TELEDYNE LEWISBURG

RADIO SET
AN/URC-9B

Teledyne Lewisburg
Lewisburg, Tennessee

January, 1981

TABLE OF CONTENTS

Section		Page
1.	GENERAL INFORMATION	1-1
	1-1. Introduction	1-1
	1-4. General Description	1-1
	1-7. Equipment Description	1-1
	1-10. RT Unit	1-1
	1-14. Power Supply	1-4
	1-16. Case	1-4
	1-17. Common Names	1-5
	1-19. Reference Data	1-5
	1-21. Equipment Supplied	1-5
	1-23. Equipment Required But Not Supplied	1-5
	1-25. Field and Factory Changes	1-5
2.	OPERATION	2-1
	2-1. Introduction	2-1
	2-3. Controls, Indicators and Connectors	2-1
	2-5. Operating Procedures	2-1
	2-7. Turn-on Procedure	2-1
	2-8. Basic Operation Check	2-1
	2-9. Full Operation Check	2-1
	2-10. Modes of Operation	2-1
	2-11. Operation Under Interfering Conditions	2-1
	2-12. Turn-Off Procedure	2-2
	2-13. Emergency Turn-Off Procedure	2-2
	2-14. Operator Maintenance	2-2
3.	FUNCTIONAL DESCRIPTION	3-1
	3-1. Overall Functional Description	3-1
	3-4. Normal Mode	3-2
	3-7. Retransmit Mode	3-2
	3-11. Tone Mode	3-2
	3-12. Broadband Mode	3-2
	3-13. Channel Selection	3-3
	3-14. Receive Function Signal Path	3-3
	3-19. Transmit Function Signal Path	3-3
	3-24. RF Exciter Assembly	3-6
	3-26. Tuned Amplifier Assembly	3-6
	3-28. RF Modulator Printed Wiring Assembly	3-6
	3-31. Broadband Amplifier Assembly	3-6
	3-33. Curveshaper Printed Wiring Assembly	3-11
	3-38. Control Printed Wiring Assembly	3-11
	3-44. Power Amplifier Assembly	3-15
	3-48. UHF Frequency Synthesizer Assembly	3-15
	3-50. VCO Printed Wiring Assembly	3-19
	3-51. Divider Printed Wiring Assembly	3-19
	3-52. Phase Detector Printed Wiring Assembly	3-19
	3-53. Reference Oscillator Printed Wiring Assembly	3-19

TABLE OF CONTENTS (CON'T)

3-54. IF Amplifier and Synthesizer Assembly 3-19
3-60. IF Amplifier Printed Wiring Assembly 3-25
3-63. Butler Amplifier Printed Wiring Assembly 3-25
3-65. VCO Printed Wiring Assembly 3-28
3-68. Divider Printed Wiring Assembly 3-28
3-71. Phase Detector Printed Wiring Assembly 3-28
3-75. Audio Processor Printed Wiring Assembly 3-32
3-78. IF Amplifier and Demodulator Assembly 3-32
3-80. RF Printed Wiring Assembly 3-32
3-88. Audio Printed Wiring Assembly 3-36
3-94. Audio Amplifier Assembly 3-36
3-96. Audio Amplifier Printed Wiring Assembly 3-36
3-102. Relay/Squelch Printed Wiring Assembly 3-40
3-115. Power Supply PP-2702/URC-9(A)XN2 3-45
3-117. 26.5V Supply Assembly 3-45
3-121. Converter Printed Wiring Assembly 3-45
3-122. Control Printed Wiring Assembly 3-45
3-129. Multiple Voltage Supply Assembly 3-49
3-130. -12V Supply Printed Wiring Assembly 3-49
3-131. 20 V Supply Printed Wiring Assembly 3-49

4. PARTS LIST 4-1

4-1. Introduction 4-1
4-3. List of Units 4-1
4-5. Maintenance Parts List 4-1
4-7. Repair and Replacement Data 4-1

5. INSTALLATION 5-1

5-1. Introduction 5-1
5-3. Unpacking and Handling 5-1
5-6. Power Requirements 5-1
5-9. Site Selection 5-1
5-11. Installation Requirements 5-1
8-12. Ships Installation 5-1
8-13. Equipment Mounting 5-1
8-14. Interconnecting Cabling 5-2
-15. Inspection and Adjustment 5-2
8-17. Post-Installation Check 5-2
8-18. Power Turn-On 5-2
8-19. Power Turn-Off 5-3
8-20. Squelch Option 5-3
8-21. Performance Check 5-3
-22. Interference Reduction 5-3

LIST OF FIGURES

Figure		Page
1-1.	Radio Set AN/URC-9(B)XN2	1-2
1-2.	Radio Set AN/URC-9(B)XN2	1-3
1-3.	RT Unit Assembly Locations	1-7
1-4.	Power Supply Assembly Locations	1-12
2-1.	Power Supply Control, Indicator, and Connector Locations	2-7
2-2.	Power Supply Control, Indicator, and Connector Locations	2-8
2-3.	RT Unit Control, Indicator, and Connector Locations	2-9
3-1.	Radio Set AN/URC-9(B)XN2 Basic Block Diagram	3-1
3-2.	Receive Function Block Diagram	3-4
3-3.	Transmit Function Block Diagram	3-5
3-4.	RF Exciter Assembly Block Diagram	3-7
3-5.	Tuned Amplifier Assembly Schematic	3-8
3-6.	RF Modulator Printed Wiring Assembly Schematic	3-9
3-7.	Broadband RF Amplifier Assembly Schematic	3-10
3-8.	Curveshaper Printed Wiring Assembly Schematic	3-12
3-9.	Control Printed Wiring Assembly Block Diagram	3-13
3-10.	Control Printed Wiring Assembly Schematic	3-14
3-11.	Power Amplifier Assembly Block Diagram	3-16
3-12.	Power Amplifier Assembly Schematic	3-17
3-13.	UHF Frequency Synthesizer Assembly Block Diagram	3-18
3-14.	VCO Printed Wiring Assembly Schematic	3-20
3-15.	Divider Printed Wiring Assembly Schematic	3-21
3-16.	Phase Detector Printed Wiring Assembly Schematic	3-22
3-17.	Reference Oscillator Printed Wiring Assembly Schematic	3-23
3-18.	IF Amplifier and Synthesizer Assembly Block Diagram	3-24
3-19.	IF Amplifier Printed Wiring Assembly Schematic	3-26
3-20.	Buffer Amplifier Printed Wiring Assembly Schematic	3-27
3-21.	VCO Printed Wiring Assembly Schematic	3-29
3-22.	Divider Printed Wiring Assembly Schematic	3-30
3-23.	Phase Detector Printed Wiring Assembly Schematic	3-31
3-24.	Audio Processor Printed Wiring Assembly Schematic	3-33
3-25.	RF Amplifier and Demodulator Assembly Block Diagram	3-34
3-26.	RF Printed Wiring Assembly Schematic	3-35
3-27.	Audio Printed Wiring Assembly Schematic	3-37
3-28.	Audio Amplifier Assembly Block Diagram	3-38
3-29.	Audio Amplifier Printed Wiring Assembly Schematic	3-39
3-30.	Relay/Squelch Printed Wiring Assembly Schematic	3-41
3-31.	Simplified Squelch and Signal-Plus-Noise to Noise Discriminated Schematic	3-43
3-32.	Power Supply Block Diagram	3-46
3-33.	26.5V Supply Assembly Block Diagram	3-47
3-34.	26.5V Supply Printed Wiring Assembly Schematic	3-48
3-35.	Voltage Regulator Signals	3-50
3-36.	Multiple Voltage Supply Assembly Block Diagram	3-51

LIST OF FIGURES (CONT)

3-37. -12V Supply Printed Wiring Assembly 3-52
3-38. 20V Supply Printed Wiring Assembly 3-53

LIST OF TABLES

Table		Page
1-1.	Nomenclature-Common Name Cross Reference	1-6
1-2.	Technical Characteristics	1-13
1-3.	Equipment Supplied	1-16
1-4.	Equipment Required But Not Supplied	1-17
1-5.	Field and Factory Changes	1-18
2-1.	Radio Set Controls, Indicators, and Connectors	2-3
2-2.	Operating Procedures	2-10
2-3.	Required Tools and Test Equipment	2-13
4-1.	Equipment Units of Radio Set AN/URC-9(B)XN1	4-2
4-2.	Maintenance Parts List for Radio Set AN/URC-9 (B)XN1	4-3
4-3.	Repair and Part Replacement Data for Radio Set	4-9

SECTION 1

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This Technical Manual contains installation and operating instructions, operating principles, maintenance procedures, and parts lists for Radio Set AN/URC-9(B)XN2.

1-3. Radio Set AN/URC-9(B)XN2 is a direct replacement for previous versions of Radio Set AN/URC-9 in all applications, including independent usage and employment as part of the configuration of the AN/SRC-20 and AN/SRC-21 families of Radio Sets.

1-4. GENERAL DESCRIPTION.

1-5. Radio Set AN/URC-9(B)XN2, shown in figure 1-1, is a fully solid-state, tactical UHF radio designed for shipboard or fixed-station operation. It provides for transmission and reception of amplitude modulated (AM), frequency modulated (FM), and tone modulated (at 1000 Hz) signals on any of 7000 channels spaced 25 kHz apart in the 225.0 to 399.975 MHz frequency range. Complete operational control, including the selection of 19 preset channels, can be exercised remotely. In addition, circuits are incorporated which permit the connection of two sets for two-way automatic retransmission and broadband transmit and receive operation.

1-6. When employed as part of the configuration of the family of AN/SRC-20 communications equipment, Radio Set AN/URC-9(B)XN2 is combined with Radio Frequency Amplifier AM-1565/URC and Radio Set Control C-3866/SRC. When employed as part of the AN/SRC-21 communications equipment, Radio Set AN/URC-9(B)XN2 is combined with Radio Set Control C-3866/SRC only.

1-7. EQUIPMENT DESCRIPTION.

1-8. Radio Set AN/URC-9(B)XN2 consists of the three basic units shown in figure 1-2: Radio Receiver-Transmitter RT-581/URC-9(B)XN2 (RT Unit), Power Supply PP-2702/URC-9(B)XN2 (Power Supply), and Receiver-Transmitter Case CY-2959/URC-9(B)XN2 (Case).

1-9. The RT Unit and the Power Supply are solid-state devices of modular construction. Access to their modules, adjustment and test points, and chassis replaceable parts is gained by removal from the Case. Active circuitry is located inside the modules, mostly on printed wiring boards which are accessible by removing the module covers. The RT Unit and Power Supply can be operated when removed from the Case by using extender cables.

1-10. RT UNIT. The RT Unit functions as a triple-conversion, superheterodyne receiver during non-transmitting conditions. When the transmitting condition is actuated by keying, a series of t/r (transmit/receive) relays converts the unit to a transmitter. Frequency synthesizers, employing voltage-controlled oscillators phase-locked to a crystal oscillator reference, provide stable RF and IF frequencies for both transmitting and receiving.

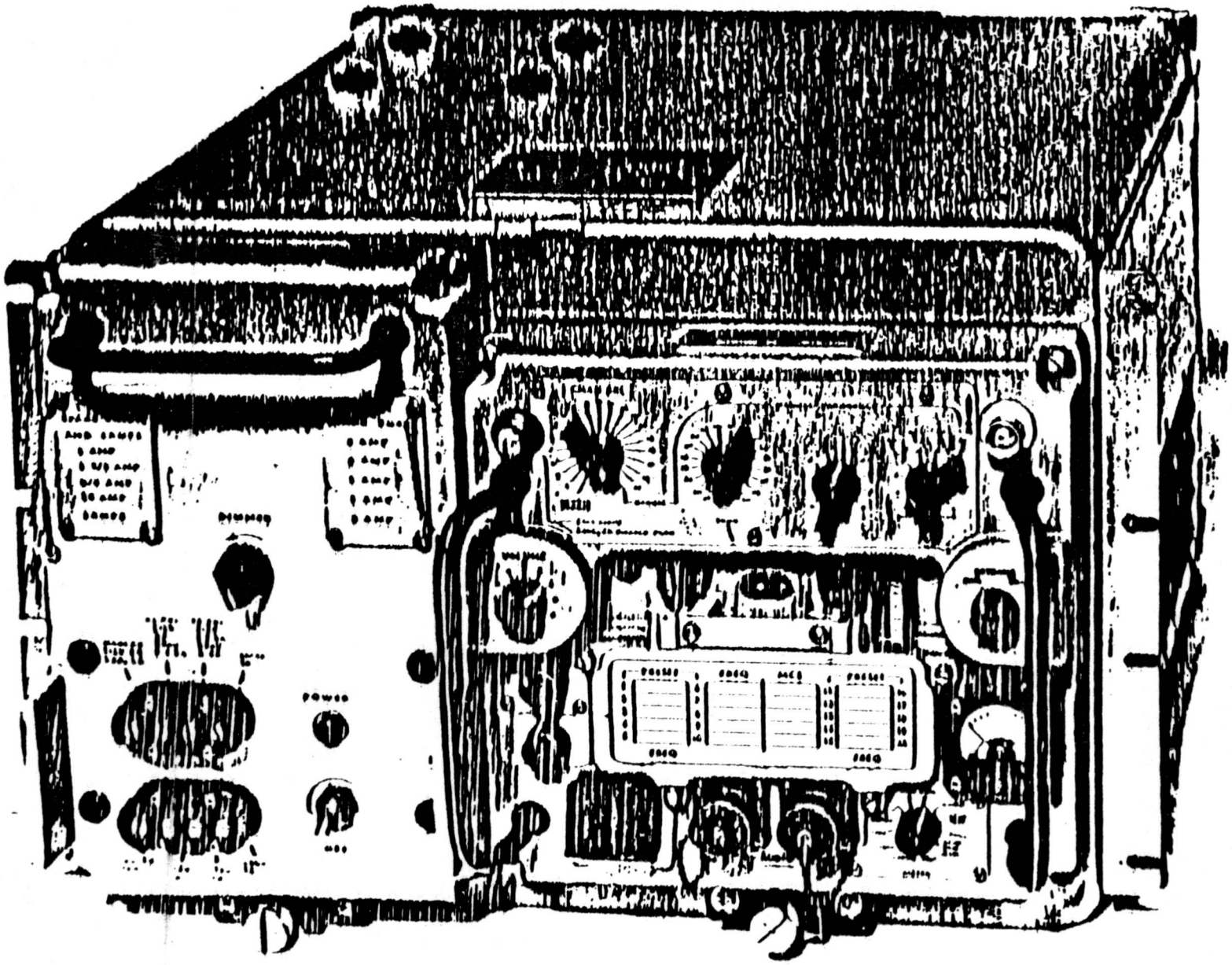


Figure 1-1. Radio Set AN/URC-9(B)XN2

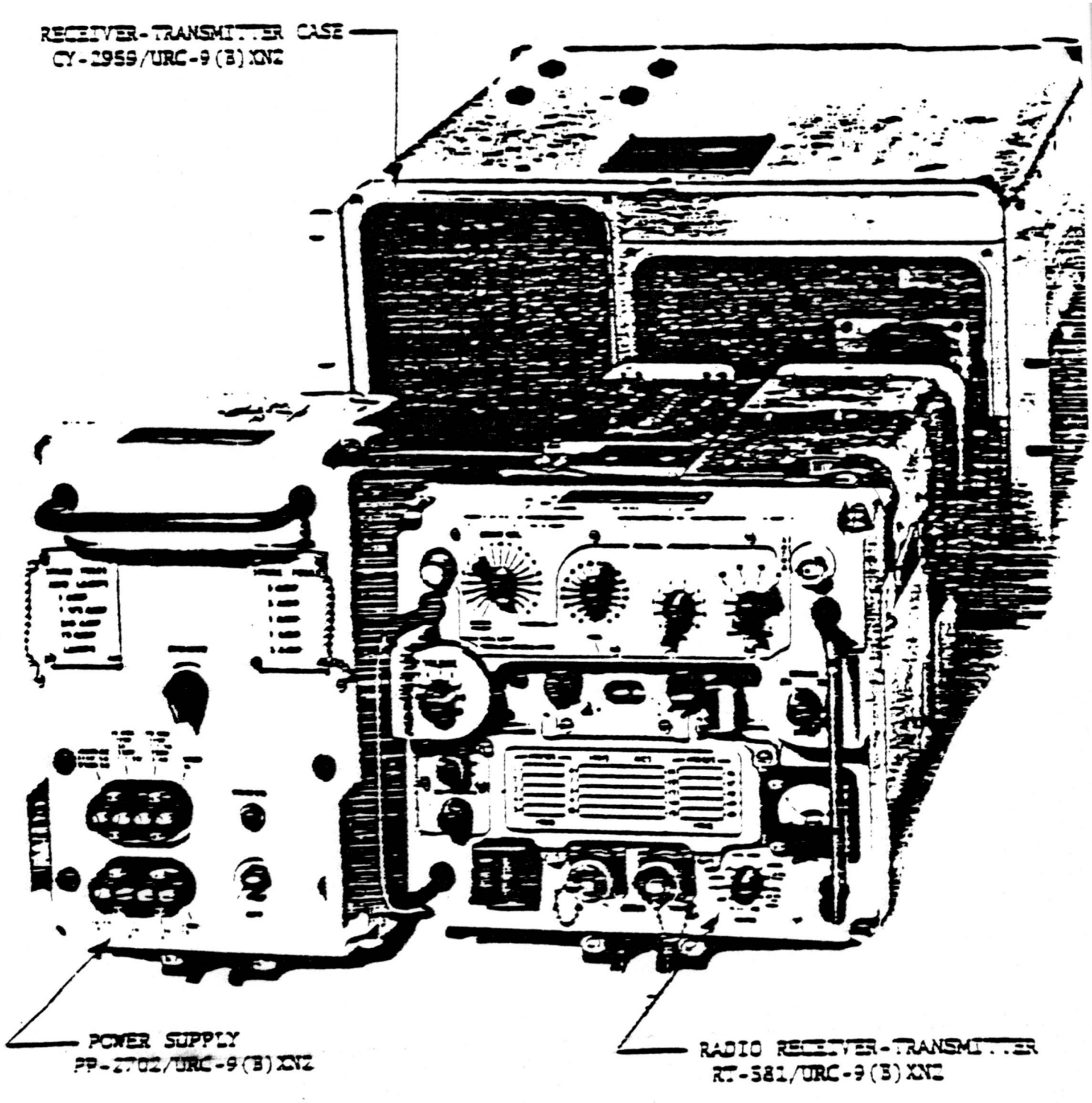


Figure 1-2. Radio Set AN/URC-9(B)XNZ

1-11. The RT Unit operates in the frequency range of 225.0 to 399.975 MHz, which is covered in 25kHz steps by 7000 channels. Frequency selection is determined by the position of the CHAN SEL switch, which has 19 preset channel positions, a MANUAL position, and a REMOTE PRESET position. The 19 channel frequencies can be preset to any one of the 7000 available channels on a memory drum, accessible through a door on the front panel. When the CHAN SEL switch is in the REMOTE PRESET position, channel information from remote equipment is accepted. When the CHAN SEL switch is in the MANUAL position, any one of the 7000 channels can be selected using the MANUAL FREQUENCY TENS, UNITS, and THOUSANDTHS-TENTHS controls on the front panel. The selected channel and its frequency are displayed by a combination of front panel indicators.

1-12. The RT Unit provides for amplitude modulation (AM) or frequency modulation (FM) selectable by the front panel AM-FM switch. Normal, retransmission, or tone operation are selectable by the front panel MODE switch. Adjustment of the squelch and audio levels is accommodated by the front panel SQUELCH and VOLUME controls. The squelch can be disabled by a front panel switch/indicator which is also used to identify that the squelch is disabled or that a signal strong enough to disable the squelch is received. A meter and associated METER switch are provided on the front panel for monitoring significant parameters.

1-13. The RT Unit is interfaced to the Power Supply and remote equipment through a rear panel connector. Front panel connectors are provided for microphone (MIKE), headset (HEADSET), handset and/or speakers (AUDIO), and antenna (ANT-50Ω).

1-14. POWER SUPPLY. The Power Supply provides all operating voltages required by the RT Unit and 115 volts ac to the blower contained in the Case. The Power Supply operates on 115 or 230 volts, 50 or 60 Hz ac selectable by two switches located just inside the front panel. All input and output lines are fused with the fuses accessible from the front panel

1-15. The Power Supply power switch controls application of power to both Power Supply and RT Unit. The status of power application is identified by the front panel power indicator. Intensity of the front panel lamps of the Power Supply and RT Unit is adjusted by the Power Supply front panel DIMMER control. Spare fuses and lamps are stored in receptacles accessible from the front panel of the Power Supply.

1-16. CASE. The case contains two compartments, one for the RT Unit and one for the Power Supply, and the associated interconnecting cabling. Connectors for interfacing to primary power and remote equipment are provided at the rear of the Case. A blower, mounted in the top of the Power Supply compartment, circulates cooling air around the heat exchanger case and through the Power Supply compartment. The louvered ports on each side of the case are covered with plates to make the equipment immersion-proof during transit. During operation, the plates are detached and re-located above the louvered ports.

1-17. COMMON NAMES.

1-18. Table 1-1 provides a cross-reference between the official nomenclature and the common names established for the components, subassemblies, and assemblies of the Radio Set. Figure 1-3 shows the major assembly locations in the RT Unit. Figure 1-4 shows the major assembly locations in the Power Supply

1-19. REFERENCE DATA.

1-20. Radio Set AN/URC-9(B)XN2 results from modification of Radio Set AN/URC-9 or Radio Set AN/URC-9(A). When modified from Radio Set AN/URC-9, Radio Set AN/URC-9(B)XN2 consists of the RT Unit (TL part number JTL 5045-11, the Power Supply (TL part number DTL 3911-1), and the Case (TL part number ATL 5288-3). When modified from Radio Set AN/URC-9A, Radio Set AN/URC-9 (B)XN2 consists of the RT Unit (TL part number JTL 5045-3), the Power Supply (TL part number DTL 3911-1), and the Case (TL part number ATL 5288-3). Radio Set AN/URC-9(B)XN2 is manufactured by Teledyne Lewisburg (TL), Lewisburg, Tennessee, a division of Teledyne Industries, Inc. Table 1-2 provides a summary of the technical characteristics of Radio Set AN/URC-9 (B)XN2.

1-21. EQUIPMENT SUPPLIED.

1-22. Equipment supplied as part of the Radio Set is listed in table 1-3.

1-23. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

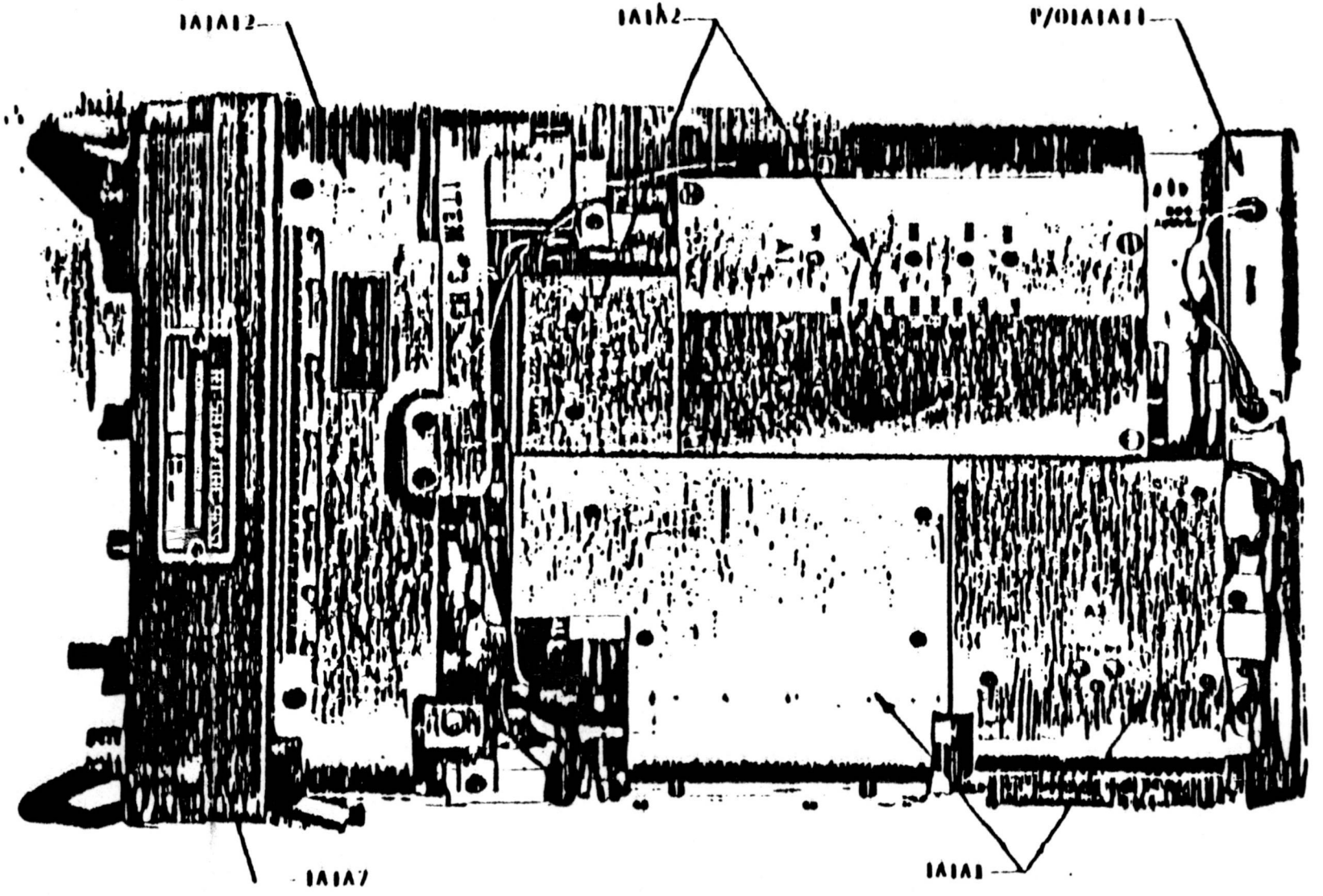
1-24. Equipment required, but not supplied, for the Radio Set is listed in table 1-4.

1-25. FIELD AND FACTORY CHANGES.

1-26. Effective as of the date of this technical manual, there have been no field or factory changes to the Radio Set. Field and/or factory changes made subsequent to the publication of this technical manual are to be listed in Table 1-5.

Table 1-1. Nomenclature-Common Name Cross Reference

REF DES	NOMENCLATURE	COMMON NAME
1	Radio Set AN/URC-9(B)XN2	Radio Set
LA1	Receiver-Transmitter RT-581/URC-9(B)XN2	RT Unit
LA1A1	RF Exciter Assembly	RF Exciter
LA1A2	UHF Frequency Synthesizer Assembly	FMO Module
LA1A3	IF Amplifier and Synthesizer Assembly	1st and 2nd IF Module
LA1A4	Not Used	
LA1A5	IF Amplifier and Demodulator Assembly	3rd IF Module
LA1A6	Relay-Filter Assembly	Relay-Filter Module
LA1A7	Front Panel Assembly	Front Panel
LA1A8	Audio Amplifier Assembly	Modulator Module
LA1A9	Low Pass-Band Pass Filter Assembly	LP-BP Filter Module
LA1A10	Not Used	Modulator Module
LA1A11	Main Frame Assembly	Main Frame
LA1A12	Frequency Selector Assembly	Frequency Selector
LA1A13	Directional Coupler Assembly	Directional Coupler
LA1A14	Not Used	
LA1A15	Not Used	
LA1A16	Broadband Sidetone Amplifier Assembly	Broadband Module
LA2	Receiver-Transmitter Case CY-2959/URC-9(B) XN2	Case
LA3	Power Supply PP-2702/URC-9(B) XN2	Power Supply
LA3A1	26.5V Supply Assembly	26.5V Module
LA3A2	Multiple Voltage Supply Assembly	12V/ 20V Module



Note: RT-581/URC-9(SS) designation superceded by RT-581/URC-9(R)XN2 designation

Figure 1-3. RT Unit Assembly Locations (Sheet 1 of 5)

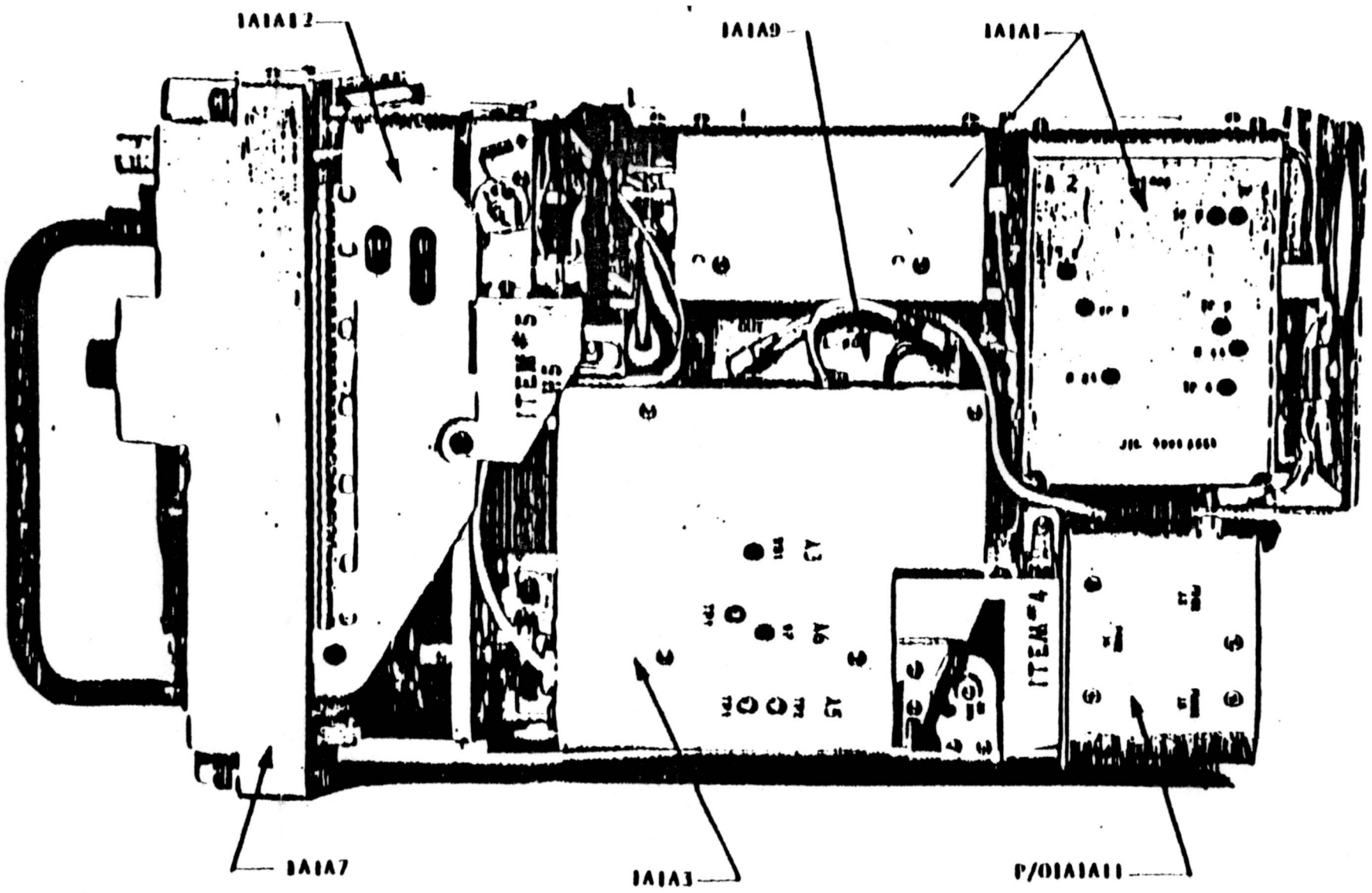


Figure 1-3. RT Unit Assembly Locations (Sheet 2 of 5)

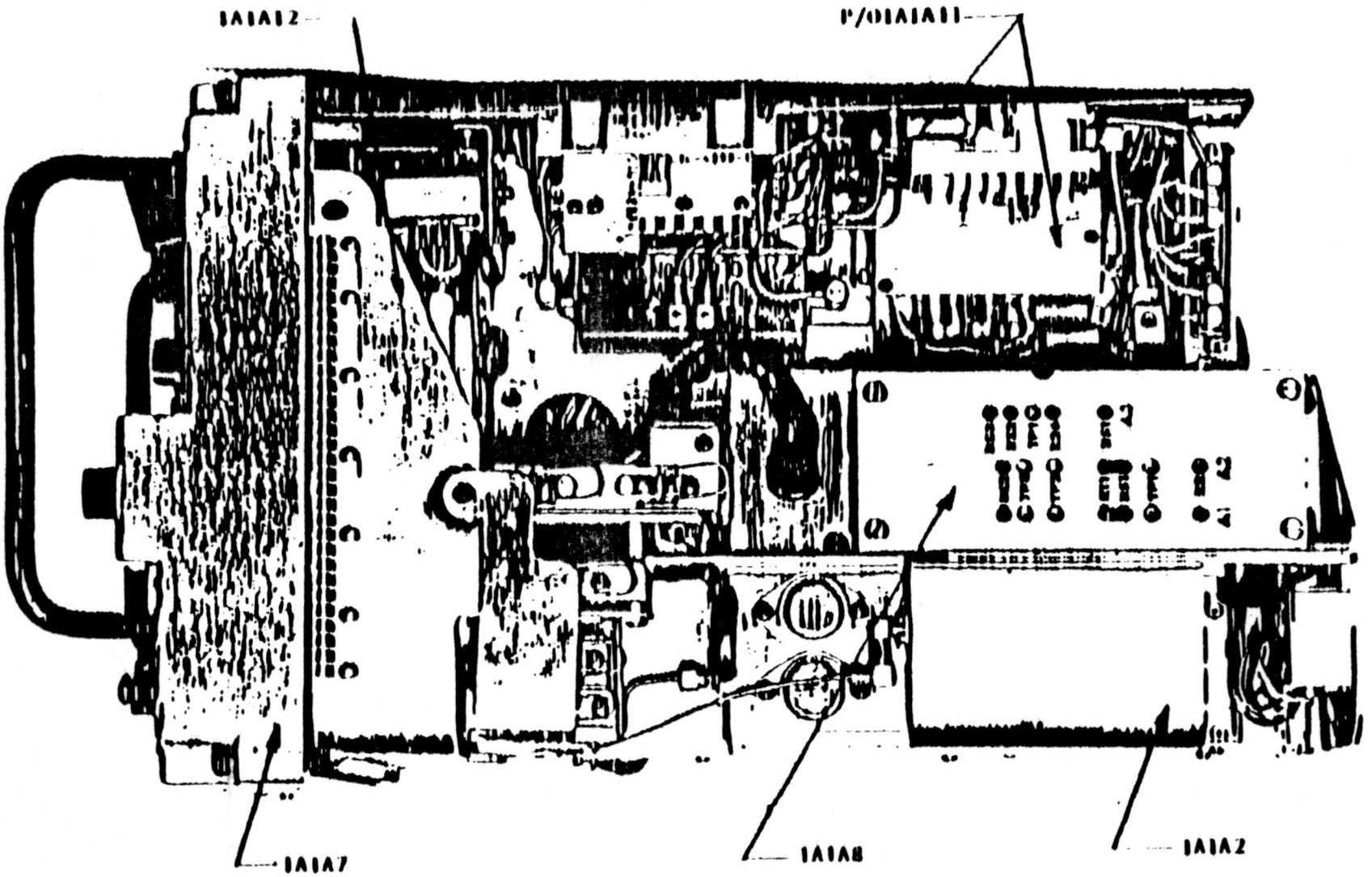


Figure 1-3. RT Unit Assembly Locations (Sheet 3 of 5)

