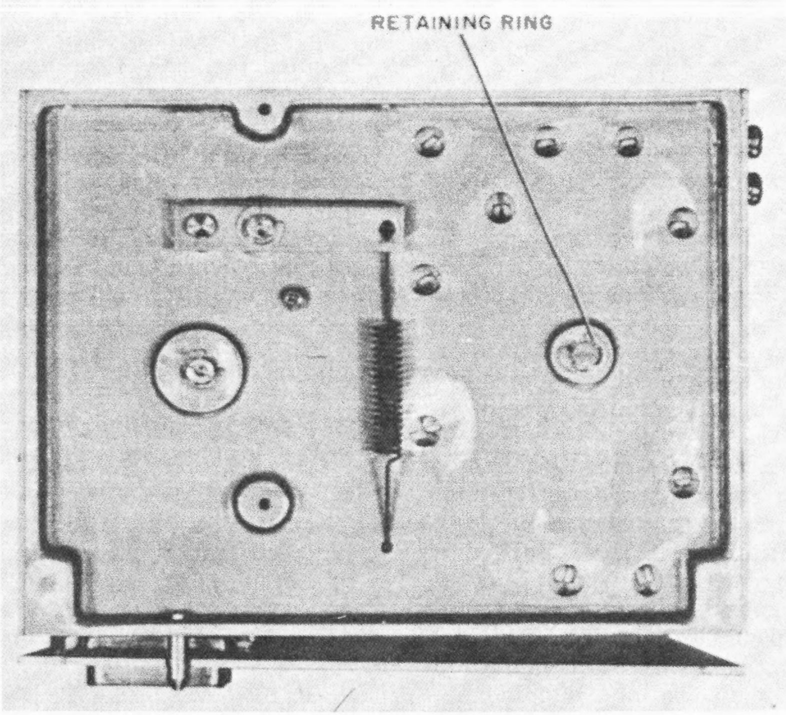


Figure 6-23. Signal Data Translator CV-1377( )/PRC-47(A3), Rear View, Location of Frequency Range Switch Shaft Retaining Ring

To completely disconnect and remove either card assemblies or switch cards, it may be necessary to unsolder interconnecting wires. Tag these wires so that they can be identified and reconnected correctly during reassembly.

(2) REPAIR. - Replace any component parts found defective. Figures 6-40 through 6-56E show the location of component parts on the seven card assemblies and nine switch cards. Also refer to paragraphs 6-13*a*(1) through (3).

Note that tubes V1 and V2, on card assemblies TB1 and TB2, respectively, are connected directly to the card assembly wiring. To remove these tubes when defective, unsolder the connections at the terminals to which tube leads are connected. Replace with new tube and resolder connections. Figures 6-40 and 6-41 show the correct wire connections for tubes V1 and V2, respectively.

To replace defective driver tube V3 (figure 6-38), remove the four screws which fasten the heat sink to the side of the module. Remove the heat sink and tube. Place a new tube in the socket and push the heat sink and corrugated contactor over the new tube. Replace the four screws in the side of the module, securely fastening the heat sink to the module. Figure 6-56 shows the location of parts in the driver tube V3 compartment.

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install the card assemblies in their respective slots as shown in figures 6-38 and 6-39 and secure in place with fastening screws.

Before replacing the switch cards, make certain that all switches are set in the No. 1 position as shown in figure 6-24. Reassemble switch cards S1, S2, and S3 (and cards S6 and S7 in Signal Data Translator CV-1377/PRC-47) before reinstalling them in the module. Replace switch card groups, in addition to switch cards S4, S5, S8, and S9, in their respective slots as shown in figures 6-38 and 6-39.

NOTE

The keyways of switch card assemblies S6, S7, and S10 in Signal Data Translator CV-1377A/PRC-47 should be pointed toward the bottom of the assembly during reassembly.

With all switch cards installed, replace the frequency range switch shaft, being very careful not to disturb the switch positions or to use excessive force while sliding the shaft through the switch cards. Ensure that the groove in the switch coupler is vertical and the rivet on the coupler is at the lower right before inserting shaft (figure 6-13). When the shaft is completely reinstalled, replace the C-shaped retaining ring in the grooved part of shaft which extends through the rear of the module (see figure 6-23).

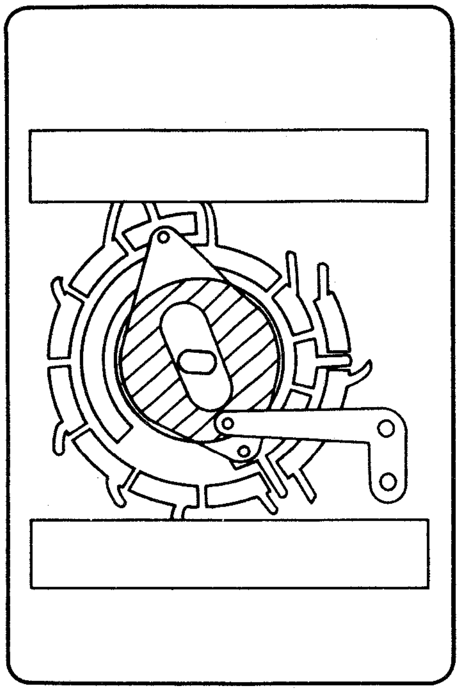


Figure 6-24. Signal Data Translator CV-1377/PRC-47 (A3), Switch Card Rotor Shown in No. 1 Position

With all card assemblies and switch cards properly installed and secure, replace top and bottom covers of module A3 and secure with fastening screws.

e. POWER SUPPLY PP-3518/PRC-47 (A5).

(1) DISASSEMBLY. - Remove screws which fasten plastic cover to power supply module A5 and remove cover. Remove component mounting boards as necessary to accomplish repairs by removing attaching screws. To completely disconnect and remove a component mounting board, it may be necessary to unsolder interconnecting wires. Tag these wires so that they can be identified and reconnected correctly during reassembly. Large major components such as power transformers T1 and T2 are mounted directly to the module chassis. The mounting screws and connecting wiring must be removed in order to remove these components. Figures 6-57 and 6-58 show the location of these major components and the component mounting boards.

(2) REPAIR. - Replace any component parts which are defective. Figure S 6-57 through 6-60 show the location of chassis-mounted major components and component parts on the component mounting boards. Also refer to paragraphs 6-13*a*(1) through (3).

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install the component mounting boards in their respective slots as shown in figures 6-57 and 6-58. Secure in place with fastening screws. Replace the plastic cover over the module and fasten in place with screws.

f. RADIO FREQUENCY OSCILLATOR O-1032/PRC-47 (A6).

(1) DISASSEMBLY. - Remove cover of radio frequency oscillator module A6 by pulling up on the cover handle while holding the base of the module. Figures 6-61 and 6-62 show the location of the module card assemblies. All component parts mounted on card assembly E1 and on the module chassis are now accessible. If it is necessary to remove card assembly E1, loosen the screws which fasten the card assembly to the module and remove the card. Also unsolder any interconnecting wiring if required. Tag all disconnected wires so that they can be identified and reconnected correctly during reassembly.

(2) REPAIR. - Replace any component parts found defective. Figures 6-61 and 6-62 show the location of component parts on card assembly E1 and on the module chassis. Also refer to paragraphs 6-13*a*(1) through (3).

No attempt should be made to repair card assembly E2 which is partially encapsulated in foam rubber. If defective, replace the entire card as follows:

Unsolder and tag the wires which are connected to terminals at the bottom of the card. Push the card out of its compartment in the module and replace with a new card. Make certain that the new card is properly oriented with the terminal connections at the bottom of the module. Reconnect and solder the external wiring to the card. The defective card assembly should be returned to a Marine Corps Supply Center for servicing and repair.

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install card assembly E1 in its appropriate slot as shown in figure 6-61 and secure in place with fastening screws. Replace the module cover making certain that the cover is held firmly in place by the retaining clips in the module.

g. OSCILLATOR CONTROL C-4311/PRC-47 (A7).

(1) DISASSEMBLY. - Remove the screws which fasten the top and bottom covers to oscillator control module A7 and remove the covers. Figure 6-63 shows the location of the module card assemblies. The first three cards (starting from rear of module), E1, E2, and E3, are removed simply by sliding the cards out through the bottom of the module. To remove card E4, unsolder a single wire connection to card E5 (tag the disconnected wire), then slide out through the bottom of the module. To remove card E5, remove the four screws which fasten the card to both sides of the module, carefully back the card off the shaft extending from the gear assembly, and slide the card out through the bottom of the module.

Cards E6, E7, and E8 cannot be removed without first moving the two switch shafts. Align the switch couplers as shown in figure 6-8 so that the groove on each coupler is vertical and the rivet on each coupler is at the lower right. The couplers should normally be in this position in order to remove (or install) module A7 from the main chassis. Note that the coupler on the left must be at its full counterclockwise position (10 turns), in addition to the groove being vertical and the rivet being at the lower right. To remove the switch shafts, remove the three screws located in the triangular-shaped retaining plates behind the couplers and then withdraw the shafts. Cards E6, E7, and E8 may now be removed by sliding them out through the bottom of the module. Be careful not to disturb the switch posiions on cards E7 and E8.

To completely disconnect and remove any of the card assemblies from the module and to separate card assemblies E6, E7, and E8 from each other. it is necessary to unsolder interconnecting wiring. Tag these wires so that they may be identified and reconnected during reassembly.

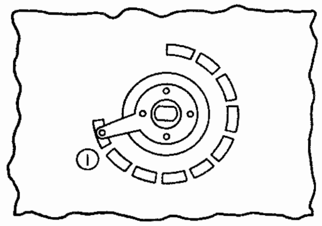
(2) REPAIR. - Replace any component found defective. Figures 6-64 through 6-70 show the location of component parts on the eight card assemblies. Also refer to paragraphs 6-13*a*(1) through (3).

(3) REASSEMBLY. - Replace and solder any wires which were disconnected during disassembly and repair. Install card assemblies E1 through E4 and E6 in their respective slots, as shown in figure 6-63, through the bottom of the module.

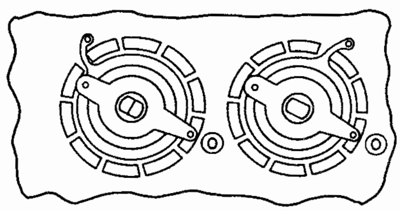
Before installing cards E5, E7, and E8, position the switch rotors on these cards in the No. 1 position as shown in figure 6-25. In addition, it is also necessary to position the gear assembly to the No. 1 position. This is accomplished by rotating the Geneva drive shaft (extending from the gear assembly located behind card E6) counterclockwise, viewed from the front of the module, until the gear assembly stops are engaged. Install card E5 in the applicable slot (figure 6-63), guiding the D hole in the switch rotor onto the shaft extending from the rear of the gear assembly. Resolder the wire between cards E4 and E5 removed during disassembly and secure the card in place with four screws.

Install cards E7 and E8 in the applicable slot shown in figure 6-63. Make certain that the switch rotors are in the No. 1 position as shown in B of figure 6-25. With the gear assembly still in the No. 1 position (fully counterclockwise), insert both switch shafts from the front of the module through the switches on cards E7 and E8. Be careful not to disturb the switch positions or to use excessive force. The S1 switch shaft (left side viewed from front) should be inserted so that the notched end mates with the shaft from the gear assembly. Also, both shafts must be installed with the groove in the switch coupler vertical and the rivet at the lower right as shown in figure 6-8. Secure both shafts by fastening the triangular shaped retaining plates to the front of the module using three screws and lock washers in each plate.

With all card assemblies installed and secure, replace top and bottom covers of module A7 and secure in place with fastening screws.



A. CARD ASSEMBLY E5 SWITCH ROTOR IN NO. 1 POSITION



B. CARD ASSEMBLIES E7 AND E8 SWITCH ROTORS IN NO. 0 POSITION.

Figure 6-25. Oscillator Control C-4311/PRC-47 (A7), Card Assemblies E5, E7, and E8 Switch Rotors in No. 1 Positions

h. POWER AMPLIFIER COMPARTMENT. - The power amplifier compartment contains the power amplifier tube, the load and tune coils and various smaller components (resistors, capacitors, etc). Figure 6-30 and 6-31 show the location of these components. However, special procedures for disassembly, repair, and replacement are required only for the power amplifier tube and the load and tune adjustment mechanism. These procedures are described in the following paragraphs.

(1) REPLACEMENT OF POWER AMPLIFIER TUBE V101. (See figure 6-30.) - The power amplifier tube is withdrawn and replaced through an access hole on front panel of the receiver-transmitter. However, access must be made to the power amplifier compartment in order to remove components connected to the tube.

WARNING

Do not attempt to remove or install the power amplifier tube while power is being applied to the receiver-transmitter. In addition, short circuit to ground terminals A1 and A2 on main chassis jack J1 (figure 6-14) in order to discharge any high voltages (+1500 volts dc and +650 volts dc) which may be retained in power supply module A5.

Loosen screws and remove cover from bottom of power amplifier compartment. Also loosen screws and remove access cover located below the power amplifier load-tune chart on the receiver-transmitter front panel. Be careful not to damage the gasket. Save the gasket for replacement. Loosen the two screws which fasten the thermal cutout to the power amplifier tube heat sink and remove the thermal cutout. From the front panel access hole, remove the power amplifier tube plate cap and push the cap out through the access hole in the side of the heat sink. Push up on the base of the tube from the power amplifier compartment and withdraw the tube and heat sink together from the front panel access hole. Remove the tube from the heat sink, noting the position of the large pin on the tube with respect to the heat sink. Insert a new tube into the heat sink in a corresponding position. Replace the tube and heat sink through the front panel access hole, properly positioning the tube, and then plug the tube into the socket. Rotate the heat sink enough to line up its mounting holes with those in the front panel. Replace the tube cap on the tube and install the thermal cutout on the heat sink, securing it in place with two fastening screws. Replace the front panel access cover and the power amplifier compartment bottom cover and secure both in place with fastening screws, making certain the access cover gasket is in place.

(2) LOAD AND TUNE MECHANISM.

(a) DISASSEMBLY. - Disassemble the load and tune mechanism only to the extent necessary to accomplish repair. Disassemble the load and tune mechanism with the aid of the functional mechanical diagram, figure 6-26. Note the following:

CAUTION

Use extreme care to avoid damaging contact fingers at the rear of the coils during disassembly.

1. Remove E-ring and gear (7) from shaft on rear of front panel.

2. Remove the front panel from the main chassis (refer to paragraph 6-13*j*).

3. Remove clamp from front end of shaft on load coil (3). Remove rear shaft of tune coil (5) from hole in the gear plate and remove clamp (6) from the shaft.

4. Remove the screws, retaining washers, and shim washers which secure load coils (2, 4) to the gear plate in the rear of the power amplifier.

5. Remove load coils (2, 3, 4). Note that gears on rear of load coils (2, 3, 4) are integral parts of the assembly and should not be removed separately. Remove E-ring and idler gear (1) from the stub shaft on the gear plate.

(b) REPAIR. - Examine all the items in the disassembled load and tune mechanism for damage or excessive wear. Note particularly the condition of the coil windings, gear teeth, and plastic bearings. If any of these items show signs of damage or excessive wear, replace them.

If the rollers on the inductors become squeaky, add Beacon #325 lubricant to the roller shafts, then wipe off the shafts with a clean soft cloth. Enough lubricant will remain on the roller shafts due to the consistency of the lubricant.

(c) REASSEMBLY. - Reassemble the load and tune mechanism with the aid of figure 6-26. Note the following:

CAUTION

Make sure that the coil contact fingers touch the contacts on the rear of the coils. Be careful not to damage the contact fingers during reassembly.

1. Mount idler gear (1) on the gear plate stub shaft. Secure with E-ring.

2. Install load coil (2) and mesh its gear with idler gear (1). Rotate the load coil counterclockwise to the stop. Scribe marks on the idler gear will be normal to a line through the centers of the gear on the load coil and the idler.

3. Mesh the gears on load coils (3, 4), in order, with idler gear (1), aligning the scribe marks on the idler gear with those on the load coils.

4. Install screw and retaining washer (and shim washers, as necessary), into the rear end of the shafts of the top two load coils (2, 4) through the rear of the power amplifier compartment. With a feeler gauge, check that clearance between the rear gear and its plastic bearing is 0.010 to 0.013 inch.

5. Assemble gear clamp (6) on rear end of tune coil shaft (5). Set shaft of the tune coil into the gear plate hole. Assemble gear clamp on front shaft of load coil (3).

6. Assemble the front panel onto the coil shafts. Adjust clamps on load coil shaft (3) and tune coil shaft (5) for 0.010- to 0.013-inch end play.

7. Assemble gear (7) on its shaft and secure with E-ring. Locate the stop idler as shown. If gear (7) cannot make a complete revolution away from its stop, remesh the gear one tooth away from the stop.

8. With load and tune coils (3, 5) fully counterclockwise against the stops, the shaft flats should be facing upward. Reassemble the front panel to the main chassis in the reverse order described in paragraph 6-13*j*. Replace the LOAD and TUNE control knobs.

NOTE

With the load and tune mechanism synchronized, the coil roller contacts should be set on the last turn at the rear of the coils and the TUNE and LOAD control knobs should be at zero.

i. FREQUENCY SELECTOR MECHANISM.

(1) DISASSEMBLY. - Disassemble the frequency selector mechanism only to the extent necessary to accomplish repair. Disassemble the frequency selector mechanism with the aid of the functional mechanical diagram shown in figure 6-27.

NOTE

All disassembly and assembly procedures are to be done with the frequency selector control switches set to 2000 kc. Always set the frequency selector control switches to 2000 kc before removing Signal Data Translator CV-1377( )/PRC-47 (A3) or Oscillator Control C-4311/PRC-47 (A7).

(a) Set the frequency controls to 2000 kc. Then remove modules A3 and A7.

(b) Remove the frequency control knobs.

(c) Remove the five screws which secure the gear plate to the panel post spacers. Pull the gear plate away from the panel. This leave gears accessible on either gear plate or panel.

(d) Remove the E-ring clamp from the end of a stub shaft in order to remove a defective panel-mounted gear. The switch knob shafts can be pulled through the panel from the rear without removing their C-ring clamps.

(e) Be sure to retain the small washer which is placed between the coupler shaft-clamp-pinion assembly and its plastic flange bearing in the panel. This washer prevents the pinion from roughing the plastic bearing.

(f) The counter assembly should be removed and replaced as an assembly.

(g) If the knob shaft panel bearings are to be replaced, put a new O-ring seal under the new bearing. This is part of the waterproofing of the panel. Use a light silicone grease on the O-rings before reassembly.

CAUTION

Do not lubricate any gears or bearings. These items are permanently lubricated and over-lubrication will damage the equipment.

(h) Do not disassemble any gear assemblies which are pinned together. They are replaced as assemblies.

(i) To replace the ball bearing on the small pinion end of the shaft (14), loosen the shaft clamp, pull the shaft out of the plastic gear, remove the C-ring clamp and pull the bearing off its shaft away from the small pinion.

(j) Do not disassemble item 1 or 2. Item 1 consists of a plastic gear and a stainless steel collar. Item 2 consists of a plastic gear and the driving portion of a switch coupler. Each of these are assembled before the gear is hobbed. Disassembly and reassembly will misalign these items. Always replace each as an assembly.

(k) The shaft of item 2 has two C-rings. Remove both C-rings and pull the gear out from the rear.

(l) Remove center knob shaft as follows. Release pawl spring. Remove E-ring from shaft of gear (3) and remove gear. Remove setscrew from gear (4) and pull gear off the shaft. Pull shaft with pinion and bevel gear (15) from front of gear plate.

(m) Remove the two outside switch couplers on the gear plate as follows. Release pawl springs from spade lug. Loosen the setscrews in both of the collar clamps on the aluminum gears (18, 21). Pull the aluminum gears off the switch coupler shafts from the front end of the gear plate. Loosen the other two collar clamps and pull the driving portion of the switch coupler from the rear end of the gear plate through the detent hub.

(n) Remove the detent pawls by removing the mounting nuts from the gear plate. Two mounting nuts are on the rear of plate; one is on the front.

(o) Remove counter assembly (5) by removing three mounting screws from the rear of the gear plate.

(2) REPAIR. - Examine all the items in the disassembled frequency selector mechanism. Note particularly the condition of gear teeth, bearings, and springs. Also check that the counter number dials move freely and do not bind. If any of these items show signs of damage or excessive wear, replace them.

(3) REASSEMBLY.

(a) Replace counter (5) as an assembly.

(b) The C-ring on shaft of bevel gear and shaft assembly (6) locates the bevel gear and shaft assembly vertically. Hold shaft up and assemble top bevel gear; then tighten setscrew in top bevel gear.

(c) Install the middle vertical shaft (7). Loosen top bevel gear setscrew, push shaft assembly upward, and tighten setscrew in top bevel gear. The lower bevel gear is not adjustable on the shaft.

(d) To install bevel gear and shaft assembly (8), push the assembly upward, making sure top bevel gear is in mesh with its mating gear; then tighten top bevel gear setscrew.

NOTE

At this point, the lower bevel gears on three vertical shaft (6, 7, 8) are up far enough to be out of mesh (or to be loosely meshed) with their mating gears.

INDEX NO.	MANUFACTURER'S PART NUMBER	DESCRIPTION
1	549-6105-002	Gear Assy, Spur No. 2
2	549-6212-003	Coil, R-F - Loading, No. 1, L111
3	549-6214-003	Coil, R-F - Loading, No. 3, L112
4	549-6213-003	Coil, R-F - Loading, No. 2, L110
5	549-6215-003	Coil, R-F - Tuning, L109
6	504-7577-002	Clamp
7	549-6104-002	Gear Assy, Spur 46T, No. 1
8	340-0025-00	Ring Retaining
9	281-0114-00	Tuning/Load Turns Count Dial Assemblies

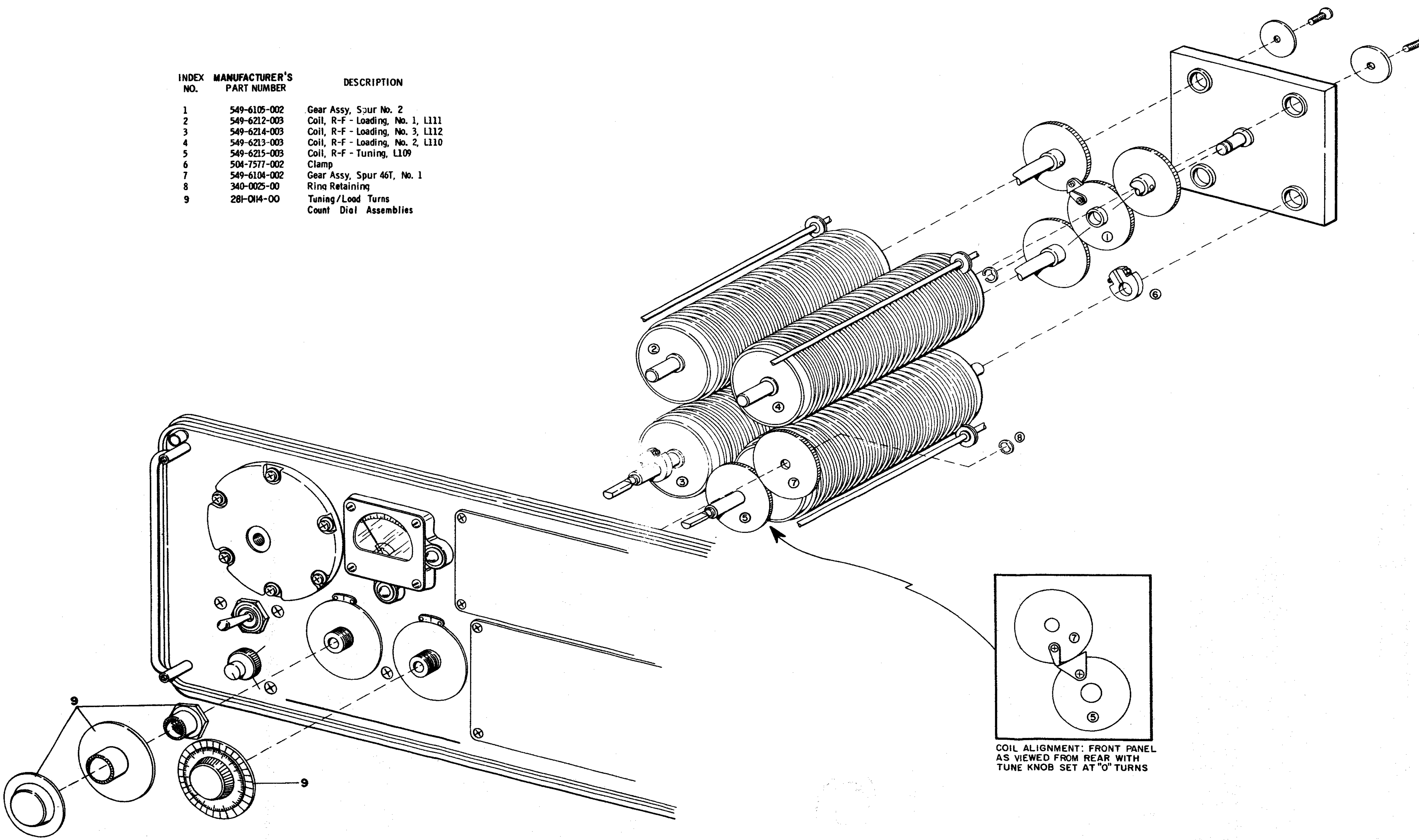
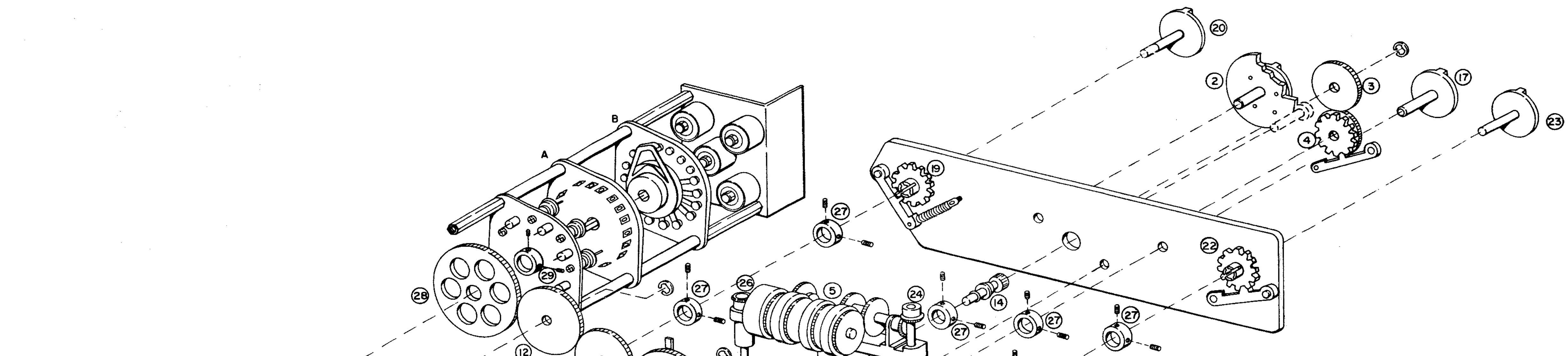
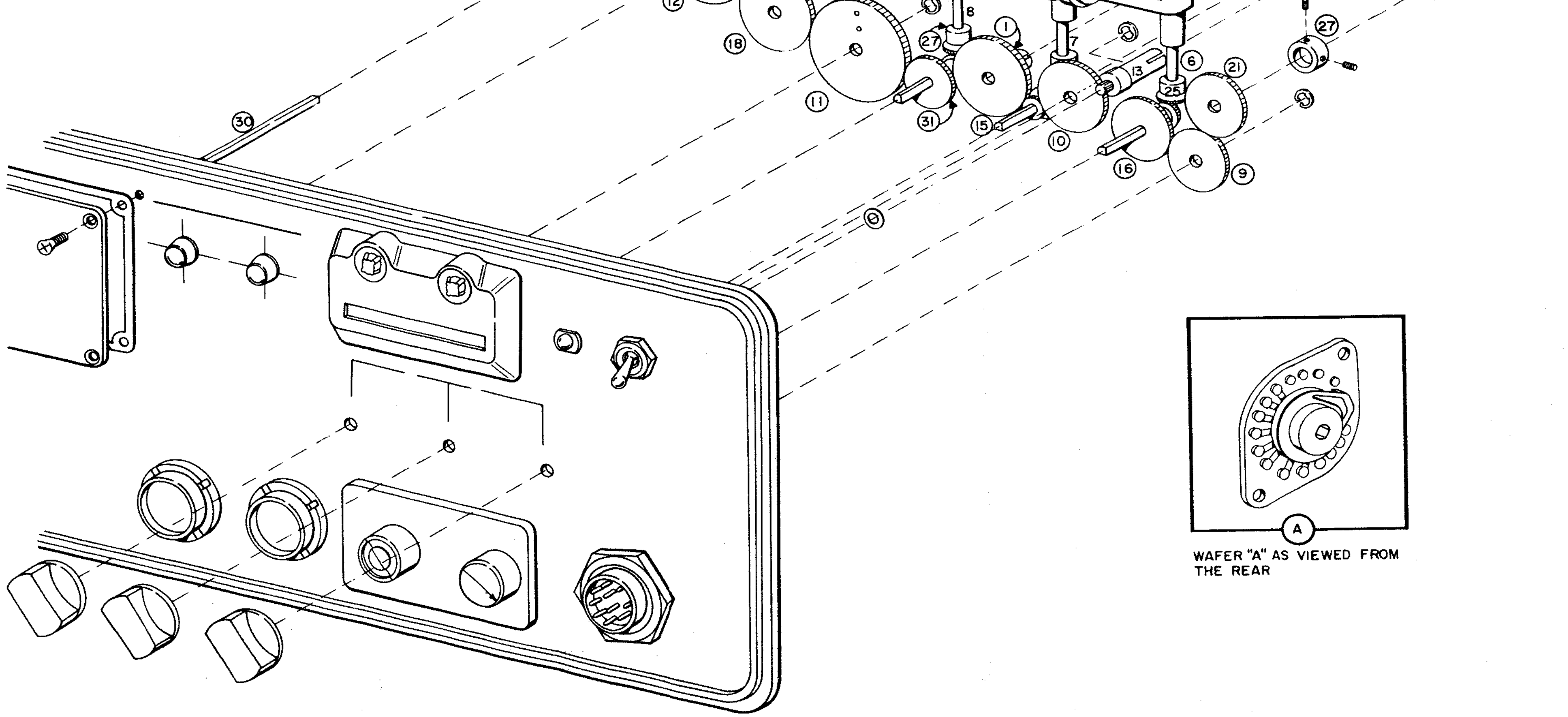


