TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(DEPOT)

RADIO RECEIVER-TRANSMITTER,
RT-1446/URC, P/N 10085-0000

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components inside the equipment with the power supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge circuits to ground before touching any circuit components. Remove watches and rings before performing any maintenance procedures.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Cardiopulmonary resuscitation procedures are outlined in T.O. 31-1-141-1, and annual refresher training requirements are outlined in AFOSH STD 127-50.

The following warning appears in the text in this volume, and is repeated here for emphasis.

WARNING

Dangerous voltages exist in this radio equipment. Before removing any covers, disconnect the primary power.

HANDLING OF ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (EDSD)

Electrostatic Discharge Sensitive Devices (EDSD) must be handled with certain precautions that must be followed to minimize the effect of static build-up. Consult T.O. 00-25-234, DOD Std-1686, and DOD HDBK 263. EDSD devices are identified in this technical order by the following symbol:

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GLOSSARY

A	Ampere(s)
A/D	Analog-to-Digital (Converter)
AFSK	Audio frequency shift keying; a baseband modulation scheme in which two audio frequencies are used to represent binary coded data; the frequency is shifted to one frequency to represent a 1 (mark) and to the other to represent a 0 (space).
AGC	Automatic gain control
ALE	Address latch enable
AM	Amplitude modulation; a modulation scheme in which the carrier is made to vary in amplitude in accordance with the modulating signal.
AME	Amplitude modulation equivalent
ANTIVOX	Prevents false VOX operation; see VOX
BFO	Beat Frequency Oscillator, used in SSB detection circuits
BIT	Built-in Test
BIU	Bus interface unit
BW	Bandwidth
CPU	Central processing unit
CREV	Converter reverse
CW	Continuous wave; a wave that does not vary in amplitude or frequency and is turned on and off to carry intelligence, e.g., Morse Code
D/A	Digital-to-Analog (Converter)
dB	Decibel(s)
dBm	Decibel(s) relative to one milliwatt
EMI	Electromagnetic interference
EPROM	Erasable programmable read-only memory
EU	Execution unit
HF	High frequency; a radio frequency band extending from about 3 MHz to 30 MHz; in this manual, HF includes 1.6 to 30 MHz.
HV	High voltage
IF	Intermediate frequency
IM	Intermodulation (distortion)
I/O	Input/Output
KREV	Keyer reverse
LCD	Liquid crystal display
LED	Light emitting diode
LPA	Linear power amplifier
LSB	Lower sideband; a modulation scheme in which the intelligence is carried on the first sideband below the carrier frequency; see SSB
MIC	Microphone
mA	Milliampere(s)
mV	Millivolt(s)
NBSV	Narrow band secure voice
PEP	Peak envelope power
PPC	Peak power control
PWB	Printed wiring board
RAM	Random access memory
rms	Root mean square
RTC	Real time clock
RX	Receive

GLOSSARY (Continued)

S TONE	Sidetone
SSB	Single sideband; a modulation scheme in which the intelligence is carried by one of the carrier sidebands, the other sideband and the carrier center frequency being suppressed
TGC	Transmitter gain control
TX	Transmit
uA	Microampere(s)
uP	Microprocessor
USB	Upper sideband; a modulation scheme in which the intelligence is carried on the first sideband above the carrier frequency; see SSB
uV	Microvolt(s)
Vac	Volts, alternating current
VCO	Voltage controlled oscillator
Vdc	Volts, direct current
VOX	Voice operated transmission
VSWR	Voltage standing wave ratio; the ratio of the maximum to the minimum voltage of a standing wave on a radio frequency transmission line
W	Watt(s)

INTRODUCTION

The purpose of this manual is to provide information necessary for the depot-level maintenance of Receiver-Transmitter, Radio, RT-1446/URC, manufactured by the RF Communications Group of Harris Corporation, Rochester, New York. The manual is divided into three chapters. The contents of each chapter are briefly described in the following paragraphs.

NOTE

This manual only contains three chapters, because chapters 1-5 are contained in the On-Equipment Manual, T.O. 31R2-2URC-81. For a description of the contents of these chapters, see the INTRODUCTION in T.O. 31R2-2URC-81.

Chapter 6 describes the depot-level maintenance procedures. The maintenance procedures in this chapter are based on performance testing and trouble analysis of the subassembly or PWB to locate and replace faulty parts at the lowest replaceable unit level (LRU).

Chapter 7 contains the Illustrated Parts Breakdown (IPB) information at the depot level. This includes assemblies and parts that may be replaced at the depot location.

Chapter 8 contains foldout (FO) drawings, which consist of the schematic diagrams for all the PWB assemblies. A cross reference list is also provided. The diagrams are numbered FO-1, FO-2, etc. They are printed on sheets with page-size blank aprons to permit viewing the diagram with the rest of the book closed or opened to another page.

The following specifications, standards, and publications were used in the preparation of this manual.

APPLICABLE SPECIFICATIONS

SPECIFICATION	NAME
MIL-M-38798B, para. 3.4	Combined Operation and Maintenance Instructions Manual (Equipment).
MIL-M-38807, Amend. 4	Preparation of Illustrated Parts Breakdown.
MIL-M-38790 and MIL-M-38784A	General Requirements for Preparation of Technical Manuals.

APPLICABLE STANDARDS

STANDARD	NAME
MIL-STD-12	Abbreviations for use on Drawings and in Technical Type Publications.
MIL-STD-15-1A	Graphic Symbols for Electrical Components.
MIL-STD-17-1	Mechanical Symbols.
MIL-STD-806	Graphic Symbols for Logic Diagrams.

APPLICABLE PUBLICATIONS

PUBLICATION	NAME
DOD 5200.20	Distribution Statements on Technical Documents.
USAS Y14.15-1966	Electrical and Electronic Diagrams.
USAS Y32.16-1968	Electrical and Electronic Reference Designations.
T.O. 31-1-141 (Series)	Technical Manual-Basic Electronic Technology and Testing Practices.

CHAPTER 6

MAINTENANCE

WARNING

Dangerous voltages exist in this radio equipment. Before removing any covers, disconnect the primary power.

Section I. INTRODUCTION

6-1. CHAPTER ORGANIZATION. This chapter is divided into three sections. Section I tells how the chapter is organized. Section II contains alignment procedures for the replaceable modules. This information is also contained in the On-Equipment Manual, T.O. 31R2-2URC-81 , and is repeated here for convenience. Section III consists of diagnostic procedures which will enable you to troubleshoot faulty modules to the component level. These procedures are based on use of the BIT feature. For more information on BIT, as well as removal/replacement procedures and periodic maintenance procedures, see the On-Equipment Manual, T.O. 31R2-2URC-81.

Section II. ALIGNMENT PROCEDURES

6-2. INTRODUCTION. This section contains instructions for checking and adjusting the replaceable subassemblies in the 100 Watt Transceiver. This section also contains circuit board layouts to help you identify the components that can be adjusted. To do the procedures described in this section, you need the test equipment listed in Table 6-1 or equivalents.

Table 6-1. Test Equipment*

Generic Name	Military Designation	Manufacturer, Model No.	National Stock No.	Required Range
Oscilloscope	AN/USM-425 (V) 1	Tektronix, Model 465m	6625-01-032-6914	5 mV to 200 V AC or DC; DC to 100 MHz
Signal Generator (RF)	SG-1093/U	Hewlett Packard, Model 8640B	6625-00-318-6304	-120 to +20 dBm, 440 KHz to 70.5 MHz in 10 Hz increments
Signal Generator (audio)		Hewlett Packard, Model 204D	6625-00-427-4513	-70 to +10 dBm; 300 Hz to 3.3 KHz
Electronic Voltmeter w/ AC Probe & T-connector		Hewlett Packard, Model 410C Model 11036A Model 11042A	6625-00-469-2258 6625-00-910-5973 5985-00-713-4356	10 to 100 V rms; 1.6 to 30 MHz (peak reading)
AC Voltmeter		Hewlett Packard, Model 400F	6625-00-403-6526	300 uV to 3 V (audio frequency)
Digital Multimeter		Fluke, Model 8012A	6625-01-140-0221	200 mV to 250 Vac; 200 mV to 40 Vdc; 0 to 20 megohms
Microprocessor, Adapter	9000A-8088	Fluke	6625-01-210-7865	
Spectrum Analyzers		Textronix Model 496 or Model 492	6625-01-156-6760 6625-01-074-2550	-70 to +20 dBm; 455 KHz to 70.5 MHz
10:1 Probe (for oscilloscope)		Hewlett Packard, Model 10080A		Input impedance: 1 megohm
10 dB Pad		Texscan, Model FP-50-10	5985-01-089-3229	

* NOTE: Equivalent Items Authorized

Table 6-1. Test Equipment (continued)

Generic Name	Military Designation	Manufacturer, Model No.	National Stock No.	Required Range
In-Line fuse	MX-1730/U	Hewlett Packard, Model 11509A	5920-00-636-0679	DC-480 MHz
Frequency Counter*		Hewlett Packard, Model 5335A	6625-01-099-8151	Calibrate 10 MHz to within 1 part in 10^9
DC Power Supply		Raytheon, Model DCR40-70B	6130-01-136-3142	28 Vdc at 15 A; 13.6 Vdc at 30 A
Dummy Load		Bird, Model 8833	6625-00-225-9074	100 W, 50 ohms
Wattmeter	AN/USM-298	Bird, Model 43	6625-00-880-5119	100 W, 50 ohms
PROM Programmer		Data I/O, Model System 19	7045-01-115-8993	
DC Milli-ammeter		Hewlett Packard, Model HP 4288		0 - 500 mA, DC
Inductive Current Probe	ME-488/U	Hewlett Packard, Model HP428B	6625-00-816-9324	0 - 500 mA, DC
100 Watt Transceiver	RT-1446/URC	RF Communications Model RF-350K	5820-01-162-3402	
AFSK Option		RF Communications Model RF-358	5820-01 174-7219	
Remote Control Interface Board		RF Communications P/N 10088-6000	5820-01-162-1112	

* Must be connected to an external frequency standard with a stability of at least 1 part in 10^9 per day.

6-3. ALIGNMENT PROCEDURES.

NOTE

After each of the following alignments, disconnect test equipment and reconfigure equipment (module or circuit card) to normal operating condition.

NOTE

Disconnect LPA, antenna coupler, and remote control unit before performing alignments. Connect transceiver to dummy load.

a. <u>EXCITER PWB ASSY., A1A1 (figure 6-2)</u>

(1) R110/R117, Carrier Null Adjustments

(a) Disconnect A1A7J3 from P1. Connect a spectrum analyzer to P1, with setup as follows:

- Input Attn............20 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.1 KHZ
- Scan Time/Div.....0.1 Sec
- Log Ref Level......-30 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(b) Key the transceiver in CW mode with the CW key.

(c) You should see a signal something like figure 6-1.

(d) Adjust R110 and R117 for a minimum carrier level (at least 40 dB down from sidetones).

NOTE

THE ILLUSTRATION BELOW ASSUMES THAT SWITCH S1 ON IF FILTER PWB A1A2 IS IN THE UPPER SIDE BAND POSITION (U). IF S1 IS IN THE LOWER SIDE BAND POSITION (L), THE FREQUENCIES SHOWN WILL BE SHIFTED DOWNWARD BY 2 KHZ.

