

TECHNICAL MANUAL

GENERAL SUPPORT MAINTENANCE MANUAL

RADIO SET
AN / PRC- 1 04(A)
(NSN 5820-01-141-7953)

HEADQUARTERS, DEPARTMENT OF THE ARMY
15 JANUARY 1986



5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

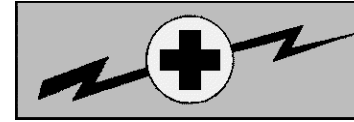
1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION



HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operator's, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections or 115 volt ac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

Warning: Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

For Artificial Respiration, refer to FM 21-11.

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. Unless specifically directed in this manual, do not replace components or make adjustments inside the equipment with any power supply turned on. Under certain conditions, dangerous potentials may exist in the power supplies when the power control is in the off position. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

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

FIRST AID

Each person engaged in electrical operations will be trained in first aid, particularly in the technique of mouth to mouth resuscitation and closed chest heart massage (FM 21-11).

The following warnings appear in this volume, and are repeated here for emphasis.

WARNING

A 3-wire (line, neutral, and safety ground) AC line power connections is required when operating the equipment. If a 3-wire safety grounded AC power receptacle is not available, a separate ground wire must be installed from the chassis ground to an earth ground. Without an adequate ground, the equipment chassis and frame will float to a dangerously high potential.

WARNING

Lethal voltage is used in the operational checkout of this unit. Death on contact may result if personnel fail to observe the following safety precautions. Remove watches and rings and exercise extreme caution when working inside the equipment throughout the remainder of this procedure.

WARNING

Prior to performing the following functions all electrical power is to be removed from the system. External power disconnected and a "MAINTENANCE IN PROGRESS" tag attached or power switches will be locked out to prevent inadvertent energizing of the system.

WARNING

Lifting heavy equipment incorrectly can cause serious injury. Do not try to lift more than 35 pounds by yourself. Get a helper. Bend legs while lifting. Don't support heavy weight with your back.

Technical Manual
No. 11-5820-919-40-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 January 1986

**GENERAL SUPPORT MAINTENANCE MANUAL
RADIO SET
AN/PRC-104A
(NSN 5820-01-141-7953)**

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSELME-MP, Fort Monmouth, NJ 07703-5007. A reply will be furnished to you.

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 available for Army use In maintaining
 this equipment.

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SECTION 0**GENERAL**

0-1. SCOPE. This manual covers Radio Set AN/PRC-104(A). This manual provides instructions for general support maintenance. Throughout this manual AN/PRC-104 should be AN/PRC-104(A).

0-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

0-3. MAINTENANCE FORMS, RECORDS, AND REPORTS

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.74AJAFR400-54/MCO 4430.3F.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19/DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your Radio Set AN/PRC-104(A) needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703-5007. We'll send you a reply.

0-5. ADMINISTRATIVE STORAGE. Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in TM 740-90 1.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL. Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244 2.

INTRODUCTION

This technical manual provides maintenance prints for Radio Set ANtPRC-104 (radio set). It is used in conjunction with the general instructions, maintenance information, and theory contained with the general instructions, maintenance information, and theory contained in TM 11-5820-919-40-1. For parts ordering information refer to TM 11-5820-919-24P

Maintenance prints are provided for the radio set; the receiver/exciter unit and its 5 modules; and the amplifier/coupler unit and its 2 modules. The maintenance prints radio set and the two units are the same as those contained in TM 11-5820-919-40-1. The maintenance prints include schematics, power distribution; component location; test and alignment setup; performance test; and alignment procedures.

Schematic diagrams contain pertinent voltage and waveform reference data to assist in fault isolation and are used in conjunction with the performance test flowcharts.

Component location diagrams locate and list every replaceable component, and identify the location of test points and pins required to monitor voltages and waveforms on performance test flowcharts.

Test and alignment setup diagrams provide a list of test equipment, a list of special tools and materials, fabricated cables and fixtures, and initial connections for the test setup. They are used in conjunction with the performance test flowcharts. Module performance tests may be performed more easily if the module is tested while inside the radio set, rather than extended via cables. Once a fault is indicated, the module should be removed from the radio set and connected via appropriate extender cables.

Performance test flowcharts provide performance test (heavy flow line) and troubleshoot mug procedures (light flow line) for fault isolating to a component or group of components. The flowcharts are supported by the reference information provided in the other diagrams.

Alignment procedures are used in conjunction with the performance test flowcharts.

NOTE

Poor electrical connection due to dirty or bent connector plus may often be the cause of equipment malfunction or faulty test indication. All electrical connections should be double-checked before proceeding with test or fault isolation.

TECHNICAL CHARACTERISTICS

Characteristic	Description	Characteristic	Description	Characteristic	Description
RADIO SET AN/PRC-104 (Radio Set)					
Frequency Range	2.0000 to 29.9999 MHz in. 0.0001 MHz (100 Hz) increments (280,000 possible frequency settings)	Power Requirements	20.0 to 32.0 vdc with input at 3.5 amp (24 vdc) for transmit (typical). 200 ma for receive (typical).	Audio Distortion	5 percent at 5 mw, 350 to 3000 Hz
Frequency Accuracy	±1 ppm for -51°F (-46°C) to +160°F (+71°C) (±2 to 30 Hz of setting) from 2 to 30 MHz respectively.	Operating Temperature Range Environmental	-51°F (-46°C) to +160°F (+71°C) Meets applicable provisions of MIL-STD-810B	Desensitization (signal to degrade SINAD 3 db)	±2.5% to -29 dbm; ±10% to -15 dbm; ±50% to +17 dbm
Operating Modes	- Single sideband (selectable USB or LSB) - Voice/cw (Morse or burst cw at 300 wpm) - Data (FSK or DPSK up to 2400 bps) compatible with 75 baud military teletype - Receive only (inhibits transmit operation)	Mean Time Between Failure (MTBF)	2500 hours (demonstrated per MIL-STD-785)	RF Output Power	0.3 W (PEP) for RT-1209, 20W (PEP or average) with AM-6874
Audio Input Impedance and Level	150 ohms, -56 dbm (voice) or, 6 mv. RMS.	Mean Time to Repair (MTTR)	15 minutes (module replacement)	Intermodulation Distortion (IMD)	-25 db (two equal tones at rated output power)
RP Output Power	600 ohms, 0 dbm (data) or, 77 v. RMS, 20w (PEP), 0.25w (PEP) exciter output	Dimensions	12 1/2 x 10 1/2 x 2 5/8 (31.75 cm x 26.67 cm x 6.66 cm) D x U x H	Harmonic Radiation	-50 db
RF Output Impedance	50-ohms, unbalanced. Output protected to infinite VSWR due to antenna short or open.	Weight	14 pounds (6.36 Kg), including 4.8 AN silver zinc battery (without accessories)	Carrier Suppression	-42 db
Antenna Tuning	Automatic to 1.5:1 VSWR (3 seconds tuning time, typical)	Sensitivity	RECEIVER	Unwanted Sideband Suppression	-45 db
		SSB, Cal, FSK	0.7 v for 10 db SINAD (-110 dbm voice, -70 dbm data)	All Other Spurious	-45 to -60 db
		Selectivity		Duty Cycle	1 minute continuous keydown, 9:1 transmit/receive ratio
		SSB, CW, FSR	2.5 kHz Bandwidth at -3 db	Battery	BATTERY PACK
		Image Rejection	6.0 kHz Bandwidth at -60 db		Silver-zinc (AgZn), rechargeable 4.8 AH
		I.F. Rejection	70 db		
		Audio Output	60 db		
			25 tow into 500 (nominal)		

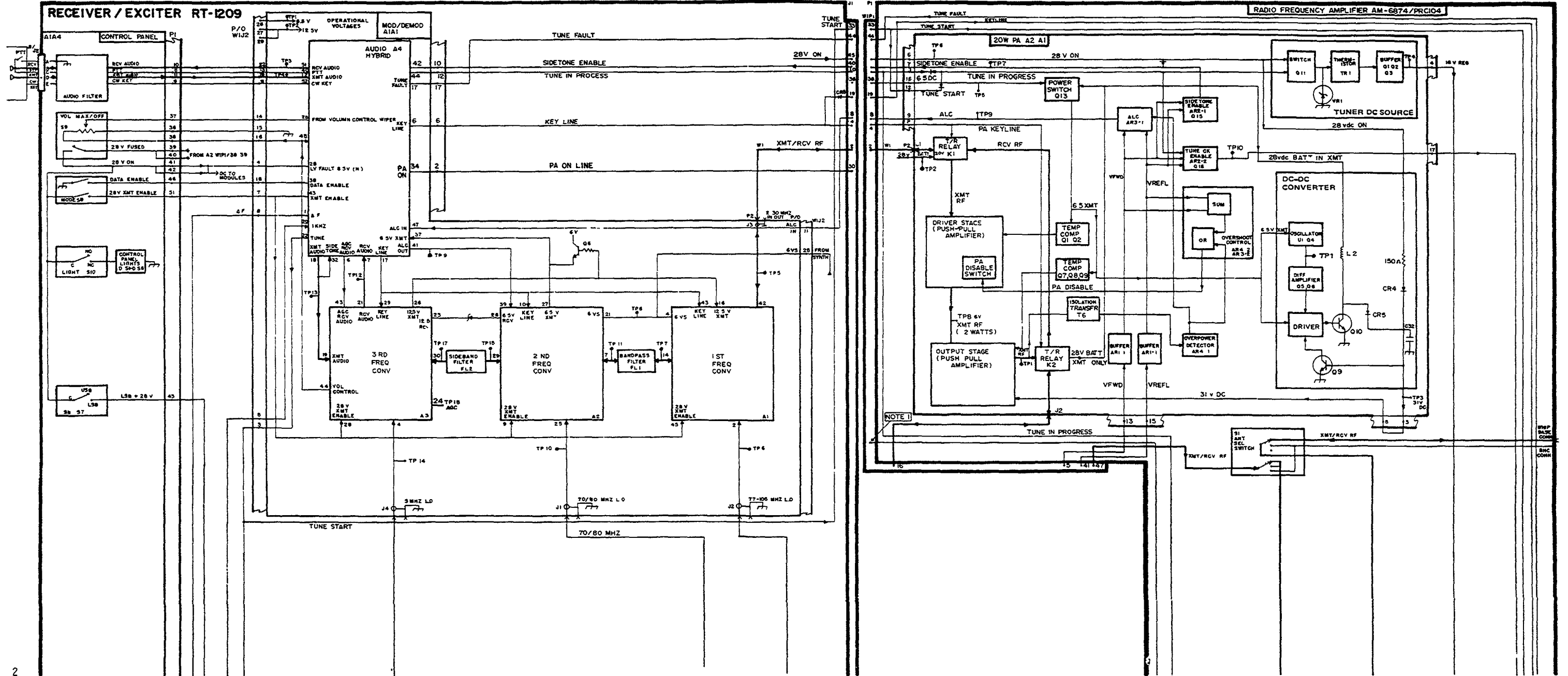


Figure 1-1. Radio Set Block Diagram (Sheet 1 of 2)

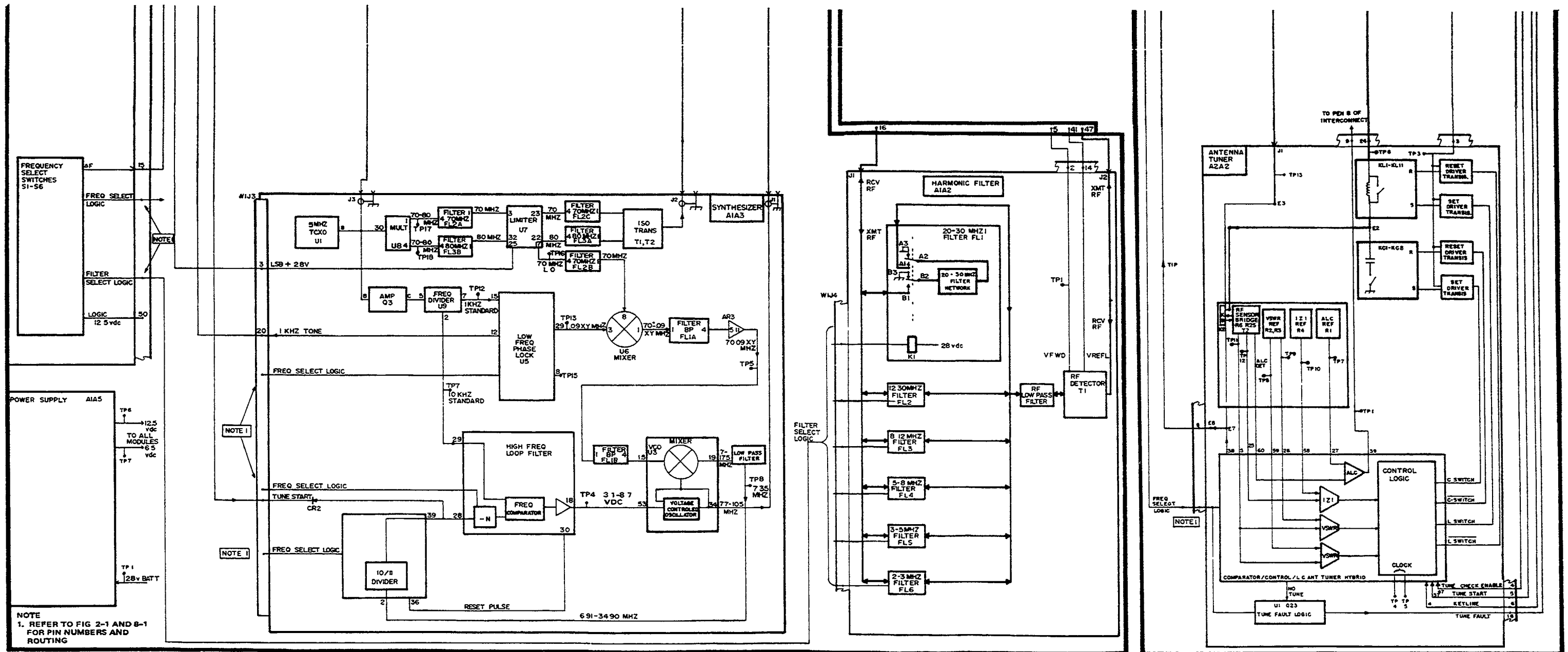


Figure 1-1. Radio Set Block Diagram (Sheet 2 of 2)

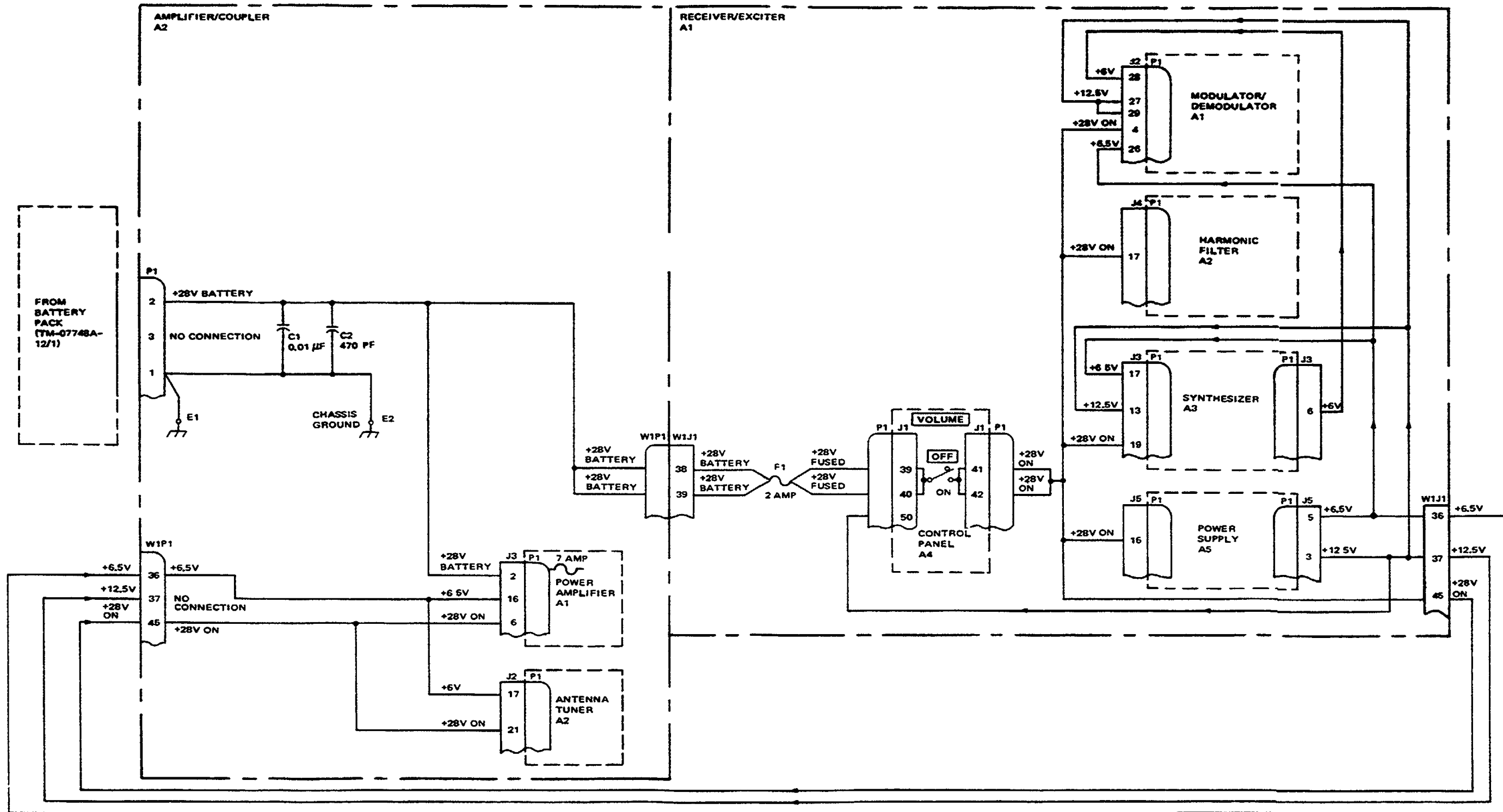


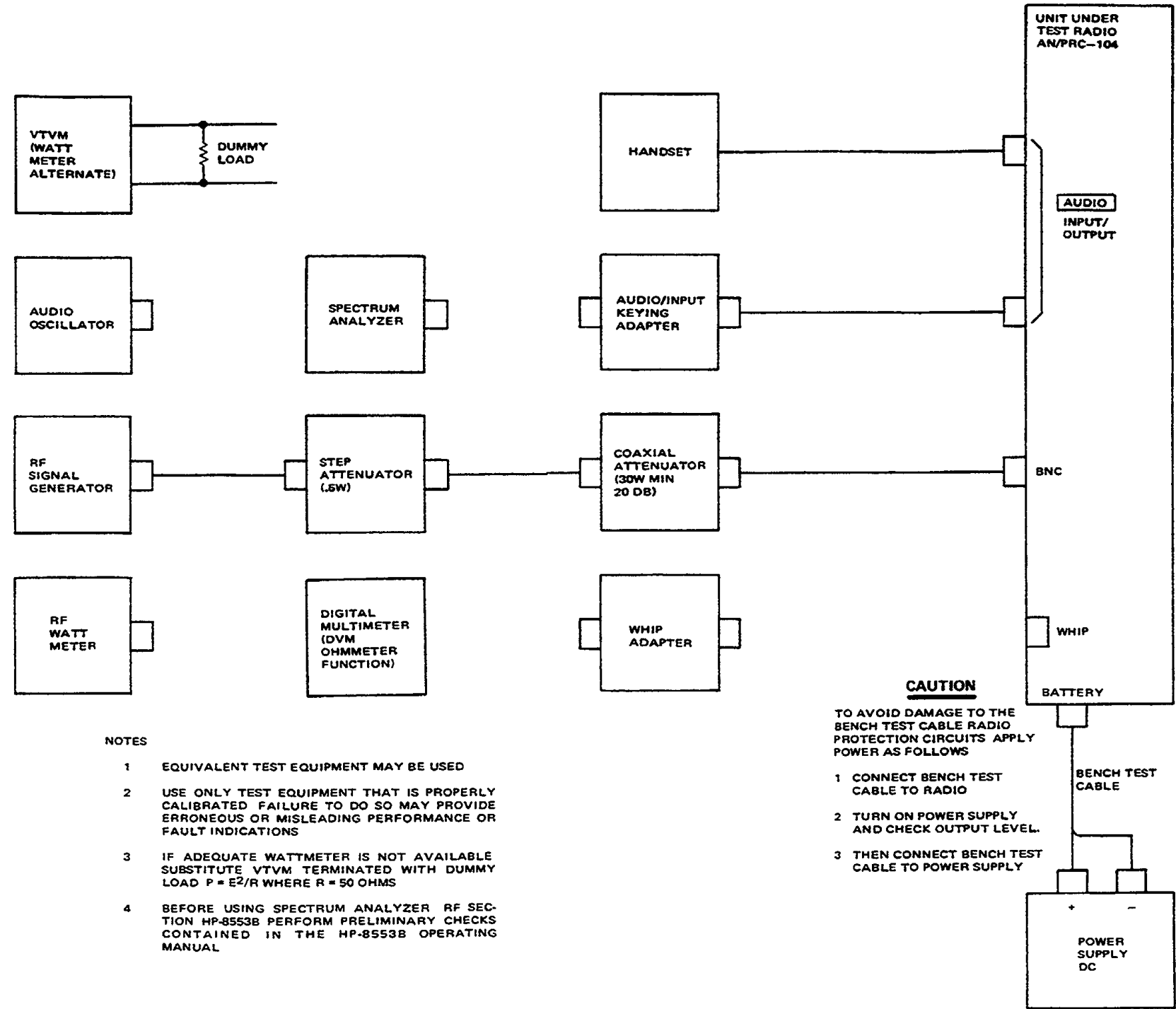
Figure 1-2. Radio Set Power Distribution

SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Audio Input/Keying Adapter	...	Figure 3-11C
Whip Adapter	...	Figure 3-11D
Kit, Tool, Electrons	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT		
Name	Designation	Quantity
Audio Oscillator	AN/URM-127	1
VTVM	AN/USM-116	1
Dummy Load (50 ohm)	DA-553()/4	1
Signal Generator, RF	AN/USH-323	1
Digital Multimeter (DVM, oh meter function)	AN/USM-341	1
Attenuator, Step CN-1128/U 1 10-db steps, 0.5w, 50 ohm		
Watt Meter, RF		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power	Hewlett Packard HP-8482A	1
Sensor		
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution	Hewlett Packard HP-8552B	1
IF Section		
- RF Section Hewlett	Packard HP-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
Attenuator, Coaxial	Narda 765-20	1
Power Supply, DC	Hewlett Packard HP-6439B	1



- NOTES
- 1 EQUIVALENT TEST EQUIPMENT MAY BE USED
 - 2 USE ONLY TEST EQUIPMENT THAT IS PROPERLY CALIBRATED FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OR FAULT INDICATIONS
 - 3 IF ADEQUATE WATTMETER IS NOT AVAILABLE SUBSTITUTE VTVM TERMINATED WITH DUMMY LOAD $P = E^2/R$ WHERE R = 50 OHMS
 - 4 BEFORE USING SPECTRUM ANALYZER RF SECTION HP-8553B PERFORM PRELIMINARY CHECKS CONTAINED IN THE HP-8553B OPERATING MANUAL

Figure 1-3. Radio Set Performance Test Setup

NOTE 1:

RADIO SET PERFORMANCE TEST

	Radio Set Frequency (kHz)	Sideband	RF Signal Generator Frequency (MHz)
No. 1.	a.	USB	2.2220
	b.	LSB	2.2200
No. 2.	a.	USB	3.3350
	b.	LSB	3.3330
No. 3.	a.	USB	6.6660
	b.	LSB	6.6640
No. 4.	a.	USB	8.8900
	b.	LS	8.8880
No. 5.	a.	USB	15.5550
	b.	LSB	15.5530
No. 6.	a.	USB	27.7790
	b.	LSB	27.7770

NOTE 2: Harmonic filter bands are 2-3 MHz, 3-5 MHz, 5-8 MHz, 8-12 MHz, 12-20 MHz, and 20-30 MHz.

NOTE 3: For a thorough test, use all the test frequencies listed in Note 1 on USB only.

NOTE 4: Frequency must be changed each time to cause tune-up tone when PIT is closed.

NOTE 5: See page 8.

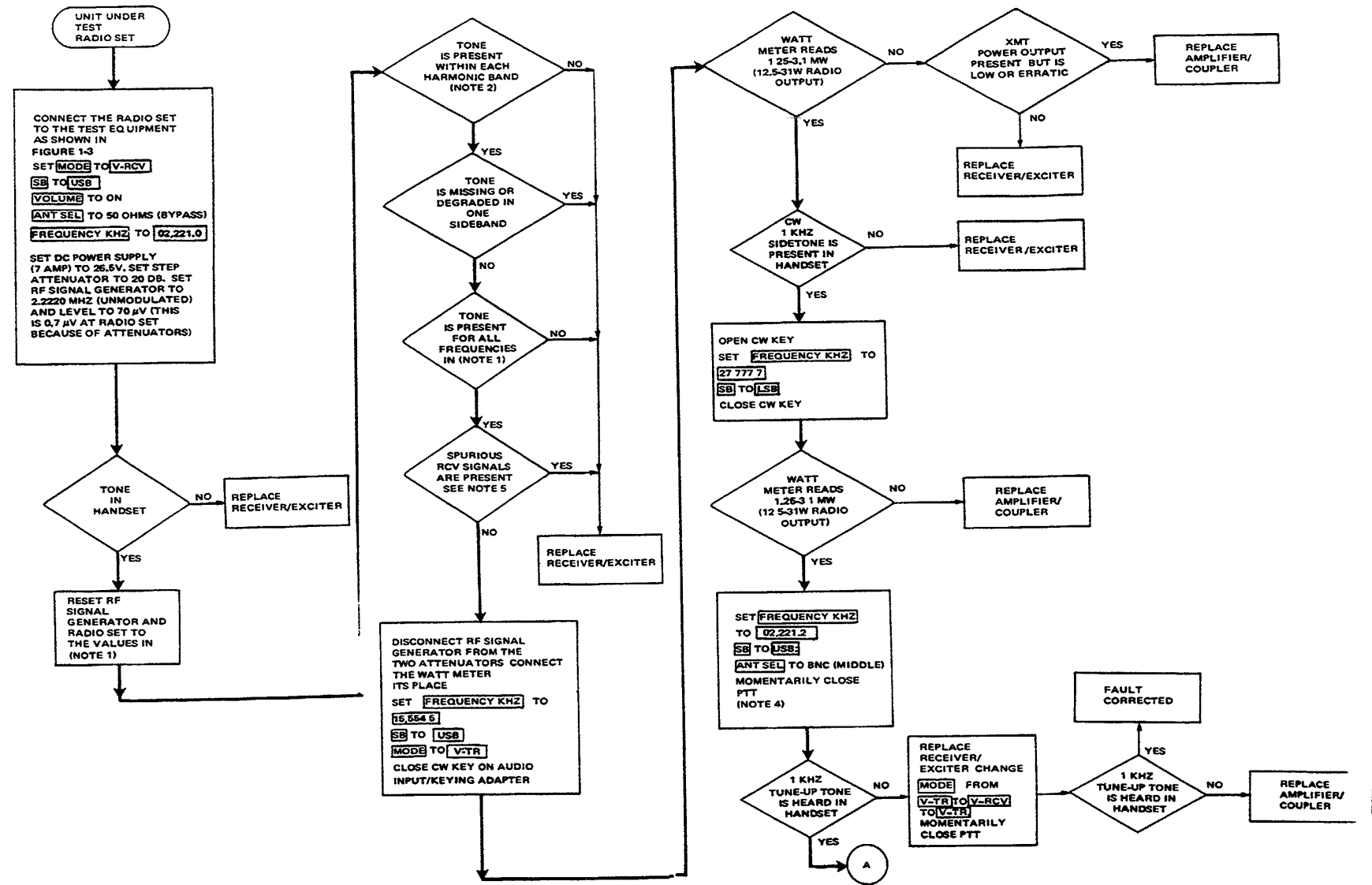


Figure 1-4. Radio Set Performance Test (Sheet 1 of 2)

- REVALIDATE
- BANDWIDTH 300 KHZ
 - SCAN (INNER RED) PER DIV 20 DB
 - INPUT ATTEN 0-110 MHZ
 - RANGE 50 MHz
 - CENTER FREQ 100 HZ
 - VIDEO FILTER SINGLE
 - SCAN MODE 10 DB LOG
 - 10 DB LOG AUTO
 - SCAN TRIGGER 10 DB
 - LOG REF 0
 - LINEAR SENSITIVITY 10 MHZ
 - SCAN WIDTH 1 SECOND
 - SCAN TIME STD
 - STORAGE CENTERED
 - INTENSITY
-
- BANDWIDTH 0.1 KHZ
 - SCAN 1 KHZ/DIV
 - INPUT ATTEN 20 DB
 - RANGE 0-110 MHZ
 - CENTER FREQ 16,000 MHZ
 - VIDEO FILTER 10 HZ
 - SCAN MODE SINGLE
 - 10 DB LOG 10 DB LOG
 - SCAN TRIGGER AUTO
 - LOG REF +10 0 DB
 - LINEAR SENSITIVITY* -12 DB
 - SCAN TIME/DIV 2 SECONDS
 - STORAGE STD
 - INTENSITY CENTERED

*VARY LINEAR SENSITIVITY TO OBTAIN WAVEFORM LEVEL SIMILAR TO FIGURE B

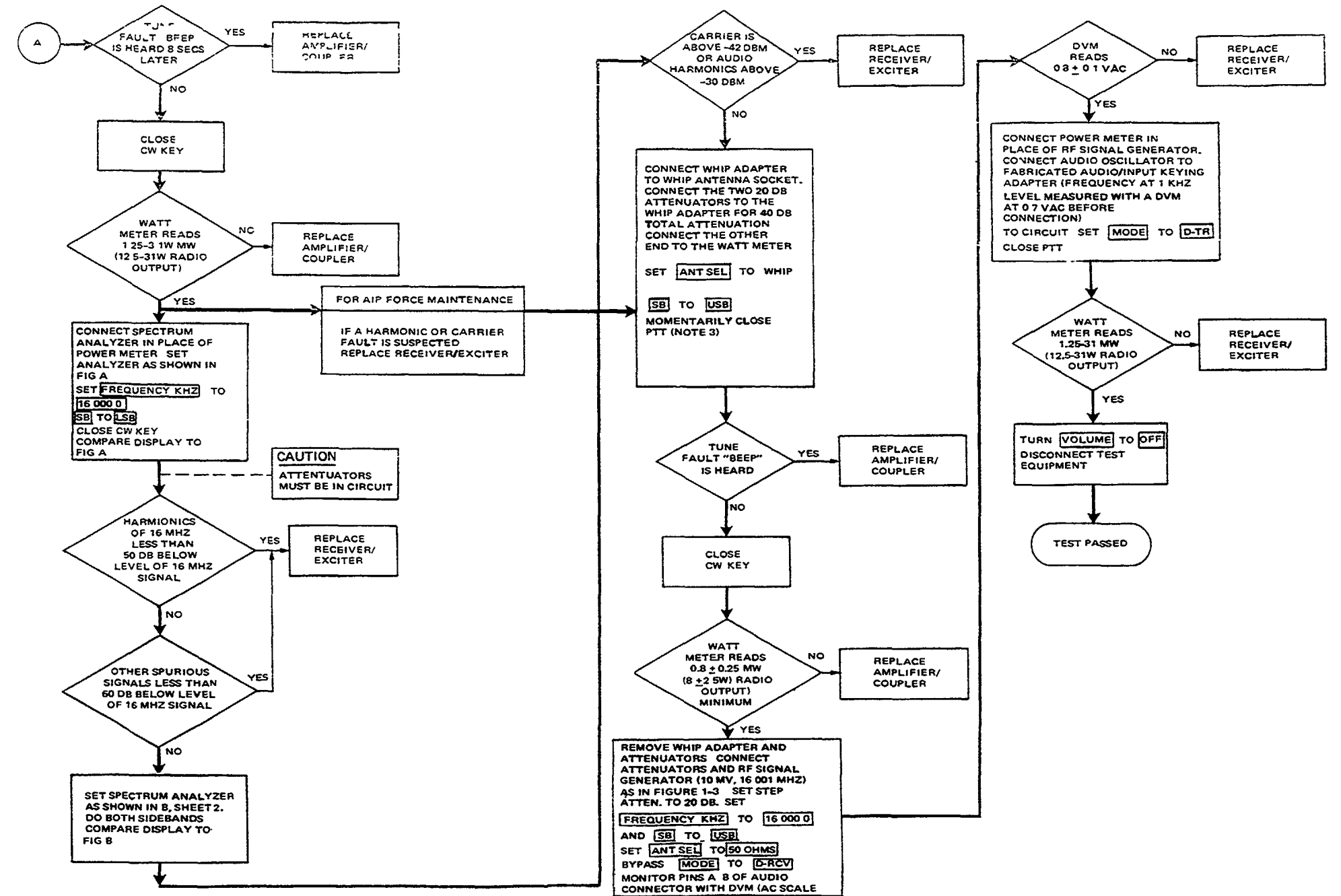
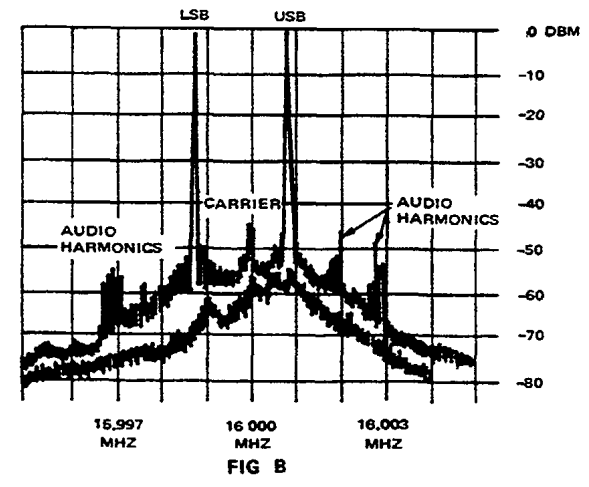
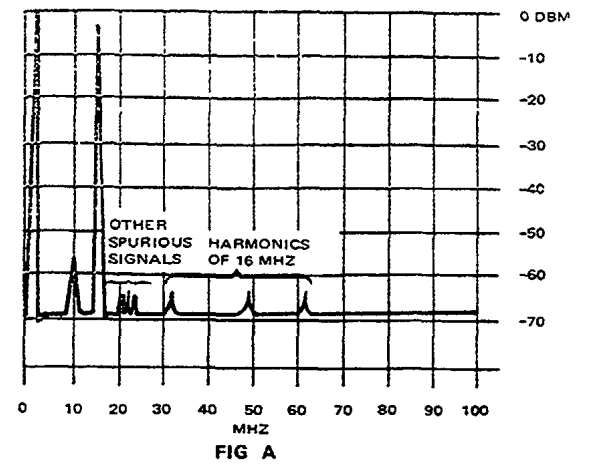


Figure 1-4. Radio Set Performance Test (Sheet 2 of 2)

NOTE 5. SPURIOUS RECEIVE SIGNALS

1. A spurious receive signal is an audio tone heard in the handset in receive when no tone should be present (i.e., no signal present at the antenna connector). These signals are produced as a result of interaction (harmonic crossover) between the first and second local oscillators. Military specifications for this radio set permit a maximum of 200 spurious signals to be generated within the frequency synthesizer, A1A3, without adversely affecting the radio set's acceptability. Table A lists those frequencies at which acceptable spurious signals may be encountered in some radio sets. In addition to those frequencies listed in table A are the fundamental of the 5 MHz local oscillator (see frequency [sited on case of 5 MHz L.O., A1A3U1]).