Figure 6-26. Load and Tune Mechanism, Functional Mechanical Diagram





INDEX NO.	MANUFACTURER'S PART NUMBER	DESCRIPTION
1	549-6039-002	Gear, Spur No. 4
2	549-6046-002	Gear, Shaft - Coupler Assy
3	549-6079-002	Gear, Stop - No. 2 - Riveted
4	549-6078-002	Gear, Stop - No. 1 - Riveted
5	549-6116-004	Indicator, Frequency
6	549-6053-002	Shaft
7	549-6225-002	Shaft, Counter Pressed (includes Bevel Gear)
8	549-6225-002	Shaft, Counter Pressed (includes Bevel Gear)
9	549-6044-002	Gear, Spur - 32T
10	549-6054-002	Gear, Spur - 54T
11	549-6066-002	Gear - 78T, Riveted
12	549-6060-002	Gear, Spur - 69T
13	549-6030-002	Gear Shaft, Spur - 12T
14	549-6034-002	Gear Shaft, Spur - No. 2
15	549-6055-002	Gear Shaft - Pressed
16	549-6047-002	Gear Assy, Bevel Spur - No. 3
17	549-6048-002	Coupling Half, Shaft No. 2
18	549-6037-002	Gear, Spur - 60T
19	549-6065-002	Gear, Spur - 12T Detent
20	549-6049-002	Coupling Half Shaft - No. 3
21	549-6052-002	Gear Spur - Detent
22	549-6036-002	Gear Spur No. 2
23	549-6049-002	Coupling Half, Shaft No. 3
24	549-6051-002	Gear, Bevel - No. 3
25	549-6121-002	Gear Bevel
26	549-6051-002	Gear, Bevel - No. 3
27	549-6021-002	Collar, Shaft - No. 1
28	549-6196-002	Gear Spur - 90T
29	549-6137-002	Collar, Shaft
30	549-6195-002	Shaft, Shouldered - Switch
31	549-6045-002	Gear Assy, Bevel - Spur - No. 1

Figure 6-27. Frequency Selector Mechanism, Functional Mechanical Diagram

(e) Assemble the two end switch couplers, detents, and drive gears in the reverse order of their disassembly (paragraph 6-13*i*(1) *(m)*). Push the assembly together and tighten the collar clamps on both switch coupler shafts. Hook the spring on the detent pawl.

(f) Insert gear and switch coupler assembly (2) through the rear of the gear plate. Place both C-rings on its shaft.

(g) Install gears (9, 10, 11, 12) on their panel-mounted shafts and secure with E-rings. Install gear (11) with its stop oriented vertically.

(h) Replace megacycle knob shaft and gear assembly (31). Start the shaft into the panel bearing. Rotate the assembly so that the shaft end (viewed from front of panel) shows the two flats of the shaft to the right and to the bottom. Hold gear (11) with its stop against the top peg, then turn the gear away from the stop by two gear teeth. Mesh the gear on the megacycle shaft with gear (11) by pushing the assemblies straight together.

(i) Place washer over plastic bearing and under edge of gear (10). Place collar clamp on shaft of item 13. Push pinion gear (13) into mesh with the gear.

(j) Assemble item 14 with pinion shaft, bearing, and C-ring. Install collar clamp on hub of gear (1). Slip the gear onto shaft of item 14 and push shaft of item 14 into bearing in panel. Do not tighten collar clamp on hub of the gear at this time.

(k) Assemble C-ring to 10-kc knob shaft (15). Push the 10-kc knob shaft into its panel bearing from the rear while meshing the knob shaft pinion with gears (1, 10). Exercise care to prevent damage to plastic gear (1).

(l) Assemble E-ring to 1-kc knob shaft (16). Place the shaft through the panel bearing and mesh with gear (9). Line up all shafts and proceed to mount the gear plate assembly with the parts and bearings of the front panel. Be careful in meshing pinion gear on item 14 with plastic gear on item 2 to prevent damage to the plastic gear.

CAUTION

Make sure all gears are meshing properly as assemblies are brought together.

(m) Replace five screws and split lock washers to secure the gear plate assembly to the front panel spacer posts.

(n) Insert switch coupler (17) shaft into item 13.

(o) Install gear (4) on its shaft with the detent gear nearest the gear plate. Align the setscrew in the gear with the countersink in the shaft and tighten securely.

(p) Hook the pawl spring. Turn 10-kc knob shaft clockwise to the first detent position which places the stop bar of item 4 on the top right of center as viewed from panel. Mesh gear (3) with gear (4) with the stops nearly contacting.

NOTE

Proper assembly may be checked as follows: Only 1/4 detent position counterclockwise rotation is possible. One or more turns clockwise are possible.

(q) All gears should now be meshed. Loosen the megacycle knob collar clamps (mounted on first switch coupler shaft on right as viewed from rear). Separate gears (18, 19). Turn switch coupler (20) so that its driving boss is vertical within ±0.5 degree. Position the switch coupler so that the distance between the major rear flat surface of the coupler and the centerline of the front guide pin hole (on the main chassis) for Signal Data Translator CV-1377( )/PRC-47 (A3) is 0.609 $^{+0.005}_{-0.000}$ inch. (See figure 6-28.) Tighten both collar clamps on the switch coupler shaft.

NOTE

Be sure that the collar holddown screws are tightened against the solid portion of the shaft (item 19).

As a field expediency, the translator module may be secured in place and the coupler adjusted back into its mating coupler on the translator module before the collar clamps are tightened. However, this adjustment will probably have to be repeated each time the module is replaced. The procedure given in step *(q)* should be followed for all depot level maintenance so that any replacement modules may be plugged in without the necessity of readjusting the coupler mesh.

(r) Loosen both collar clamps mounted on shaft of switch coupler (23) and separate gears (21, 22). Adjust switch coupler (23) so that its driving boss is vertical within ±0.5 degree. Position the switch coupler so that the distance between the major rear flat surface of the coupler and the centerline of the front guide pin hole (on the main chassis) for Oscillator Control C-4311/PRC-47 (A7) is 0.810 $^{+0.005}_{-0.000}$ inch. (See figure 6-28.) As stated in the note in step *(q)*, this coupler may also be adjusted and secured in position with its mating coupler on the oscillator control module, but such an adjustment will not be satisfactory for all replacement oscillator control modules.

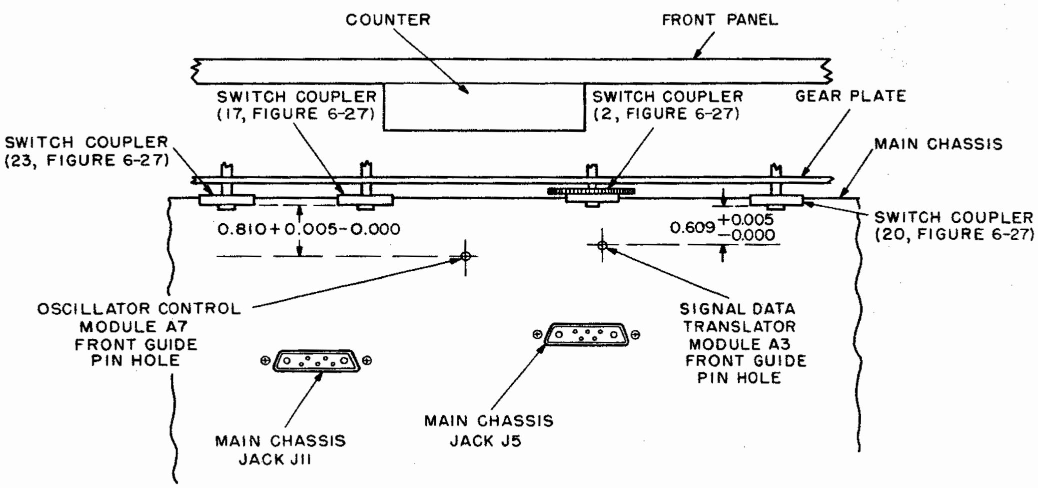


Figure 6-28. Frequency Selector Control Switch Coupler Alignment

(s) Tighten collar clamp on item 13 with switch coupler (17) adjusted in the same manner as switch coupler (23) in step *(r)*.

(t) Loosen collar clamp on item 14. Make sure gear (1) is against the front panel. Align the driving boss on item 2 to within 0.5 degree of the vertical. This assembly has no adjustment for front to rear placement.

(u) Align counter (5) as follows. Loosen setscrew in bevel gear (24). Pull shaft (6) upward against C-ring stop and mesh bevel gears at bottom of shaft. Set the 1-kc dial to read 0. Mesh bevel gear (24) with its mating gear and tighten setscrew in the bevel gear. Loosen the center top drive bevel gear (not shown in figure 6-27). Set the 100- and 10-kc dials to 0. If the bevel gear (at top of center vertical shaft) is positioned so its setscrew is not accessible, rotate the middle frequency control knob until the setscrew is accessible and count the detents as they are passed in rotation. Set the 10-kc dial to read the number of detents passed. Check this setting by rotating the center frequency control knob back to its counterclockwise stop. The last three dials to the right should now read 000. Adjust bevel gear (26) in the same manner as bevel gear (24). If the bevel gear setscrew is not accessible with the megacycle dial set at 2, rotate the megacycle frequency control knob until the setscrew is accessible, counting the detent positions as the knob is rotated. Set the megacycle dial at 2 plus the number of detents counted and tighten setscrew of bevel gear (26). Reset the megacycle dial at 2.

(v) If the gear train has been disassembled and reassembled, the power amplifier band switch must be realigned. Loosen gear clamp (29). Turn the switch hub until the contacts are made as shown in figure 6-27 and tighten gear clamp (29).

NOTE

If it is necessary to remove the power amplifier band switch to accomplish a repair, perform the following steps.

(w) Remove four screws from front panel tuning and loading chart plate. Remove the gasket.

(x) Loosen gear clamp (29). While holding gear (28), withdraw switch shaft (30); then remove gear.

(y) Unsolder only the wires connecting the power amplifier band switch to external circuits. Note that all other wires on the switch assembly are part of the assembly and may be removed with it. Tag the disconnected wires so that they can be identified and reconnected correctly during reassembly.

(z) Remove two screws from front panel that secure the two post spacers on which the band switch is mounted.

(aa) Remove two screws which secure the rear switch bracket to the side of the power amplifier compartment. Lift the switch assembly out from the top of the power amplifier compartment.

(ab) Reassemble the power amplifier band switch in the reverse order of disassembly.

j. MAIN CHASSIS. - No special repair procedures are required for the main chassis. All component parts identified with main chassis which must be replaced can be removed simply by unsoldering any interconnecting wiring and removing any component part mounting hardware. Figure 6-29 shows the location of component parts on the main chassis. If it is necessary to remove the front panel from the main chassis, perform the following steps:

(1) Remove retaining nuts from front panel mounted cable connectors (two AUDIO receptacles and POWER receptacle).

(2) Remove top and bottom covers from power amplifier compartment.

(3) Disconnect and remove all switches and knobs mounted on front panel.

(4) Unsolder wires to front panel fuses, pilot lamps, and the XMTR OUTPUT meter. Tag the wires so that they can be reconnected correctly during reassembly.

(5) Remove the power amplifier tube (refer to paragraph 6-13*h*(1)).

(6) Unscrew lug from rear of antenna connector (bowl insulator).

(7) Remove front panel load-tune chart plate. Save gasket for replacement. Loosen gear clamps (29, figure 6-27) and withdraw the power amplifier band switch shaft (30). Remove two screws from front panel that secure the two post spacers on which the power amplifier band switch is mounted. Disconnect the four roller contact shafts from spring at panel end.

(8) Remove three screws which secure the switch box inside the lower left-hand corner of the front panel.

(9) Remove three screws from each of the three main chassis brackets which secure the front panel to the main chassis. One bracket is located on each side of the main chassis, while the third bracket serves as the right-hand partition (viewed from top front) between the power amplifier compartment and the main chassis. Six of the screws are accessible from the ends of the chassis near the panel. The remaining three screws are secured by hexagonal nuts accessible from inside the power amplifier compartment. With the nine screws removed, the front panel may now be removed from the main chassis.

(10) After necessary repairs have been completed, reassemble the front panel to the main chassis in the reverse order of disassembly.

(11) After reassembly, turn tune and load coil shafts counterclockwise to stops. Set contact rollers on last turn at rear of coils. Replace tune and load dials and knobs so that they read zero.

6-14. REASSEMBLY OF MODULES ON MAIN CHASSIS.

Replace the modules on the main chassis as shown in figure 1-6. Be careful to align the guide pins on the bottom of the modules with the guide pin holes in the chassis. The use of excessive force may damage the mating electrical connectors. In addition, before installing either Signal Data Translator CV-1377( )/PRC-47 (A3) or Oscillator Control C-4311/PRC-47 (A7), make certain that the front panel frequency controls are set for 2000 kc and the switch couplers on the front of both of the modules are as shown in figures 6-8 and 6-13 (switch coupler groove vertical and rivet at lower right). Note that the S2 switch coupler on module A7 should also be at its extreme counterclockwise position.

When the modules have been installed, tighten the captive retaining screws on the bottom of the main chassis shown in figure 6-22 to secure the modules in place. Replace the stiffeners at the top of the modules. Install the main chassis into its case by placing the chassis assembly, panel down, on its two handles and sliging the case over the chassis. Tighten the five screws in the bottom of the case.

6-15. SCHEMATIC DIAGRAMS.

Schematic diagrams of the six receiver-transmitter plug-in modules and a schematic diagram of the power amplifier compartment and main chassis are shown in figures 6-71 through 6-77.

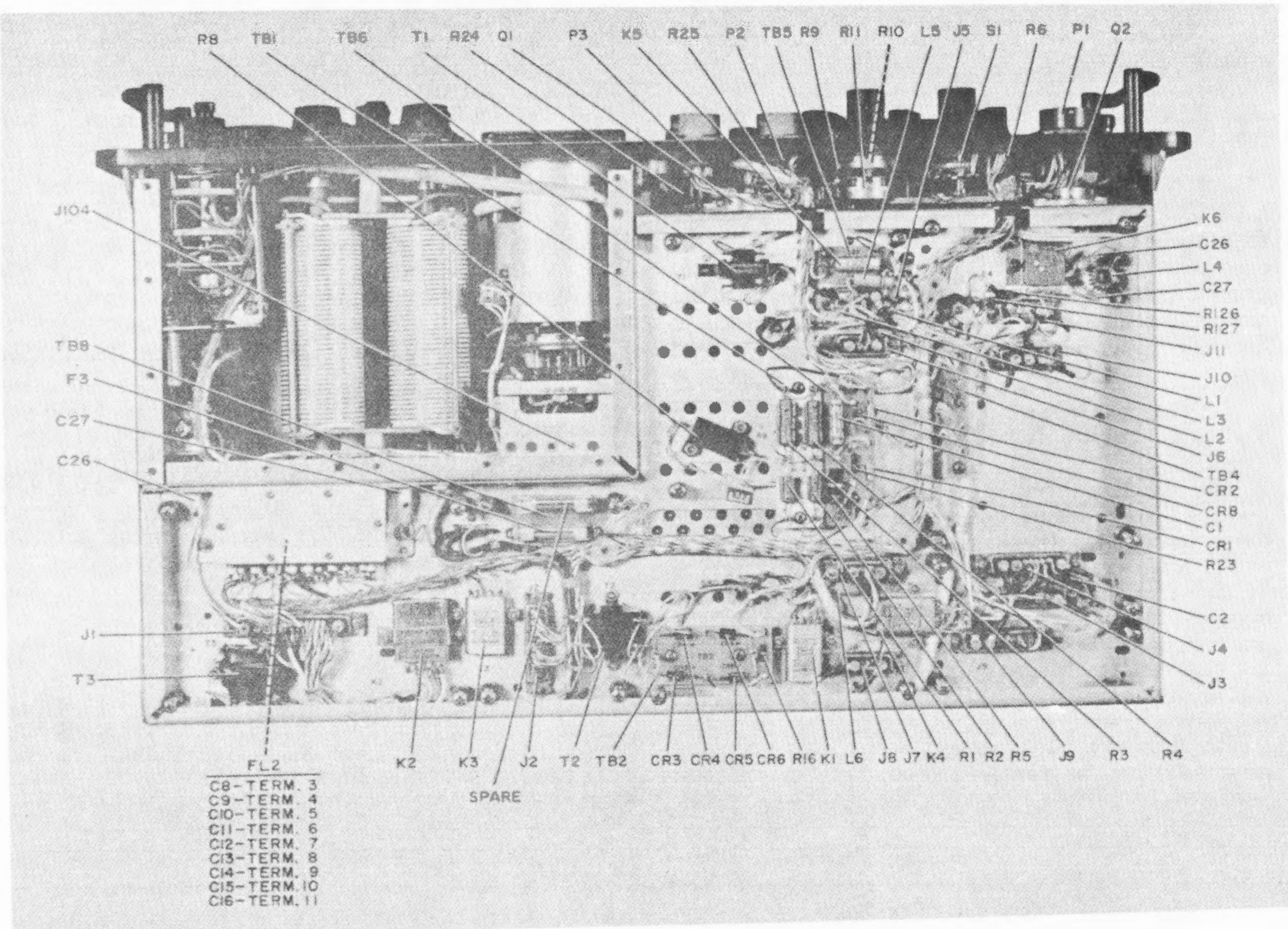


Figure 6-29. Electrical Equipment Chassis CH-474/PRC-47, Bottom View, Location of Components

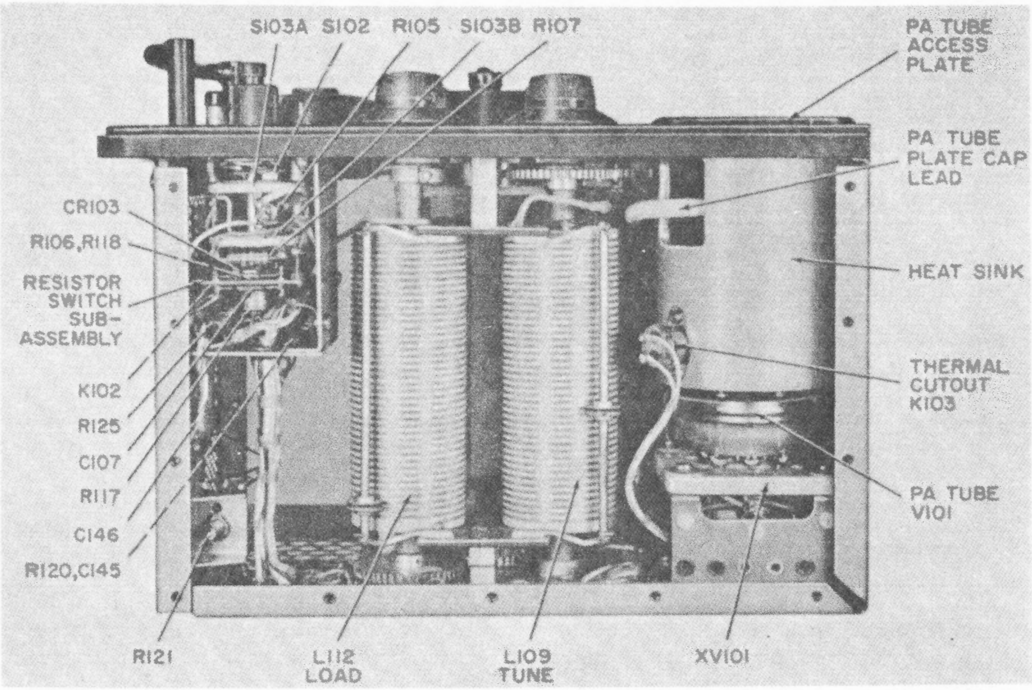


Figure 6-30. Power Amplifier Compartment, Bottom View, Parts Location

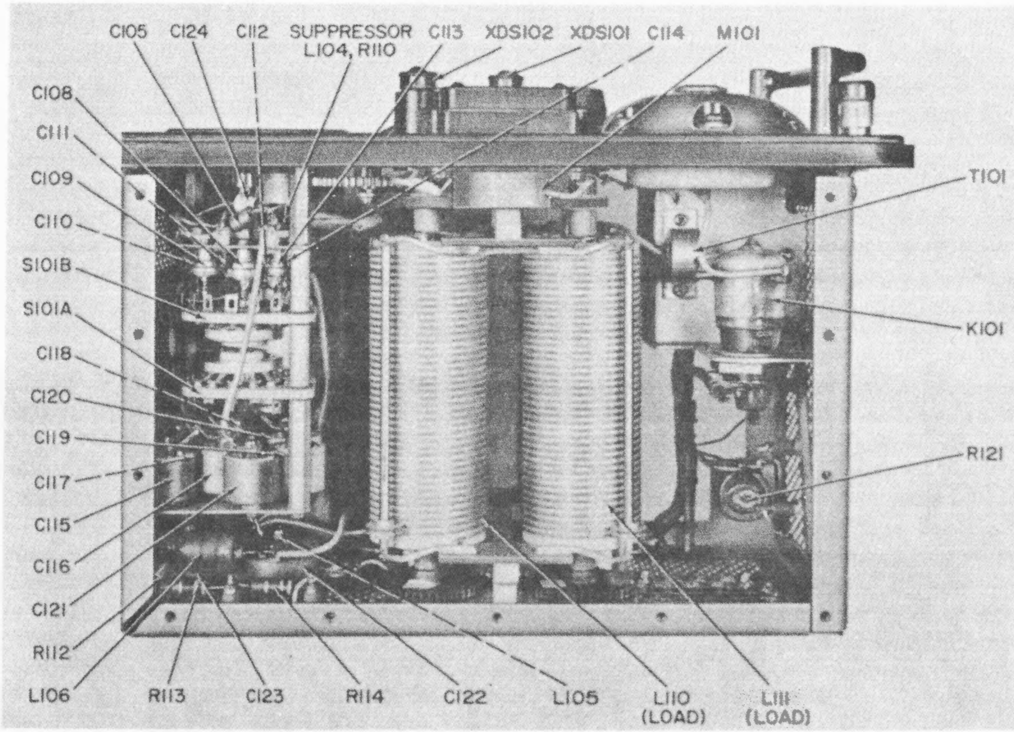


Figure 6-31. Power Amplifier Compartment, Top View, Parts Location

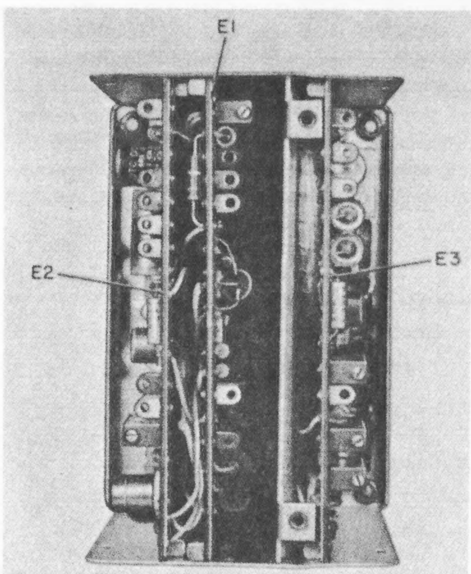


Figure 6-32. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Top View, Location of Assemblies