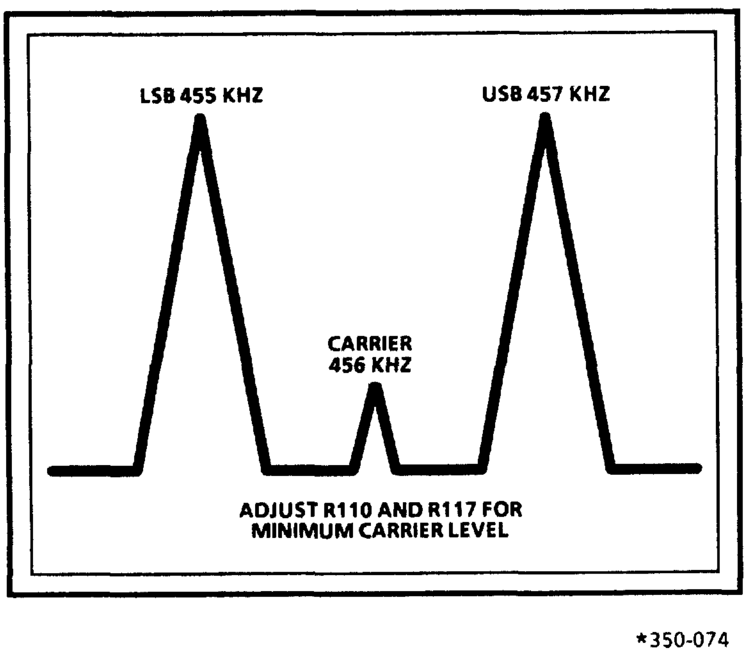
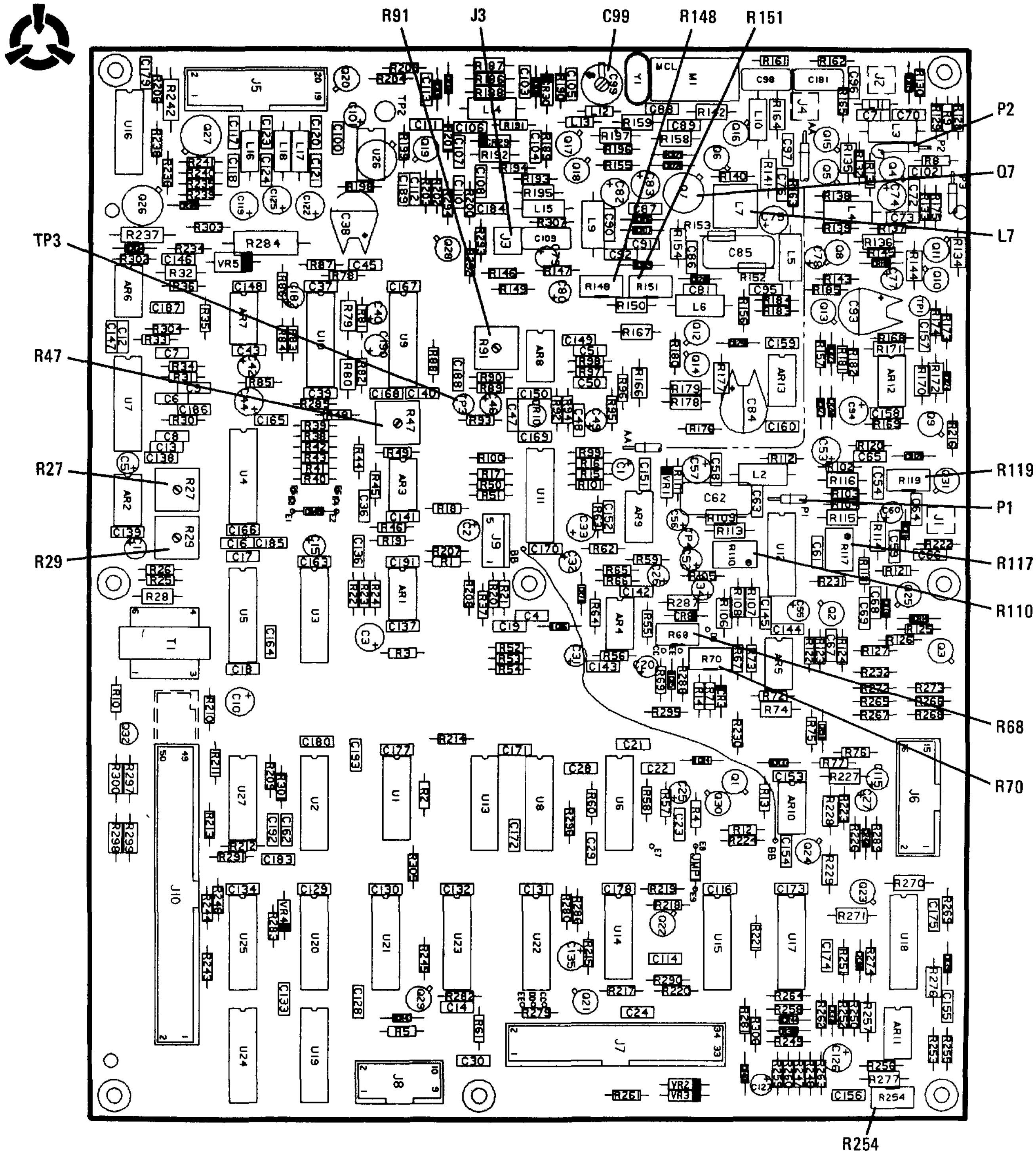


Figure 6-1. Carrier Null Adjustment



350-076A

Figure 6-2. Exciter PWB Assy

(2) L7, 455 KHZ Presence Det Peaking Adj.

(a) Using a signal generator, inject an unmodulated 455 KHz, -28 dBm signal into P2.

(b) Connect J3 to a 50 ohm dummy load.

(c) Observe the collector of Q7 with an oscilloscope.

(d) Adjust L7 for the peak signal on the oscilloscope.

(3) R119, AME Inserted Carrier Level Adjustment

(a) Connect J1 (RF in/out) of the transceiver to a wattmeter and 50 ohm dummy load.

(b) Key the transceiver in AME mode with no modulation.

(c) Adjust R119 for a level of 25 watts on the wattmeter.

(4) R148, Tune Power Adjustment

(a) Connect an antenna coupler to the transceiver with an antenna coupler control cable.

(b) Connect J1 (RF in/out) of the transceiver to a wattmeter and 50 ohm dummy load.

(c) Key the transceiver.

(d) Adjust R148 for 35 watts, as indicated on the meter.

NOTE

Performing this adjustment causes the tune power to lock up. After completing the adjustment, turn the transceiver off and on again to reset the tune power flag.

(5) C99, Bandstop Filter Adjustment

(a) Connect a spectrum analyzer to J3, with a 10 dB attenuator pad between the analyzer and J3. Setup as follows:

- Input Attn............50 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.3 KHZ
- Scan Time/Div.....50 msec
- Log Ref Level......+10 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(b) Using a signal generator, inject an unmodulated 454 KHz signal at -18 dBm into P2.

(c) Key the transceiver, and observe the signal on the spectrum analyzer. 40.454 MHz signal will be observed.

(d) Adjust C99 for maximum signal strength, as indicated on the analyzer.

(6) R254, Low Power Threshold Adjustment.

(a) Select AME mode on the transceiver front panel.

(b) Disconnect the cable from J4 on the First Converter PWB Assy.

(c) Connect a signal generator to this cable (color coded yellow).

(d) Set the signal generator for the frequency selected on the transceiver front panel. Set the output level to -20 dBm, with a modulating tone of 1 KHz at 30% modulation.

(e) Key the transceiver with the 2ND, TX KEY buttons on the front panel. Set meter to FWD.

(f) Adjust the signal generator level so that the output power of the transceiver is 50 W, as indicated on the front panel meter.

(g) Adjust R254 so that the LOW PWR indicator just comes on.

(7) **R47, Audio Meter Calibration Adjustment.**

(a) Select the AUDIO meter on the transceiver front panel.

(b) Select CW mode.

(c) Key the transceiver with the CW key, and adjust R47 for 0 dB on the meter.

(8) **R27 (LINE) and R29 (AUDIO 2), Levelling Adjustments.**

These potentiometers are used to compensate for varying input levels in these signals. Adjust them as follows:

(a) For AUDIO 2, inject a 1 KHz signal at +10 dBm into J4, pins 4 and 5, at the rear of the transceiver. For LINE, connect the Remote Control Unit's control cable into J9 at the rear of the transceiver.

(b) For AUDIO 2, select AUDIO 2 as the audio source on the transceiver front panel. For LINE, select REMOTE operation and audio source of MIC on the transceiver front panel.

(c) Select the AUDIO meter on the transceiver front panel (for AUDIO 2) or on the Remote Control Unit (for LINE).

(d) Key the transceiver, and adjust R29 (AUDIO 2) or R27 (LINE) for an indication of 0 on the transceiver meter. (For the LINE adjustment, you will have to talk into the microphone on the Remote Control Unit.)

(9) **R68 (VOX) and R70 (CW), Delay Adjustments**

These potentiometers set the "hang time" for VOX and CW keying; that is, they determine the amount of time it takes for the transceiver to unkey. These adjustments are preferential, but the normal factory setting is 1/2 to 3/4 second for VOX voice and 1 second for CW.

(a) To adjust R68 select CW mode and connect a CW key, estimate the elapsed time before the transceiver unkeys. Adjust R68 until the desired time delay is achieved.

(b) Select USB mode and VOX voice. Using MIC as the AUDIO SOURCE, adjust R70 so that the end of a test count, the desired time elapses before the transceiver unkeys.

(10) **R91, Clipper Level Adjustment.**

This adjustment is preferential. The range is from 0 dB (no clipping, R91 fully counterclockwise) to 12 dB (maximum clipping, R91 fully clockwise), with the normal factory setting at 6dB. To obtain this factory setting, do the following.

NOTE

A close approximation to the following adjustment can be obtained by simply setting R91 to the center of its turning range.

(a) Select CLIP on the transceiver.

(b) Connect an oscilloscope to TP3 on the Exciter PWB Assy.

(c) Connect an audio signal generator to PATCH IN on the rear panel terminal strip of the transceiver.

(d) Select PATCH as the AUDIO SOURCE on the transceiver. (Make sure that the Audio Interface PWB Assy is set for 4-wire PATCH.)

(e) Turn R91 fully counterclockwise.

(f) Set the signal generator frequency to 1 KHz. Adjust the signal generator level for a 1V pk-pk signal on the oscilloscope. Oscilloscope is still connected to TP3.

(g) Turn R91 clockwise until the signal on the oscilloscope increases to 2 V pk-pk.

b. IF FILTER PWB ASSY., A1A2 (figure 6-3)

(1) L2, 455 KHZ Fltr Input Adj.

(a) Select USB mode on the transceiver.

(b) Connect a spectrum analyzer to J2 on the lF Filter PWB Assy. and setup as follows:

• Input Attn............	0 DB
• Scan Width	1 KHZ/Div.
• Band Width...........	0.3 KHZ
• Scan Time/Div	50 msec
• Log Ref Level........	-40 dBm
• Scan Trigger	Auto
• Scan Mode............	Int
• Video Fltr.............	Off
• Log/Linear............	10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(c) Connect a signal generator to J1 on the lF Filter PWB Assy, and inject a 454 KHz test signal at -60 dBm.

(d) Adjust L2 for peak output at J2.

(2) R5, lF Gain Adjustment.

Using the hookup in the above procedure, adjust R5 for an amplitude of -43 dBm (17 dB gain over the input at J1) on the spectrum analyzer.

c FIRST CONVERTER PWB ASSY A1A3 (figure 6-4).

(1) L7 - L9, Low Pass Filter Adjustment.

(a) Inject a -20 dBm signal into J1 at 59.3 MHz. Unsolder JMP1.

(b) Connect a spectrum analyzer to J7, pin 1 with a 50 ohm probe, and setup as follows:

• Input Attn............	0 DB
• Scan Width	0.5 KHZ/Div.
• Band Width...........	0.3 KHZ
• Scan Time/Div	50 msec
• Log Ref Level........	-60 dBm
• Scan Trigger	Auto
• Scan Mode............	Int
• Video Fltr.............	Off
• Log/Linear............	10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(c) Adjust L7 for a null (minimum signal indication) at 59.3 MHz.

(d) Change the signal generator frequency to 40.455 MHz.

(e) Adjust L8 for a null at this frequency.

(f) Change the signal generator frequency to 44.0 MHz.

(g) Adjust L9 for a null at 44.0 MHz.

(h) Resolder JMP1.

(2) L17, and L14, 40 MHZ IF Fltr Peaking/Adj.

(a) Inject a -20 dBm signal into J1 at the transceiver's operating frequency.

(b) Connect a spectrum analyzer to J2 and setup as follows:

• Input Attn............	40 DB
• Scan Width	0.5 KHZ/Div.
• Band Width...........	0.3 KHZ
• Scan Time/Div	50 msec
• Log Ref Level........	0 dBm
• Scan Trigger	Auto
• Scan Mode............	Int