2. Use of table A: For each frequency listed at which acceptable spurious signals may be encountered, there are several dial frequencies at which audible tones may be heard.

Example: Internally generated spurious signal at 13.5000 MHz.

- a. With a dial frequency of 13,501.0KHz, LSB selected, the audio tone produced would be 1.0 KHz.
- b. With a dial frequency of 13,498.6~Bz, USB selected, the audio tone produced would be 1.4 KHz.

TABLE A

FREQ (MHz)	FREQ (MHz)	FREQ (MHz)	FREQ (MHz)	FREQ (MHz)
2.2222	5.6250	12.0833	17.7777	25.3571
2.5000	5.7143	12.5000	17.9167	25.4167
2.9412	5.8000	12.7273	17.9169	25.5555
3.0555	5.8333	12.8125	18.6666	25.6250
3.1250	6.0000	12.9167	18-7500	25.7143
3.3333	6 1338	13.1250	18.8235	26.0000
3.4375	6 2500	13.3333	18.8888	26.2500
3.5294	6.6666	13.5000	19.0909	26.3636
3.7500	7.0833	13.6111	19-1666	26.6666
4.0000	7.2727	13.6364	19.6429	26.9231
4.0625	7.5000	13.7500	20.0000	27.1429
4 1666	7.6471	14.0000	20.3125	27.2727
4 2857	7 8125	14.1176	20.3571	27 5000
4.3750	8 0000	14.2857	20.5000	27 6923
4.4444	8.1818	14.3750	20.6250	28.2143
4.5000	8.6375	14.4444	20.6666	28.5000
4.5455	8.5000	14.5455	20.9091	28.5714
4.5833	8.6666	14.6875	21.3333	28.7500
4.6154	8.9474	14.7059	21.5000	29.1666
4 6429	9.1666	15.3125	21.5385	29.2308
4 6666	9 3333	15.3333	21-7857	29.3750
4.6875	9 5000	15.3571	21.8750	29.5000
4 7059	9.6429	15.5000	22.0000	29.5833
4 7222	9 6875	15.6250	22.2222	29.9999
4.7368	9 7222	15.7141	22.3077	
5 2632	10.0000	15.7143	22.5000	
5 2777	10.3125	16.0000	23.0769	
5.2941	10.3371	16.0714	23.3333	
5.3125	10 6666	16.1538	23.5000	
5.3333	10 7692	16.5000	23.7500	
5.3571	11.0714	16.6000	23.8462	
5.3846	11.1111	16.7857	24.0000	
5 4167	11.2500	16.9231	24.2857	
5 4545	11 5385	17.1429	24.3750	
5.5000	11 8182	17.5000	24.5833	
5.5555	11.8750	17.6923	24.6875	

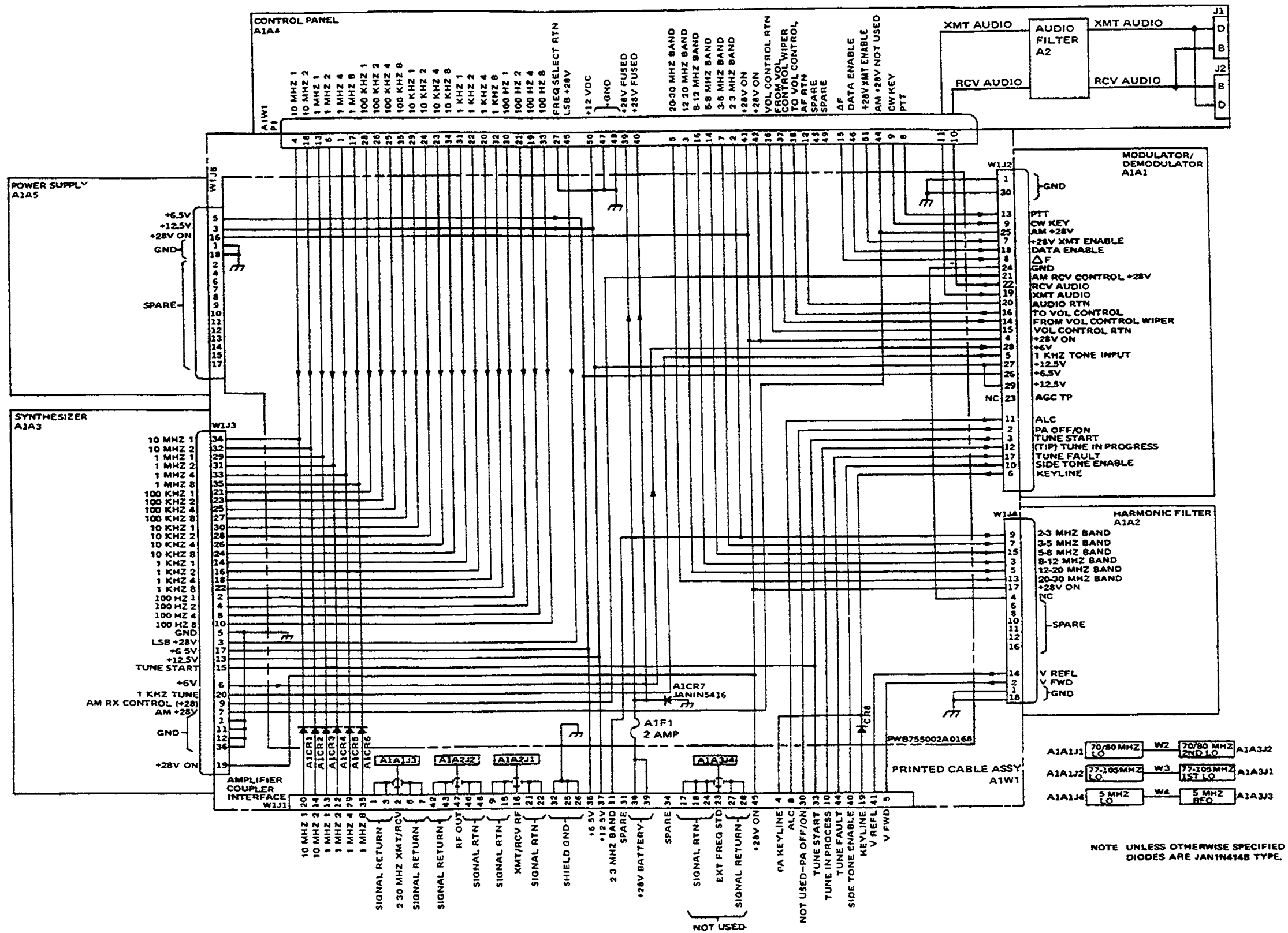
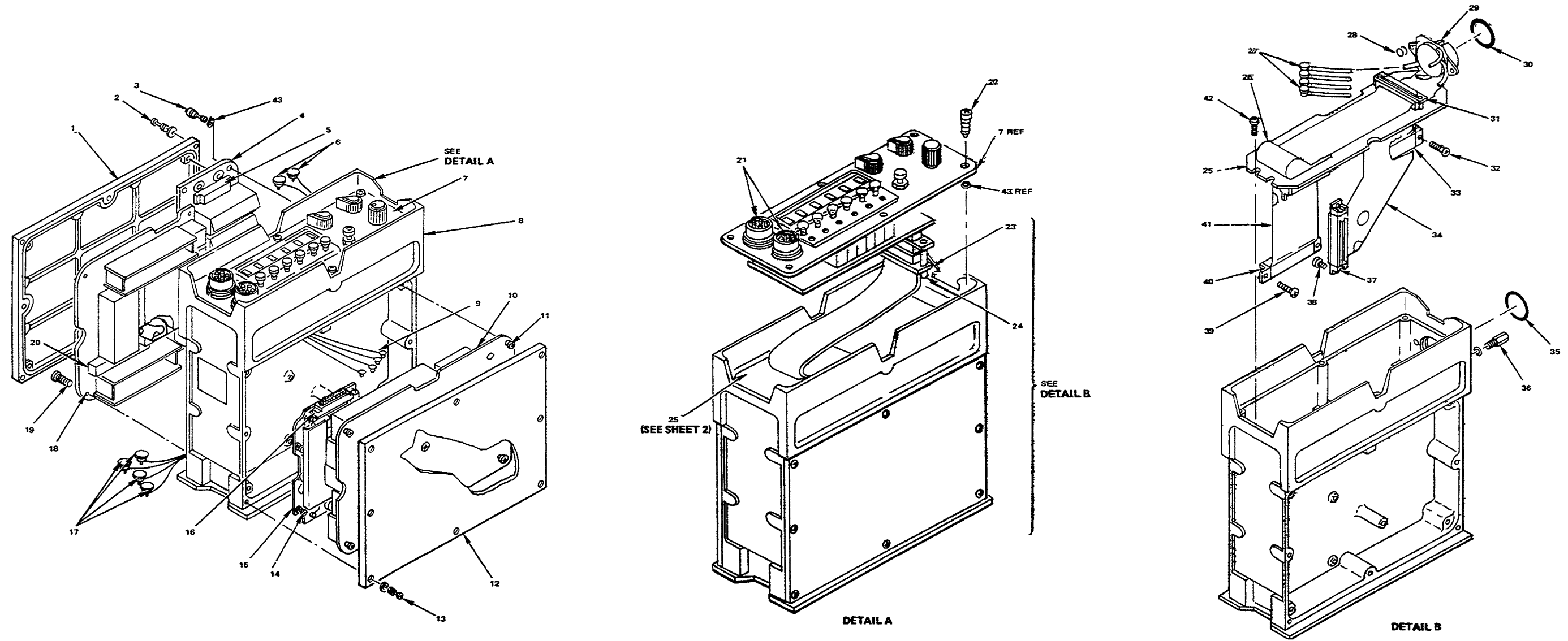


Figure 2-1. Receiver/Exciter A1 Interconnection Schematic

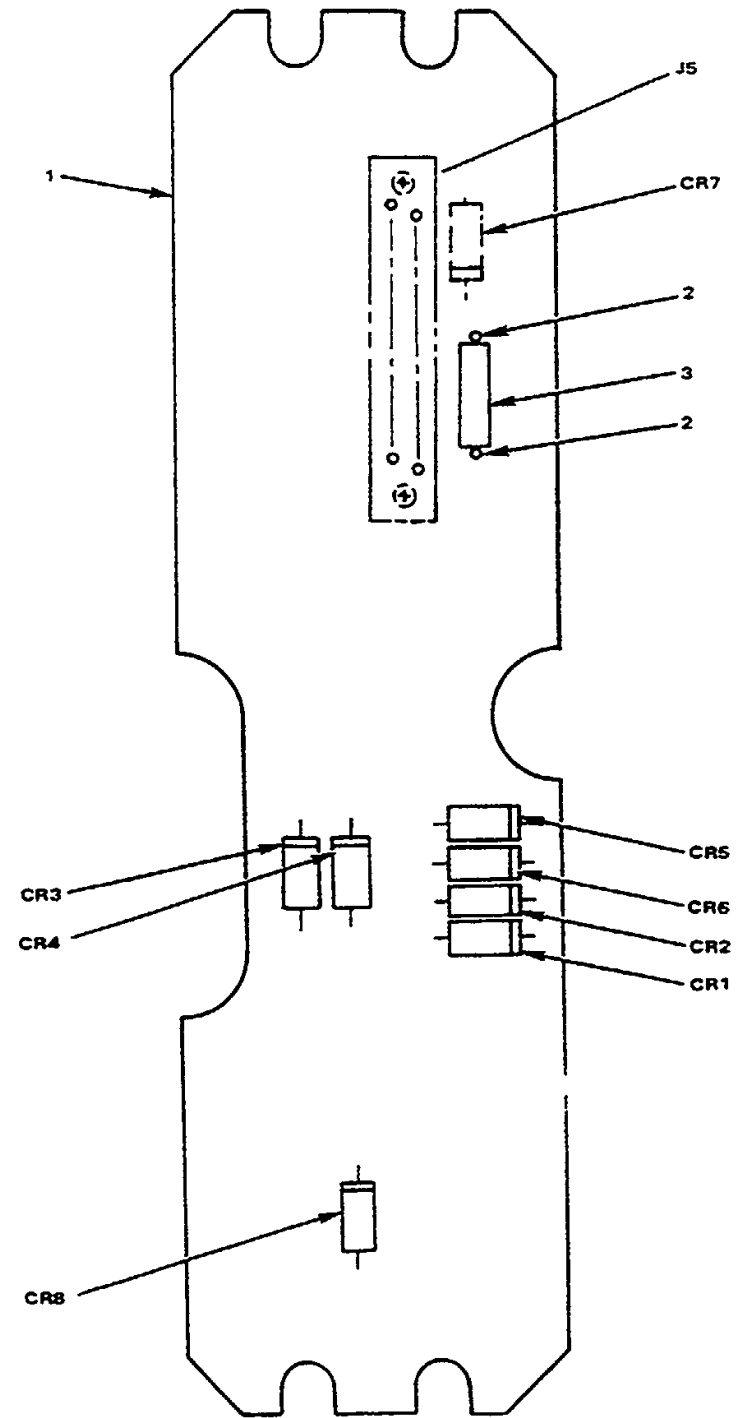
Figure 2-2. Receiver/Exciter A1 Component Location (Sheet 1 of 2)



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	Cover Assembly	23.	Multipin Connector A1A4P1
2.	Screw, Captive (8 places)	24.	Captive Allen Screw (2 places)
3.	Screw, Captive (4 places)	25.	Printed Wiring Board
4.	Harmonic Filter Module A1A2	26.	Ribbon Cable Assembly
5.	Multipin Connector (Harmonic Filter Module) A1A2P1	27.	RF Cables A1A2J2(W1) A1A2J1(W1), A1A2J3(W1), A1A2J4(W1)
6.	RF Cables A1A2J1(W1P4), 1 A1A2J2(W1P3)	28.	Mount mug Nut (2 places)
7.	Control Panel cover Assembly (Face) A1A4	29.	Jack Receptacle Connector J1
8.	Receiver/Exciter A1	30.	Packing, Preform
9.	RF Cables A1A3J3(W4), A1A3J4(W1P5), A1A3J2(W2), A1A3J1(W3)	31.	Connector, Plug (Multipin) A1A4P1
10.	Synthesizer Module A1A3	32.	Mounting Screw (2 places)
11.	Screw, Captive (5 places)	33.	Multipin, Connector, A1A2J4
12.	Cover, Assembly	34.	Ribbon Cable Assembly A1W1
13.	Screw, Captive (8 places)	35.	Packing, Preform
14.	Screw, Captive (4 places)	36.	Connector, Stud
15.	Power Supply Module A1A5	37.	Multipin Connector A1A3J3
16.	Multipin Connector A1A5P1	38.	Mounting Screw (2 places)
17.	RF Cables A1A1J1(W2), A1A1J2(W3), A1A1J3(W1P2), A1A1J4(W4)	39.	Mounting Screw (2 places)
18.	Modulator/Demodulator Module A1A1	40.	Multipin Connector A1A1J2
19.	Screw, Captive (4 places)	41.	Ribbon Cable Assembly A1W1
20.	Multipin Connector A1A1P1	42.	Circuit Board Mounting Screws, A11en (4 places)
21.	Audio Connector Plugs A1A4J1, J2	43.	.020" C Spring Clip (22 places)
22.	Screw, Captive (6 places)		

DISASSEMBLY NOTE

When disassembling radio or modules for the first time it may be necessary to heat screws to loosen the loctite compound applied at the factory



ITEM	DESCRIPTION
1	Printed Wiring Board
J5	Connector, Receptacle
CR7	Diode
2	Lead Socket
3	Fuse, Instr
CR5	Diode
CR6	Diode
CR2	Diode
CR1	Diode
CR8	Diode
CR3	Diode

Figure 2-2. Receiver/Exciter A1 Component Location (Sheet 2 of 2)

Figure 2-3. Receiver/Exciter A1 Performance Test Setup

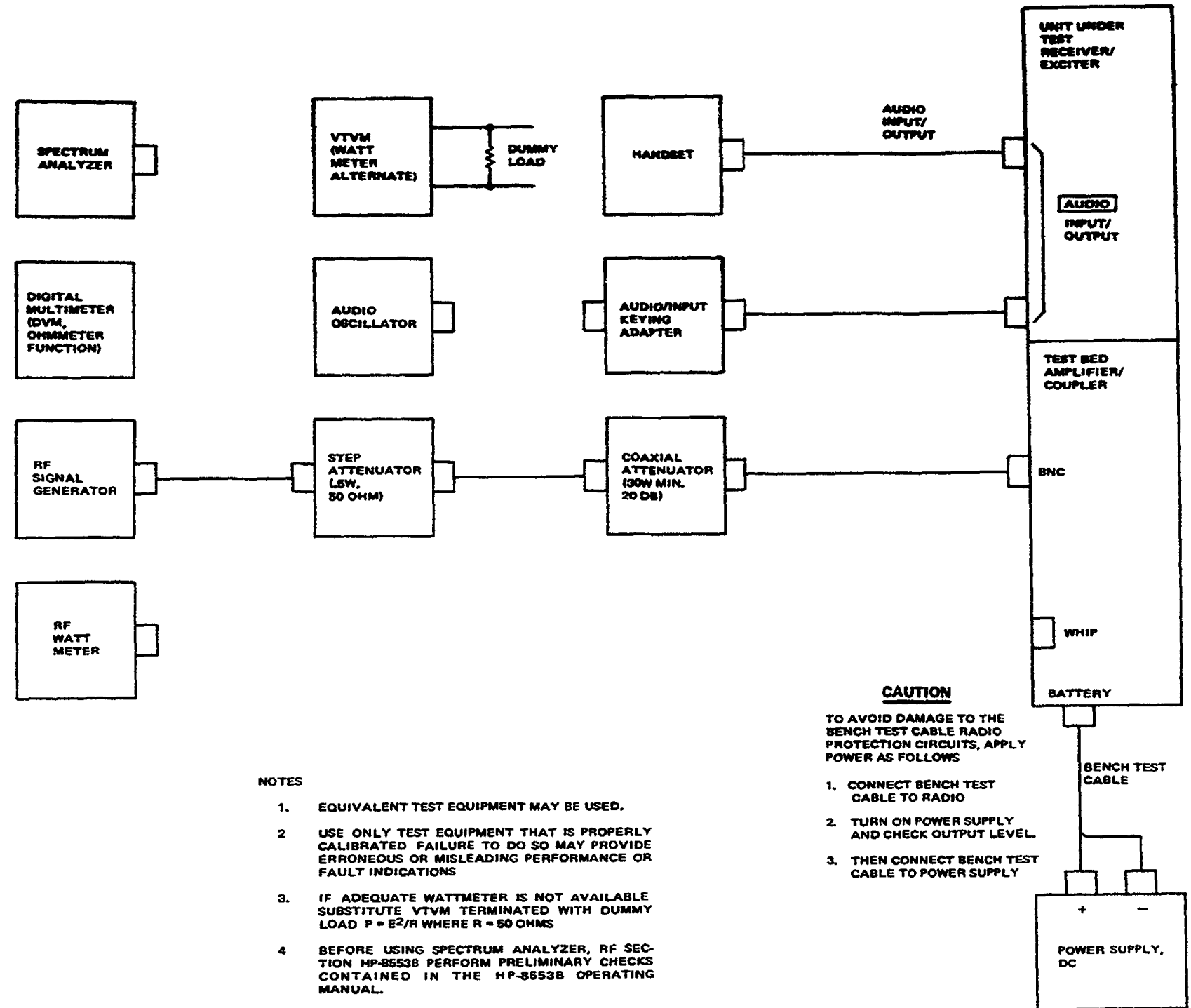
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Audio Input/Keying Adapter	•••	Figure 3-11C
Lip Adapter	•••	Figure 3-11D
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MR-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Audio Oscillator	AN/URM-127	1
VTVM	AN/USM-116	1
Dummy Load (50 ohm)	DA-553()/4	1
Signal Generator, RF	AN/USM-323	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Attenuator, Step 10-db steps, 0.5w, 50 ohm	CN-1128/U	1
Watt Meter, RF		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution IF Section	Hewlett Packard HP-8552B	1
- RF Section	Hewlett Packard HP-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
Power Supply, DC	Hewlett Packard HP-6439b	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1



RECEIVER/EXCITER PERFORMANCE TEST

NOTE 1:

	Radio Set Frequency (kHz)	Sideband	RF Signal Generator Frequency (MHz)
No. 1. a.	2,221.0	USB	2.222
b.	2,221.0	LSB	2.220
No. 2. a.	3,334.0	USB	3.335
b.	3,334.0	LSB	3.333
No. 3. a.	6,665.0	USB	6.666
b.	6,665.0	LSB	6.664
No. 4. a.	8,889.0	USB	8.890
b.	8,889.0	LSB	8.888
No. 5. a.	15,554.0	USB	15.555
b.	15,554.0	LSB	15.553
No. 6. a.	27,778.0	USB	27.779
b.	27,778.0	LSB	27.777

NOTE 2: Harmonic bands are 2-3 MHz, 3-5 MHz, 5-8 MHz, 8-12 MHz, 12-20 MHz, and 20-30 MHz.

NOTE 3: Replace original modules in reverse order (except for the faulty module) and listen for tone in handset. Otherwise, the good modules would be condemned as faulty.

NOTE 4: Frequency must be changed, or mode changed, each time to cause tune-up tone when PTT is closed.

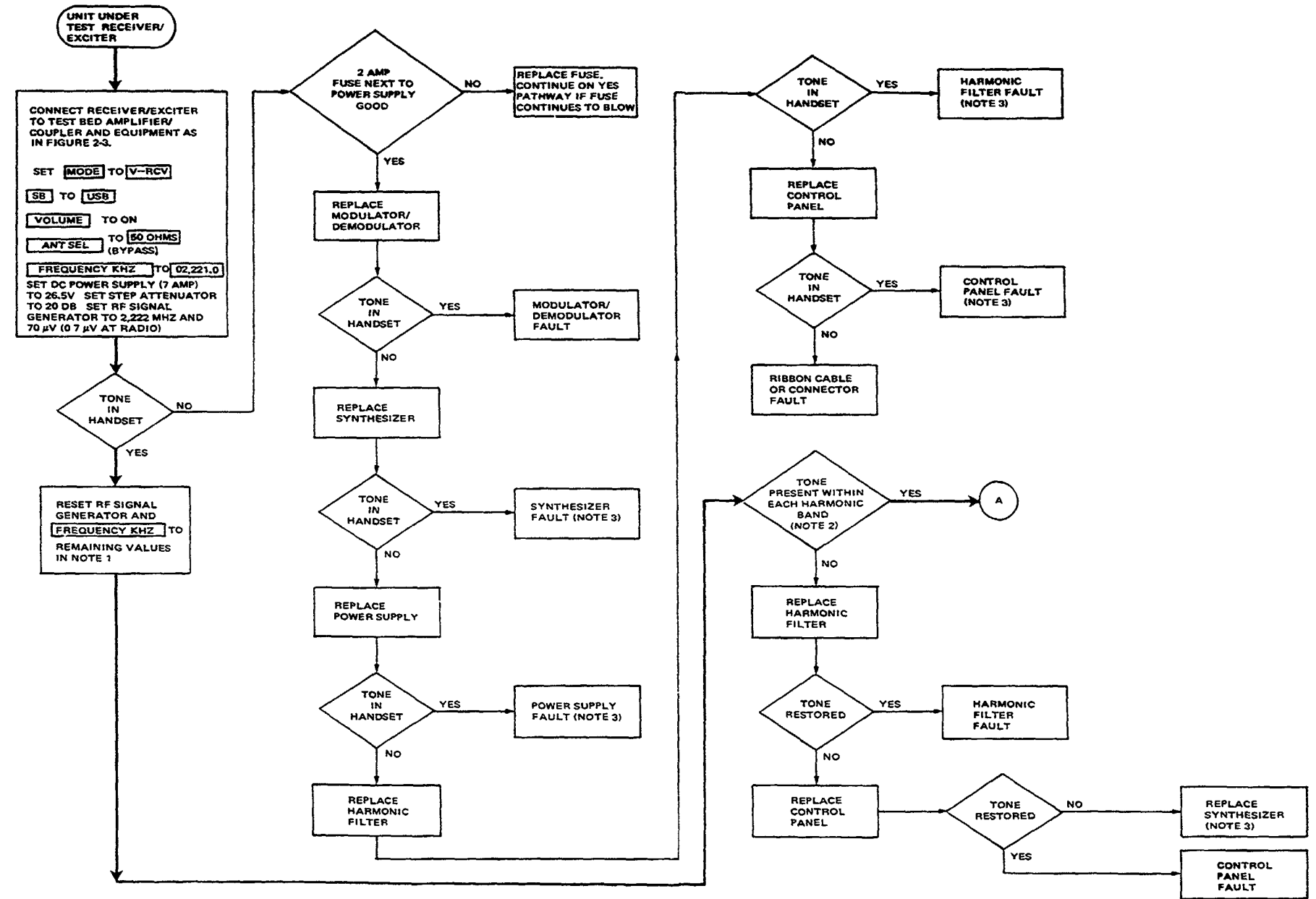
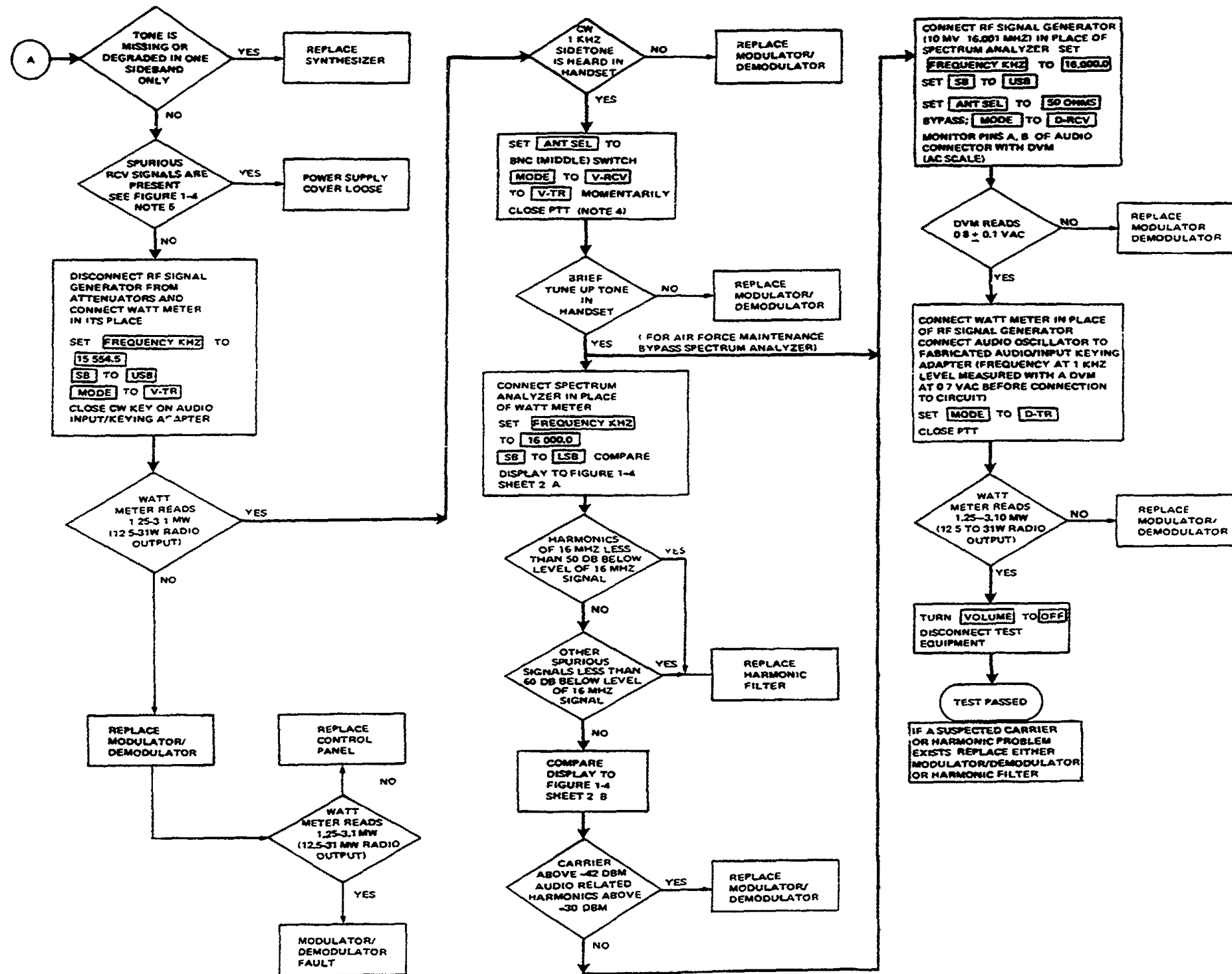


Figure 2-4. Receiver/Exciter A1 Performance Test (Sheet 1 of 2)

Figure 2-4. Receiver/Exciter A1 Performance Test (Sheet 2 of 2)