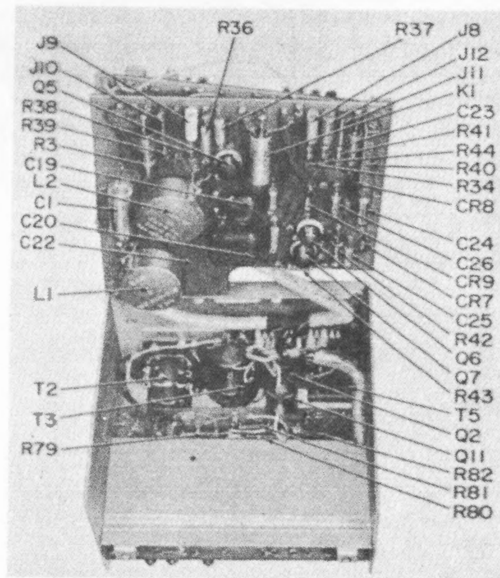


Figure 6-33. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Card Assembly E1 Parts Location

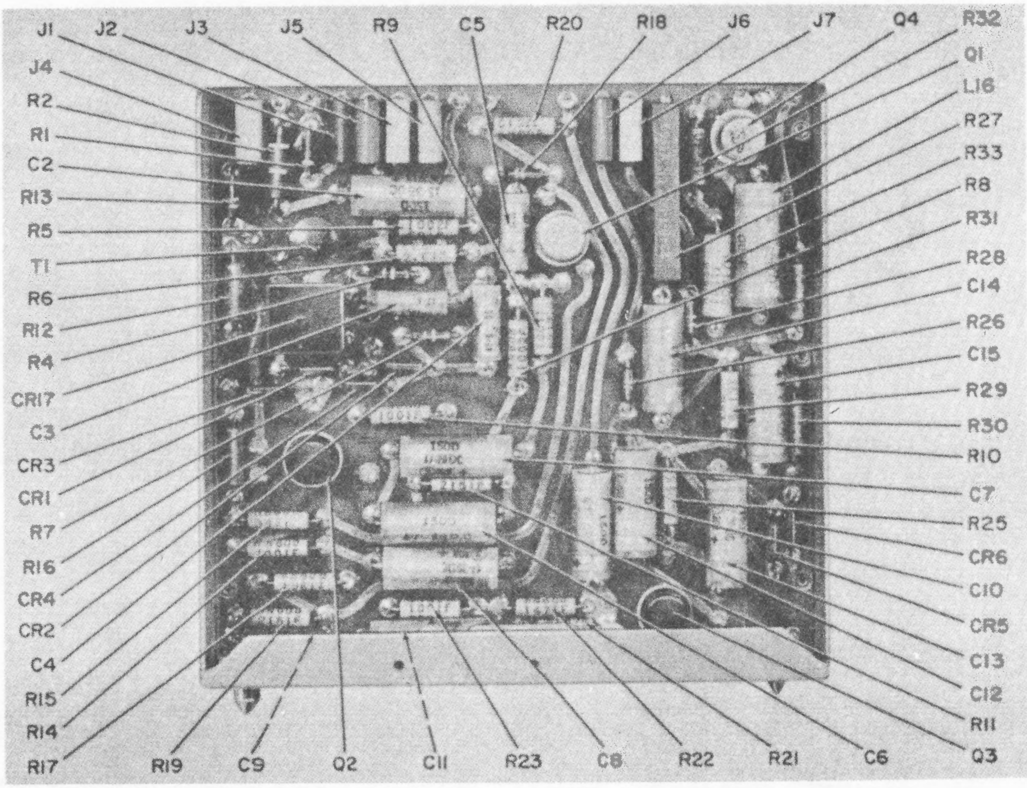


Figure 6-34. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Card Assembly E2, Parts Location

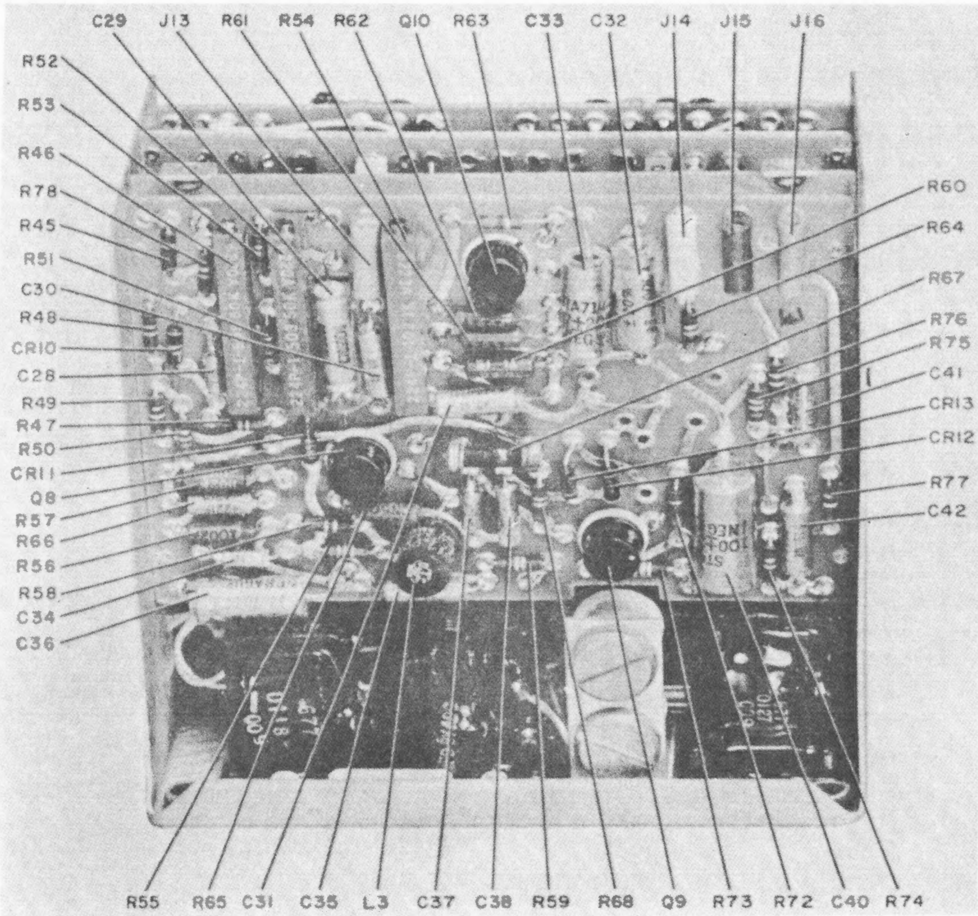


Figure 6-35. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Card Assembly E3, Parts Location

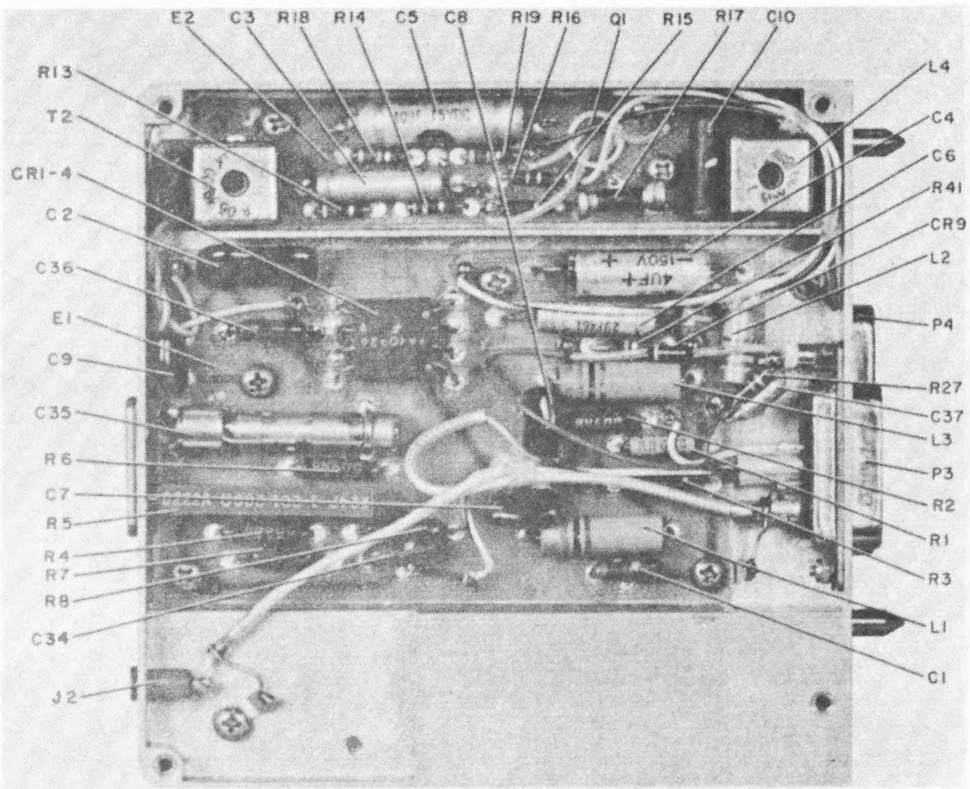


Figure 6-36. Amplifier-Modulator AM-3507/PRC-47 (A2), Side View, Location of Card Assemblies E1 and E2 and Component Parts

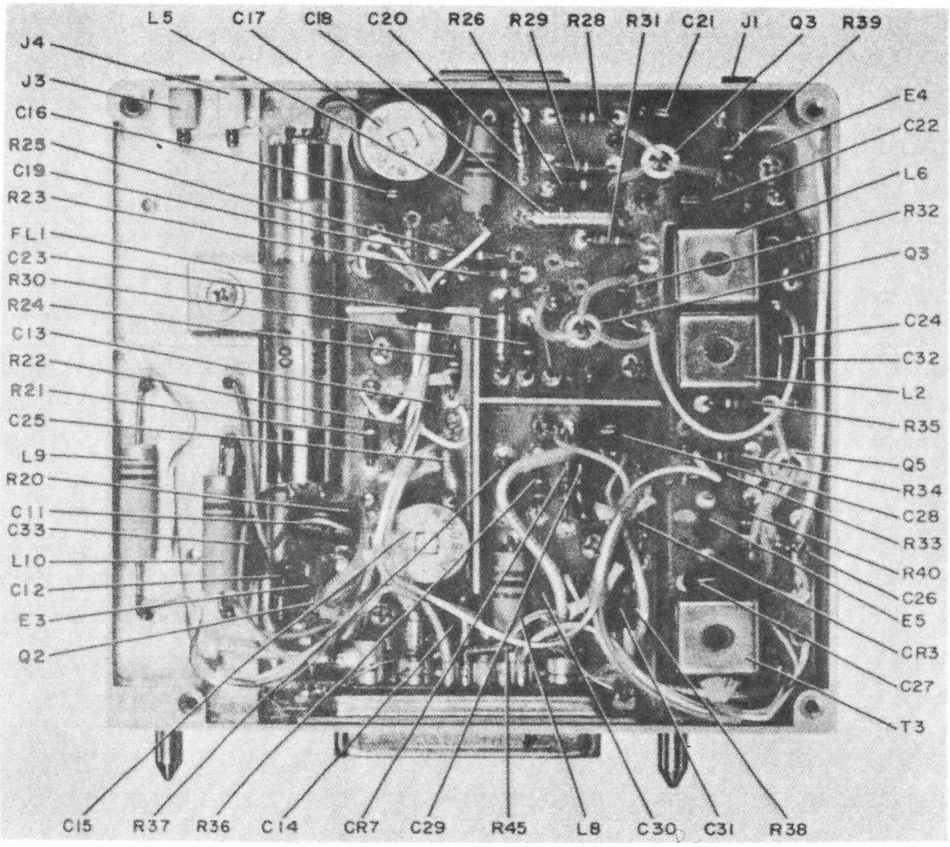


Figure 6-37. Amplifier-Modulator AM-3507/PRC-47 (A2), Side View Location of Card Assemblies E3, E4, and E5, and Component Parts

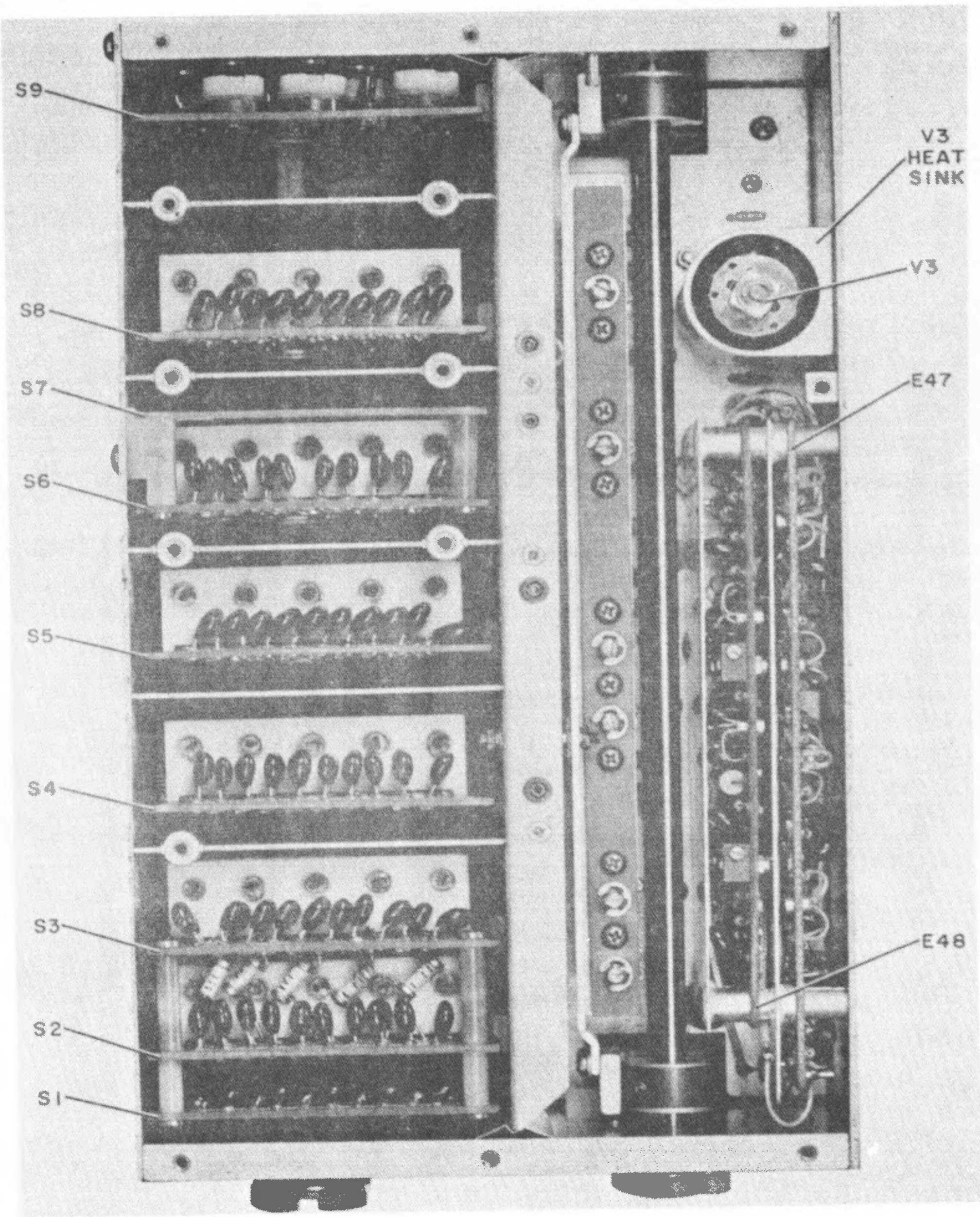


Figure 6-38. Signal Data Translator CV-1377/PRC-47 (A3), Top View, Location of Card Assemblies and Switch Cards

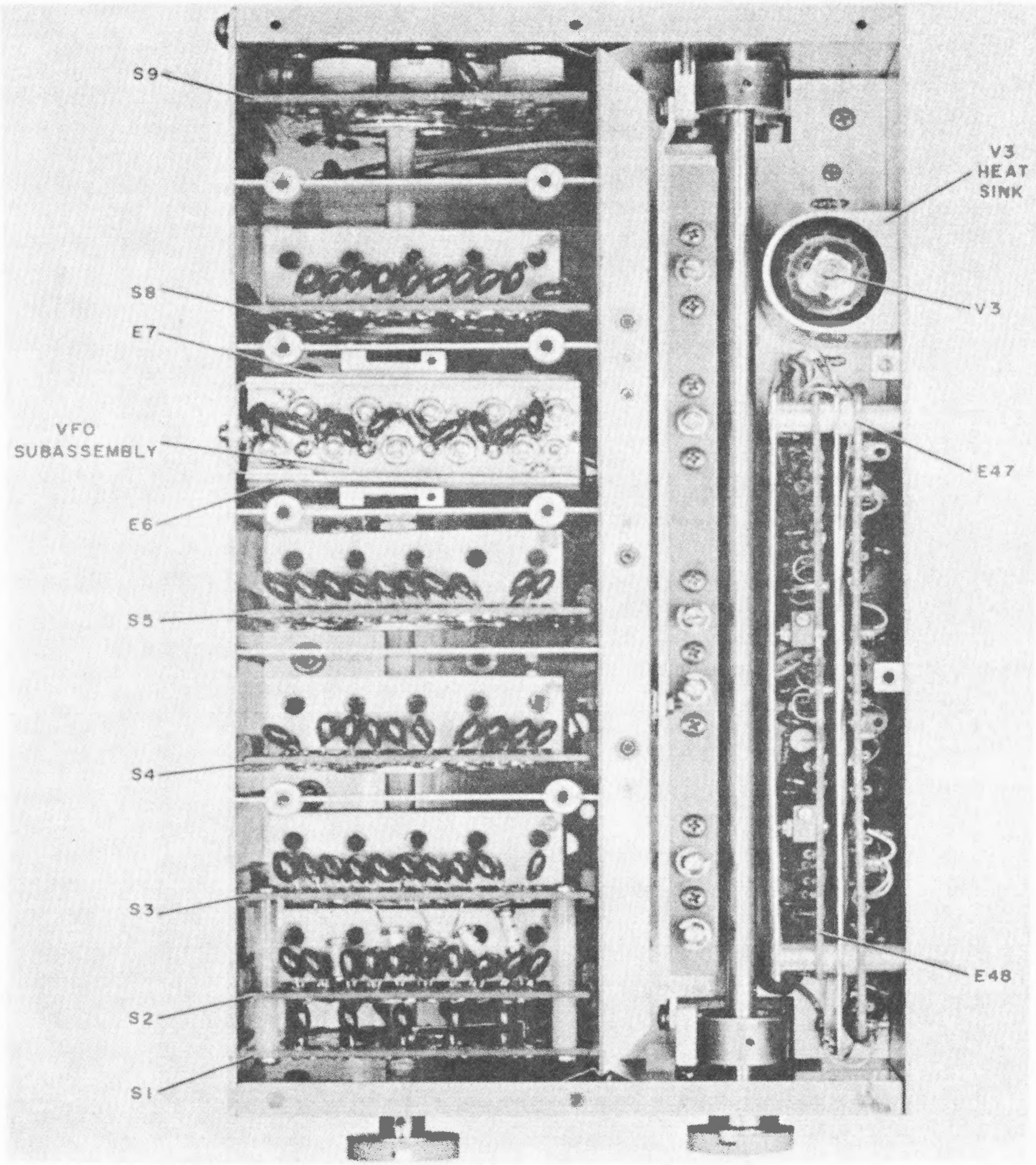


Figure 6-38A. Signal Data Translator CV-1377A/PRC-47 (A3), Top View, Parts Location

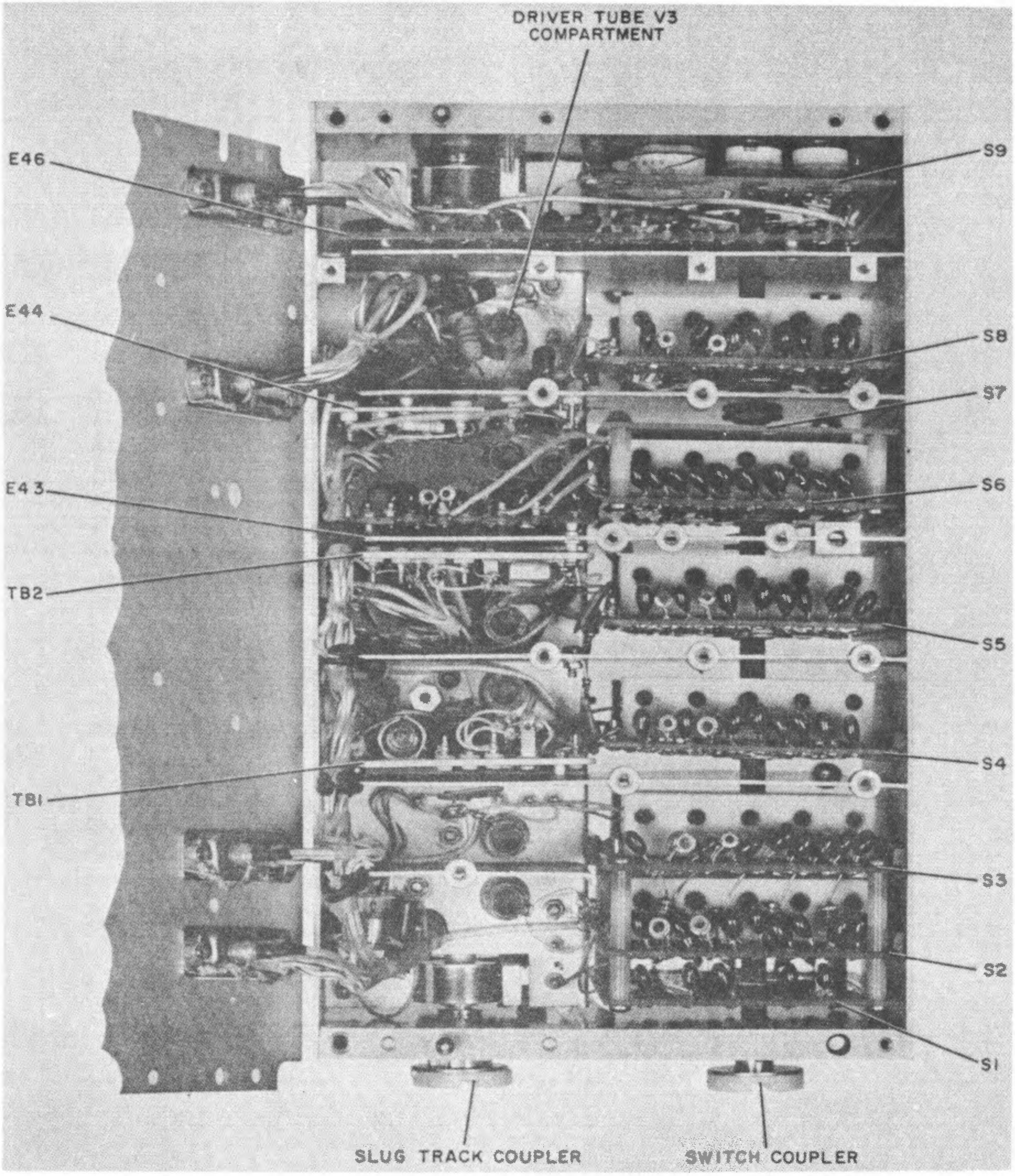


Figure 6-39. Signal Data Translator CV-1377/PRC-47 (A3), Bottom View, Location of Card Assemblies and Switch Cards

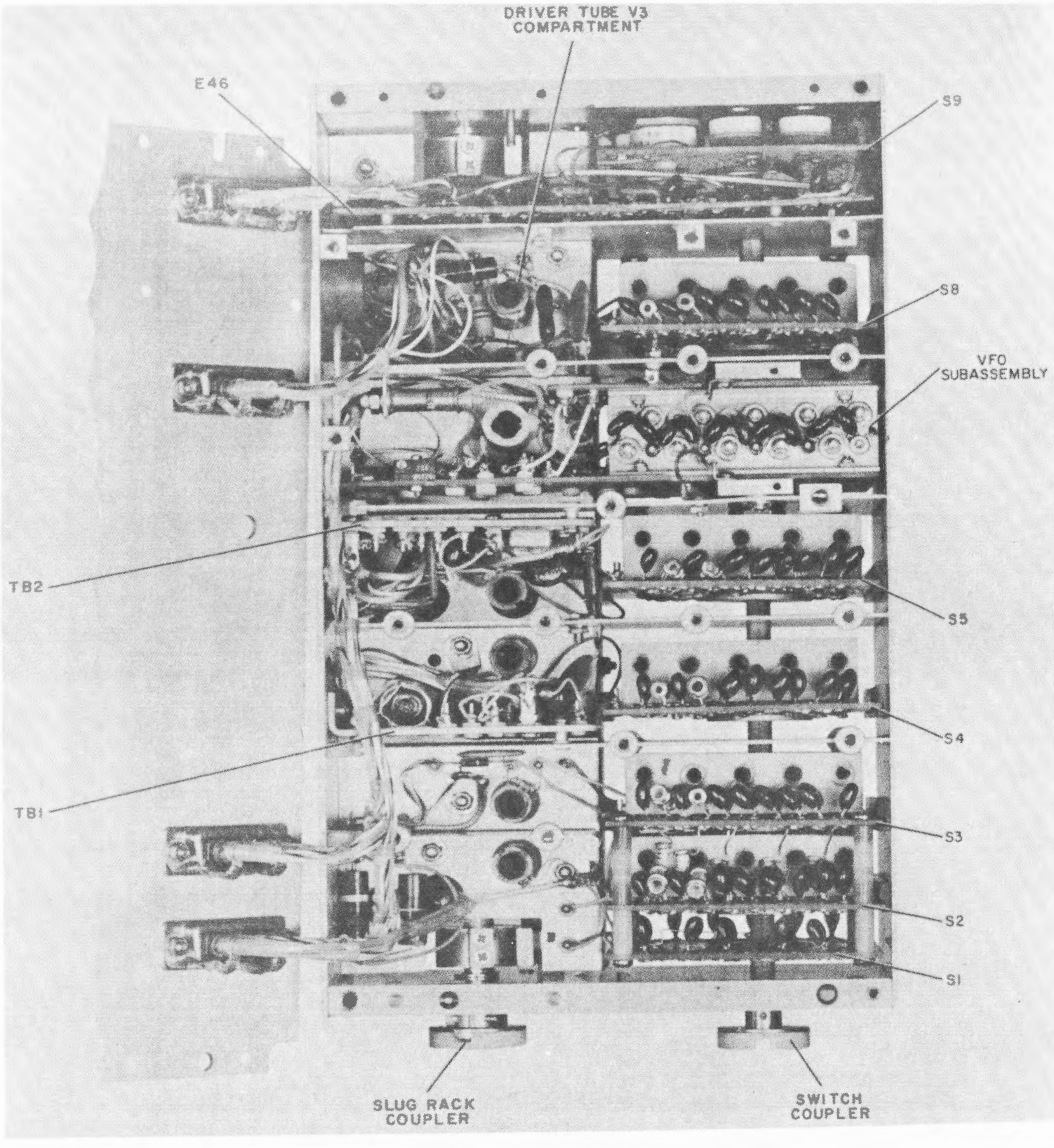


Figure 6-39A. Signal Data Translator CV-1377A/PRC-47 (A3), Bottom View, Location of Card Assemblies and Switch Cards