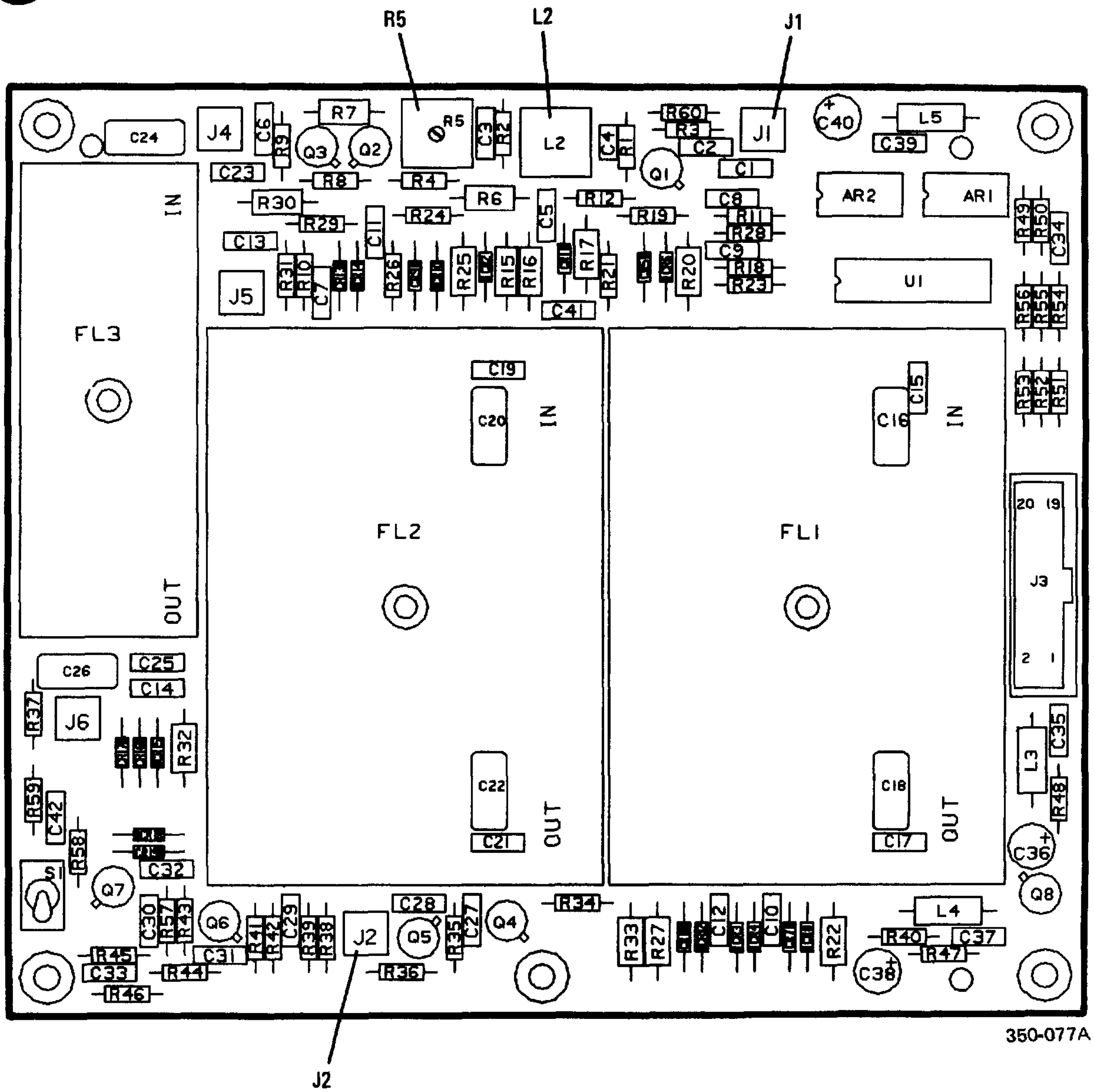


Figure 6-3. IF Filter PWB Assy

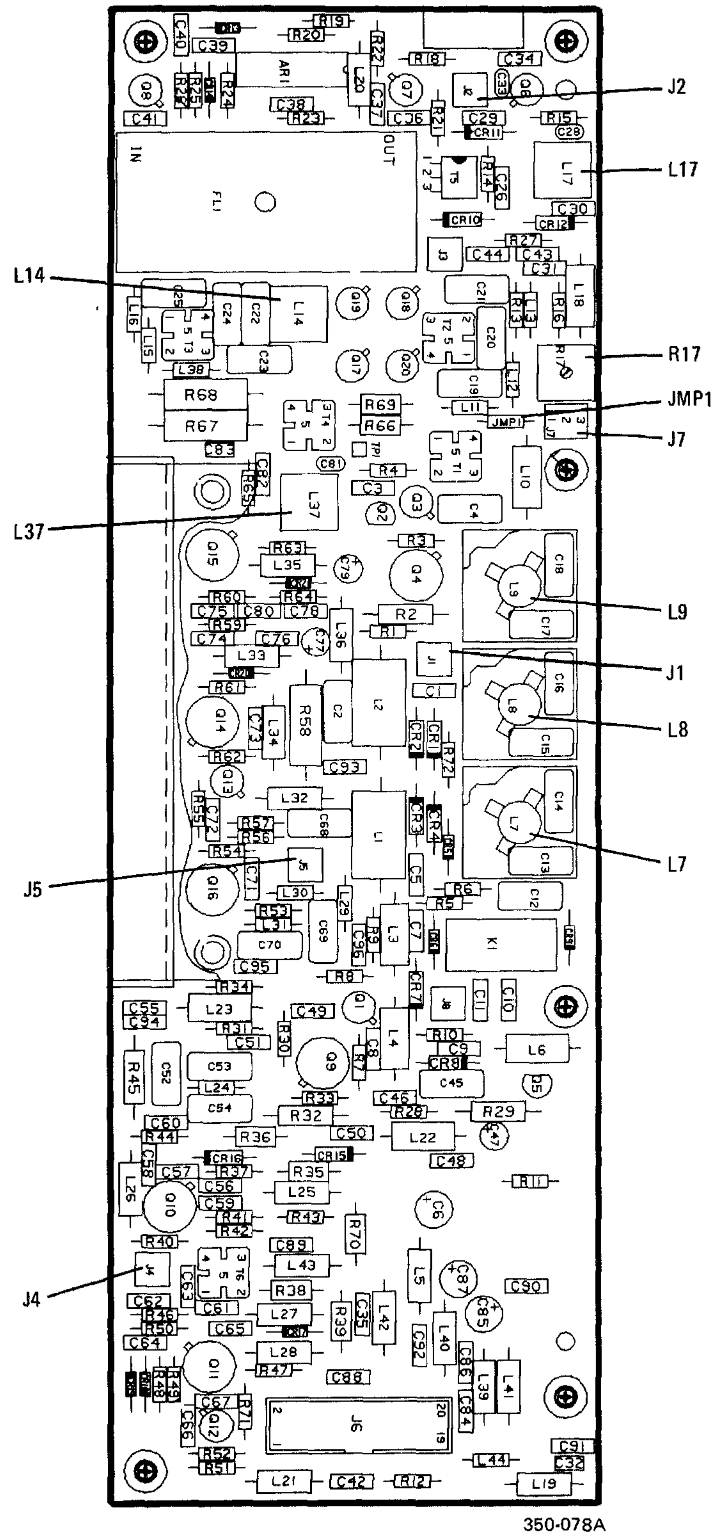


Figure 6-4. First Converter PWB Assy

- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(c) Adjust L17 and L14 for maximum level at 40.455 MHz on the spectrum analyzer.

(3) R17, AGC Adjustment

(a) Select AGC: OFF on the front panel of the transceiver.

(b) Set the RF GAIN control on the front panel fully clockwise.

(c) Connect a spectrum analyzer to J2. Setup as follows:

- Input Attn............40 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.3 KHZ
- Scan Time/Div.....50 msec
- Log Ref Level......0 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(d) Inject a -30 dBm signal at the operating frequency into J1 (RF in/out) on the back of the transceiver.

(e) Observe the level of the 40.455 MHz signal on the analyzer.

(f) Rotate the RF GAIN control fully counterclockwise.

(g) Adjust R17 so that the signal on the analyzer is 20 dB less than it was when the RF GAIN control was fully clockwise.

(4) L37, 40 MHZ If Trap Adj.

(a) Inject a 0 dBm signal at 40.455 MHz into J5.

(b) Connect a spectrum analyzer to J2. Setup as follows:

- Input Attn............40 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.3 KHZ
- Scan Time/Div.....50 msec
- Log Ref Level......0 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(c) With no signal coming in at J1, adjust L37 for minimum signal indication on the spectrum analyzer at 40.455 MHz.

d. <u>POWER AMPLIFIER A1A4 (figure 6-5).</u>

NOTE

Disconnect P1 for all of the power amplifier procedures.

Power-on Checkout and Alignment Procedure.

(1) R1 and R4, Bias Current Adjustment

(a) Disconnect internal connections to E17 and E13. Connect external DC power supply (13.6 V at 30 A) to E13 (13.6 V) and E17 (GND) on the Power Amplifier Board.

CAUTION

Insulate internal connections to E13.

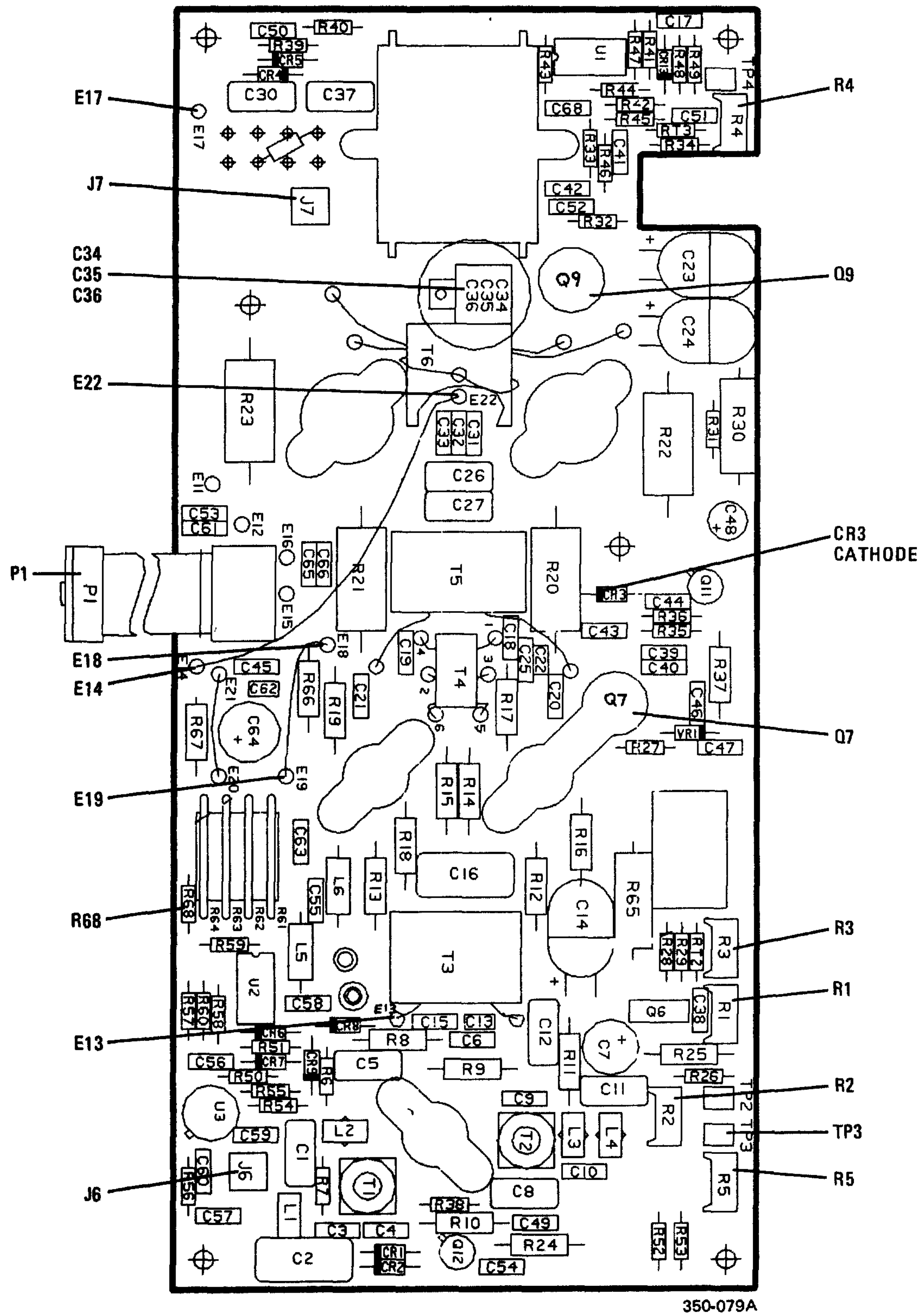


Figure 6-5. Power Amplifier PWB

(b) Using an HP4288 DC milliammeter with an HP428B inductive current probe, connect the probe to the 14 AWG wire between E14 and E22.

(c) Using a jumper wire, place a ground on cathode of CR3. This keys the Power Amplifier.

(d) Adjust R4 for 300 mA on the meter (R4 and R3 are very sensitive adjustments).

(e) Connect the probe to the 18 AWG wire between E18 and E19, and adjust R3 for 110 mA on the meter.

(f) Connect a DC voltmeter to TP3, and adjust R1 for 0.4 Vdc on the meter.

(2) **Gain Slope Adjustment**

(a) Using an SMB to BNC adapter, connect an RF signal generator to the RF input connector J6 on the Power Amplifier Board.

(b) Using a BNC to SMB adapter, connect the RF output connector J7 to a wattmeter and 50 ohm dummy load.

(c) Set the output frequency of the signal generator to 30 MHz.

(d) Adjust the RF output level of the signal generator for an output power indication of 100 watts on the wattmeter. The output power of the signal generator required to do this should not be more than approximately +12 dBm.

(e) Without changing the power output, adjust the frequency of signal generator to 1.6 MHz.

(f) Adjust R2 for an indication of 100 watts on the wattmeter.

(3) **Current Limit Adjustment**

CAUTION

Turn off the signal generator and allow the Power Amplifier to cool down for a few minutes before doing this part of the procedure.

(a) Turn the signal generator back on, using the test setup of the previous section.

CAUTION

You will be overdriving the Power Amplifier for a brief period in order to perform the current limit adjustment. Do not overdrive the Power Amplifier for more than 10 seconds.

(b) Connect a DC voltmeter to the end of R68 that is closer to the ribbon cable connector.

(c) With the signal generator frequency at 1.6 MHz, increase the RF output power until the current meter on the DC power supply indicates 24 A.

(d) Adjust R5 for +5.0 Vdc on the voltmeter.

(e) Turn off the signal generator and allow the Power Amplifier to cool down for a few minutes.

NOTE

Reconnect P1 after completing power amplifier alignment procedures.

e. LOW PASS FILTER PWB ASSY A1A5 (figure 6-6)

(1) **C1, Frequency Adjustment; R1, Level Adjustment**

(a) On J7, place the jumper in the test position (pin 2 to pin 3).