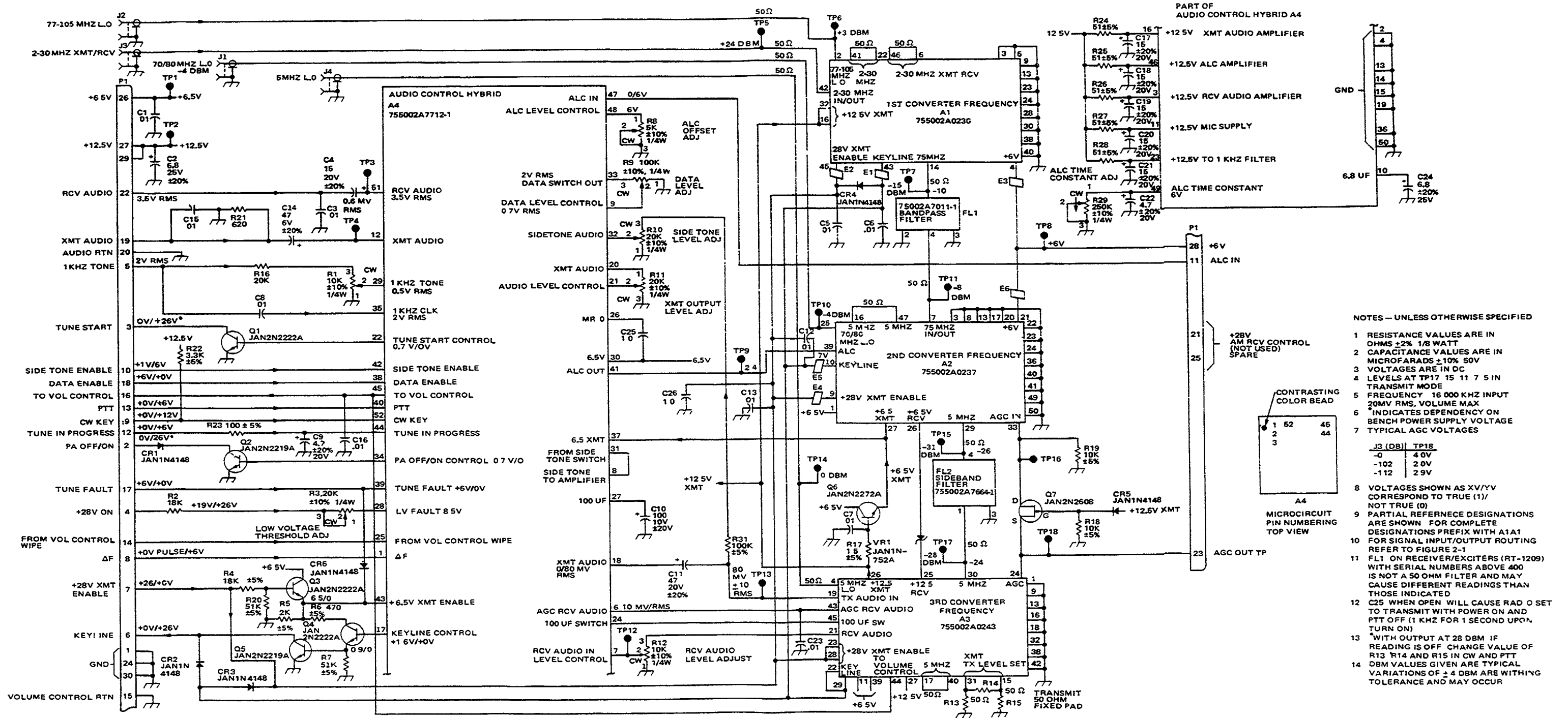
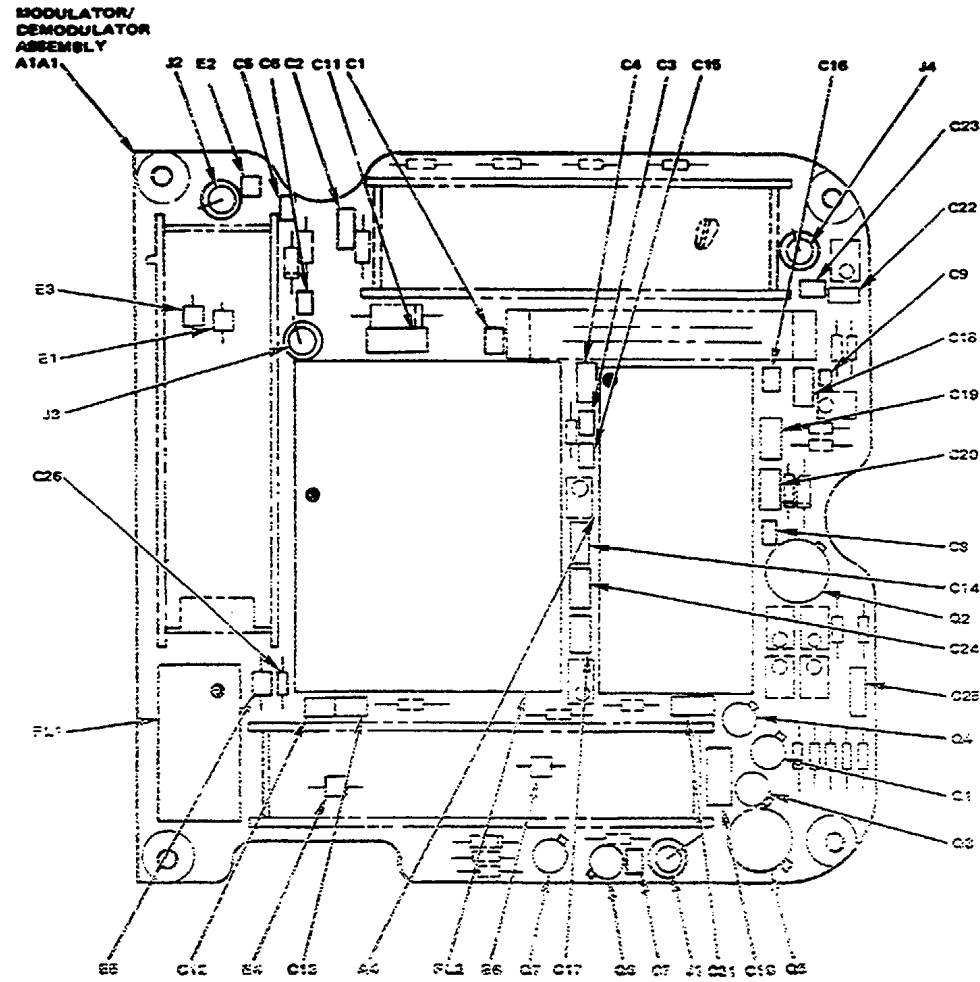
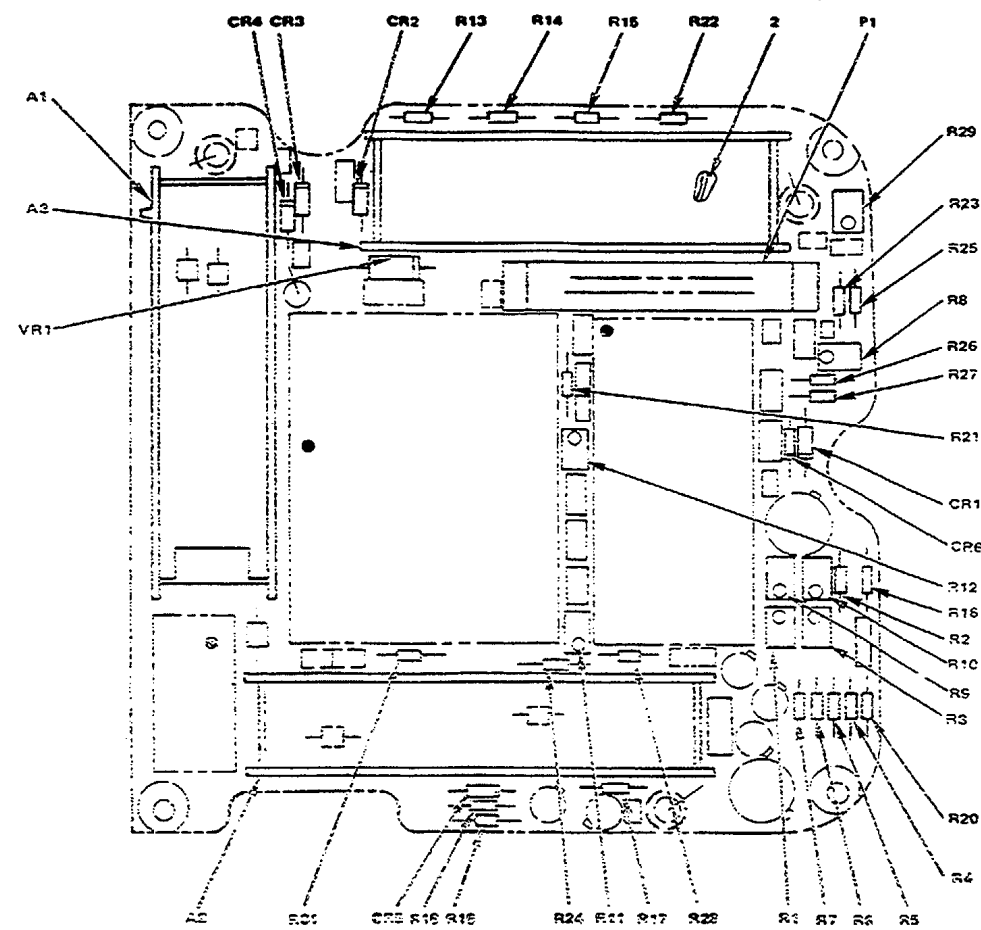


Figure 3-1. Modulator/Demodulator A1A1 Schematic

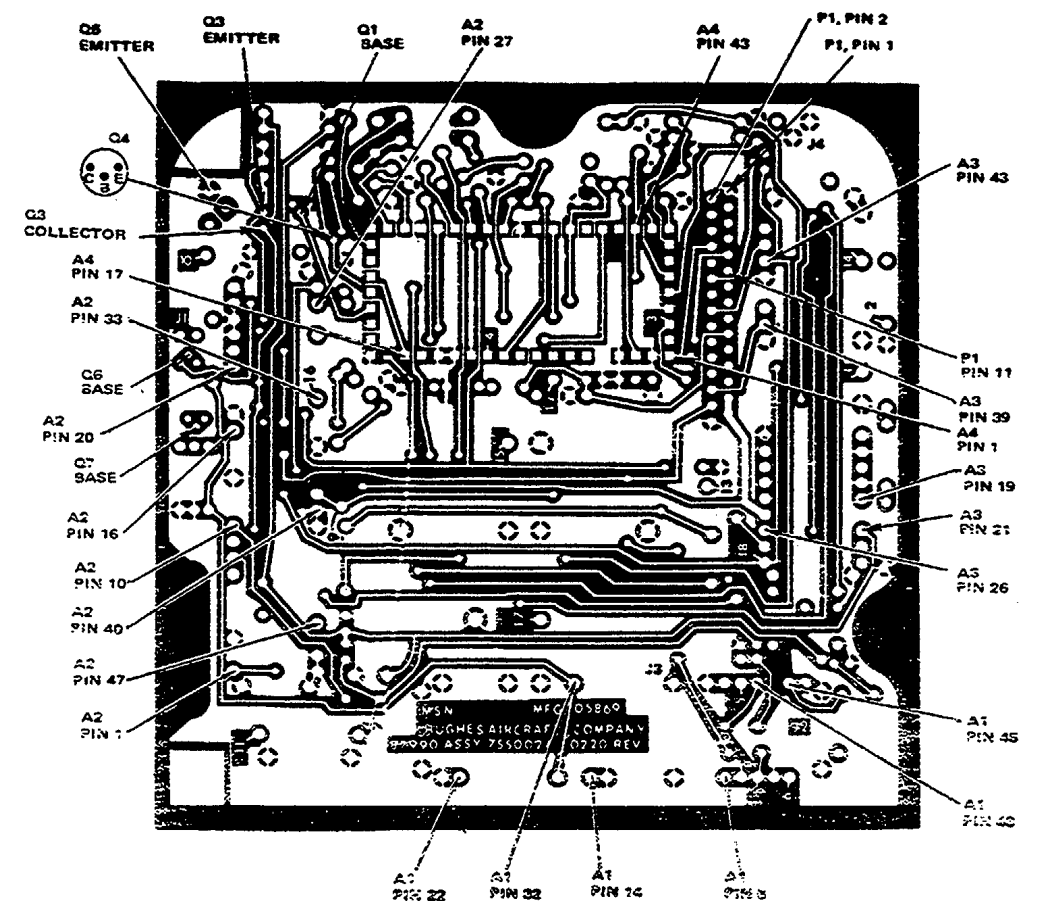
Figure 3-2. Modulator/Demodulator A1A1 Component Location (Sheet 1 of 2)



A



B



NOTE: ⊖ DENOTES TEST POINT ETC.
+ MARK ON CAPACITOR DENOTES POSITIVE TERMINAL (ELECTROLYTIC ONLY)

ITEM	DESCRIPTION <u>A</u>	ITEM	DESCRIPTION <u>B</u>
A1A	Modulator/Demodulator Assembly	CR4	Diode
J2	Connector, Coaxial, RF	CR3	Diode
E2	Core, EM	CR2	Diode
C5	Capacitor	R13	Resistor
C6	Capacitor	R14	Resistor
C2	Capacitor	R15	Resistor
C11	Capacitor	R22	Resistor
C1	Capacitor	2	Strap, Handle
C4	Capacitor	P1	Connector, Receptacle
C3	Capacitor	R29	Resistor Variable
C15	Capacitor	R23	Resistor
C16	Capacitor	R25	Resistor
J4	Connector, Coaxial, RF	R8	Resistor, Variable
C23	Capacitor	R26	Resistor
C22	Capacitor	R27	Resistor
C9	Capacitor	R21	Resistor
C18	Capacitor	CR1	Diode
C19	Capacitor	CR6	Diode
C20	Capacitor	R12	Resistor Variable
C8	Capacitor	R16	Resistor
C14	Capacitor	R2	Resistor
Q2	Transistor	R10	Resistor Variable
C24	Capacitor	R9	Resistor Variable
C25	Capacitor	R3	Resistor, Variable
Q4	Transistor Mounting Pad	R20	Resistor
Q1	Transistor	R4	Resistor
Q3	Transistor	R5	Resistor
Q5	Transistor	R6	Resistor
C10	Capacitor	R7	Resistor
C21	Capacitor	R1	Resistor, Variable
J1	Connector, Coaxial, RF	R28	Resistor
C7	Capacitor	R17	Resistor
Q6	Transistor	R11	Resistor Variable
C17	Capacitor	R24	Resistor R19 Resistor
Q7	Transistor	R18	Resistor
E6	Core, EM	CR5	Diode
FL2	Filter, Bandpass	R31	Resistor
A4	Microcircuit	A2	Converter, Second Freq.
C13	Capacitor	VR1	Diode
E4	Core, EM	A3	Converter, Third Freq
C12	Capacitor	A1	Converter, First Freq
E5	Core, EM		
FL1	Filter, Bandpass		
C26	Capacitor		
J3	Connector, Coaxial, RF		
E1	Core, EM		
E3	Core, EM		

Figure 3-2. Modulator/Demodulator A1A1 Component Location (Sheet 2 of 2)

Figure 3-3. Modulator/Demodulator A1A1 Performance Test and Alignment Setup

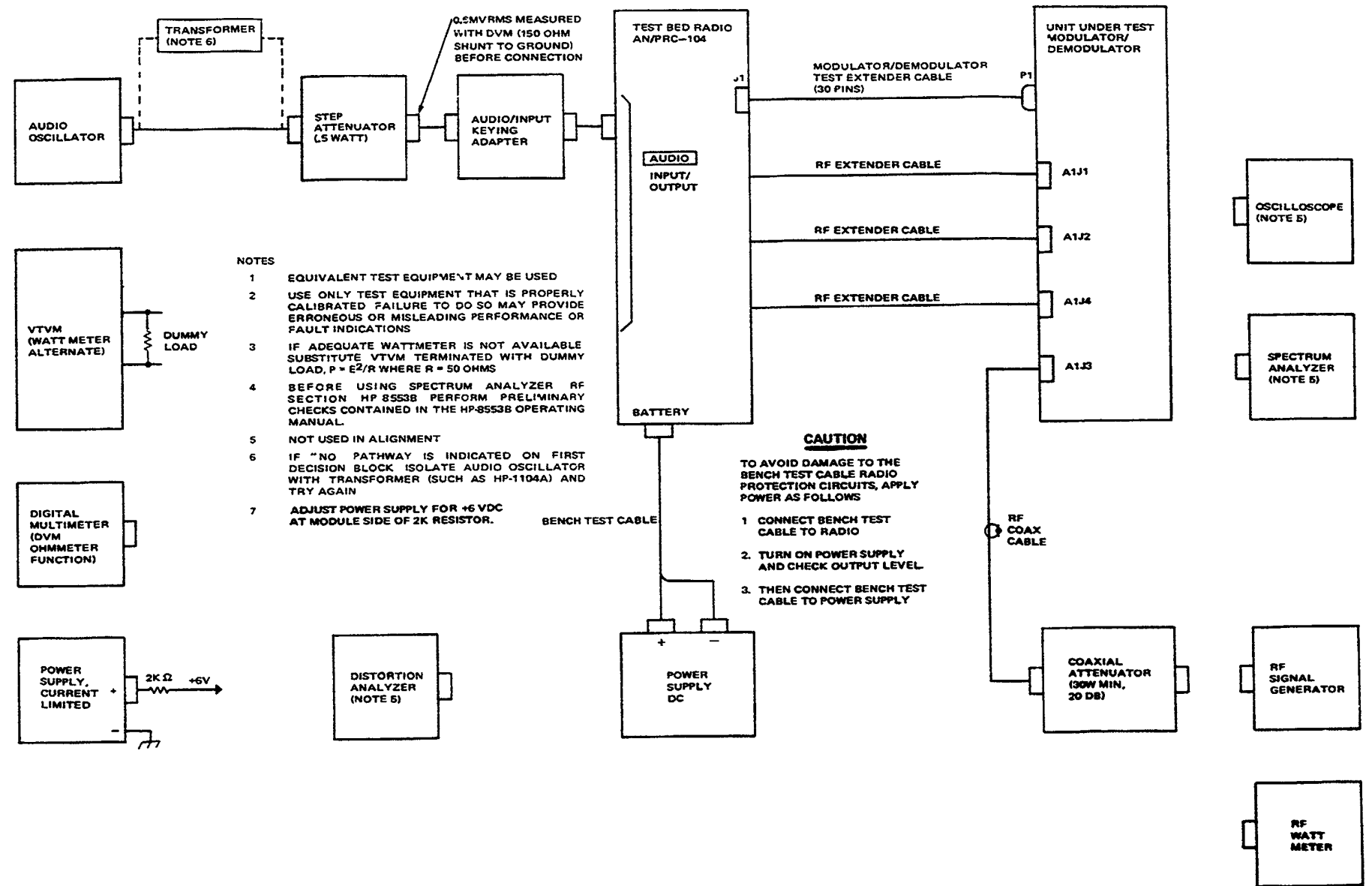
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Modulator/Demodulator Test Extender Cable	...	Figure 3-10A
RF Coax Cable (2 each)	...	Figure 3-11A
RF Extender Cable (3 each)	...	Figure 3-11B
Audio Input/Keying Adapter	...	Figure 3-11C
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Audio Oscillator	AN/URM-127	1
VTVM	AN/USM-116	1
Dummy Load (50 ohm)	DA-553()/4	1
Signal Generator, RF	AN/USM-323	1
Oscilloscope, Storage	Hewlett Packard BP-1741A	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-361	1
Attenuator, Step	CN-1128/U	1
10-db steps, 0.5w, 50 ohm		
Watt Meter		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution IF Section	Hewlett Packard HP-8552B	1
- RF Section	Hewlett Packard HP-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
- High Impedance Probe	Hewlett Packard HP-1121A	1
Distortion Analyzer	Hewlett Packard HP-334A	1
Power Supply, Current Limited	Hewlett Packard HP-6215A	1
Power Supply, DC	Hewlett Packard BP-6439B	1
Attenuator, Coaxial	Narda 765-20	1
20 db, 30w min., 50 ohm		
150-Ohm Resistor	...	1
500-Ohm Resistor	...	1
2000-Ohm Resistor	...	1



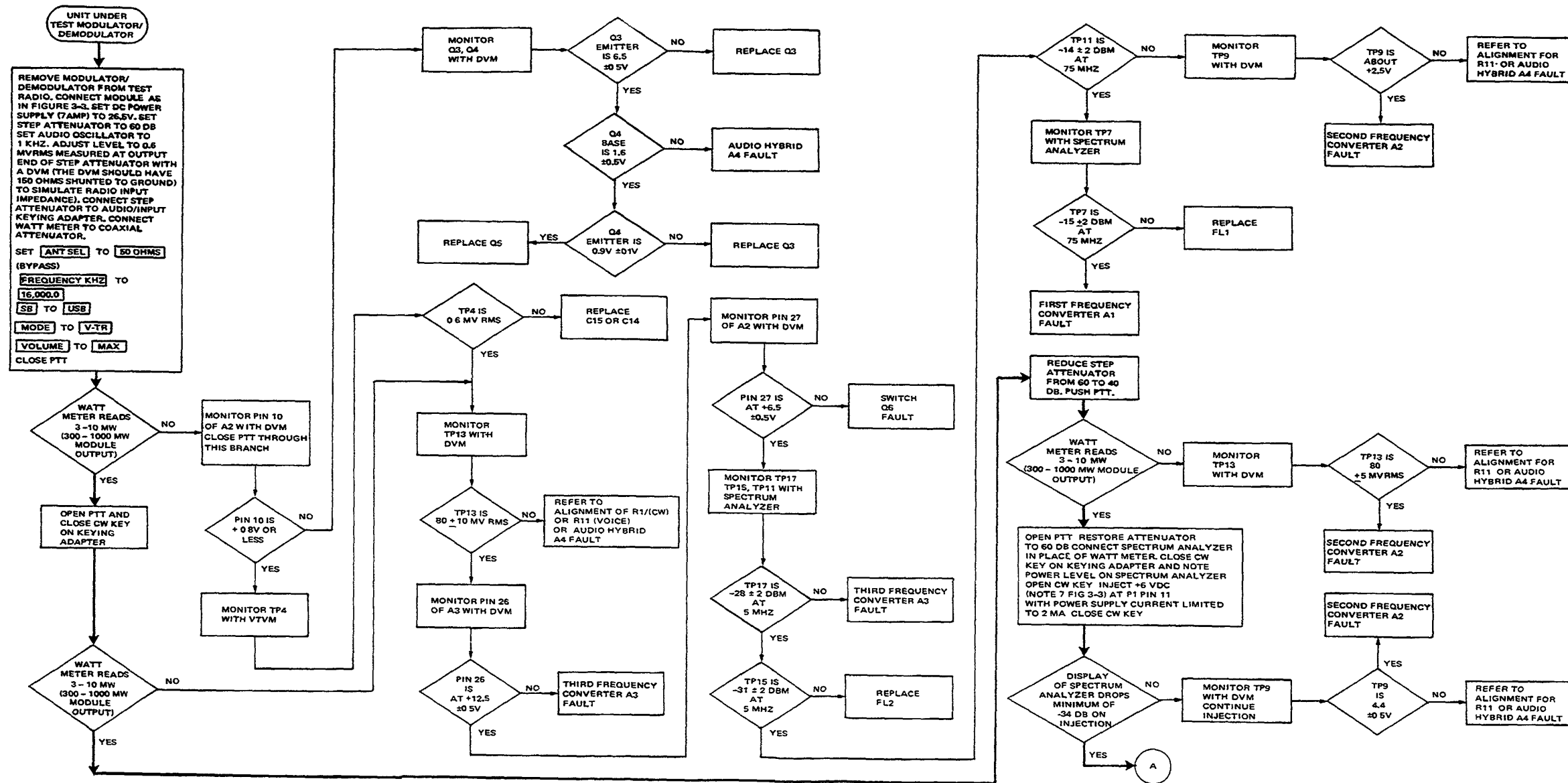
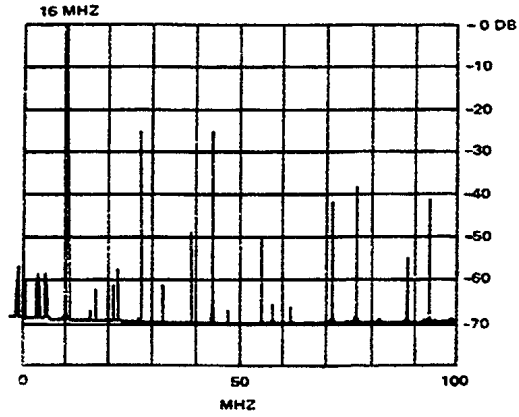


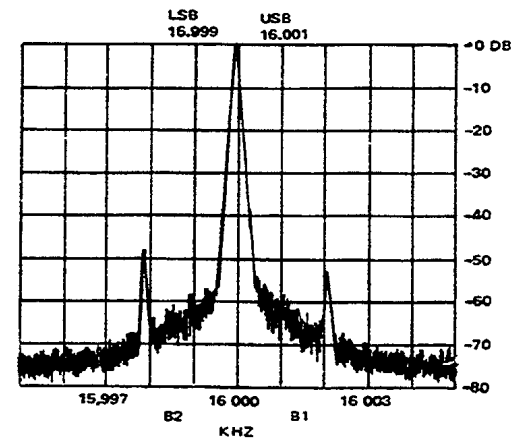
Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 1 of 4)

BAND WIDTH 100 KHZ
 SCAN WIDTH 10 MHZ PER CM
 INPUT ATTEN 40 DB
 RANGE PER DIVISION
 VIDEO FILTER 100 HZ
 LOG REF +10
 SCAN MODE SINGLE
 LINEAR SENSITIVITY AS REQ D
 SCAN TRIGGER AUTO
 CENTER FREQUENCY AS REQ D
 STORAGE 1 SECOND
 INTENSITY AS REQ D
 PERSISTANCE MAXIMUM



(FIGURE A) HARMONIC CHARACTERISTICS OF THE MODULATOR/DEMODULATOR AT 16 MHZ

BANDWIDTH 0.1 KHZ
 SCAN WIDTH 1 KHZ/DIV
 INPUT ATTEN. 40 DB
 SCAN TIME 2 SEC
 RANGE PER DIVISION
 LOG REF +10
 SCAN MODE SINGLE
 CENTER FREQUENCY 16 001
 VIDEO FILTER 10 HZ
 SCAN TRIGGER AUTO
 LINEAR SENSITIVITY AS REQ D
 STORAGE AS REQ D
 INTENSITY AS REQ D
 PERSISTANCE MAXIMUM



(FIGURE B) B1-B16 MHZ UPPER SIDEBAND CENTER FREQUENCY 16 001 B2 - 15.999 MHZ LOWER SIDEBAND

NOTE
 UNLESS OTHERWISE SPECIFIED
 ALL VOLTAGE MEASUREMENTS
 TAKEN WITH RESPECT TO
 CHASSIS GROUND

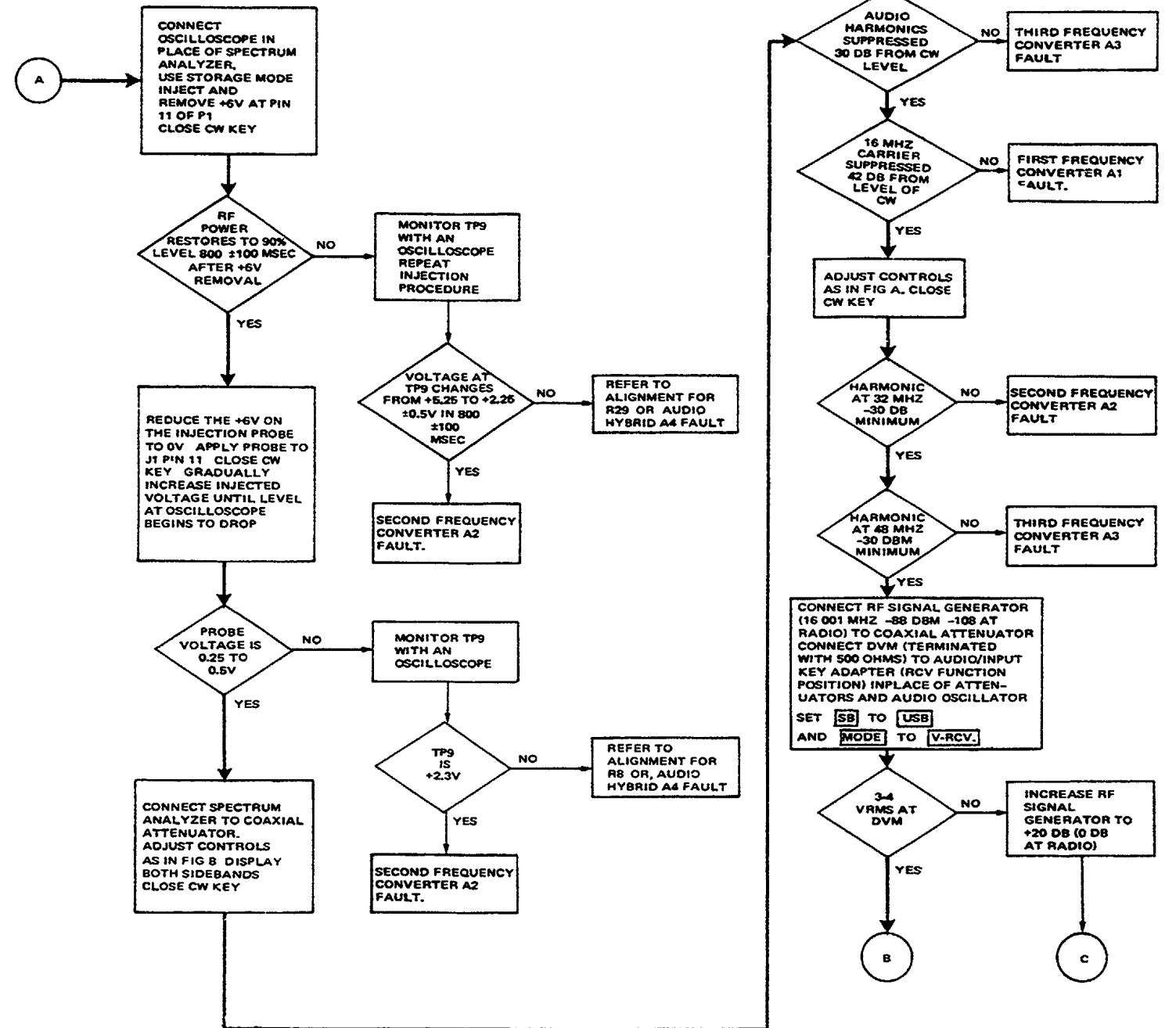


Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 2 of 4)

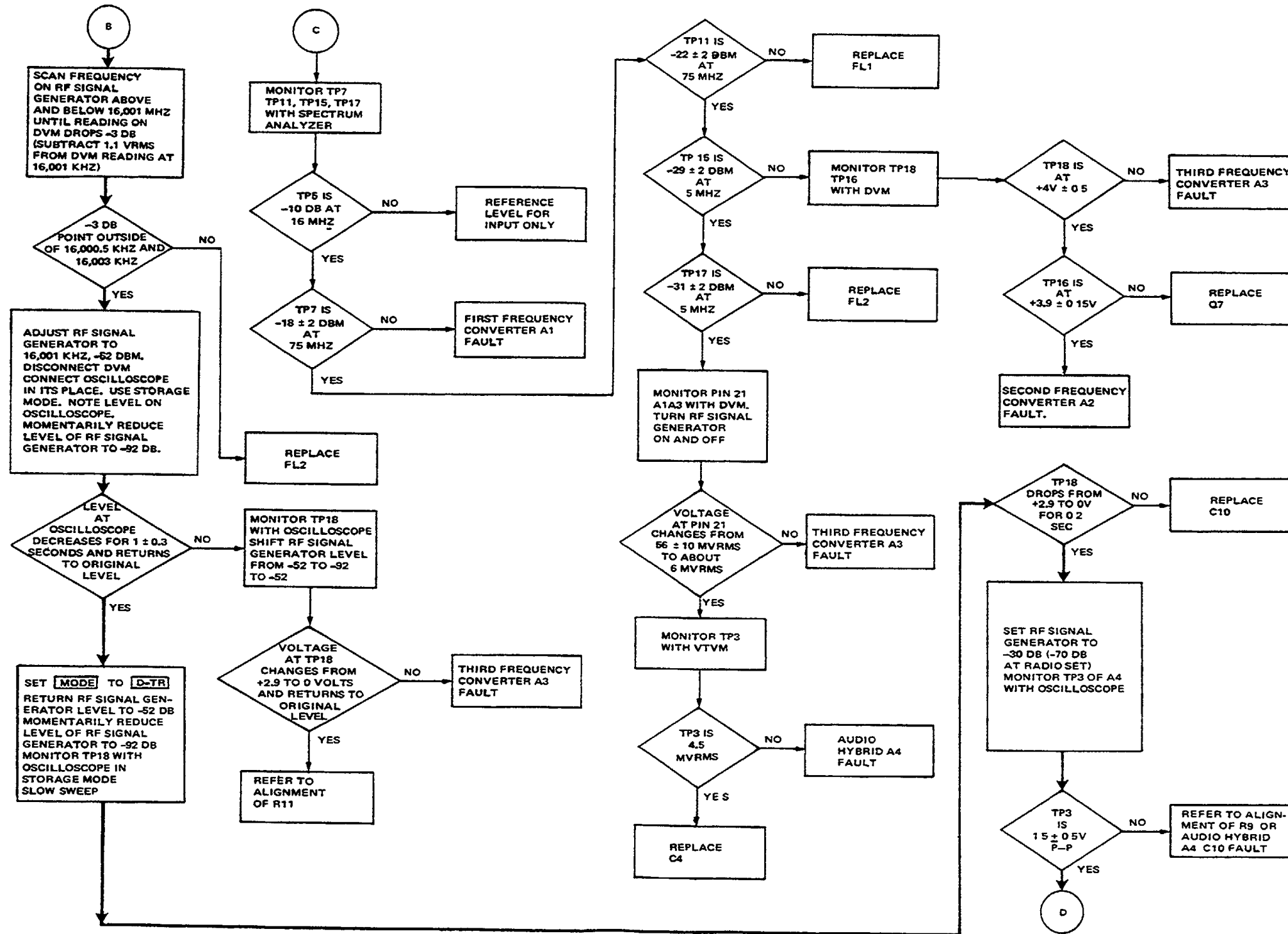
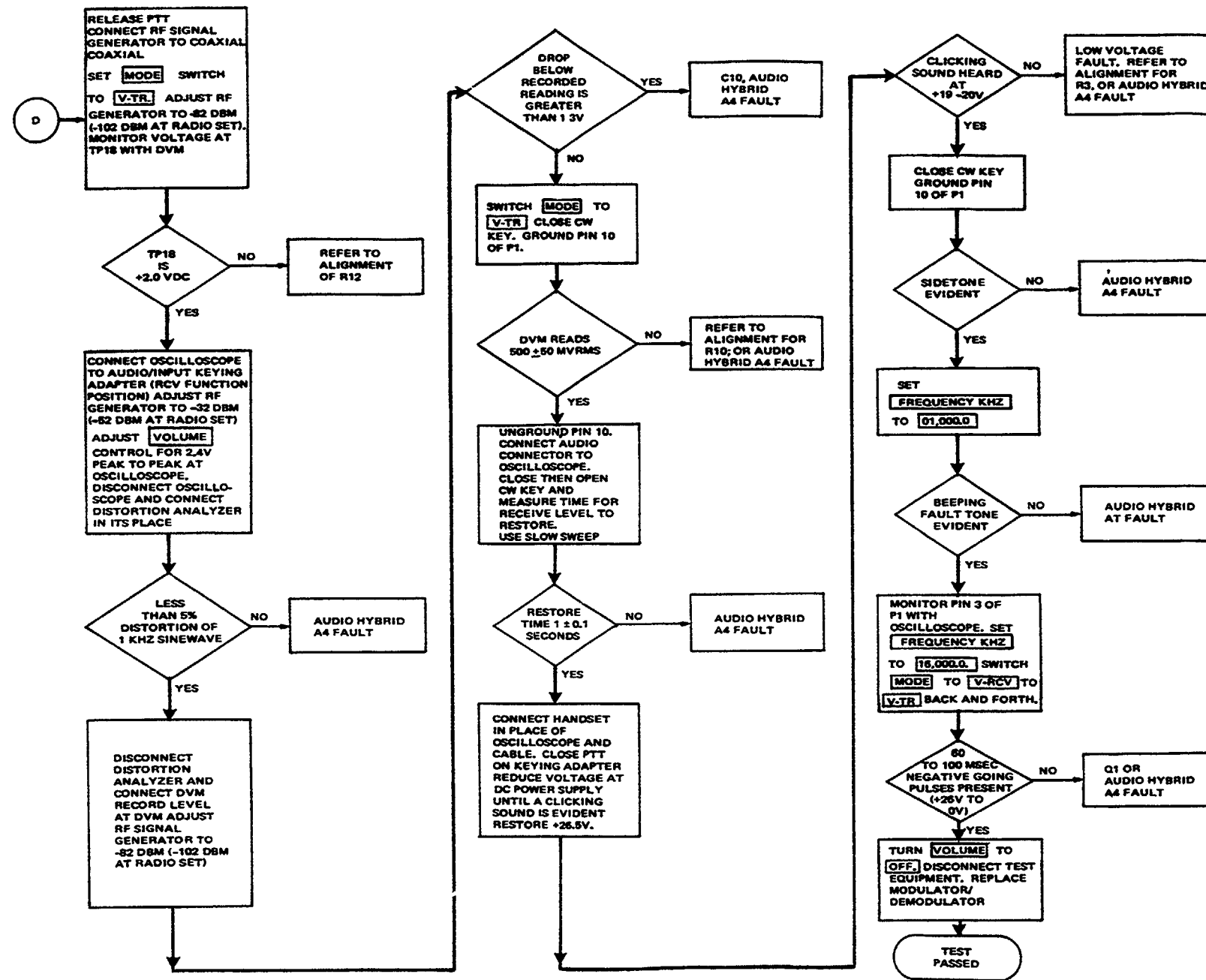


Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 3 of 4)

Figure 3-4. Modulator/Demodulator A1A1 Performance Test (sheet 4 of 4)



MODULATOR/ DEMODULATOR A1A1 ALIGNMENT

The alignment procedure is to be used in either of these situations: (1) the performance test calls a potentiometer out of adjustment, or (2) one of the following is replaced:

1. First Converter, A1A1A1
2. Second Converter, A1A1A2
3. Third Converter, A1A1A3
4. Audio Control Hybrid, A1A1A4

The procedure consists of a preliminary setup and an adjustment procedure.