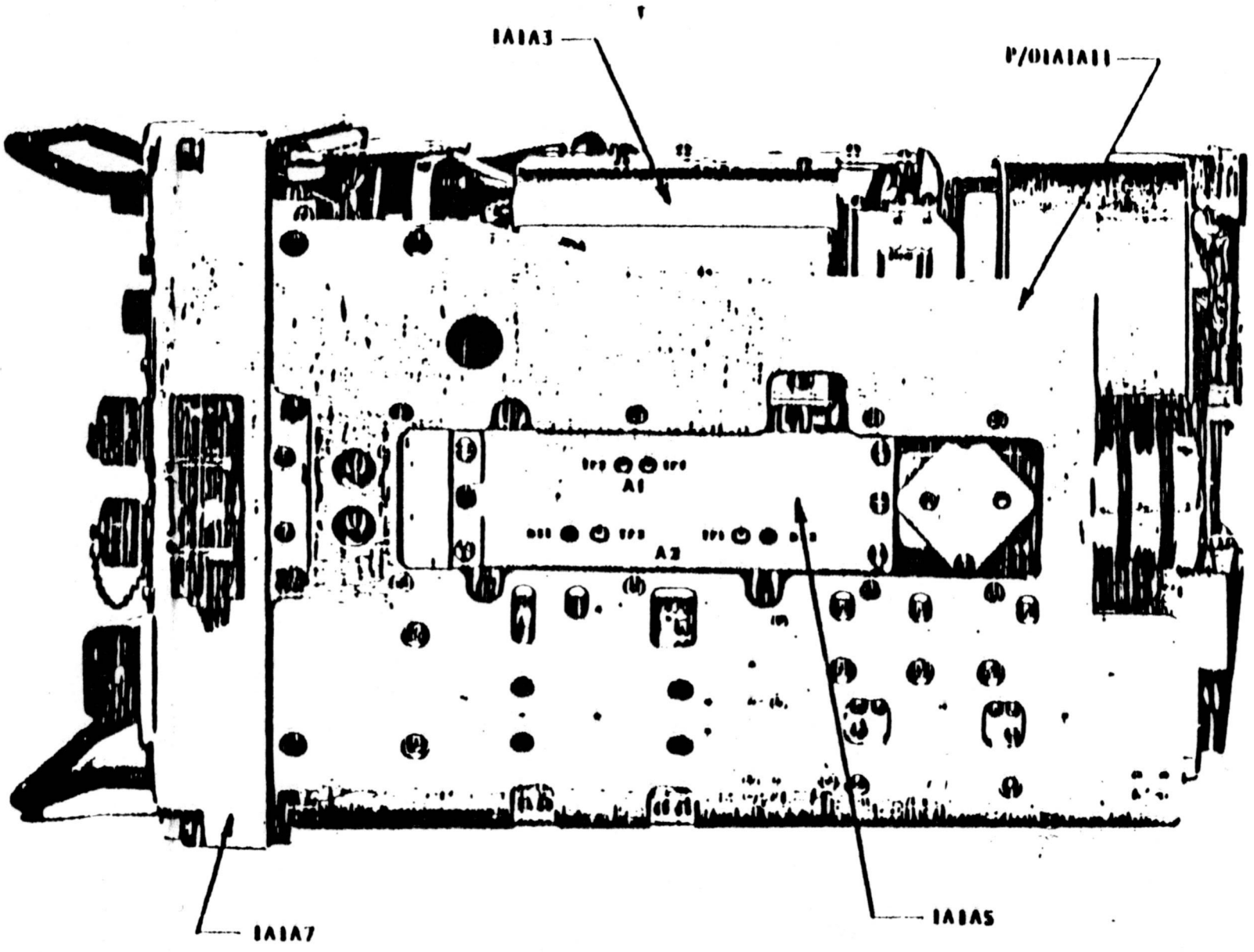


Figure 1-3. RT Unit Assembly Locations (Sheet 4 of 5)

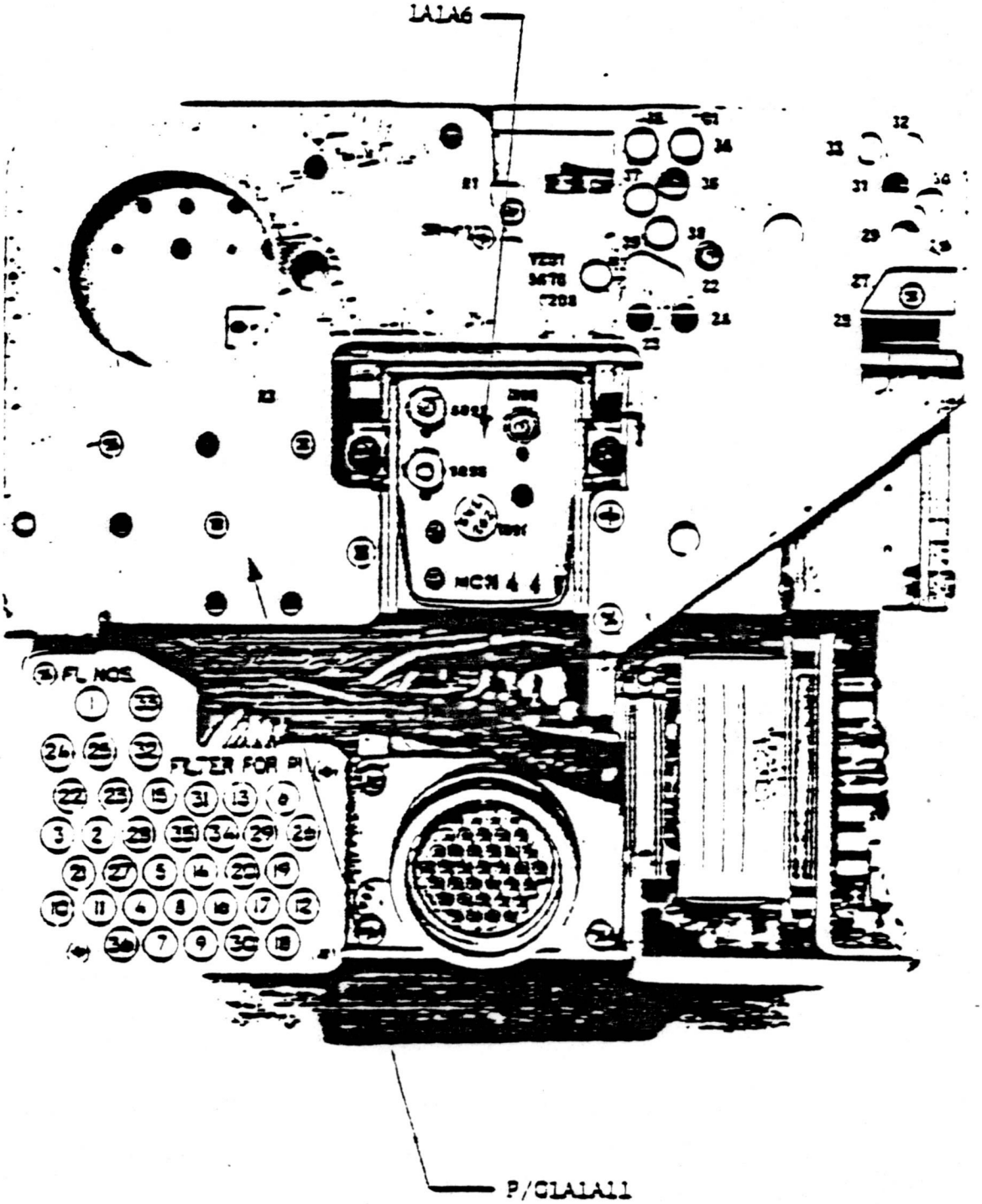
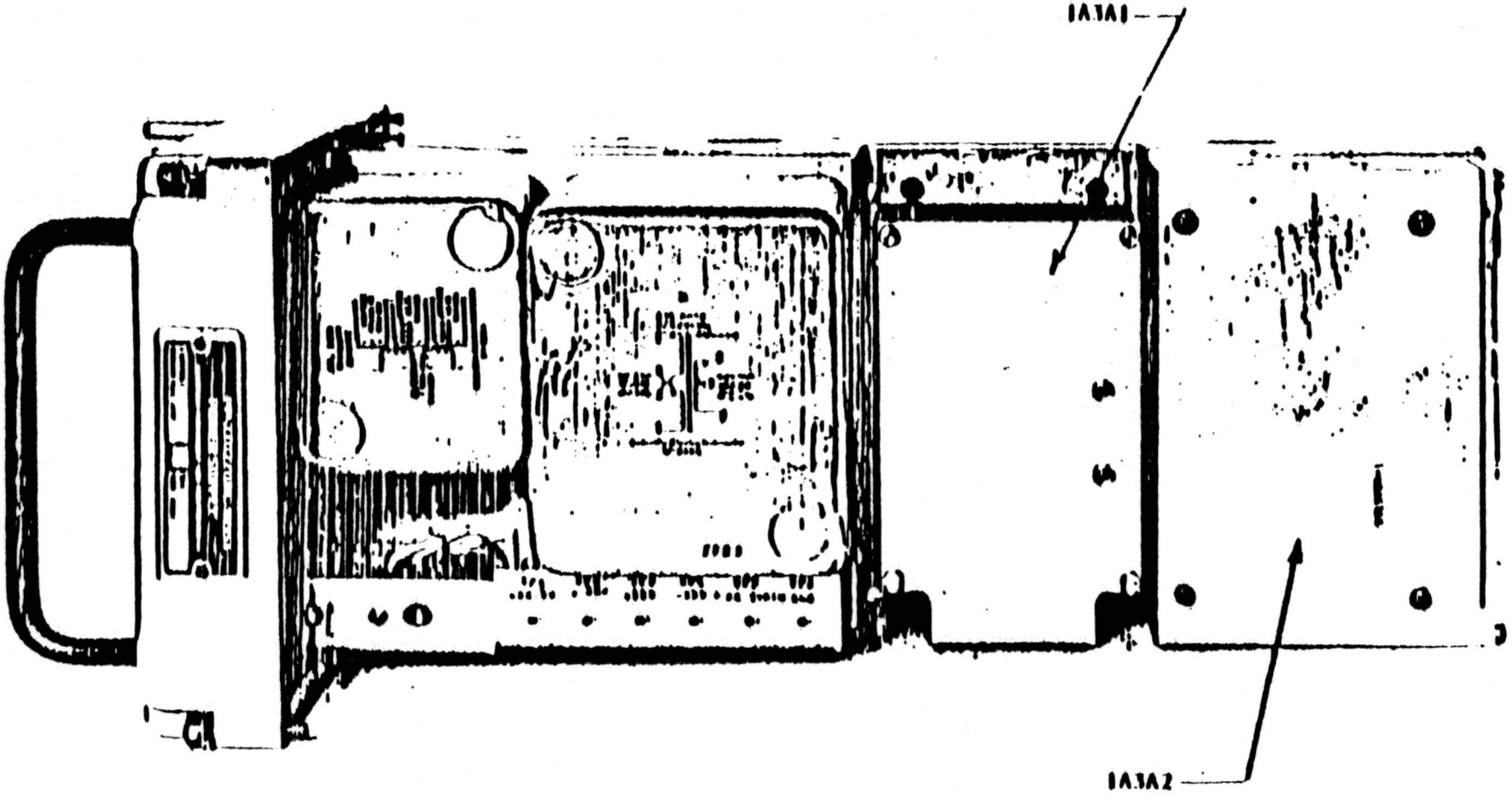


Figure 1-3. RT Unit Assembly Locations (Sheet 5 of 5)



NOTE: PP-2702/URC-9 (SS) designation superceded by PP-2702/URC-9 (R) RN2 designation

Figure 1-4. Power Supply Assembly Locations

Table 1-2. Technical Characteristics

CHARACTERISTIC	SPECIFICATION
Frequency:	
Range	225.0 to 399.975 MHz
Selection	7000 automatically selected channels spaced 0.025 MHz apart.
	19 preset channels available on local or remote control, plus manual frequency selection on local control
Accuracy	±4kHz from -45°C to +55°C
Synthesis:	
First Conversion (Receive)	225.0 to 399.975 MHz converted to 20.0 to 29.975 MHz by injection signal at 200.0 to 370.0 MHz ±0.001%
Second Conversion (Receive)	20.0 to 29.975 MHz converted to 3.0 MHz by injection signal at 23.0 to 32.975 MHz at 0.001%
Third Conversion (Receive)	3.0 MHz converted to 0.5 MHz by injection signal at 2.5 MHz ±0.001%
Sub-Carrier (Transmit)	20.0 to 29.975 MHz ±0.001%
Carrier (Transmit)	20.0 to 29.975 MHz converted to 225.0 to 399.975 MHz by injection signal at 200.0 to 370.0 MHz ±0.001%
Derivation	Four VCO's (200.0 to 250.0 MHz, 260.0 to 310.0 MHz, 320.0 to 370.0 Mhz, and 20 to 29.975 MHz) phase-locked to 2.5 MHz crystal oscillator reference signal.

Table 1-2. Technical Characteristics (Con't)

CHARACTERISTIC	SPECIFICATION
Receiver:	
Type	Triple-conversion superheterodyne, with signal-plus-noise to noise or carrier-actuated squelch
Modulation	Amplitude or frequency modulation
Input Impedance	50 Ohms
Sensitivity	3uV or less for 10 dB signal-plus-noise to noise ratio
Selectivity (third IF bandwidth)	80 kHz minimum at 6 dB attenuation 150 kHz maximum at 60 dB attenuation
Intermediate Frequencies	1st IF: 20.0 to 29.975 MHz (variable) 2nd IF: 3.0 MHz (fixed) 3rd IF: 500 kHz (fixed)
Automatic Volume Control	Audio output constant within ±6 dB from 10 µV to 0.25V with 100 uV modulated 30% at 1000 Hz and 10 mW audio output level as reference
Frequency Response:	
Normal (AM or FM)	300 Hz: -5 dB, 500 Hz: ±4 dB 1000 Hz: 0 dB, 3500 Hz: ±4 dB
Broadband (AM or FM)	Within -3 dB at 100 Hz to -7 dB at 25 kHz, 1000 Hz reference
Audio Output:	
Local	10 mW, 600 Ohms
Remote	10 mW, 600 Ohms
Audio Distortion	10% maximum
Squelch:	
S-N/N	3 dB signal-plus-noise to noise ratio
Carrier	3 µV carrier level

Table 1-2. Technical Characteristics (Con't)

CHARACTERISTIC	SPECIFICATION
Transmitter:	
Power Output	16 W minimum into 50 ohm resistive load
Modulation	Amplitude or frequency modulation
Frequency Response:	
Normal (AM or FM)	Within +3 dB from 300 to 3500 Hz, 1000 Hz reference
Broadband (AM)	300 Hz: 0 to -3 dB 100 Hz: 0 dB 10 kHz: -1 to -3 dB
Audio Distortion	Less than 7.5% at 3 dB below 80% modulation
Broadband Sidetone	175 mW, 300 to 3000 Hz into 600 ohms
Spurious Radiation	All spurious radiation suppressed to 60 dB below carrier level from 245.0 to 380.0 MHz. On any frequency outside this range, not more than one spurious radiation which must be at least 30 dB below carrier
Types of Emission	Radio telephone (A3 or F3) Tone (A2 or F2)
Audio Input:	
Microphone	0.08 V, 82 ohms
Retransmission	0.51 V
Broadband	1.55 V peak-to-peak
Sidetone Output:	
Local	10mW, 300 to 3500 Hz, from 600 ohm receiver audio output
Remote	10 mW, 300 to 3500 Hz, from 600 ohm receiver audio output
Fidelity	Within +3 dB from 300 to 3500 Hz, 1000 Hz reference
Duty Cycle	Continuous transmission with 80% modulation at +65°C

Table 1-2. Technical Characteristics (Con't)

CHARACTERISTIC	SPECIFICATION
Primary Power:	
Voltage	115 or 230 Vac, 50/60 Hz single phase
Consumption	185 W receive/385 W transmit
Operating Environment:	
Temperature	-55°C to +65°C
Humidity	Up to 95% relative

Table 1-3. Equipment Supplied

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (in.)			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH	(cu.ft.)	(lb.)
1	RT Unit	RT-581/URC-9 (B)XN 2	11-3/4 in	10 in.	15-1/2 in	1.1	77
1	Power Supply	PP-2702/URC-9 (B)XN 2	11-3/4 in	7-1/2 in	19 in.	1.0	80
1	Case	CY-2959/URC-9 (B)XN 2	13-13/16 in.	19 in.	19-1/2 in	3.1	157

Table 1-4. Equipment Required But Not Supplied

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE
	NAME	DESIGNATION	
1 and 1 or 1	Headset Microphone Handset	MT-49985-A M-53/U H-51/U	Local Operation Local Operation Local Operation
1	Radio Frequency Wattmeter	AN/URC-43 and AN/URM/120	Radio frequency wattage check
1	Electronic Multimeter	AN/USM-116	Voltage check
1	Electronic Voltmeter	AN/USM-143	Voltage check
1 1	Signal Generator	AN/USM-25 and AN/USM-44	Signal generation for checking
1	Audio Oscillator	AN/URM-127	Signal generation for checking
1	Dummy Load	DA-91/U	Antenna termination
1	Multimeter	AN/PSM-4	Troubleshooting
1	Frequency Counter	AN/USM-207	Troubleshooting and alignment
1	Cable Assembly	CX-7259-U	Retransmission
1	Cable Assembly	CX-7260/U	Maintenance
1	Cable Assembly	CX-7300/U	Maintenance
1	Cable Assembly	CX-8521/U	Relay Unit Extension
1	Test Adapter	MX-947/URC-9	General Testing
1	Spectrum Analyzer	HP141C	Troubleshooting and alignment
1	Directional Coupler	HP 774D	Troubleshooting and alignment
1	Crystal Detector	HP8471A	Troubleshooting and alignment

Table 1-5. Field and Factory Changes

CHANGE NUMBER	NOMENCLATURE	DESCRIPTION

SECTION 2

OPERATION

2-1. INTRODUCTION.

2-2. This section contains the operating instructions for Radio Set AN/URC-9(B)XNZ. This information is presented in tabular form and consists of operating controls, indicators, and connectors; equipment turn-on, operating and turn-off procedures; and operator maintenance.

2-3. CONTROLS, INDICATORS AND CONNECTORS

2-4. Controls and indicators used in operating the Radio Set are listed in table 2-1 and shown in figures 2-1 through 2-3.

2-5. OPERATING PROCEDURES.

2-6. Operating procedures for the Radio Set are given in table 2-2. These procedures are divided into the areas of turn-on, basic operation check, full operation check, modes of operation, operation under interfering conditions, turn-off, and emergency turn-off procedures. Each of these areas are titled in table 2-2 and are described in the following paragraphs.

NOTE

To ensure proper Radio Set operation, the operator must read and thoroughly understand all instructions and associated description before accomplishing procedures.

2-7. TURN-ON PROCEDURE. Table 2-2, part 1, contains the Radio Set turn-on procedure. This procedure assumes that the Radio Set is properly connected to all external equipment.

2-8. BASIC OPERATION CHECK. Table 2-2, part 2, contains the procedure to accomplish an abbreviated check of the Radio Set performance. This basic operation check requires no tools or test equipment.

2-9. FULL OPERATION CHECK. Table 2-2, part 3, contains the procedure to accomplish a full check of the Radio Set performance. This full operation check requires the tools and test equipment listed in table 2-3.

2-10. MODES OF OPERATION. Table 2-2, part 4, contains instructions for adjusting the Radio Set to obtain the desired mode of operation.

2-11. OPERATION UNDER INTERFERING CONDITIONS. Table 2-2, part 5, contains procedures to aid in reducing the effects of conditions which interfere with Radio Set operation.

2-12. TURN-OFF PROCEDURE. Table 2-2, part 6, contains the procedure normally used to turn off the Radio Set.

2-13. EMERGENCY TURN-OFF PROCEDURE. Table 2-2, part 7, contains the procedure for turning off the Radio Set if an emergency condition occurs.

2-14. OPERATOR MAINTENANCE.

2-15. Operator maintenance is limited to fuse and indicator lamp replacement, and general cleanliness of the Radio Set. See table 2-1 and figures 2-1 and 2-3 for front panel fuse and indicator lamp locations. Remove grease, dirt, or oil with ethyl alcohol. The best commercial 99 per cent pure (by volume) grade of isopropyl alcohol is acceptable. Clean with lintless cloth.

Table 2-1. Radio Set Controls, Indicators, and Connectors

UNIT	DEVICE	FUNCTION
Power Supply (Figure 2-1)	1-Power OFF switch	Controls application of input power
	2-POWER indicator	Indicates status of application of input power
	3-DIMMER control	Adjusts itensity of RT Unit front panel lamps
	4-Fuse block	Contains following slow-blow fuses used to protect AC circuitry: Main AC: 115V 5A fuse or 230V 3A fuse T1 PR1: 115V 3A fuse or 230V 1-½A fuse T2 PR1: 115V 1-½A fuse or 230V 3/4A fuse Spare: 1A fuse
	5-Fuse block	Contains following slow-blow fuses used to protect circuitry: 26.5V: 15A fuse +12V: 1A fuse -12V: 1A fuse -20V: 1A fuse
	6-SPARE FUSES receptacle	Provides storage for two 5 AMP, two 1 AMP, and one 3 AMP fuses.
	7-SPARES FUSES AND LAMPS receptacle	Provides storage for one 1 AMP, one 1-½ AMP, one 3/4 AMP, and one 15 AMP fuses, and for LAMPS

Table 2-1. Radio Set Controls, Indicators, and Connectors (con't)

UNIT	DEVICE	FUNCTION
Power Supply (Figure 2-2)	1-Input power selector switch	Select proper input circuitry for 115Vac or 230 Vac
RT Unit (Figure 2-3)	1-CHAN SEL switch	A 21-position switch with the following positions: REMOTE PRESET: Transfers control to remote devices 1 through 19: Selects preset channels MANUAL: Transfers frequency selection to MANUAL FREQUENCY switches
	2-MANUAL FREQUENCY switches	Select operating frequency when CHAN SEL switch is in MANUAL position
	a-TENS switch	Selects first two digits
	b-UNITS switch	Selects third digit
	c-TENTHS switch	Selects fourth digit
	d-THOUSANDTHS switch	Selects fifth and sixth digits
	3-Channel indicator	Indicates preset channel in use or manual frequency (M) function
	4-Frequency indicator	Indicates frequency in use
	a-tens indicator	Indicates first two digits
	b-units indicator	Indicates third digit
	c-tenths indicator	Indicates fourth digit
	d-thousandths indicator	Indicates fifth and sixth digits (LED display)

Table 2-1. Radio Set Controls, Indicators, and Connectors (con't)

UNIT	DEVICE	FUNCTIONS
	5-Squelch disable switch/indicator	Disables squelch when pressed (inoperative when CHAN SEL switch in REMOTE PRESET position) and indicates squelch disable or signal strong enough to operate squelch
	6-SQUELCH control	Controls the ability to receive weak signals by establishing minimum signal strength required to operate receiver. In OFF position, squelch is disabled and receiver sensivity is maximum. At maximum (fully clockwise) position, 100 μv signal required to operate squelch. Control is disabled when CHAN SEL switch in REMOTE PRESET position.
	7-VOLUME control	Adjusts audio level to local speaker or handset.
	8-AM-FM switch	Selects amplitude modulation (AM) or frequency modulation (FM) operation for receive and transmit.
	9-MODE switch	Selects following modes of operation: NOR: Normal operation RETRANS: Automatic relaying operation TONE: Modulates carrier with constant 1000Hz

Table 2-1. Radio Set Controls, Indicators, and Connectors (con't)

UNIT	DEVICE	FUNCTION
	10-Meter and METER switch	Meter monitors any one of the following 11 parameters selected by the METER switch: S METER: strength of received signal SWR : Reflected RF power PWR : RF power output % MOD : Modulator output RCVR TEST: Receiver self-test selection (no indication) PAIcc : Power amplifier current RCVR LINE LEVEL : Output audio voltage -12V : -12Vdc voltage +26,5v : +26,5Vdc voltage +20v : +20Vdc voltage +12v : +12Vdc voltage
	11-ANT-50Ω connector	Coaxial (50 ohm BNC) connection to cable interfacing antenna
	12-MIKE connector	Phone jack connection to carbon microphone
	13-HEADSET connector	Phone jack connection to headset
	14-AUDIO connector	Multi-conductor connection to handset (parallel connectors)
	15-LAMP Holder	Contains lamps illuminating channel and frequency indicators (3 and 4)
	16-Channel assignment placard	Identifies frequencies assigned to preset channels

Table 2-1. Radio Set Controls, Indicators, and Connectors (con't)

UNIT	DEVICE	FUNCTIONS
	5-Squelch disable switch/indicator	Disables squelch when pressed (inoperative when CHAN SEL switch in REMOTE PRESET position) and indicates squelch disable or signal strong enough to operate squelch
	6-SQUELCH control	Controls the ability to receive weak signals by establishing minimum signal strength required to operate receiver. In OFF position, squelch is disabled and receiver sensivity is maximum. At maximum (fully clockwise) position, 100 uv signal required to operate squelch. Control is disabled when CHAN SEL switch in REMOTE PRESET position.
	7-VOLUME control	Adjusts audio level to local speaker or handset.
	8-AM-FM switch	Selects amplitude modulation (AM) or frequency modulation (FM) operation for receive and transmit.
	9-MODE switch	Selects following modes of operation: NOR: Normal operation RETRANS: Automatic relaying operation TONE: Modulates carrier with constant 1000Hz

Table 2-1. Radio Set Controls, Indicators, and Connectors (con't)

UNIT	DEVICE	FUNCTION
	10-Meter and METER switch	Meter monitors any one of the following 11 parameters selected by the METER switch: S METER: strength of received signal SWR : Reflected RF power PWR : RF power output % MOD : Modulator output RCVR TEST: Receiver self-test selection (no indication) PAIcc : Power amplifier current RCVR LINE LEVEL : Output audio voltage -12V : -12Vdc voltage +26.5v : +26.5Vdc voltage +20v : +20Vdc voltage +12v : +12Vdc voltage
	11-ANT-50Ω connector	Coaxial (50 ohm BNC) connection to cable interfacing antenna
	12-MIKE connector	Phone jack connection to carbon microphone
	13-HEADSET connector	Phone jack connection to headset
	14-AUDIO connector	Multi-conductor connection to handset (parallel connectors)
	15-LAMP Holder	Contains lamps illuminating channel and frequency indicators (3 and 4)
	16-Channel assignment placard	Identifies frequencies assigned to preset channels

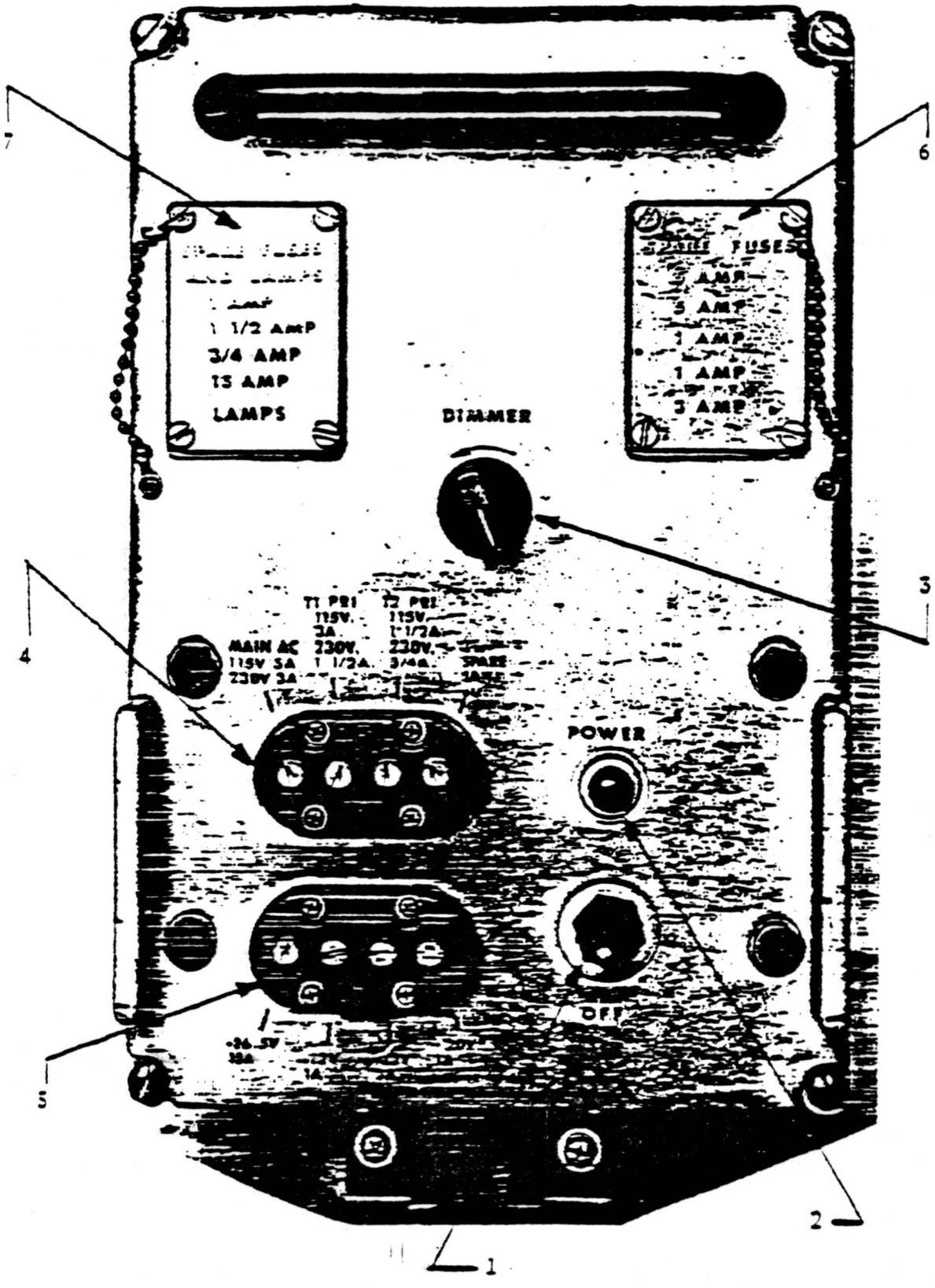
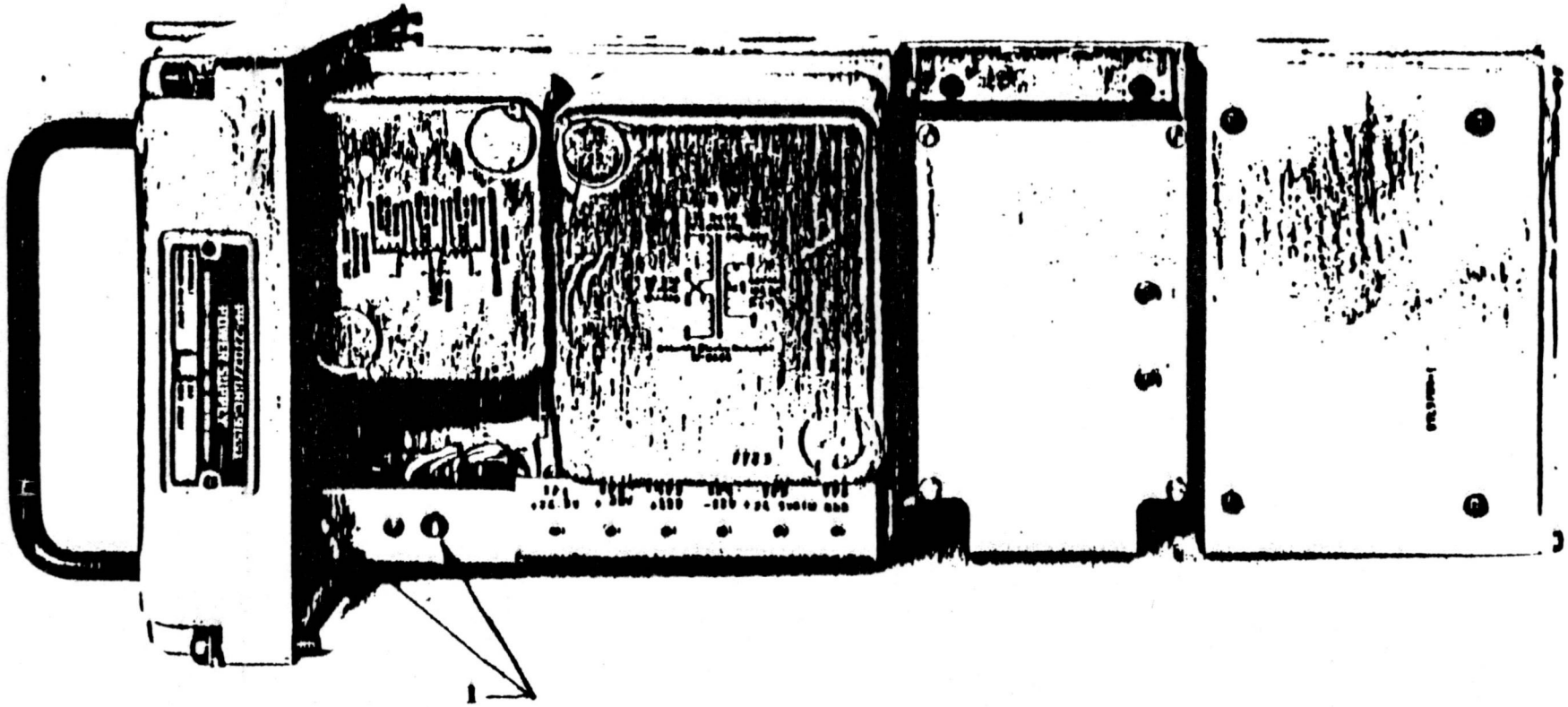


Figure 2-1. Power Supply Control, Indicator, and Connector Locations



NOTE: PP-2702/URC-9 (SS) designation superceded by PP-2702/URC-9 (B) XN2 designation