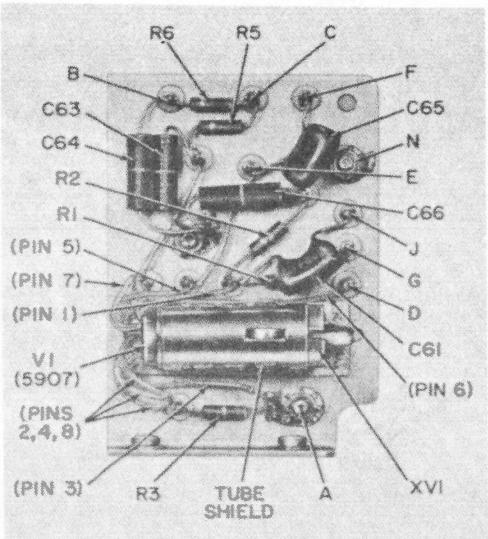


Figure 6-40. Signal Data Translator CV-1377/PRC-47 (A3), Card Assembly TB1, Parts Location

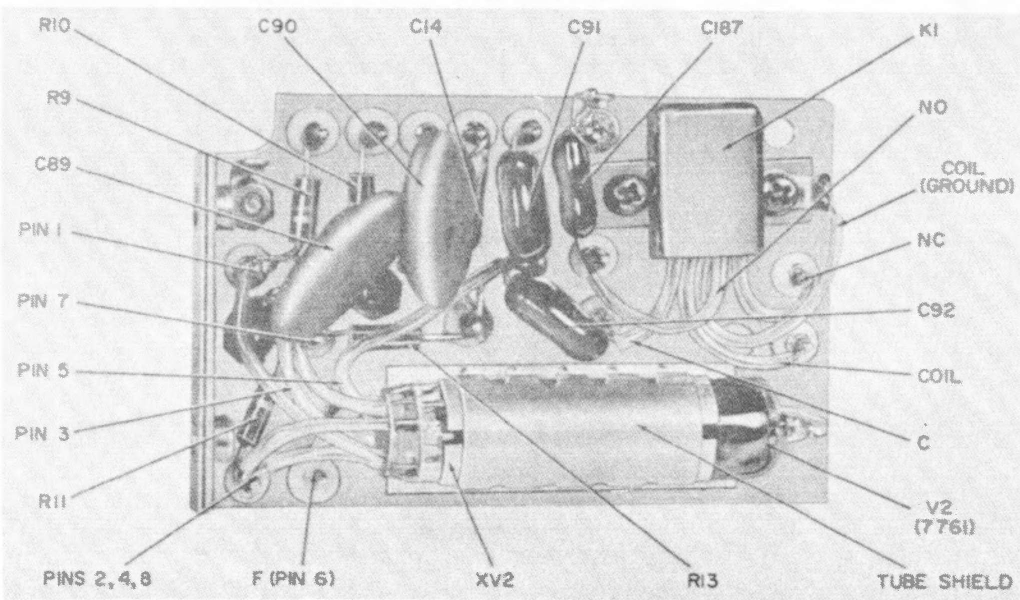


Figure 6-41. Signal Data Translator CV-1377/PRC-47 (A3), Card Assembly TB2, Parts Location

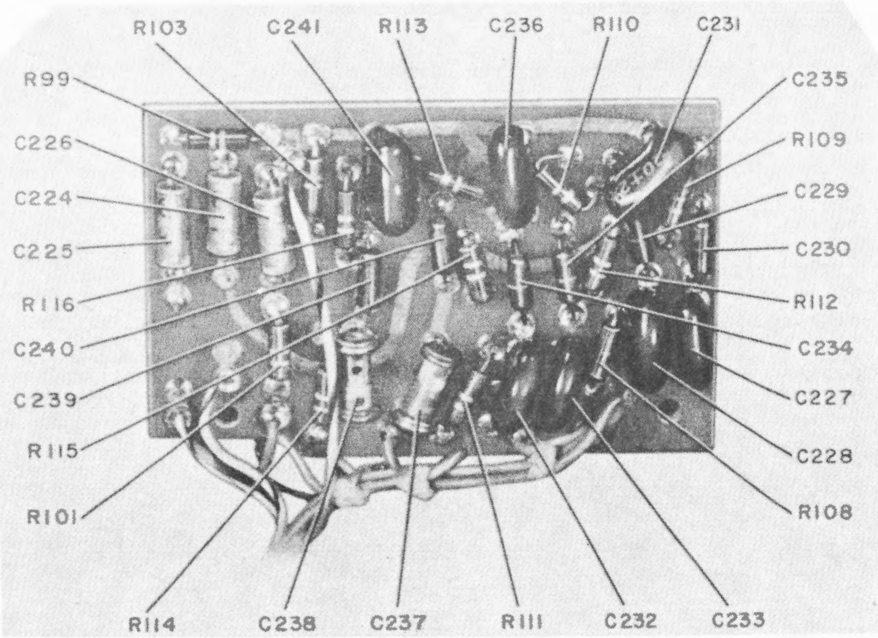


Figure 6-42. Signal Data Translator CV-1377/PRC-47 (A3), Card Assembly E43, Parts Location

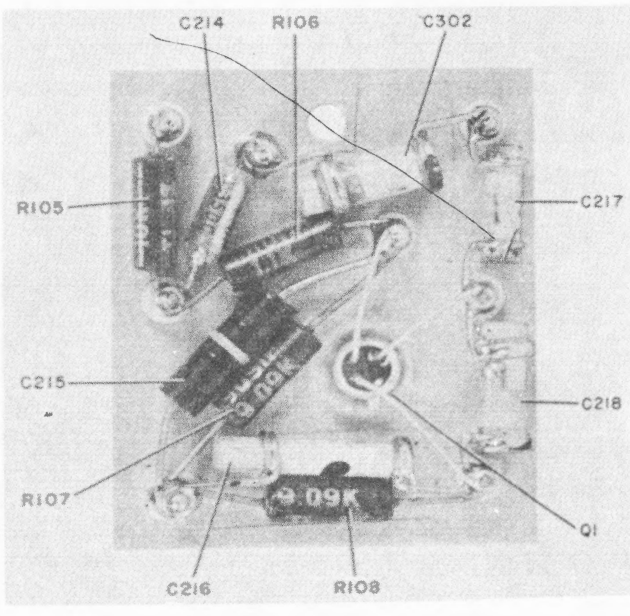


Figure 6-43. Signal Data Translator CV-1377/ PRC-47 (A3), Card Assembly TB3 Parts Location

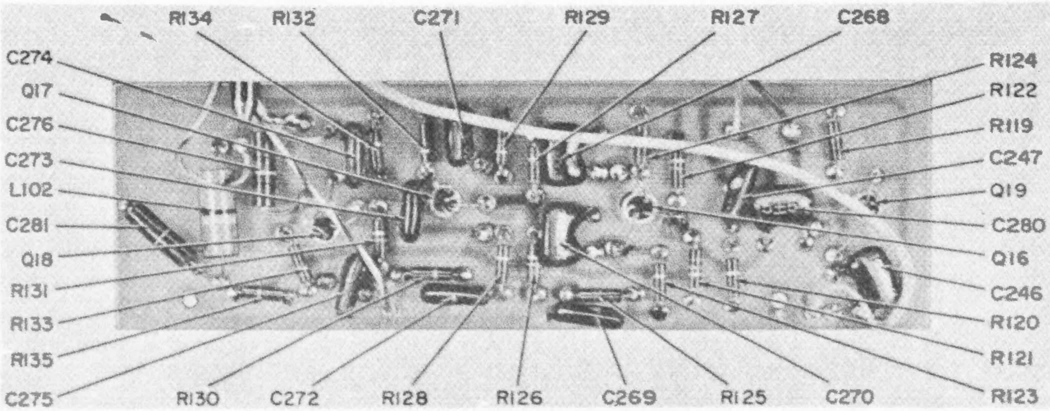


Figure 6-44. Signal Data Translator CV-1377( )/PRC-47 (A3),
Card Assembly E46, Parts Location

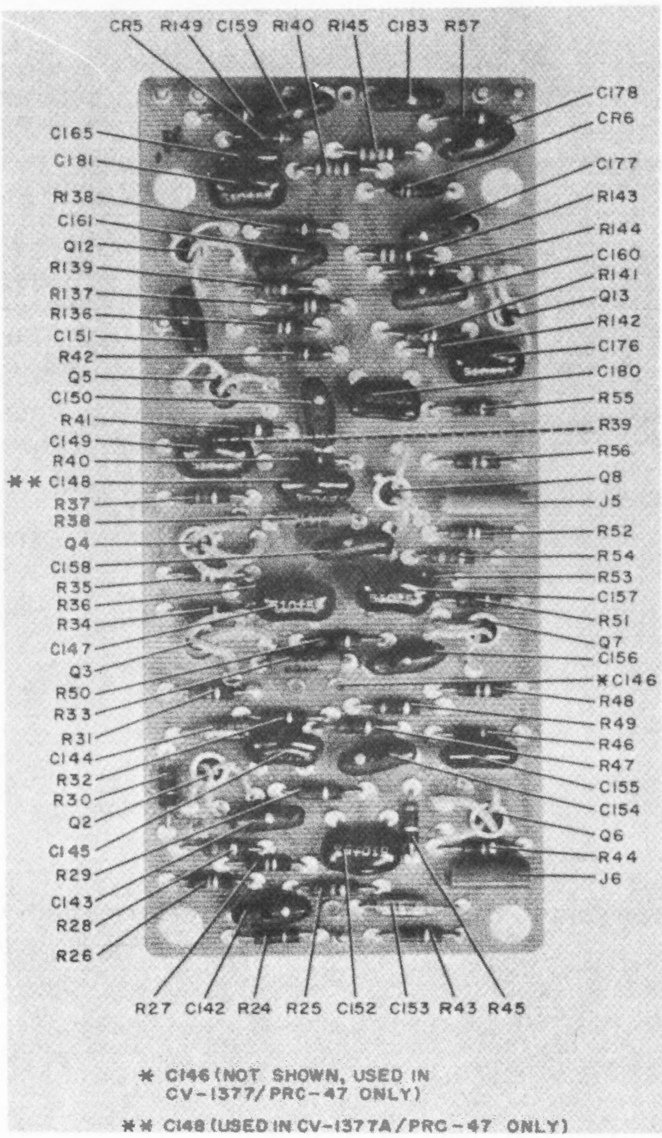


Figure 6-45. Signal Data Translator CV-1377( )/PRC-47 (A3),
Card Assembly E47, Parts Location

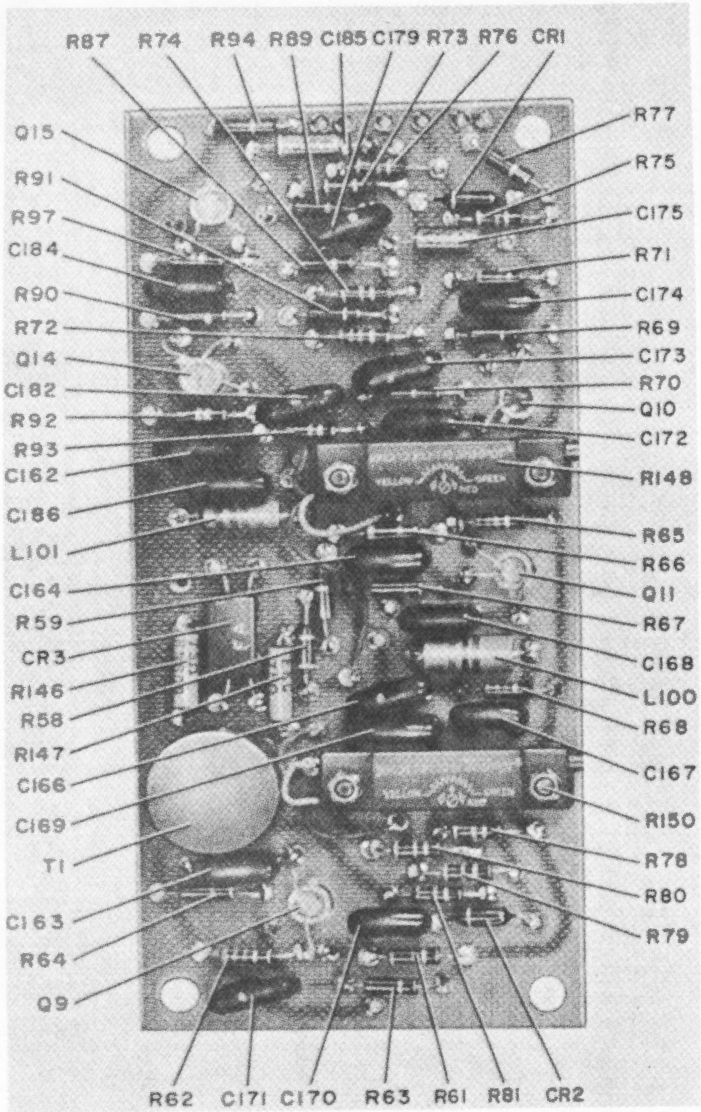


Figure 6-46. Signal Data Translator CV-1377( )/PRC-47 (A3), Card Assembly E48, Parts Location

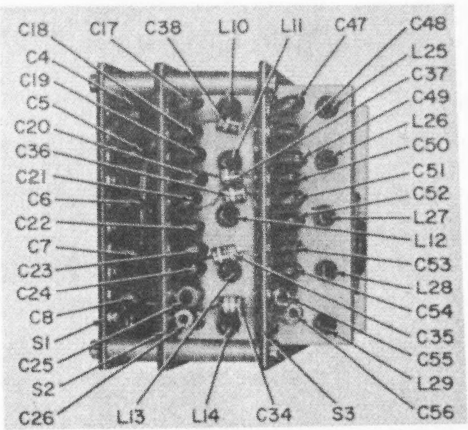


Figure 6-47. Signal Data Translator CV-1377/ PRC-47 (A3), Switch Boards S1, S2, and S3, Top View, Parts Location

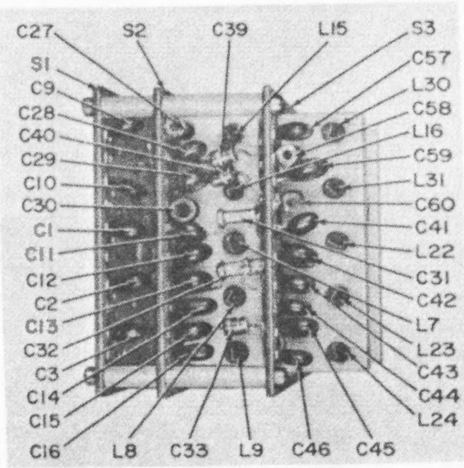


Figure 6-48. Signal Data Translator CV-1377/ PRC-47 (A3), Switch Boards S1, S2, and S3, Bottom View, Parts Location

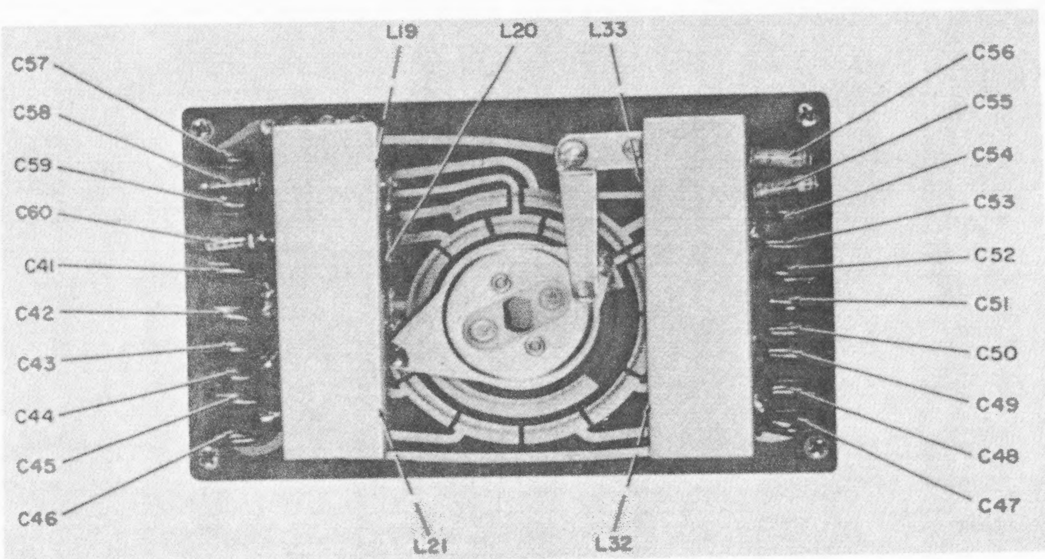


Figure 6-49. Signal Data Translator CV-1377/PRC-47 (A3), Parts Location on Rear of Switch Board

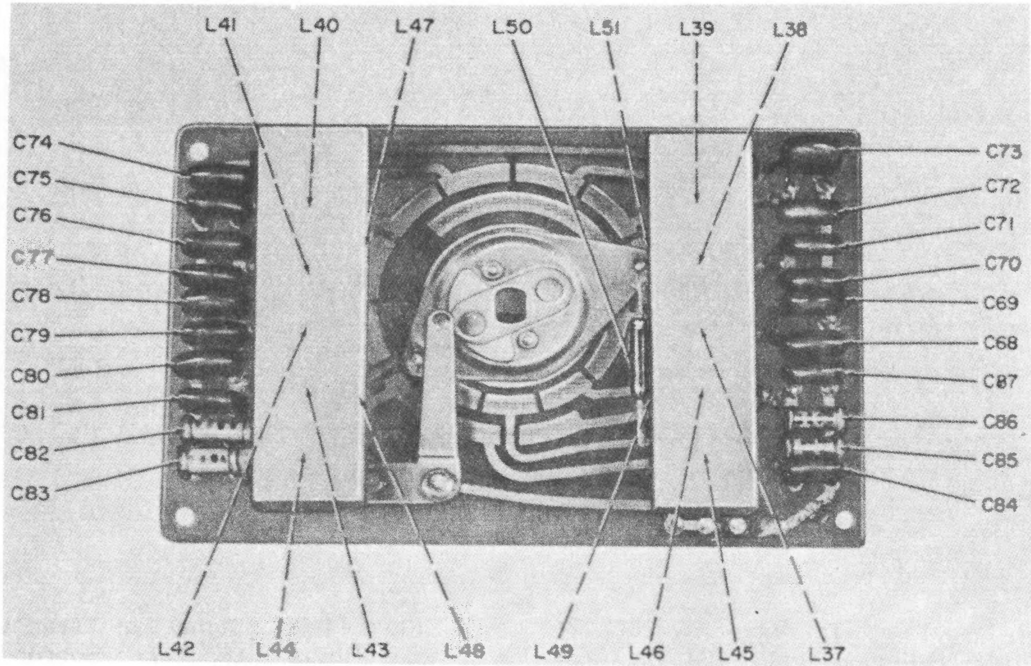


Figure 6-50. Signal Data Translator CV-1377/PRC-47 (A3), Switch Board S4, Parts Location

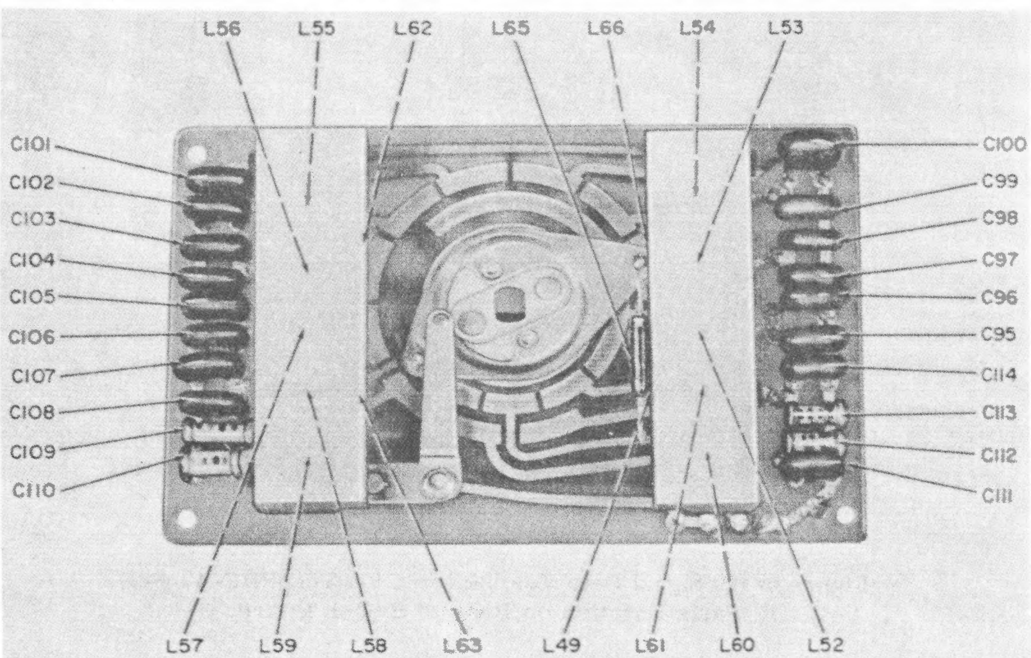


Figure 6-51. Signal Data Translator CV-1377/PRC-47 (A3), Switch Board S5, Parts Location

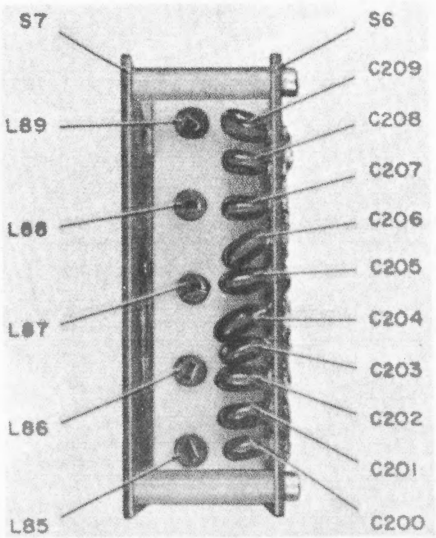


Figure 6-52. Signal Data Translator CV-1377/
PRC-47 (A3), Switch Boards S6 and S7,
Top View, Parts Location

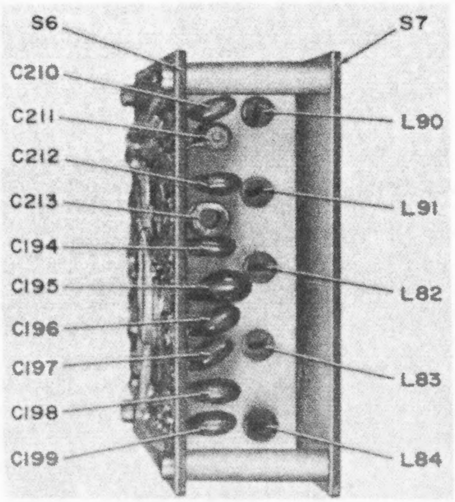


Figure 6-53. Signal Data Translator CV-1377/
PRC-47 (A3), Switch Boards S6 and S7,
Bottom View, Parts Location

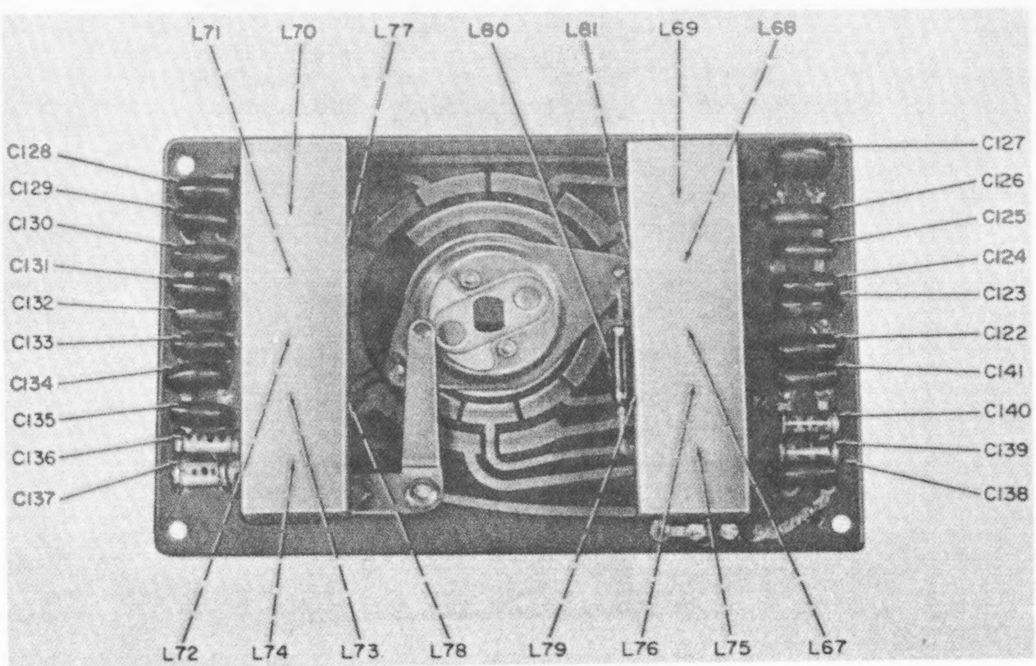


Figure 6-54. Signal Data Translator Cv-1377( )/PRC-47 (A3),
Switch Board S8, Parts Location

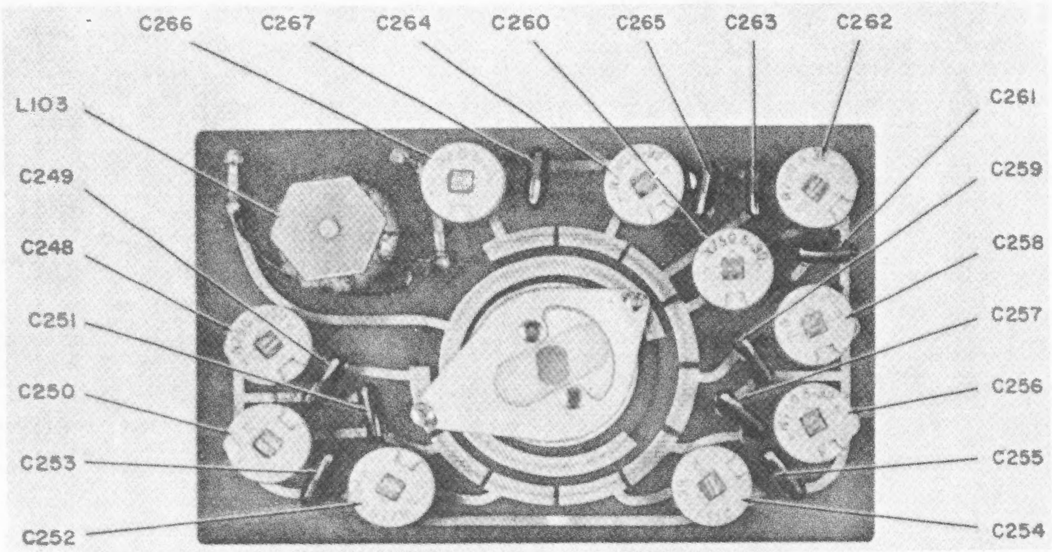


Figure 6-55. Signal Data Translator CV-1377( )/PRC-47 (A3), Switch Board S9, Parts Location