PRELIMINARY SETUP

1. Remove the modulator/demodulator from the receiver/exciter and connect the module as in figure 3-3.
2. Connect the power meter to the coaxial attenuator. Set the power supply (7 amp) to +26.5v. Set the step attenuator to 60 db.
3. Connect the fabricated audio input/keying adapter to one of the radio audio input plugs. Connect the audio oscillator to the step attenuator. Monitor the output of the step attenuator with the DVM shunted with 150 ohms and adjust the level of the audio oscillator for 0.6 mv rms. This simulates the input impedance of the radio, which is 150 ohms in the voice mode (since the DVM is 1M ohms). Connect the step attenuator to the audio input/keying adapter.
4. Connect the vtvm to the audio output with 500 ohms termination.
5. Set the radio controls located on the control panel as follows:
 - a. ANT SEL to 50 OBMS (bypass)
 - b. FREQUENCY KBZ to 16,000.0
 - c. MODE to V-TR
 - d. VOLUME to MAXIMUM
 - e. SB to USB
2. Close the PTT switch.

TRANSMIT OUTPUT LEVEL ALIGNMENT, R1, R8, R10, R11

1. Turn ALC offset adjust potentiometer R8 to maximum ccw.
2. Close the PTT switch.
3. Adjust R11 until power meter reads ± 28 dbm. Verify test point 13 reads 80 ± 10 mv ac.
4. Adjust the transmit 50 ohm fixed pad R13, R14 and R15 as necessary in order meet the requirements of step 3.
5. Open the PTT switch.
6. Close the CW KEY switch on the audio input/keying adapter.
7. Adjust 1-kHz tone level R1 to obtain 28 ± 0.5 dbm at the watt meter (minus 20 db for the attenuator).
8. Adjust ALC offset, R8, to obtain a 0.25-db reduction at the watt meter.
9. Adjust sidetone level adjust R10 to obtain 500 ± 10 mv rms at the vtvm.

ALC RELEASE TIME ALIGNMENT, R29

1. Monitor A1J3 via the coaxial attenuator with the oscilloscope in storage mode.
2. Turn off radio set. Connect a 2K resistor in series with the positive output of the HP-6215A power supply and a Sharp steel tip injection probe, apply to J-11, measure the voltage at this point with the DVM and adjust the HP-6215A power supply for + 6VDC at J1-11. Remove probe And turn on the radio set. Inject +6V to P-1-11, close CW key.
3. Momentarily remove the -6v at pin 11 and observe the period required for the rf Power at A1J3 to return to 90 percent of full value. This is the LAC release time.
4. Adjust R29 for an ALC release time Of 750 ± 100 milliseconds.
5. Open CW KEY switch on the audio Input/keying adapter.

RECEIVE LEVEL ALIGNMENT, R12

1. Set MODE to V-RCV.
2. Connect the rf signal generator to The coaxial attenuator.
3. Adjust the rf signal generator to 16.0010 MHz and -83 dbm (-103 dbm at radio).
4. Short gate of Q3 of A1A1A2 (FET case is the gate) to ground with a jumper wire.
5. Adjust receive audio level adjust R12 to obtain -2.0 ± 0.1 vdc at TP18. (Measure with DVM and probe.) Remove jumper wire.

DATA MODE AUDIO OUTPUT ALIGNMENT, R9

1. Set MODE to D-RCV.
2. Increase the rf signal generator to -72 dbm (-92 dbm at radio.).
3. Adjust data level adjust R9 to obtain 0.775 ± 0.05 vrms (measure with DVM on ac volts).

LOW VOLTAGE ALARM ALIGNMENT, R3

1. Disconnect the rf signal generator from the coaxial attenuator and connect the watt meter. Connect the handset in Place of the vtvm.
2. Close the PTT switch on the audio Input/keying adapter.
3. Reduce the input voltage to the Radio to +19.0 vdc.
4. Adjust low voltage threshold adjust, R3, to the point where a continuous clicking sound is heard in the handset.

DISCONNECT THE TEST EQUIPMENT

TABLE 3-1. Selected Resistors for Mod/Demod R13, R14 & R15

Transmit fixed 50Ω pad adjustment. Refer to modulator/demodulator A1A1 alignment.
 (Prior to replacing R13, 14, 15, examine these resistors on modulator/demodulator,
 record individual values for reference.)

Pad Attenuation DB	Resistor Values (OHMs)		
	R13	R14	R15
3 db	300	18	300
4 db	220	24	220
5 db	180	30	180
6 db	150	36	150
7 db	130	43	130
8 db	110	51	110
9 db	110	62	110
10 db	91	68	91
11 db	91	82	91
12 db	82	91	82
13 db	82	110	82

<u>Ω</u> <u>OHMs</u>	<u>Military No.</u>
18	RLR05C18R0GM
24	RLR05C24R0GM
30	RLR05C30R0GM
36	RLR05C36R0GM
43	RLR05C43R0GM
51	RLR05C51R0GM
62	RLR05C62R0GM
68	RLR05C68R0GM
82	RLR05C82R0GM
91	RLR05C91R0GM
110	RLR05C1100GM
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180	RLR05C1800GM
220	RLR05C2200GM
300	RLR05C3000GM

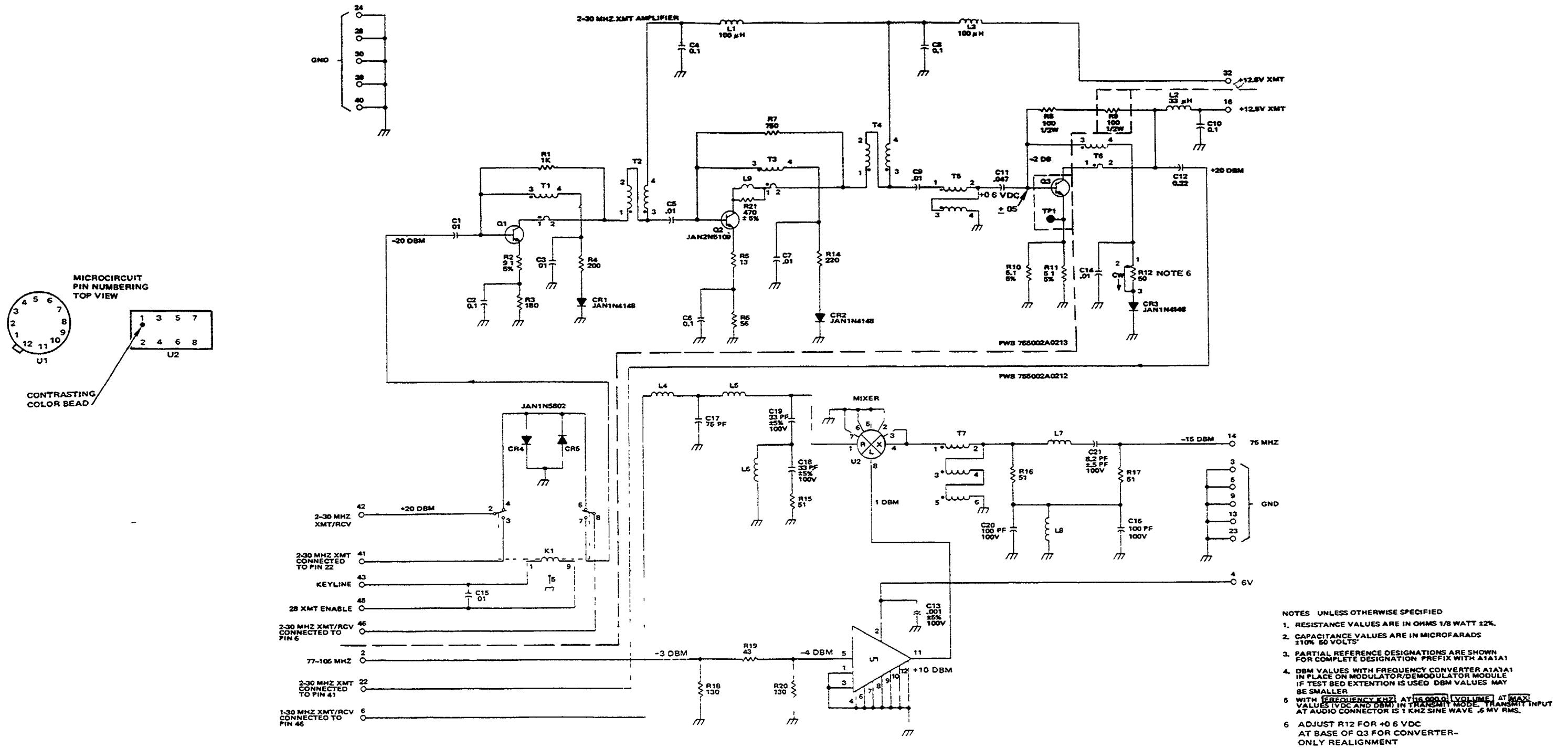
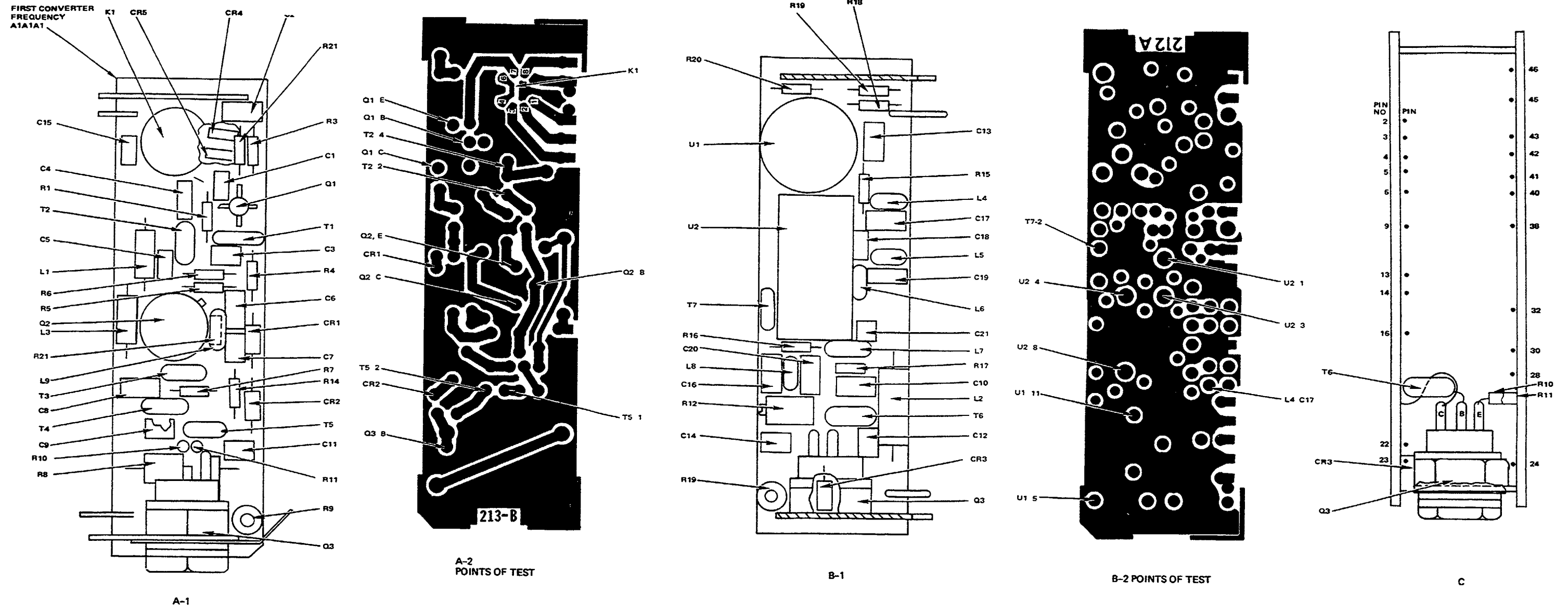


Figure 3-5. First Frequency Converter A1A1A1 Schematic

Figure 3-6. First Frequency Converter A1A1A1 Component Location (Sheet 1 of 2)



ITEM	DESCRIPTION	ITEM	DESCRIPTION
A1A1A1	<u>A-1</u> First Frequency Converter (755002A0230)	R20	<u>B-1</u> Resistor
K1	Relay, Electromagnetic	R19	Resistor
CR5	Diode	R18	Resistor
CR4	Diode	C13	Capacitor
C2	Capacitor	R15	Resistor
R21	Resistor	L4	Inductor
R3	Resistor	C17	Capacitor
C1	Capacitor	C18	Capacitor
Q1	Transistor	L5	Inductor
T1	Inductor	C19	Capacitor
C3	Capacitor	L6	Inductor
R4	Resistor	C21	Capacitor
C6	Capacitor	L7	Inductor
CR1	Diode	R17	Resistor
C7	Capacitor	C10	Capacitor
R7	Resistor	L2	Coil, RF
R14	Resistor	T6	Inductor
CR2	Diode	C12	Capacitor
T5	Transformer, RF	CR3	Diode
C11	Capacitor	Q3	Transistor
R11	Resistor	R19	Resistor
R9	Resistor	C14	Capacitor
Q3	Transistor	R12	Resistor
R8	Resistor	C16	Capacitor
R10	Resistor	L8	Inductor
C9	Capacitor	C20	Capacitor
T4	Transformer	R16	Resistor
C8	Capacitor	T7	Transformer
T3	Inductor	U2	Mixer, RF
L9	Inductor	U1	Amplifier, RF
R21	Resistor		<u>C</u>
L3	Coil, RF	R10	Resistor
Q2	Transistor	R11	Resistor
R5	Resistor	Q3	Transistor
R6	Resistor	CR3	Diode
L1	Coil, RF	T7	Inductor
C5	Capacitor		
T2	Transformer, RF		
R1	Resistor		
C4	Capacitor		
C15	Capacitor		

Figure 3-6. First Frequency Converter A1A1A1 Component Location (Sheet 2 of 2)

Figure 3-7. Frequency Converter A1A1A1, A1A1A2, A1A1A3 Performance Test Setup

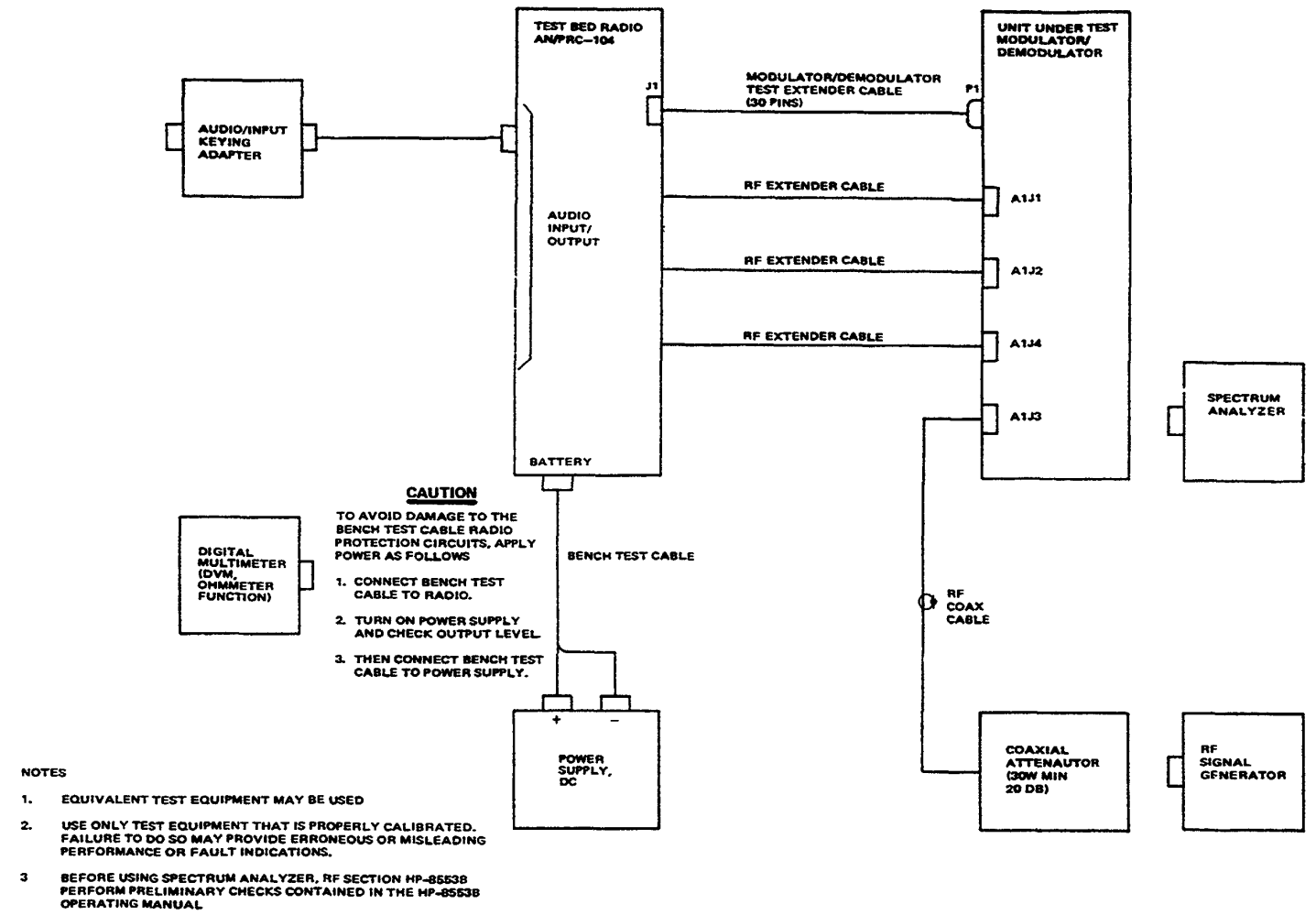
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
RF Coax Cable (2 each)	...	Figure 3-11A
RF Extender Cable (3 each)	...	Figure 3-11B
Audio Input/Keying Adapters	...	Figure 3-11C
Modulator/Demodulator Test Extender Cable	...	Figure 3-10A
Frequency Converter Test Bed	...	Figure 3-12
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Signal Generator, RF	AN/USM-323	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution IF Section	Hewlett Packard HP-8552B	1
- RF Section	Hewlett Packard HP-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
- High Impedance Probe	Hewlett Packard HP-1121A	1
Power Supply, DC	Hewlett Packard HP-6439B	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1



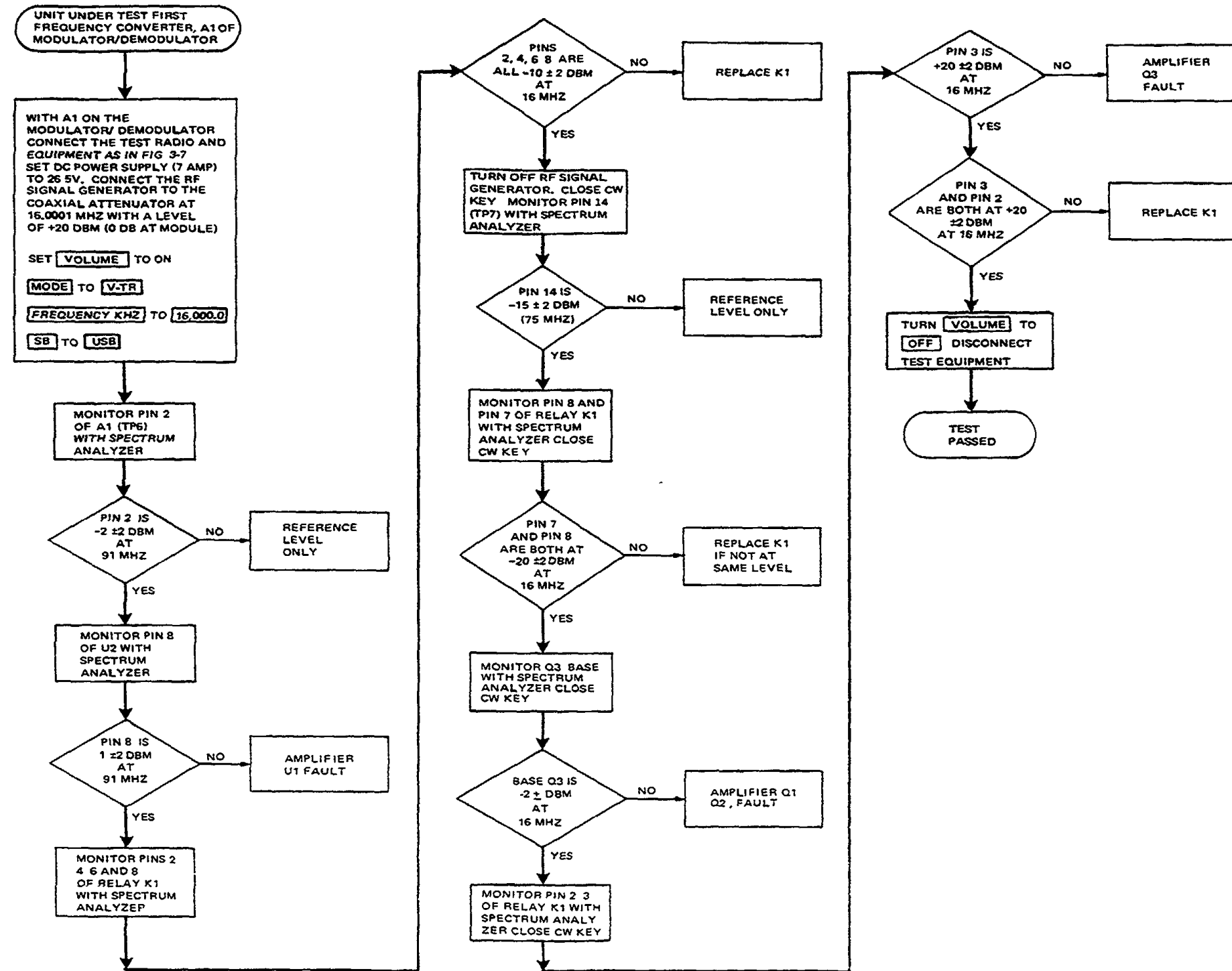


Figure 3-8. First Frequency Converter A1A1A1 Performance test

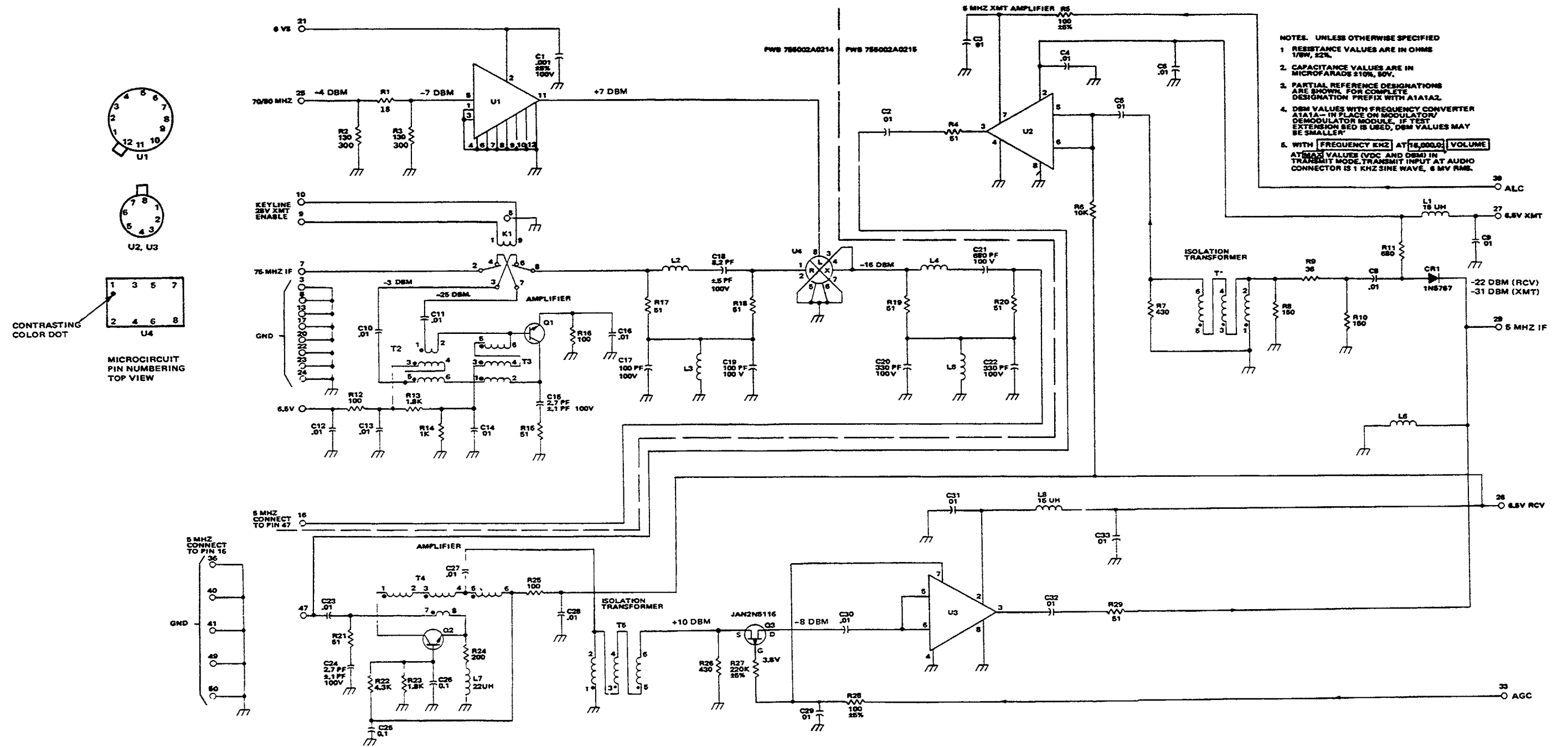
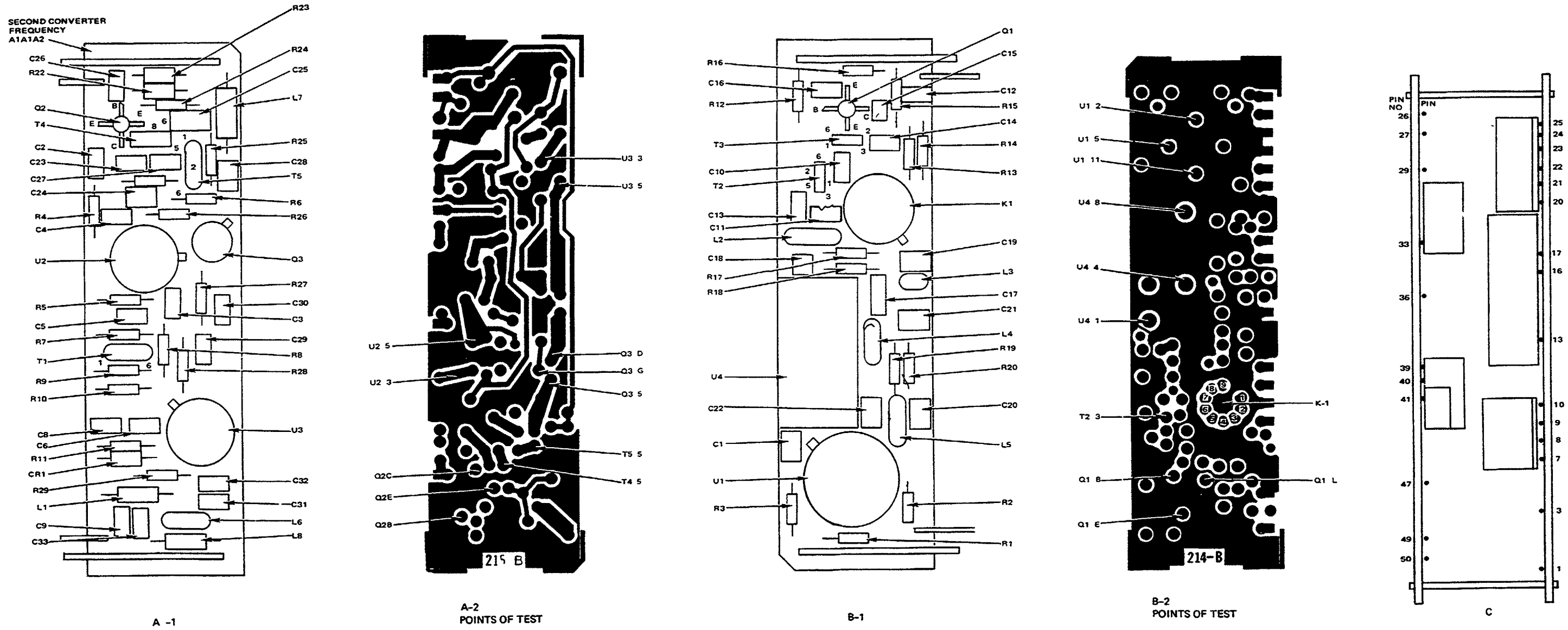