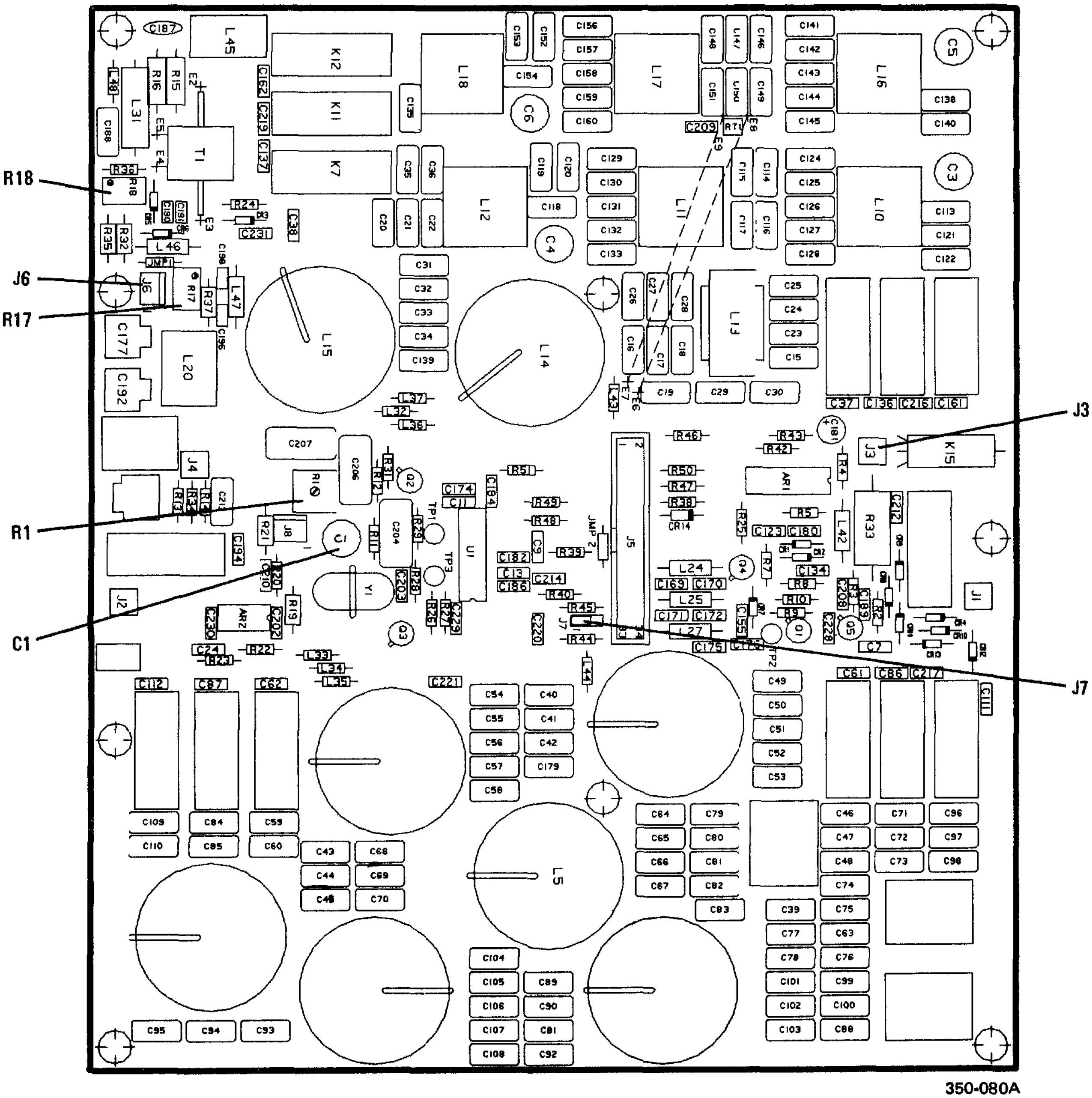


Figure 6-6. Low Pass Filter PWB Assy

(b) Connect a frequency counter to J3, and use C1 to adjust the frequency on the counter to 2.45760 MHz.

(c) Disconnect the frequency counter from J3, and connect a spectrum analyzer in its place. Setup as follows:

- Input Attn............40 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.3 KHZ
- Scan Time/Div.....50 msec
- Log Ref Level......0 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(d) Adjust R1 for -18 dBm at 2.4576 MHz on the spectrum analyzer.

(e) On J7, place jumper (PN65474-001) in the normal position (pin 1 to 2).

) **R17 and R18, Forward and Reflected Power Adjustments**

(a) Disconnect the RF input to the Power Amplifier at J6 on the Power Amplifier PWB.

(b) Connect an RF signal generator to the Power Amplifier at J6.

(c) Connect the output of the 100 Watt Transceiver (J1) to an RF wattmeter (50 ohms) and dummy load.

(d) Adjust the frequency of the signal generator to 15 MHz.

(e) Select USB on the transceiver and key the mike.

(f) Adjust the output level of the signal generator for 100 W on the wattmeter.

(g) Connect a DC voltmeter to J6-1 on the Low Pass Filter PWB Assy.

(h) Adjust R18 for a null (minimum voltage) on the voltmeter. Null can be negative; if so, adjust for maximum negative voltage.

(i) Connect the voltmeter to J6-2.

(j) Adjust R17 for +8.0 ±05 Vdc.

f. AGC/TGC PWB ASSY A1A6 (figure 6-7).

(1) R167, AGC Threshold Adjustment

(a) Inject a 15.001 MHz, -103 dBm signal at the antenna jack J1 on the transceiver. Set AGC to MED.

(b) Set the transceiver for a frequency of 15.000 MHz USB.

(c) Verify that a 1 KHz tone is audible.

(d) Connect a multimeter to TP11, and adjust R167 for 0 (±0.1) Vdc on the meter

(2) R119, TGC Clock Frequency Adjustment

(a) Connect a frequency counter to TP6.

(b) Power up the transceiver and adjust R119 for 32.768 KHz ±800 Hz as indicated on the frequency counter.

(3) R37, 100 Watt Set Point Adjustment.

(a) Turn R37 fully counterclockwise.

(b) Power up the transceiver and set the frequency to 15.000 MHz.

(c) Connect J1 (RF IN/OUT) of the transceiver to a dummy load.

(d) Key the transceiver in CW mode.

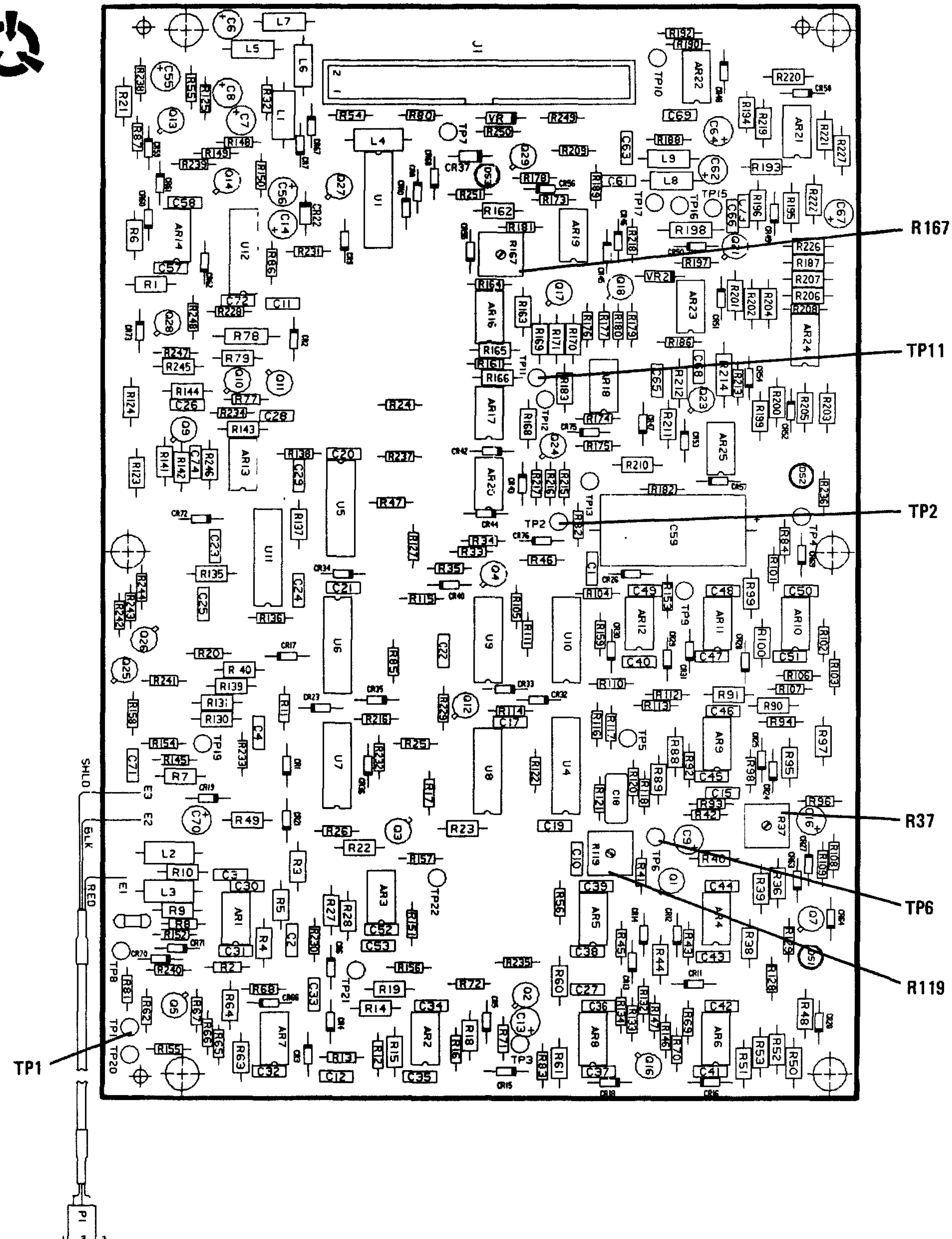


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Figure 6-7. AGC/TGC PWB Assy

(e) Read the voltage on TP2 with a high-impedance (10 megohms or greater) DC voltmeter. This voltage should be +8 ±0.25 Vdc.

(f) Connect the voltmeter to TP1.

(g) Slowly turn R37 clockwise until the voltage at TP1 is within 100 mV of the TP2 voltage. For example, if the voltage at TP2 was +8.05 Vdc, you would adjust R37 clockwise until the voltage at TP1 was +7.95 to +8.15 Vdc.

g. <u>RECEIVER PWB ASSY A1A7 (figure 6-8).</u>

(1) L24, 455 KHZ IF Peaking Adj.

(a) Select AME mode, AGC OFF on the transceiver front panel.

(b) Inject a 455 KHz, -80 dBm signal into J5.

(c) Connect an oscilloscope to TP1.

(d) Adjust L24 for maximum AC signal at TP1.

(2) R42, Gain Adjustment.

(a) Select AME mode, AGC OFF on the transceiver front panel.

(b) Inject a 455 KHz signal at -80 dBm into J5.

(c) Connect an oscilloscope to TP1.

(d) Adjust RF GAIN control fully clockwise.

(e) Adjust R42 for 35 mV pk-pk on the oscilloscope.

(3) R197, AGC Adjustment

(a) Select AME mode, AGC OFF on the transceiver front panel.

(b) Adjust the RF GAIN control fully clockwise.

(c) Inject a 455 KHz signal at -80 dBm into J5.

(d) With an oscilloscope, verify that the signal at TP1 is 35 mV pk-pk. If it is not, adjust R42 (GAIN ADJUST). See paragraph 2 above.

(e) Rotate the RF GAIN control fully counterclockwise.

(f) Increase the signal strength to -20 dBm.

(g) Adjust R197 for 35 mV pk-pk at TP1.

(h) Reduce the signal strength to -80 dBm, rotate the RF GAIN control fully clockwise, and check the signal at TP1. It should be 35 mV pk-pk. If it is not, adjust R42 (GAIN ADJUST) and repeat steps e-h.

(4) L6, 39.545 MHZ OSC Peaking Adj.

(a) At J1, inject a 40.455 MHz, -40 dBm signal.

(b) Connect a spectrum analyzer to J2. Observe the output at 455 KHz. Set up as follows:

- Input Attn............0 DB
- Scan Width..........0.5 KHZ/Div.
- Band Width.........0.3 KHZ
- Scan Time/Div.....50 msec
- Log Ref Level......0 dBm
- Scan Trigger........Auto
- Scan Mode..........Int
- Video Fltr............Off
- Log/Linear..........10 DB Log

NOTE

It may be necessary to start at a higher scan width to find the desired signal initially.

(c) Adjust L6 for maximum signal at this frequency (the signal should be approximately -34 dBm or greater).

(5) R93, Sidetone Level Adjustment.

(a) Select CW mode.

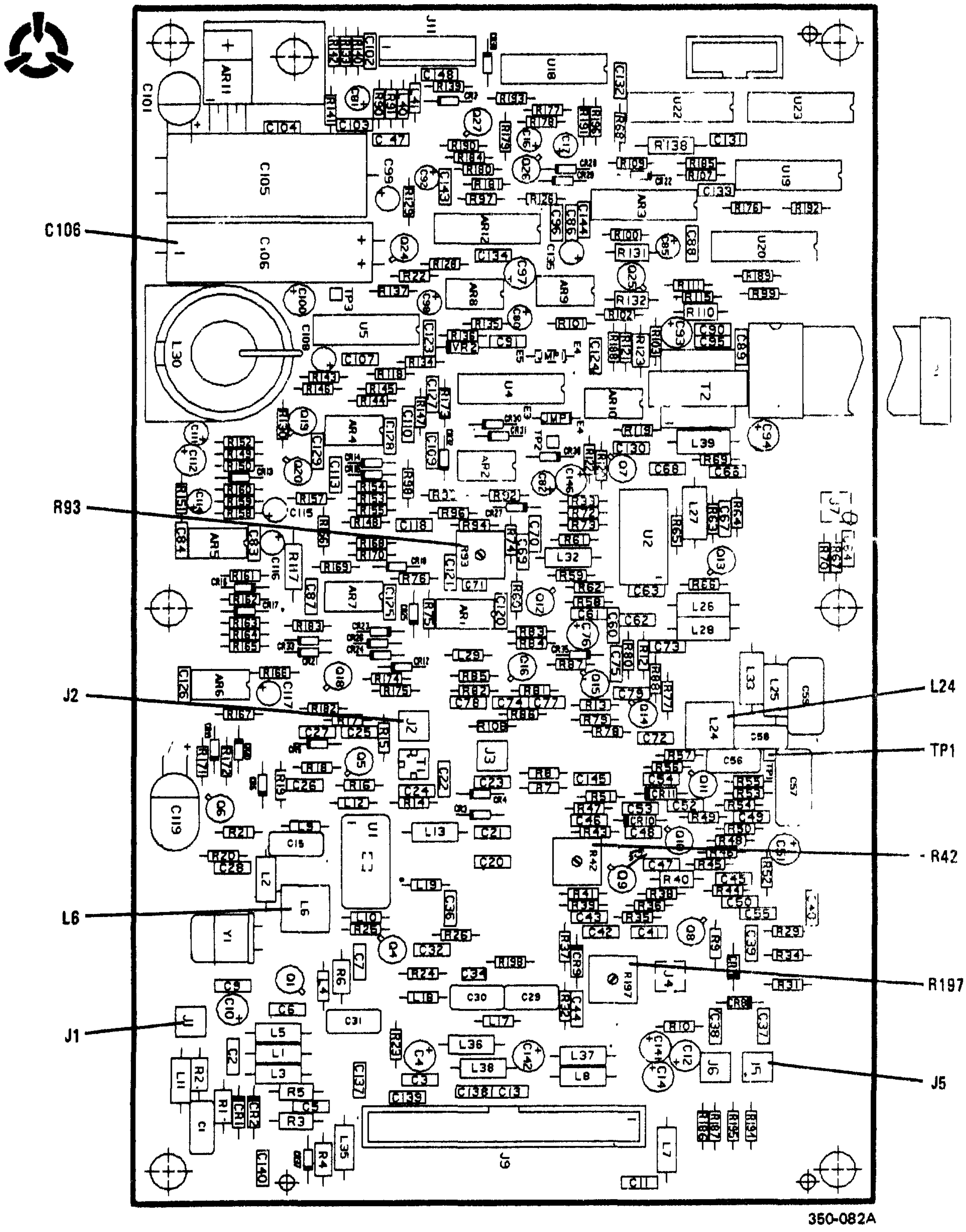


Figure 6-8. Receiver PWB Assy

(b) Connect oscilloscope to (-) lead of C106.