Figure 2-2. Power Supply Control, Indicator, and Connector Locations

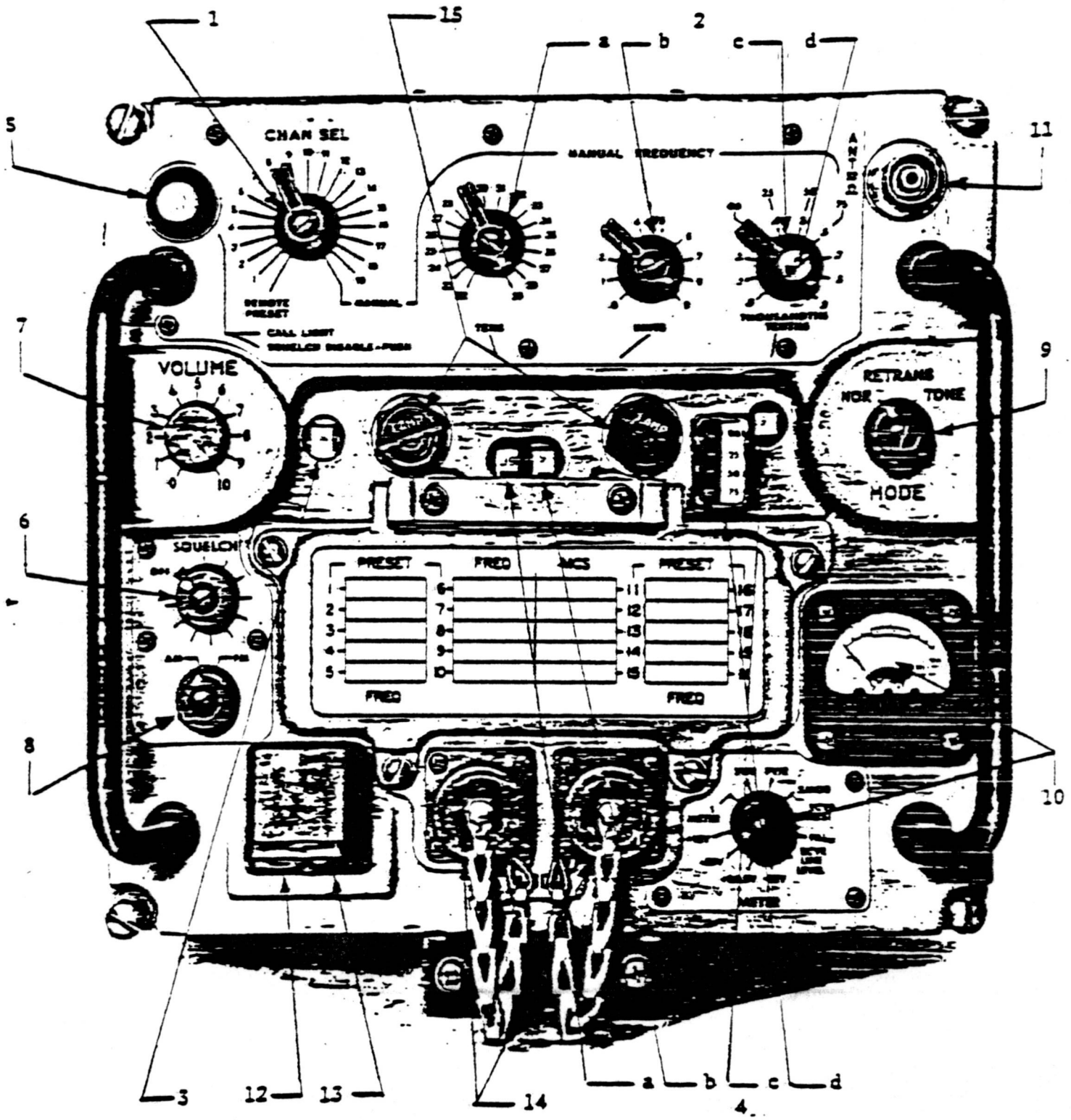


Figure 2-3. RT Unit Control, Indicator, and Connector Locations

Table 2-2. Operating Procedures

STEP	SETTINGS AND INSTRUCTIONS	INDICATIONS
Part 1 - Turn-On Procedure		
1	Check cabling against appropriate cabling diagrams	
2	Check for proper primary voltage operation and proper fusing; fuses are located on front panel of the Power Supply with ratings marked adjacent to fuse holders.	
3	The Radio Set is supplied ready for 115-volt, 50/60 Hz operation. If 230-volt operation is required, slide out Power Supply from Radio Set and set switches S1501 and S1502 to 230-volt position. Return Power Supply to normal position in Case. On front panel of the Power Supply, change MAIN AC, T1 FKI, and T2 FKI fuses to those with 230-volt ratings (fuses for 230-volt operation are in spare fuse holders)	
4	Check that air vent covers on sides of the Radio Set are in operating position. That is, make sure that covers are detached from louvered ports and relocated above louvered ports.	
5	Set power switch on front panel of Power Supply to on position.	Power Supply front panel POWER indicator illuminates
6	Check Radio Set supply voltages by setting METER switch on front panel of RT Unit to -12V, +26.5V, +20V and +12V position.	Meter indication near center mark at all METER switch positions
Part 2 - Basic Operation Check		
1	Ensure Part 1 - Turn-On Procedure has been accomplished	
2	Set METER switch on front panel of RT Unit to S METER position	Meter varies with strength of received signal with handset not keyed and indicates far left with handset keyed
3	Set METER switch on front panel of RT Unit to SWR position	Meter indicates to left with handset keyed and farther to left with handset not keyed
4	Set METER switch on front panel of RT Unit to PWR position	Meter indicates near center with handset keyed and far left with handset not keyed

Table 2-2. Operating Procedures.(Con't)

STEP	SETTINGS AND INSTRUCTIONS	INDICATIONS
5	Set METER switch on front panel of RT Unit to ZMOD position	Meter indicates near center with modulation applied and far left with modulation not applied.
6	Set METER switch on front panel of RT Unit to RCVR TEST position	Meter indicates slightly negative (beyond left end of scale) and audio tone is present in handset
7	Set METER switch on front panel of RT Unit to PAlec position	Meter indicates near center with handset keyed and far left with handset not keyed
8	Set METER switch on front panel of RT Unit to RCVR LINE LEVEL position	Meter indicates near center with modulated received signal and far left without modulated received signal
Part 3 - Full Operation Check		
1	Ensure Part 1 - Turn-On Procedure has been accomplished	
2	Perform full operation tests per section 6	Data correlating with results of initial testing after installation
Part 4 - Modes of Operation		
1	Normal Mode: Set MODE switch on front panel of RT Unit to NOR	Normal operation
2	Retransmit Mode: Set MODE switch on front panel of RT Unit to RETRANS	Automatic relaying operation
3	Tone-Mode: Set MODE switch on front panel of RT Unit to TONE	Constant 1000 Hz modulation
4	Plain Mode: Set PLAIN - BROADBAND switch on rear of Radio Set to PLAIN	Direct operation
5	Broadband Mode: Set PLAIN - BROAD-BAND switch on rear of Radio Set to BROADBAND	Indirect operation
6	Amplitude Modulation Mode: Set AM-FM switch on front panel of RT Unit to AM	Amplitude modulation operation
7	Frequency Modulation Mode: Set AM-FM switch on front panel of RT Unit to FM	Frequency modulation operation

Table 2-2. Operating Procedures (Con't)

STEP	SETTINGS AND INSTRUCTIONS	INDICATIONS
Part 5 - Operation Under Interfering Conditions		
1	For weak amplitude modulated (AM) signals with noisy conditions, disable squelch by setting SQUELCH control on front panel of RT Unit to OFF position	Improved operation
2	For weak amplitude modulated (AM) signals with noisy conditions, change to frequency modulation (FM) operation by setting AM-FM switch on front panel of RT Unit to FM position	Improved operation
3	For difficulties of operating in any mode on one frequency, change operating frequency	Improved operation
Part 6 - Turn-Off Procedure		
1	Set power switch on front panel of Power Supply to OFF position	Power Supply front panel POWER indicator is extinguished
2	Set METER switch on front panel of RT Unit to -12V, +26.5V, +20V and +12V positions	Meter indication at far left at all METER positions
Part 7 - Emergency Turn-Off Procedure		
1	Same as Part 6 - Turn-Off Procedure	Same as Part 6 - Turn-Off Procedure

SECTION 3

FUNCTIONAL DESCRIPTION

3-1. OVERALL FUNCTIONAL DESCRIPTION.

3-2. Radio Set AN/URC-9(B)XN2 is a shipboard unit designed to operate in the ultra-high-frequency (UHF) range. The Radio Set is a transceiver capable of alternately transmitting and receiving amplitude modulated or frequency modulated telephone signals in the 225.000 to 399.975 MHz frequency range. This range is covered in 25 kHz steps by 7000 channels. The minimum carrier output is 16 watts with a modulation capability of 80 percent in amplitude modulation (AM) and 5.6 kHz deviation in frequency modulation (FM).

3-3. The Radio Set may be used in the normal, retransmit, tone or broadband operational modes. The actual mode is selected by the MODE switch located on the front panel, and the PLAIN-BROADBAND SWITCH located at the rear of the radio case. The selection of either AM or FM signals is done by a switch on the front panel. The basic block diagram, figure 3-1, illustrates inputs and outputs which, effectively, represent the over-all function of the Radio Set.

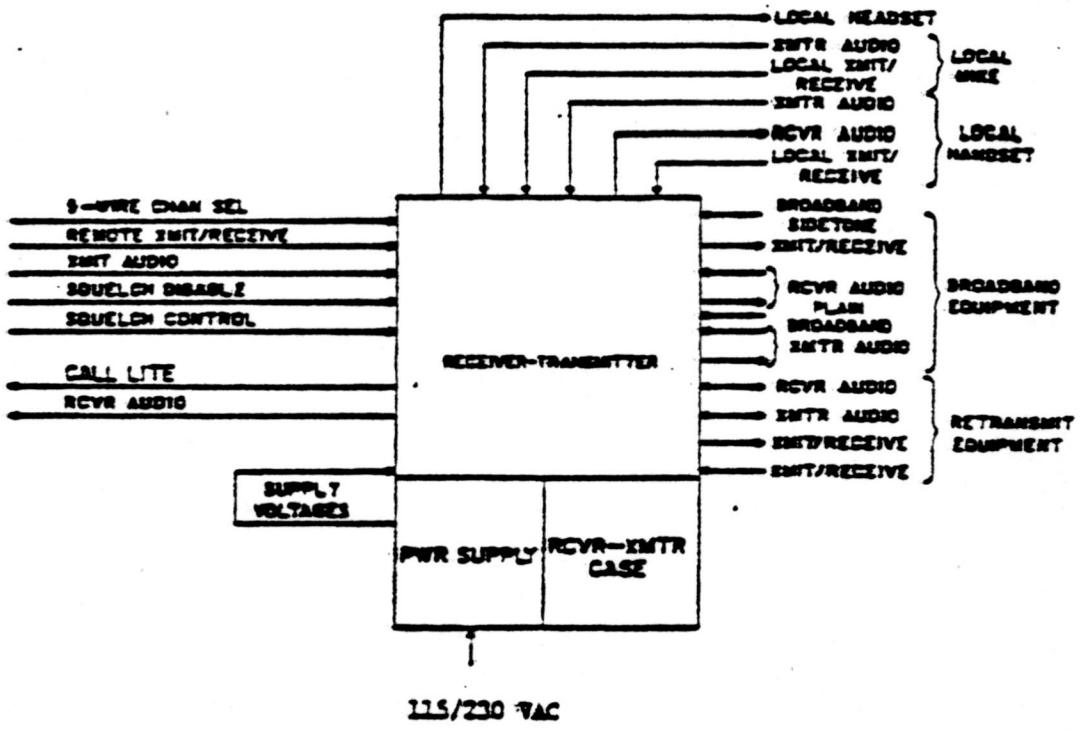


Figure 3-1. Radio Set AN/URC-9(B)XN2 Basic Block Diagram

3-4. NORMAL MODE. The normal mode is selected by the MODE switch in the NOR position and the PLAIN-BROADBAND switch at PLAIN. Operation is the same for either AM or FM providing that other units being communicated with are using the same type of modulation.

3-5. Unless the Radio Set is specifically keyed to transmit by the local microphone or handset, it will function in the receive condition with received audio present in the local headset and the local handset. Squelch control is available at the front panel with the CHAN SEL switch either at MANUAL or any of the 19 preset frequency positions. Either signal-plus-noise to noise or carrier squelch is available with the actual change made via a wire link in the audio amplifier.

3-6. When the microphone or handset press-to-talk switch is actuated, the Radio Set is keyed to transmit. The transmitted audio is available in the local headset.

3-7. RETRANSMIT MODE. When the Radio Set is connected with another AN/URC-9 Radio Set automatic relaying is selected by setting the MODE switches of both units at RETRANS which also automatically provides carrier squelch operation.

3-8. In this mode, the Radio Sets automatically relay signals in either direction: Both Radio Sets operate as receivers until one of the sets receives a signal strong enough to operate the carrier-controlled squelch circuit.

3-9. The squelch circuit of the receiving set keys the remaining set to transmit, and the audio of the receiving set is applied to the transmit audio input of the transmitting set. During this interval, a normal audio signal is present in the headset of the receiving radio set, and a sidetone audio signal is heard in the headset of the transmitting set. When the signal is no longer present, the transmitting set returns to the receive condition.

3-10. When the microphone press-to-talk switch of either Radio Set is pressed, both radios are keyed to transmit and the microphone audio signal is applied to both Radio Sets for simultaneous (duplex) transmission.

3-11. TONE MODE. With the MODE switch on Radio Set AN/URC-9(B)XN2 in the TONE position, a 1000 Hz (1kHz) tone oscillator is connected in place of the normal microphone circuit. Keying the transmitter results in the emission of a carrier modulated at 1000 Hz. A 1000 Hz tone will be heard in the headset, and the percent of modulation indicated on the front panel meter in the % MOD position should be midscale.

3-12. BROADBAND MODE. The broadband mode is selected by the PLAIN-BROADBAND switch in the BROADBAND position. Broadband operation is similar to normal operation with the following exceptions:

(a) The squelch function is not performed by the Radio Set, and Radio Set audio signals are routed through the broadband equipment.

(b) Normal sidetone is replaced by sidetone from the broadband equipment, and the broadband sidetone is amplified in the Radio Set in the broadband sidetone amplifier.

(c) The amplified broadband audio is applied from the broadband sidetone amplifier to the headsets.

(d) During transmit, the microphone signal is applied to the broadband equipment, and the output of the broadband equipment is applied to the audio amplifier. In turn, the output of the audio amplifier is transmitted in the same manner as the normal mode transmitted signal.

3-13. CHANNEL SELECTION. Local channel selection is accomplished by the CHAN SEL switch on the front panel of the AN/URC-9(B)XN2 Radio Set. Nineteen channel frequencies are preset on the 19-channel memory drum which is accessible through a door in the front panel of the RT Unit. When the CHAN SEL switch is in the MANUAL position, the frequency of operation is controlled by the MANUAL FREQUENCY TENS, UNITS, AND TENTHS-THOUSANDTHS switches on the front panel of the RT Unit. When the CHAN SEL switch is in the REMOTE PRESET position, channel information is received from Radio Set Control C-2383/URC-9. When the Radio Set is used as part of an AN/SRC-20 or AN/SRC-21 communication equipment, REMOTE PRESET channel information is received from Radio Set Control C-3866/SRC.

3-14. RECEIVE FUNCTION SIGNAL PATH.

3-15. The receive function signal path for Radio Set AN/URC-9(B)XN2 is shown in the simplified block diagram of figure 3-2.

3-16. During normal receive operation, the 225.000 to 399.975 MHz signal from the antenna passes through a directional coupler of the Radio Set to the RF Exciter. The signal is amplified in this circuit and mixed with a frequency in the 200 to 370 MHz range (injected by the UHF Frequency Synthesizer) to produce a difference frequency in the 20.000 to 29.975 MHz range.

3-17. The difference frequency is amplified in the IF Amplifier and Synthesizer and then mixed in that circuit with a self-contained frequency source that appears in the 23.000 to 32.975 MHz frequency range. The subsequent difference frequency of 3.000 MHz is filtered and mixed with a 2.500 MHz signal to produce a 500 kHz output signal.

3-18. The 500 kHz output from the IF Amplifier and Synthesizer is applied through a 500 kHz filter to the IF Amplifier and Demodulator. The signal is demodulated, passed through a noise limiter, amplified again and applied to the Audio Amplifier. The audio signal is amplified and fed to the headset or speakers. Broadband audio signals are routed directly from the demodulator to the BROADBAND connector without noise limiting.

3-19. TRANSMIT FUNCTION SIGNAL PATH

3-20. The transmit function signal path for Radio Set AN/URC-9(B)XN2 is shown in the simplified block diagram of figure 3-3.

3-21. During normal transmit operation, signals from the microphone input on the front panel are amplified by the Audio Amplifier and then coupled to the IF Amplifier and Synthesizer.

3-22. The IF Amplifier and Synthesizer produces a signal in the 20.000 to 29.975 MHz range. When frequency modulation is selected, the modulation signal is applied to the output of the IF Amplifier and Synthesizer. When amplitude modulation is selected, both the audio and RF signals are coupled to the RF Exciter.

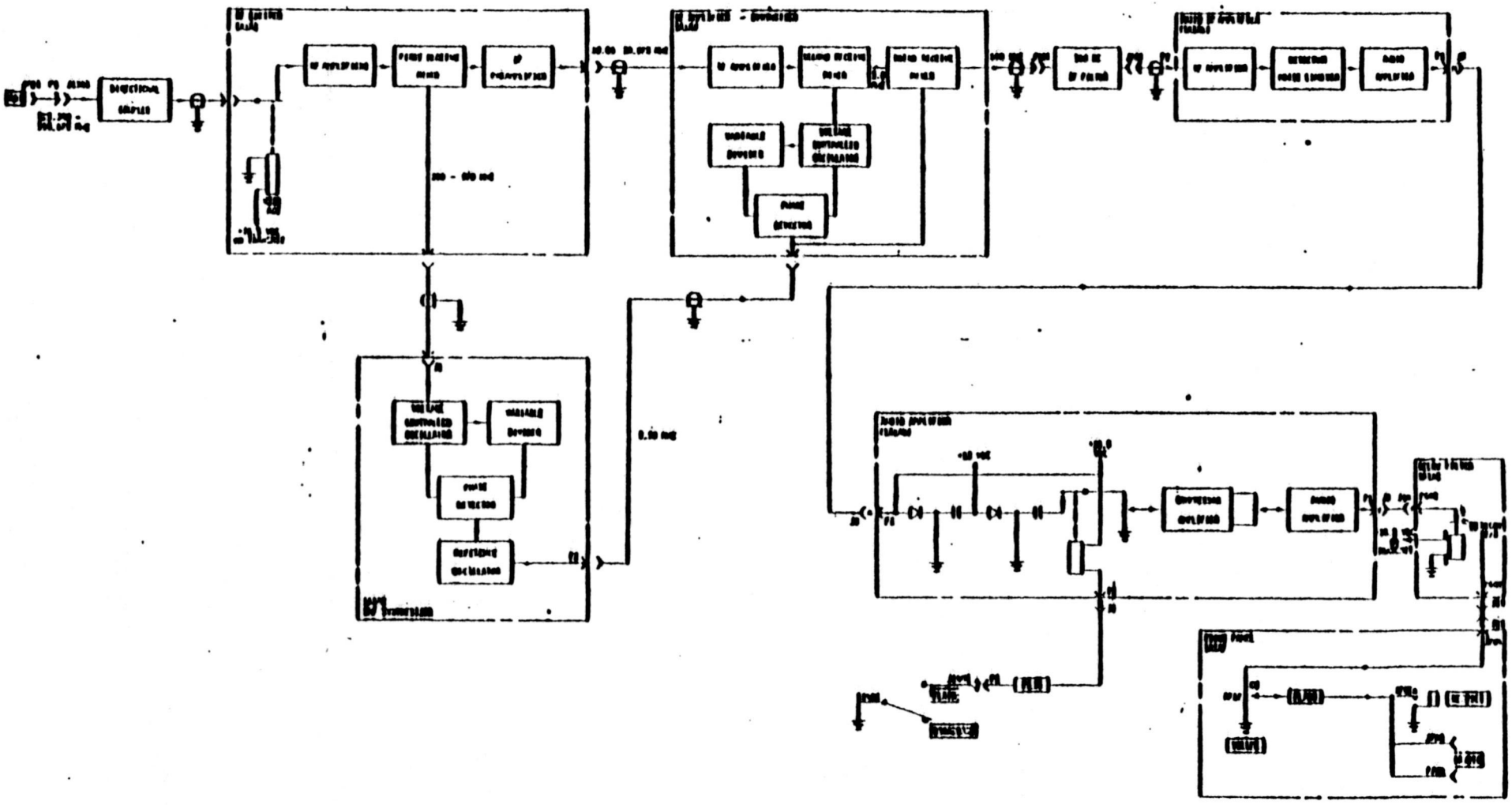


Figure 3-2. Receive Function Block Diagram

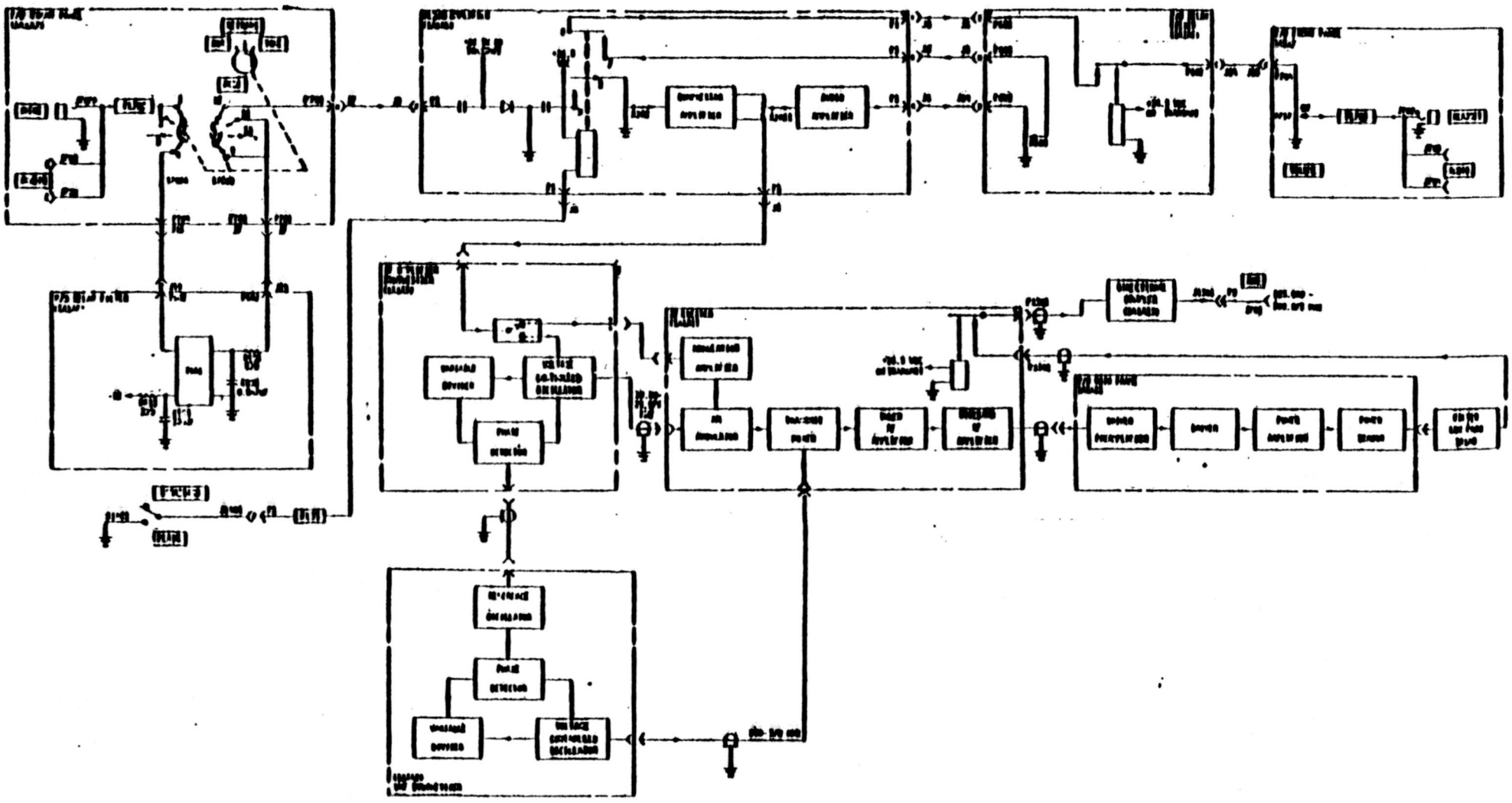


Figure 3-3. Transmit Function Block Diagram

3-23. After passing through the AM modulator, the 20.000 to 29.975 MHz signal is mixed with a signal in the range of 200 to 370 MHz to produce a sum frequency of 225.00 to 399.975 MHz. This signal is amplified to a level of approximately 20 watts and coupled to the antenna connector via a low-pass filter, antenna relay, and directional coupler.

3-24. RF EXCITER ASSEMBLY.

3-25. The RF Exciter Assembly, shown in figure 3-4 contains a Tuned Amplifier Assembly and an RF Modulator Printed Wiring Assembly. The Tuned Amplifier Assembly consists of three transistor amplifiers coupled by varactor tuned circuits. The RF Modulator Printed Wiring Assembly contains a transmit mixer and a receive mixer with diode switching circuits for routing the signals. It also contains the AM audio modulator and an IF pre-amplifier stage.

3-26. TUNED AMPLIFIER ASSEMBLY. The Tuned Amplifier Assembly, shown in figure 3-5, is used in both receive and transmit modes. The signal path is identical in both modes, with signal levels being greater in transmit. The amplifier tuning range is from 225 MHz to 400 MHz, with varactor diodes CR1, CR2, CR3 and CR4 acting as the tuning elements. The tuning voltage of 3 to 18V is supplied by the Curveshaper Printed Wiring Assembly.

3-27. The RF signal enters transistor Q1 via tuned circuit L4, L5, C11 and CR1 from the RF Modulator Printed Wiring Assembly. This stage amplifies the level some 6 db. This signal is then fed to Q2 via L6, L7, C12 and CR2. Q2 also amplifies the signal some 6 db and feeds it to transistor Q3 for an overall gain of 18 db by the total amplifier. The output of Q3 is fed to L10, L11, C14, CR4 tuned circuit and back to the RF Modulator Printed Wiring Assembly.

3-28. RF MODULATOR PRINTED WIRING ASSEMBLY. The RF Modulator Printed Wiring Assembly, shown in figure 3-6, has both receive and transmit signals present.

3-29. The receive signal enters the RF Modulator Printed Wiring Assembly at C2 from the antenna relay. The signal then is fed to the Tuned Amplifier Assembly via pin diode switch CR3. Once amplified, the signal returns to the RF Modulator Printed Wiring Assembly and is fed into the receive mixer (A2) via CR6 and C18. Here it is mixed with the local UHF oscillator signal to produce the IF signal. After filtering by L3, L4 and C22 the signal is fed to Q2 transistor, where the level is amplified for use by the IF Amplifier and Synthesizer Assembly.

3-30. The transmit signal enters the RF Modulator Printed Wiring Assembly at T1 transformer as an RF frequency signal. The signal is then fed to amplitude modulator Q1 where the transmit audio is combined with the signal to produce an AM wave form. The passive low pass filter L1, L2, L6, L7, C9, C29, C30 and C34 then filters out the unwanted spurious modulation. Once filtered the signal is mixed, in the mixer (A1) with the local UHF oscillator signal to produce the proper frequency signal for transmission. Then the signal is fed to the Tuned Amplifier Assembly via pin diode switch CR4. The signal reenters the RF Modulator Printed Wiring Assembly and is routed through pin diode CR5 and C26 and fed out again to the Broadband RF Amplifier Curveshaper Printed Wiring Assembly.

3-31. BROADBAND AMPLIFIER ASSEMBLY. The Broadband Amplifier Assembly, shown in figure 3-7, consists of a two stage transistor amplifier with an overall gain of 14 db. It boosts the transmit rf signal to ensure a greater than 0 dbm drive level to the Power Amplifier Assembly.