Figure 3-9. Second Frequency Converter A1A1A2 Schematic

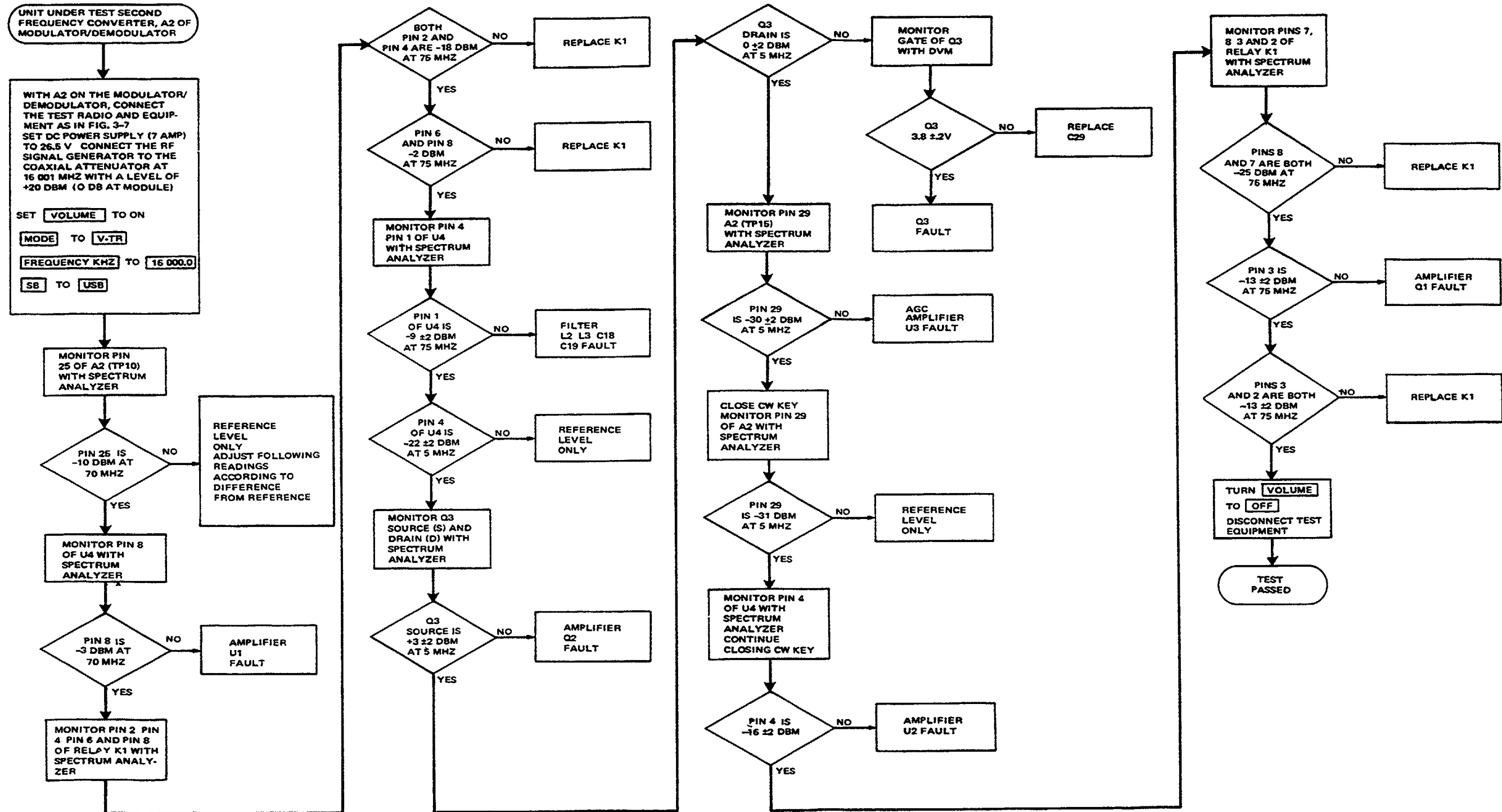
Figure 3-10. Second Frequency Converter A1A1A2 Component Location (Sheet 1 of 2)



ITEM	DESCRIPTION	ITEM	DESCRIPTION
<u>A-1</u>			
A1A1A2	Second Frequency Converter (755002A0237)	Q2	Transistor
R23	Resistor	R22	Resistor
R24	Resistor	C26	Capacitor
C25	Capacitor		
L7	Coil		<u>B-1</u>
R25	Resistor	Q1	Transistor
C28	Capacitor	C15	Capacitor
T5	Transformer, RF	C12	Capacitor
R6	Resistor	R15	Resistor
R26	Resistor	C14	Capacitor
Q3	Transistor	R14	Resistor
R27	Resistor	R13	Resistor
C30	Capacitor	K1	Relay, Electromagnetic
C3	Capacitor	C19	Capacitor
C29	Capacitor	L3	Inductor
R8	Resistor	C17	Capacitor
R28	Resistor	C21	Capacitor
U3	Mixer	L4	Inductor
C32	Capacitor	R19	Resistor
C31	Capacitor	R20	Resistor
L6	Inductor	C20	Capacitor
L8	Inductor	L5	Inductor
C33	Capacitor	R2	Resistor
C9	Capacitor	R1	Resistor
L1	Coil, RF	R3	Resistor
R29	Resistor	U1	Amplifier, RF
CR1	Diode	C1	Capacitor
R11	Resistor	C22	Capacitor
C6	Capacitor	U4	Mixer, RF
C8	Capacitor	R18	Resistor
R10	Resistor	R17	Resistor
R9	Resistor	C18	Capacitor
T1	Transformer, RF	L2	Inductor
R7	Resistor	C11	Capacitor
C5	Capacitor	C13	Capacitor
R5	Resistor	T2	Transformer, RF
U2	Microcircuit	C10	Capacitor
C4	Capacitor	T3	Transformer
R4	Resistor	R12	Resistor
C24	Capacitor	C16	Capacitor
C27	Capacitor	R16	Resistor
C23	Capacitor		
C2	Capacitor		
T4	Transformer, RF		

Figure 3-10. Second Frequency Converter A1A1A2 Component Location (Sheet 2 of 2)

Figure 3-11. Second Frequency Converter A1A1A2 Performance Test



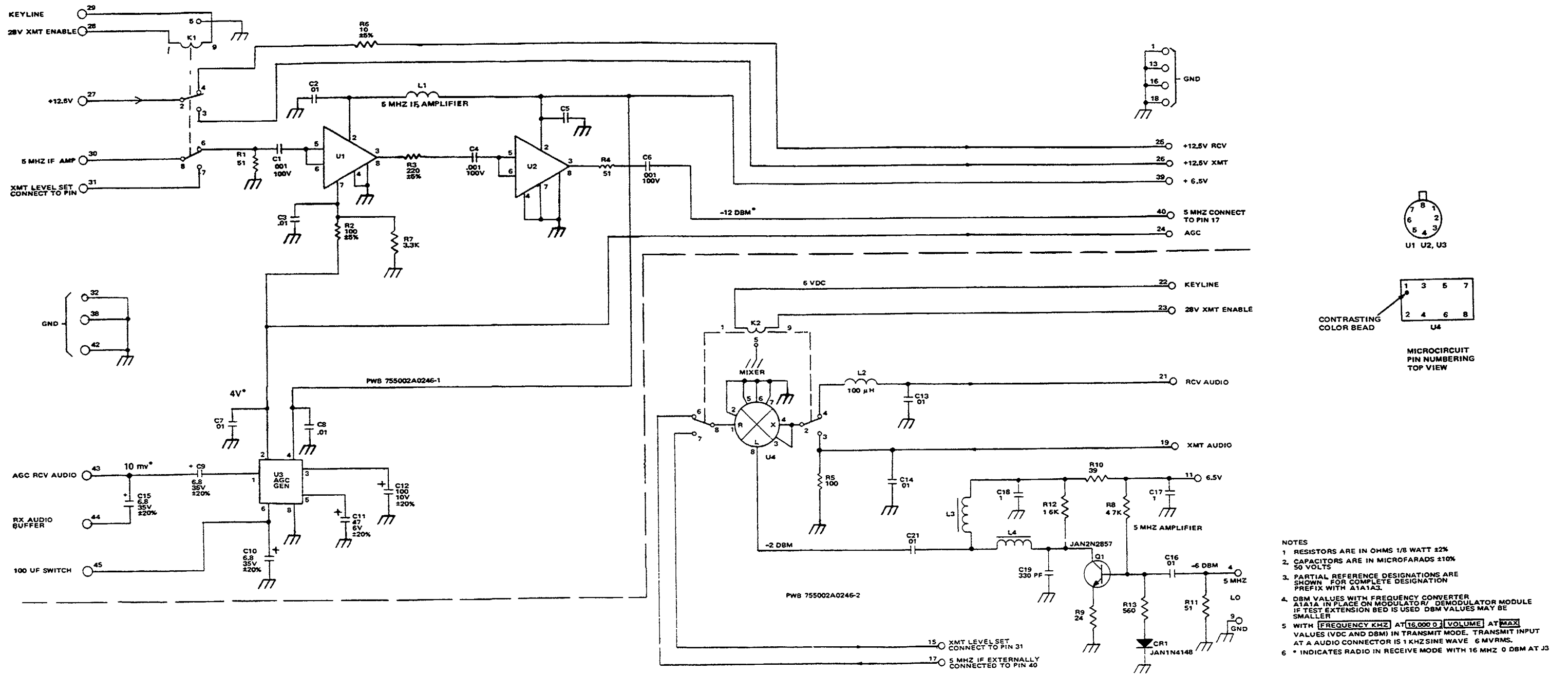
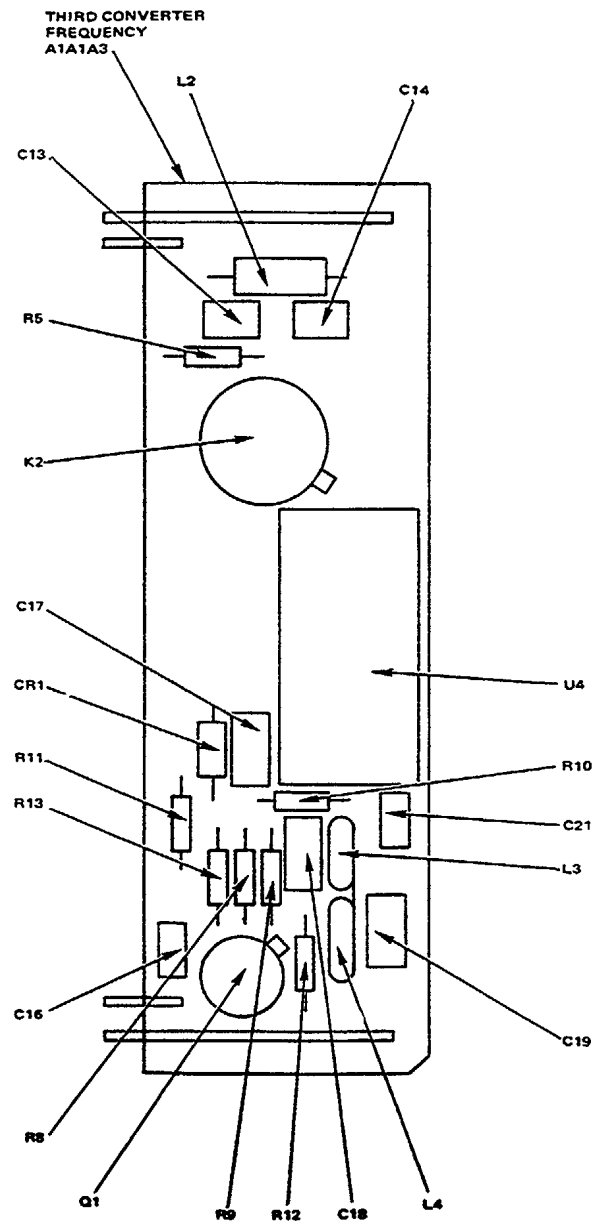
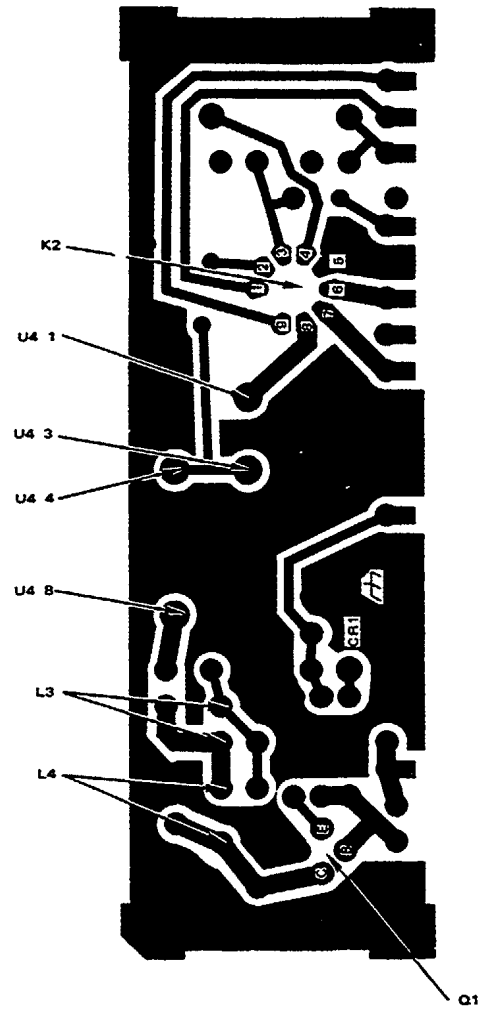


Figure 3-12. Third Frequency Converter A1A1A3 Schematic

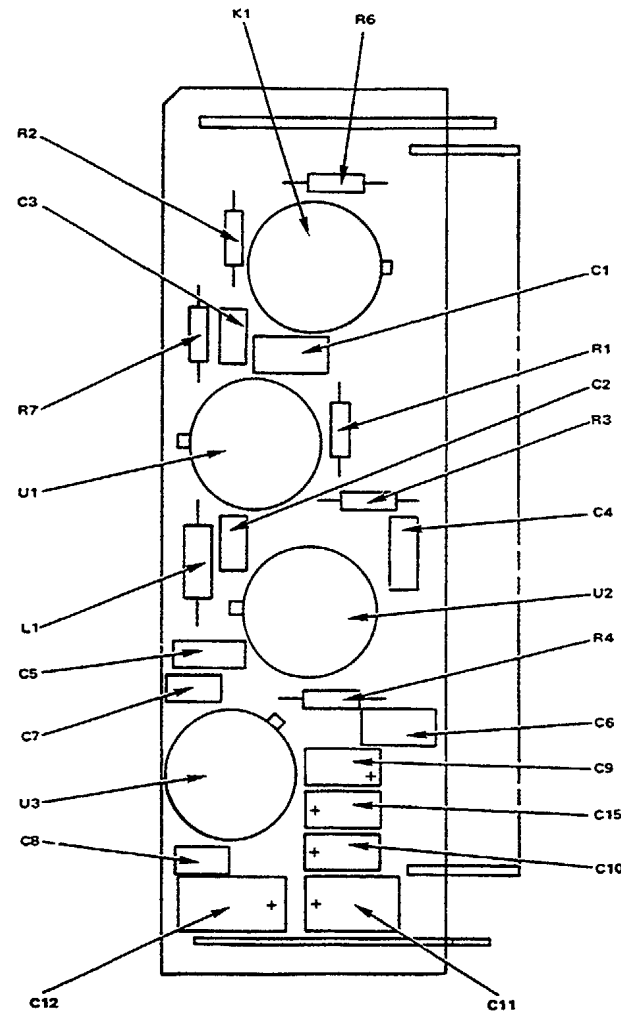
Figure 3-13. Third Frequency Converter A1A1A3 Components Location (Sheet 1 of 2)



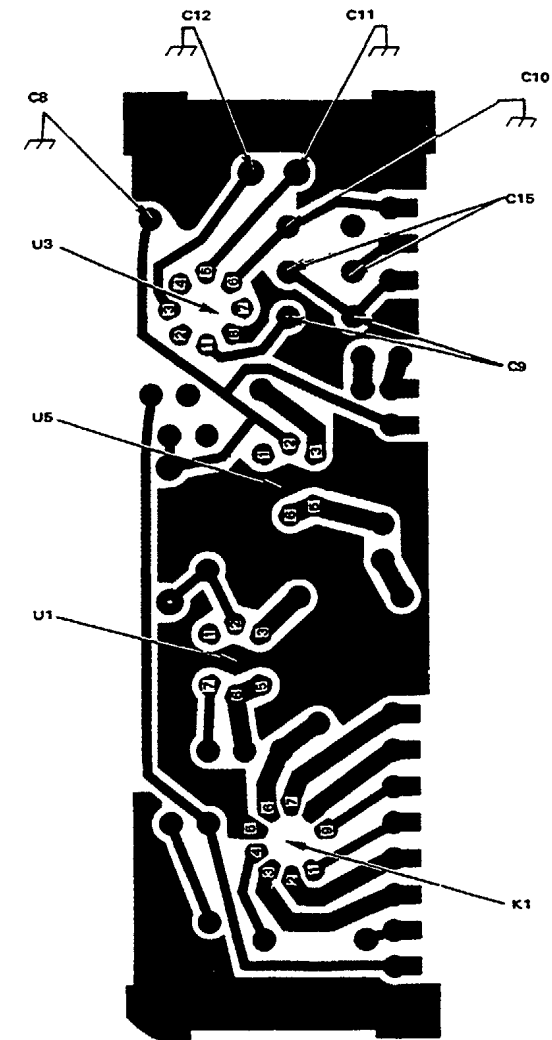
A-1



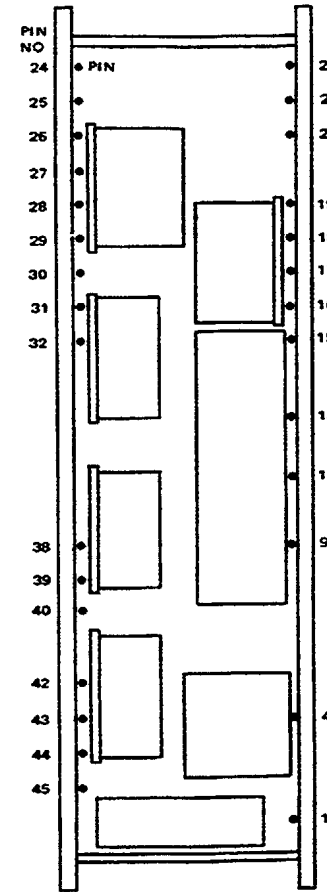
A-2
POINTS OF TEST



B-1



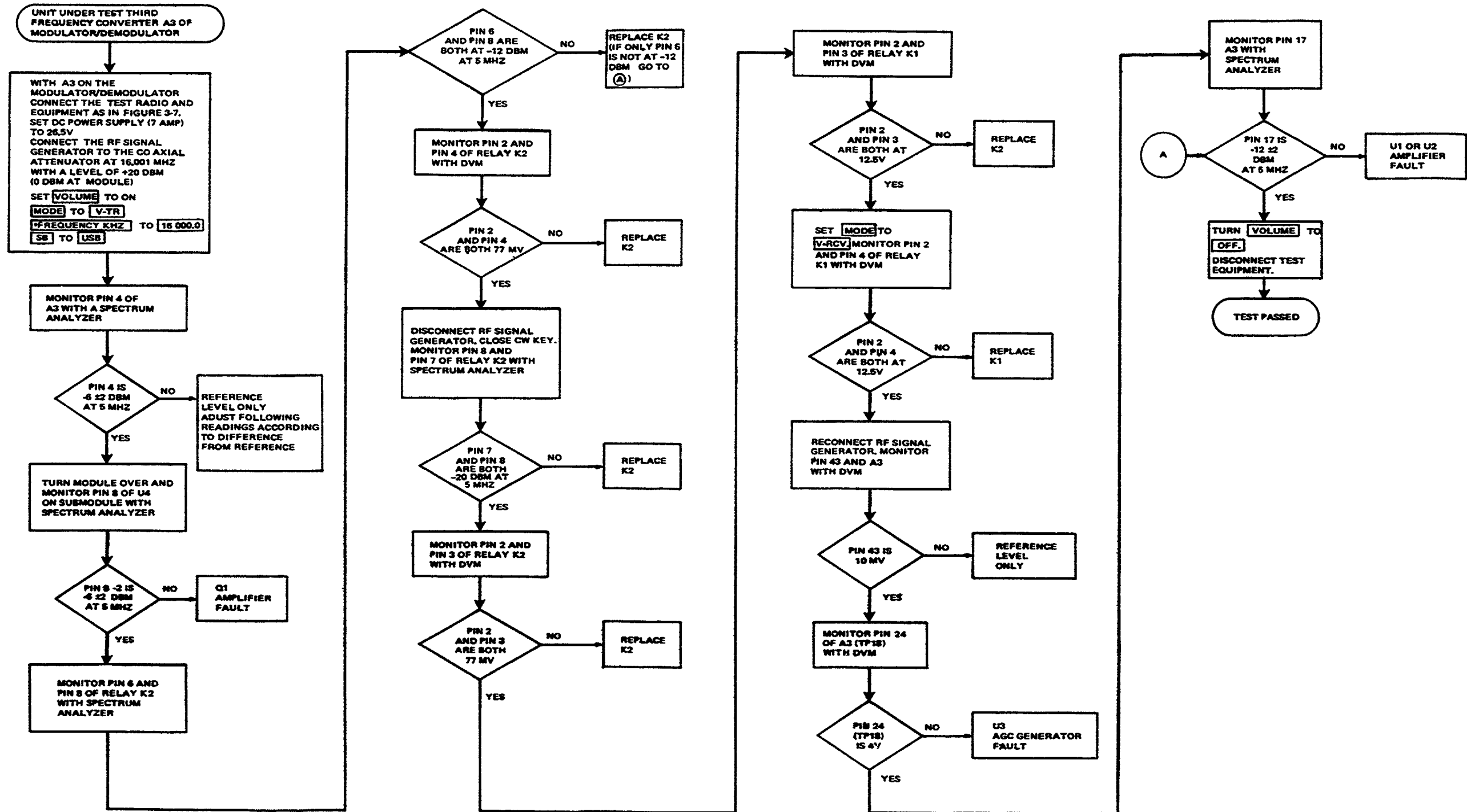
B-2
POINTS OF TEST

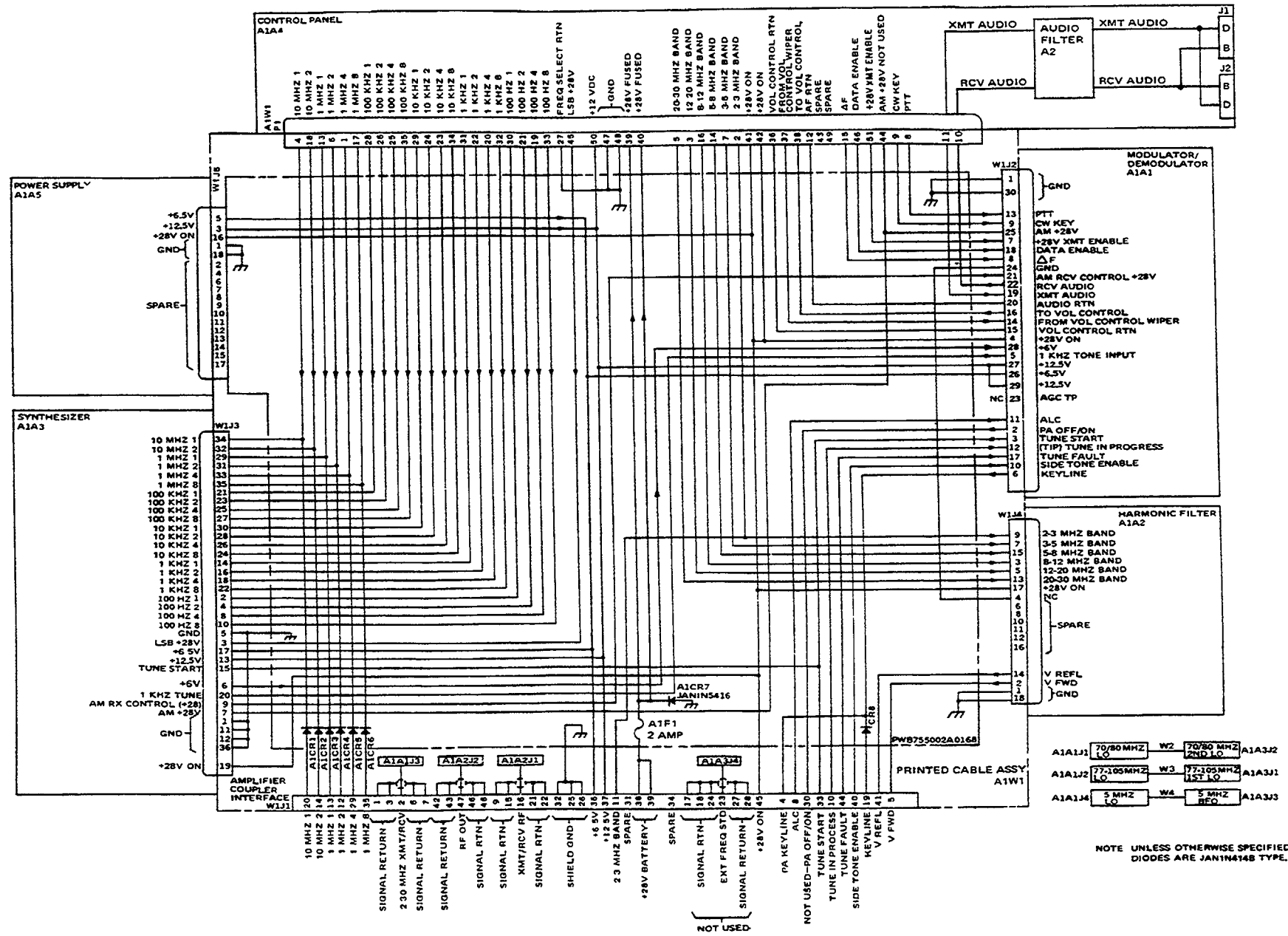


ITEM	Description	ITEM	DESCRIPTION
	<u>A-1</u>		<u>B-1</u>
A1A1A3	Third Frequency Converter (755002A0343)	K1	Relay, Electromagnetic
L2	Coil, RF	R6	Resistor
C14	Capacitor	C1	Capacitor
U4	Mixer, RF	R1	Resistor
R10	Resistor	C2	Capacitor
C21	Capacitor	R3	Resistor
L3	Inductor	C4	Capacitor
C19	Capacitor	U2	Microcircuit
L4	Inductor	R4	Resistor
C18	Capacitor	C6	Capacitor
R12	Resistor	C9	Capacitor
R9	Resistor	C15	Capacitor
Q1	Transistor	C10	Capacitor
R8	Resistor	C11	Capacitor
C16	Capacitor	C12	Capacitor
R13	Resistor	C8	Capacitor
R11	Resistor	U3	Microcircuit
CR1	Diode	C7	Capacitor
C17	Capacitor	C5	Capacitor
K2	Relay, Electromagnetic	L1	Coil, RF
R5	Resistor	U1	Microcircuit
C13	Capacitor	R7	Resistor
		C3	Capacitor
		R2	Resistor

Figure 3-13. Third Frequency Converter A1A1A3 Component Location (Sheet 2 of 2)

Figure 3-14. Third Frequency Converter A1A1A3 Performance test





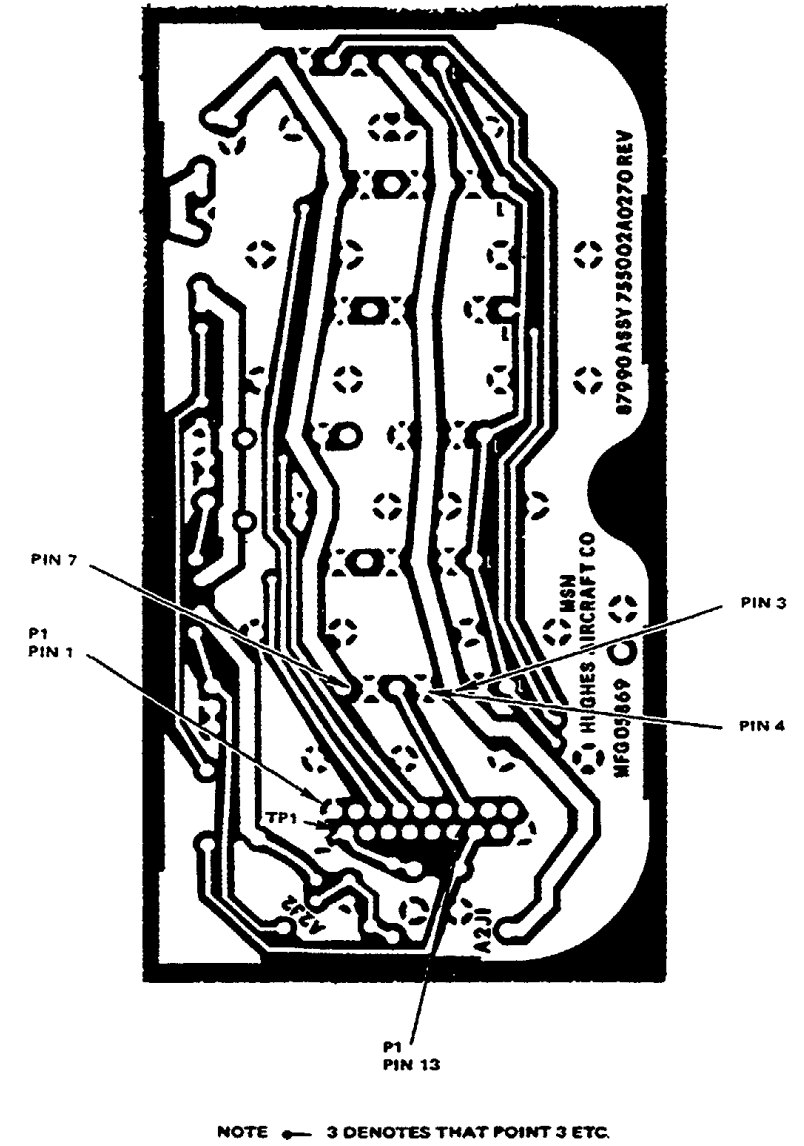
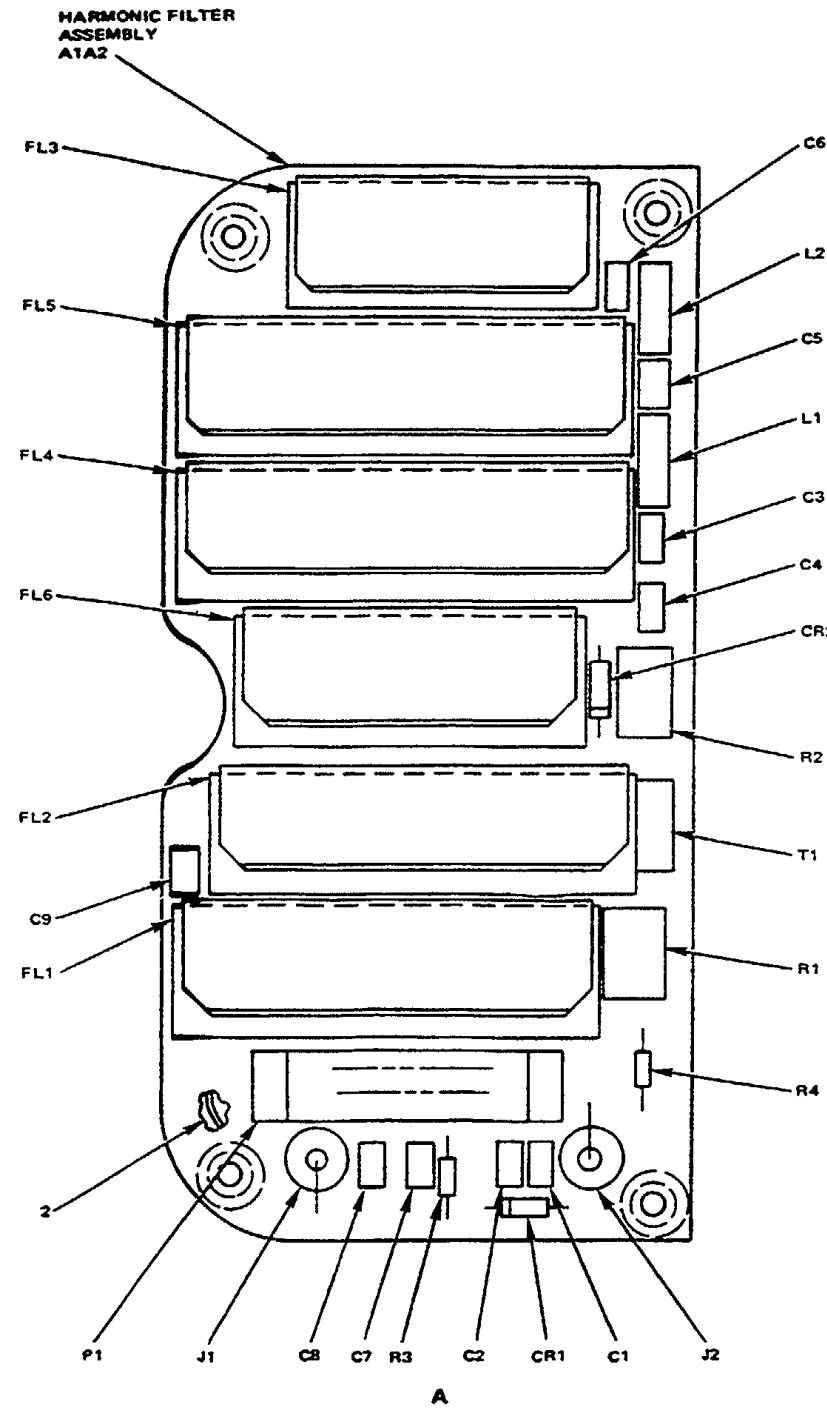
NOTES: UNLESS OTHERWISE SPECIFIED

1. PARTIAL REF DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH A1A2
2. CAPACITANCE VALUES ARE IN PICOFARADS +5%, 500V
3. INDUCTOR RESONANT FREQ. ARE IN MEGAHERTZ (MHz).
4. ALL RELAYS EXCEPT FOR FL1-K ARE SHOWN DE-ENERGIZED.
5. INDICATES DEPENDENCY ON BENCH POWER SUPPLY VOLTAGE
6. VOLTAGES IN TRANSMIT MOOD WITH 50 OHM RADIO SET LOAD, RF OUTPUT 20W
7. FOR SIGNAL INPUT/OUTPUT ROUTING REFER TO FIGURE 2-1

Figure 4-1. Harmonic Filter A1A2 Schematic.