(c) Using a signal generator, inject a 40.455 MHZ signal into J1 at -40 dBm.

(d) Adjust R93 so that, for a given volume control setting on the front panel, the audio level of the sidetone (when the transceiver is keyed) is about the same as the received audio level.

h. CRYSTAL OSCILLATOR ASSEMBLY A1A8.(figure 6-9).

The purpose of the following procedures is to determine whether the Crystal Oscillator Assembly is functioning properly and, if it is found to be off-frequency, to attempt to adjust the frequency to the specified value.

(1) Obtain an SMB female to BNC adapter cable of 18 inches (or less) in length. Connect the SMB female end to the Crystal Oscillator Assembly, and connect the BNC end to a frequency counter. The frequency counter should be referenced to a frequency source whose stability is better than 1 part in 10^8 per day.

(2) Check that the frequency of the Crystal Oscillator Assembly is 10.000000 (± the offset, if specified on the label) MHz.

NOTE

Some Crystal Oscillator Assemblies may have an offset. The reason for this offset is to enable the Crystal Oscillator Assembly to meet the temperature stability specification. For example, the Crystal Oscillator Assembly may have to be set for a room-temperature (25° C) frequency of 10.000001 MHz in order to meet the temperature stability specification. In this case, the offset would be +1 Hz.

(3) If the frequency is not correct, do the adjustment procedure below.

(a) Remove the screw from the top of the Crystal Oscillator Assembly.

(b) Insert a tuning tool, and adjust the variable capacitor for 10.000000 (±the offset, if specified on the label) MHz on the frequency counter.

(c) If the Crystal Oscillator Assembly cannot be adjusted to specification, discard it.

i. REFERENCE/BFO PWB ASSY A1A9 (figure 6-10).

(1) L1, L2, 40 MHZ REF Output Peaking Adj.

(a) Connect an oscilloscope to the end of R15 closer to L2.

(b) Adjust both L1 and L2 for maximum amplitude of the 40 MHz sine wave. These adjustments are interactive, so you may have to go back and forth a couple of times to get the best result.

(2) C35, VCO Frequency Adjust

(a) Center-tune the BFO (455.00 KHz). (The BFO is automatically center-tuned in USB or LSB receive mode, as long as the BFO key on the transceiver front panel is not activated.)

(b) Connect a DC voltmeter to TP2

(c) Adjust C35 for +6.5 Vdc at TP2.

(3) L14, 10 MHz Standard Input Adjustment

(a) Connect an oscilloscope to the ungrounded end of R99.

(b) Adjust L14 for maximum signal on the oscilloscope.

j. SYNTHESIZER PWB ASSY A1A10 (figure 6-11).

(1) R1, R3, R4: API Alignment Procedure

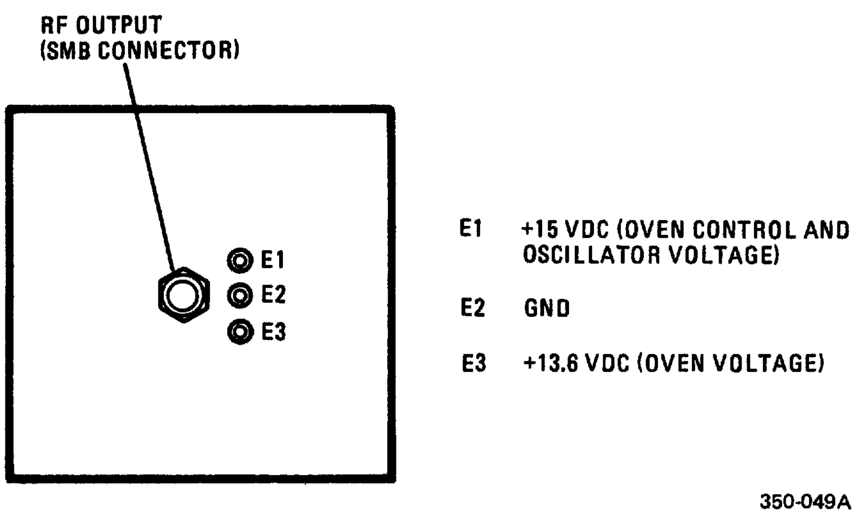


Figure 6-9. Crystal Oscillator Assy (Bottom View)

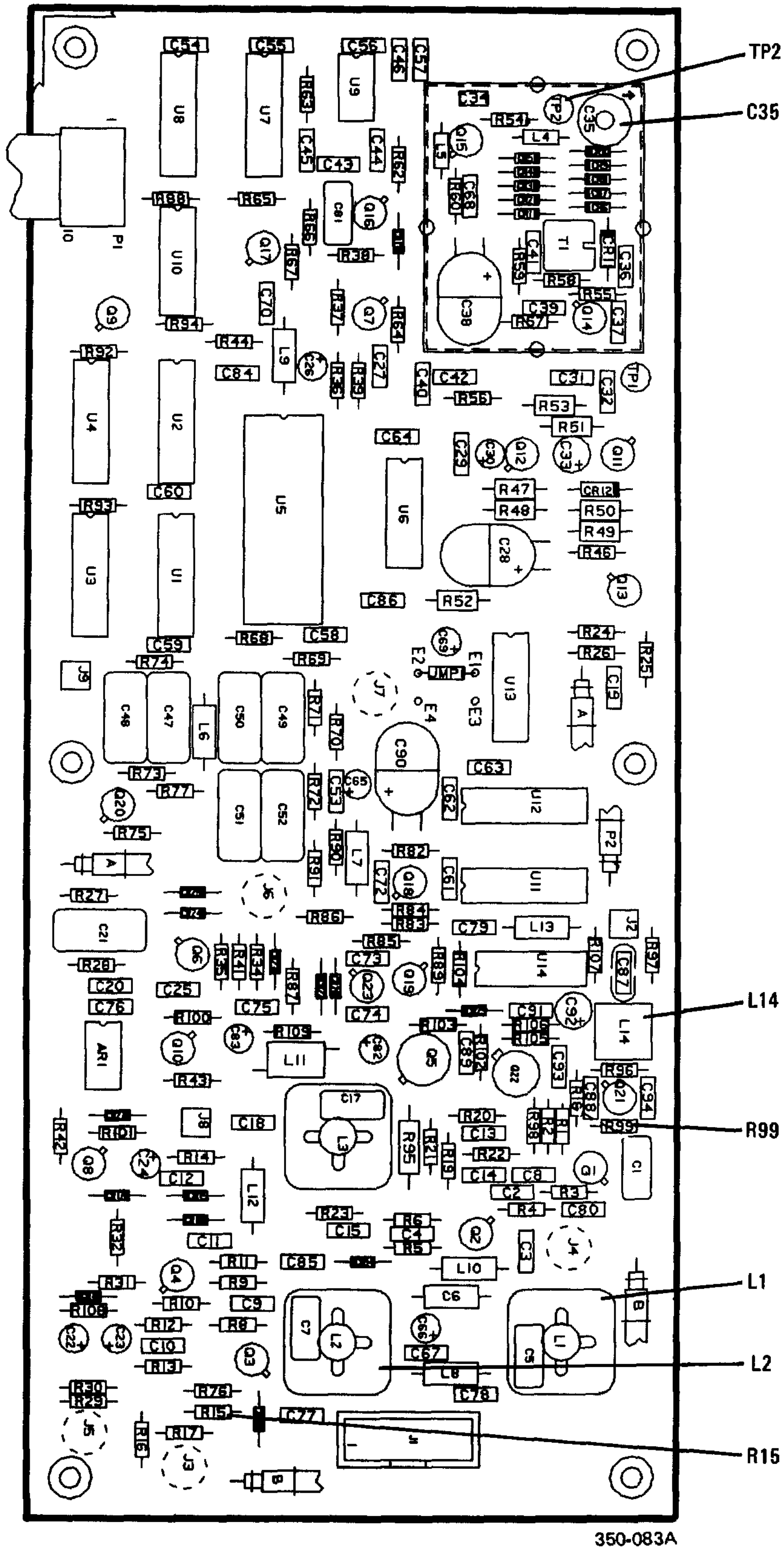


Figure 6-10. Reference/BFO PWB Assy

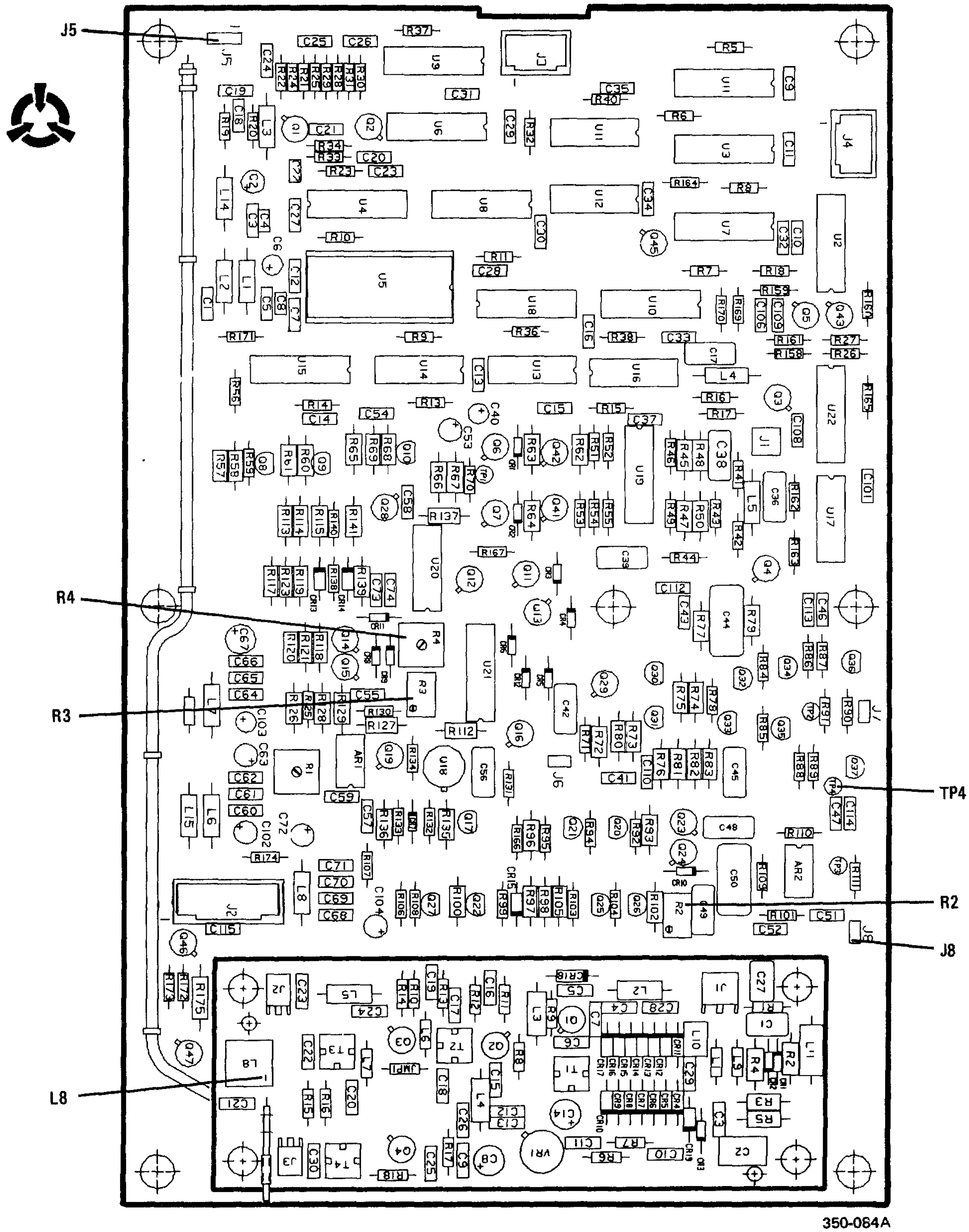


Figure 6-11. Synthesizer PWB Assy

(a) Remove the cover from the Synthesizer PWB Assy.