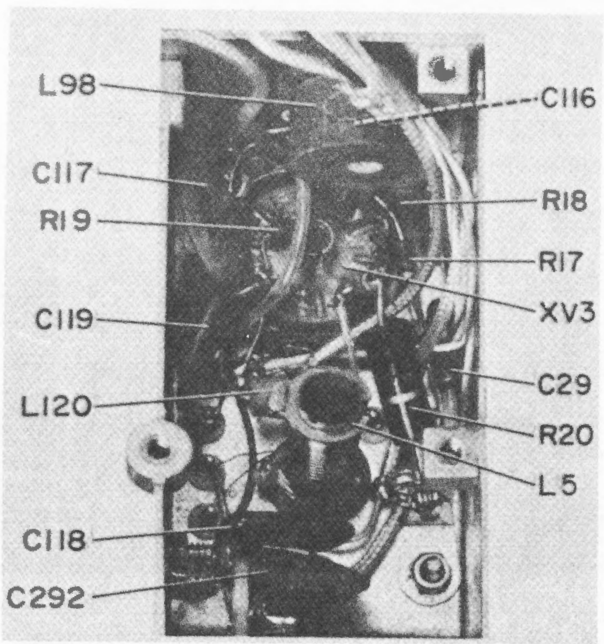


Figure 6-56. Signal Data Translator CV-1377( )/ PRC-47 (A3), Driver Tube V3 Compartment, Parts Location

Figure 6-56A. Signal Data Translator CV-1377A/ PRC-47 (A3), VFO Subassembly, Bottom View, Parts Location

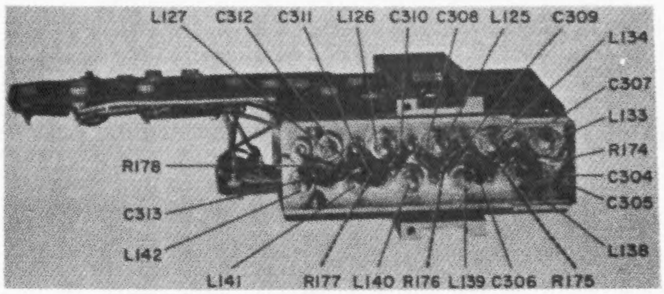


Figure 6-56B. Signal Data Translator CV-1377A/ PRC-47 (A3), VFO Subassembly, Top View, Parts Location

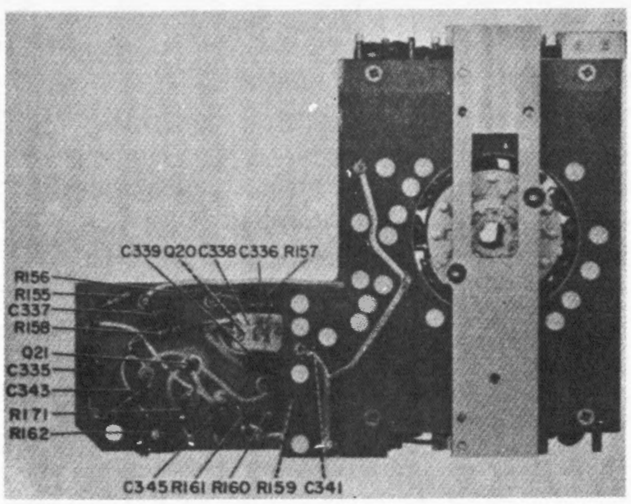


Figure 6-56C. Signal Data Translator CV-1377A/ PRC-47 (A3), VFO Subassembly, Front View, Parts Location

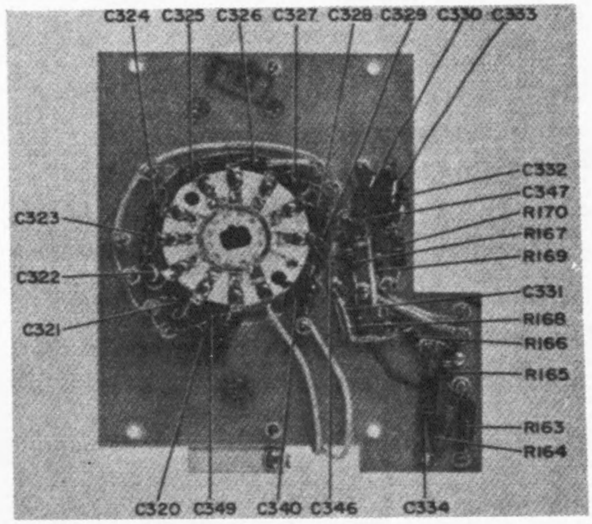


Figure 6-56D. Signal Data Translator CV-1377A/ PRC-47 (A3), VFO Subassembly, Card Assembly S7, Parts Location

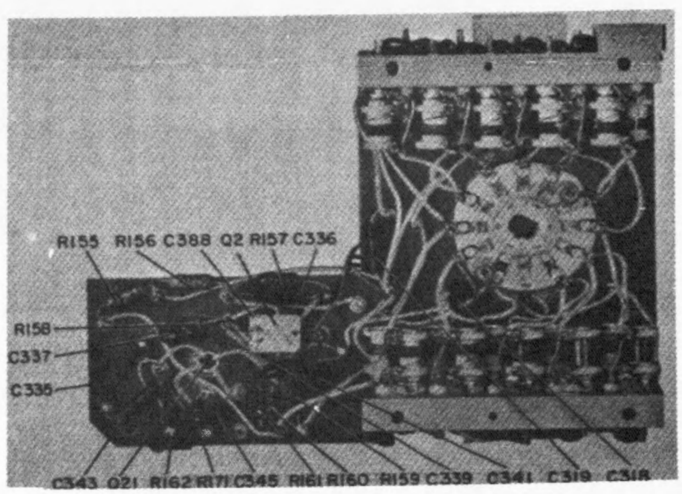


Figure 6-56E. Signal Data Translator CV-1377A/ PRC-47 (A3), VFO Subassembly, Card Assembly S6, Parts Location

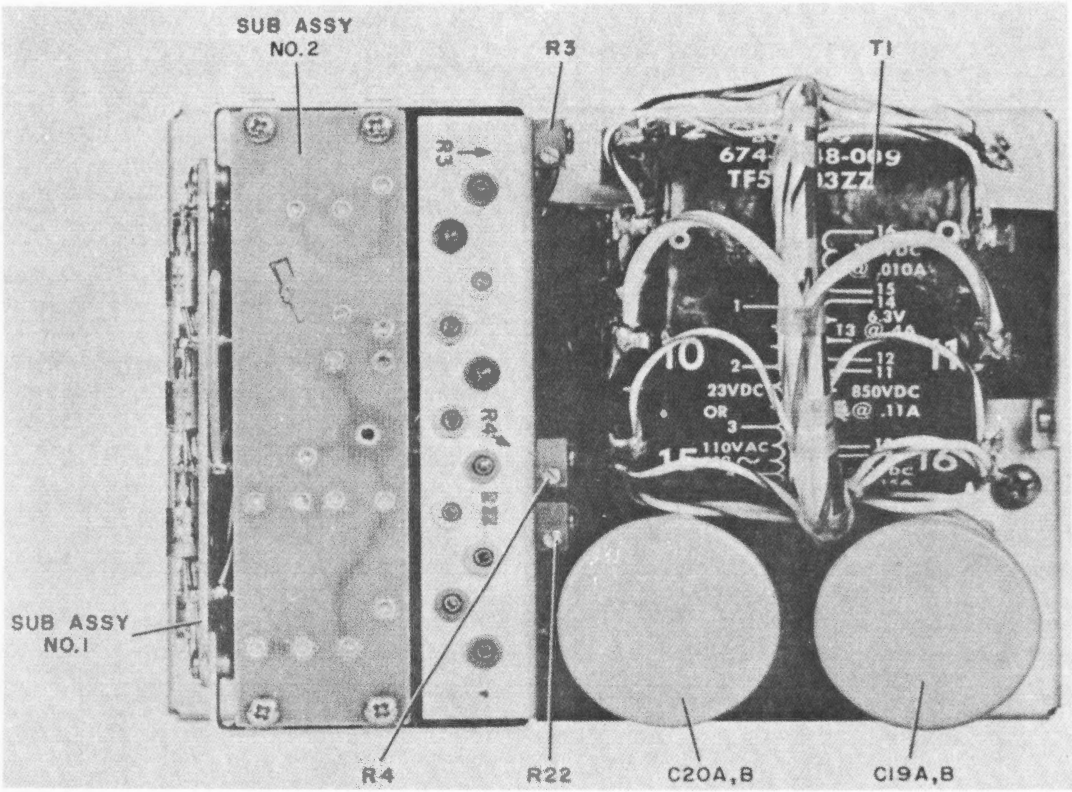


Figure 6-57. Power Supply PP-3518/PRC-47 (A5), Top View, Location of Major Components and Component Mounting Boards

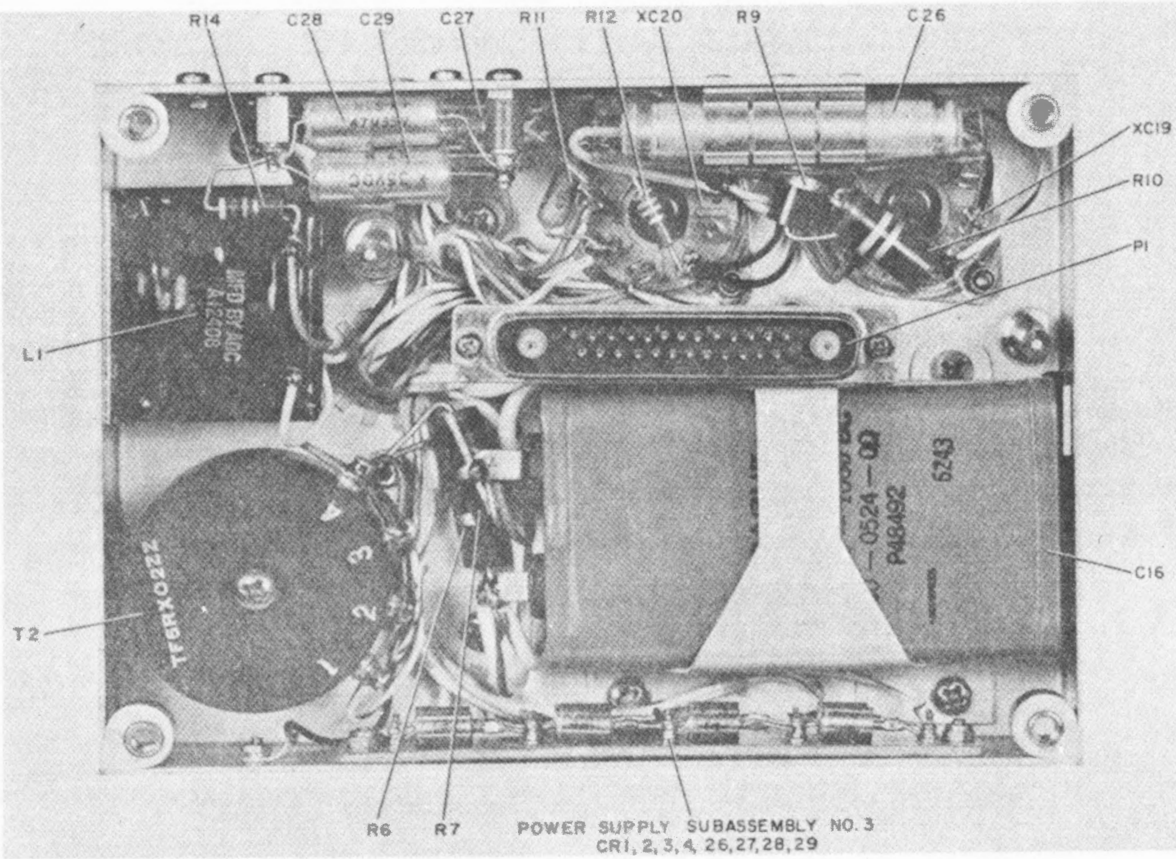


Figure 6-58. Power Supply PP-3518/PRC-47 (A5), Bottom View, Location of Major Components and Component Mounting Board Subassembly No. 3, Parts Location

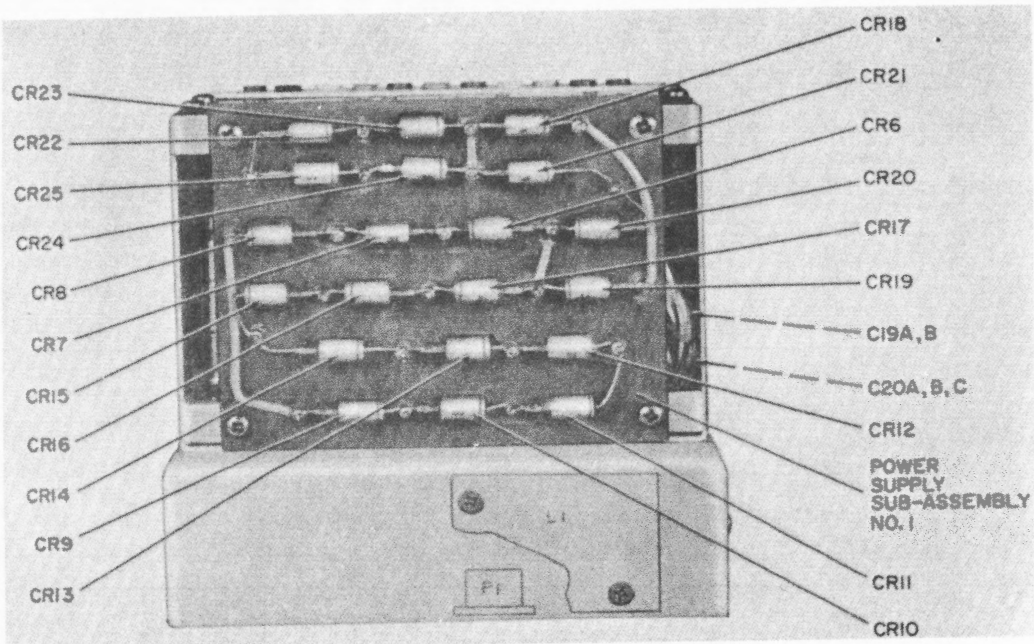


Figure 6-59. Power Supply PP-3518/PRC-47 (A5), Component Mounting Board Subassembly No. 1, Parts Location

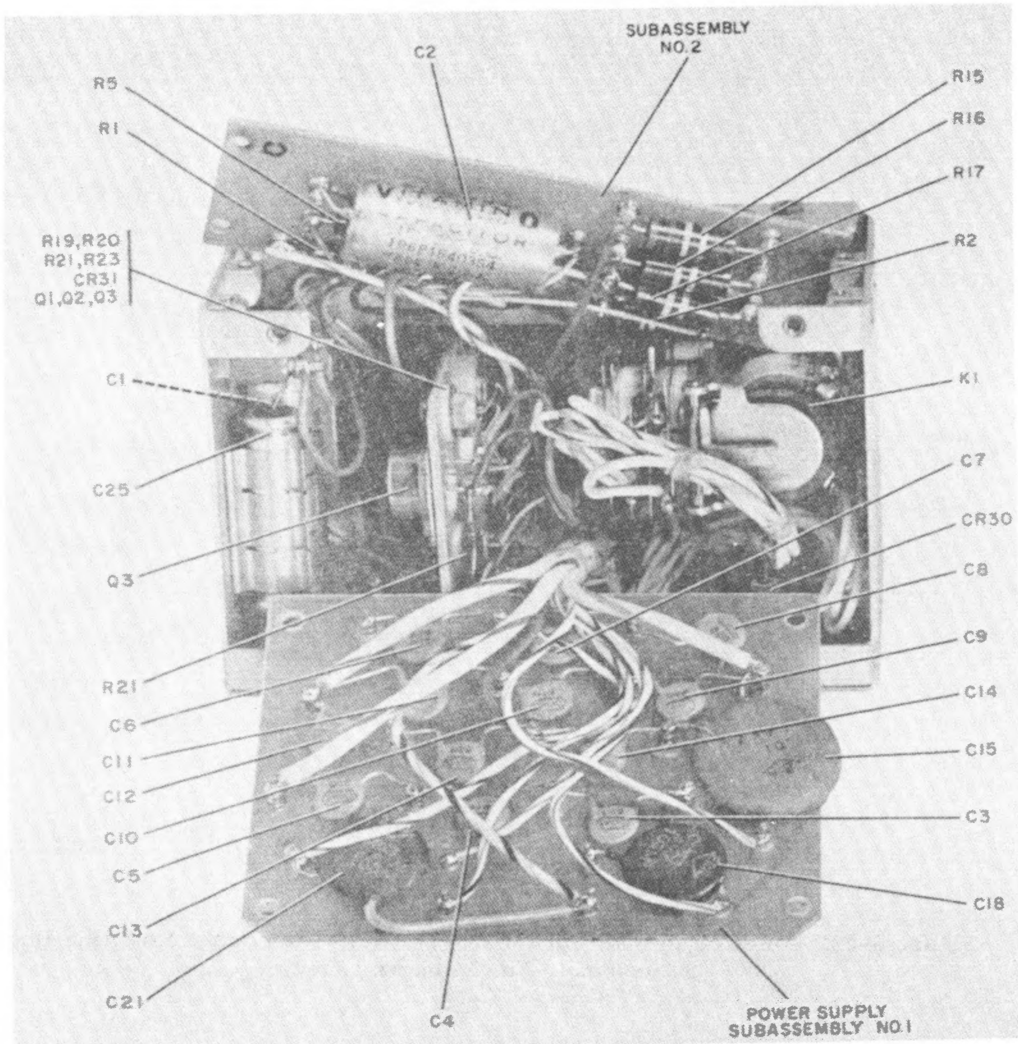


Figure 6-60. Power Supply PP-3518/PRC-47 (A5), Location of Major Components and Component Mounting Board Subassemblies No. 1 and No. 2, Parts Location

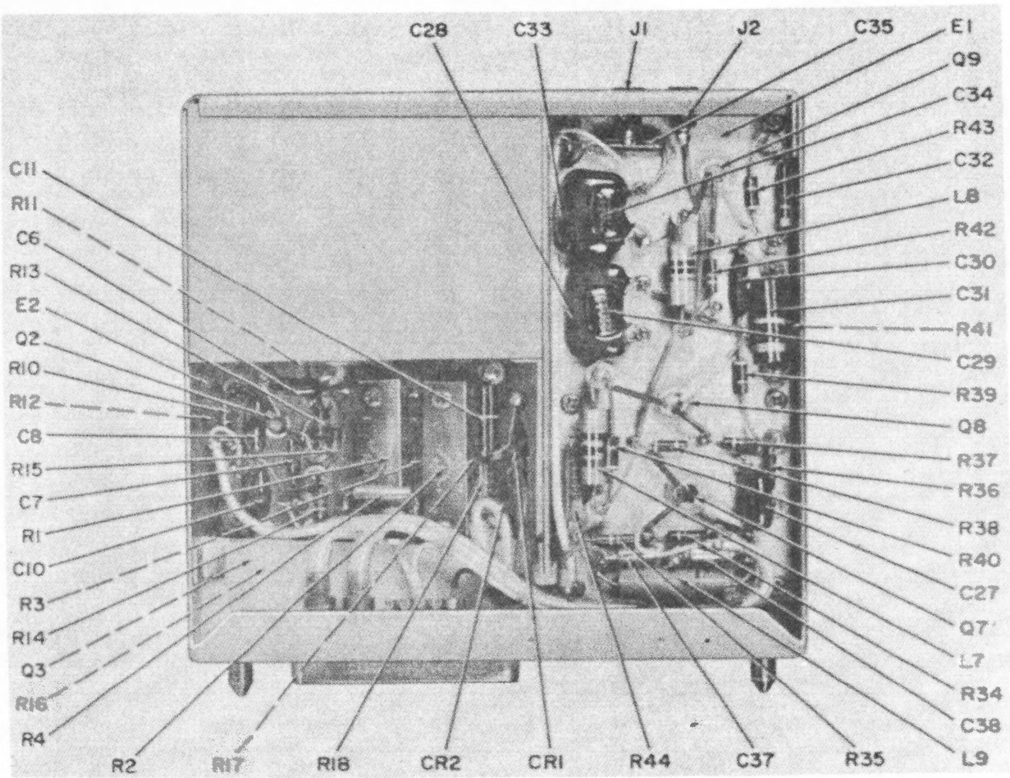


Figure 6-61. Radio Frequency Oscillator O-1032/PRC-47 (A6), Card Assemblies E1 and E2, Parts Location

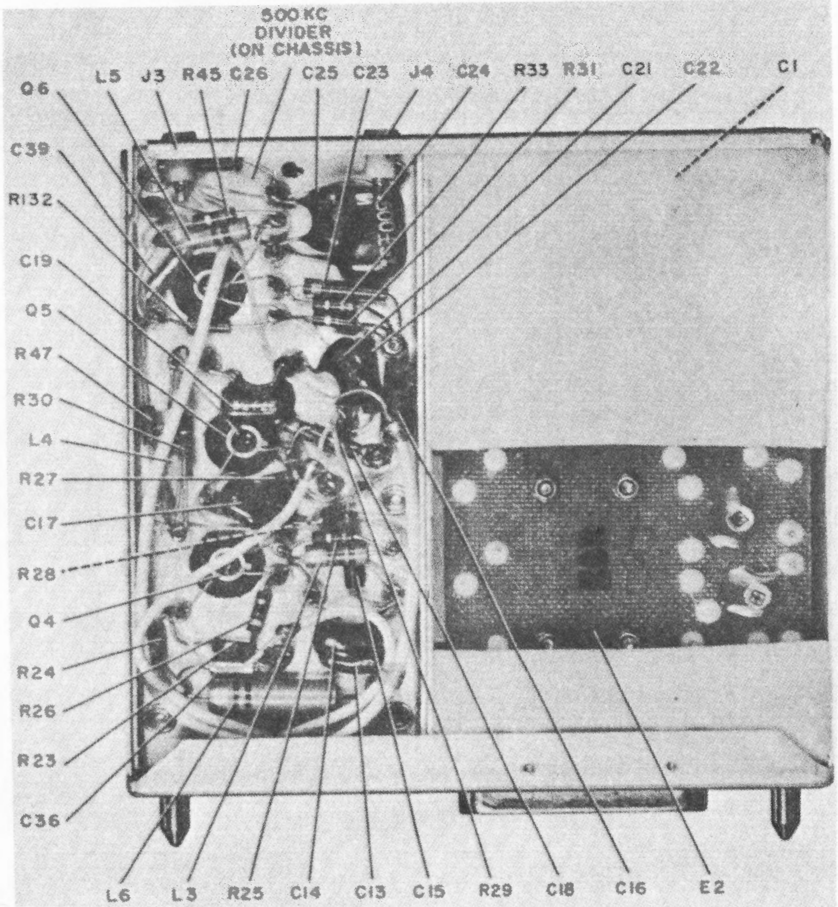


Figure 6-62. Radio Frequency Oscillator O-1032/PRC-47 (A6), Chassis, Parts Location

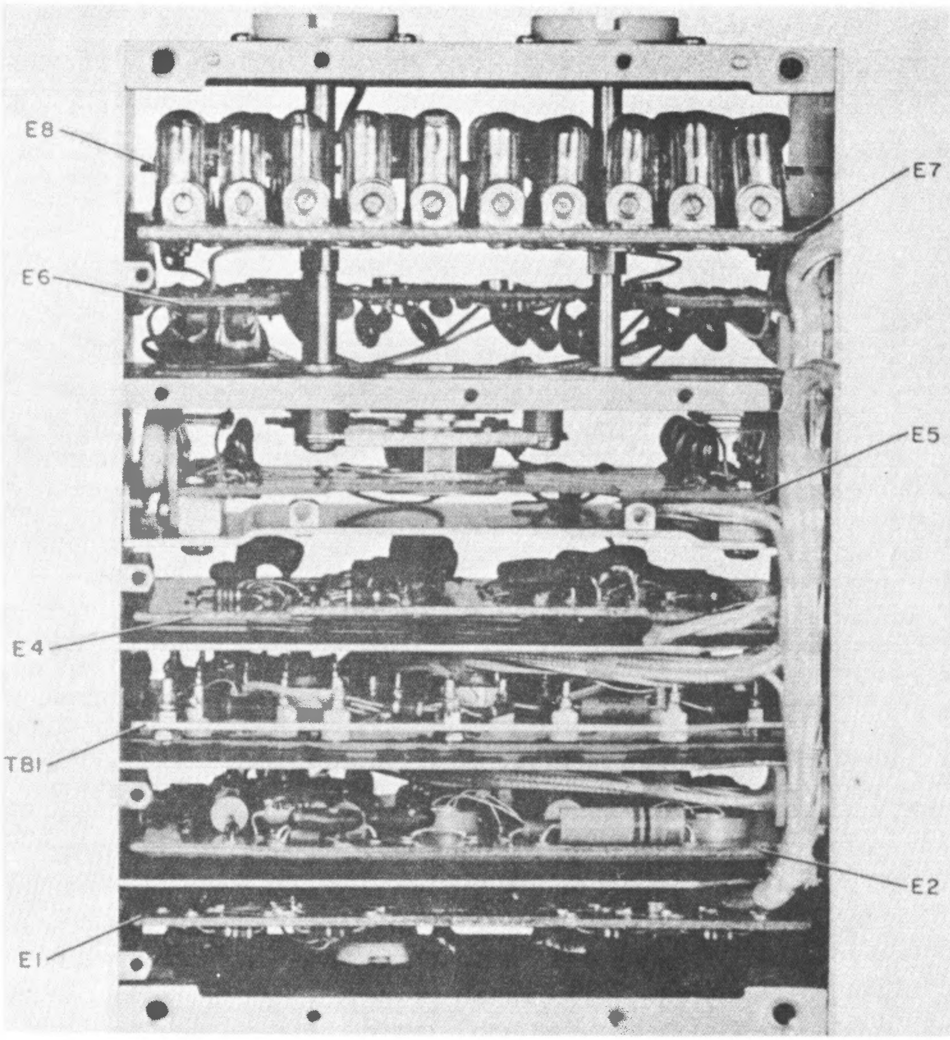


Figure 6-63. Oscillator Control C-4311/PRC-47 (A7), Top View, Location of Card Assemblies