Figure 4-2. Harmonic Filter A1A2 Component Location

ITEM	DESCRIPTION
A1A2	Harmonic Filter Assembly
C6	Capacitor
L2	Inductor
C5	Capacitor
L1	Inductor
C3	Capacitor
C4	Capacitor
CR2	Diode
R2	Resistor, Variable
T1	Inductor
R1	Resistor, Variable
R4	Resistor
J2	Connector, Coaxial, RF
C1	Capacitor
CR1	Diode
C2	Capacitor
R3	Resistor
C7	Capacitor
C8	Capacitor
J1	Connector, Coaxial, RF
P1	Connector, Receptacle, Electric
2	Strap, Handle
FL1	Filter, Submodule
C9	Capacitor
FL2	Filter, Submodule
FL6	Filter, Submodule
FL4	Filter, Submodule
FL5	Filter, Submodule
FL3	Filter, Submodule



SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Harmonic Filter/Power Amplifier	•••	Figure 3-10D
Test Extender Cable		
RF Coax Cable (2 each)	•••	Figure 3-11A
Audio Input/Keying Adapter	•••	Figure 3-110
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MEL-984/A	None

NOTE: Referenced figures are in 1M 11-5820-919-40*1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Digital Voltmeter (DVM, ohmmeter function)	AN/USM-341	1
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution IF Section	Hewlett Packard HP-8552B	1
- RF Section	Hewlett Packard-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
Power Supply, DC	Hewlett Packard HP-64398	1
Attenuator, Coaxial 20 db, 30w man., 50 ohm	Narda 765-20	1

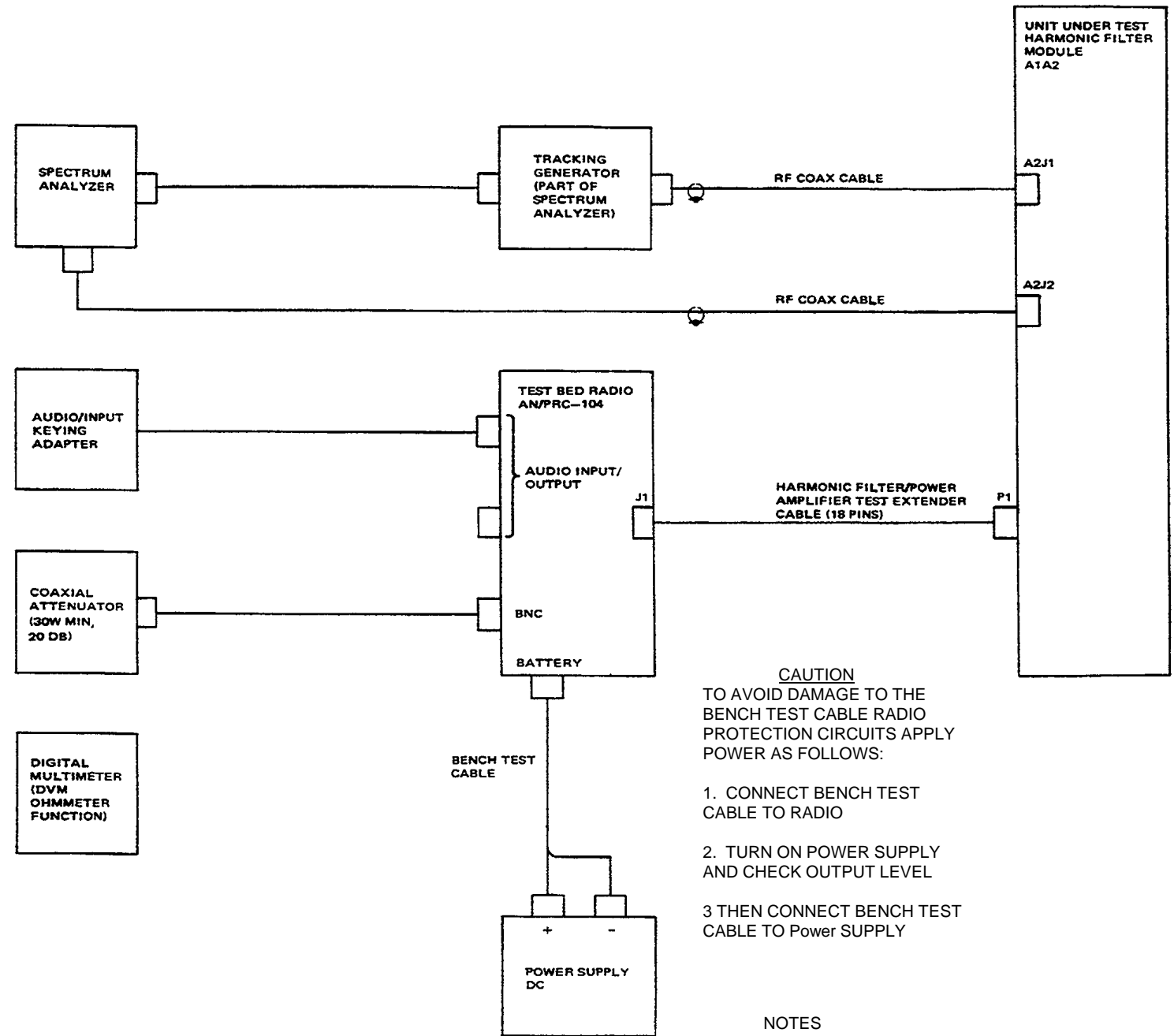


Figure 4-3. Harmonic Filter A1A2 Module Performance Test Setup.

Figure 4-4. Harmonic Filter A1A2 Performance Test (Sheet 1 of 3)

HARMONIC FILTER PERFORMANCE TEST

NOTE 1: The narrowband criterion is a maximum of 1.8 db insertion loss in the passband. A shorting bar, connected between the two fabricated rf cables, should be used to achieve a 0-db reference. The wideband criterion is -40 db suppression beyond 3 times the lower band frequency of the selected filter. To obtain narrow and Sideband spectral outputs as in the figures, set the controls on the spectrum analyzer as follows:

Controls:	Narrow	Wide
Scan Trigger - AUTO	AUTO	AUTO
Scan Mode - INT.	INT.	INT.
Video Filter - 10 kHz	OFF	10 kHz
Log/CM	2 db Log	10 db Log
Linear Sensitivity - 1	-1	-6
Log Reference - 0	0	10
Scan Time	5 ms	20 ms
Range	0-11 MHz	0-110 MHz
Input Attenuation	50 db	20 db
Bandwidth	100 kHz	300 KHz
Center Frequency	2.5 MHz	50 MHz
Scan width	0.2 MHz (Per Division)	.05 KHz (0-100 MHz) (Inner Red)
Tracking Generator		
Function	Track Analyzer	Same
RF Level	0 dbm	Same

Each filter can legitimately be checked by attaching the RF signal generator to A2J1 and the power meter to A2J2; the of signal generator is set to upper, middle, and lower points on the passband, and the insertion loss (1.8 db maximum) is read on the power meter. A zero reference is established by connecting the rf signal generator to poser meter.

NOTE 2: Scan width is 0.5 MHz, center frequency is 4,000 KHz

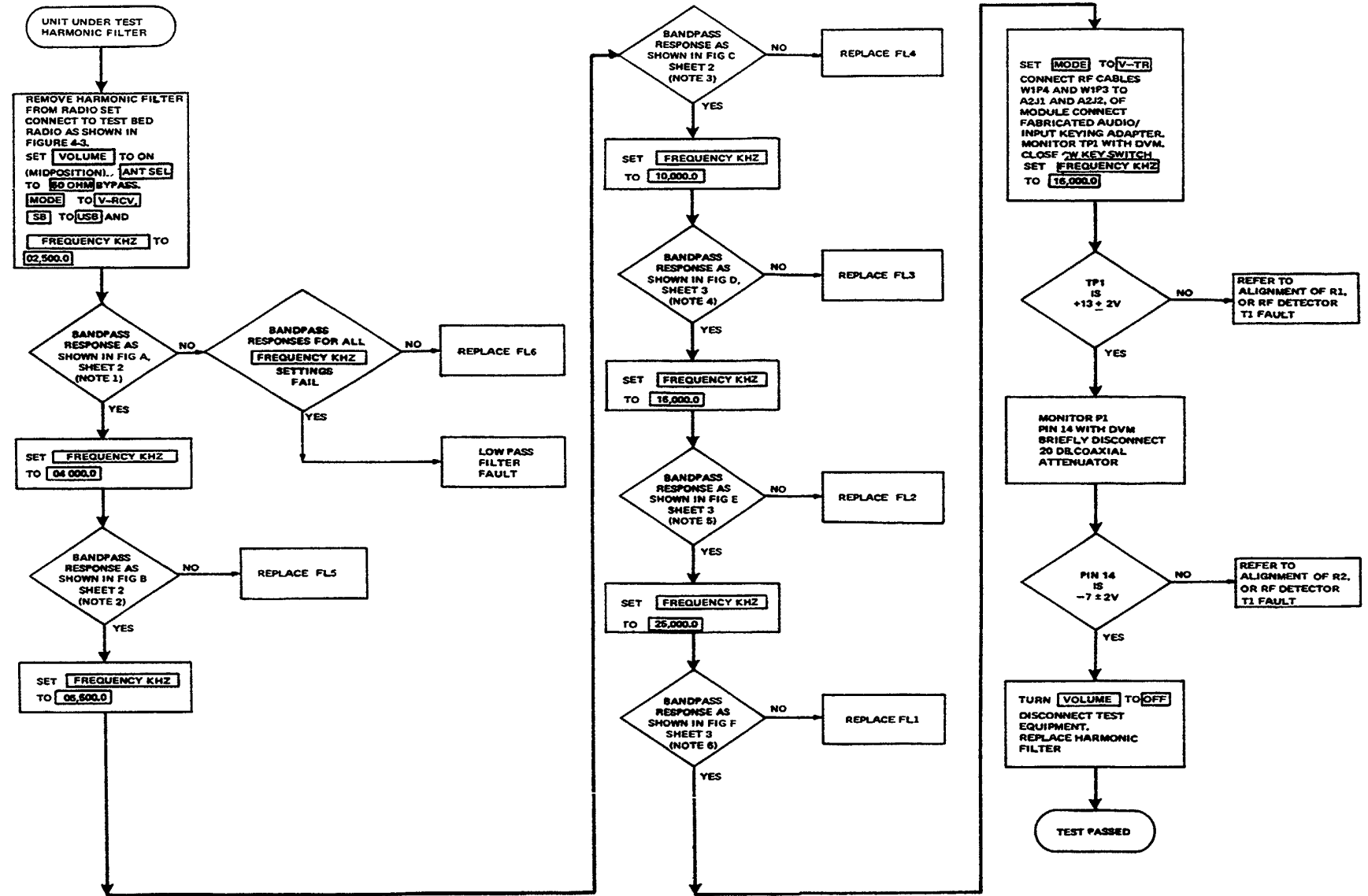
NOTE 3: Scan width is 0.5 MHz, center frequency is 6,500 KHz

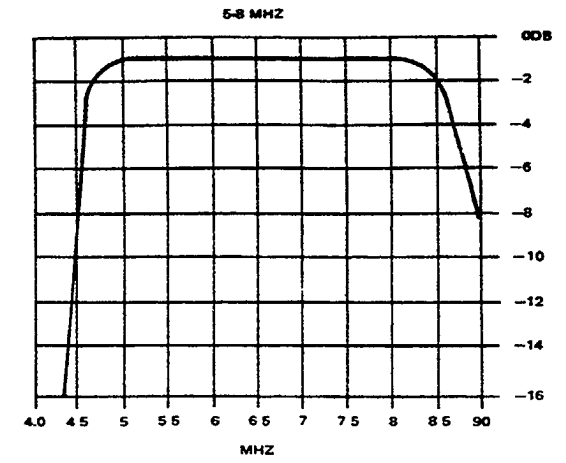
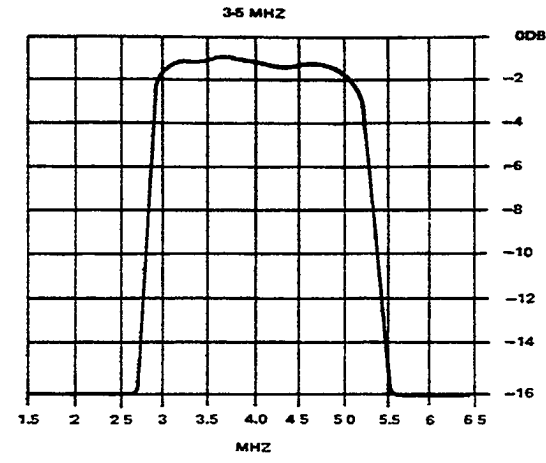
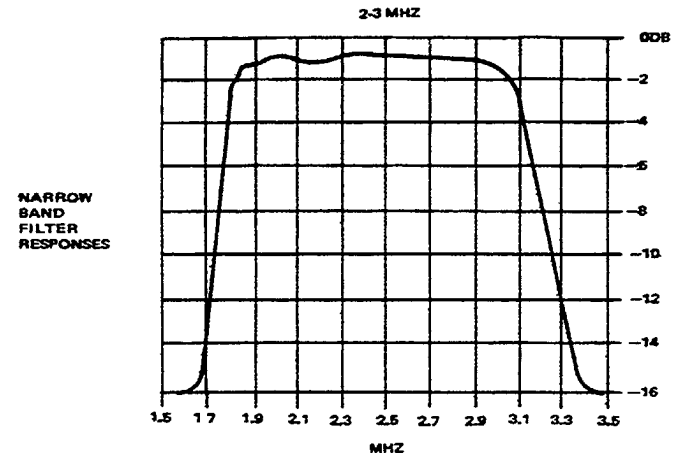
NOTE 4: Scan width is 1 MHz, center frequency is 10,000 KHz, range 0-110

NOTE 5: Scan width is 2 MHz, center frequency is 16,000 KHz, scan time 10 ms

NOTE 6: Scan width is 5 MHz, center frequency is 25,000 KHz, scan time 20 ms

NOTE 7: Unless otherwise specified, all voltage measurements taken with respect to chassis ground.





SPECTRUM ANALYZER SETTINGS IN PERFORMANCES TEST NOTES.

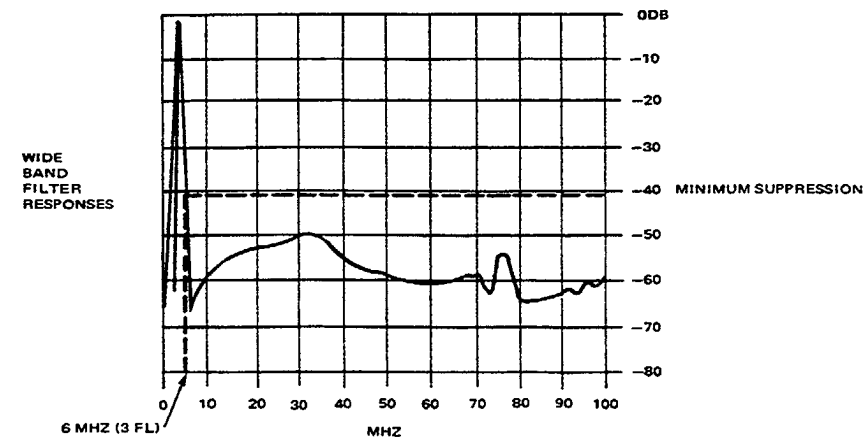


FIG A

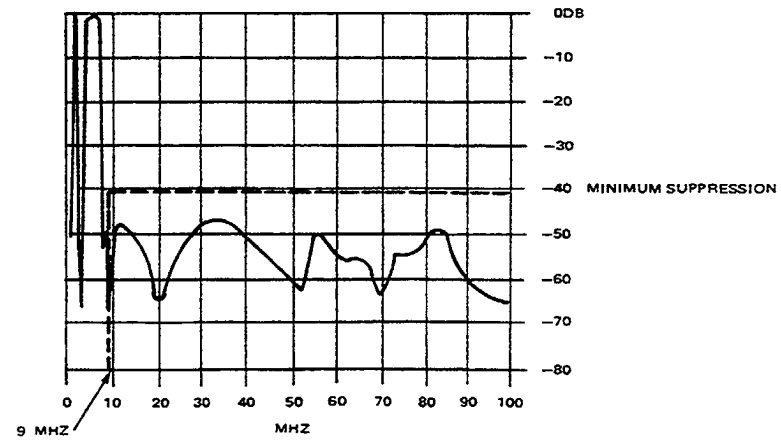


FIG B

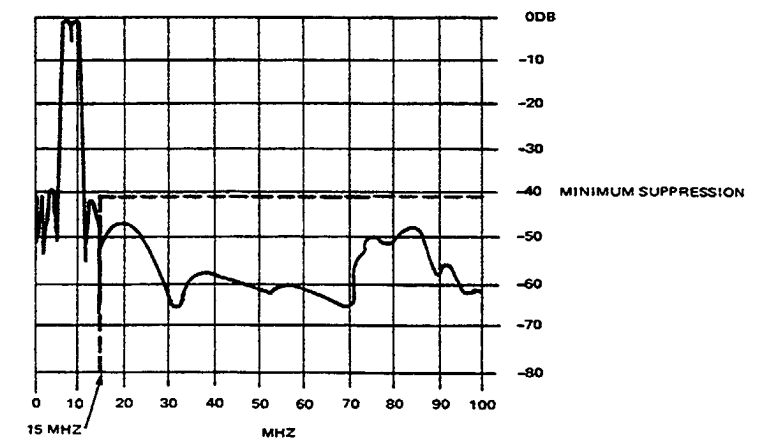
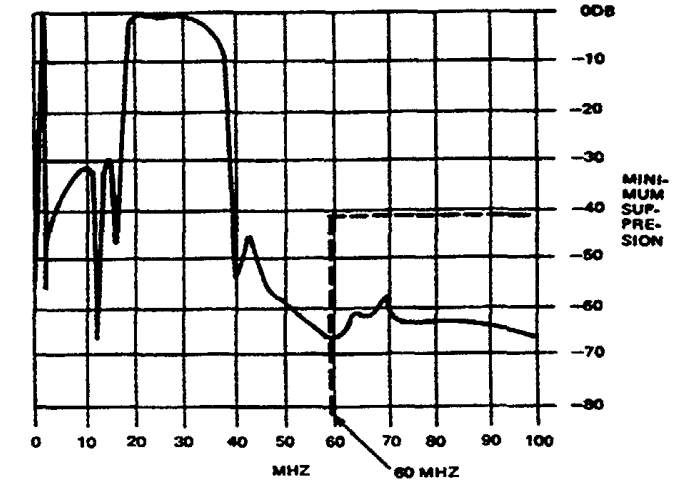
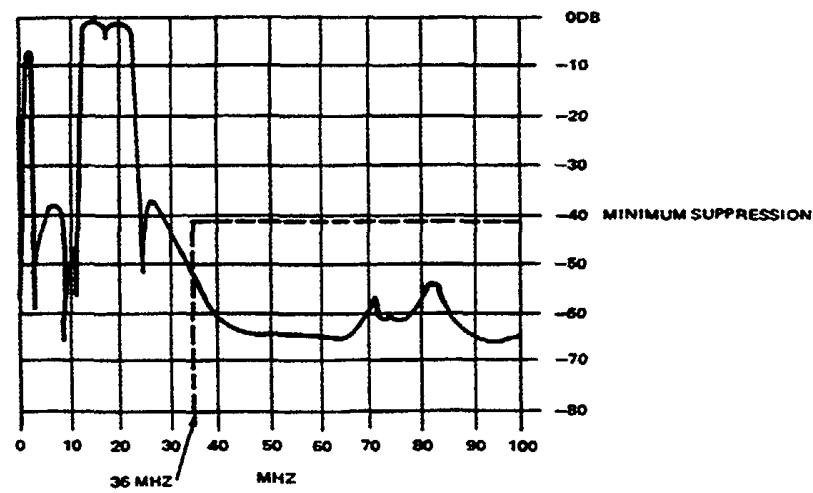
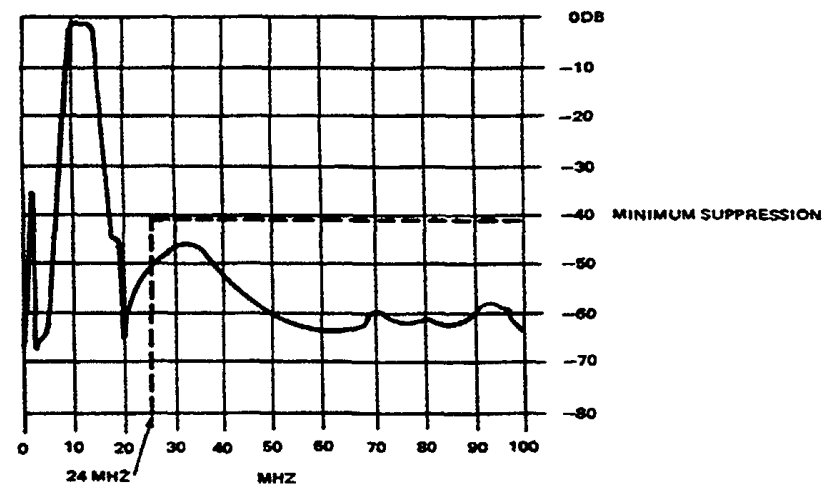
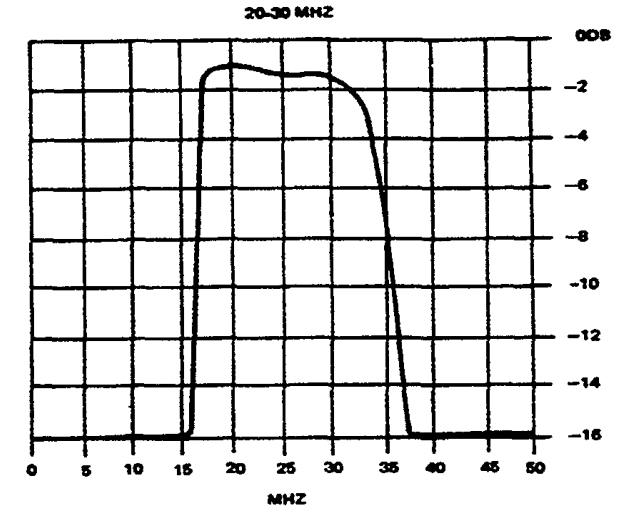
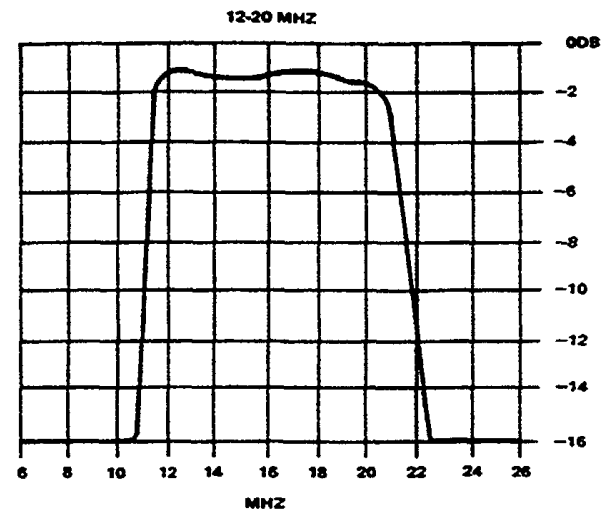
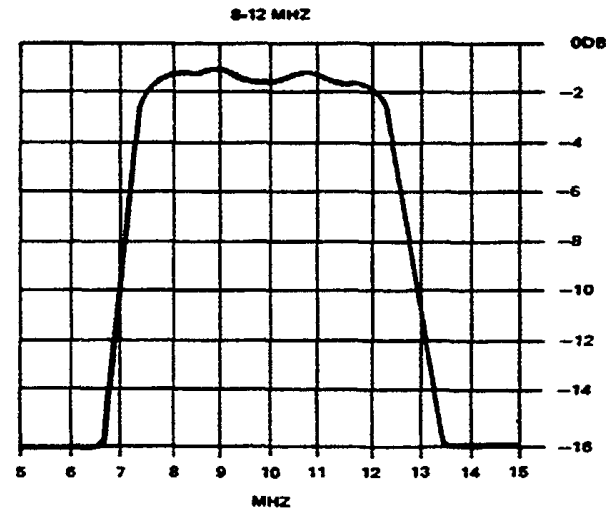


FIG C

Figure 4-4. Harmonic Filter A1A2 Performance Test (Sheet 2 of 3)

Figure 4-4. Harmonic Filter A1A2 Performance Test (Sheet 3 of 3)



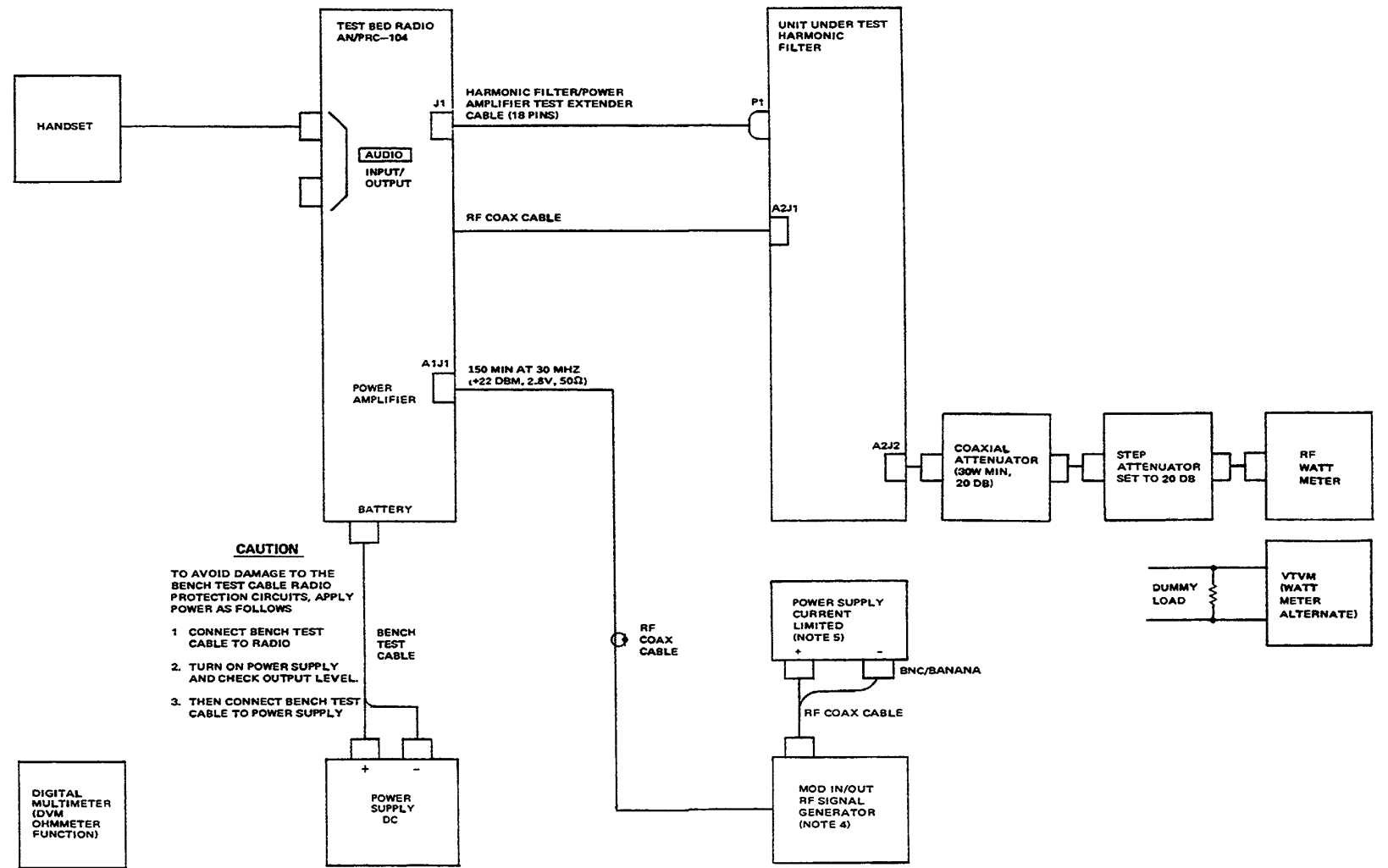
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Harmonic Filter/Power Amplifier Test Extender Cable	•••	Figure 3-10D of -40-1
RF Coax Cable (2 each)	•••	Figure 3-11A of -40-1
RF Coax Cable (1 each)		Figure 3-11B of -40-1

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name Designation	Quantity
Radio Set, Test Bed	AN/PRC-104 1
VTVM	AN/USM-116 1
Signal Generator, RF	AN/USM-323 1
Digital Multimeter (DVK, ohmmeter function)	AN/USM-341 1
Dummy Load (50 ohm)	DA-553()/4 1
Watt Meter	
- Power Meter	Hewlett Packard HP-435A 1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A 1
Power Supply, DC	Hewlett Packard HP-6439B 1
Power Supply, Current Limited	Hewlett Packard HP-6215A 1
Attenuator, Coaxial (20 db, 30w min., 50 ohm)	Narda 765-20 1
Attenuator, Step	CN1128/U



NOTES:

- EQUIVALENT TEST EQUIPMENT MAY BE USED
- USE ONLY TEST EQUIPMENT THAT IS PROPERLY CALIBRATED FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OR FAULT INDICATIONS
- IF ADEQUATE WATTMETER IS NOT AVAILABLE SUBSTITUTE VTVM TERMINATED WITH DUMMY LOAD $P = E^2/R$ WHERE $R = 50$ OHMS
- SET MODULATION MODE SWITCH TO AM, EXT, DC, AND TURN LEVEL SWITCH TO COW POSITION PRIOR TO CONNECTING D C CABLE TO MOD IN/OUT CONNECTOR
- SET OUTPUT VOLTAGE TO +2 VOLTS D.C. CAUTION DO NOT EXCEED +5VDC SET CURRENT REGULATION TO MINIMUM REQUIRED TO PERFORM ALIGNMENT

Figure 4-5. Harmonic Filter A1A2 Alignment Setup.