(b) Set the transceiver to 4.54800 MHz USB.

(c) Disconnect the coax cable from J5 on the First Converter PWB Assy. Using an SMB to BNC adapter, connect this cable to the RF input of a spectrum analyzer.

(d) Set the spectrum analyzer controls as follows:

Input Attenuation: ....20 dB
Scan Width:................05 MHz per division
Bandwidth: ....10 KHz
Scan Time Per Division: .2 ms
Log Reference Level: ...+10 dBm
Scan Trigger: ....Auto
Scan Mode: ....Int
Video Filter: ....Off
Log/Linear: ....10 dB log

(e) Adjust the frequency control on the spectrum analyzer to center the Synthesizer output, which is at 45.00300 MHz.

(f) Readjust the spectrum analyzer to give a center frequency of 45.00600 MHz with a bandwidth of 100 Hz and a scan width of 1 KHz per division. Adjust the scan time to maintain a calibrated display.

(g) Set the video filter to 10 KHz, and adjust the log reference level to place the peak of the Synthesizer output on the top line of the display.

(h) The spectrum analyzer display should now be centered on the API sideband, which is 3 KHz above the Synthesizer output at 45.00300 MHz.

(i) Set the spectrum analyzer scan mode to manual, and set the video filter to 10 Hz.

(j) Adjust the manual scan control on the analyzer to display the peak of the API sideband (45.00600 MHz), which should be at the center of the display

(k) Adjust trim pot R3 on the Synthesizer to reduce the sideband level (at 45.00600 MHz) to a minimum. If the API circuitry is functioning properly, you should be able to reduce the sideband level at least 50 dB below the Synthesizer output level (at 45.00300 MHz), and typically better than 60 dB.

(l) Set the transceiver frequency to 4.54530 MHz.

(m) Adjust the center frequency of the spectrum analyzer to 45.00000 MHz, the scan width to 1 KHz per division, and the bandwidth to 100 Hz. Adjust the log reference level to place the peak of the Synthesizer output at the top line of the display.

(n) Set the analyzer scan mode to manual, set the video filter to 10 Hz, and use the manual scan control to display the peak of the API sideband 3 KHz above the Synthesizer output (at 45.0030 MHz).

(o) Adjust trim pot R4 on the Synthesizer to reduce the sideband level (at 45.0030 MHz) to a minimum. If the API circuitry is functioning properly, you should be able to reduce the sideband level at least 50 dB below the Synthesizer output level (at 45.0030 MHz), and typically better than 60 dB.

NOTE

The API 4 adjustment potentiometer, R1, need not be adjusted, since the maximum frequency resolution of the transceiver is 10 Hz.

(2) L8, 40.455 MHz Trap Adjustment.

(a) Remove the covers from the Synthesizer PWB Assy and the VCO Assy. (The VCO Assy is the subassembly at the back of the Synthesizer PWB Assy.)

(b) Remove jumper P3 from J5, pins 2 and 3.

(c) Connect a suitable test cable (ITT Pomona Electronics 3787-C-36 or equivalent) from J5 pin 3 and J5 pin 1 (ground) to a frequency counter.

(d) Remove jumper P2 from J8.

(e) Connect the + terminal of a DC power supply to pin 2 of J8 (pin 2 is the one closer to the VCO Assembly) and the - terminal to TP4 (ground).

CAUTION

The voltage on the power supply should not exceed 12 Vdc.

(f) Disconnect the coax cable from J5 on the First Converter PWB Assy. Using an SMB to BNC adapter, connect this cable to the RF input of a spectrum analyzer.

(g) Adjust the power supply to produce a frequency reading of 40.455 ±0.100 MHz on the frequency counter.

(h) Adjust the spectrum analyzer controls to center the Synthesizer output signal at 40.455 ±0.1 MHz. Set the analyzer scan width to .05 MHz per division. Set bandwidth to 30 KHz.

(i) Using a non-inductive tuning tool, adjust L8 on the VCO Assembly for a minimum signal level on the spectrum analyzer.

(3) R2, 100 KHz Sideband Null Adjustment

(a) Remove the cover from the Synthesizer PWB Assy.

(b) Disconnect the coaxial cable from J5 on the First Converter PWB Assy.

(c) Using an SMB to BNC adapter, connect this cable to the RF input of the spectrum analyzer.

(d) Set the transceiver to 14.54500 MHz USB.

(e) Adjust the spectrum analyzer to center the Synthesizer output at 55.000 MHz on the analyzer display.

(f) Set the input attenuation on the spectrum analyzer to 20 dB.

(g) Adjust the Log Ref Level controls to place the peak of the Synthesizer signal (55.000 MHz) at the top line of the analyzer display (0 dB line).

(h) Retune the center frequency of the spectrum analyzer to 55.100 MHz. The Synthesizer sideband at 55.100 MHz should now be displayed.

(i) Decrease the Log Ref Level of the spectrum analyzer by 10 dB.

(j) Adjust potentiometer R2 on the Synthesizer to reduce the sideband at 55.100 MHz to a minimum.

k. <u>FRONT PANEL PWB ASSY A1A11A1</u>. Aside from the AUDIO, RF GAIN, and SQUELCH controls, which are adjusted by the operator while the equipment is in use, there are six other potentiometers on the Front Panel PWB Assy. These are the VOX, ANTIVOX, MIC, LINE, PATCH RCV, and PATCH XMIT potentiometers, which are accessible through holes in the front panel. Since these are also adjustable by operators in the field, the adjustment procedures are contained in Chapter 4, Operation.

l. <u>DISPLAY ASSEMBLY A1A11A2</u>.

No adjustments.

m. <u>TRANSCEIVER CONTROL PWB ASSY A1A12 (figure 6-12)</u>.

Power Off Reset Potentiometer R2 Adjustment

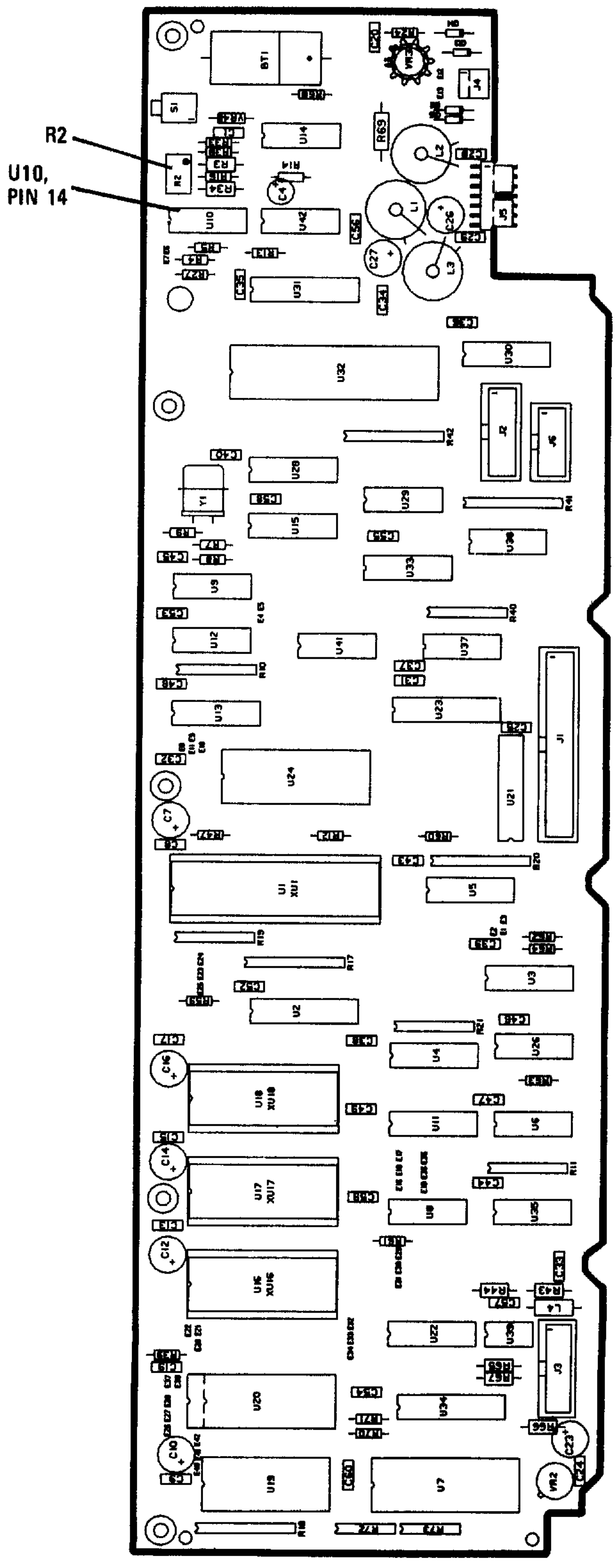


Figure 6-12. Transceiver Control PWB Assy

(a) Measure the +13.6 Vdc supply line at TP4 (yellow) on the Interconnect PWB Assy with a multimeter. Note the actual voltage.

(b) Monitor the dc voltage at U10 pin 14 on the Transceiver Control PWB Assy with a multimeter.

(c) Adjust R2 to produce a dc voltage at U10 pin 14 which is 0.56 times the voltage measured at TP4 on the Interconnect PWB Assy.

n. LPA/COUPLER INTERFACE PWB ASSY A1A13.

No adjustments.

o. MULTIVOLTAGE SUPPLY ASSY A1A14 (figure 6-13).

(1) R61 (+5 V Adjustment)

Adjust R61 for +5 Vdc at TP5 (green) on the Interconnect PWB Assy.

(2) R4 (+15 V Adjustment)

Adjust R4 for +15 Vdc at TP3 (orange) on the Interconnect PWB Assy.

p. INTERCONNECT PWB ASSY A1A15.

No adjustments.

q. AUDIO INTERFACE PWB ASSY A1A16 (figure 6-14).

(1) PATCH Nulling Potentiometer R1

NOTE

This adjustment only affects a 2-wire PATCH hookup.

(a) Set the PATCH selector switch (S1) on the Audio Interface PWB Assy to the "2W" position.

(b) Connect the nominal 600-ohm system termination across the "2W" PATCH terminals on TB1 (pins 2 and 3) at the rear of the transceiver.

(c) Set the transceiver to receive USB mode at 2.4560 MHz.

(d) Activate the BIT test tone by placing the jumper plug (PN65474-001, FSCM 00779) at J7 on the Low Pass Filter PWB Assy to the test position (between pins 2 and 3).

(e) Listen for an audio tone from the speaker.

(f) Select PATCH for the audio source, and select PATCH for the meter. Note the output level. Temporarily adjust the PATCH RCV potentiometer on the front panel to maximum clockwise.

(g) Select AUDIO for the front panel meter, and adjust potentiometer R1 (accessible through a hole in the Audio Interface PWB Assy's frame) for a null (minimum reading) on the front panel meter.

(h) Readjust the front panel PATCH RCV potentiometer to its original setting by using the PATCH meter position on the front panel. After completing the adjustment, be sure to replace the jumper plug at J7 on the Low Pass Filter PWB Assy to the normal position (between pins 1 and 2).

(2) LINE Nulling Potentiometer R5

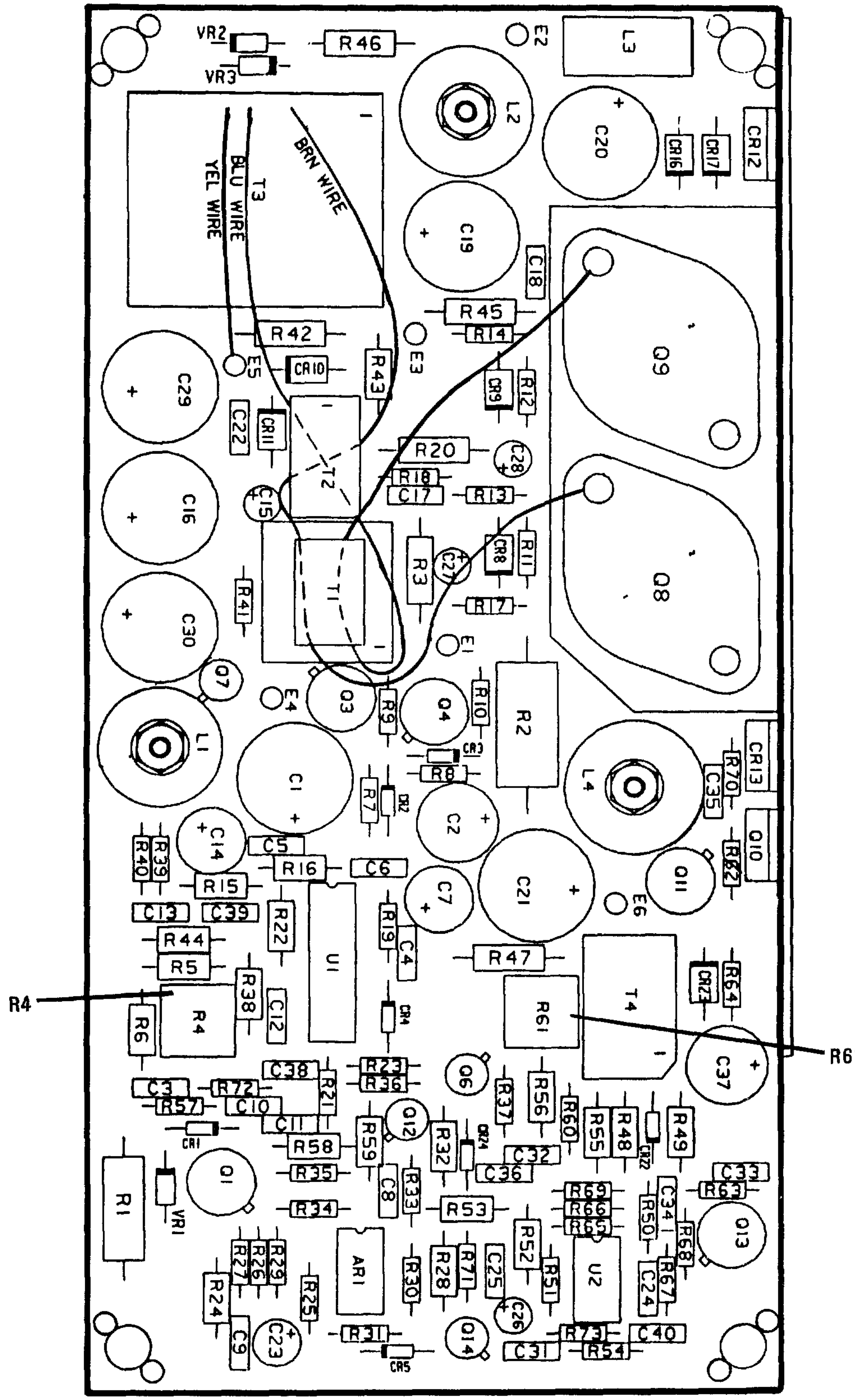
NOTE

This adjustment only affects a 2-wire LINE hookup (as when a REMOTE CONTROL UNIT is connected to the 100 Watt Transceiver).