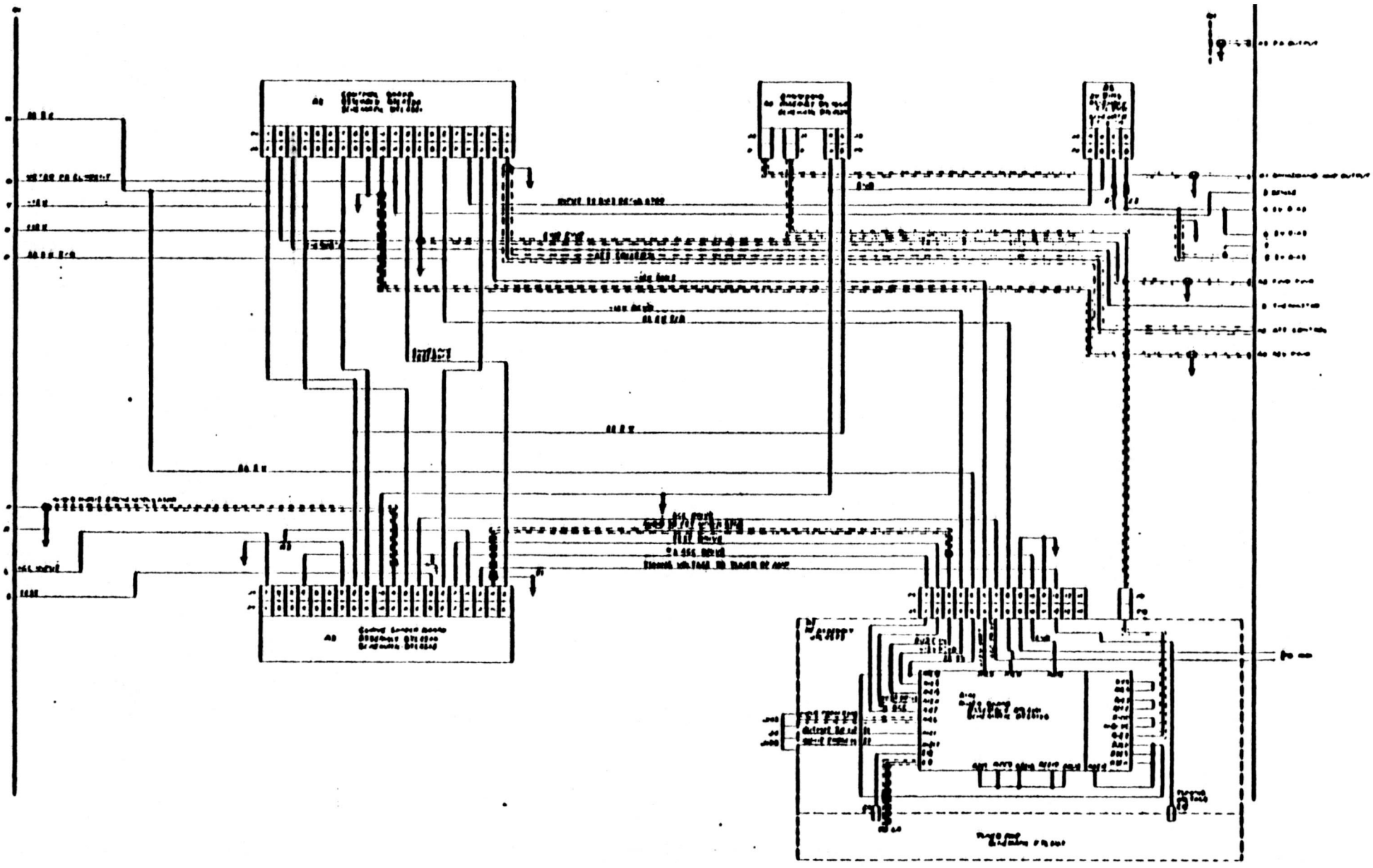


Figure 3-4. RF Exciter Assembly Block Diagram

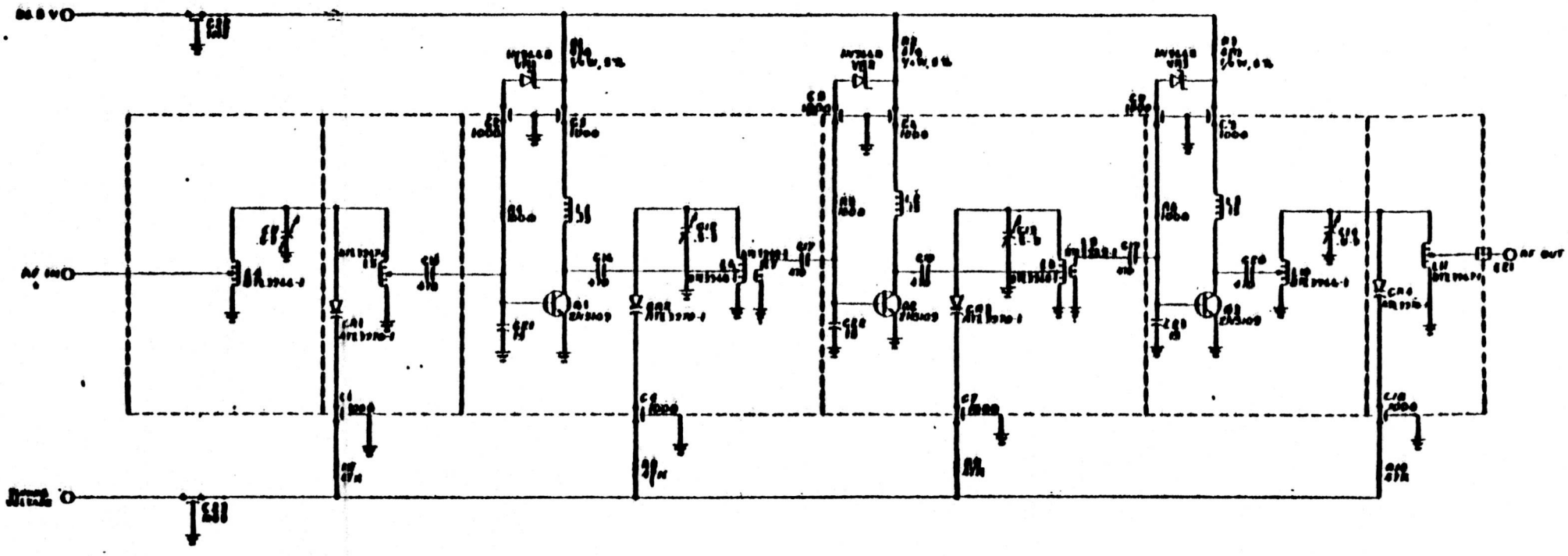


Figure 3-5. Tuned Amplifier Assembly Schematic

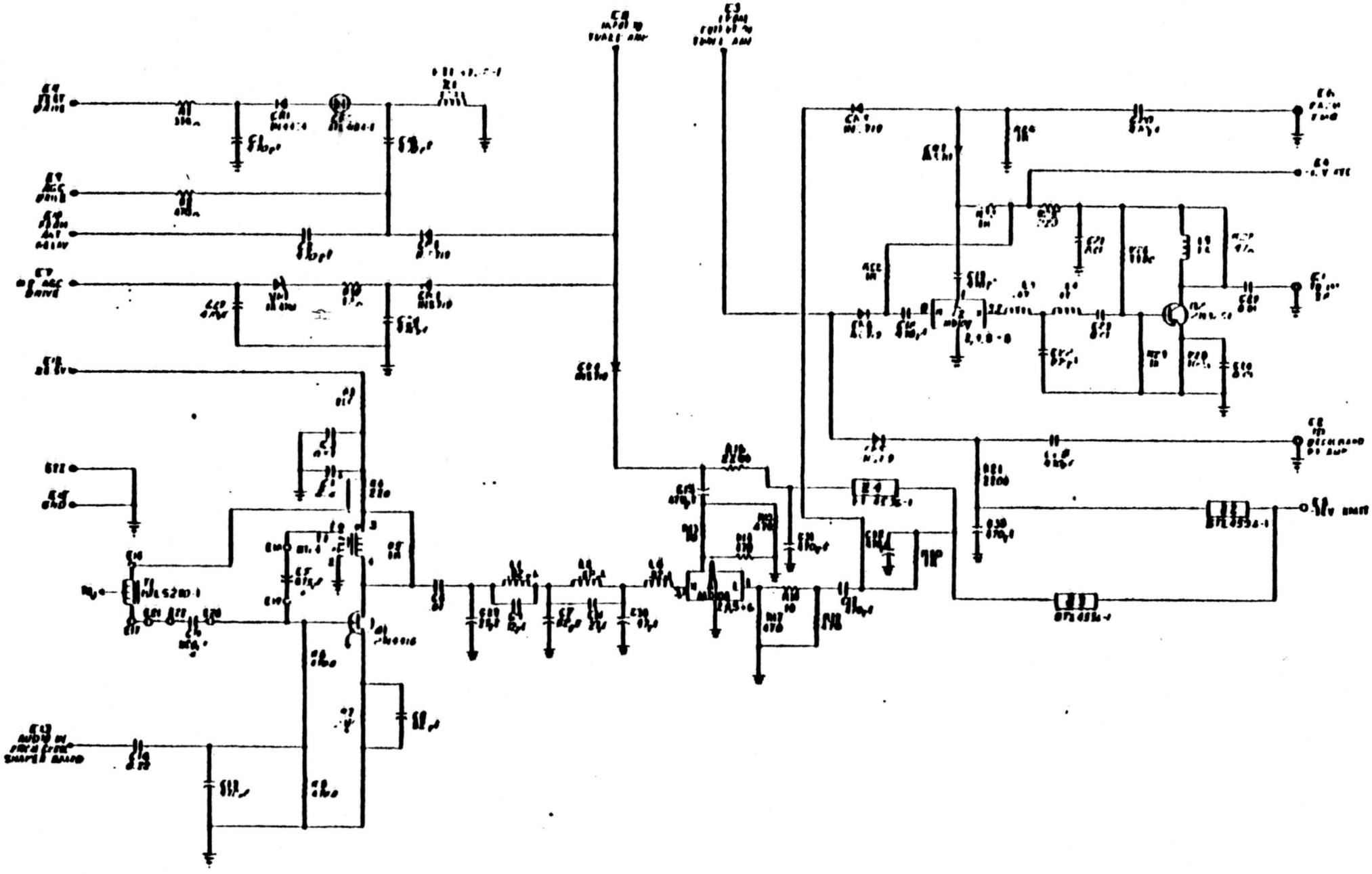


Figure 3-6. RF Modulator Printed Wiring Assembly Schematic

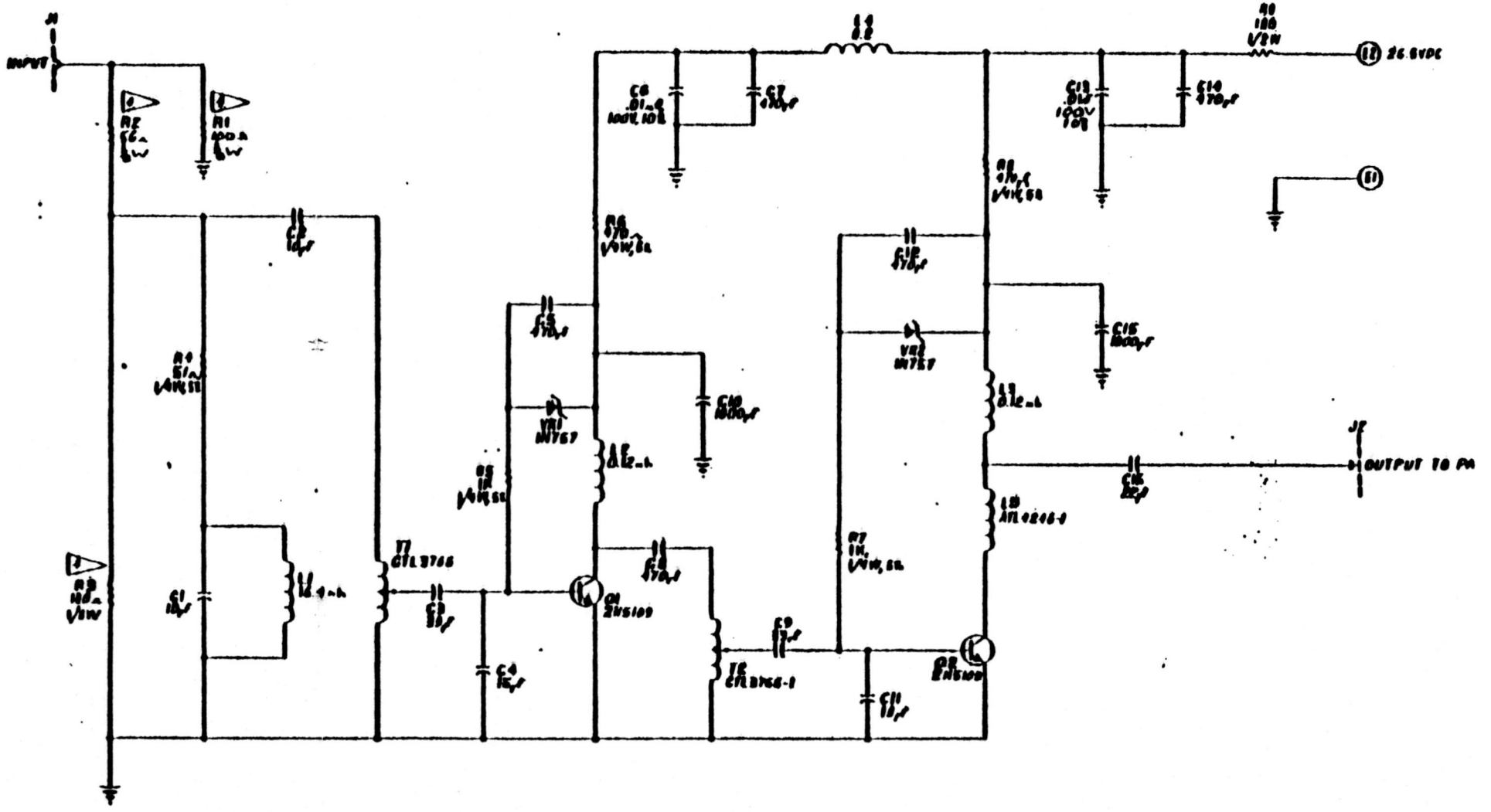


Figure 3-7. Broadband RF Amplifier Assembly Schematic

3-32. The transmit signal enters the assembly at J1. The signal is first amplified by transistor Q1 and then by Q2. The output is taken from J2 and is fed directly to the Power Amplifier Assembly.

3-33. CURVESHAPER PRINTED WIRING ASSEMBLY. The Curveshaper Printed Wiring Assembly, shown in figure 3-8, consists of four separate circuits; the RF tuning voltage curveshaper, the audio amplifier, the RF AGC amplifier and the receiver test oscillator.

3-34. The Curveshaper is basically a DC amplifier, U2, with programmed feedback. The DC output swings from 3 to 18 volts to cover the tuning range of 225 to 400 MHz of the Tuned Amplifier Assembly. The input to U2 is varied by a variable resistor which is linked to the front panel channel selection mechanism.

3-35. The Audio Amplifier Circuit includes integrated circuit U1 which is an audio mixer circuit. It combines the processed transmit audio with the envelope feedback audio. This process is necessary to compensate for any modulation distortions which may occur in the modulator or RF amplifier chain. Resistor R5 sets the level of the amount of envelope feedback to be introduced while R1 is used to set the modulation percentage. The combined audio is then fed to a FET modulator.

3-36. The AGC amplifier circuit takes the negative voltage RF AGC developed in the IF Amplifier and Demodulator Assembly and processes it for use by the front end pin diodes. Q1, Q2 and Q3 are the active components in the circuit.

3-37. The receiver test oscillator circuit is used to pulse the noise diode CR2 on the RF Modulator Printed Wiring Assembly. The circuit is comprised of a single op amp, U3, connected as a multivibrator whose frequency is determined by R31 and C8. The circuit is enabled by a HIGH command from the front panel METER switch being in the RCVR TEST position.

3-38. CONTROL PRINTED WIRING ASSEMBLY. This assembly, shown in figures 3-9 and 3-10, processes the inputs from the various sense elements of the Power Amplifier Assembly and generates a control output to attenuate and protect the Power Amplifier Assembly.

3-39. When the Power Amplifier Assembly current exceeds 15 amperes, transistor Q7 conducts because of the voltage developed across current sense resistor R1. When Q7 conducts it puts a bias on the base of driver transistor Q10. Since Q10 is an emitter follower circuit, this voltage, less the base/emitter voltage drop, appears on the emitter and is fed to the Power Amplifier Assembly control circuitry to cut back the output power.

3-40. Integrated circuit U2A is the temperature sense amplifier. Its input comes from changes in the resistance of thermistor RT1 located in the Power Amplifier Assembly. As the temperature in the Power Amplifier Assembly rises, the resistance of the thermistor increases. This increases the bias on the non-inverting input terminal of U2A, which increases its output level. Initially U2A's output voltage is negative with respect to ground, which reverse biases diode CR2. Consequently, it is not until the output of U2A goes above ground that CR2 will conduct. This happens when the Power Amplifier Assembly temperature rises above a safe operating level. When CR2 conducts, its output drives Q10 which cuts back the RF output power.

3-41. The forward RF output power is sensed after the final RF stages. A

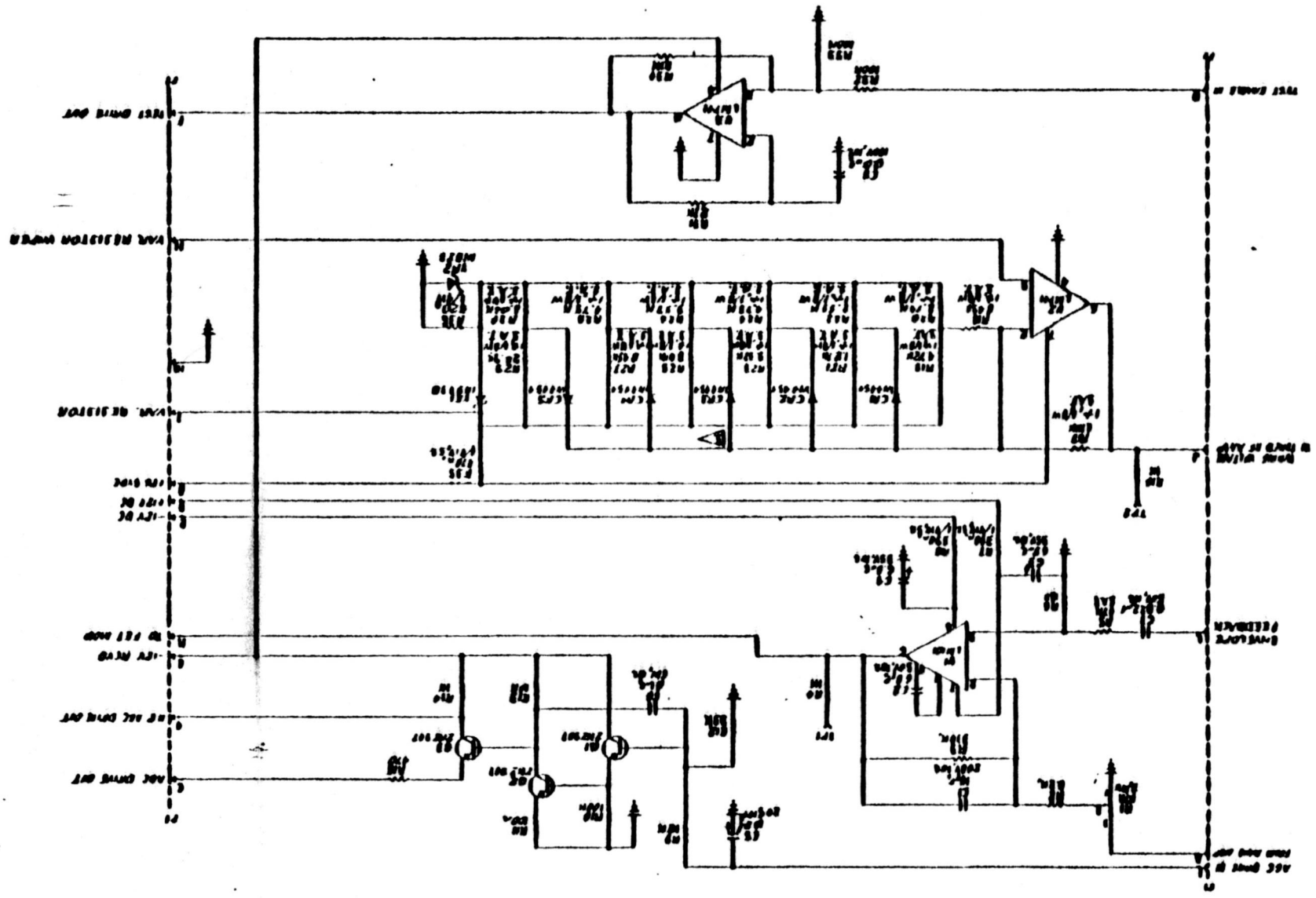
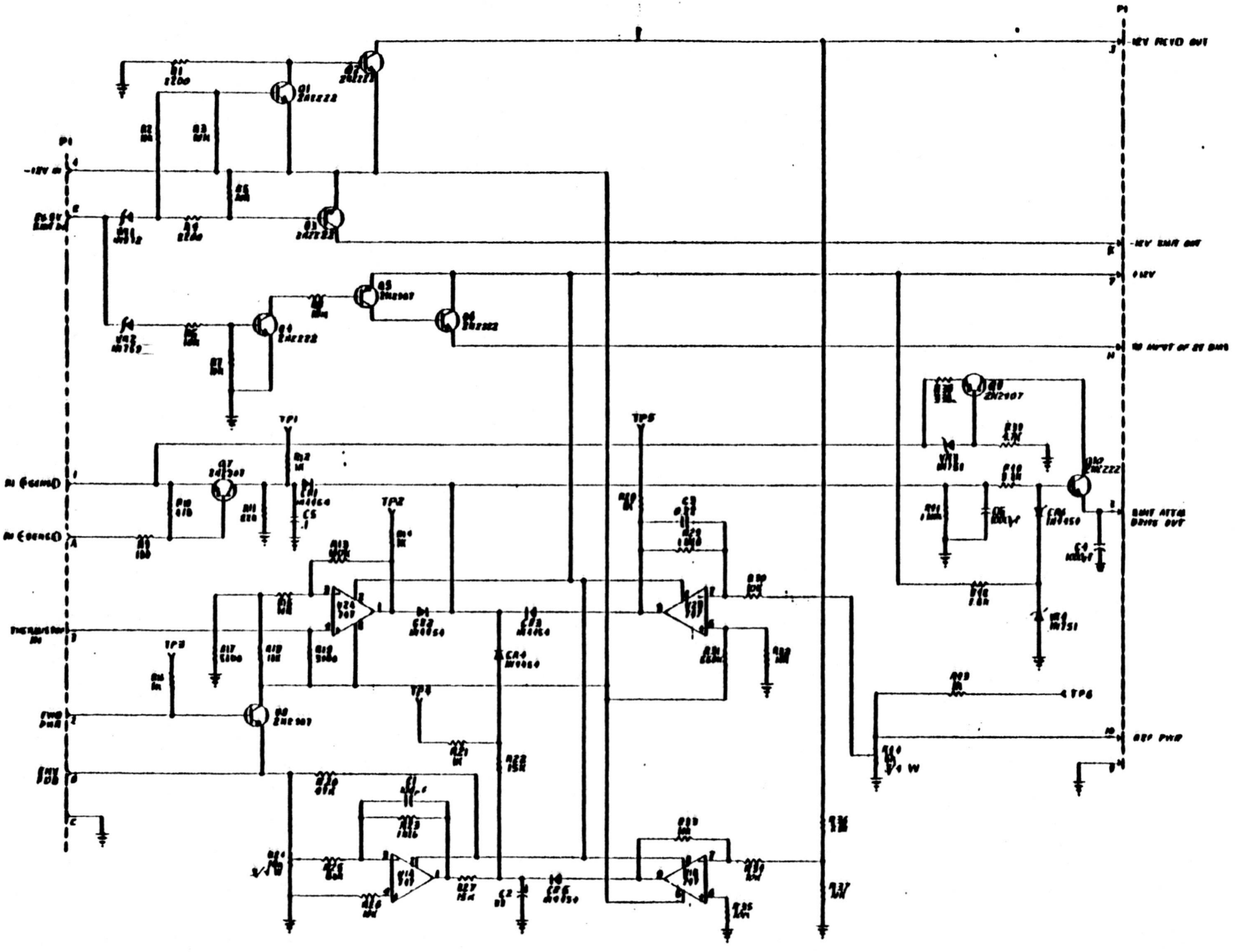


Figure 3-8. Curveshaper Printed Wiring Assembly Schematic



negative DC level is obtained which corresponds to the amount of power output. This level is sent to inverting input terminal U1A via Q8. Initially U1A's output is below ground. Not until the RF output power exceeds a predetermined level does the output go higher than ground. Then CR4 forward biases, turning ON Q10, and Q10's output cuts back the power output.

3-42. The reflected power is sensed just after the final RF stages. A negative DC level is developed based on the amount of RF power that is being sent back from the RF output. The level is fed to inverting input terminal U2B. The output of op amp U2B is biased below ground until the reflected level exceeds a predetermined level. U2B then forward biases diode CR3 which turns on Q10, decreasing the output power.

3-43. In order to prevent a full surge of RF power output instantaneously when keying, a bias delay circuit is provided. U1B's output is biased to a point above ground where it charges capacitor C2 via CR5 in receive. When keyed into transmit, U1B's output goes low, while capacitor C2 discharges through R22 and CR4 into Q10. This keeps Q10 on, turning down the RF output momentarily until C2 is discharged. At this time the forward power sensing circuitry is up and ready to control.

3-44. POWER AMPLIFIER ASSEMBLY.

3-45. The Power Amplifier Assembly, shown in figures 3-11 and 3-12, consists of four amplifier modules and power, temperature, and current sensors. The amplifier modules boost the 0 dbm signal out of the RF Exciter Assembly to a nominal 20 watt level.

3-46. The transmit RF signal enters the RF preamplifier. It has a gain over 35 db. It also contains a pin diode attenuator. This attenuator is used to regulate or cut back the RF signal. It is controlled by the Control Printed Wiring Assembly. The RF preamplifier drives the RF driver amplifier. The driver's output is fed into a coupler that splits the signal so it can be used to drive the parallel RF Power Amplifier. Their outputs recombine in a second coupler resulting in the RF transmit output signal.

3-47. The three sensors on the Power Amplifier Assembly, which monitor various points input to the Control Printed Wiring Assembly. The current sense is taken across resistor R46 and the 26.5 volt line. Thermistor RT1 senses the temperature at the parallel RF power amplifiers. The forward and reflected powers are sampled by a power sensor.

3-48. UHF FREQUENCY SYNTHESIZER ASSEMBLY.

3-49. The UHF Frequency Synthesizer Assembly, shown in figure 3-13, produces 18 frequencies from 200 to 370 mHz in 10 mHz steps. One of three voltage controlled oscillators (VCO) is activated depending on the output frequency. The signal is coupled through a buffer amplifier to the RF Exciter Assembly and also via a divider circuit that divides the signal frequency by 32 and then again by a number that varies from 20 to 37 depending on the selected frequency of the radio. After being divided the frequency signal is coupled to a phase detector circuit. The phase detector has a second input signal of 312.5 kHz that is controlled by a temperature compensated crystal oscillator. If the first signal is not also at 312.5 kHz the phase detector produces a DC control voltage that varies the frequency of the voltage controlled oscillator until the first signal to the phase detector is 312.5 kHz When this happens, the VCO frequency will be 312.5kHz times 32 times N. For example, if N=20, the VCO frequency will be 312.5 kHz x 32 x 20 = 200mHz.

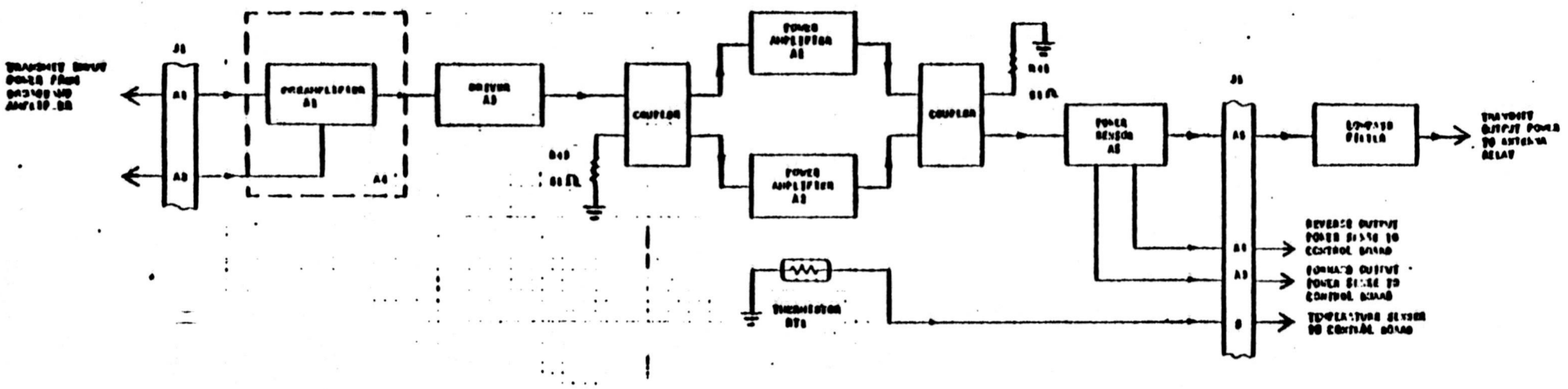


Figure 3-11. Power Amplifier Assembly Block Diagram

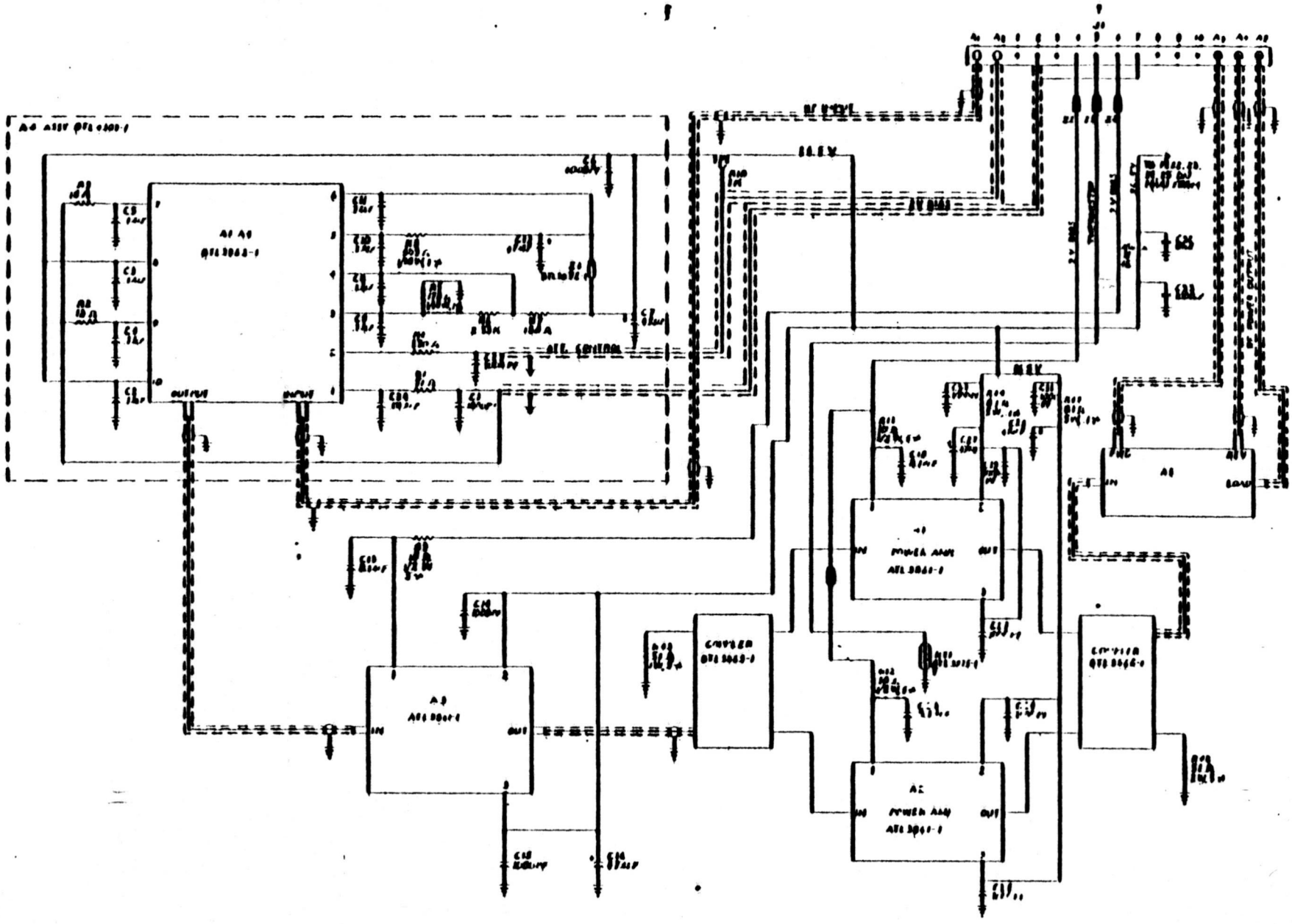


Figure 3-12. Power Amplifier Assembly Schematic

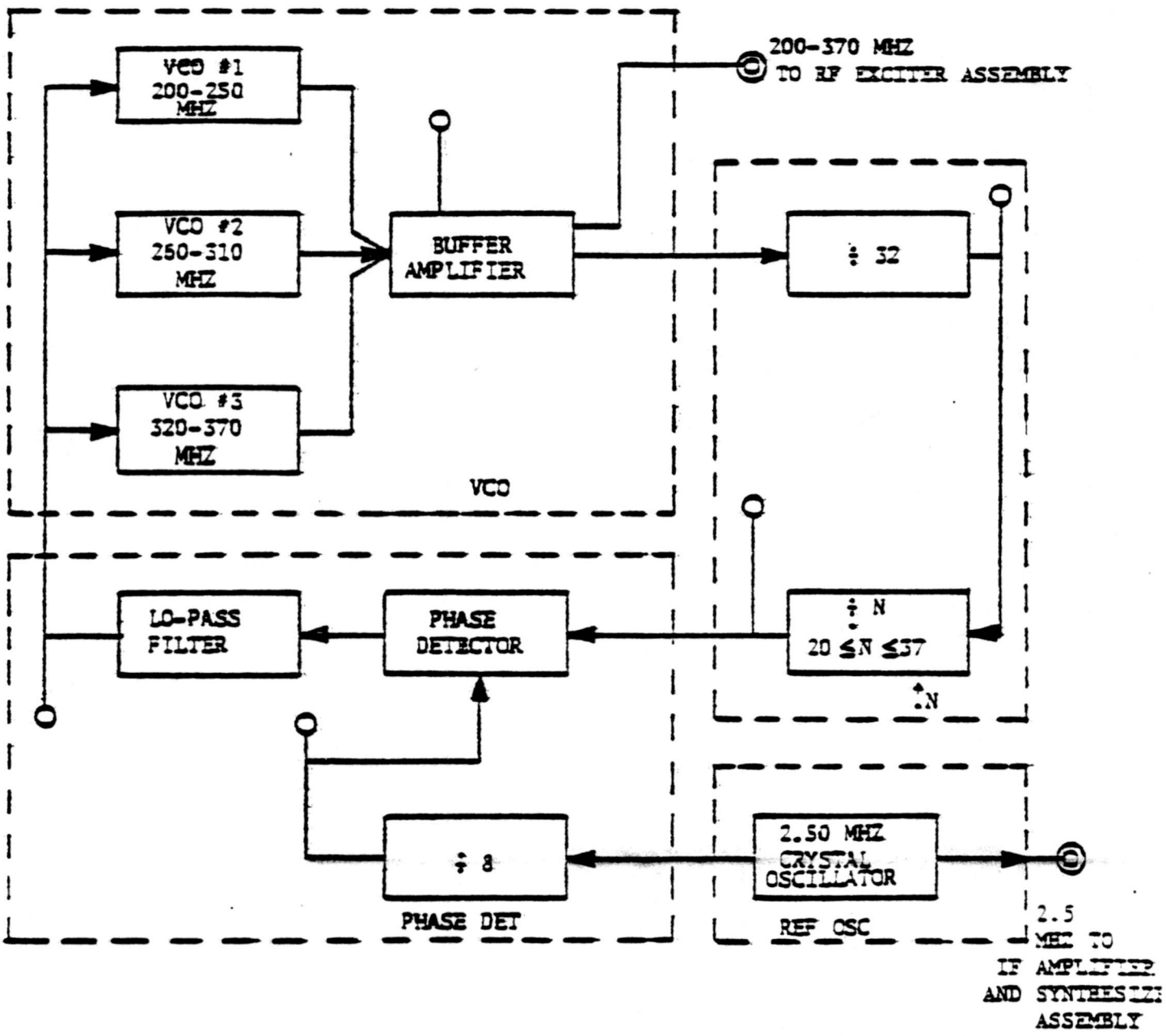


Figure 3-13. UHF Frequency Synthesizer Assembly Block Diagram

3-50. VCO PRINTED WIRING ASSEMBLY. The VCO Printed Wiring Assembly, shown in figure 3-14, contains three identical oscillators, each of which covers a separate 50MHz range in order to cover the entire range from 200 to 370 MHz. Each of the oscillators is a Colpitts type that uses voltage variable capacitance diodes to tune the circuit. The output of each oscillator is coupled to the input of a cascode buffer amplifier. The output of the buffer amplifier is taken through a transformer with two secondaries. The main secondary winding couples the signal out to a coaxial connector. The other secondary winding provides a signal to the Divider Printed Wiring Assembly.

3-51. DIVIDER PRINTED WIRING ASSEMBLY. The Divider Printed Wiring Assembly, shown in figure 3-15, contains two separate divider circuits on one plug-in card. The first divider consists of integrated circuits U1-U4. These integrated circuits operate at very high frequencies and divide the input frequency by 32. The second divider consists of integrated circuits U5-U7 which divide the signal again, but the divide ratio can be any number from 20 to 37. The number by which it divides is controlled by grounding various combinations of pins 1-5 of the card connector. Grounding of the pins is controlled by a rotary switch driven by the Frequency Selector Assembly. After the second division, the signal is coupled to the Phase Detector Printed Wiring Assembly.

3-52. PHASE DETECTOR PRINTED WIRING ASSEMBLY. The Phase Detector Printed Wiring Assembly, shown in figure 3-16, receives the divided VCO signal as one input and a crystal-controlled reference frequency as a second input. Integrated circuit U1 compares the two input signals and produces a pulsed DC voltage that corresponds to the phase difference between them. R8 and C5 filter the pulses away and the voltage is coupled to buffer amplifier Q4-Q5. The DC signal is coupled through a notch filter to a second buffer amplifier, Q6-Q7. The notch filter is at 312.5 kHz which is also the reference frequency to the phase detector. The signal from the crystal oscillator is 2.5 mHz so it is divided by integrated circuits U2-U3 to get 312.5 kHz.

3-53. REFERENCE OSCILLATOR PRINTED WIRING ASSEMBLY. The Reference Oscillator Printed Wiring Assembly, shown in figure 3-17, contains a very stable crystal oscillator circuit. After being temperature compensated at the factory, the assembly is embedded in potting compound to protect it. The circuit has two outputs - a large signal output that is used by the UHF Frequency Synthesizer Assembly and a small signal output that is used by the IF Amplifier and Synthesizer Assembly.

3-54. IF AMPLIFIER AND SYNTHESIZER ASSEMBLY.

3-55. The IF Amplifier and Synthesizer Assembly, shown in figure 3-18, contains a frequency synthesizer that provides a local oscillator signal for both the transmit and receive modes, a variable frequency tuned amplifier and mixers that are used only in receive, and audio processing circuits used for transmitting FM voice signals.

3-56. The frequency synthesizer consists of a VCO (Voltage Controlled Oscillator), a programmable (÷N) frequency counter, and a phase detector and low-pass filter which form a phase-locked-loop. The loop causes the oscillator output frequency to be locked to a selected multiple of the 2.5 kHz reference frequency.