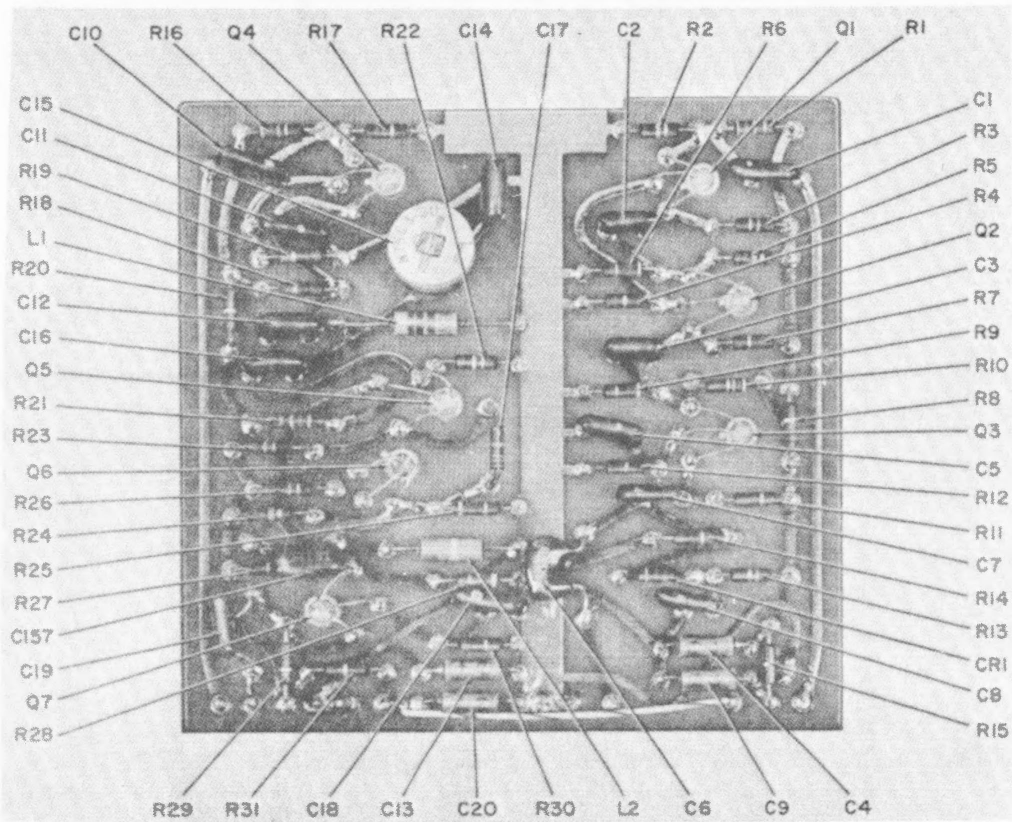


Figure 6-64. Oscillator Control C-4311/PRC-47 (A7), Card Assembly E1, Parts Location

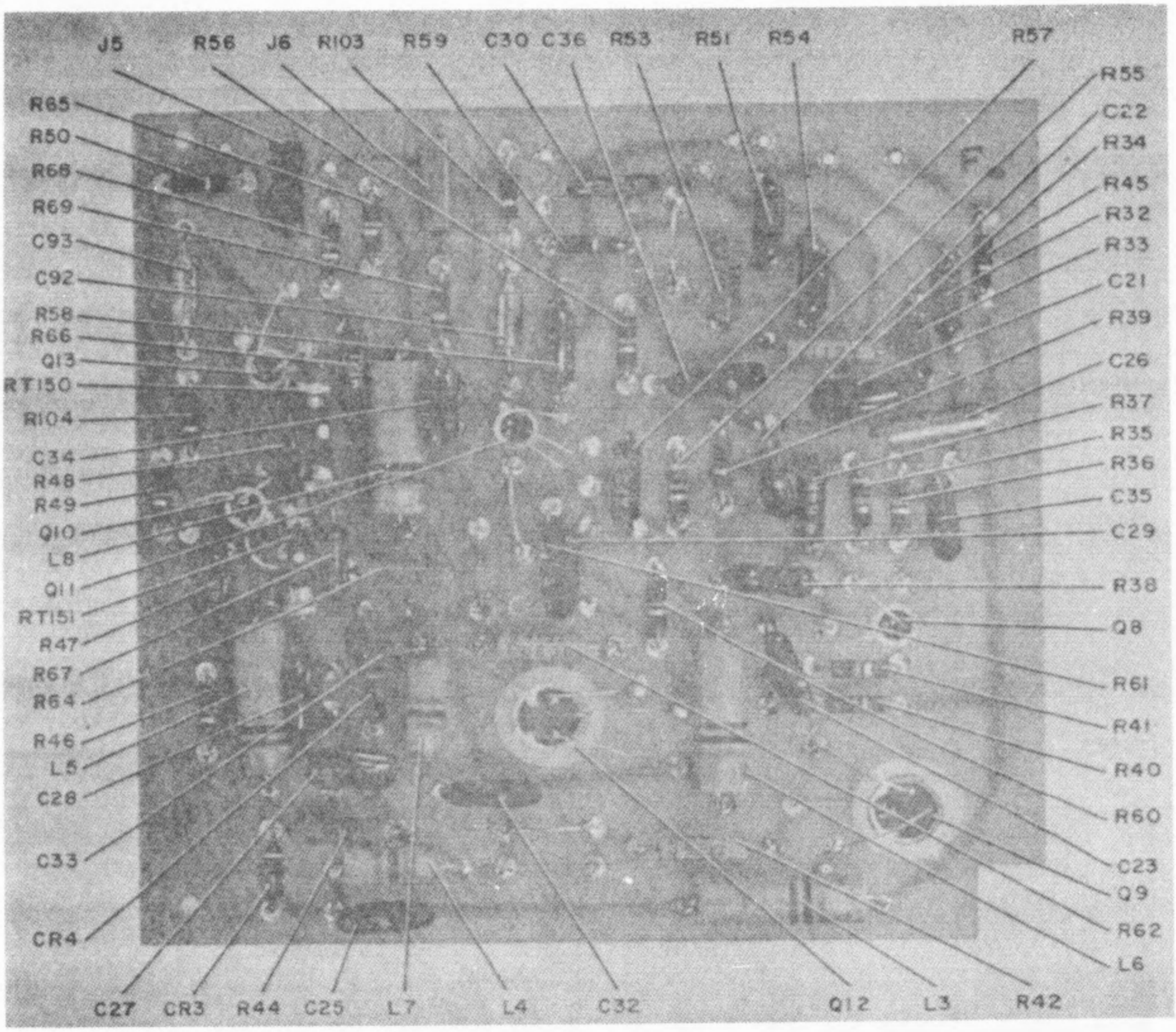


Figure 6-65. Oscillator Control C-4311/PRC-47 (A7), Card Assembly E2, Parts Location

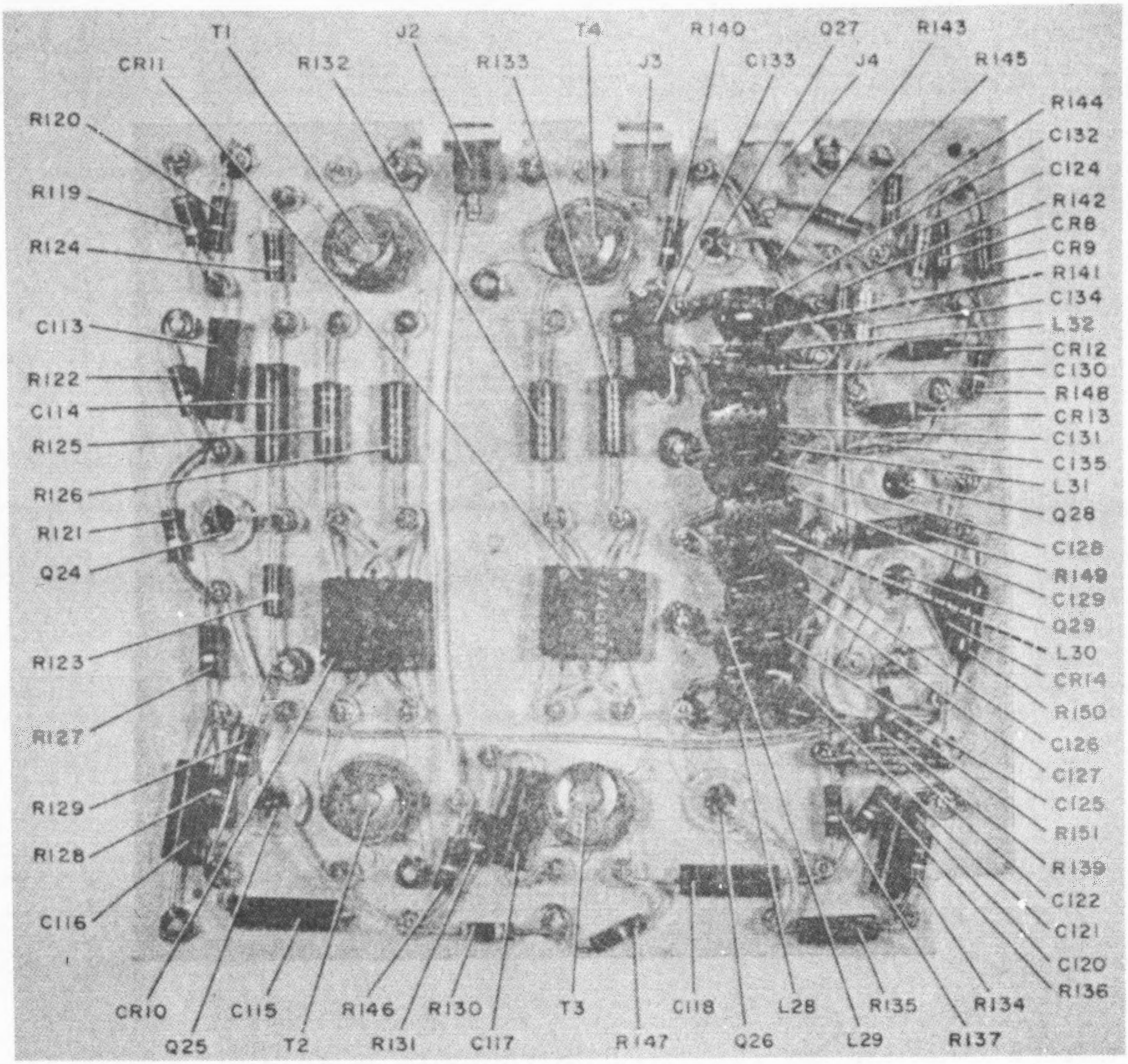


Figure 6-66. Oscillator Control C-4311/PRC-47 (A7), Card Assembly TB1, Parts Location

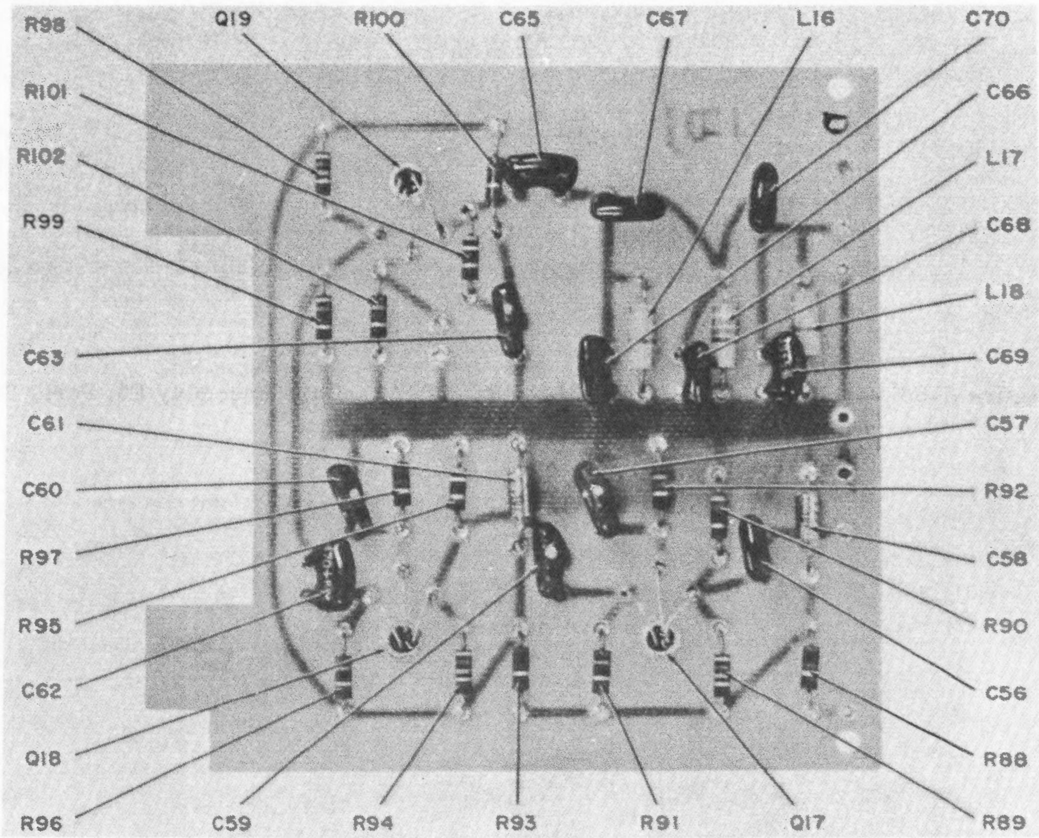


Figure 6-67. Oscillator Control C-4311/PRC-47 (A7), Card Assembly E4, Parts Location

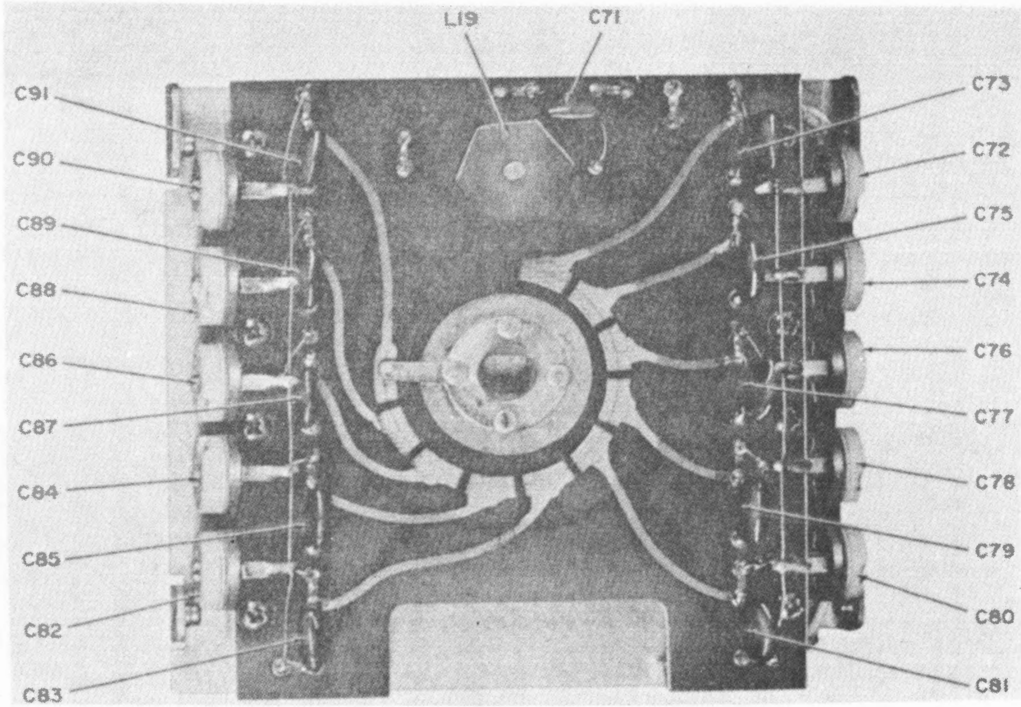


Figure 6-68. Oscillator Control C-4311/PRC-47 (A7), Card Assembly E5, Parts Location

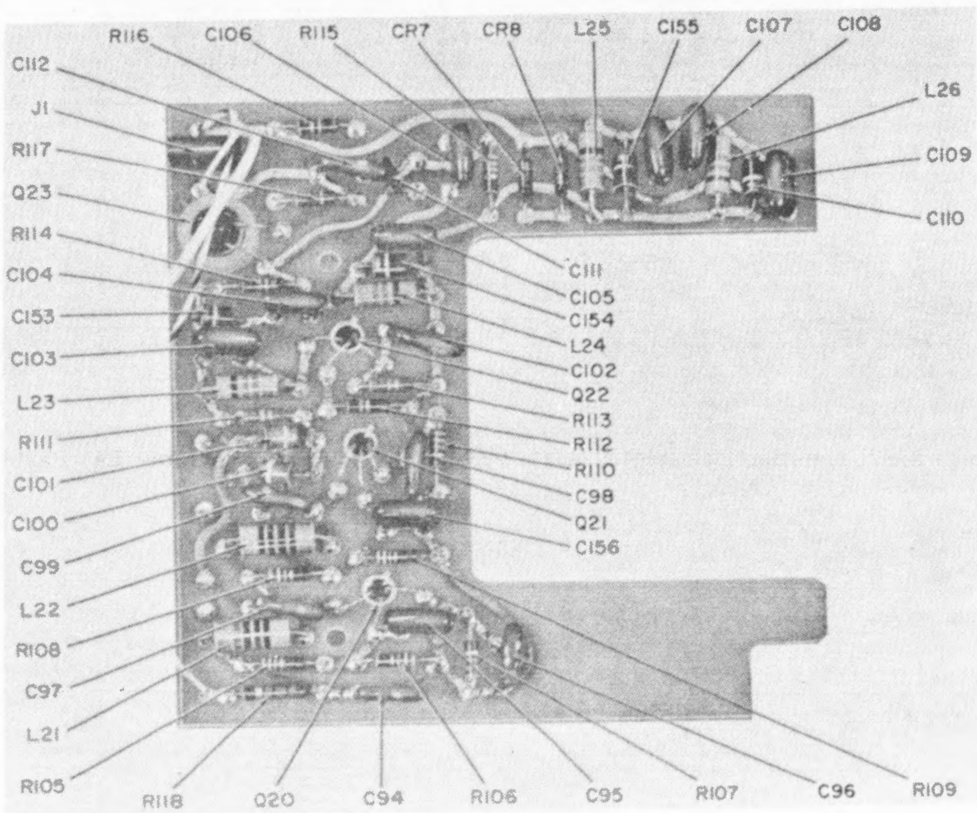


Figure 6-69. Oscillator Control C-4311/PRC-47 (A7), Card Assembly E6, Parts Location

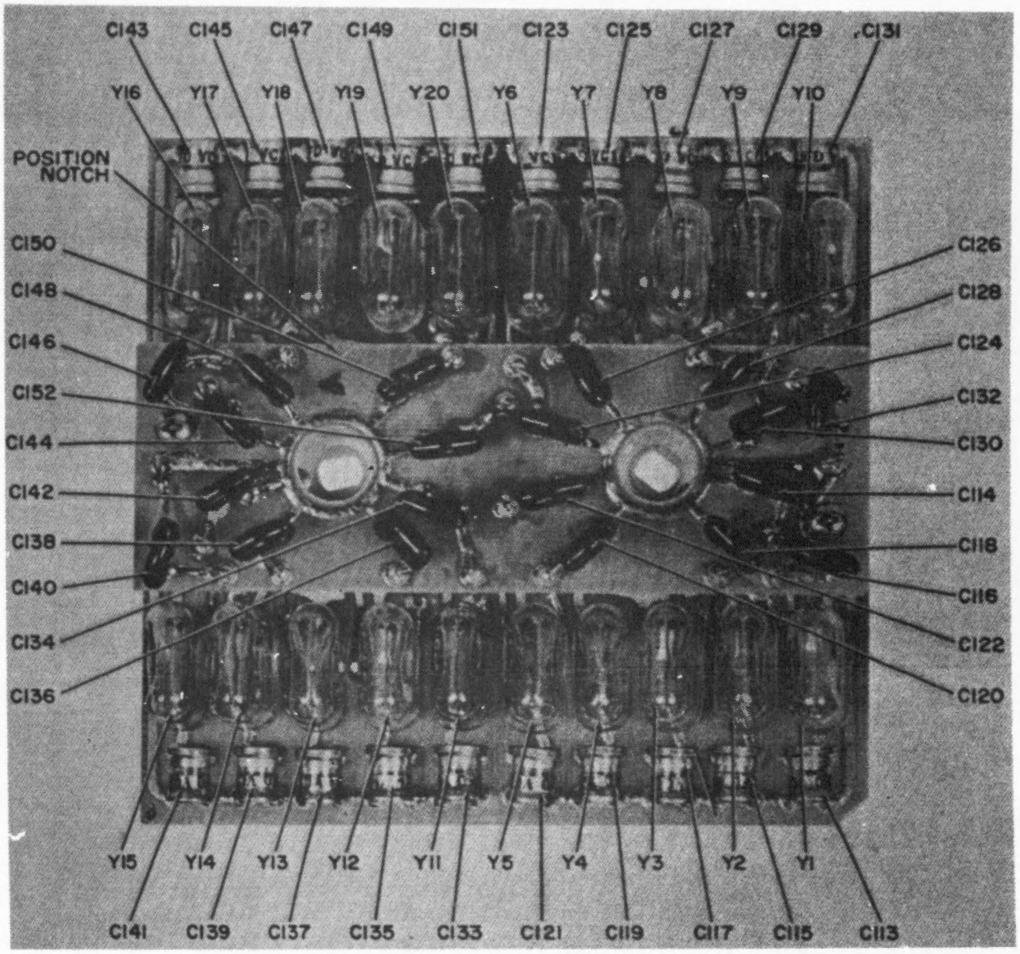


Figure 6-70. Oscillator Control C-4311/PRC-47 (A7),
Cards E7 and E8, Parts Location