(a) On the transceiver, select CW mode at 15 MHz. Connect J1 (RF in/out) on the rear of the transceiver to a 50 ohm dummy load.

(b) Select the LINE meter.

(c) Ensure sidetone is present.



350-086A

Figure 6-13. Multivoltage Supply PWB Assy

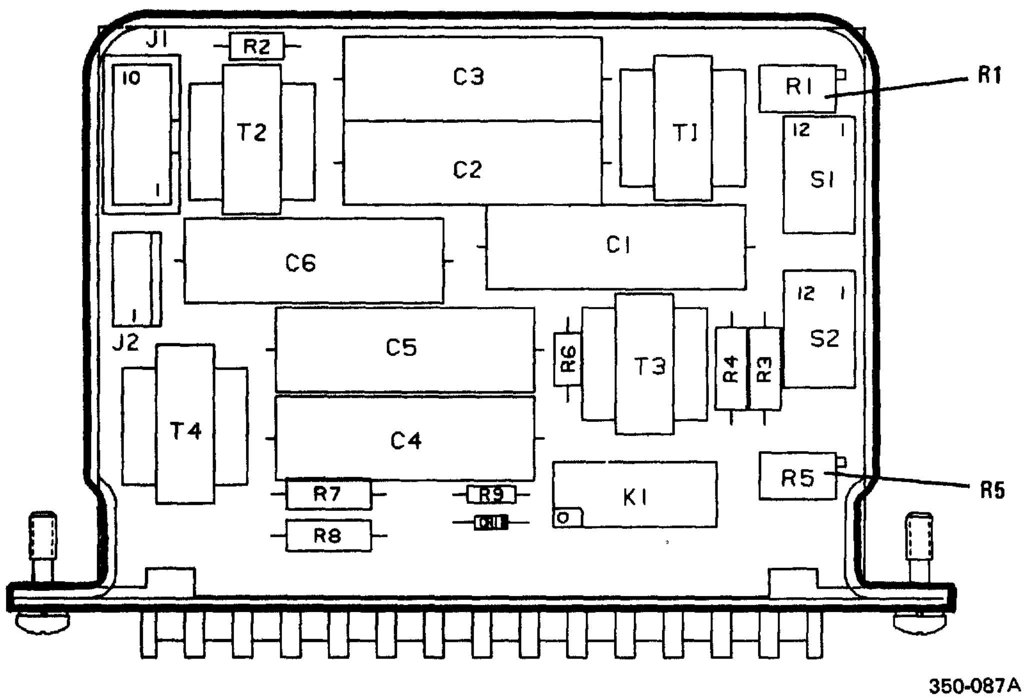


Figure 6-14. Audio Interface PWB Assy

(d) Connect the nominal 600-ohm termination across the "2W" LINE terminals on TB1 at the rear of the transceiver.

(e) Set the LINE selector switch (S2) on the Audio Interface PWB Assy to the "2W" position. Note line level reading on front panel meter.

(f) Adjust the LINE potentiometer on the front panel of the transceiver fully clockwise.

(g) Key the transceiver with the CW key , and adjust R5 (accessible through a hole in the chassis frame and the Audio Interface PWB Assy's frame) for a null (minimum reading) on the meter.

(h) Rotate the LINE potentiometer to its former position.

r. <u>COUPLER CONNECTOR PWB ASSY A1A17.</u>

No adjustments.

s. <u>AFSK MODULE ASSY A1A18 (figure 6-15)</u>.

(1) C22, Oscillator Frequency Adjust

(a) Select AFSK on the transceiver front panel.

(b) Connect a frequency counter to TP3.

(c) Adjust C22 for 1.24890 MHz ±100 Hz at TP3.

(2) R8, TTL DC Offset Adjust

(a) Set the AFSK shift to 170 Hz with S1 on the AFSK IF Filter PWB Assy (figure 6-16).

(b) Inject a 1000 Hz audio signal at pin 19 of J2. The signal level should be 50 mV rms.

(c) Connect an oscilloscope to TP1.

(d) Adjust R8 for equally spaced pulses on the oscilloscope (R8 has only minimal affect).

(3) R21, Duty Cycle (+/-12 V) Balance Adjust

(a) Set the AFSK shift to 170 Hz with S1 on the AFSK IF Filter PWB Assy.

(b) Inject a 1000 Hz audio signal at pin 19 of J2. The signal level should be 100 mV rms.

(c) Connect an oscilloscope to TP2. (Use the DC coupled input to the oscilloscope.)

(d) Adjust R21 so that the signal at TP2 is a symmetrical signal approximately ± 12 Vdc relative to ground at twice the audio input frequency.

(4) R86, AFSK Meter Balance Adjust

(a) Set the AFSK shift to 170 Hz with S1 on the AFSK IF Filter PWB Assy.

(b) Inject a 1000 Hz audio signal at pin 19 of J2. The signal level should be 100 mV rms.

(c) Connect a DC voltmeter to the junction of R87 and R88.

(d) Adjust R86 for +2.50 (±0.05) Vdc on the meter.

(5) R73, Detector Threshold Adjust

(a) Set the AFSK shift to 170 Hz with S1 on the AFSK IF Filter PWB Assy.

(b) Inject a 1000 Hz audio signal at pin 19 of J2. The signal level should be 5 mV rms.

(c) Connect a DC voltmeter to pin 1 of AR7A.

(d) Adjust R73 for a positive transition to +13 Vdc or more on the meter. It maybe necessary to initially set R73 in the CW direction until a negative voltage is indicated.

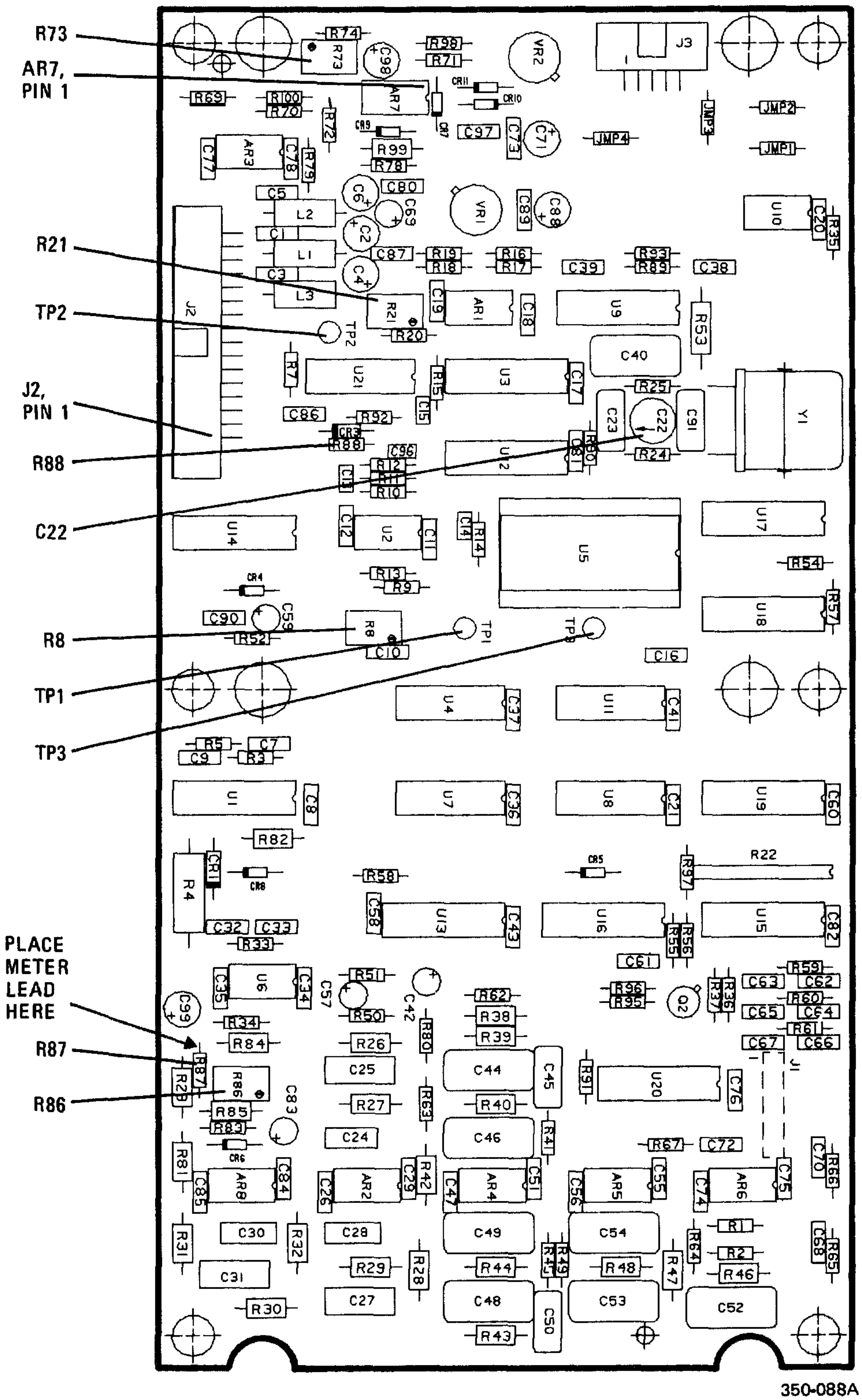


Figure 6-15. AFSK Keyer/Converter PWB Assy

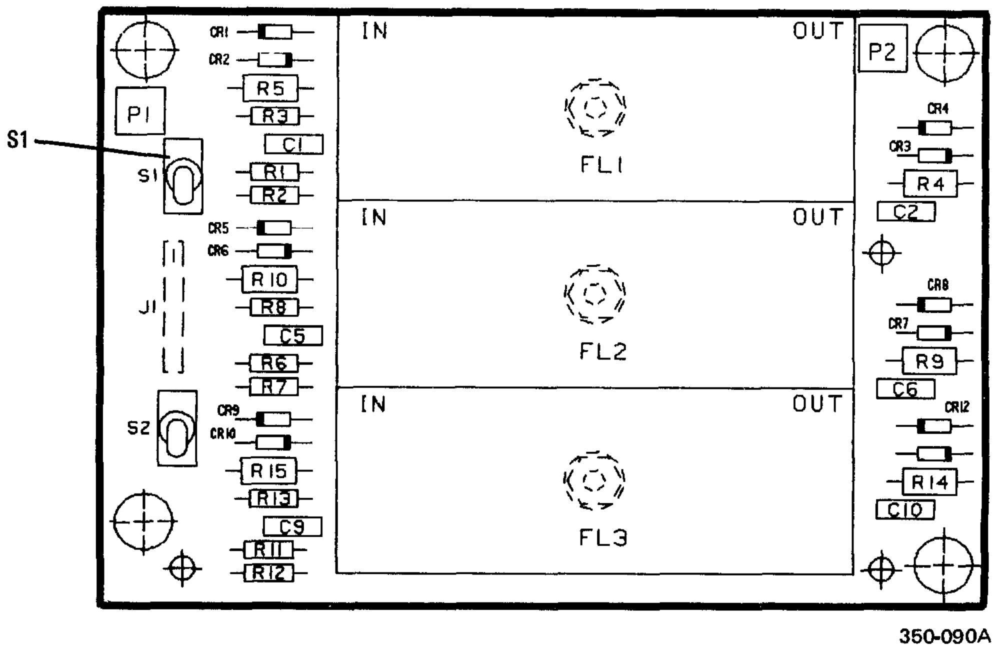


Figure 6-16. AFSK IF Filter PWB Assy

t. REMOTE CONTROL INTERFACE PWB ASSY A1A19.

No adjustments.

u. POWER SUPPLY PROTECTION AND CONTROL PWB ASSY A2A1.

No adjustments.

v. 13.6 V POWER SUPPLY ASSY A2A2 (figure 6-17).

(1) R26, +13.6 Vdc Voltage Adjustment.

(a) Set mode to USB.

(b) Adjust R26 for +13.6 Vdc (± 0.05 Vdc) at TP4 (yellow) on the Interconnect PWB Assy, A1A15.