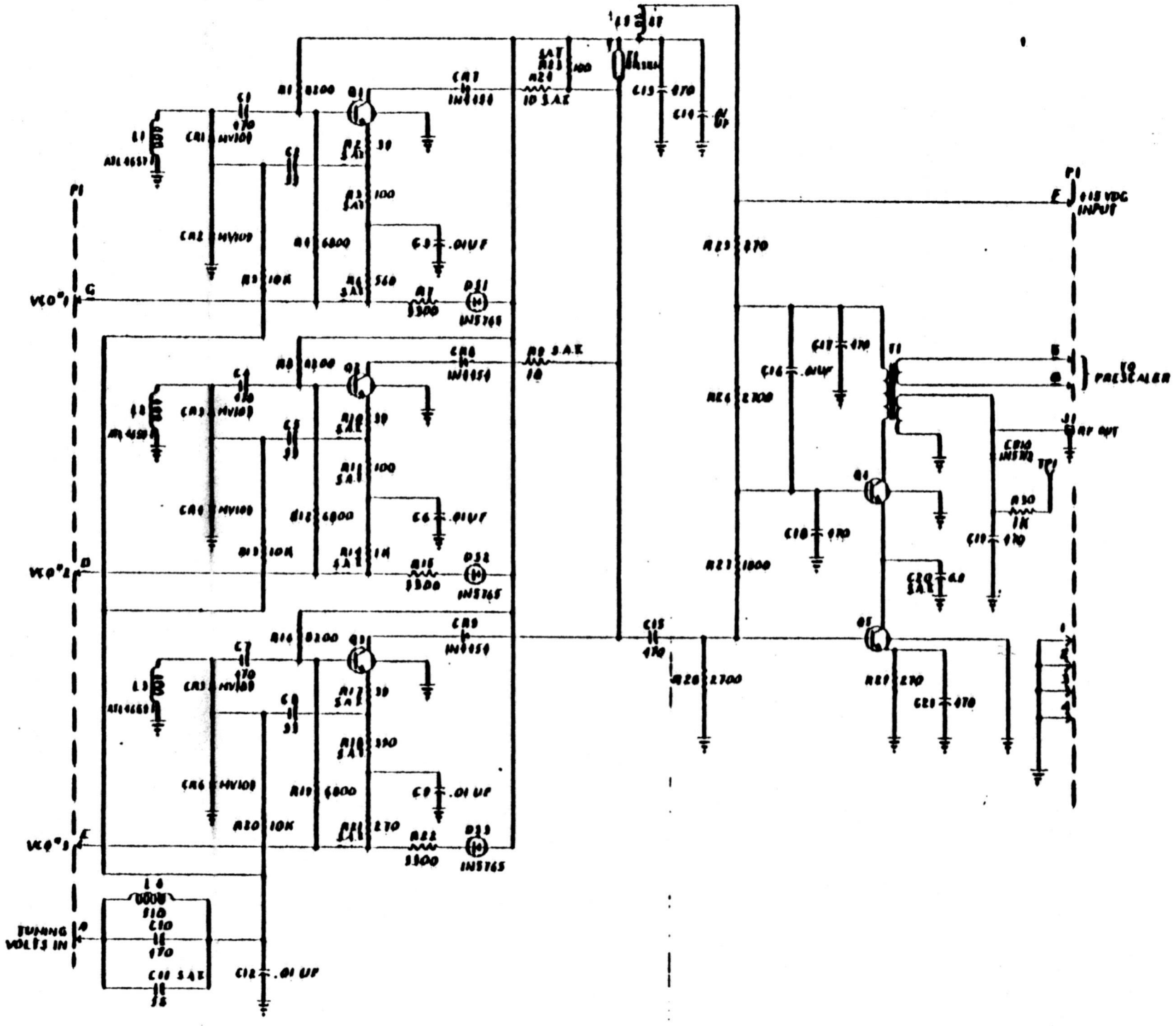


Figure 3-14. VCO Printed Wiring Assembly Schematic

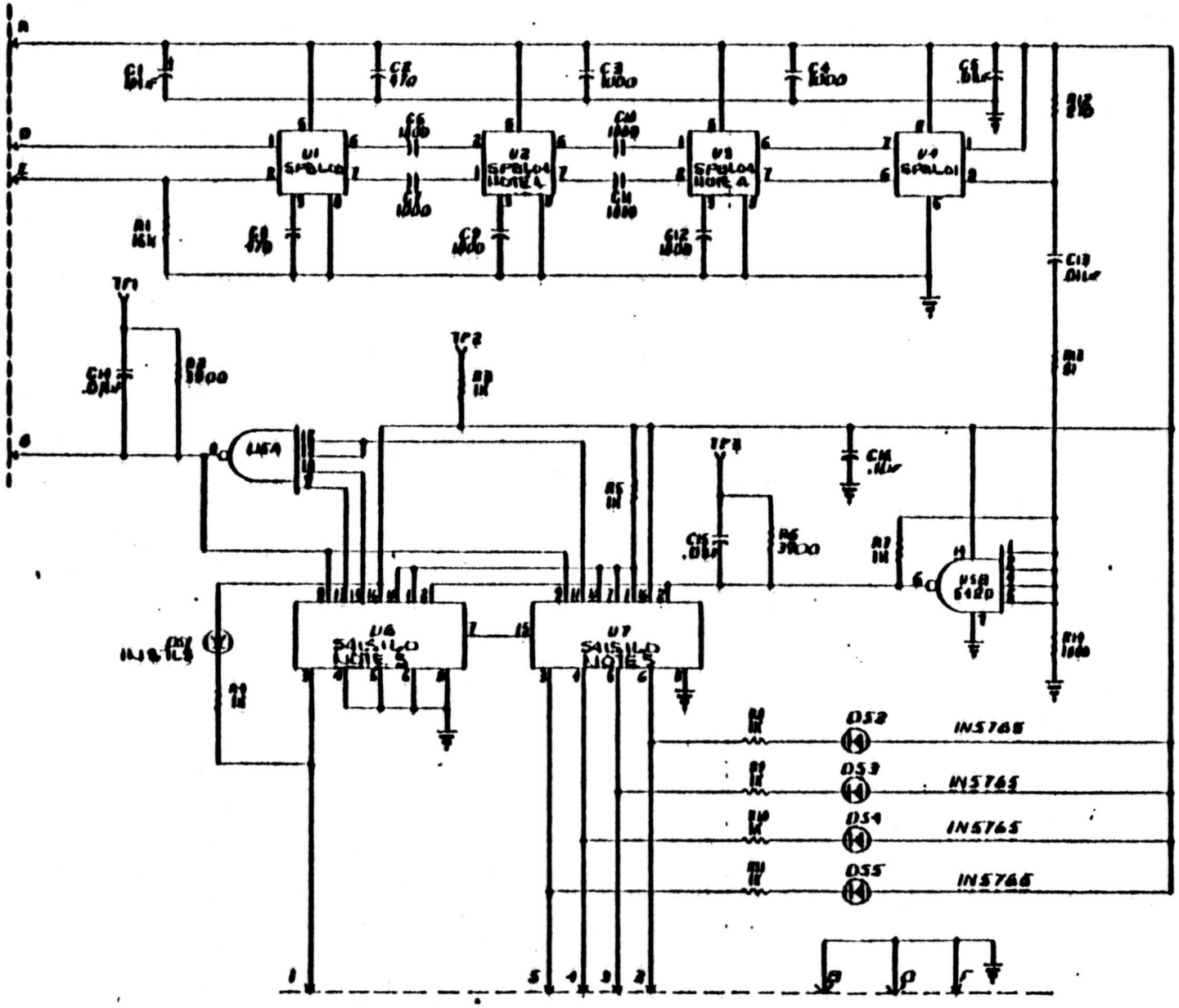


Figure 3-15. Divider Printed Wiring Assembly Schematic

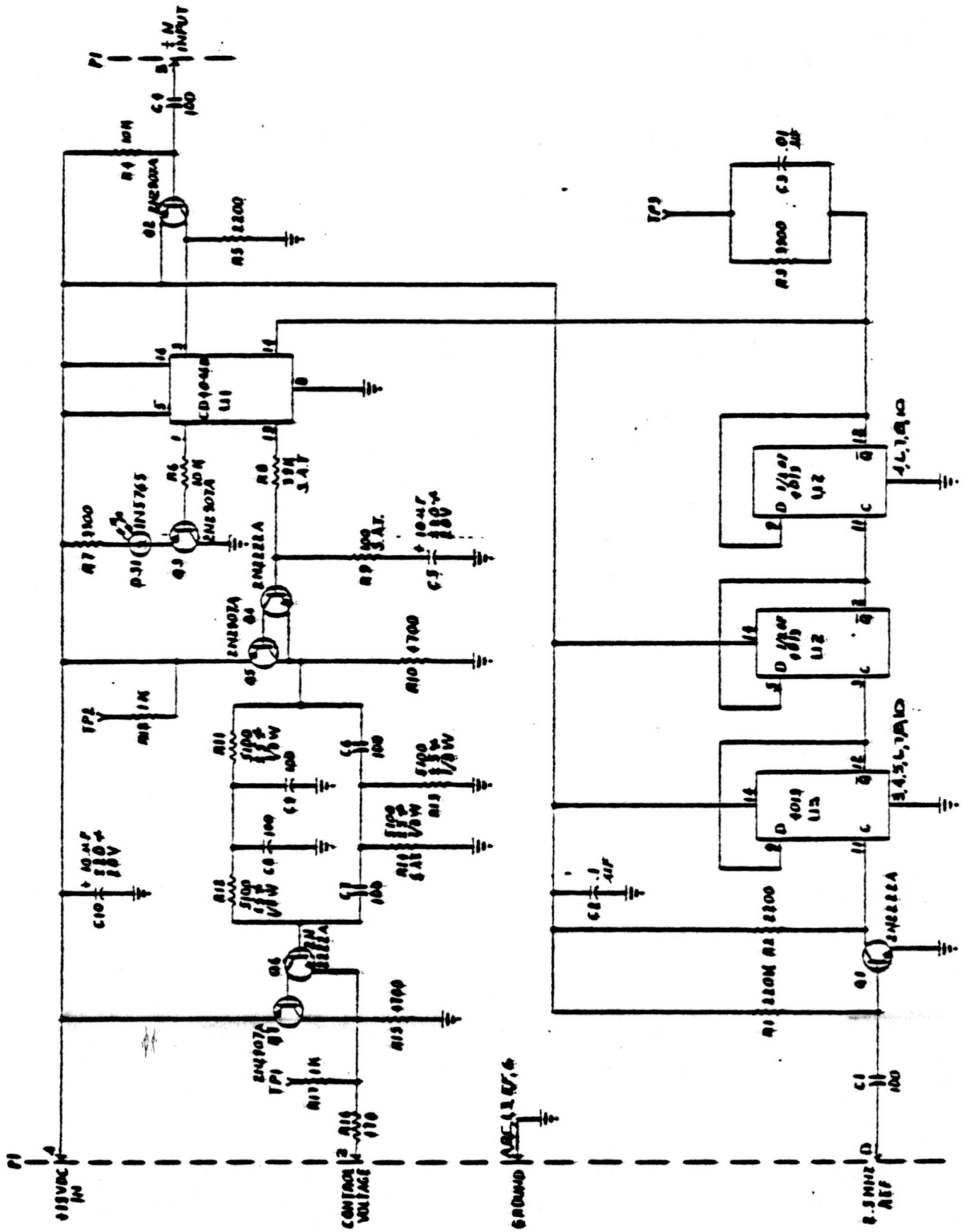


Figure 3-16. Phase Detector Printed Wiring Assembly Schematic

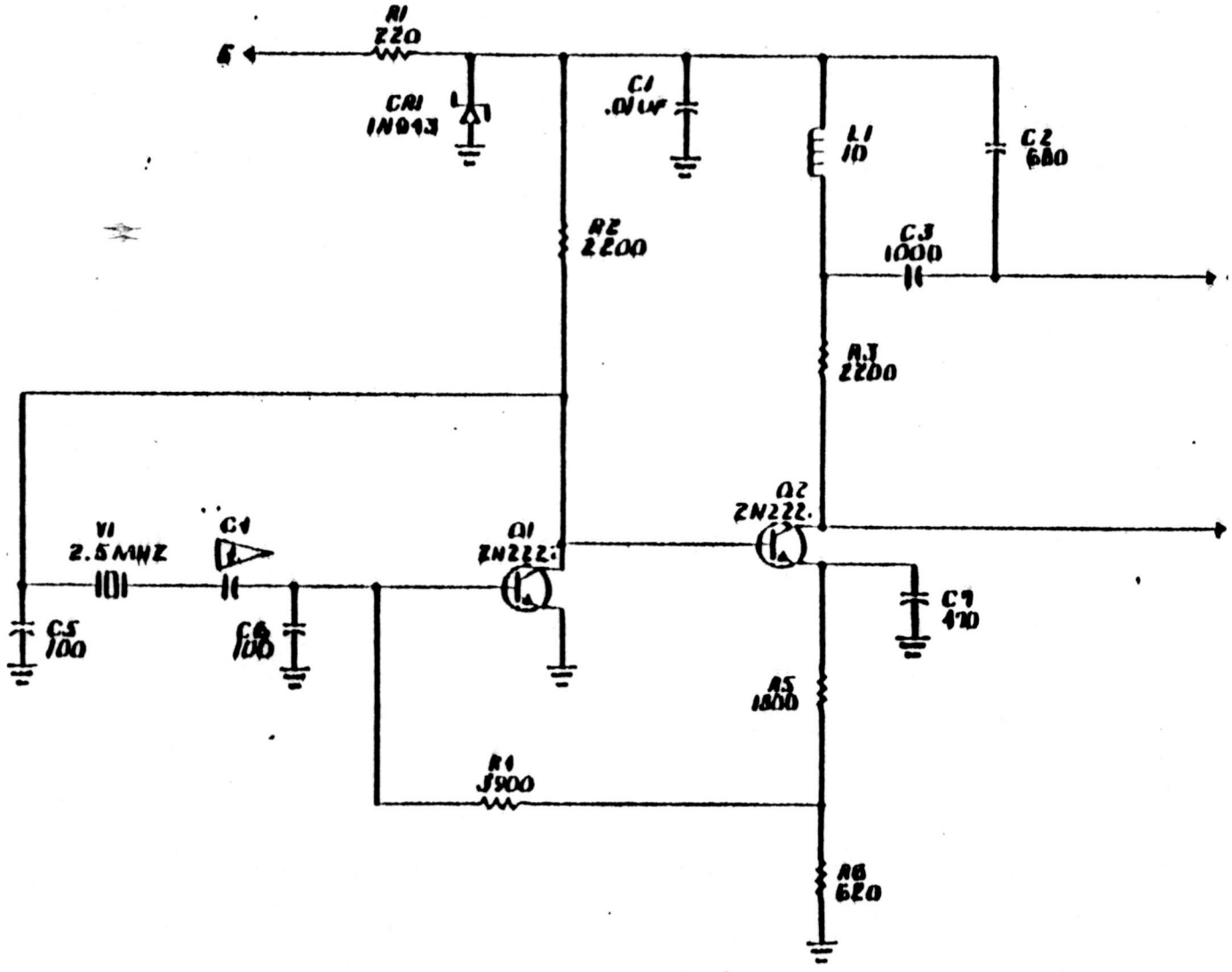


Figure 3-17, Reference Oscillator Printed Wiring Assembly Schematic

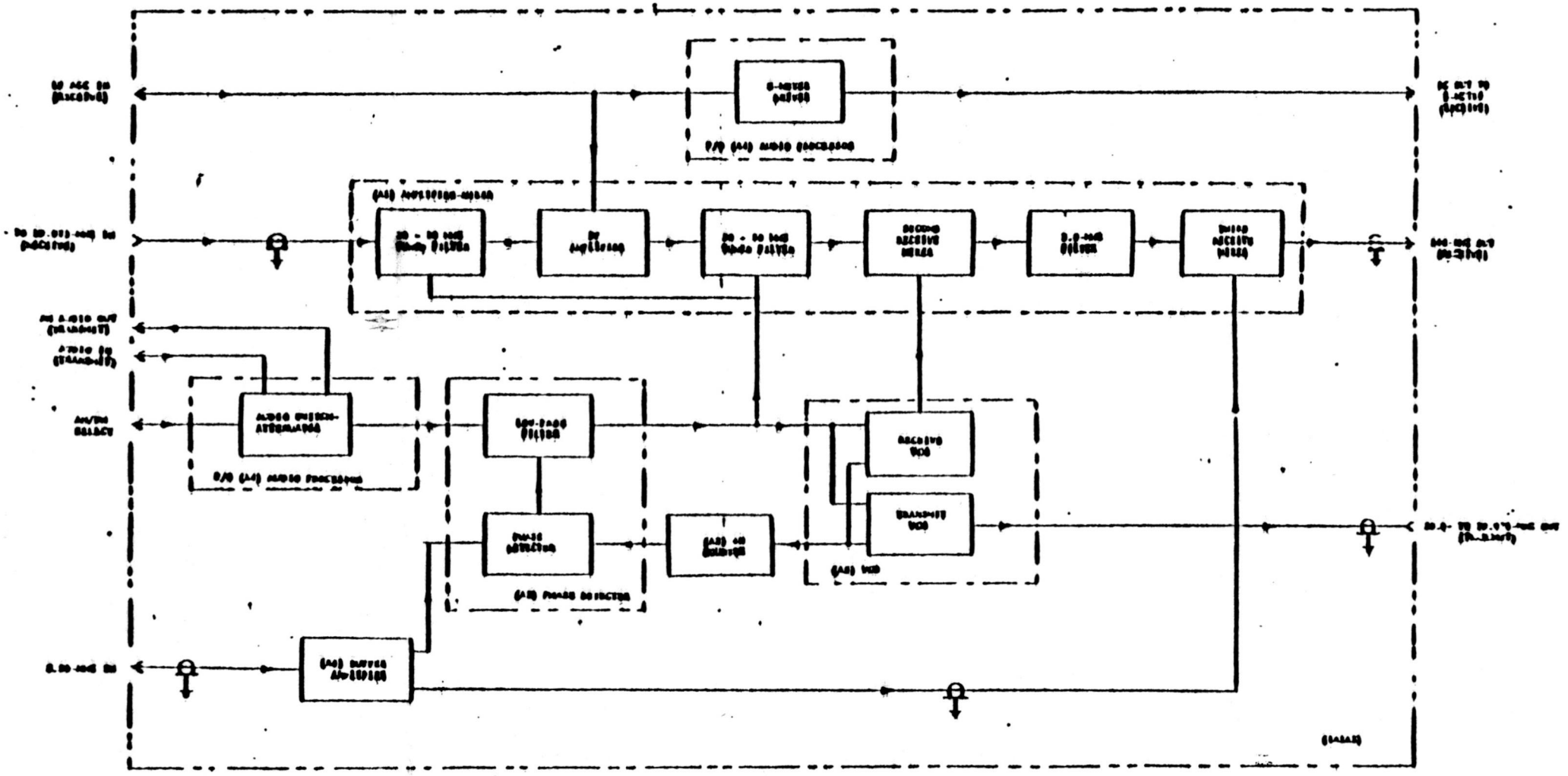


Figure 3-18. IF Amplifier and Synthesizer Assembly Block Diagram

3-57. In receive, IF signals from the RF Exciter Assembly are in the range of 20.000 to 29.975 MHz. They are coupled to the amplifier-mixer where they are filtered, amplified, filtered again and then applied to the second receive mixer. Here they are mixed with a signal from the frequency synthesizer that is 3.0 MHz above the IF signal producing a difference frequency of 3.0 MHz. This difference frequency of 3.0 MHz is filtered and applied to the third receive mixer where it is mixed with a 2.5 MHz signal to form the third IF difference frequency of 500 kHz, which is coupled out to an external filter.

3-58. In transmit, the frequency synthesizer produces a signal in the 20.000 to 29.975 MHz range which is coupled out to the RF Exciter Assembly. When frequency modulation is selected, audio input signals are applied to the synthesizer to frequency modulate the 20.000 to 29.975 MHz signal. When amplitude modulation is selected, the audio input signal passes through the unit for use in the RF Exciter Assembly.

3-59. The IF Amplifier and Synthesizer Assembly contains the driver for the S METER function of the front panel meter which monitors the receiver signal level by sampling the IF AGC voltage.

3-60. IF AMPLIFIER PRINTED WIRING ASSEMBLY. The IF Amplifier Printed Wiring Assembly, shown in figure 3-19, is an amplifier-mixer used during receive to amplify and convert the 20.000 to 29.975 mHz IF signal from the RF-Exciter Assembly to 500 khz for use by the IF Amplifier and Demodulator Assembly.

3-61. An integrated circuit amplifier, U1, is used to amplify the input signal. It has up to 45 db of gain depending on the AGC voltage applied through R13. There are bottom coupled two-pole filters ahead and behind the amplifier to filter the IF signal. The filters are tuned by voltage variable capacitance diodes, CR1-CR4. The tuning voltage is supplied by the frequency synthesizer. The tuning voltage varies from 3 Vdc to 15 Vdc as the frequency varies from 20.000 to 29.975 MHz.

3-62. The output of the second filter is coupled to one gate of a dual-gate field-effect-transistor, Q1. Here the signal is mixed with an injection signal from the frequency synthesizer applied to the second gate producing a difference frequency of 3.0 MHz. The signal is passed through a 3-pole filter fixed tuned at 3.0 MHz to the third receive mixer, Q2. This transistor mixes the 3.0 MHz signal with a 2.5 MHz injection signal to produce a difference frequency of 500 KHz which is coupled out to a 500 kHz filter.

3-63. BUFFER AMPLIFIER PRINTED WIRING ASSEMBLY. The Buffer Amplifier Printed Wiring Assembly, shown in figure 3-20, is used to amplify and condition the 2.5 MHz signal from the UHF Frequency Synthesizer Assembly. This signal is used as the injection signal for the third receiver mixer and also as the reference frequency for the frequency synthesizer.

3-64. The 2.5 mHz signal is coupled directly into the Buffer Amplifier Printed Wiring Assembly by a coaxial cable from UHF Frequency Synthesizer Assembly. The signal is amplified by Q1 which has a resonant circuit as a collector load. The resonant circuit filters out harmonics and other stray signals that may be present in the output of the UHF Frequency Synthesizer Assembly. The amplified and filtered signal is coupled to the base of transistor Q2. This stage has a split load, with part in the collector circuit and part in the emitter circuit, which gives isolation between the two circuits being driven by the Buffer Amplifier Printed Wiring Assembly. The output from the emitter load is coupled to the third receive mixer in the IF Amplifier Printed Wiring Assembly and the output from the collector load is coupled to the Phase Detector Printed Wiring Assembly.

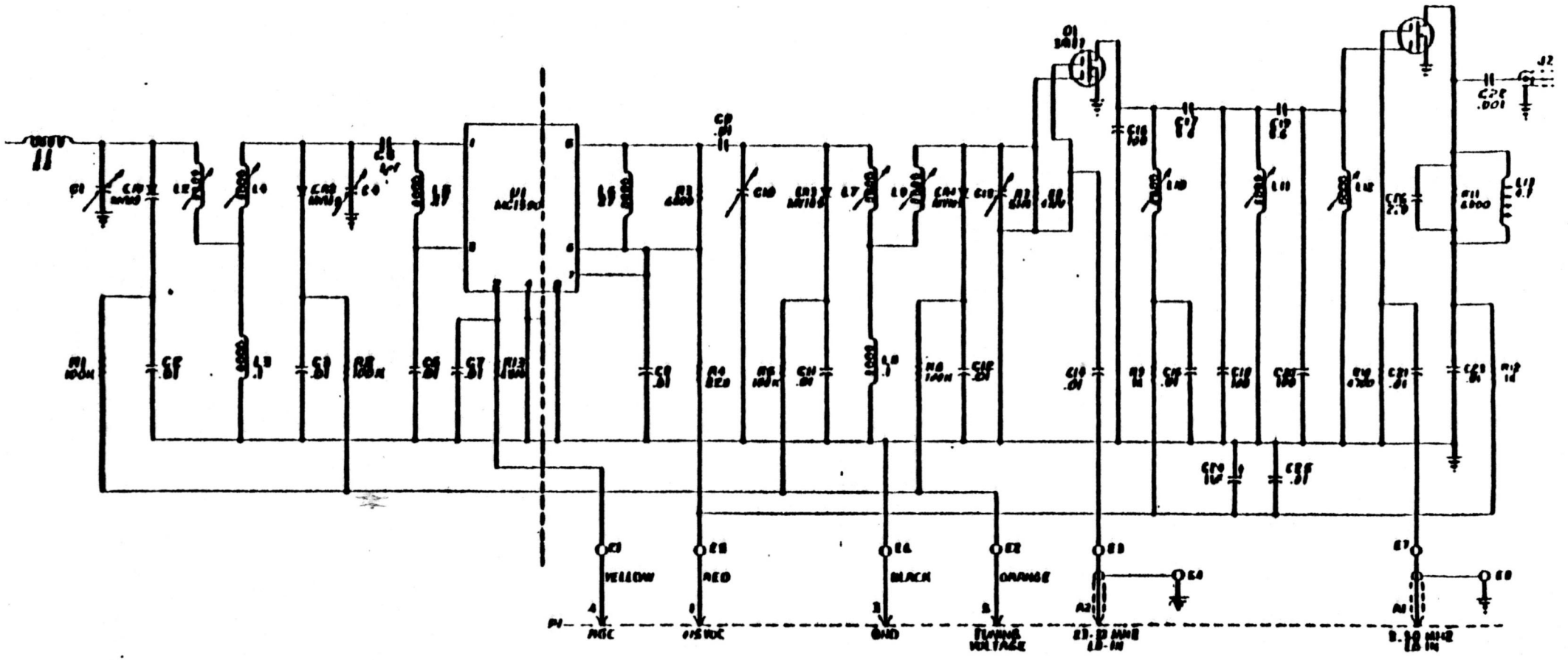


Figure 3-19. IF Amplifier Printed Wiring Assembly Schematic

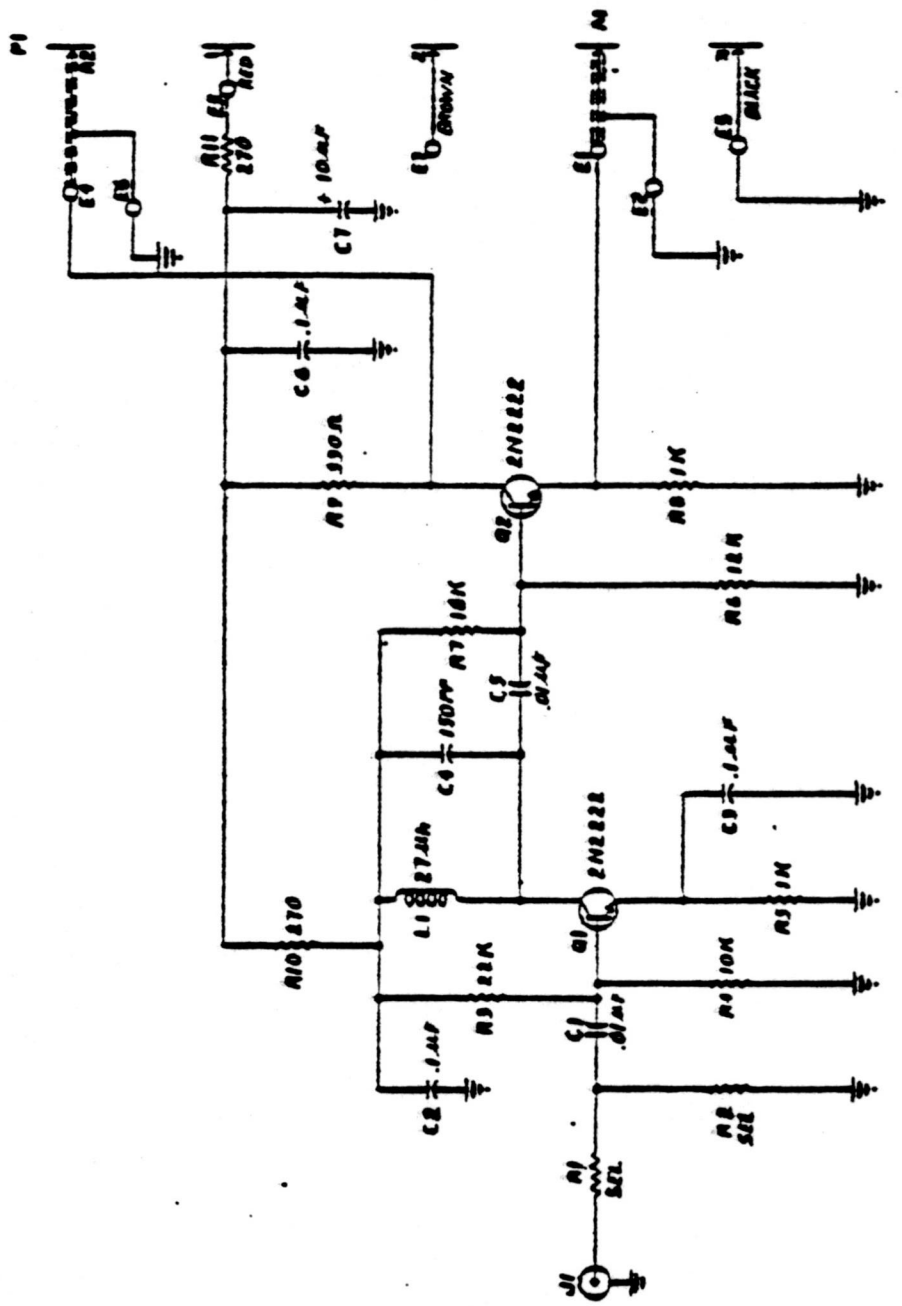


Figure 3-20. Buffer Amplifier Printed Wiring Assembly Schematic

3-65. VCO PRINTED WIRING ASSEMBLY. The VCO (Voltage Controlled Oscillator), Printed Wiring Assembly, shown in figure 3-21, together with the Divider and Phase Detector Printed Wiring Assemblies form a digital frequency synthesizer. The VCO Printed Wiring Assembly contains two separate oscillators; one for transmit and one for receive.

3-66. Transistors Q1, Q2 are their associated components form the receive oscillator. Q2 operates as a common gate amplifier and supplies the gain necessary to sustain oscillation. Q1 operates as a source-follower and provides a high input impedance across the tuned circuit of L1, C2, and CR1.

3-67. The transmit oscillator, consisting of Q3, Q4, and Q5 and associated circuitry is similar to the receive oscillator except that a buffer amplifier, Q5, is included.

3-68. DIVIDER PRINTED WIRING ASSEMBLY. The Divider Printed Wiring Assembly, shown in figure 3-22, receives an input frequency from the VCO Printed Wiring Assembly which is divided by a number determined by the Frequency Selector Assembly. When the synthesizer is locked on frequency, the output of the divider will be 25 kHz and the input will be N times 25 kHz.

3-69. The Divider Printed Wiring Assembly can be split into a high-speed divider and a low-speed divider. The high-speed divider consists of integrated circuits U1-U5, and divides by either 4 or 5. It is configured as a pulse-swallowing counter that normally divides the input frequency by four, but on command will divide by five up to 3 times.

3-70. The low-speed divider consists of integrated circuits U6-U10. During transmit, the frequency at TP2 is divided by a number in the range from 200 to 299, which corresponds to a VCO frequency of 20.0 to 29.9 MHz. In receive, the number is in the range from 23.0 to 32.9 MHz. The output of the low-speed divider is a pulse that is coupled to the Phase Detector Printed Wiring Assembly.

3-71. PHASE DETECTOR PRINTED WIRING ASSEMBLY. The Phase Detector Printed Wiring Assembly, shown in figure 3-23, compares an input frequency from the Divider Printed Wiring Assembly with the crystal-controlled reference frequency from the Buffer Amplifier Printed Wiring Assembly and produces a DC output voltage that is proportional to the phase difference between the two inputs.

3-72. The reference frequency from the Buffer Amplifier Printed Wiring Assembly is a 2.5 MHz sine wave that is coupled to integrated circuit U1, which converts it to a square wave. The 2.5 MHz square wave is coupled to integrated circuit U2 which contains a circuit which divides 2.5 MHz by 100 to produce a stable 25 KHz signal which is one of the inputs to the phase detector. The other input to the Phase Detector Printed Wiring Assembly comes from the Divider Printed Wiring Assembly through Q1, which amplifies the signal for the phase detector.

3-73. The output of the phase detector is coupled to integrated circuit U3, which is configured as a low-pass filter to make a smooth DC voltage. When the Radio Set is transmitting in FM, the audio signal to be transmitted is added to the phase detector output voltage at the low-pass filter.

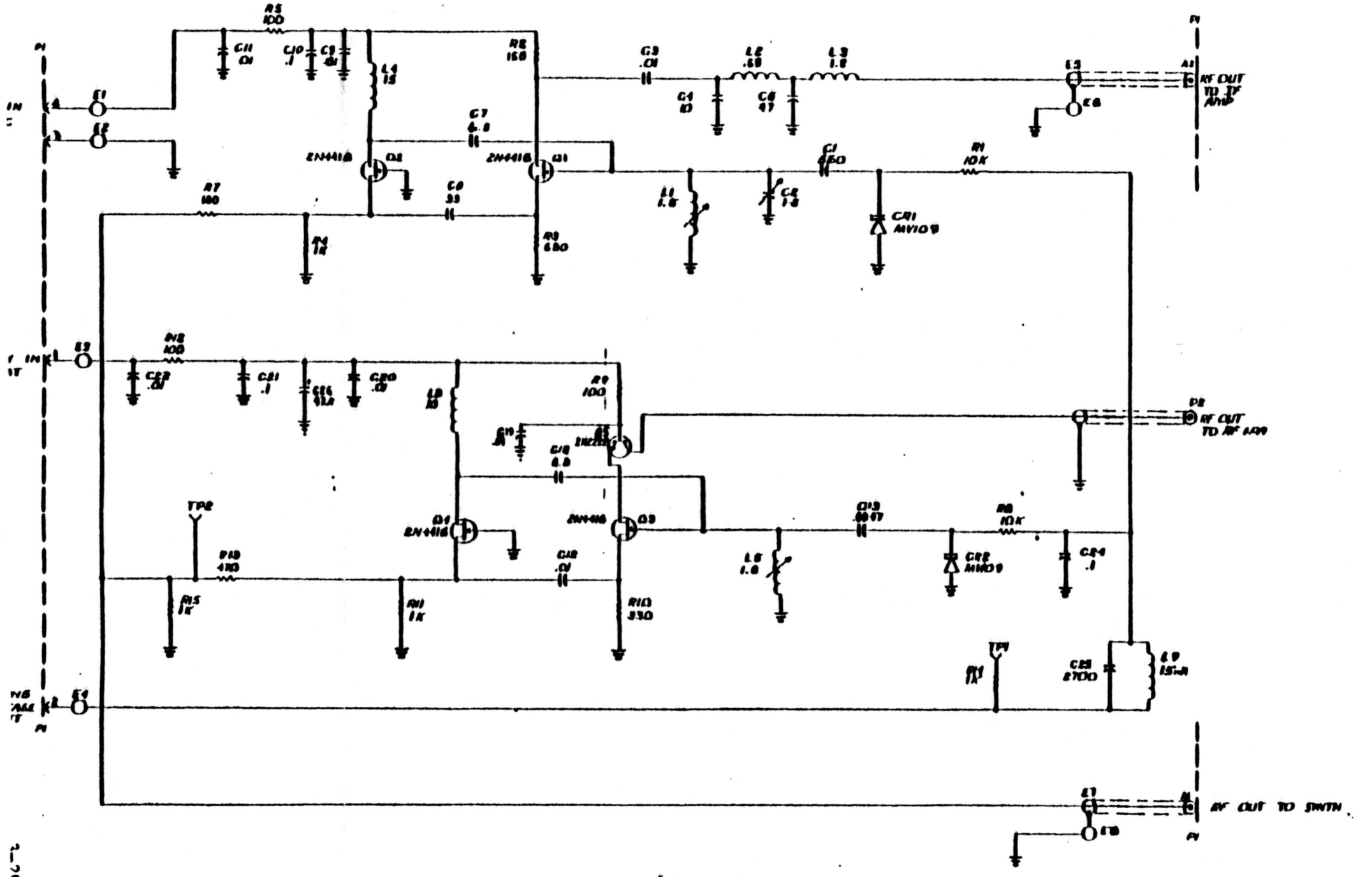


Figure 3-21. VCO Printed Wiring Assembly Schematic

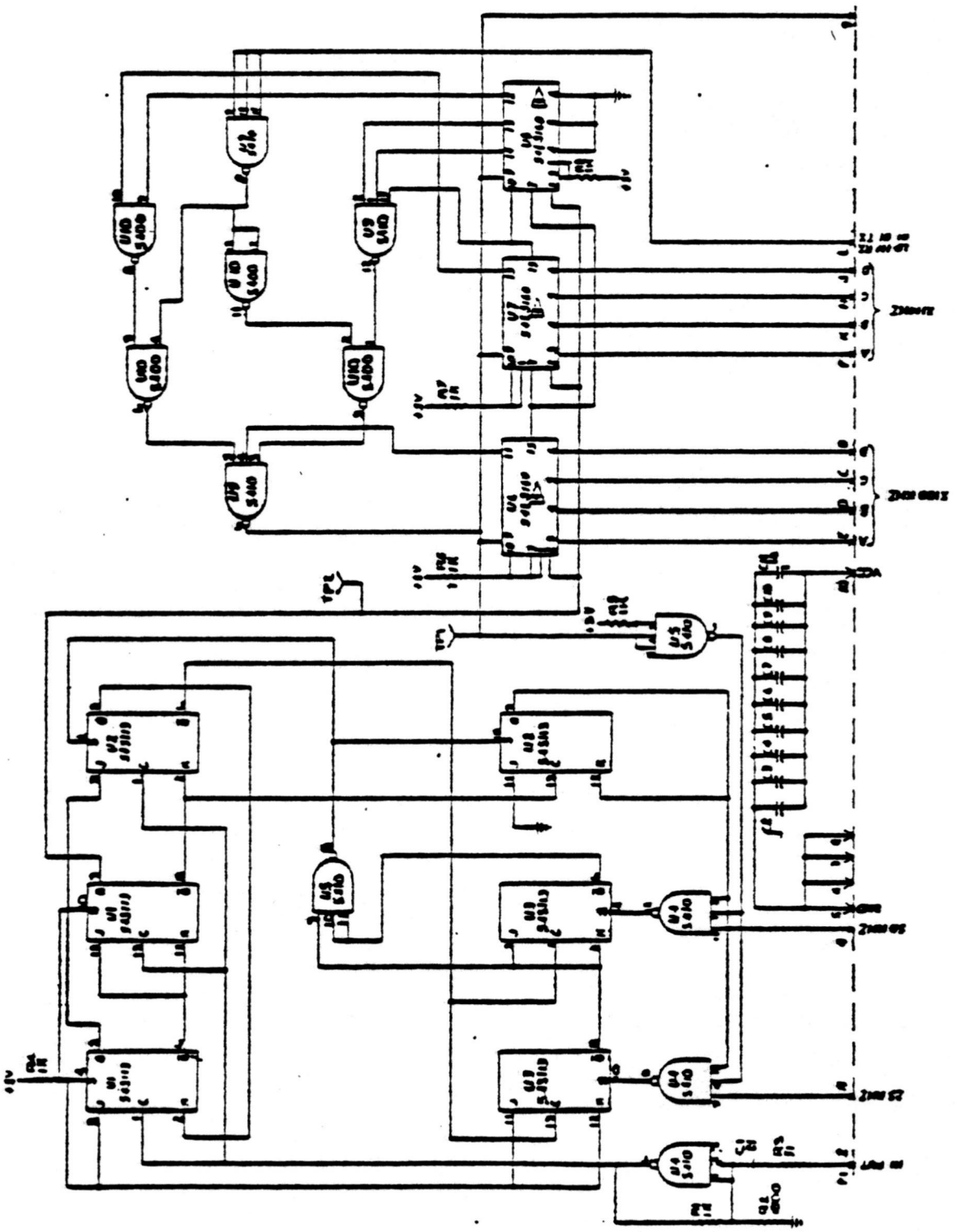


Figure 3-22. Divider Printed Wiring Assembly Schematic

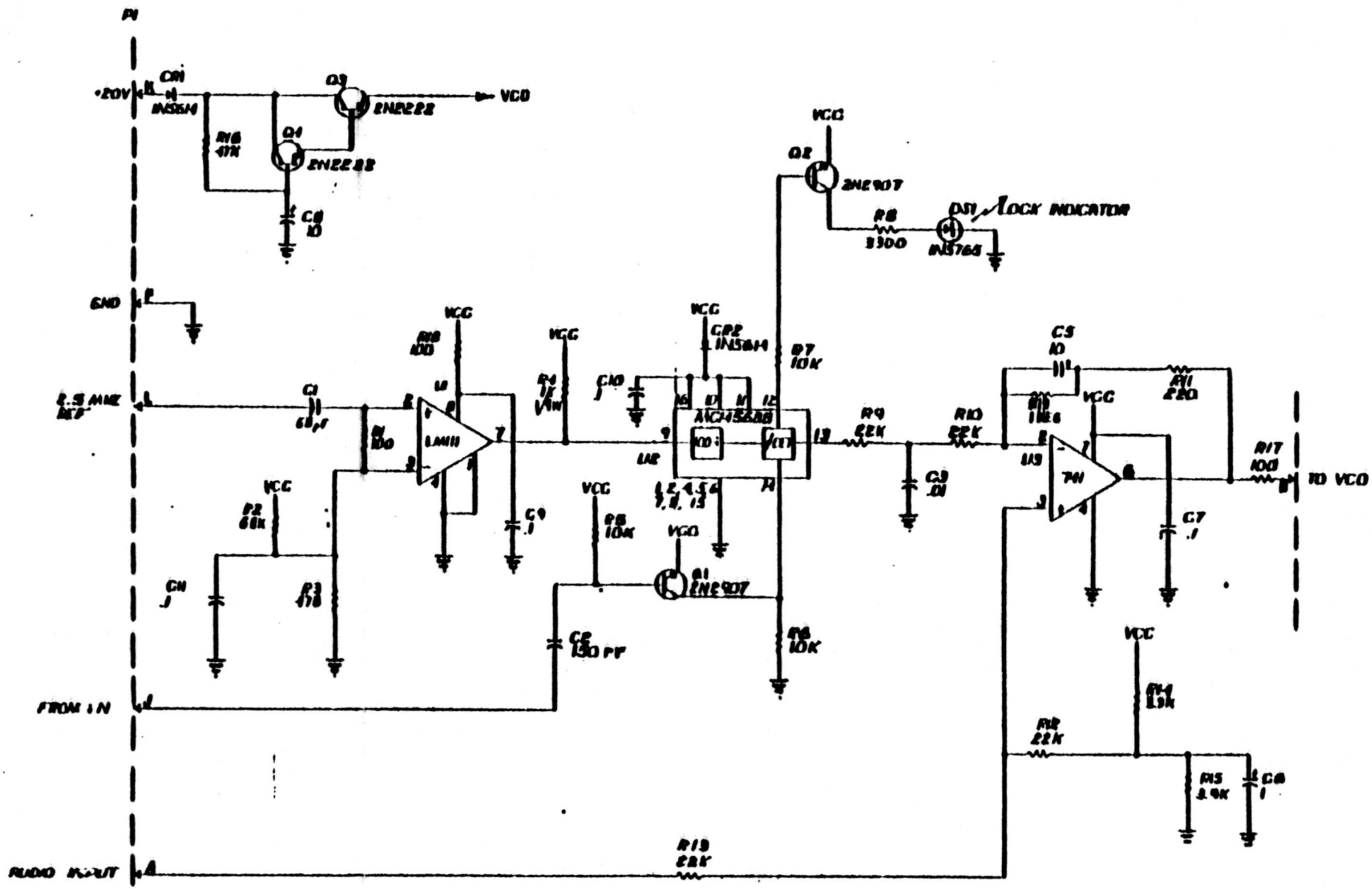


Figure 3-23. Phase Detector Printed Wiring Assembly Schematic

3-74. The phase detector also has a lock-indicator lamp that lights when the two signals don't have the same frequency. A two-stage electronic filter, Q3, Q4, is used to smooth the DC supply voltage to the Phase Detector Printed Wiring Assembly.