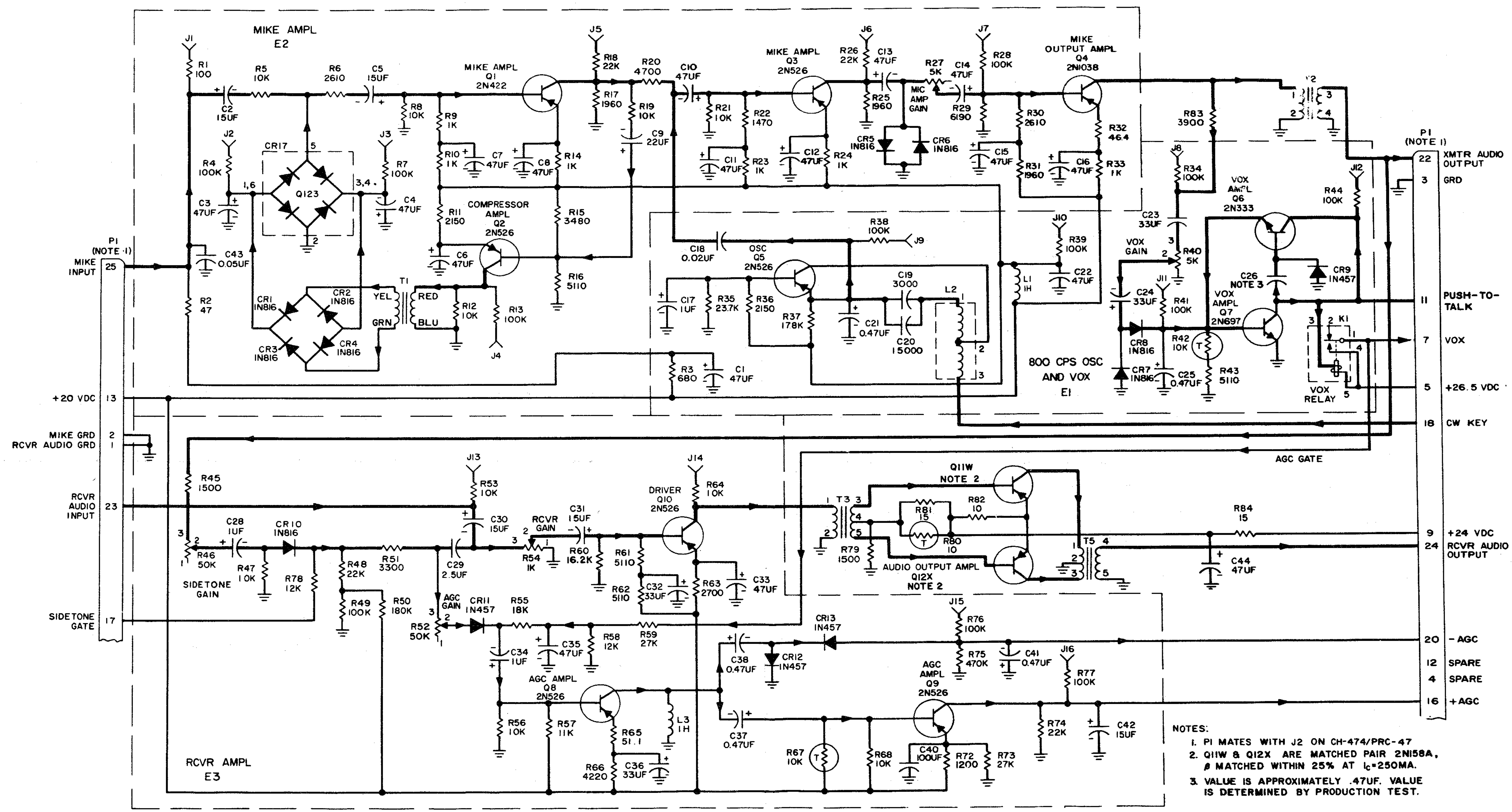


Figure 6-71. Audio Frequency Amplifier AM-3506/PRC-47 (A1), Schematic Diagram

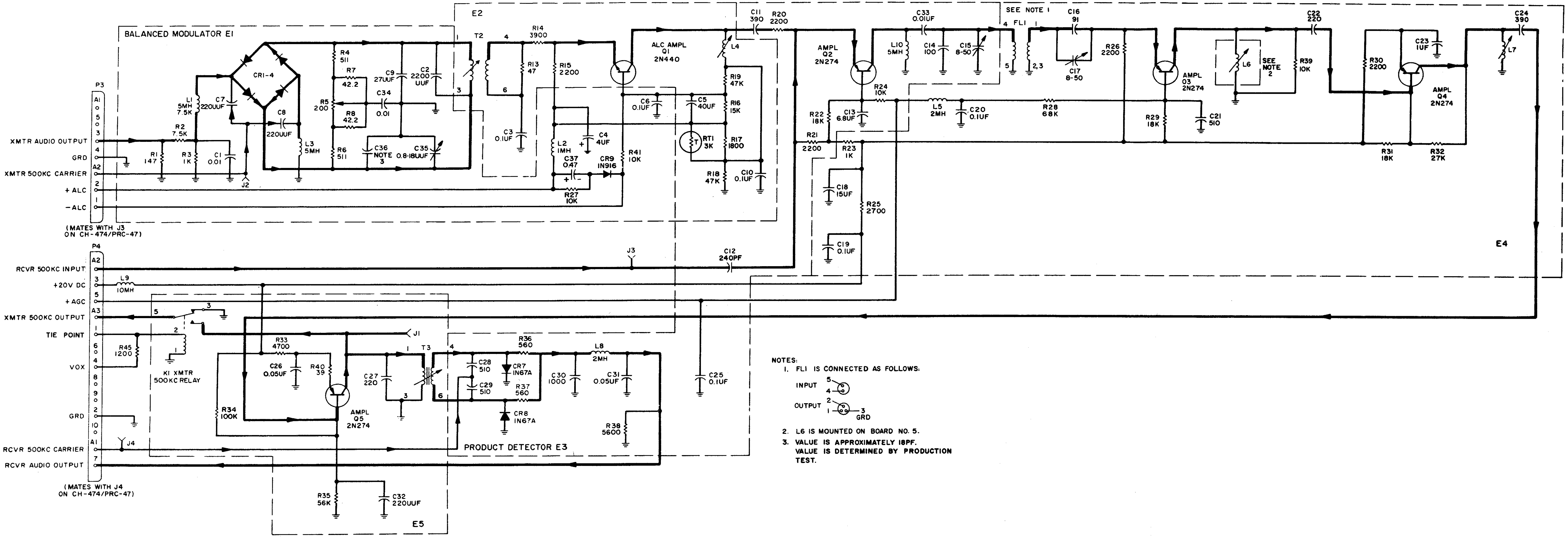


Figure 6-72. Amplifier-Modulator AM-3507/PRC-47 (A2), Schematic Diagram

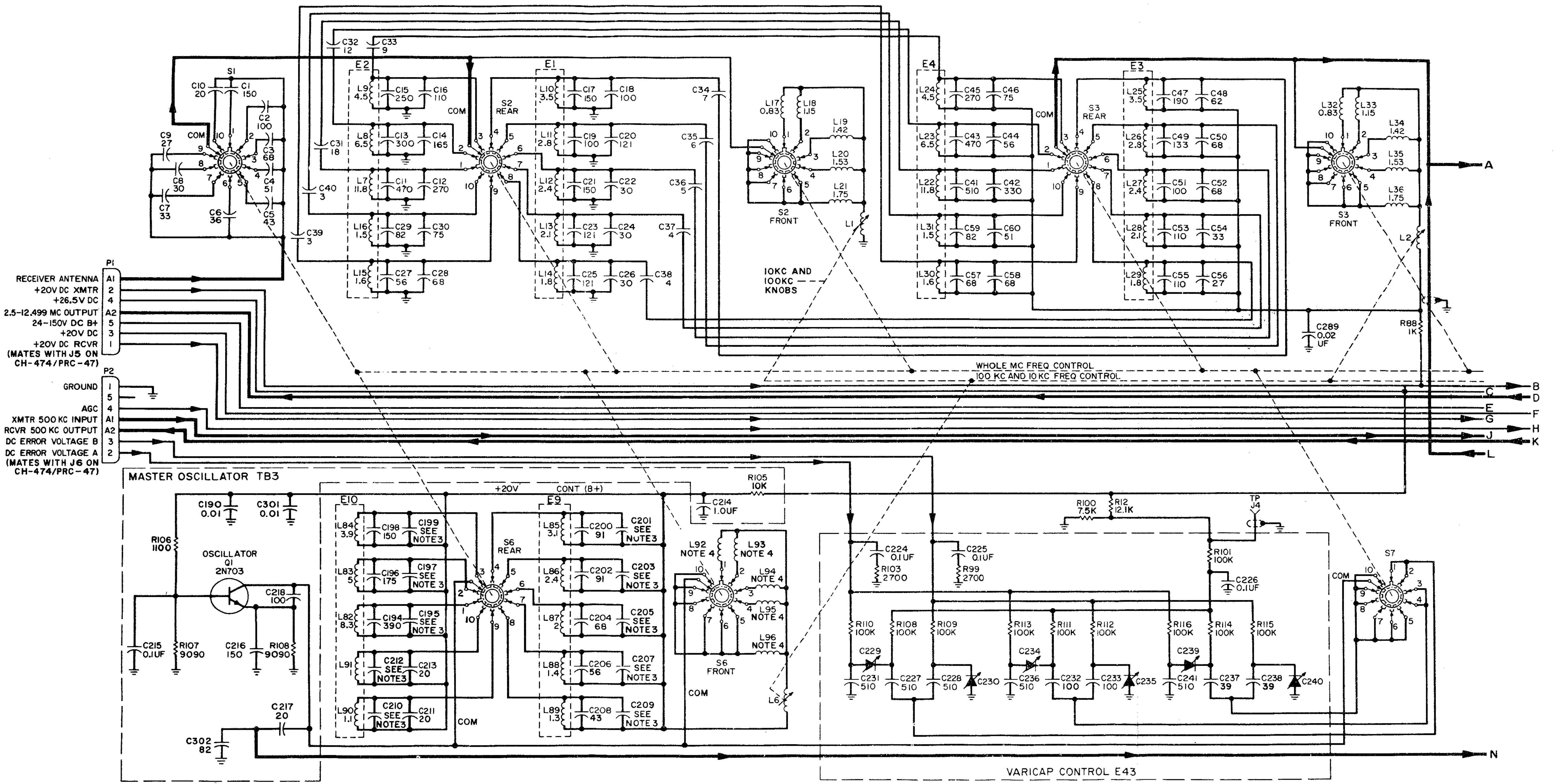


Figure 6-73. Signal Data Translator CV-1377/PRC-47, Schematic Diagram (Sheet 1 of 3)

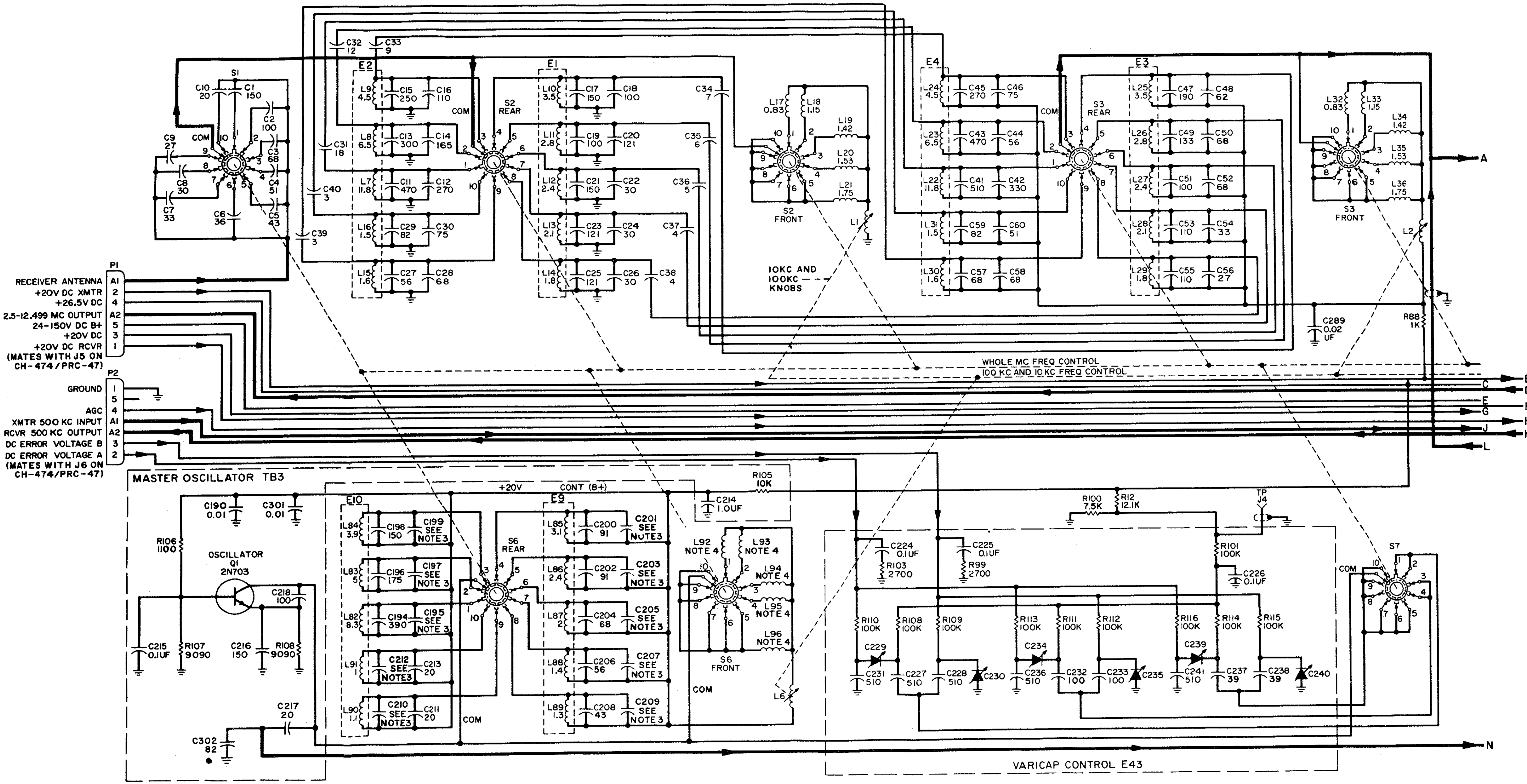


Figure 6-73. Signal Data Translator CV-1377/PRC-47, Schematic Diagram (Sheet 1 of 3)

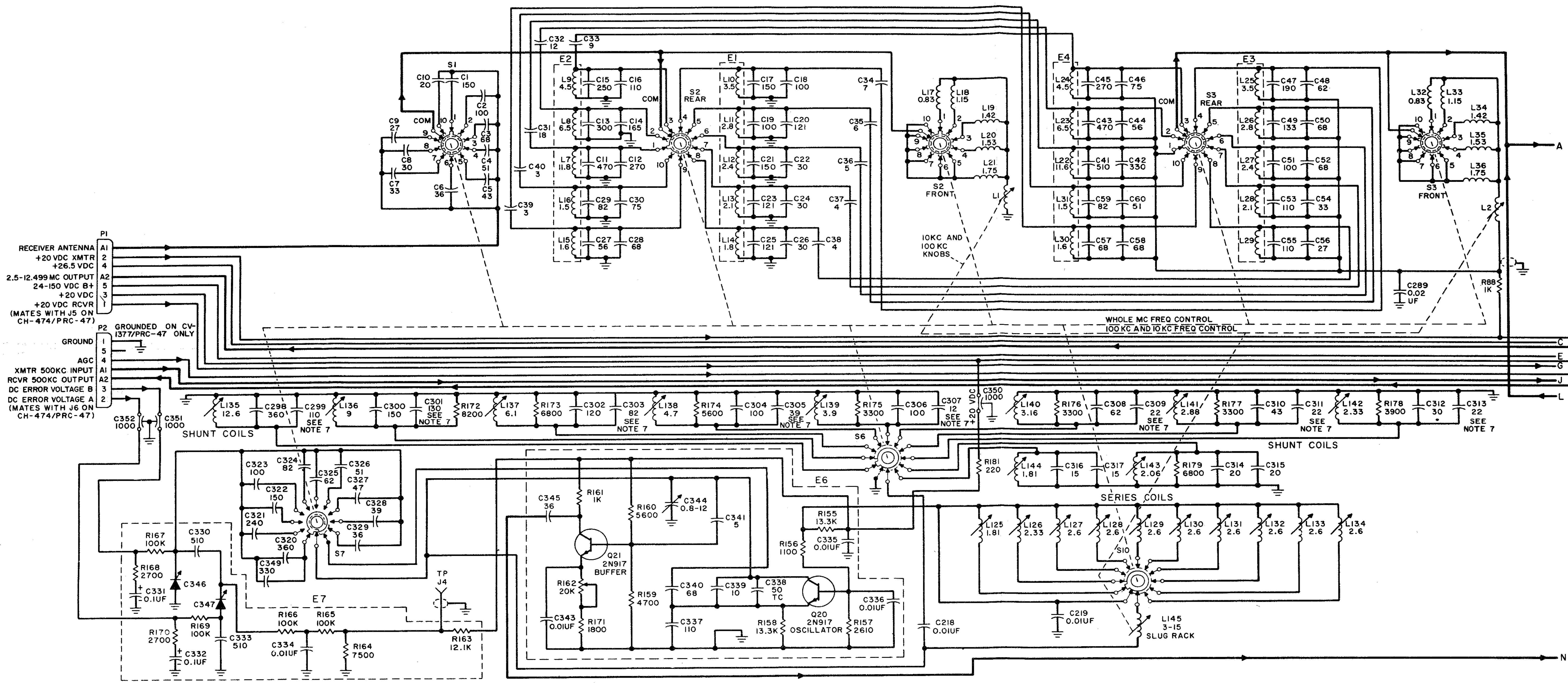


Figure 6-73. Signal Data Translator CV-1377A/PRC-47. Schematic Diagram (Sheet 1A of 3)

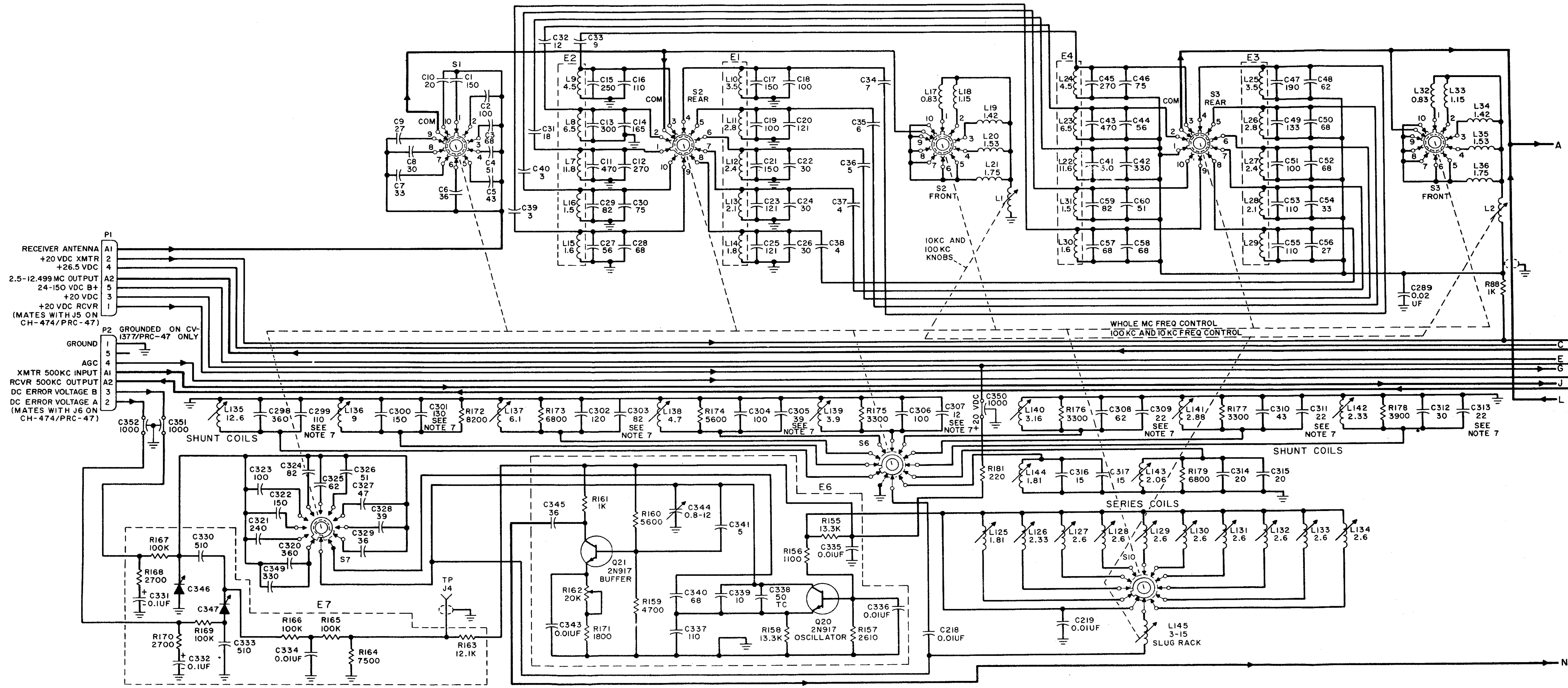


Figure 6-73. Signal Data Translator CV-1377A/PRC-47. Schematic Diagram (Sheet 1A of 3)

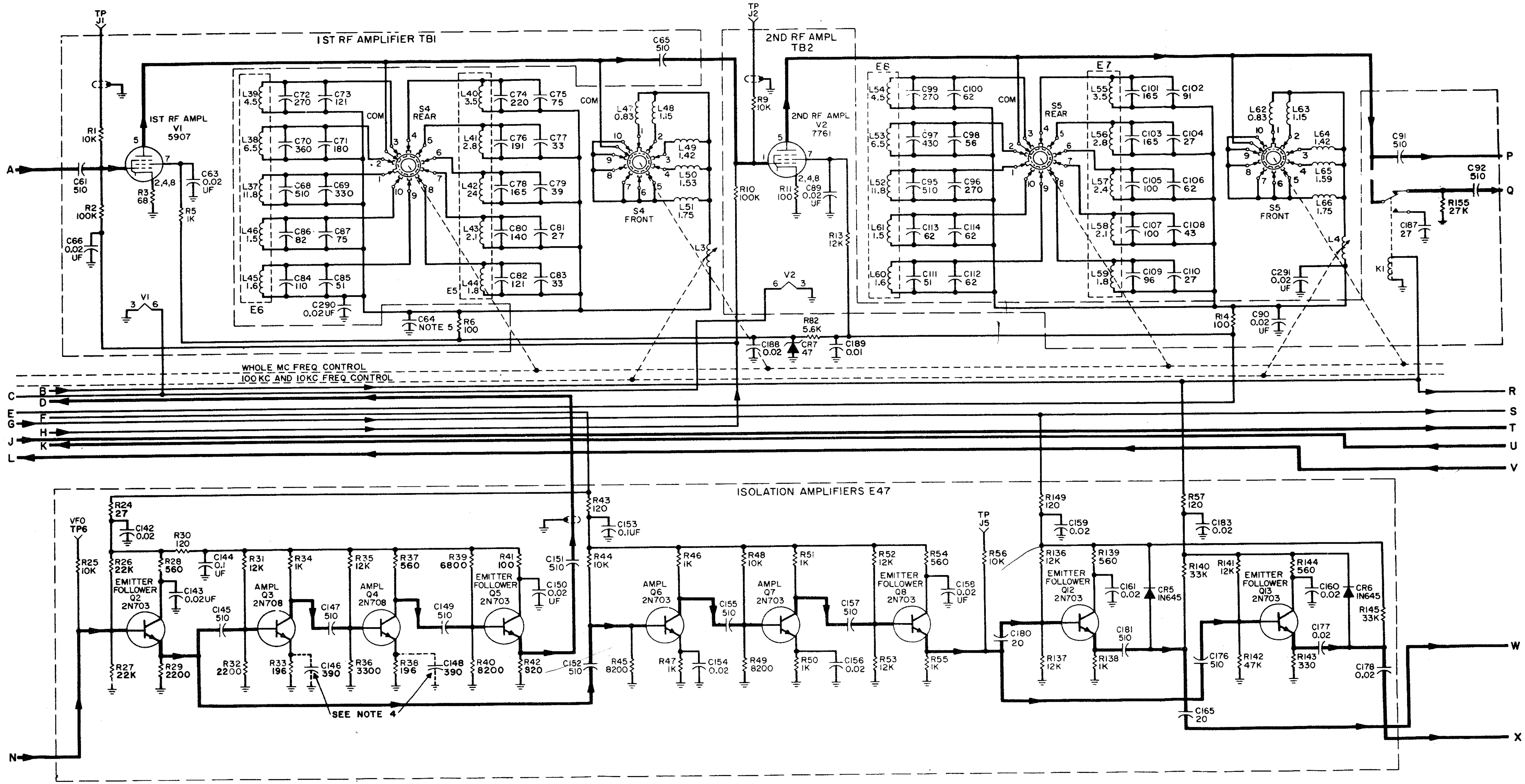


Figure 6-73. Signal Data Translator CV-1377/PRC-47, Schematic Diagram (Sheet 2 of 3)

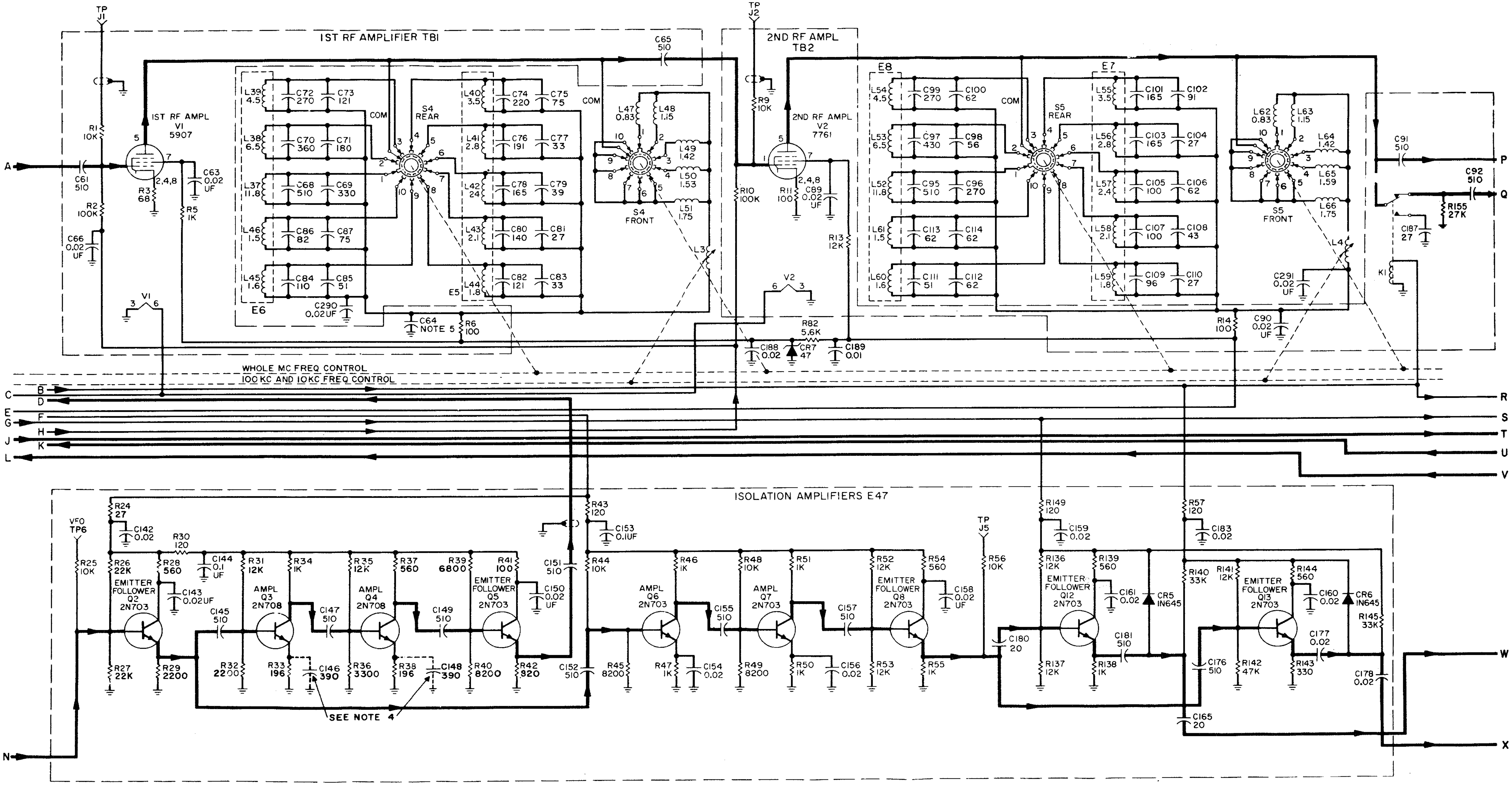
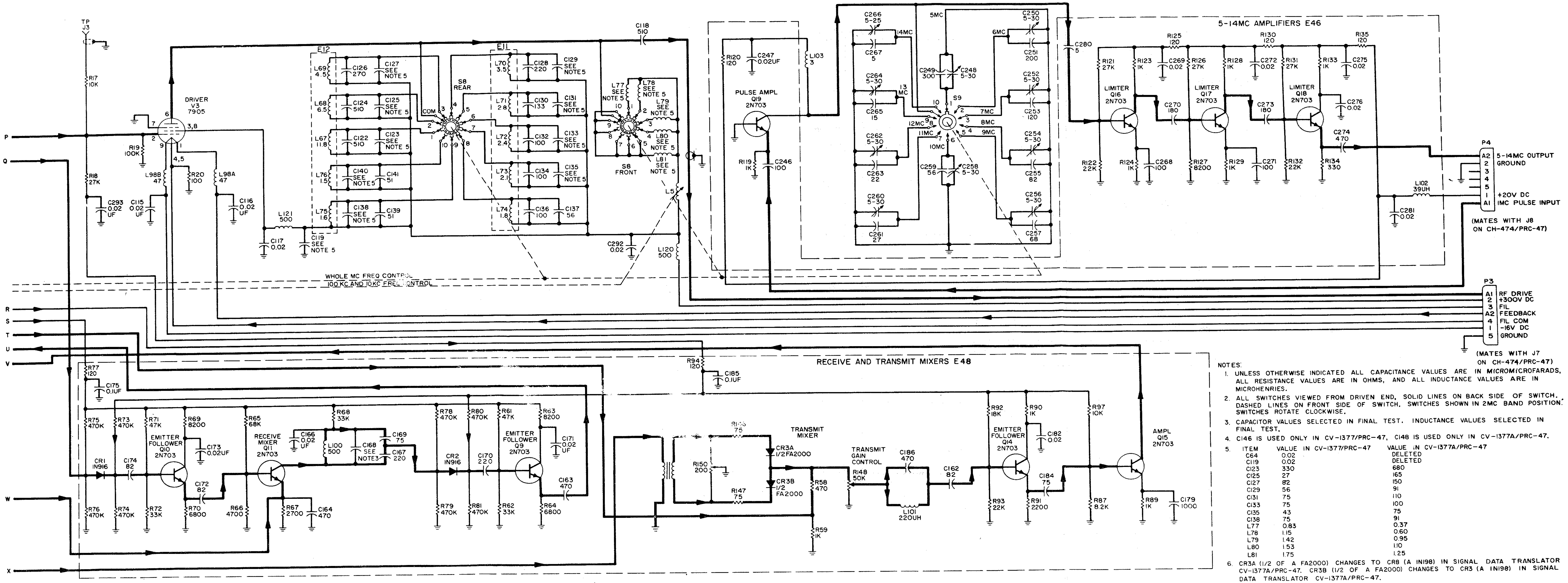


Figure 6-73. Signal Data Translator CV-1377/PRC-47, Schematic Diagram (Sheet 2 of 3)