(2) R28, AFSK/CW Voltage Cutback Adjustment

(a) Set mode at CW or AFSK Mode.

(b) Adjust R28 for +12.3 Vdc (± 0.05 Vdc) at TP4 (yellow) on the Interconnect PWB Assy A1A15.

NOTE

Maximum AC ripple at TP4 is 50 mVac.

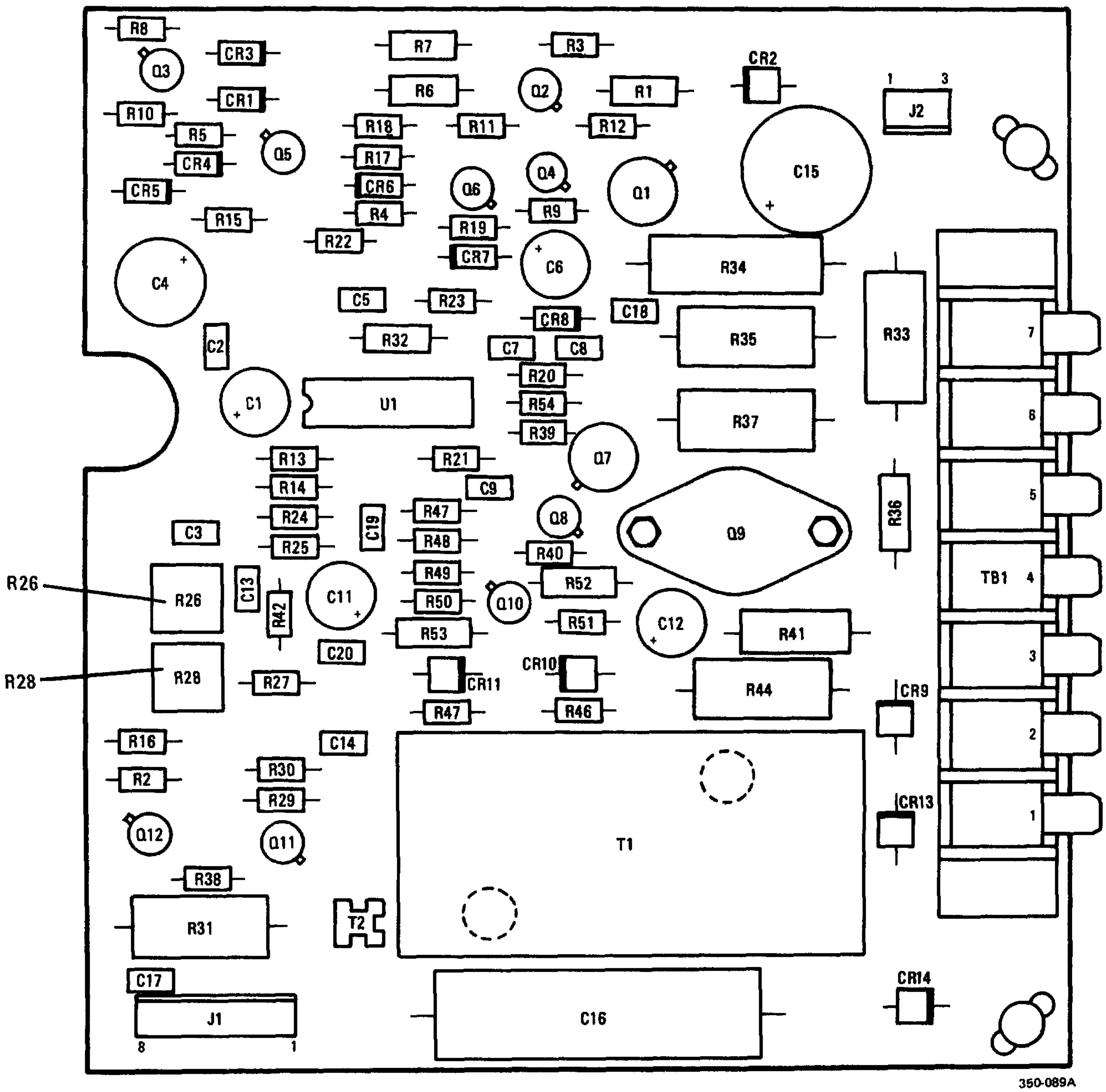


Figure 6-17. 13.6 Vdc Power Supply PWB Assy

MAINTENANCE

Section III. DIAGNOSTIC PROCEDURES

6-4. DEPOT MAINTENANCE PHILOSOPHY. The diagnostic procedures presented in this chapter assume that equipment problems have already been isolated to one of the replaceable subassemblies listed below. This has been accomplished in the field using the BIT (Built-In Test) troubleshooting approach. (For a detailed description of BIT, see Chapter 6 in the On-Equipment Manual for the 100 Watt Transceiver, T.O. 31R2-2URC-81.) As a depot maintenance technician, your job is to take these defective subassemblies returned from the field, swap them with known good subassemblies in a properly functioning 100 Watt Transceiver (the "test bed"), and troubleshoot the defective subassemblies to the component level. Once you have identified and replaced the faulty component (resistor, capacitor, transistor, etc.), you will then perform whatever adjustment or alignment procedures are required to restore the subassembly to peak operating condition. To accomplish these tasks, you will need the procedures contained in this chapter, a complete set of schematics (in Chapter 8 of this manual), and the test equipment listed in Table 6-1. Also, refer to Appendix B, "Meter Functions." The following is a list of the subassemblies covered in Section III:

NOTE

In order to find the location of components on circuit boards, refer to the circuit board layout drawings in the Alignments section of this chapter or in the Illustrated Parts Breakdown in chapter 7.

SUBASSEMBLY **PARAGRAPH**

Exciter PWB Assy, A1A1 6-5
IF Filter PWB Assy, A1A2 6-6
First Converter PWB Assy, A1A3 6-7
Power Amplifier Assy, A1A4 6-8
Low Pass Filter PWB Assy, A1A5 6-9
AGC/TGC PWB Assy, A1A6 6-10
Receiver PWB Assy, A1A7 6-11
Crystal Oscillator Assembly, A1A8 6-12
Reference/BFO PWB Assy, A1A9 6-13
Synthesizer PWB Assy, A1A10 6-14
Front Panel PWB Assy, A1A11A1 6-15
Display Assembly, A1A11A2 6-16
Transceiver Control PWB Assy, A1A12 6-17
LPA/Coupler Interface PWB Assy, A1A13 6-18
Multivoltage Supply Assy, A1A14 6-19
Interconnect PWB Assy, A1A15 6-20
Audio Interface PWB Assy, A1A16 6-21
Coupler Connector PWB Assy, A1A17 6-22
AFSK Module Assy, A1A18 6-23
Remote Control Interface PWB Assy, A1A19 6-24
Power Supply Protection and Control PWB Assy, A2A1 6-25
13.6 V Power Supply, A2A2 6-26

6-5. EXCITER PWB ASSY, A1A1.

a Preliminary Procedure.

(1) Remove the good Exciter PWB Assy from the test-bed 100 Watt Transceiver, and replace it with the faulty Exciter PWB Assy.

(2) Power up the transceiver.

(3) Connect a dummy load to the transceiver.

(4) Check for the presence of the following power supply voltages on the board. Voltages should be within 0.5 V of the nominal value, except for the +10 Vdc, which should be within 0.25 V of the nominal value.

Voltage:	Measure at:
+5 Vdc	+ side of C119
+15 Vdc	+ side of C125
-15 Vdc	- side of C122
+10 Vdc	TP2

(5) If the voltages check good, run the receive-transmit BIT test.

b. Interpreting the BIT Fault Codes. Use the fault codes listed below as a guide in troubleshooting the Exciter PWB Assy. Refer to the section corresponding to the fault code you get. In the event that the BIT test runs without generating a fault code, look for other obvious symptoms, such as no VOX operation or no PATCH transmit. Then refer to the "ADDITIONAL SYMPTOMS" section following the BIT code sections.

BIT Test Description for the
Exciter PWB Assy

(1) Checks for the presence of the Exciter PWB Assy by sending data to the board and receiving the MCB loopback bit in reply.

(2) Applies a 1 KHz test signal to the MIC input, selects USB, and keys the transceiver.

(3) Verifies the presence of the 455 KHz IF output from the Exciter PWB Assy.

(4) Verifies the presence of the 40.455 MHz IF output from the Exciter PWB Assy.

(5) Disables the 1 KHz test signal, selects AME mode, and verifies the presence of the 40.455 MHz IF output from the Exciter PWB Assy.

(6) Selects CW mode and verifies the presence of the 40.455 MHz IF output from the Exciter PWB Assy.

1A1A1-0

This fault code indicates that the microprocessor sent data to the Exciter PWB Assy but did not receive the expected MCB loopback bit in reply.

Connect an oscilloscope (a storage scope is best) to pin 11 of U24. This pin should go high momentarily at the start of the receive-transmit BIT test. If it does not, the problem is U19-U24 or their associated circuitry. If the signal at pin 11 of U24 is good, then the problem is U25, U20D, U20C, or their associated components.

1A1A1-1

This fault code indicates that there is no 455 KHz IF output from P1 on the Exciter PWB Assy.

(1) Connect an oscilloscope (a storage scope is best) to pin 15 of U11. Run the receive-transmit BIT test. You should see a 1 KHz signal at 50 mV pk-pk momentarily on the oscilloscope. If you do not, U11 or one of its surrounding components is probably bad. If the signal is good, proceed to step 2.

(2) Check the audio signal path as follows:

(a) On the transceiver, select MIC as the audio source.

(b) Set the CLIP function to off.

(c) Inject a 1 KHz, 600 uV audio signal into pin D of the front panel HANDSET/MIC connector J2.

(d) Key the transceiver with the 2ND, TX KEY buttons on the front panel.

(e) Look at TP4 with the oscilloscope. You should see a 1 KHz signal at approximately 100 mV pk-pk.

(f) If the signal at TP4 is not good, check for the signal at AR1 pin 6. If the signal is bad there, the problem is AR1 or its associated components. If the signal is good at AR1, trace the signal through the following stages:

U3, pin 14	AR7, pin 7
U5, pin 10	U9, pin 15
AR3A, pin 1	U9, pin 12
U9, pin 3	U11, pin 4

(g) If the signal at TP4 is good, proceed to step 3.

(3) Check the BFO as follows:

NOTE

The transceiver is keyed during the following steps.

(a) Check pin 8 of U12 for a 455 KHz signal at 300 mV pk-pk.

(b) If the signal is not good there, check for a problem in CR11 or its associated components. If these components appear good, check for a problem in the CARRIER ENABLE line. Skip to step 4.

(c) If the signal is good at U12 pin 8, connect a spectrum analyzer to P1 and check for 454 and 456 KHz at -35 dBm each. If these signals are bad, the problem is probably U12. If the signals are good, the problem is in the BIT Detector circuit (Q2, Q3, and their associated components).

(4) Check the CARRIER ENABLE line as follows:

NOTE

The transceiver is keyed during the following steps.

(a) Check the collector of Q25. You should see approximately +5.50 Vdc. If it is high, there is probably something wrong in the CR11 circuitry at the pin 8 input to U12.

(b) If the collector of Q25 is low, check for a low at pin 9 of U15. If it is low, either Q25 is bad or the CARRIER ENABLE line is shorted to ground.

(c) If pin 9 of U15 is high, check for a high at pin 5. If pin 5 is not high, the problem is in U27, U11, U13, U14A, U14B, or Q21.

(d) If pin 5 is high, check for a low at pin 6. If pin 6 is not low, the fault is probably in U14C or Q22.

(e) If pin 6 is low, verify that pins 3 and 7 are high. Check for a low at pin 10. If these levels are not correct, U15 is probably bad.

(f) If pins 3, 7, and 10 are good, check for a high at pin 2. If pin 2 is not high, the fault is probably in AR10A, Q24, or U16 (less likely).

(g) If pin 2 is high, the problem is probably U15.

1A1A1-2

This fault code indicates that there is no 40 MHz IF output at J3 in the transmit USB mode.

(1) Set up the transceiver as follows:

(a) Select USB on the front panel.

(b) Inject a 455 KHz, -18 dBm signal at P2.

(c) Connect a spectrum analyzer to J3, with a 10 dB attenuator pad between the analyzer and J3.

(2) Key the transceiver by pressing 2ND, TX KEY. You should see a 40.455 MHz signal at -6 dBm (+/-2 dB) on the analyzer (this takes into account the attenuator pad). If the signal is good, proceed to step 3. If it is bad, proceed to step 4.

(3) The BIT Detector circuit is at fault. Check it as follows:

(a) Since the BIT Detector is active only during the BIT test, you must unsolder the end of R200 that connects to pin 11 of U21.

(b) Apply +5 Vdc to the disconnected end of R200. (You may use the +5 Vdc on the board by connecting a jumper to R200.) The BIT Detector is now activated.

(c) Check for a low on the collector of Q20. If it is not low, work your way back through Q20, Q19, Q28, and their associated components.

(4) Look at the collector of Q7 with an oscilloscope. You should see a 455 KHz signal at 17 V pk-pk. If this signal is bad, the problem is in Q4-Q7 or their associated components. Another possibility is a fault in the ALC circuitry. Check it as follows:

(a) Look at AR12 pin 1 with a DC voltmeter.

(b) If the voltage is +8.2 Vdc or greater, then the problem is in CR17 through AR12.

(c) If the voltage at AR12 pin 1 is less than +7.8 Vdc, check TP1.

(d) If TP1 is +2.0 Vdc or greater, the problem is in the AR12 or Q9 circuitry. If TP1 is less than +1.6 Vdc, then the problem is the Q10, Q11, or CR15 circuitry.