3-75. AUDIO PROCESSOR PRINTED WIRING ASSEMBLY. The Audio Processor Printed Wiring Assembly, shown in figure 3-24, performs three functions. During transmit, it routes the audio signals to either the AM or FM modulation circuits, it adjusts the level of the audio signal to keep the amount of FM modulation constant at all frequencies, and it contains the driver for the S METER function of the front panel meter of the Radio Set.

3-76. During AM transmit, audio signals are coupled through integrated circuit U2 to the am modulator. During FM transmit, audio signals are coupled to a variable attenuator consisting of U1, Q1, and associated circuitry. The DC output voltage from the Phase Detector Printed Wiring Assembly is used to control the amount of attenuation of the audio signal before it is coupled to the FM modulator.

3-77. Integrated circuit U3 monitors the IF AGC voltage and produces a signal that drives S METER function of the front panel meter of the Radio Set.

3-78. IF AMPLIFIER AND DEMODULATOR ASSEMBLY.

3-79. The IF Amplifier and Demodulator Assembly, shown in figure 3-25, contains two printed wiring assemblies. One contains the IF amplifiers, AM and FM detector, and RF AGC detector. The other contains IF AGC amplifier, squelch amplifier, audio amplifiers and the broadband and normal audio switching circuitry. All of the circuits in this assembly function only in receive.

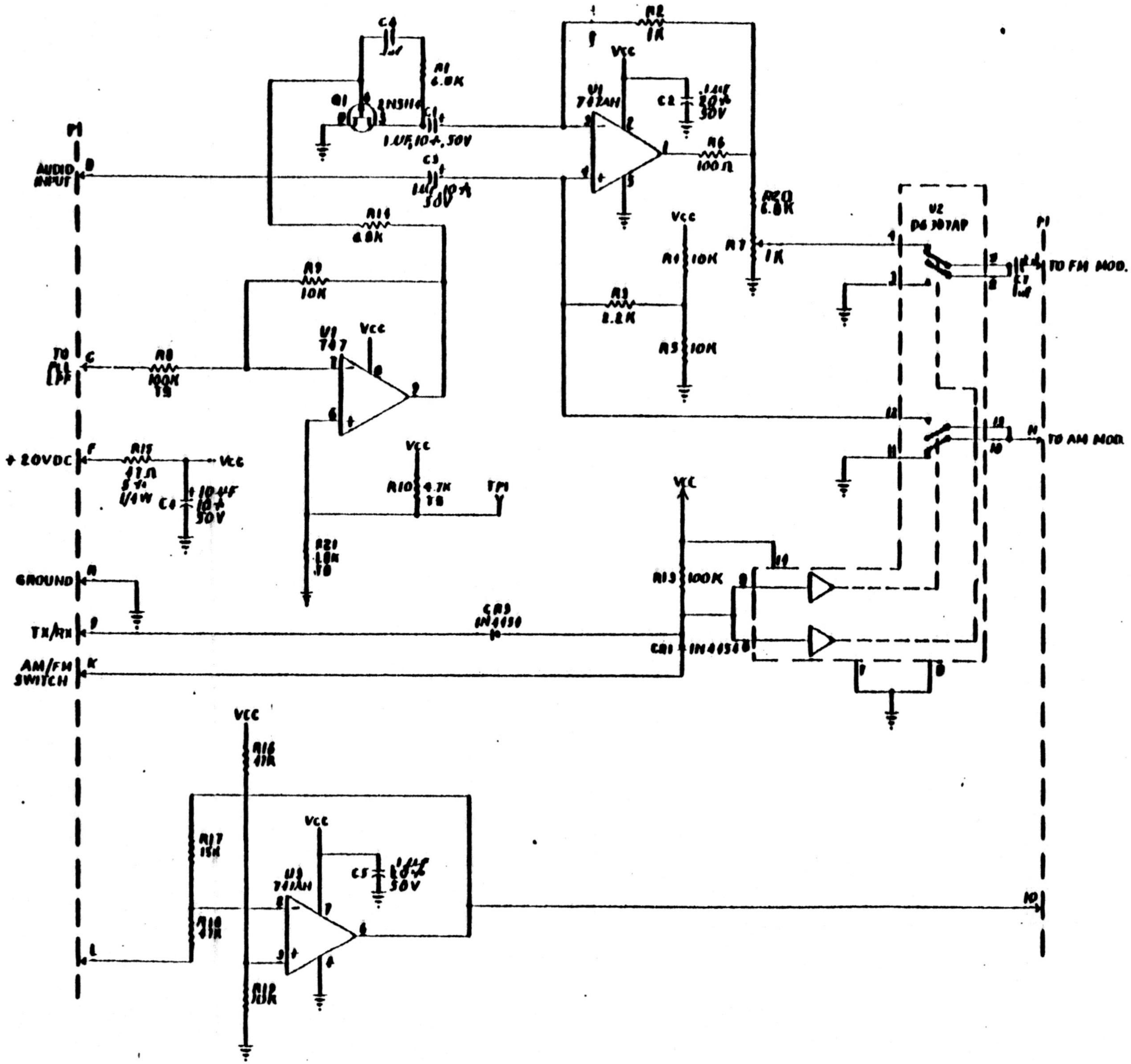
3-80. RF PRINTED WIRING ASSEMBLY. The RF Printed Wiring Assembly, shown in figure 3-26, contains all of the circuits of the IF Amplifier and Demodulator Assembly except those associated with audio processing.

3-81. In the IF amplifier circuit, the 500 kHz signal passes through the 500 kHz IF filter assembly to the gate of source follower transistor Q1. There the 500 kHz signal splits and is fed to two integrated circuit amplifiers U2 and U3 via coupling capacitors C11 and C18 respectively. U2 is an additional gain stage for the AM detector and U3 is the limiter stage for the FM detector circuit.

3-82. In the AM detector circuit, Q2 serves as the AM detector. It receives the amplified 500 kHz from U2 via C35. Capacitors C16 and C17 and choke L5 filter the RF component from the detected signal.

3-83. In the FM detector circuits, U4 is an integrated circuit phase locked loop (PLL) used as an FM demodulator. Pin 6 receives the limited 500 kHz signal from U3 via C22. C26 across pins 2 and 3 is the PLL's VCO frequency determining capacitor. Fine tuning of the oscillator is accomplished by adjusting R19. Terminal E1 is provided for ease in monitoring the VCO frequency during adjustment or trouble-shooting. R19 adjusts the VCO to 500 kHz.

3-84. Capacitors C23 and C24 are the PLL's low pass filter roll-off frequency determining components. Capacitor C27 is the de-emphasis component. The recovered audio output is available at Pin 9. C28 is a DC blocking capacitor. L7 and C37 form a series resonant notch filter for eliminating any 500 kHz signal on the output.


P1
AUDIO INPUT
TO PLL LPF
+ 20VDC
GROUND
TX/RX
AM/FM SWITCH
TO FM MOD.
TO AM MOD.
U2 DG307AP
VCC
R15 47Ω 1/4W
C6 10 UF 50V
R1 10K
R2 1K
R3 8.2K
R5 10K
R6 100Ω
R7 1K
R8 100K
R9 10K
R10 4.7K
R13 100K
R14 6.8K
R16 47K
R17 15K
R18 47K
R20 6.8K
TP1
U1 747
U3 741AH
C3
C4
C5
C7
CR1 1N4150
CR3 1N4150
Q1 2N5116
1 UF, 10%, 50V

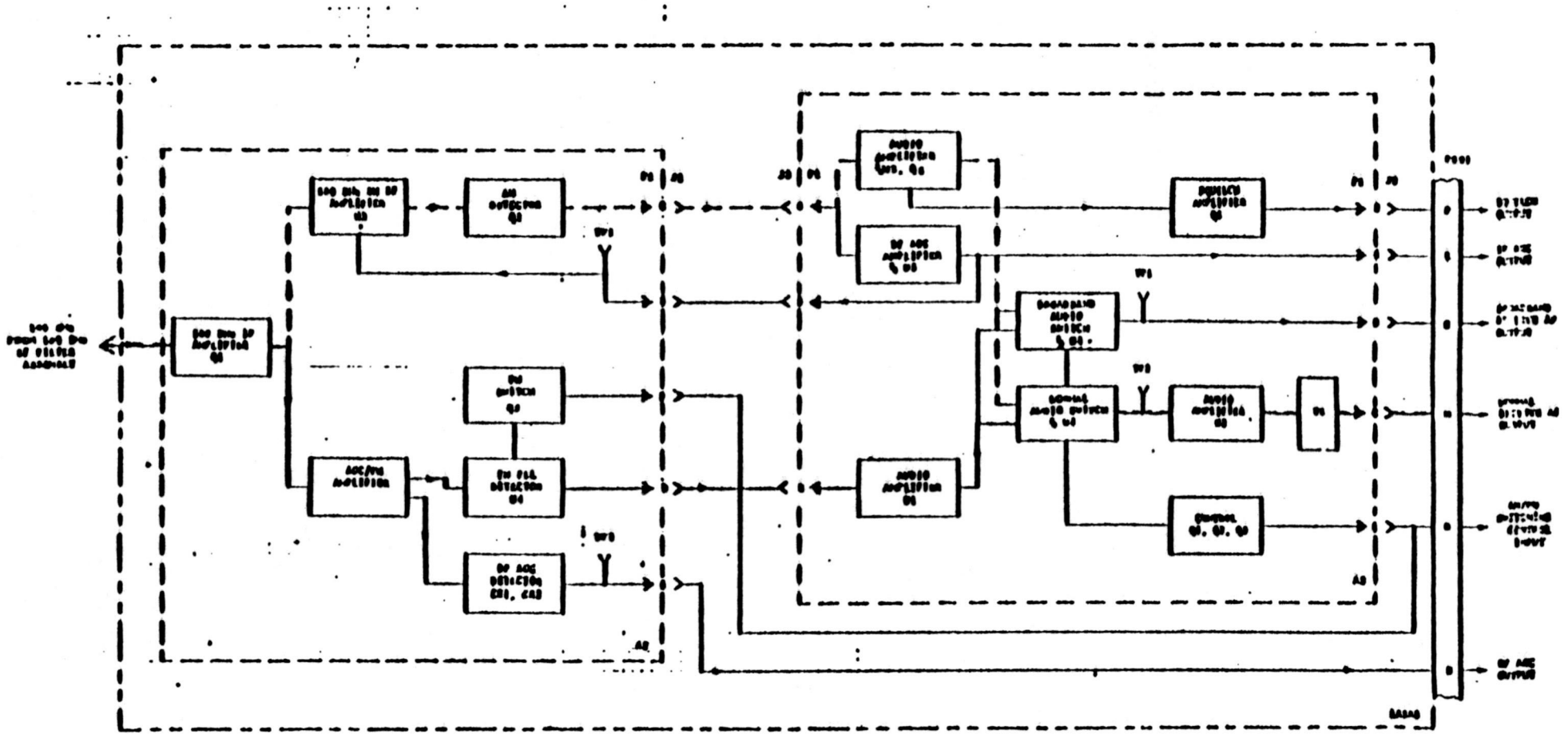


Figure 3-25. IF Amplifier and Demodulator Assembly Block Diagram

3-85. Q3 is used to switch on supply voltage to the U4 PLL in the FM mode.

3-86. The RF AGC circuit is used to derive the RF AGC by sampling the output of the AM 500 kHz IF amplifier. Capacitor C30 couples the signal to the half wave voltage doubler rectifiers CR1 and CR2. The circuit developes a negative voltage which is filtered by C31, R26 and C36. TP2 is provided as a test point for monitoring the DC level.

3-87. The IF AGC circuit is used to derive the IF AGC from the output of the AM detector Q2. Components R33 and C15 filter the audio signal out leaving a low level DC. This level is amplified by half of U3 for distribution to the if amplifier stages.

3-88. AUDIO PRINTED WIRING ASSEMBLY. The Audio Printed Wiring Assembly, shown in figure 3-27, has two types of audio outputs available, normal and broadband. These outputs are available simultaneously with either the AM or FM mode.

3-89. The recovered AM audio enters the Audio Printed Wiring Assembly on pin 6, and is amplified by transistor Q4. At this point, the broadband AM audio is tapped off and fed to switch U4 while the normal audio is fed to a clipper. The clipper, comprised of R24 thru R27, CR2, C13 and C14, eliminates any high level high frequency noise spikes that may occur on the recovered audio signal. This signal is filtered by Q6 and its associated components and routed to AM/FM switch U4.

3-90. The recovered FM audio enters the Audio Printed Wiring Assembly on Pin 2, and is fed directly into amplifier U1. Here the audio is amplified and fed to two quarters of the AM/FM switch, U4.

3-91. A MOS quad switch U4 is used to route the AM and FM normal and broadband signals to their respective outputs. The am broadband signal enters U4 at pin 1 and the FM broadband at pin 4. The broadband output is taken at pins 2 and 3 and fed to pin D of the Audio Printed Wiring Assembly via C6 and R16. The AM normal signal enters at pin 11 and the FM audio at pin 8. Normal audio output is taken from pins 9 and 10 and fed to amplifier U2.

3-92. Switching of U4 is accomplished by transistors Q1 and Q2. Q1 provides a HIGH state output to switch the FM signals through U4 with a ground command from the front panel AM/FM switch. Q2 output is LOW with this command thus blocking any AM audio from passing through U4. In the AM mode, Q1 is in the OFF state opening up the FM audio switches. Q2 is also in the OFF state making its output HIGH, turning ON the AM switches in U4.

3-93. Amplifier U2 amplifies the normal audio signal. The signal is then fed to Pin C of the Audio Printed Wiring Assembly.

3-94. AUDIO AMPLIFIER ASSEMBLY.

3-95. The Audio Amplifier Assembly shown in figure 3-28 consists of three printed wiring assemblies, two used as amplifiers and driver circuits, and one used as a squelch circuit.

3-96. AUDIO AMPLIFIER PRINTED WIRING ASSEMBLIES. Two Audio Amplifier Printed Wiring Assemblies, shown in figure 3-29, are used in the Audio Amplifier Assembly.

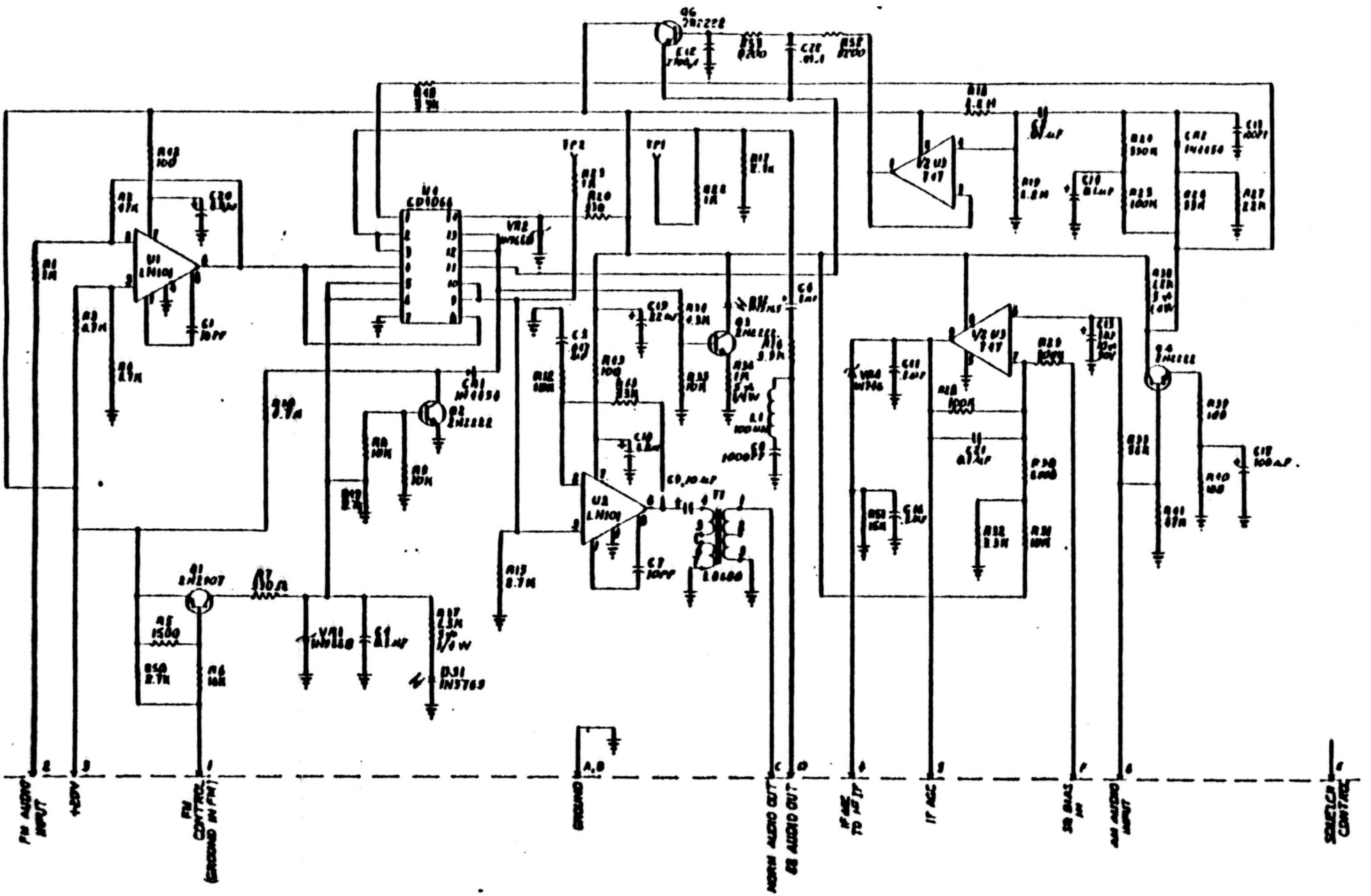


Figure 3-27. Audio Printed Wiring Assembly Schematic

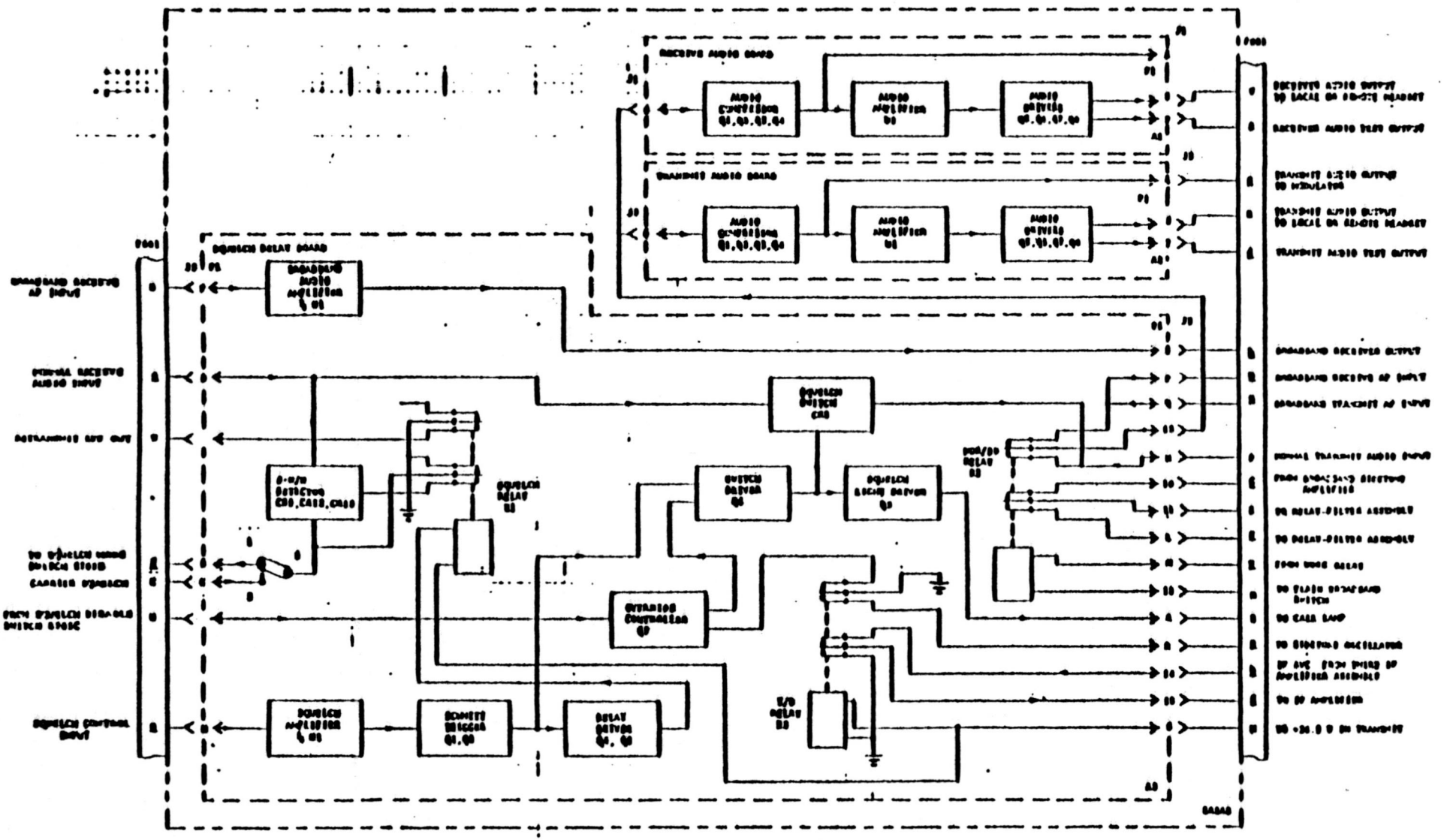


Figure 3-28. Audio Amplifier Assembly Block Diagram

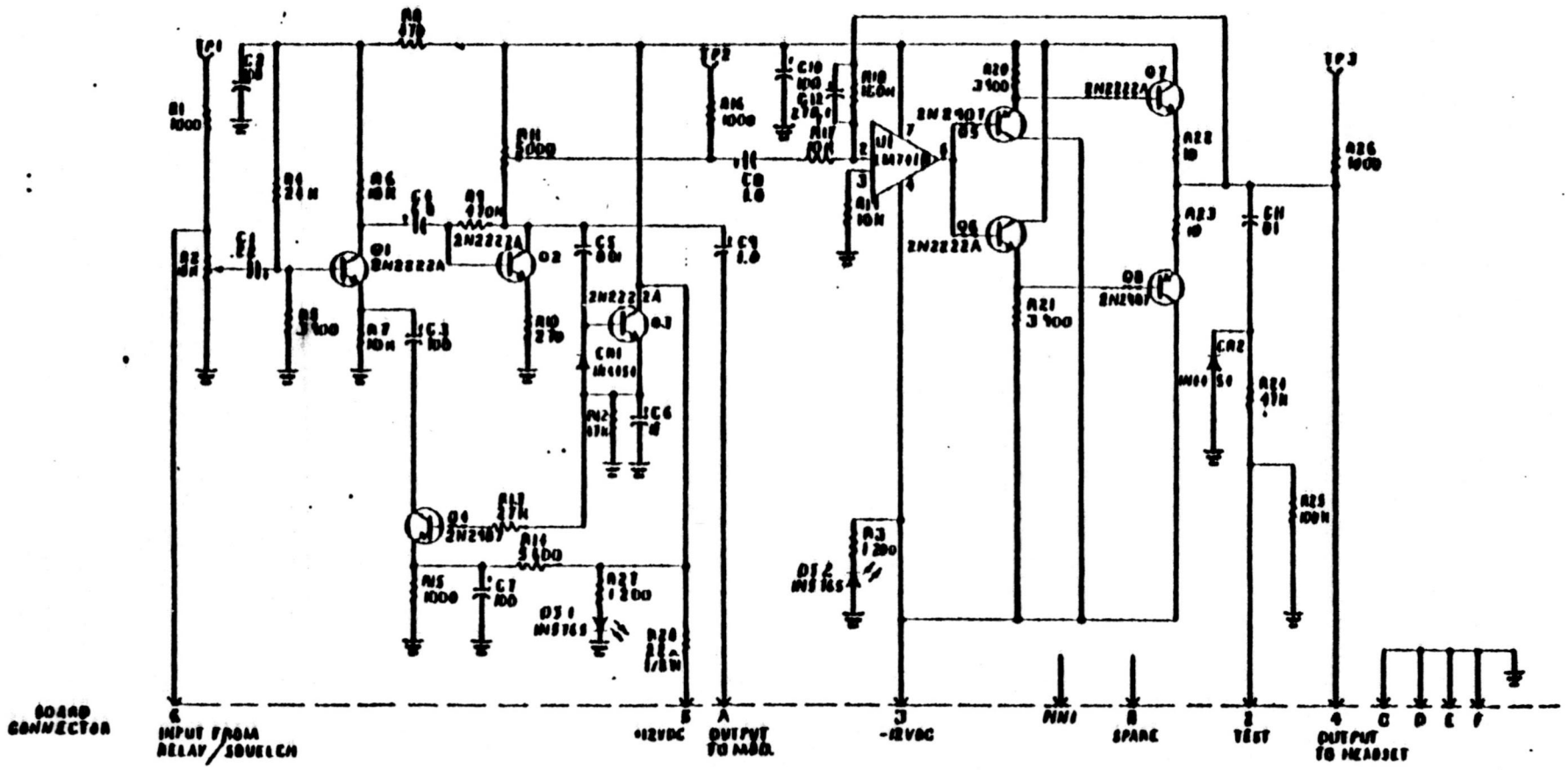


Figure 3-29. Audio Amplifier Printed Wiring Assembly Schematic

3-97. The audio input signal from the IF Amplifier and Demodulator Assembly is applied to the base of audio amplifier Q1. The path of the input signal is as follows: through pin A plug P801, pin D of J3, resistor R29, capacitor C8, diode CR5 (this diode is forward baised when a signal is received), capacitor C10, diode CR6 (this diode is forward biased in the receiver mode of operation), capacitor C14, contacts 3 and 2 of broadband relay K2 (closed on PLAIN operation), pin 13 of J3, Pin 6 of J1, and to input level control resistor R2. A portion of the voltage developed across control R2 is coupled to the base of transistor Q1 through capacitor C1. TP1 is a test point for measuring the audio input to the amplifier compressor circuit.

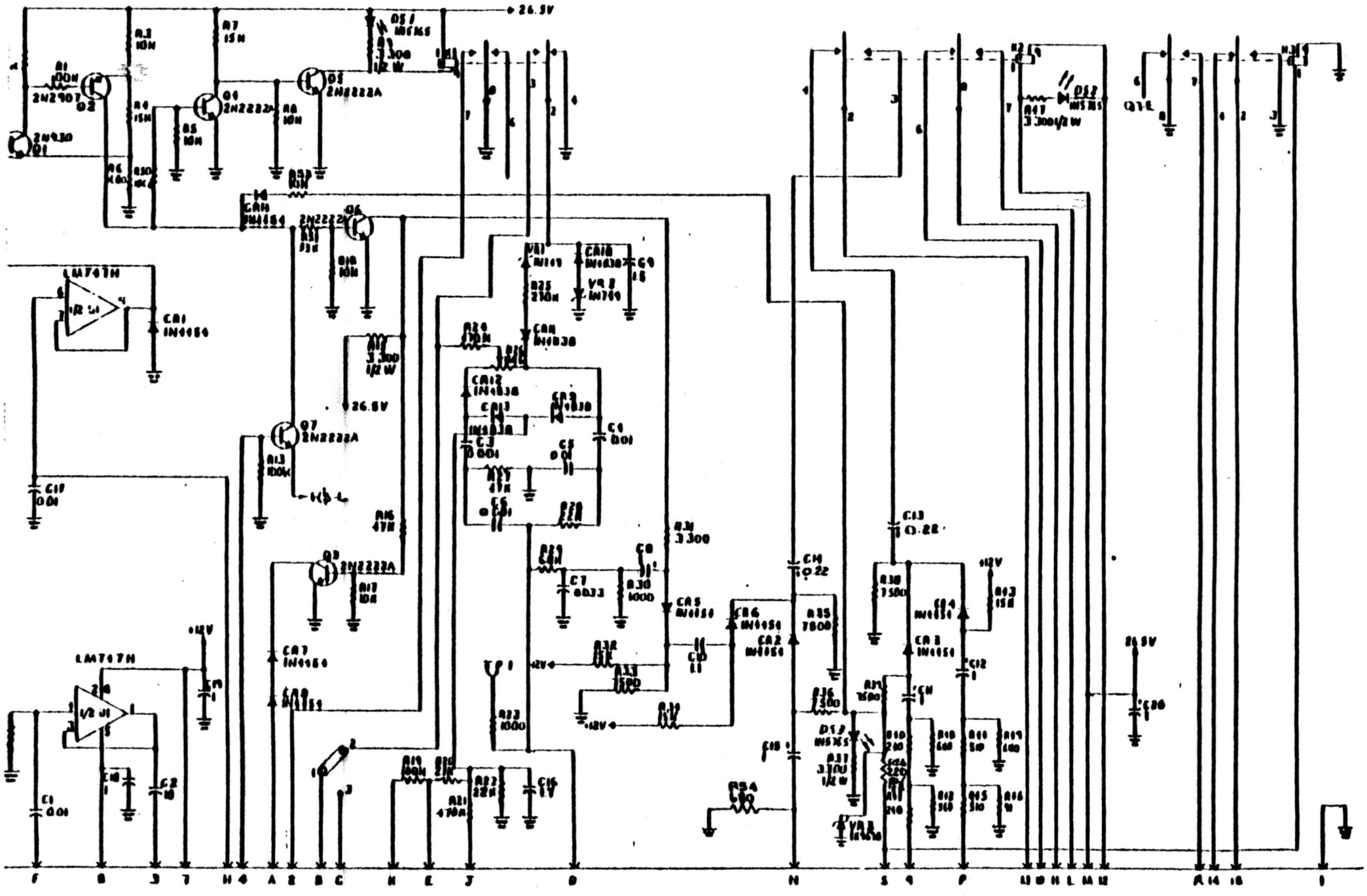
3-98. Transistor Q1 is a variable gain audio amplifier. The gain of this stage is varied by changing the impedance of the emitter resistance. The variable element in the emitter circuit is transistor Q4 and its associated circuitry. When no audio signal is received or the signal is below the compression threshold Q4 will be saturated to provide the lowest emitter impedance for transistor Q1. If the input signal is above the compression threshold transistor Q3 and its associated circuitry will detect the amplified audio signal. The detected voltage will start turning off transistor Q4, which will increase the emitter impedance of Q1 and reduce the gain of this stage.