HARMONIC FILTER A1A2 ALIGNMENT

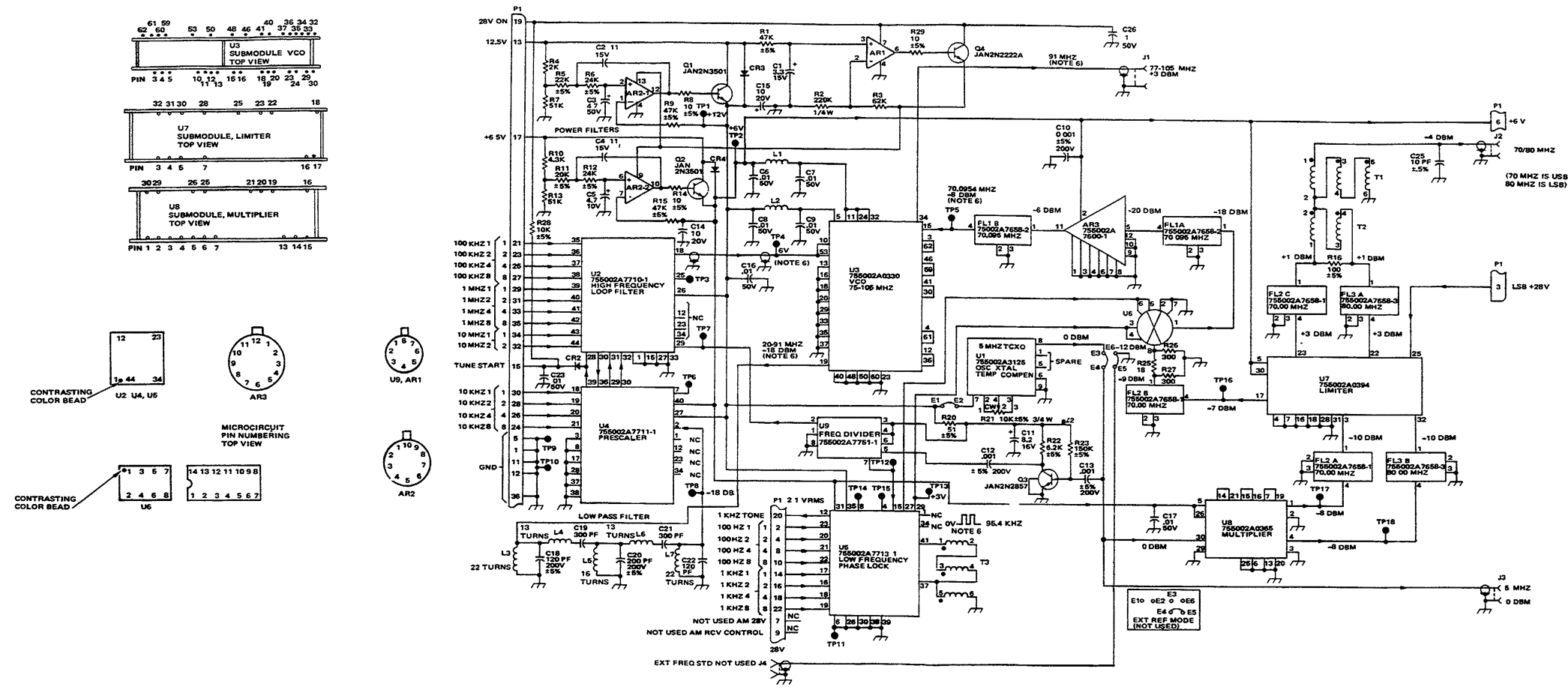
The alignment procedure is to be used in either of these d situations: (1) the performance test calls a potentiometer out of adjustments or (2) the following is replaced: RF Detector T1, CRT, CR2, C1, C2, C3, and C4. The procedure consists of a preliminary setup and an adjustment procedure.

Preliminary Setup

1. Remove the harmonic filter from the receiver/exciter.
2. Remove the cover from the power amplifier module of the test bed radio set. Disconnect the rf radio coax A1J1 at the module and plug in the fabricated rf coax cable in its place.
3. Connect the test radio, module, cables and test equipment as shown in figure 4-5. Comply with notes 1-5 on figure 4-5.
4. Select the rf signal generator frequency of 29.9999 MHz and an initial level output of 0 dbm at radio. Set dc power supply (7 amp) to +26.5v.
5. See the test ratio controls on the control panel and amplifier/coupler as follows:
 - a. FREQUENCY KHZ to 29,999.9
 - b. Mode to V-TR
 - c. ANT SEL to 50 OEM (bypass)
 - d. VOLUME to ON

ADJUSTMENT

1. Monitor VFWD, TP1, of the module using the test DVM and a sharp probe.
2. Close the PTT switch on the handset and adjust the rf signal generator output to +19 dbm, turn the modulation level control to obtain 20 watts output (2 milliwatts indicated on the wattmeter from the harmonic filter module.
3. Adjust R1 to obtain +14.5 \pm 0.1 vdc at TP1 of the module with 20 watts module output
4. Change the DVM monitor point from TP1 to A1A2P1 pin 14, VREFL (reflected voltage).
5. Adjust R2 to obtain the minimum voltage at pin 14. It should be between zero and -3.0 vdc
6. Open the handset PTT switch.
7. Disconnect the +26.5 vdc input to the radio and remove the cables connected to the module.



- NOTES: UNLESS OTHERWISE SPECIFIED
1. CAPACITANCE VALUES ARE IN MICROFARADS 10% 100 V
 2. RESISTANCE VALUES ARE IN OHMS 1/10W
 3. ALL DIODES ARE JAN1 N4148
 4. FOR SIGNAL INPUT/OUTPUT ROUTING REFER TO FIGURE 2-1
 5. PARTIAL REF DESIGNATION ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH A1A3
 6. VALUES SHOWN WITH FREQUENCY KHz SET TO 16005.4 (TEST POINT ACCEPTABLE RANGE 15+31VT087V)

Figure 5-1. Synthesizer A1A3 Schematic

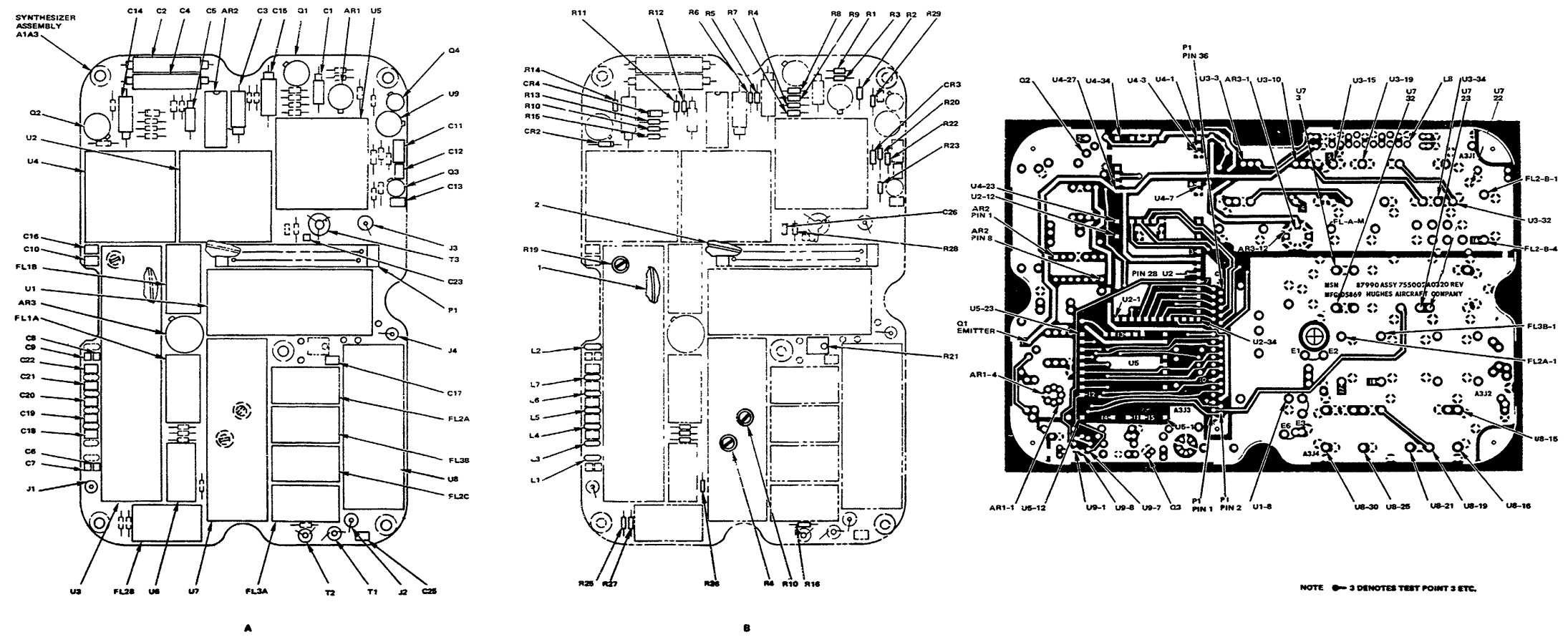


Figure 5-2. Synthesizer A1A3 Component Location (Sheet 1 of 2)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
	A		
A1A3	Synthesizer Assembly	FL1B	Filter, Bandpass
C14	Capacitor	C10	Capacitor
C2	Capacitor	C16	Capacitor
C4	Capacitor	U4	Microcircuit
C5	Capacitor	U2	Microcircuit
AR2	Microcircuit	Q2	Transistor
C3	Capacitor		B
C15	Capacitor	R11	Resistor
Q1	Transistor	R12	Resistor
C1	Capacitor	R6	Resistor
AR1	Microcircuit	R5	Resistor
U5	Microcircuit	R7	Resistor
Q4	Transistor	R4	Resistor
U9	Microcircuit	R8	Resistor
C11	Capacitor	R9	Resistor
C12	Capacitor	R1	Resistor
Q3	Transistor	R3	Resistor
C13	Capacitor	R2	Resistor
J3	Connector, Coaxial RF	R29	Resistor
T3	Transformer, RF	CR3	Diode
C23	Capacitor	R20	Resistor
P1	Connector, Receptacle	R22	Resistor
J4	Connector, Coaxial RF	R23	Resistor
C17	Capacitor	C26	Capacitor
FL2A	Filter, Bandpass	R28	Resistor
FL3B	Filter, Bandpass	R21	Resistor, Variable
U8	Frequency Multiplier Assembly	R16	Resistor
FL2C	Filter, Bandpass	U7R10	Resistor, Variable
C25	Capacitor	U7R4	Resistor, Variable
J2	Connector, Coaxial RF	R26	Resistor
T1	Transformer RF	R27	Resistor
T2	Transformer RF	R25	Resistor
FL3A	Filter, Bandpass	L1	Inductor
U7	Limiter, Amplitude	L3	Inductor
U6	Mixer, Radio	L4	Inductor
FL2B	Filter, Bandpass	L5	Inductor
U3	Oscillator, Volume, Control	L6	Inductor
J1	Connector, Coaxial RF	L7	Inductor
C7	Capacitor	L2	Inductor
C6	Capacitor	1	Cable Assembly, RF
C18	Capacitor	U3R19	Resistor, Variable
C19	Capacitor	2	Strap, Handle
C20	Capacitor	CR2	Diode
C21	Capacitor	R15	Resistor
C22	Capacitor	R10	Resistor
C9	Capacitor	R13	Resistor
C8	Capacitor	CR4	Diode
FL1A	Filter, Bandpass	R14	Resistor
AR3	Amplifier, RF		
U1	Oscillator, Crystal, Temp.		

Figure 5-2. Synthesizer A1A3 Component Location (Sheet 2 of 2)

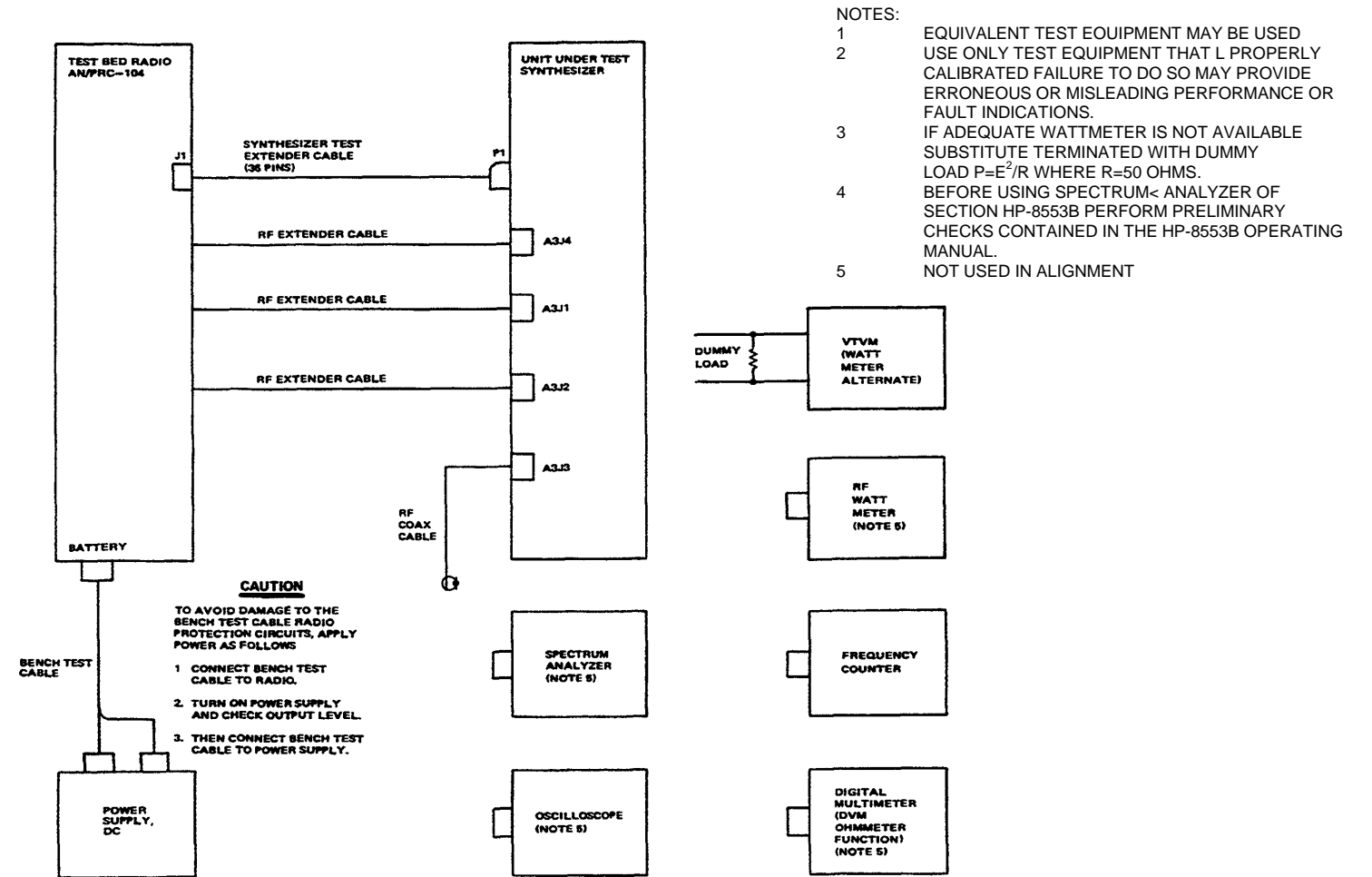
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
RF Coax Cable (2 each)	...	Figure 3-11A
RF Extender Cable (4 each)	...	Figure 3-11B
Synthesizer Teat Extender Cable	...	Figure 3-10C
KIT Tool, Electronic	Tg-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MR-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1,

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Frequency Counter	AN/CP-843P/D	1
VTVM	AN/USM-116	1
Oscilloscope, Storage	Hewlett Packard HP-1741A	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Dummy Load (50 ohm)	DA-553()/4	1
Watt Meter		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Bewlett Packard BP-8482A	1
Spectrum Analyzer	Bewlett Packard BP-141-T	1
- High Resolution IF Section	Bewlett Packard BP-8552B	1
- RF Section	Hewlett Packard BP-8558B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
- High Impedance Probe	Hewlett Packard BP-1121A	1
Power Supply, DC	Hewlett Packard HP-6439B	1



- NOTES:
- 1 EQUIVALENT TEST EQUIPMENT MAY BE USED
 - 2 USE ONLY TEST EQUIPMENT THAT L PROPERLY CALIBRATED FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OR FAULT INDICATIONS.
 - 3 IF ADEQUATE WATTMETER IS NOT AVAILABLE SUBSTITUTE TERMINATED WITH DUMMY LOAD $P=E^2/R$ WHERE R=50 OHMS.
 - 4 BEFORE USING SPECTRUM< ANALYZER OF SECTION HP-8553B PERFORM PRELIMINARY CHECKS CONTAINED IN THE HP-8553B OPERATING MANUAL.
 - 5 NOT USED IN ALIGNMENT

Figure 5-3. Synthesizer A1A3 Performance Test and Alignment Setup

SYNTHESIZER PERFORMANCE TEST

NOTE 1: Spurious signal applies between 4.995 and 5.005 MHz. Set spectrum analyzer at:

Log Reference Level	10 db
Linear Sensitivity	0
Bandwidth	1 kHz
Scan Width	10 kHz/div
Scan Time	2 sec/div.
Video Falter	10 Hz
Center Frequency	5 MHz
10 db Log	
Input Attenuation	30 db
Range	0-110 MHz
Storage	STD
Scan Mode	SINGLE

NOTE 2: Spurious signal applies between 40 and 90 MHz. Set spectrum analyzer at:

Log Reference Level	0
Linear Sensitivity	0
Bandwidth	300 kHz
Scan Width	10 MHz/div.
Scan Time	10 ms/div.
Video Falter	10 kHz
10 db Log	
Input Attenuation	20 db
Center Frequency	70 MHz, USB
Range	0-110 MHz
Scan Mode	INT

NOTE 3: A3J1 output IS frequency kHz plus 75,000 kHz. Spurious applies between 60 and 110 MHz. If output power IS low, adjust R19 of VCO (U3). If unable to raise power, continue with troubleshooting flowchart.

NOTE 4: Spurious signal applies between 60 and 110 MHz. TP5 frequency is 70,090,000 Hz + XY, where X is 1 kHz frequency kHz digit and Y is 100 Hz frequency Hz digit. Set spectrum analyzer as in Note 2, except that the center frequency is 91 MHz.

NOTE 5: When 1 kHz digit of frequency kHz is 0, TP15 voltage is 3v. When this same digit is 9, TP15 is 9v.

NOTE 6: Unless otherwise specified, all voltage measurements taken with respect to chassis ground.

NOTE 7: If the phase locking action of the synthesizer is functioning correctly, TP4 voltage would be 6v. Since it IS not locking, U2 should be pruned at one end or the other of the 3 to 9v VCO tune voltage.

NOTE 8: Low frequency adjust transformer T3 must be replaced and returned as specified on paragraph 5-9 whenever low frequency loop filter hybrid (U5) is replaced.

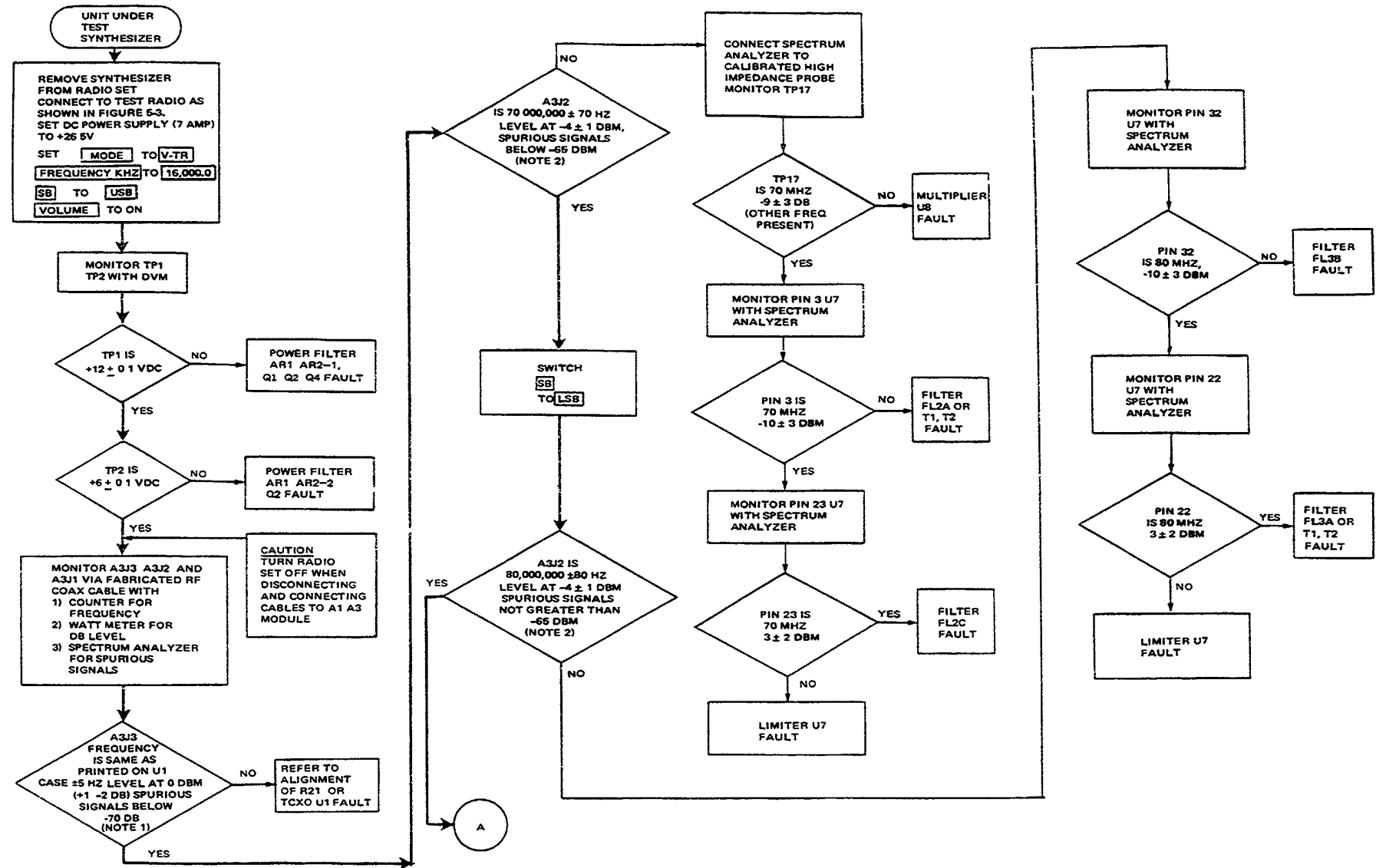


Figure 5-4. Synthesizer A1A3 Performance Test (Sheet 1 of 2)

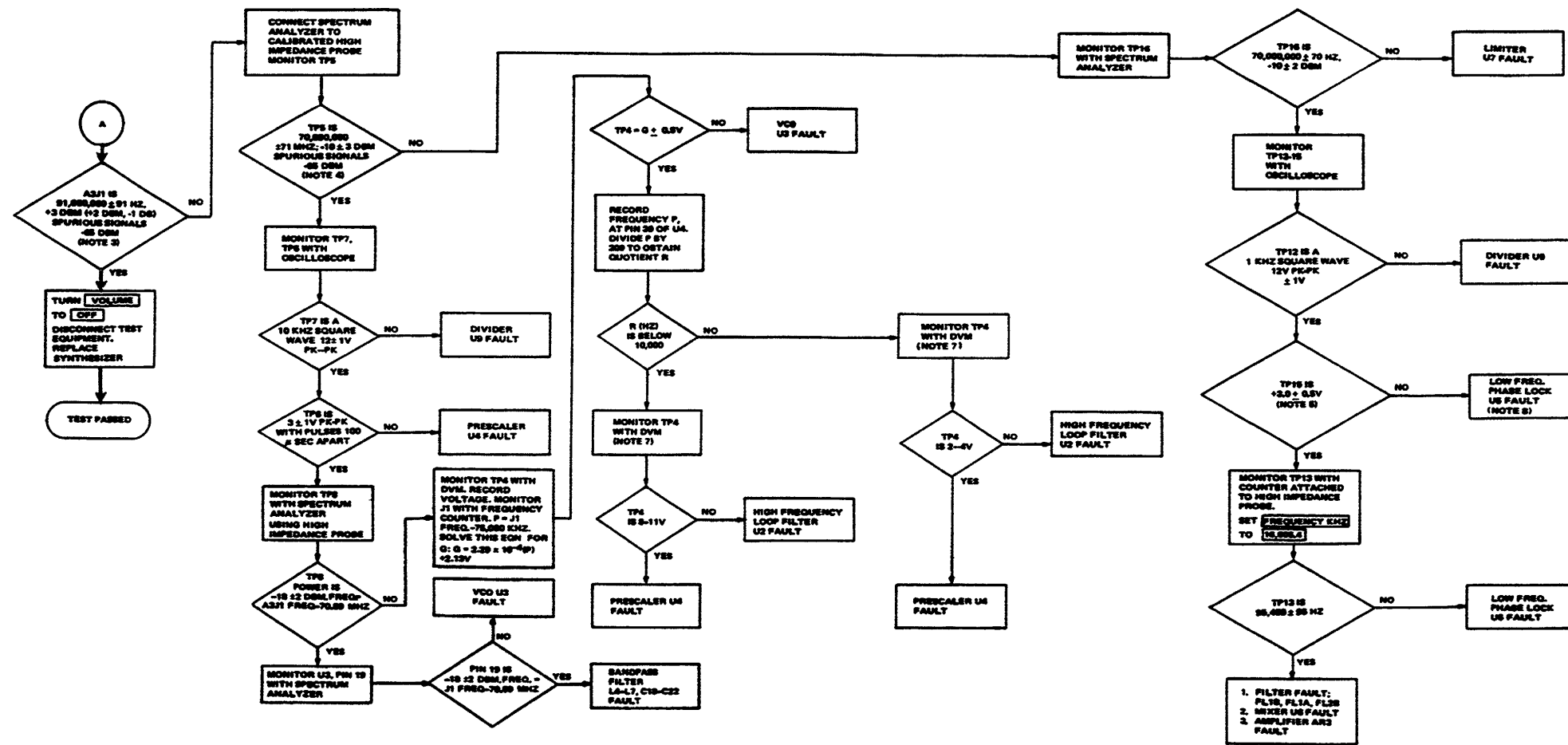


Figure 5-4. Synthesizer A1A3 Performance Test (Sheet 2 of 2)

SYNTHESIZER A1A3 ALIGNMENT

The alignment procedure is to be used whenever TCXO U1, VCO U3, or 1mlter U7 is replaced or whenever the first LO, second LO, or TCXO output frequency or power is out of alignment. The procedure consists of preliminary setup and adjustment.

PRELIMINARY SETUP

1. Remove the synthesizer from the receiver /exciter and connect the module as in figure 5-2.
2. Set dc power supply (7 amp) to +26.5v.
3. Connect the tracking generator (used as a counter) to A3J3 via rf coax cable.
4. Set VOLUME switch on control panel to on.
5. Set SB switch on control panel to USB.
6. Set FREQUENCY KHZ switches on control panel to 29,990.0.

ADJUSTMENT

1. Monitor TP15 filth DVM. If required, remove turns from T3 winding 1-2 (red wire) until DVM reads $+3.1 \pm 0.4v$.
2. Adjust R21 so that A3J3 is at the frequency stenciled on TCXO U1 case ± 0.5 Hz.
3. Disconnect rf extender cable from A3J2. Disconnect rf coax cable. Connect the watt meter to A3J2 via rf coax cable.
4. Adjust R4 of limiter U7 until wattmeter reads -4.0 ± 0.1 dbm.
5. Set SB switch on control panel to LSB.
6. Adjust R10 of limiter U7 until wattmeter reads -4.0 ± 0.1 dbm.
7. Disconnect of extender cable from A3J1. Disconnect rf coax cable from A3J2 and connect to A3J1. Reconnect rf extender cable (step 3) to A3J2.
8. Adjust R19 of VCO U3 until wattmeter reads $+3.0 \pm 0.1$ dbm.
9. Disconnect the test equipment.

- NOTES: UNLESS OTHERWISE SPECIFIED
1. DIODES ARE JAN1N4148.
 2. RESISTANCE VALUES ARE IN OHMS $\pm 5\%$, 1/2W.
 3. TRANSISTORS ARE JAN2N2222A.
 4. DS1 THROUGH DS6 ARE PART OF SWITCH ASSEMBLY S1 THROUGH S6 RESPECTIVELY.
 5. PARTIAL REF DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH A1A4.
 6. CAPACITANCE VALUES ARE IN MICROFARADS $\pm 10\%$.
 7. VOLTAGES WITH FREQUENCY KHZ SET TO 02.500.0.

NOTE 8. SWITCH S1 BCD LOGIC

DIAL SETTING	OUTPUT PIN					
	2	1	X	A	B	C
0	0	0	-	0	NC	1
1	0	1	-	1	NC	1
2	1	0	-	1	NC	0

1 = OPEN (+12V PULLUP)
 0 = GND
 - = NORMALLY OPEN, MOMENTARILY GND WHEN SWITCH IS CHANGED

NOTE 9. S2 - S6 BCD LOGIC

DIAL SETTING	OUTPUT PIN					
	8	4	2	1	X	
0	0	0	0	0	-	-
1	0	0	0	1	1	-
2	0	0	0	1	0	-
3	0	0	0	1	1	-
4	0	1	0	0	0	-
5	0	1	0	1	1	-
6	0	1	1	0	0	-
7	0	1	1	1	1	-
8	1	0	0	0	0	-
9	1	0	0	1	1	-

1 = OPEN (+12V PULLUP)
 0 = GND
 - = NORMALLY OPEN, MOMENTARILY GND WHEN SWITCH IS CHANGED

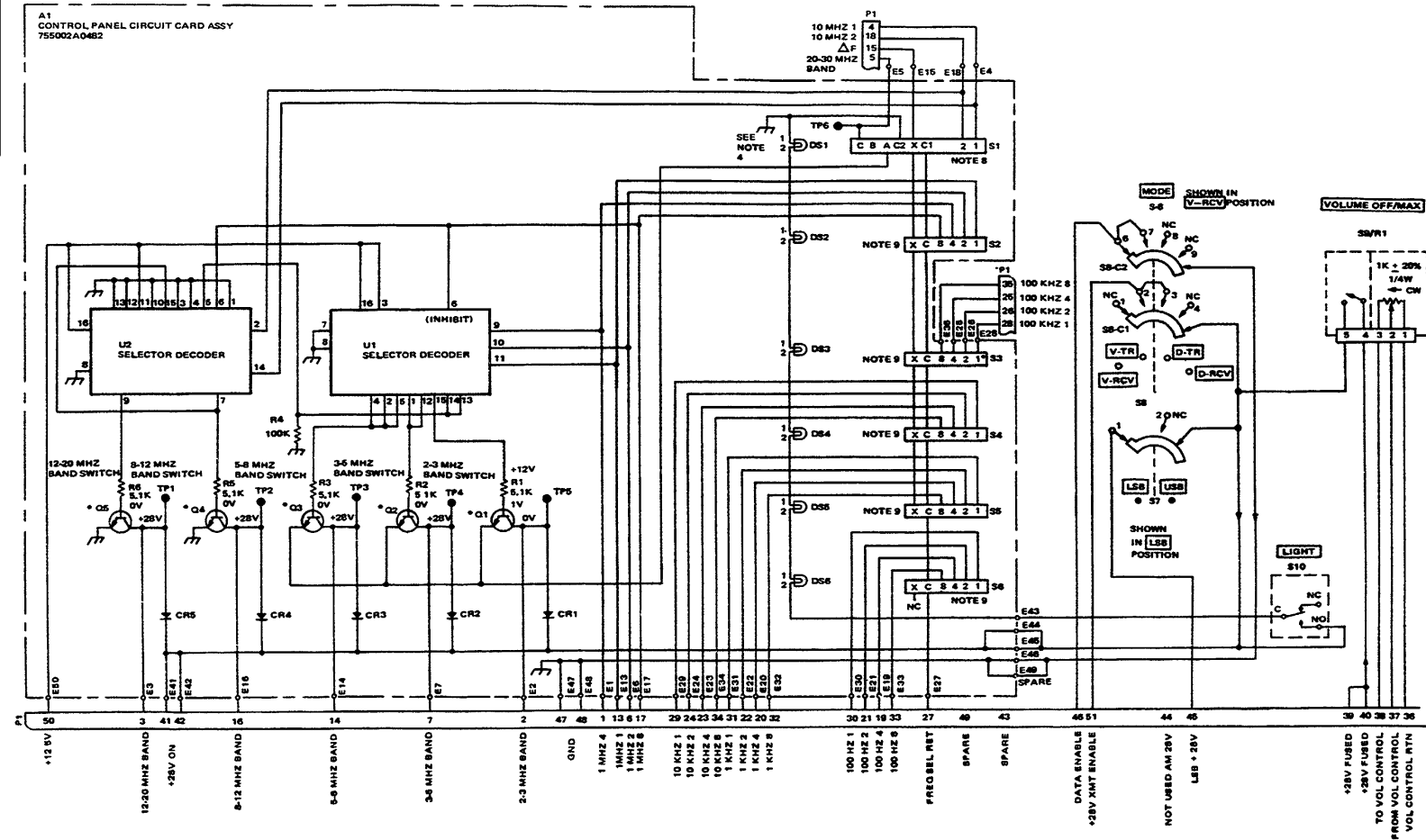


Figure 6-1. Control Panel A1A4 Schematic (Sheet 1 of 2)