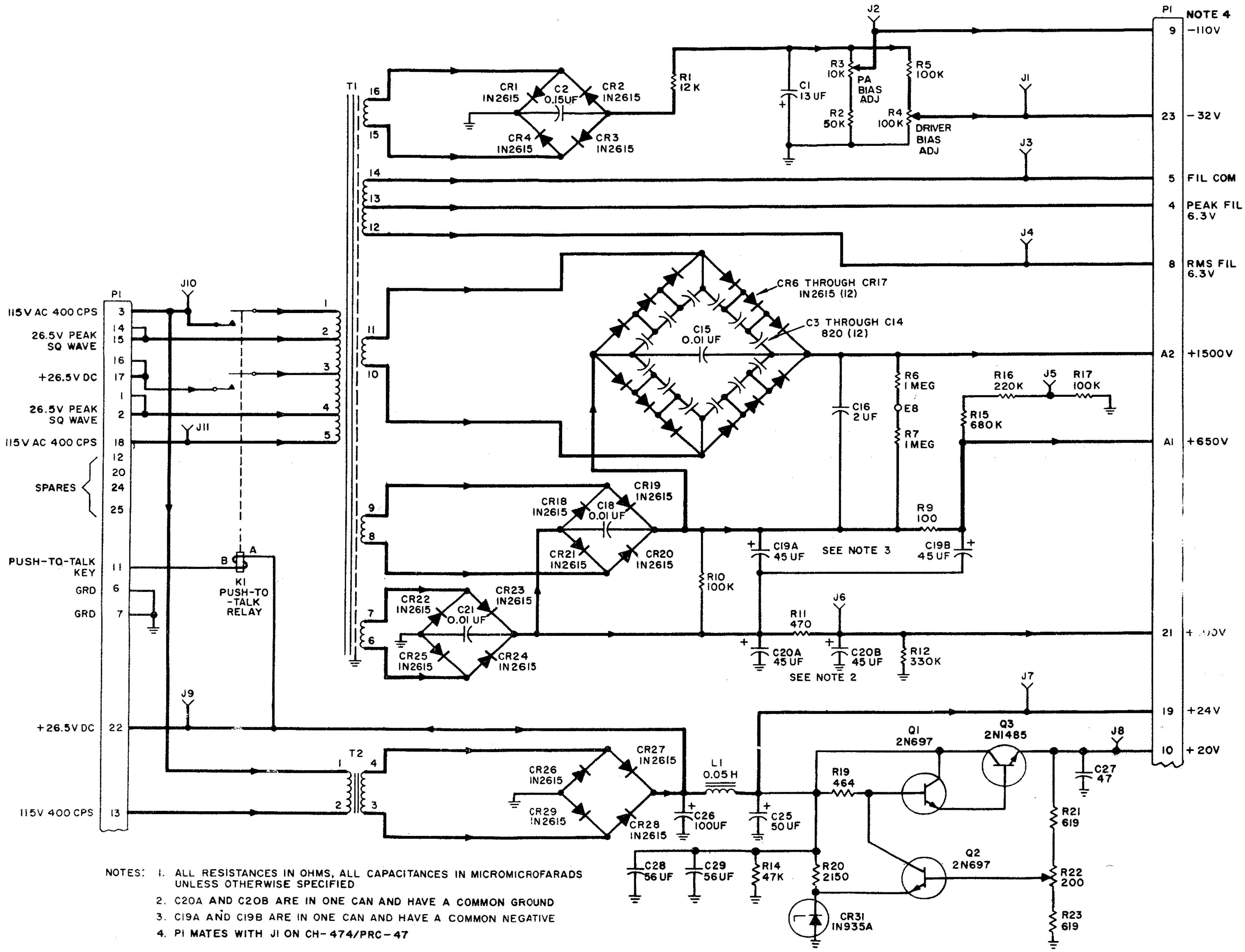
NOTES:

1. UNLESS OTHERWISE INDICATED ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ALL RESISTANCE VALUES ARE IN OHMS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
2. ALL SWITCHES VIEWED FROM DRIVEN END, SOLID LINES ON BACK SIDE OF SWITCH. DASHED LINES ON FRONT SIDE OF SWITCH. SWITCHES SHOWN IN 2MC BAND POSITION. SWITCHES ROTATE CLOCKWISE.
3. CAPACITOR VALUES SELECTED IN FINAL TEST. INDUCTANCE VALUES SELECTED IN FINAL TEST.
4. C146 IS USED ONLY IN CV-1377/PRC-47, C148 IS USED ONLY IN CV-1377A/PRC-47.
5.

ITEM	VALUE IN CV-1377/PRC-47	VALUE IN CV-1377A/PRC-47
C64	0.02	DELETED
C119	0.02	DELETED
C123	330	680
C125	27	165
C127	82	150
C129	56	91
C131	75	110
C133	75	100
C135	43	75
C138	75	91
L77	0.83	0.37
L78	1.15	0.60
L79	1.42	0.95
L80	1.53	1.10
L81	1.75	1.25

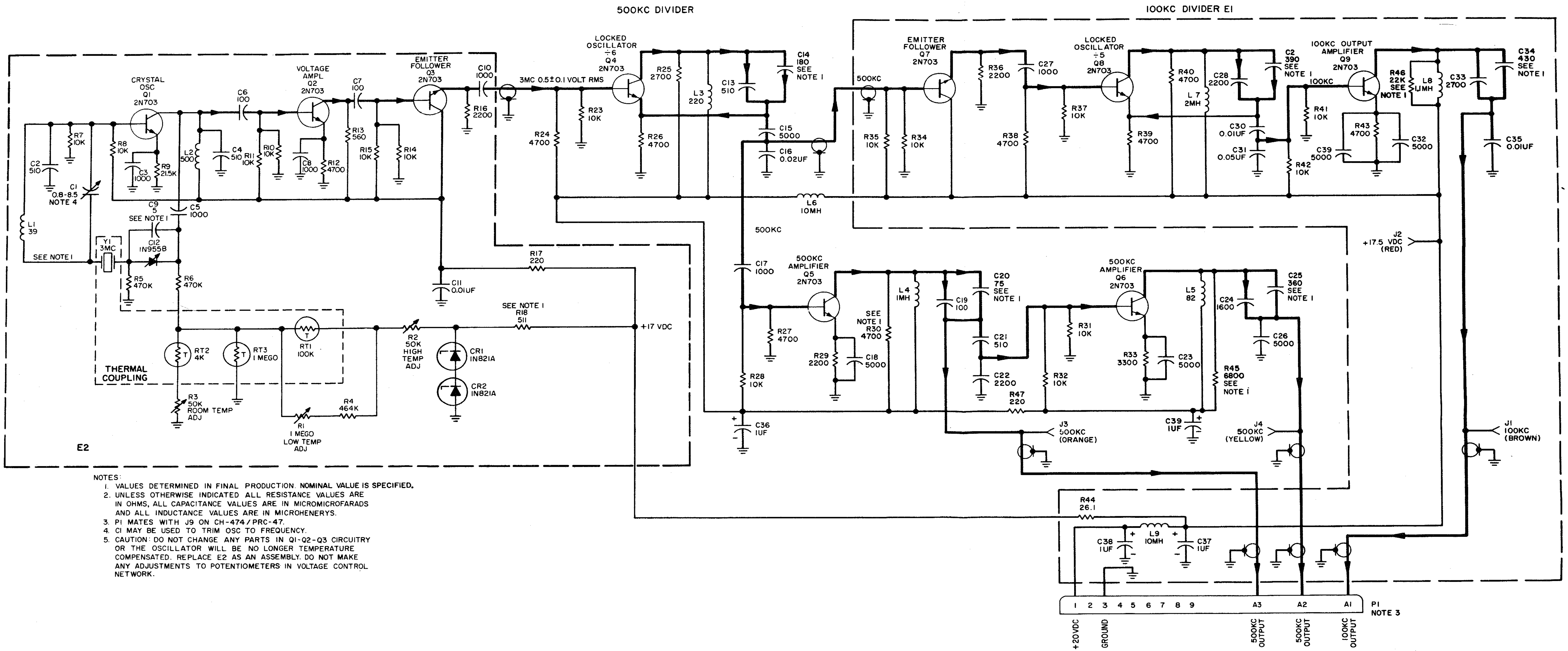
6. CR3A (1/2 OF A FA2000) CHANGES TO CR8 (A IN198) IN SIGNAL DATA TRANSLATOR CV-1377A/PRC-47. CR3B (1/2 OF A FA2000) CHANGES TO CR3 (A IN198) IN SIGNAL DATA TRANSLATOR CV-1377A/PRC-47.
7. SELECTED IN FINAL TEST. MAY DEVIATE FROM VALUE SPECIFIED.

Figure 6-73. Signal Data Translator CV-1377/PRC-47, Schematic Diagram (Sheet 3 of 3)



NOTES:
1. ALL RESISTANCES IN OHMS, ALL CAPACITANCES IN MICROMICROFARADS UNLESS OTHERWISE SPECIFIED
2. C20A AND C20B ARE IN ONE CAN AND HAVE A COMMON GROUND
3. C19A AND C19B ARE IN ONE CAN AND HAVE A COMMON NEGATIVE
4. P1 MATES WITH J1 ON CH-474/PRC-47

Figure 6-74. Power Supply PP-3518/PRC-47, Schematic Diagram



NOTES:

1. VALUES DETERMINED IN FINAL PRODUCTION. NOMINAL VALUE IS SPECIFIED.
2. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENERYS.
3. P1 MATES WITH J9 ON CH-474/PRC-47.
4. C1 MAY BE USED TO TRIM OSC TO FREQUENCY.
5. CAUTION: DO NOT CHANGE ANY PARTS IN Q1-Q2-Q3 CIRCUITRY OR THE OSCILLATOR WILL BE NO LONGER TEMPERATURE COMPENSATED. REPLACE E2 AS AN ASSEMBLY. DO NOT MAKE ANY ADJUSTMENTS TO POTENTIOMETERS IN VOLTAGE CONTROL NETWORK.

Figure 6-75. Radio Frequency Oscillator O-1032/PRC-47 (A6), Schematic Diagram

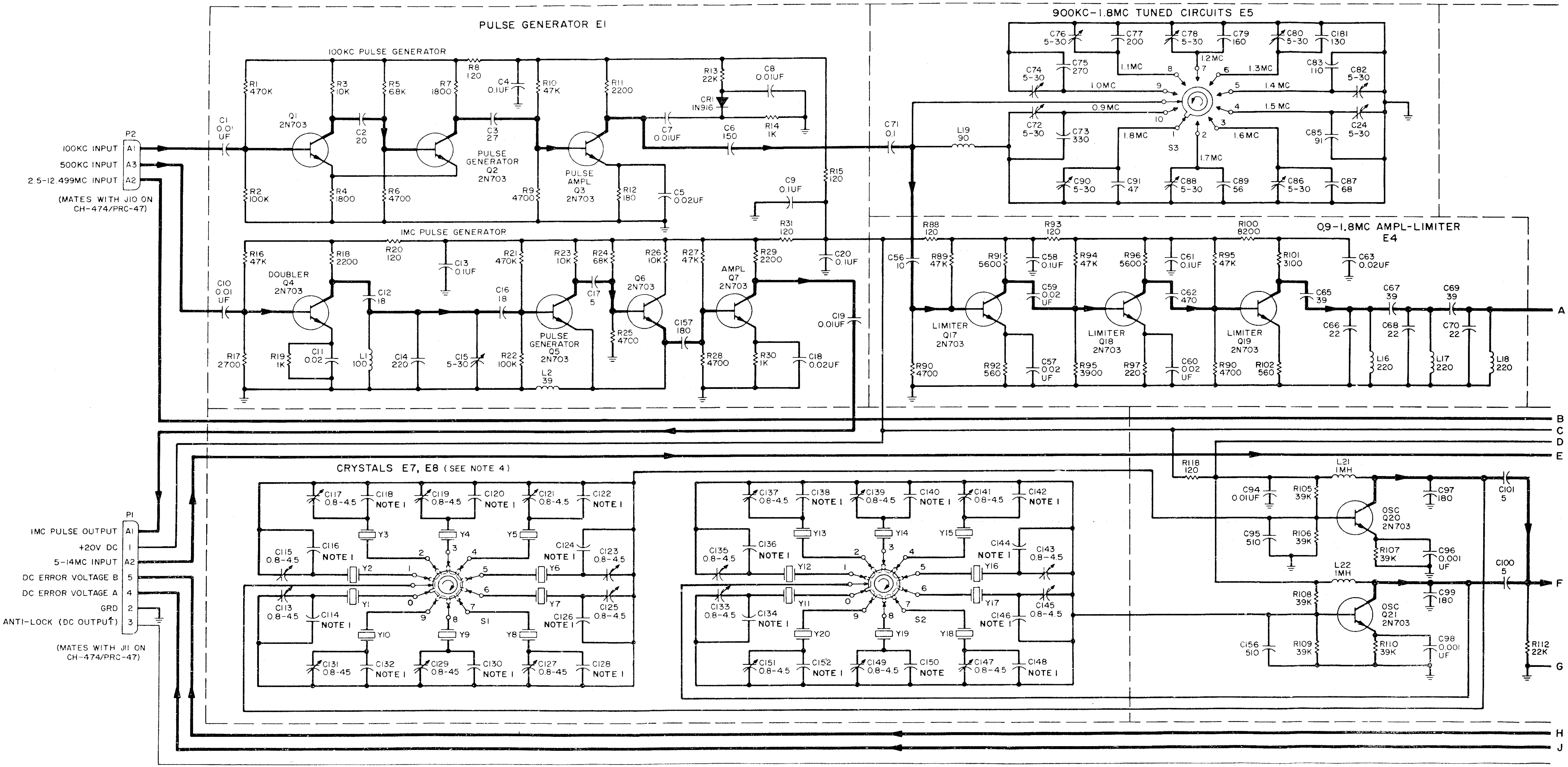


Figure 6-76. Oscillator Control C-4311/PRC-47 (A7), Schematic Diagram (Sheet 1 of 2)

NOTES CONT:

6. RT150 AND RT151 ARE NOT INCLUDED IN SOME UNITS. IF THESE TWO THERMISTORS ARE NOT INCLUDED, THE RESISTANCE VALUES OF R47, R48, R66, AND R67 ARE 31.6K, 10K, 31.6K, AND 10K RESP.
7. SELECTED IN FINAL TEST.

NOTES:

1. VALUES ARE APPROXIMATELY 36 UUF. ACTUAL VALUES ARE DETERMINED BY PRODUCTION TEST.
2. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN UUF, AND ALL INDUCTANCE VALUES ARE IN UH.
3. SWITCHES VIEWED FROM DRIVEN END. SOLID LINES ON FRONT OF SWITCH, DASHED LINES LINES ON BACK OF SWITCH. ARROW DENOTES SWITCH ROTATION, S1 & S2 SHOWN IN 700KC POSITION.
4. CRYSTAL FREQUENCIES

Y1 - 3007KC	Y8 - 3014KC	Y15 - 3667KC
Y2 - 3008KC	Y9 - 3015KC	Y16 - 3657KC
Y3 - 3009KC	Y10 - 3016KC	Y17 - 3647KC
Y4 - 3010KC	Y11 - 3707KC	Y18 - 3637KC
Y5 - 3011KC	Y12 - 3697KC	Y19 - 3627KC
Y6 - 3012KC	Y13 - 3687KC	Y20 - 3617KC
Y7 - 3013KC	Y14 - 3677KC	

5. W & X MATCHED PAIR 2N703, Y & Z MATCHED PAIR 2N703, } β 40-60, MATCHED WITHIN 10% AT V_{CE}=5V, I_C=10MA
U & V MATCHED PAIR 2N697, } MATCHED WITHIN 5% β AT I_C=8MA AND V_{CE}=5V

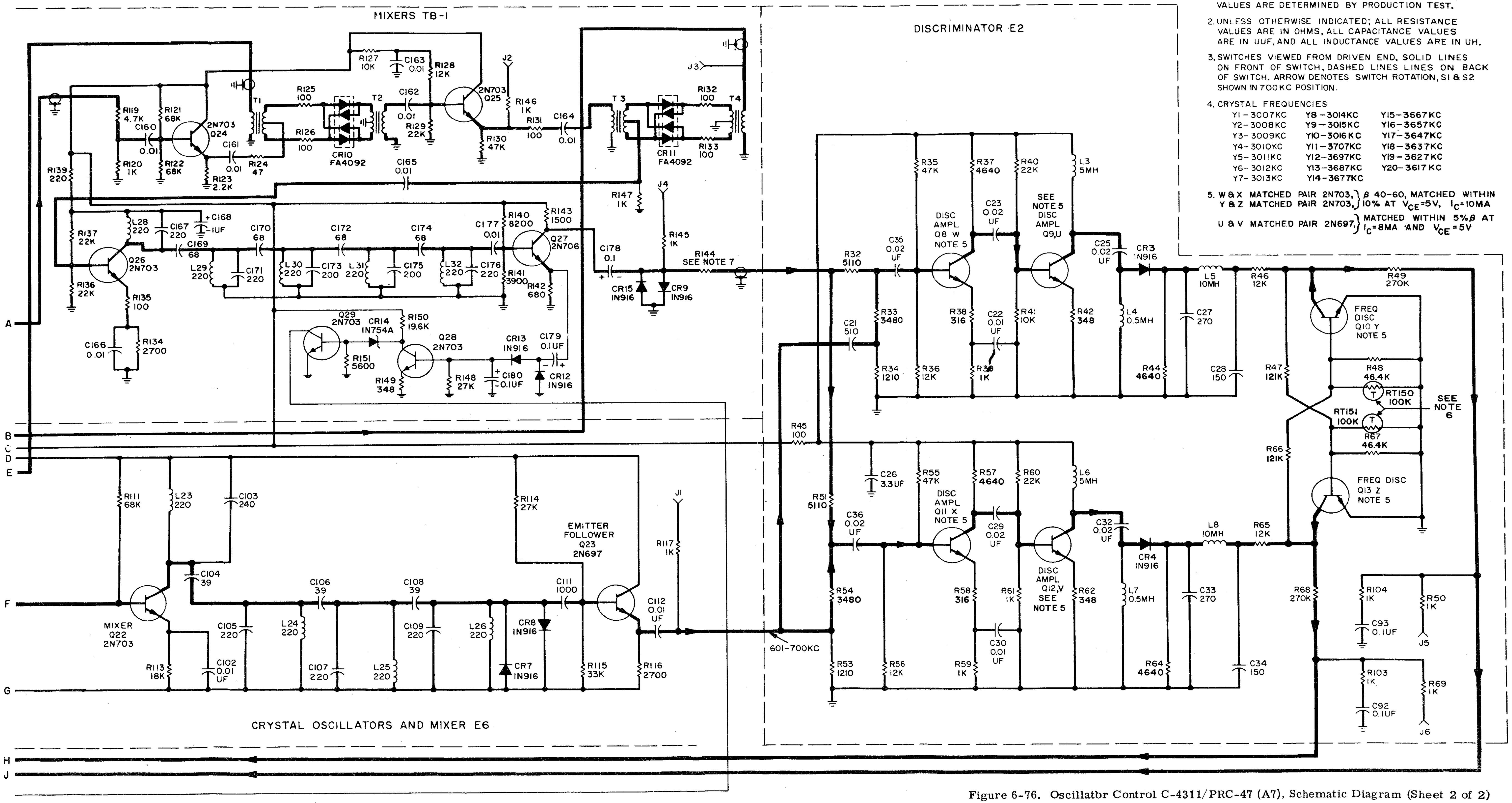


Figure 6-76. Oscillator Control C-4311/PRC-47 (A7), Schematic Diagram (Sheet 2 of 2)

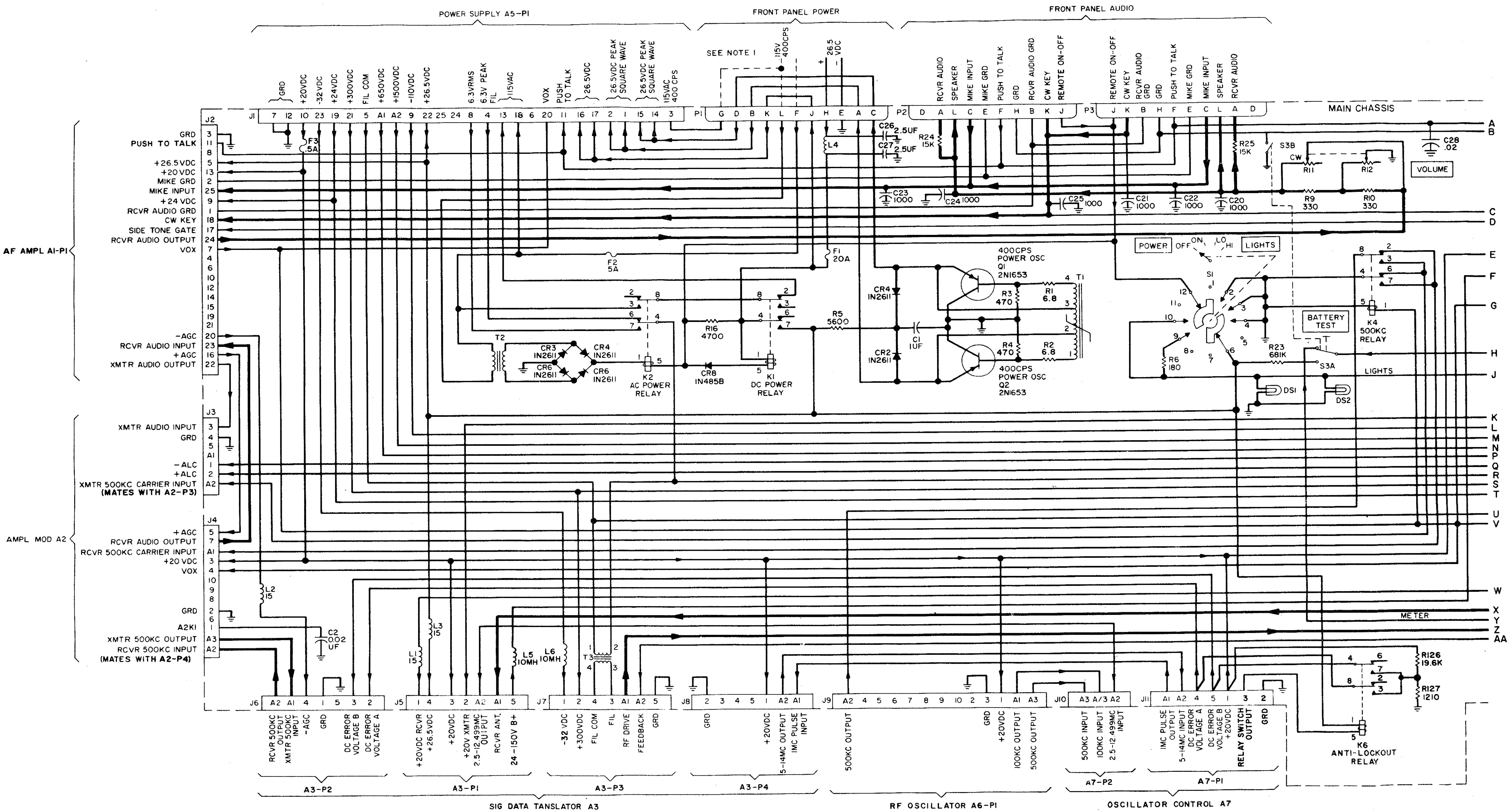


Figure 6-77. Electrical Equipment Chassis CH-474/PRC-47, Schematic Diagram (Sheet 1 of 2)

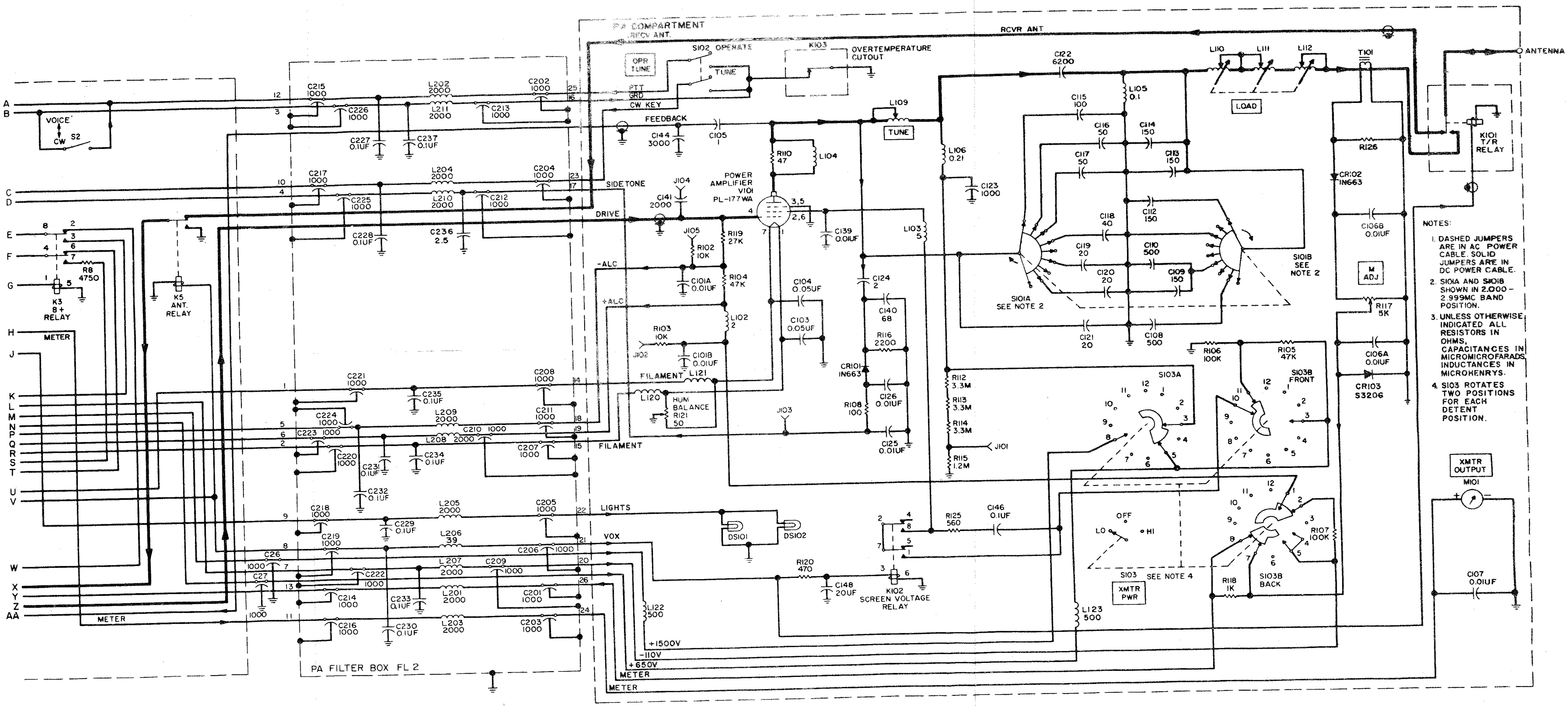


Figure 6-77. Electrical Equipment Chassis CH-474/PRC-47, Schematic Diagram (Sheet 2 of 2)

INDEX

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