3-99. The output of transistor Q1 is developed across resistor R6 and is coupled to the base of amplifier Q2 via capacitor C4. The output of the compressor amplifier is developed across the control R11 and coupled to the driver amplifier U1 via capacitor C8 and resistor R17. Control R11 is used to set the headset output to a nominal level of +10 dbm. Test point TP2 is used to measure the audio output of the compressor amplifier when troubleshooting.

3-100. Operational amplifier U1 amplifies the signal from the compression amplifier by about 10. This output is direct coupled to a set of complementary output pairs, composed of transistors Q5 through Q8 and their associated circuitry. The complementary output pairs provide the drive necessary to provide nominal output of +10 dbm into the headset impedance. The test point TP3 provides access to the output of the headset amplifier for test or troubleshooting.

3-101. The normal receive local and remote audio output is coupled from the complementary output pair amplifier to pin 4 of J1, pin V of P801, to contacts 9 and 10 of T/R relay K602 in the Realy-Filter Assembly. From pin 10 of K602 the remote audio is coupled directly to the remote audio output jack; the local audio is passed through a parallel combination of resistor R3 and VOLUME control R717 and through resistor R705 to local HEADSET jack J702B and audio output jacks J703 and J704 of the Front Panel Assembly. In addition to the audio output from the headset amplifier a test voltage is provided for the front panel meter M701. The path of this test voltage is from the complementary output pair amplifier to C11, across diode CR2 where the audio signal is detected, resistor R24 and across resistor R25. The voltage developed across R25 is connected to the meter on the front panel of the Radio Set by the path of connector J1 pin 2, pins of P801.

3-102. RELAY/SQUELCH PRINTED WIRING ASSEMBLY. The Relay Squelch Printed Wiring Assembly, shown in figure 3-30, de-energizes the audio stages when no signal is received or when the input signal falls below the threshold level of the squelch circuit. The SQUELCH control on the Front Panel Assembly enables the squelch circuit and controls the gain of the receiver by applying a negative bias voltage to the IF AGC line. Thus, the setting of the SQUELCH control determines what input-signal amplitude will deactivate the squelch circuit.



3-103. As shown in figure 3-31, the squelch DC amplifiers receive their control voltage in one of two ways, depending on the type of squelch connection and the mode of operation. In the NOR (normal) and TONE settings of MODE switch S702B, and with the link connection between 1 and 2 (S+N/N squelch) as shown in the figure, control voltage is supplied to the voltage follower U1, pin 6 from S+N/N discriminator control R26, through R24, link connections 1 and 2, J3 pin B, f of P801, pin K of P701 and contacts 1 or 3 of MODE switch S702B, contact 4 of switch S702B, pin W of P701, pin e of P801, and pin H of J3. In the RETRANS (retransmit) mode, the input to the voltage follower U1 is connected to the carrier squelch/RF AGC line through resistor R1, connector P501 pin P, pin BB of connector P701, contact 2 of MODE switch S702B; contact 4 of switch S702B, pin W of P701, pin e of P801, and pin H of J3. (Resistor R1 and connector P501 are located on the IF Amplifier and Demodulator Assembly. Connector P701 and switch S702 are located on the Front Panel Assembly). When the link connection is made between 1 and 3 (carrier squelch), the input to the voltage follower U1 is connected to the carrier squelch/RF AGC line, regardless of the setting of MODE switch S702B.

3-104. Voltage follower U1 provides a high input impedance for the squelch control voltage. The output of the voltage follower is connected to the base of Q1. Transistors Q1 and Q2 and their circuits comprise a schmitt trigger. The hysteresis for the circuit is controlled by the voltage divider R3, R4, and R6.

3-105. When no signal is being received, a positive bias is applied to the input of voltage follower U1. This bias is the result of the delay bias on the detector load (provided by R19, R20 and R22), or the reference bias on the sensing circuit (depending upon which squelch circuit, carrier or S+N/N, is being used). The voltage follower U1 output provides a positive bias that turns on the two transistors Q1 and Q2 of the schmitt trigger. The output of the Schmitt trigger (Q2-C) provides a control signal to the Relay Driver Q4 and Q5 and to the Switch Driver Q6. Transistor Q4 will be on. Transistor Q5 cannot conduct because of no base bias with transistor Q4 saturated. Squelch relay K1 is de-energized. Switch Driver Q6 will be saturated and audio line from the IF Amplifier and Demodulator Assembly is open because the Squelch Switch CR5 is back biased.

3-106. When a signal is received, the negative voltage developed by the carrier across RF AGC detector load (carrier squelch), or the negative voltage developed in the sensing circuit (S+N/N squelch), will turn off the Schmitt Trigger Q1 and Q2. With the Schmitt Trigger off transistor Q4 will be off which will turn on the relay driver Q5. The collector current of Q5 will activate Squelch relay K1. At the same time that transistor Q4 is off transistor Q6 will be off with the collector voltage of Q6 high. Squelch light driver Q3 will turn on to light the Call Light DS703 and squelch switch CR5 will be forward biased, thereby closing the audio line from audio amplifier U2 to audio compressor amplifier Q1.

3-107. The SQUELCH control (R702, on the Front Panel Assembly) is normally adjusted for threshold at the frequency of minimum received signal strength. Weak signals or noise may cause the squelch switching circuits to operate intermittently. This intermittant operation will be indicated by CALL LIGHT DS703 which will flicker on and off. To determine whether noise or signals are causing the lamp to flicker, depress SQUELCH DISABLE PUSH switch S704 on the front panel. This switch provides a bias voltage for override control Q7 from the 26.5 V dimmed voltage. The override control Q7 will operate the squelch circuits, thereby operating squelch switch CR5. The audio output from the headset permits indentification of the input signal.

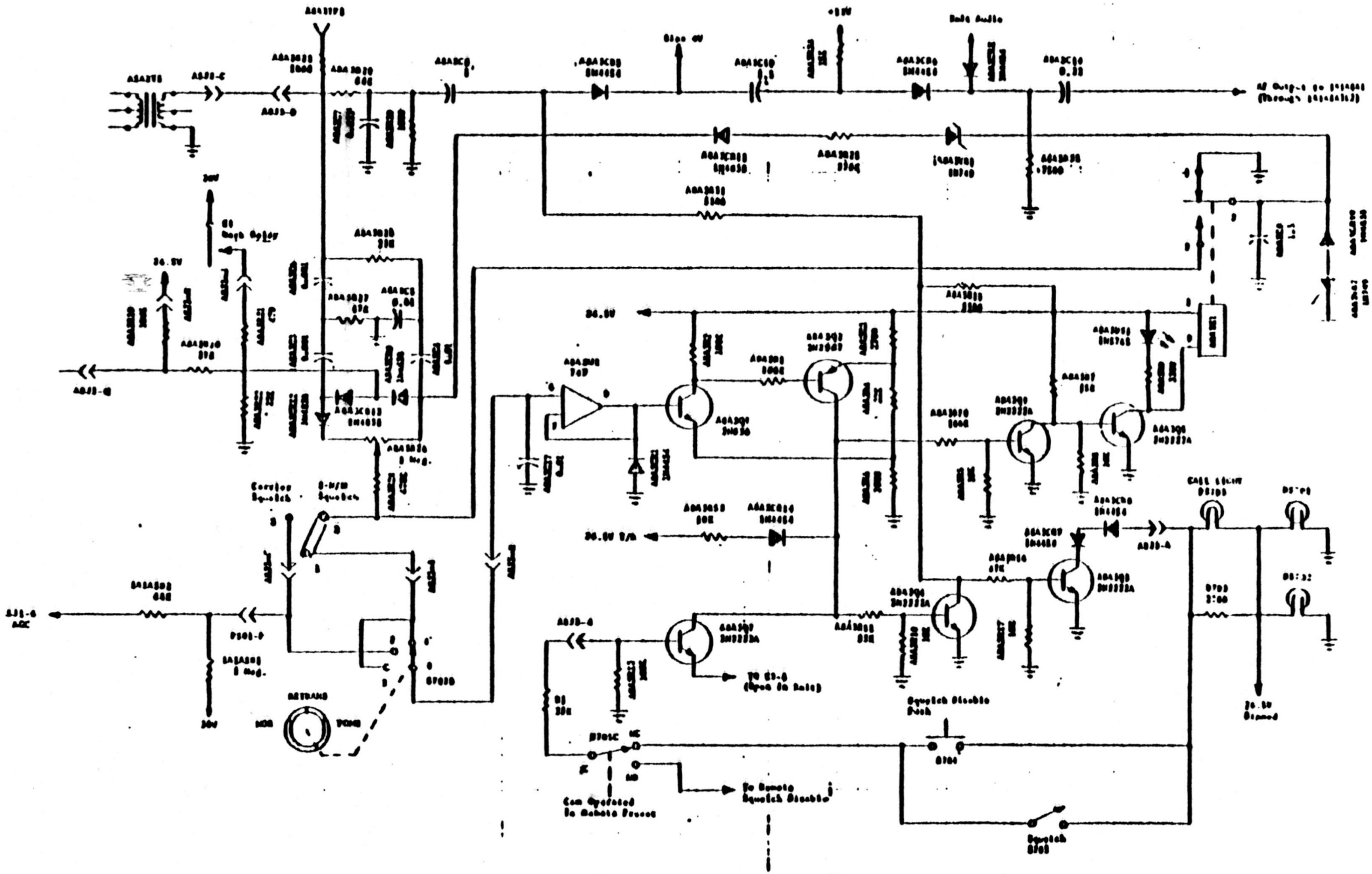


Figure 3-31. Simplified Squelch and Signal-Plus-Noise to Noise

3-108. When the equipment is operated from a remote station, switch S705C transfers control of the squelch operation to a remote control unit.

3-109. In the signal-plus-noise to noise squelch discriminator circuit, the signal-plus-noise/noise (S+N/N) squelch is put into operation automatically in the NOR (normal) and TONE modes when pin 6 of U1 is connected to the wiper arm of potentiometer R26. The voltage divider consisting of resistor R22 and R20 provides a positive bias of approximately 3 volts DC on receive, which is applied to the junction of diode rectifiers CR9 and CR13. The low-pass filter consisting of resistor R28 and capacitor C5 passes the audio signal to DC blocking capacitor C4, which couples the audio signal to CR9. Diode rectifier CR9 rectifies the signal and develops a negative voltage at the right-hand end of R26. The high-pass filter consisting of capacitor C6 and resistor R27 passes the high-frequency noise to diode rectifier CR13. Diode rectifier CR13 rectifies the noise and develops a positive voltage at the left-hand end of R26. Thus, the voltage distribution across R26 is dependent upon the ratio of the amplitude of the audio signal to the amplitude of the noise (signal-plus noise/noise ratio).

3-110. The signal-plus-noise/noise ratio that will cut off the Schmitt trigger and open the squelch is determined by the setting of potentiometer R26. When squelch relay K1 is energized, contacts 3 and 2 connect C9 across the output of the signal-plus-noise/noise sensing circuit through R24. The switching of C9 provides a fast attack and slow release in the squelch operation. When C9 is not in the squelch circuit (when squelch relay K1 is de-energized) it is discharged to ground by contacts 2 and 4 of K1. Diode CR11 is a blocking diode used to prevent charge leakage on C9; Zener diode VR1 breaks down at the proper voltage value to charge C9. Diode CR10 prevents the charging voltage from being grounded, and Zener diode VR2 limits the amount of charge on C9.

3-111. When the link connection in the carrier squelch circuit is made between 1 and 3 (carrier squelch), pin 7 of the input to the squelch DC amplifier U1 is connected to the carrier squelch/RF AGC line through resistor R1, regardless of the setting of MODE switch S702B.

3-112. The broadband receive circuit is used in operation with broadband equipment. It is necessary that broadband relay K2 is de-energized and that broadband switches CR3 and CR4 are forward biased. This is done by placing PLAIN-BROADBAND switch S1401, on the rear of Receiver-Transmitter Case CY-2959/URC-9(3)XN2 in the broadband position. This action ungrounds one side (terminal 9) of the solenoid of K2; the other side (terminal 1) of the solenoid is connected to the +26.5 volt supply.

3-113. The input to the broadband voltage follower U1 pin 4 is supplied by the broadband receive signal from pin E of P501, the broadband output of the IF Amplifier and Demodulator Assembly. Capacitor C1 couples the input signal to the input of U1, and capacitor C2 couples the output signal of the voltage follower to the broadband equipment.

3-114. The broadband receive audio input signal from the broadband equipment is applied to the input of the audio amplifier U1. The path of the input signal is as follows: through pin m of P501, pin P of J3, resistor R45 and R44 capacitor C12, broadband T/R switch CR4, capacitor C13, contacts 4 and 2 (normally closed in broadband) of broadband relay 2, pin 13 of J3, pin 6 of J1 and resistor R2. The amplification of the broadband receive audio through the audio amplifier and driver circuits is the same as described for the normal audio.

3-115. POWER SUPPLY PP-2702/URC-9(B)XN2

3-116. The Power Supply, shown in figure 3-32, operates from either 115 VAC or 230 VAC to provide separate outputs of +26.5 volts DC, +20 volts DC, ± 12 volts DC and 3 to 26 volts DC variable. AC power is supplied to transformers T1 and T2 from the line input. T1 steps down the line input voltage for the 26.5V Supply Assemply and T2 steps down the line voltage for use in the Multiple Voltage Supply Assembly.

3-117. 26.5 V SUPPLY ASSEMBLY. The 26.5 V Supply Assembly, shown in figure 3-33, is a high current, high efficiency solid state switching type with LC filtering. The high efficiency is a result of operating the series pass regulating transistor in a switching mode of full ON then full OFF mode.

3-118. The pulses which drive the power switch transistor are derived from an oscillator, ramp generator, voltage comparator, and driver circuits. The oscillator determines the rate of switching, while the ramp generator and voltage comparator establish the duty cycle and drive wave form.

3-119. Compensation for changes in input voltage and output loading is accomplished by varying the duty cycle of the power switch. A change in the error control signal level to the voltage comparator shifts the duty cycle of its output pulses which drive the power switch. This error control signal is derived by the error amplifier which compares the regulator output voltage to a reference voltage.

3-120. Filtering the pulsed DC output of the power switch is accomplished by two low pass passive filters. A clamping diode provides a path for current to flow during the OFF cycles of the power switch.

3-121. CONVERTER PRINTED WIRING ASSEMBLY. The Converter Printed Wiring Assembly, shown in figure 3-34, is a switching regulator. Transistor Q1 which is driven by transistor Q2 is used as a power switch capable of supplying up to 15 amps of continuous current.

3-122. CONTROL PRINTED WIRING ASSEMBLY. The Control Printed Wiring Assembly, shown in figure 3-34, contains power switch pulse generation and driving circuitry. U1 is a multivibrator oscillator. Resistor R3 and capacitor C2 establish its operating frequency at 70 KHz (nominal).

3-123. The oscillator's output signal is fed via C3 to a ramp generator where the signal is changed into a sawtooth by the charging and discharging of capacitor C4. On a command pulse from the oscillator transistor Q2 rapidly discharges C4. Between command pulses C4 is recharged linearly by the constant current source of transistor Q2 and its associated circuitry. The sawtooth is routed via R9 resistor into the non-inverting INPUT port of voltage comparator U3 where the signal is converted to square wave pulses through the schmitt trigger action of the comparator. Transistors Q3 and Q4 amplify the pulses to provide adequate drive to the power switch.

3-124. Amplifier U2 provides the error control signal to the trigger threshold level inverting input port of the voltage comparator. The regulator output sampling is obtained via R24 and R26 resistive voltage divider and R17, while the reference voltage input is derived by the zener diode VR2. L1, C4, L2 and C2 components filter the pulsed DC output of the power switch. These components along with the clamping diode CR3 provide a pure DC output of 26.5 volts.

3-125. If the regulator's output rises above the desired level, a change in the duty cycle of the power switch is required. The ON time must shorten in relation to the normal operation on time.

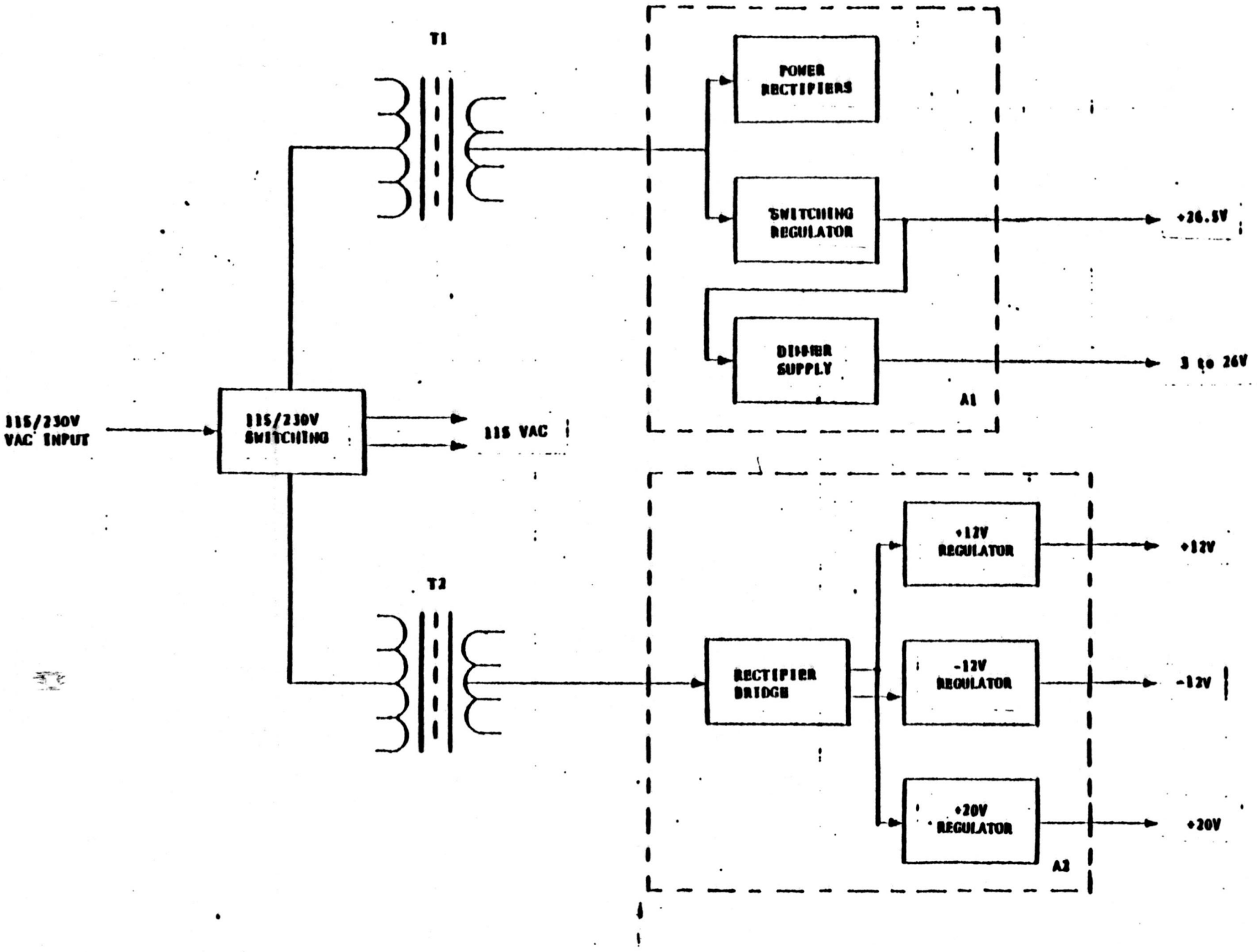


Figure 3-32. Power Supply Block Diagram

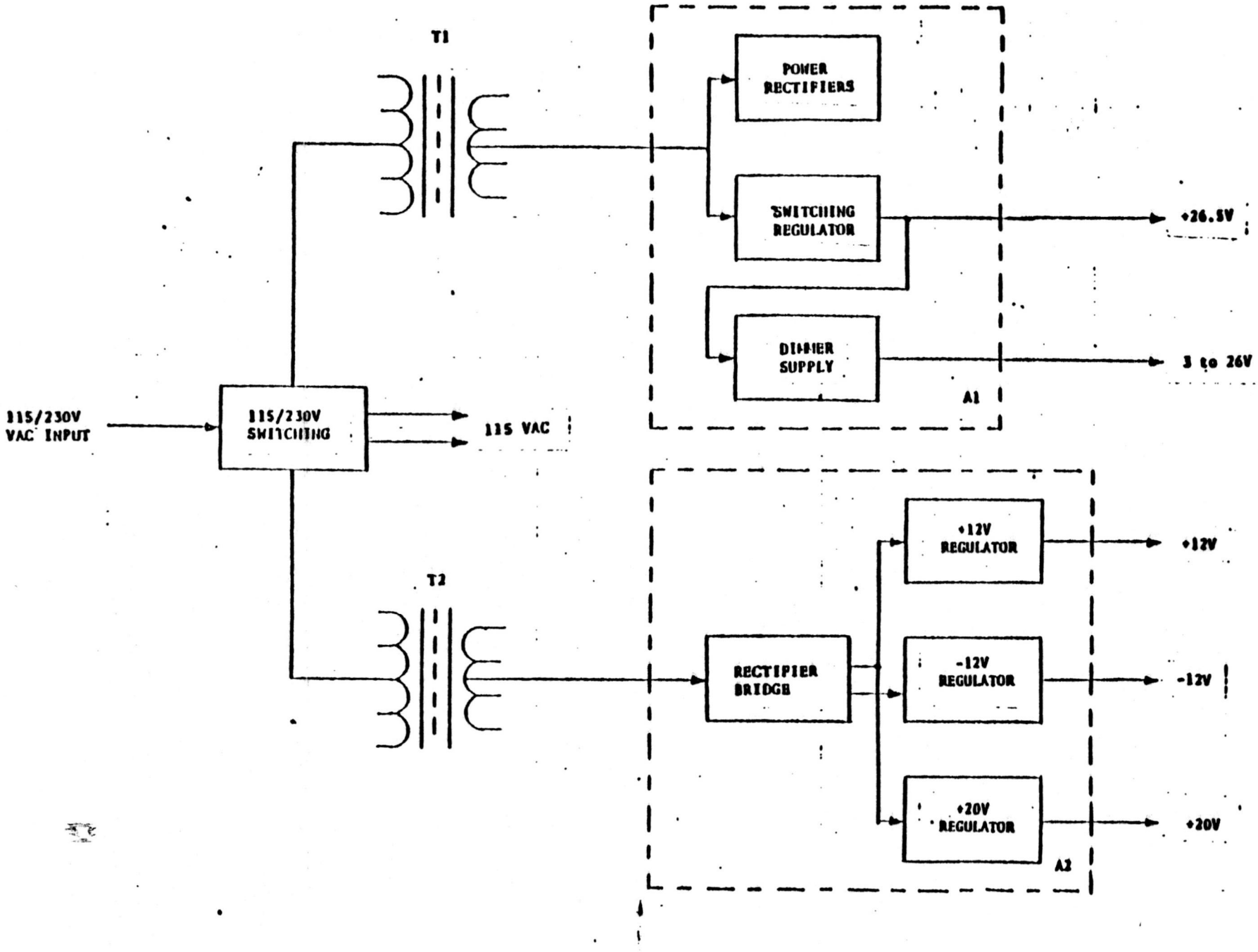


Figure 3-32. Power Supply Block Diagram

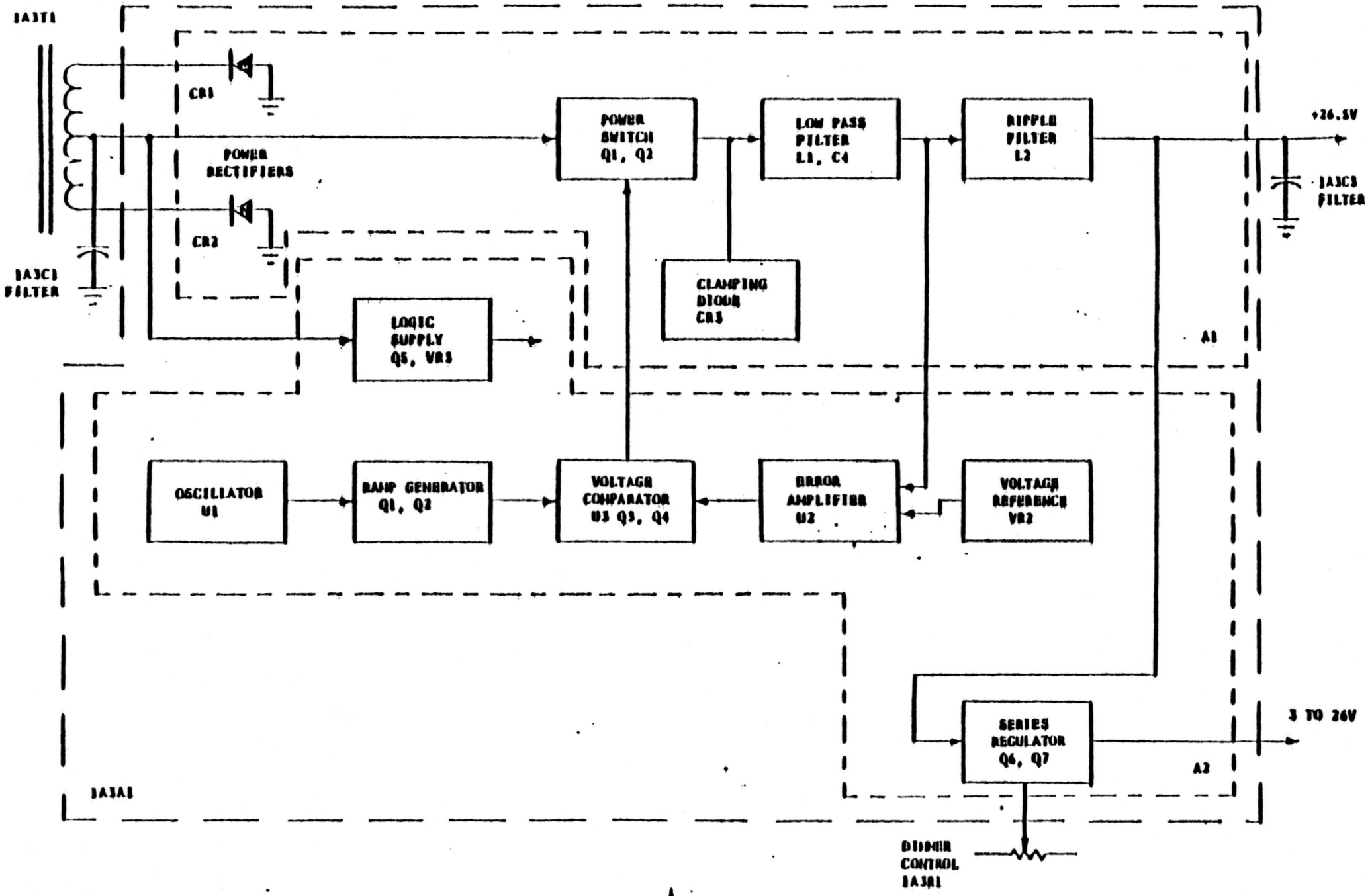


Figure 3-33. 26.5V Supply Assembly Block Diagram

3-126. As shown in figure 3-35, the high output voltage is inverted to a drop in output voltage of the error control signal by the error amplifier. This lower level to the comparator means a longer high level output pulse of the circuit. Transistors Q3 and Q4 invert the pulses twice, making Q4's collector voltage high longer for a pulse cycle. A high voltage appearing here turns OFF the driver transistor Q2. With the driver transistor OFF, the power switch transistor is OFF. Therefore, the longer high pulse cycles of Q4 mean a shorter ON time or power switch operating duty cycle.

3-127. When the output of the regulator falls below the desired level, the opposite happens and the duty cycle of the power switch must be lengthened. Error amplifier voltage comparator and driver circuits respond with inverted levels with respect to a higher voltage output.

3-128. The dimmer circuit is located on the Control Printed Wiring Assembly. Transistors Q6 and Q7 are used as a series regulator whose reference control is the variable resistor Dimmer control on the front panel of the Power Supply. Varying the resistor typically varies the output voltage of the regulator from 3 to 26 volts.

3-129. MULTIPLE VOLTAGE SUPPLY ASSEMBLY. The Multiple Voltage Supply Assembly, shown in figure 3-36, contains three separate circuits for delivering +12V, -12V and +20V. Each circuit consists of a series control pass transistor circuit and a voltage adjustable integrated circuit type regulator. These regulators each have a self contained voltage reference, error amplifier and low current pass transistor circuits, and are operated in the linear mode. They also contain a current limit circuit which is externally programmed.

3-130. ±12 V SUPPLY PRINTED WIRING ASSEMBLY. The ± 12 Supply Printed Wiring Assembly, shown in figure 3-37, holds the bridge rectifiers and the ± 12 volt and -12 volt DC regulators. CR1 through CR4 rectify the AC from T2 for use by the multiple supplies. Q1 is the +12 volt supply series pass transistor which is driven by U1 voltage regulator. R8 resistor sets the current limit at approximately 1 ampere. Q2 is the -12 volt supply series pass transistor, with Q3 as a driver. U2 is the voltage regulator for this supply. R9 sets the current limit for the -12 volts at 1 ampere.

3-131. 20 V SUPPLY PRINTED WIRING ASSEMBLY. The 20 V Supply Printed Wiring Assembly, shown in figure 3-38, contains the +20 volt regulator. Q1 is the series pass transistor, with U1 as the voltage regulator. R1 sets the current limit again at 1 ampere.

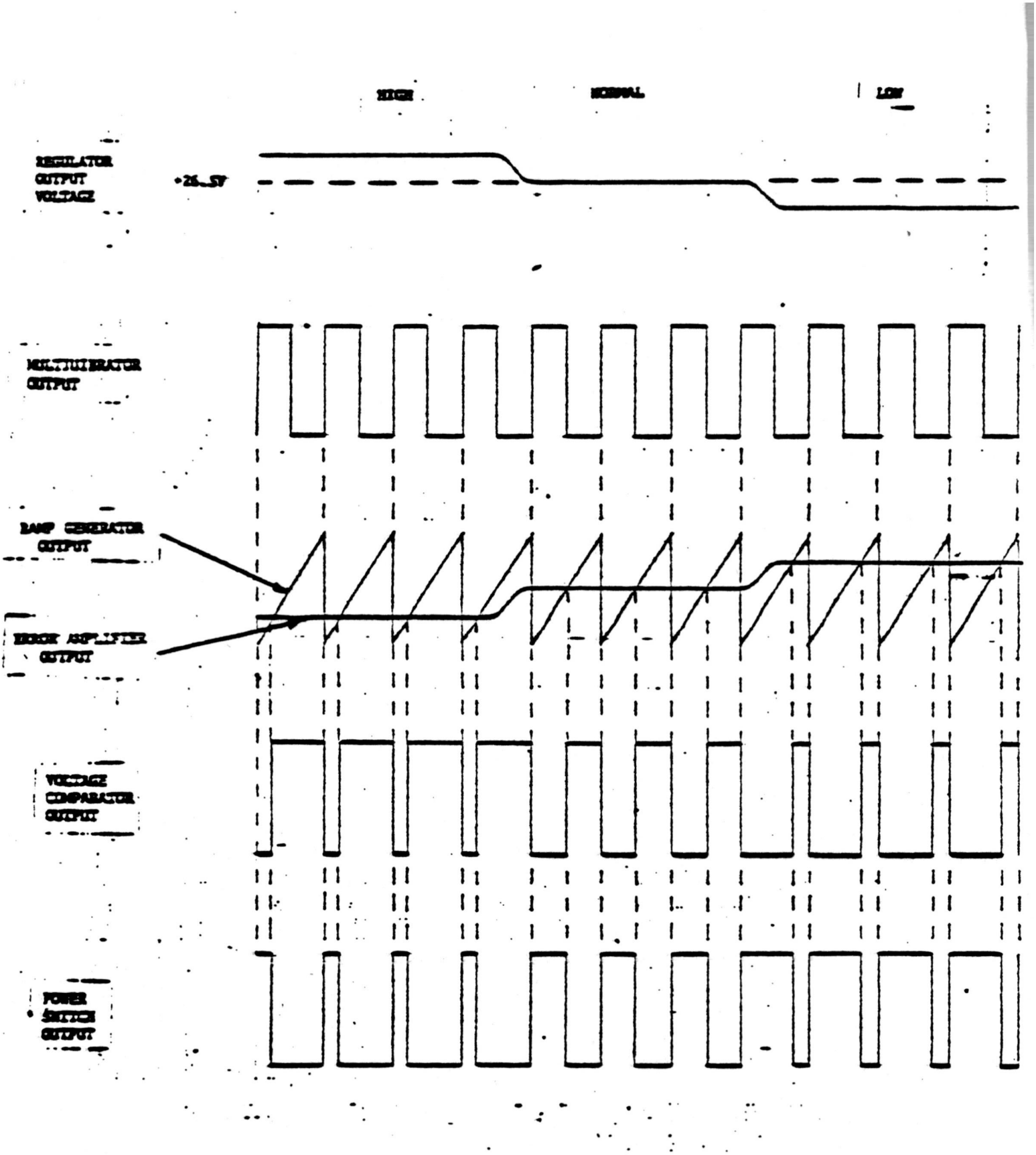


Figure 3-35. Voltage Regulator Signals

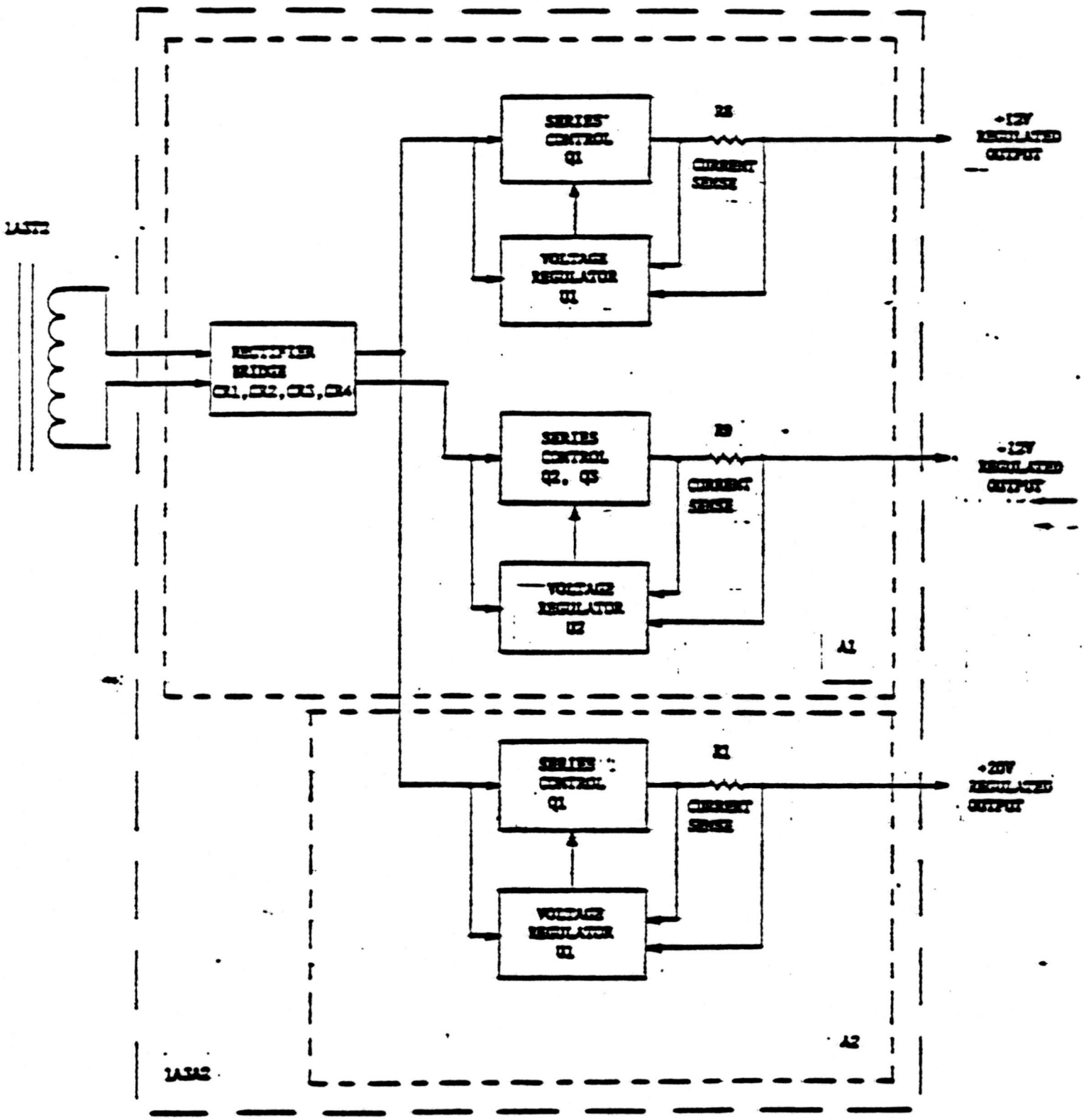


Figure 3-36. Multiple Voltage Supply Assembly

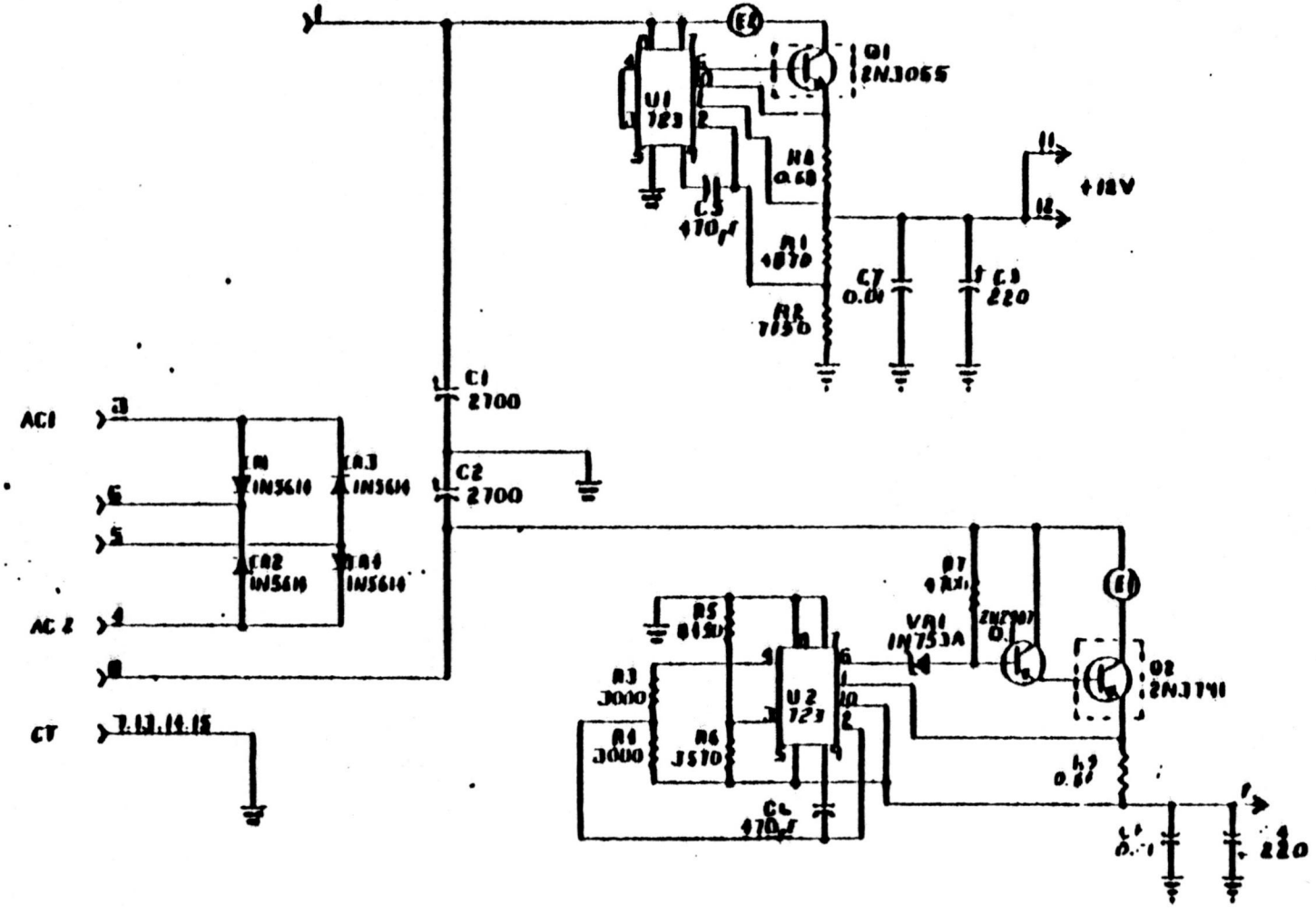


Figure 3-37. ±12V Supply Printed Wiring Assembly

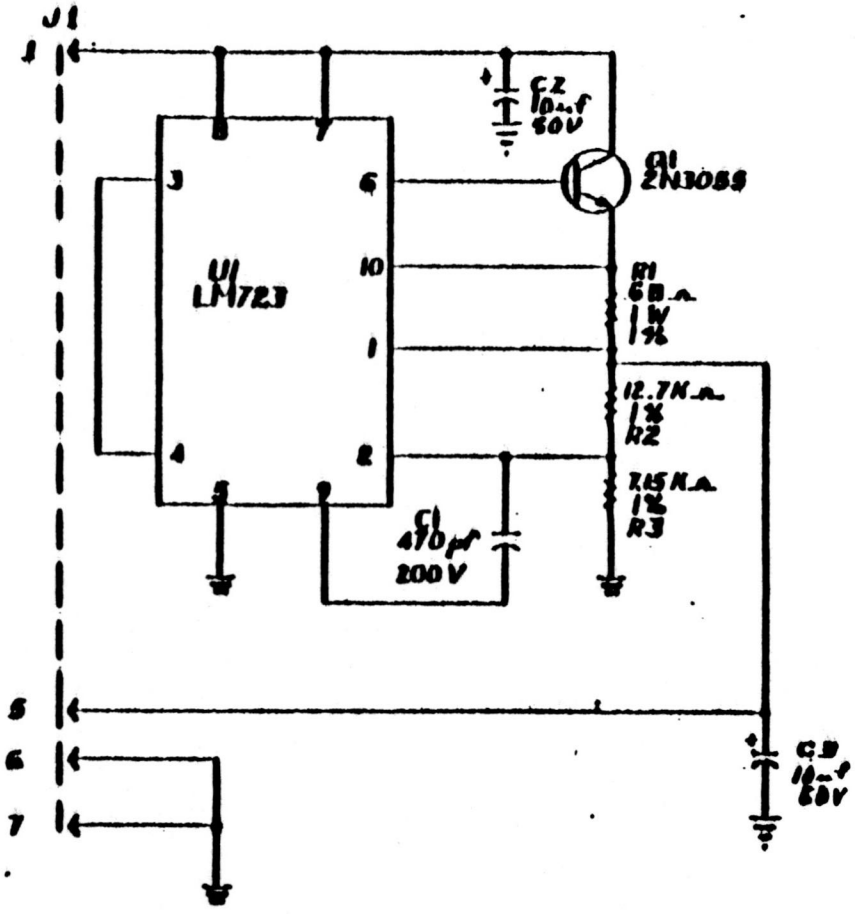


Figure 3-38. 20V Supply Printed Wiring Assembly

SECTION 4

PARTS LIST

4-1. INTRODUCTION.

4-2. This section provides reference data on the units, assemblies, subassemblies and parts of Radio Set AN/URC-9(B)XN2. The data is primarily in tabular form and is intended to supplement the trouble shooting, maintenance and repair information presented in other sections of the manual.

4-3. LIST OF UNITS.

4-4. Table 4-1 lists the equipment units of Radio Set AN/URC-9(B)XN2 in numerical order by unit number. Table 4-1 provides the following information of each unit: quantity per equipment, official name, designation, colloquial name, and location of the first page of its maintenance parts listing in table 4-2.

4-5. MAINTENANCE PARTS LIST.

4-6. Table 4-2 lists the parts required to support the maintenance function of Radio Set AN/URC-9(B)XN2 arranged in the same unit numerical order as table 4-1. The maintenance parts for each unit are arranged in alpha-numeric sequence by class of part following the unit's designation. Thus, the maintenance parts listed in the table are grouped by units. Table 4-2 provides the following information: complete reference designation of each unit, assembly, subassembly or part; noun name and brief description; and identification of the illustration which pictorially locates the part. Unless otherwise indicated, all drawing numbers given in the descriptions of the parts apply to the equipment manufacturer, and all type numbers apply to the part manufacturer. Refer to table 4-4 for a listing of the part manufacturers.

4-7. REPAIR AND REPLACEMENT DATA.

4-8. Table 4-3 presents unit or assembly repair data and part replacement data to aid in the maintenance support function of Radio Set AN/URC-9(B) XN2 following the unit numerical order of table 4-1 for those units presented. Table 4-3 provides the following information: unit or assembly repairable on-board or not on-board, location of spare unit or assembly, parts replaceable on-board, and location of the first page of the unit or assembly maintenance part listing in table 4-2.

TABLE 4-1. EQUIPMENT UNITS OF RADIO SET AN/URC-9(B)XN2

UNIT NO.	QTY	NAME OF UNIT	DESIGNATION	COLLOQUIAL NAME
1A1	1	Receiver-Transmitter	RT-581/ URC-9(B)XN2	RT Unit
1A1A1	1	RF Exciter Assembly	-	RF Module
1A1A2	1	UHF Frequency Synthesizer Assembly	-	FMD Module
1A1A3	1	IF Amplifier and Synthesizer Assembly	-	1st and 2nd IF Module
1A1A5	1	IF Amplifier and Demodulator Assembly	-	3rd IF Module
1A1A6	1	Relay-Filter Assembly	-	Relay Filter Module
1A1A7	1	Front Panel Assembly	-	Front Panel
1A1A8	1	Audio Amplifier Assembly	-	Audio Amplifier Module
1A1A9	1	Low Pass-Band Pass Filter Assembly	-	LP-BP Filter Module
1A1A11	1	Main Frame Assembly	-	Main Frame
1A1A12	1	Frequency Selector Assembly	-	Frequency Selector
1A1A13	1	Directional Coupler Assembly		Directional Coupler
1A1A16	1	Broadband Sidetone Amplifier Assembly	-	Broadband Module
1A2	1	Receiver-Transmitter Case	CY-2959/ URC-9(B)XN2	Case
1A3	1	Power Supply	PP-2702/ URC-9(B)XN2	Power Supply
1A3A1	1	26.5V Supply Assembly	-	26.5V Module
1A3A2	1	Multiple Voltage Supply Assembly	-	12V/20V Module

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2

REF. DES.	NAME AND DESCRIPTION
1A1	Receiver-Transmitter, Radio: RT-581/URC-9(B)XN2; 16 watts power output; 225.00 to 399.975 MHz; 7000 channels; 26.5, 20 and ±12Vdc operating power; 10 in. by 11-3/4 in. by 15-1/2 in. over all dimensions; MFR 26687 part no. JTL 5045-1 or -3.
1A1A1	RF Exciter Assembly: MFR 26687 part no. JTL 4573-1
1A1A1A1	RF Assembly: MFR 26687 part no. JTL 4573-1
1A1A1A1A1	RF Modulator Printed Wiring Assembly: MFR 26687 part no. DTL 4141-1
Q1	Transistor: JANTX2N4416
Q2	Transistor: JANTX2N3251
1A1A1A1Q1	Transistor: JANTX2N5109
1A1A1A1Q2	Transistor: Same as 1A1A1A1Q1
1A1A1A1Q3	Transistor: Same as 1A1A1A1Q1
1A1A1A2	Control Printed Wiring Assembly: MFR 26687 part no. DTL 4524-1
Q1	Transistor: JANTX2N2222
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
Q4	Transistor: Same as Q1
Q5	Transistor: JANTX2N2907
Q6	Transistor: Same as Q1
Q7	Transistor: Same as Q5
Q8	Transistor: Same as Q5
Q9	Transistor: Same as Q5
Q10	Transistor: Same as Q1
U1	Integrated Circuit: M38510/101-02BIX
U2	Integrated Circuit: Same as U1
1A1A1A3	Curveshaper Printed Wiring Assembly: MFR 26687 part no. DTL 4544-1
Q1	Transistor: JANTX2N2907
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
U1	Integrated Circuit: M38510/101-03BGB
U2	Integrated Circuit: M38510/101-01BGB
U3	Integrated Circuit: Same as U2
1A1A1A4	Broadband Amplifier Assembly: MFR 26687 part no. DTL 4560-1
1A1A1A4A1	Broadband Amplifier Printed Wiring Assembly: MFR 26687 part no. DTL 4528-1
Q1	Transistor: JANTX2N5109
Q2	Transistor: Same as Q1

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME AND DESCRIPTION
1A1A1A5	ZV Bias Assembly: MFR 26687 part no. CTL 3907-1
1A1A1A5A1	ZV Bias Printed Wiring Assembly: MFR 26687 part no. DTL 4172-1
Q1	Transistor: JANTXZN2907
Q2	Transistor: JANTXZN2218
U1	Integrated Circuit: M38510/101-02BIB
U2	Integrated Circuit: M38510/103-04BGB
1A1A2	UHF Frequency Synthesizer Assembly: MFR 26687 part no. FTL 3771-1
1A1A2A1	VCO Printed Wiring Assembly: MFR 26687 part no. DTL 4630-1
Q1	Transistor: JANTXZN2857
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
Q4	Transistor: Same as Q1
Q5	Transistor: Same as Q1
1A1A2A2	Divider Printed Wiring Assembly: MFR 26687 part no. DTL 4601-1
U1	Integrated Circuit: MFR 26687 part no. BTL 3805-2
U2	Integrated Circuit: MFR 26687 part no. BTL 3805-3
U3	Integrated Circuit: Same as U2
U4	Integrated Circuit: MFR 26687 part no. BTL 3805-1
U5	Integrated Circuit: M38510/001-02BCX
U6	Integrated Circuit: M38510/315-11BEX
U7	Integrated Circuit: Same as U6
1A1A2A3	Phase Detector Printed Wiring Assembly: MFR part no. DTL 4589-1
Q1	Transistor: JANTXZN2222A
Q2	Transistor: JANTXZN2907A
Q3	Transistor: Same as Q2
Q4	Transistor: Same as Q1
Q5	Transistor: Same as Q2
Q6	Transistor: Same as Q1
Q7	Transistor: Same as Q2
U1	Integrated Circuit: MFR 26687 part no. CTL 4624-1
U2	Integrated Circuit: M38510/051/01BCX
U3	Integrated Circuit: Same as U2
1A1A2A4	Reference Oscillator Printed Wiring Assembly: MFR 26687 part no. CTL 4134-1
1A1A2U1	Integrated Circuit: M38510/107-01BYX
1A1A2U2	Integrated Circuit: M38510/107-08BYX
1A1A3	IF Amplifier and Synthesizer Assembly: MFR 26687 part no. FTL 3592-1

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME AND DESCRIPTION
1A1A3A1	IF Amplifier Printed Wiring Assembly: MFR 26687 part no. DTL 4684-1
Q1	Transistor: JANTXZN4416
Q2	Transistor: Same as Q1
U1	Integrated Circuit: MFR 26687 part no. ATL 4685-1
1A1A3A2	Divider Printed Wiring Assembly: MFR 26687 part no. DTL 4644-1
U1	Integrated Circuit: M38510/071-03BCX
U2	Integrated Circuit: Same as U1
U3	Integrated Circuit: Same as U1
U4	Integrated Circuit: M38510/001-03BCX
U5	Integrated Circuit: Same as U4
U6	Integrated Circuit: M38510/315-03BEX
U7	Integrated Circuit: Same as U6
U8	Integrated Circuit: Same as U6
U9	Integrated Circuit: Same as U4
U10	Integrated Circuit: M38510/001-04BCX
1A1A3A3	Phase Detector Printed Wiring Assembly: MFR 26687 part no. DTL 4654-1
Q1	Transistor: JANTXZN2907
Q2	Transistor: Same as Q1
Q3	Transistor: JANTXZN2222
Q4	Transistor: Same as Q3
U1	Integrated Circuit: M38510/103/04BGB
U2	Integrated Circuit: MFR 26687 part no. ATL 4709-1
U3	Integrated Circuit: M38510/101-01BGB
1A1A3A4	Audio Processor Printed Wiring Assembly: MFR 26687 part no. DTL 4694-1
Q1	Transistor: JANTXZN5114
U1	Integrated Circuit: M38510/101-02BIX
U2	Integrated Circuit: MFR 26687 part no. ATL 4735-1
U3	Integrated Circuit: M38510/101-01BGX
1A1A3A5	VCO Printed Wiring Assembly: MFR 26687 part no. DTL 4698-1
Q1	Transistor: JANTXZN4416A
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
Q4	Transistor: Same as Q1
1A1A3A6	Buffer Amplifier Printed Wiring Assembly: MFR 26687 part no. DTL 4664-1
Q1	Transistor: JANTXZN2222A
Q2	Transistor: Same as Q1
1A1A3U1	Integrated Circuit: M38510/107-01BYX
1A1A3U2	Integrated Circuit: M38510/107-03BYX

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME AND DESCRIPTION
1A1A5	IF Amplifier and Demodulator Assembly: MFR 26687 part no. JTL 4593-1
1A1A5A1	RF Assembly: MFR 26687 part no. DTL 4764-1
1A1A5A1A1	RF Printed Wiring Assembly: MFR 26687 part no. DTL 4725-1
Q1	Transistor: JANTX2N4416
Q2	Transistor: Same as Q1
Q3	Transistor: JANTX2N2907
Q4	Transistor: JANTX2N2218
U1	Integrated Circuit: MFR 26687 part no. ATL 4685-1
U2	Integrated Circuit: Same as U1
U3	Integrated Circuit: Same as U1
U4	Integrated Circuit: MFR 26687 part no. ATL 4758-1
1A1A5A2	Audio Printed Wiring Assembly: MFR 26687 part no. DTL 4756-1
Q1	Transistor: JANTX2N2907
Q2	Transistor: JANTX2N2222
Q3	Transistor: Same as Q2
Q4	Transistor: Same as Q2
Q5	Transistor: Same as Q2
U1	Integrated Circuit: M38510/101-03BGX
U2	Integrated Circuit: Same as U1
U3	Integrated Circuit: M38510/101-02BIX
U4	Integrated Circuit: MFR 26687 part no. ATL 4757-1
1A1A6	Relay-Filter Assembly: MFR 13499 part no. 528-0255-005
1A1A7	Front Panel Assembly: MFR 26687 part no. ATL 5085-1 or ATL 5086-1
1A1A8	Audio Amplifier Assembly: MFR 26687 part no. DTL 3656-1
1A1A8A1	Audio Amplifier Printed Wiring Assembly: MFR 26687 part no. CTL 3622-1
Q1	Transistor: JANTX2N2222
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
Q4	Transistor: JANTX2N2907
Q5	Transistor: Same as Q4
Q6	Transistor: Same as Q1
Q7	Transistor: Same as Q1
Q8	Transistor: Same as Q4
U1	Integrated Circuit: M38510/101-01BGB

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME AND DESCRIPTION
1A1A8A2	Audio Amplifier Printed Wiring Assembly: MFR 26687 part no. CTL 3622-1
Q1	Transistor: JANTX2N2222
Q2	Transistor: Same as Q1
Q3	Transistor: Same as Q1
Q4	Transistor: JANTX2N907
Q5	Transistor: Same as Q4
Q6	Transistor: Same as Q1
Q7	Transistor: Same as Q1
Q8	Transistor: Same as Q4
U1	Integrated Circuit: M38510/101-01RGB
1A1A8A3	Relay/Squelch Printed Wiring Assembly: MFR 26687 part no. DTL 3626-1
Q1	Transistor: JANTX2N930
Q2	Transistor: JANTX2N2907
Q3	Transistor: JANTX2N2222A
Q4	Transistor: Same as Q3
Q5	Transistor: Same as Q3
Q6	Transistor: Same as Q3
Q7	Transistor: Same as Q3
K1	Relay: M39016/20-030L
K2	Relay: Same as K1
K3	Relay: Same as K1
1A1A9	Low-Pass Band Pass Filter Assembly: P/O MFR 26687 part no. ATL 5091-1 or ATL 5092-1
1A1A11	Main Frame Assembly: MFR 26687 part no. ATL 5091-1 or ATL 5092-1
1A1A11A1	Bottom Frame Assembly: MFR 26687 part no. FTL 4329-1
1A1A11A1A1	Mounting Plate Assembly: MFR 26687 part no. DTL 4309-1
U1	RF Preamplifier: MFR 26687 part no. BTL 3862-1
1A1A11A1U1	Power Amplifier: MFR 26687 part no. BTL 3681-1
1A1A11A1U2	Power Amplifier: Same as U1
1A1A11A1U3	Power Amplifier: Same as U1
1A1A11A1U4	Directional Coupler: MFR 26687 part no. BTL 3860-1
1A1A11A1U5	Directional Coupler: Same as U4
1A1A12	Frequency Selector Assembly: MFR 26687 part no. ATL 5093-1 or 5094-1

Table 4-2. Maintenance Parts List for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME AND DESCRIPTION
1A1A16	Broadband Sidetone Amplifier Assembly: MFR 13499 part no. 549-6408-004
1A2	Case, Receiver-Transmitter: CY-2959/URC-9(B)XN2: MFR 26687 part no. ATL 5288-3
1A3	Power Supply: PP-2702/URC-9(B)XN2: MFR 26687 part no. DTL 3911-1
1A3A1	26.5V Supply Assembly: MFR 26687 part no. DTL 3744-1
1A3A1A1	Converter Assembly: MFR 26687 part no. DTL 3747-1
1A3A1A1A1	Converter Printed Wiring Assembly: MFR 26687 part no. DTL 3618-1
Q2	Transistor: JANTX2N3868
1A3A1A1Q1	Transistor: JANTX2N5672
1A3A1A2	Control Printed Wiring Assembly: MFR 26687 part no. DTL 3615-1
Q1	Transistor: JANTX2N2907
Q2	Transistor: JANTX2N2222
Q3	Transistor: Same as Q2
Q4	Transistor: Same as Q2
Q5	Transistor: JANTX2N3055
Q6	Transistor: JANTX2N3791
Q7	Transistor: Same as Q2
U1	Integrated Circuit: M38510/103-04BGB
U2	Integrated Circuit: M38510/101-01BGB
U3	Integrated Circuit: Same as U1
1A3A2	Multiple Voltage Supply Assembly: MFR 26687 part no. DTL 3709-1
1A3A2A1	±12V Supply Printed Wiring Assembly: MFR 26687 part no. DTL 3632-1
Q1	Transistor: JANTX2N3055
Q2	Transistor: JANTX2N3791
Q3	Transistor: JANTX2N2907
U1	Integrated Circuit: M38510/102-01BIB
U2	Integrated Circuit: Same as U1
1A3A2A2	20V Supply Printed Wiring Assembly: MFR 26687 part no. DTL 4373-1
Q1	Transistor: JANTX2N3055
U1	Integrated Circuit: M38510/102-01BIB

Table 4-3. Repair and Part Replacement Data for Radio Set AN/URC-9(B)XN2

REF. DES.	NAME	REPAIR STATUS	LOCATION OF SPARES	PARTS REPLACEABLE ABOARD
1A1	Receiver-Transmitter, Radio	Aboard	Aboard	See 1A1
1A1A1	RF Exciter Assembly	Aboard	Aboard	See 1A1A1
1A1A1A1	RF Assembly	Aboard	Aboard	1A1A1A1A1 1A1A1A1Q1 1A1A1A1Q2 1A1A1A1Q3
1A1A1A2	Control Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q10 U1, U2
1A1A1A3	Curveshaper Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q3 U1 thru Q3
1A1A1A4	Broadband Amplifier Assembly	Aboard	Aboard	1A1A1A4A1
1A1A1A4A1	Broadband Amplifier Printed Wiring Assembly	Aboard	Aboard	Q1, Q2
1A1A1A5	ZV Bias Assembly	Aboard	Aboard	1A1A1A5A1
A1A1A5A1	ZV Bias Printed Wiring Assembly	Aboard	Aboard	Q1, Q2 U1, U2
1A1A2	UHF Frequency Synthesizer Assembly	Aboard	Aboard	1A1A2A1 1A1A2A2 1A1A2A3 1A1A2A4 1A1A2U1 1A1A2U2
1A1A2A1	VCO Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q5
1A1A2A2	Divider Printed Wiring Assembly	Aboard	Aboard	U1 thru U7
1A1A2A3	Phase Detector Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q6 U1 thru U3
1A1A2A4	Reference Oscillator Printed Wiring Assembly	No Repair	N/A	None

Table 4-3. Repair and Part Replacement Data for Radio Set AN/URC-9(B)XN2 (con't)

REF. DES.	NAME	REPAIR STATUS	LOCATION OF SPARES	PARTS REPLACEABLE ABOARD
1A1A3	IF Amplifier and Synthesizer Assembly	Aboard	Aboard	1A1A3A1 1A1A3A2 1A1A3A3 1A1A3A4 1A1A3A5 1A1A3A6 1A1A3U1 1A1A3U2
1A1A3A1	IF Amplifier Printed Wiring Assembly	Aboard	Aboard	Q1, Q2 U1
1A1A3A2	Divider Printed Wiring Assembly	Aboard	Aboard	U1 thru U10
1A1A3A3	Phase Detector Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q4 U1 thru U3
1A1A3A4	Audio Processor Printed Wiring Assembly	Aboard	Aboard	Q1 U1 thru U3
1A1A3A5	VCO Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q4
1A1A3A6	Buffer Amplifier Printed Wiring Assembly	Aboard	Aboard	Q1, Q2
1A1A5	IF Amplifier and Demodulator Assembly	Aboard	Aboard	1A1A5A1A1 1A1A5A2
1A1A5A1	RF Assembly	Aboard	Aboard	1A1A5A1A1
1A1A5A1A1	RF Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q4 U1 thru U4
1A1A5A2	Audio Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q5 U1 thru U4
1A1A6	Relay-Filter Assembly	No Repair	N/A	None
1A1A7	Front Panel Assembly	No Repair	N/A	None
1A1A8	Audio Amplifier Assembly	Aboard	Aboard	1A1A8A1 1A1A8A2 1A1A8A3

Table 4-3. Repair and Part Replacement Data for Radio Set AN/URC-9(B)YN2 (con't)

REF. DES.	NAME	REPAIR STATUS	LOCATION OF SPARES	PARTS REPLACEABLE ABOARD
1A1A8A1	Audio Amplifier Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q8
1A1A8A2	Audio Amplifier Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q8 U1
1A1A8A3	Relay/Squelch Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q7 K1 thru K3
1A1A9	Low-Pass-Band Filter Assembly	No Repair	N/A	None
A1A11	Main Frame Assembly	Aboard	Aboard	1A1A11A1A1U1 1A1A11A1U1 1A1A11A1U2 1A1A11A1U3 1A1A11A1U4 1A1A11A1U5
1A1A12	Frequency Selector Assembly	No Repair	N/A	None
1A1A16	Broadband Sidetone Amplifier Assembly	No Repair	N/A	None
1A2	Case, Receiver-Transmitter	No Repair	N/A	None
1A3	Power Supply	Aboard	Aboard	See 1A3
1A3A1	26.5V Supply Assembly	Aboard	Aboard	1A3A1A1 1A3A1A2
1A3A1A1	ConverterAssembly	Aboard	Aboard	1A3A1A1A1 1A3A1A1Q1
1A3A1A1A1	Converter Printed Wiring Assembly	Aboard	Aboard	Q2
1A3A1A2	Control Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q7 U1 thru U3
1A3A2	Multiple Voltage Supply Assembly	Aboard	Aboard	1A3A2A1 1A3A2A2
1A3A2A1	±12V Supply Printed Wiring Assembly	Aboard	Aboard	Q1 thru Q3 U1, U2
1A3A2A2	20V Supply Printed Wiring Assembly	Aboard	Aboard	Q1, U1

SECTION 5

INSTALLATION

5-1. INTRODUCTION .

5-2. This section provides information for installation of Radio Set AN/URC-9(B)XN2. Included are data related to unpacking and handling, power requirements, site selection, installation requirements, cable assemblies, and inspection and adjustment.

5-3. UNPACKING AND HANDLING.

5-4. Exercise care in unpacking to prevent damage. Use adequate lifting and transport gear. Set crates in the positions indicated by crate markings before opening. Use a nail puller to remove nails; do not use a bar or other tool which may damage equipment.

5-5. Check the equipment against the packing slip and the list of equipment supplied (see table 1-3). Check equipment for internal damage; determine that all modules are in place. Immediately report any shortage of materials or damaged parts.

5-6. POWER REQUIREMENTS.

5-7. Radio Set AN/URC-9(B)XN2 can be operated from a primary power source of 115 or 230 volts, 50/60 Hz. Radio Set AN/URC-9(B)XN2 requires 220 watts at 0.9 power factor on receive and 320 watts at 0.9 power factor on transmit.

5-8. Radio Set AN/URC-9(B)XN2 is shipped ready for 115-volt operation. To operate the Radio Set on 230 volts, it is necessary to change the primary power fuses and voltage selectors; see 5-17, steps a. through c. .

5-9. SITE SELECTION.

5-10. The selected location should provide sufficient space and light to allow proper operation and maintenance of the equipment. Remember that sufficient space is required in front of the equipment to allow individual units to be removed.

5-11. INSTALLATION REQUIREMENTS.

5-12. SHIPS INSTALLATION. The latest approved ships installation plans should be used for installation of this equipment. The installing personnel should be familiar with the operation of Radio Set AN/URC-9(B) XN 2 before attempting installation.

5-13. EQUIPMENT MOUNTING. Radio Set AN/URC-9(B)XN 2 is configured with slots to accommodate mounting in standard equipment racks. The outline and mounting dimensions for installing the Radio Set for independent operation are dependent upon the particular installation. The outlines and mounting dimensions for installing the Radio Set for operation as part of the AN/SRC-20 and AN/SRC-21 communication equipments are shown in their respective technical manuals.

5-14. INTERCONNECTING CABLING. All interconnecting cabling drawings are shown in section 3. The cable assemblies required for installation of Radio Set AN/URC-9(B)XN 2 are dependent upon its particular installation.

5-15. INSPECTION AND ADJUSTMENT.

5-16. The following procedures are applicable to post-installation check, power turn-on, power turn-off, squelch option, and performance check.

5-17. POST-INSTALLATION CHECK. Perform the following steps before applying power to Radio Set AN/URC-9(B)XN2.

a. Check cabling against appropriate cabling diagrams.
b. Check for proper primary voltage operation and proper fusing; fuses are located on the front panel of the Power Supply PP-2702/URC-9(B)XN2 with ratings marked adjacent to the fuse holders.
c. The Radio Set is supplied ready for 115-volt, 50/60 Hz operation. If 230-volt operation is required, slide out Power Supply PP-2702/URC-9(B)XN2 from the Radio Set and set switches S1501 and S1502 (see table 2-1 and figure 2-2) to the 230-volt position. Return the Power Supply to normal position in Case. On the front panel of the Power Supply, change MAIN AC, T1 PRI and T2 PRI fuses (see table 2-1 and figure 2-1) to those with 230-volt ratings (fuses for 230-volt operation are in the spare fuse holders; see table 2-1 and figure 2-1).
d. Check that air vent covers on the sides of the Radio Set are in operating position. That is, make sure that the covers are detached from the louvered ports and relocated above the louvered ports.

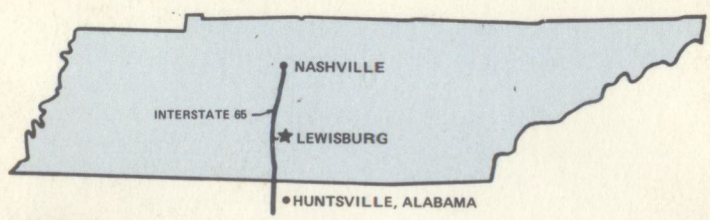
5-18. POWER TURN-ON. To apply power to Radio Set AN/URC-9(B)XN2, perform the following sequence.

a. Set the power switch on the front panel of the Power Supply (see table 2-1 and figure 2-1) to the on position.
b. If the Radio Set is in independent use, power is now applied. Check that POWER indicator on the front panel of the Power (see table 2-1 and figure 2-1) is illuminated and that its illumination level is adjustable by the Power Supply front panel DIMMER control (see table 2-1 and figure 2-1).
c. If the Radio Set is used as part of the AN/SRC-20 or AN/SRC-21 communication equipment, the appropriate procedures for that equipment should be used and the Power Supply front panel POWER indicator and DIMMER control should be checked as in the preceding step 2).
d. Check the Radio Set supply voltage by setting the METER Switch on the front panel of Receiver-Transmitter Unit RT-581/URC-9(B) XN2 to the -12V, +26.5V, +20V and 12V positions (see table 2-1 and figure 2-3). On all positions the meter needle should be near the center mark on the meter scale.

TELEDYNE LEWISBURG

INDUSTRIAL PARK - P. O. BOX 326 LEWISBURG, TENNESSEE 37091

PHONE (615)359-4531 TWX (810)384-4076



Teledyne International Offices

Teledyne S.A.
1, Rue du Temple
1201 Geneva, Switzerland
Phone: (022)31-87-40/49
Telex: 27578 (TDY CH)

Teledyne Belgium S.A.
181 chausce de la Hulpe
1170 Brussels, Belgium
Phone: (02)673-99-88
Telex: 25881 (TDYSEM B)

Teledyne Intertech Corporation
146 Taf:kte Jamshid Avenue
Shahla Building, 7th Floor
Tehran, 15, Iran
Phone: 897.178/893.851
Telex: 212876 (SERV IR)

Teledyne Japan K.K.
Nihon Seimei Akasaka Building, 3rd Floor
8-1-19 Akasaka, Minato-ku
Tokyo 107, Japan
Phone: (03)403-8141
Telex: (781)J24439 (PBE TOKYO)

Teledyne International Marketing
Room 601, Kwang Wu Mansion
386 Tun Hwa South Road
Taipei, Taiwan
Phone: 781-8651/781-2923
Cable: TDYMKTG
Telex: 23218 (TDYMKTG)

Teledyne International Marketing
Room 1302, Center Building
C.P.O. Box No. 3599
Seoul, Korea
Phone: 22-6940
Telex: K2331 or K2332
(MOCNDM ATTN TINTCONKOR)

Teledyne Ltd.
Heathrow House, Bath Road, Cranford
Hounslow, Middlesex, England
Phone: (01)897-2501
Telex: 935-008 (TELEDYNE HNSLOW)

Teledyne GmbH
62 Wiesbaden
Burgstrasse 6-8
West Germany
Phone: 06121-39171
Telex: 04186846 (TSCD D)