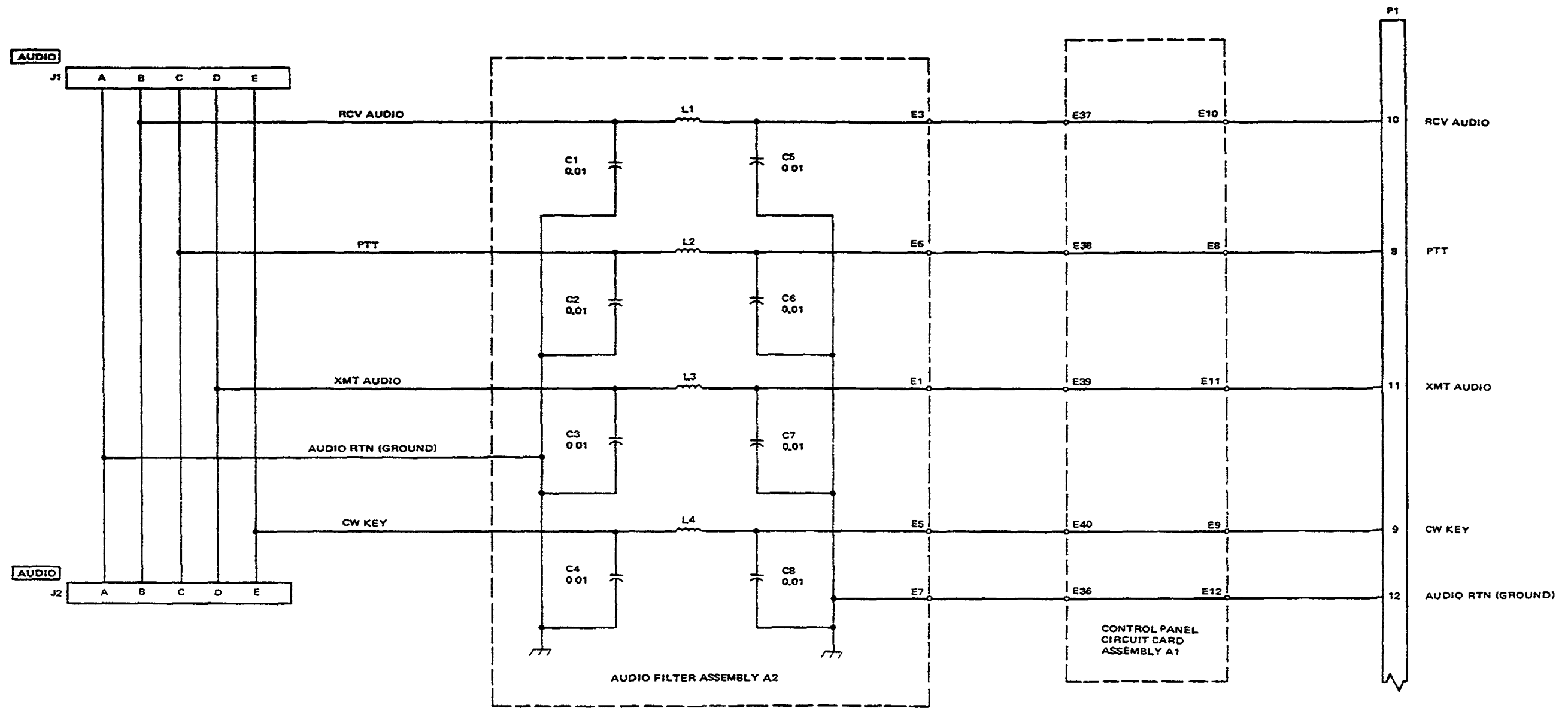


Figure 6-1. Control Panel A1A4 Schematic (Sheet 2 of 2)

ITEM	DESCRIPTION
1.	Panel
2.	Connector Ring (2 places)
3.	Deleted
4.	Nut
5.	Allen Screw (2 places)
6.	SB Switch Knob
7.	Retainer (threaded)
8.	Allen Screw N
9.	Light switch Knob
10.	Mode Switch Knob
11.	Allen Screw (2 places)
12.	Nut
13.	Deleted
14.	Volume Knob
15.	Allen Screw (2 places)
16.	Screw, Captive (6 places)
17.	Nut
18.	Deleted
19.	Gasket
20.	Gasket
21.	Gasket
22.	Gasket
23.	Switch, Volume
24.	Switch, Mode
25.	Switch, Light
26.	Switch, Rotary SB
27.	100 Hz
28.	1 KHz
29.	10 KHz
30.	100 KHz
31.	1 MHz
32.	Switch, Rotary, 10 MHz
33.	Connector, Multipin A1A4J1
34.	Allen Screw (12 places)
35.	Circuit Board Assembly (Control Panel) A1A4A1
36.	Audio Filter Assembly A1A4A2
37.	Connectors A1A4A2J1 A1A4A2J2
38.	Connector Washer (2 places)
39.	Gasket
40.	Lockwasher (12 places)

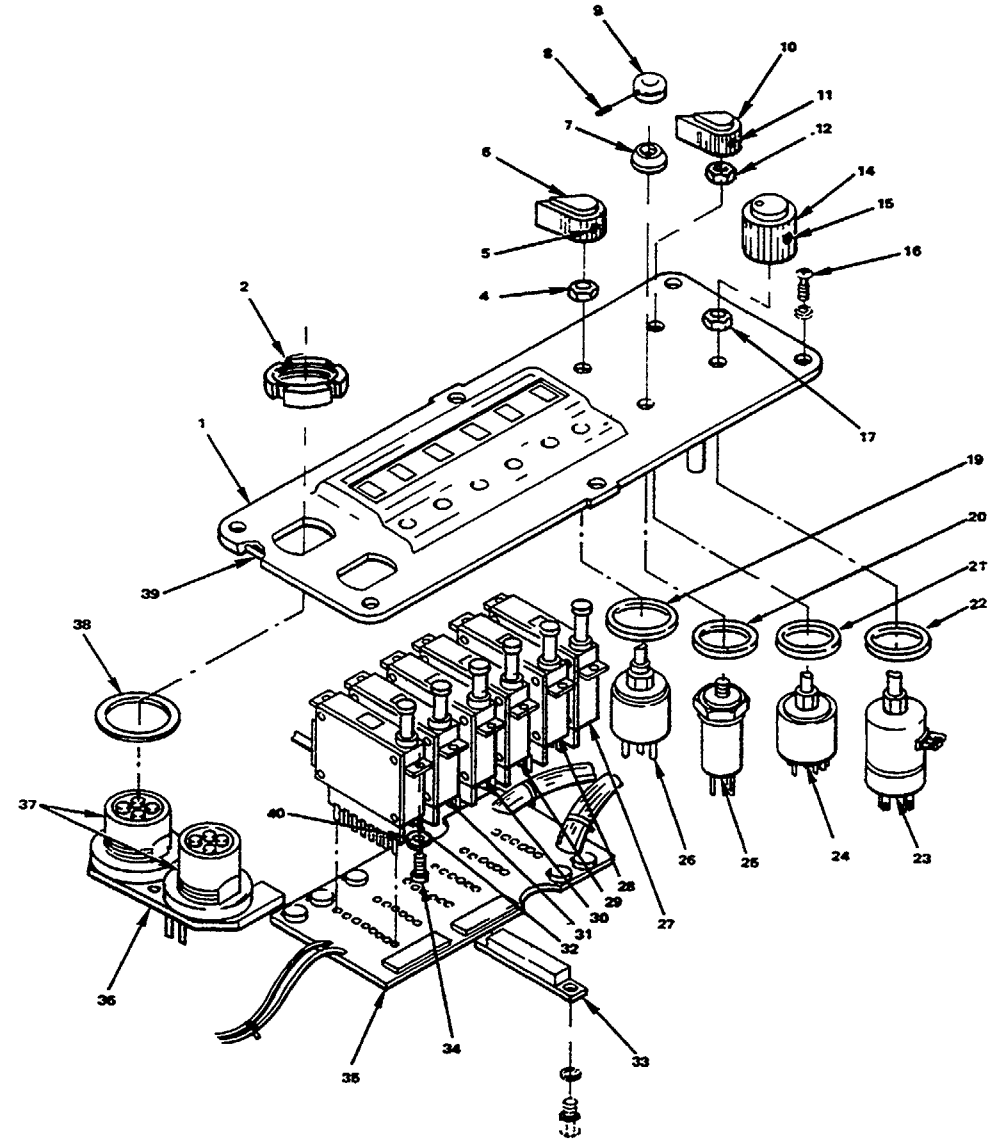


Figure 6-2. Control Panel A1A4 Component Location (Sheet 1 of 2)

ITEM DESCRIPTION

A2

- 1 Audio Filter, A1A4
- L2 Inductor, Filter
- J1 Connector, Audio
- C2 Capacitor
- C4 Capacitor
- L4 Inductor, Filter
- L1 Inductor, Filter
- C1 Capacitor
- C3 Capacitor
- J2 Connector, Audio
- L3 Inductor, Filter
- C7 Capacitor
- C5 Capacitor
- C8 Capacitor
- C6 Capacitor

A1

- 2 Control Panel Circuit Card Assembly
PWB
Machined Board
- Q4 Transistor
Mounting Pad
- Q5 Transistor
Mounting Pad
- U2 Microcircuit
- CR4 Diode
- R5 Resistor
- R4 Resistor
- U1 Microcircuit
- CR5 Diode
- R6 Resistor
- R3 Resistor
- CR3 Diode
- R2 Resistor
- CR2 Diode
- CR1 Diode
- R1 Resistor
- Q2 Transistor
- Q1 Transistor
- Q3 Transistor

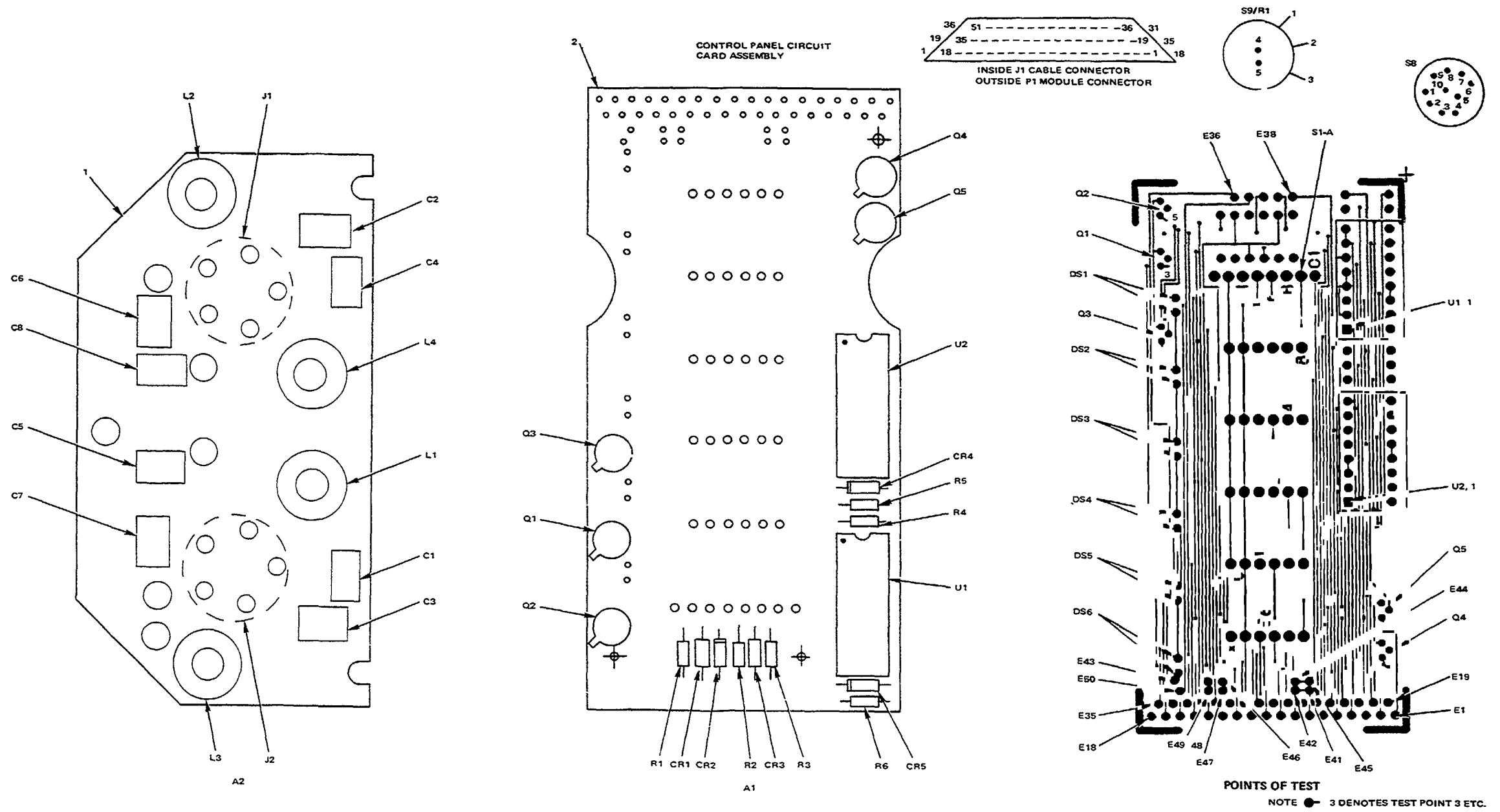


Figure 6-2. Control Panel A1A4 Component Location (Sheet 2 of 2)

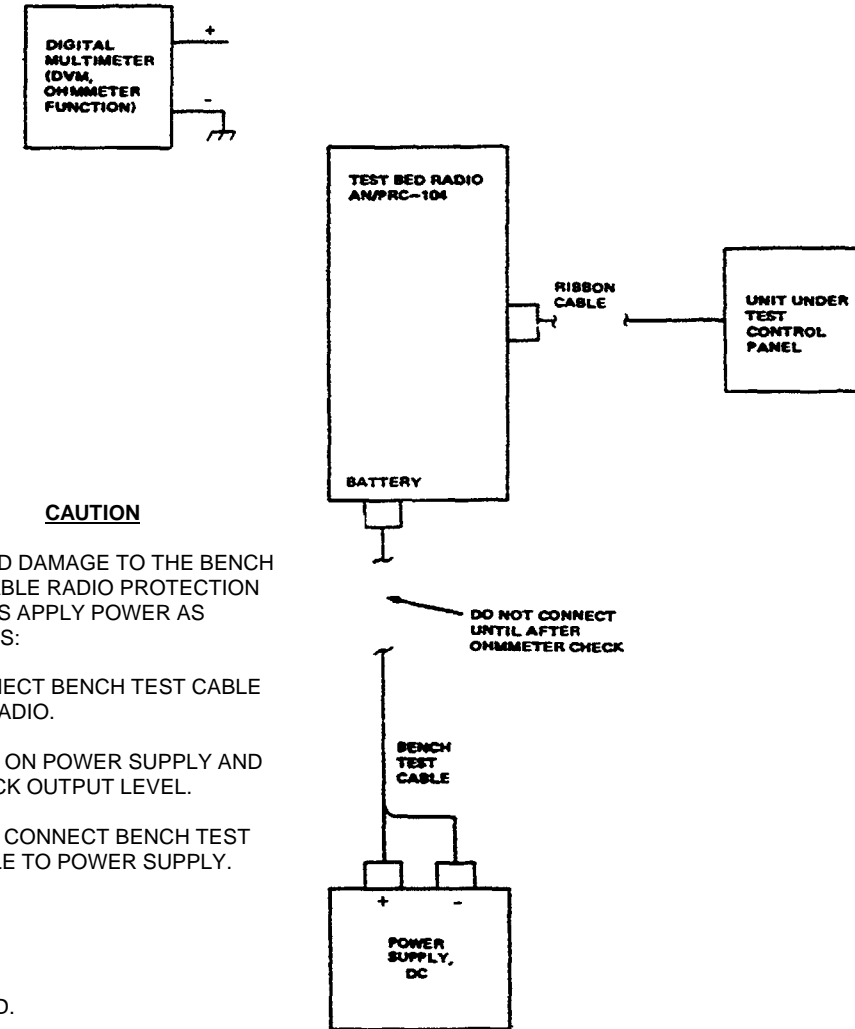
Figure 6-3. Control Panel A1A4 Performance Test Setup

SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

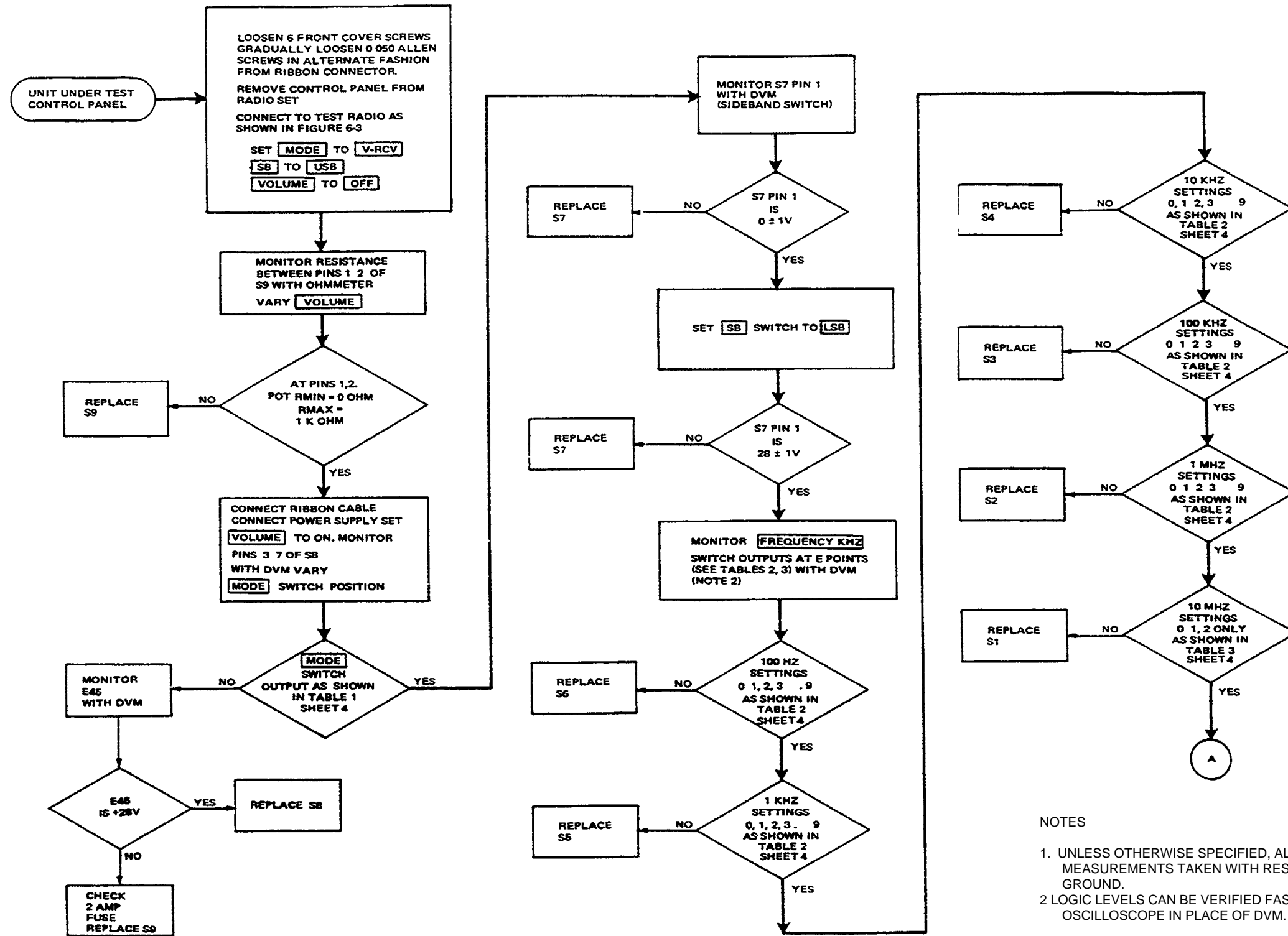
TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Power Supply, DC	Hewlett Packard HP-6439B	1



NOTES:

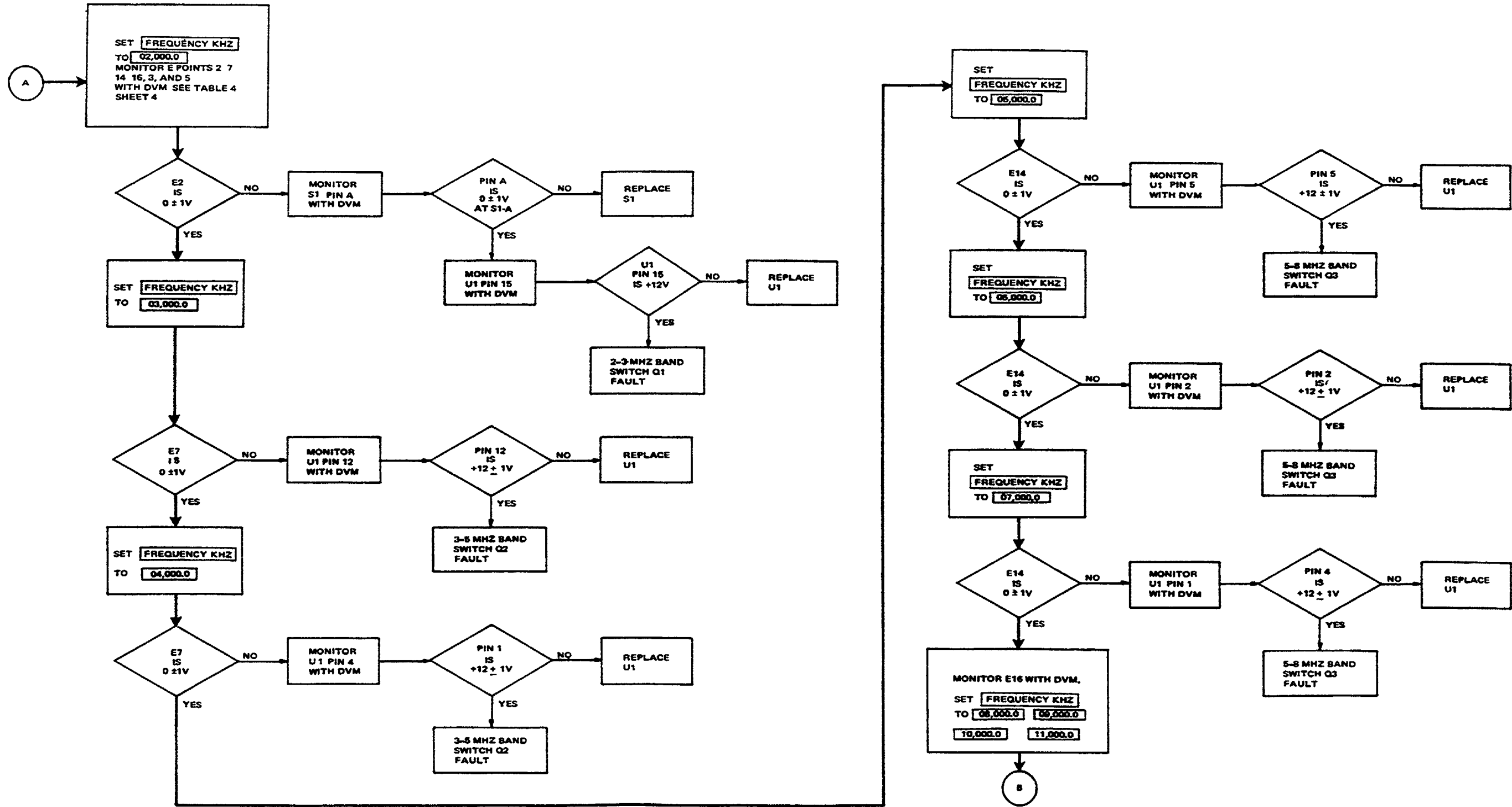
1. EQUIVALENT TEST EQUIPMENT MAY BE USED.
2. USE ONLY TEST EQUIPMENT THAT IS PROPERLY CALIBRATED. FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OF FAULT INDICATIONS.



NOTES
 1. UNLESS OTHERWISE SPECIFIED, ALL VOLTAGE MEASUREMENTS TAKEN WITH RESPECT TO CHASSIS GROUND.
 2. LOGIC LEVELS CAN BE VERIFIED FASTER BY USING AN OSCILLOSCOPE IN PLACE OF DVM.

Figure 6-4. Control Panel A1A4 Performance Test (Sheet 1 of 4)

Figure 6-4. Control Panel A1A4 Performance Test (Sheet 2 of 4)



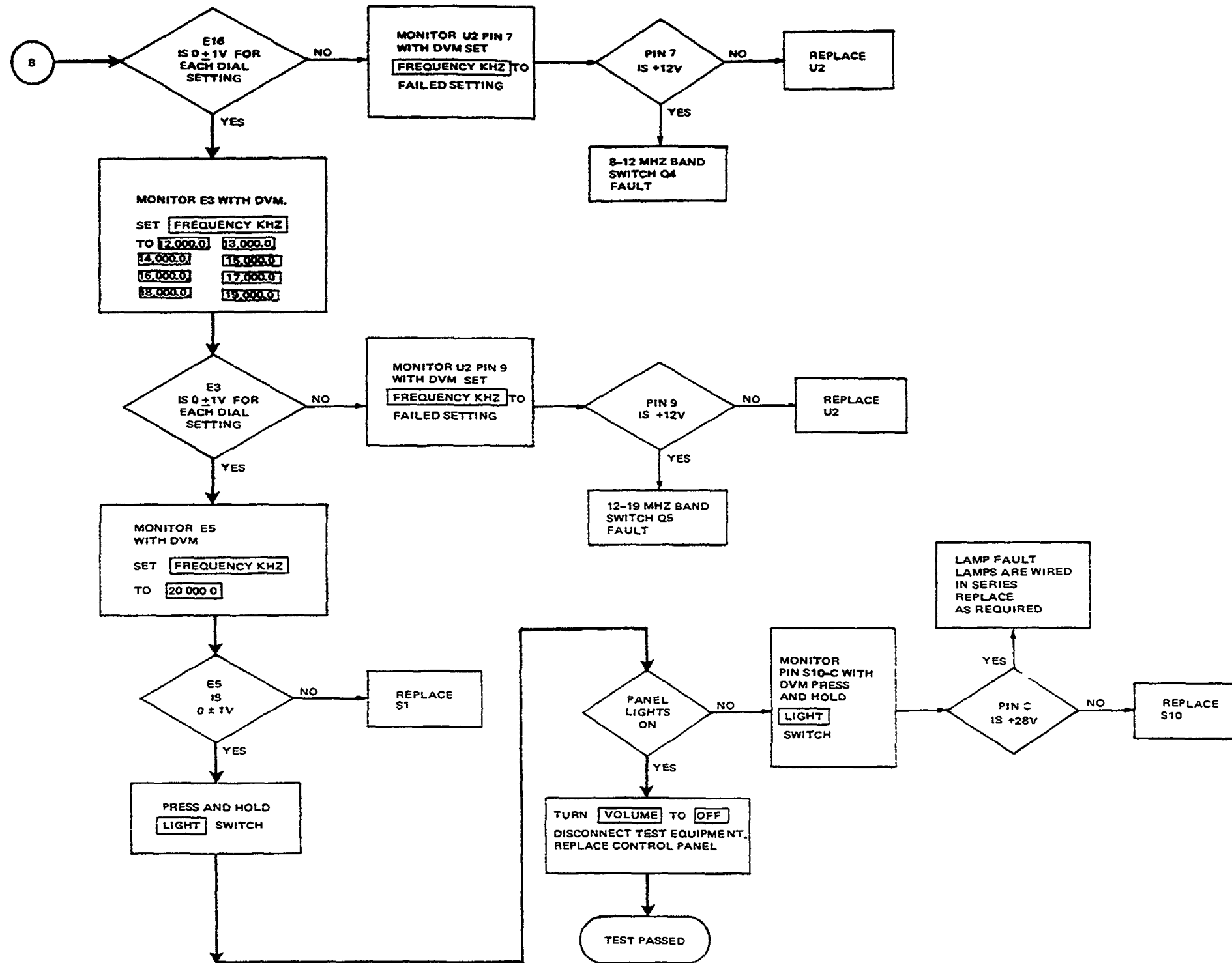


Figure 6-4. Control Panel A1A4 Performance Test (Sheet 3 of 4)

Figure 6-4. Control Panel A1A4 Performance Test (Sheet 4 of 4)

TABLE 1. MODE SWITCH OUTPUTS

S8-Pin	Circuit	V - RCV	V - TR	D - TR	D - RCV
3	+28v XMT EN	0 ±1v	+27 ±1v	+27 ±1v	0 ±1v
7	DATA EN	0 ±1v	0 ±1v	+6.5v	+6.5v

TABLE 3. 10 MHZ FREQUENCY SELECT LOGIC

20 MHz Switch S1 Dial Setting	E Points	
	4	18
0	0	0
1	+12	0
2	0	+12

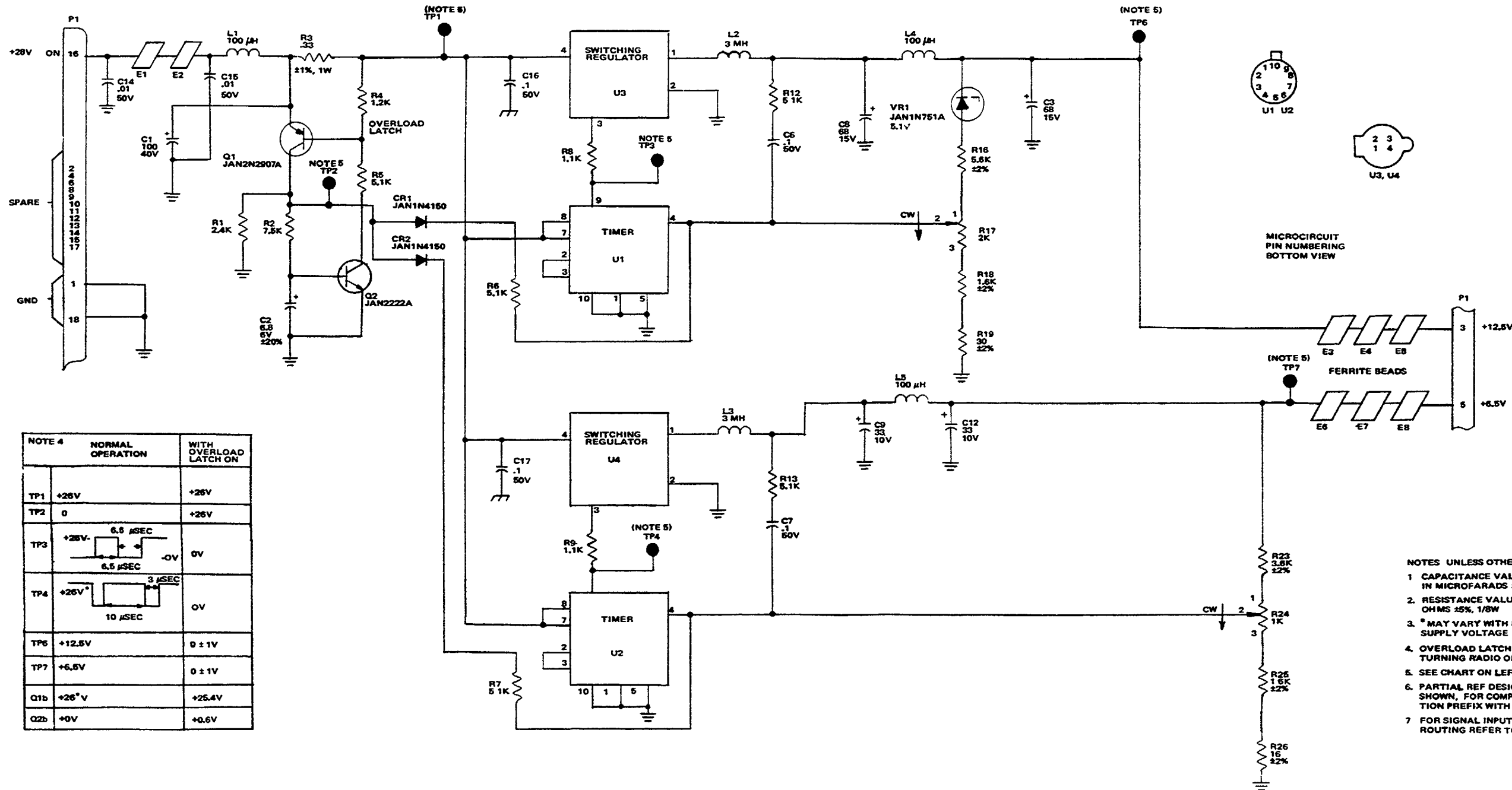
TABLE 2. FREQUENCY SELECT LOGIC

	E Points			
	100 Hz Switch (S6)	33	19	21
1 KHz Switch (S5)	32	20	22	31
10 KHz Switch (S4)	34	23	24	29
100 KHz Switch (S3)	35	25	26	28
1 MHz Switch (S2)	17	1	6	13
Dial Setting	Voltage ±1v			
0	0	0	0	0
1	0	0	0	+12
2	0	0	+12	0
3	0	0	+12	+12
4	0	+12	0	0
5	0	+12	0	+12
6	0	+12	+12	0
7	0	+12	+12	+12
8	+12	0	0	0
9	+12	0	0	+12

TABLE 4. BAND SWITCH DECODER OUTPUT

Freq. in MHz		HARMONIC FILTER BAND SWITCH LOGIC OUTPUT																											
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
PIN	CKT																												
2	2-3 MHz Band	X																											
7	3-5 MHz Band		X	X																									
14	5-8 MHz Band				X	X	X																						
16	8-12 MHz Band							X	X	X	X																		
3	12-20 MHz Band											X	X	X	X	X	X	X	X										
5	20-30 MHz Band																			X	X	X	X	X	X	X	X	X	X

X = Ground, □ = +28 ±1v

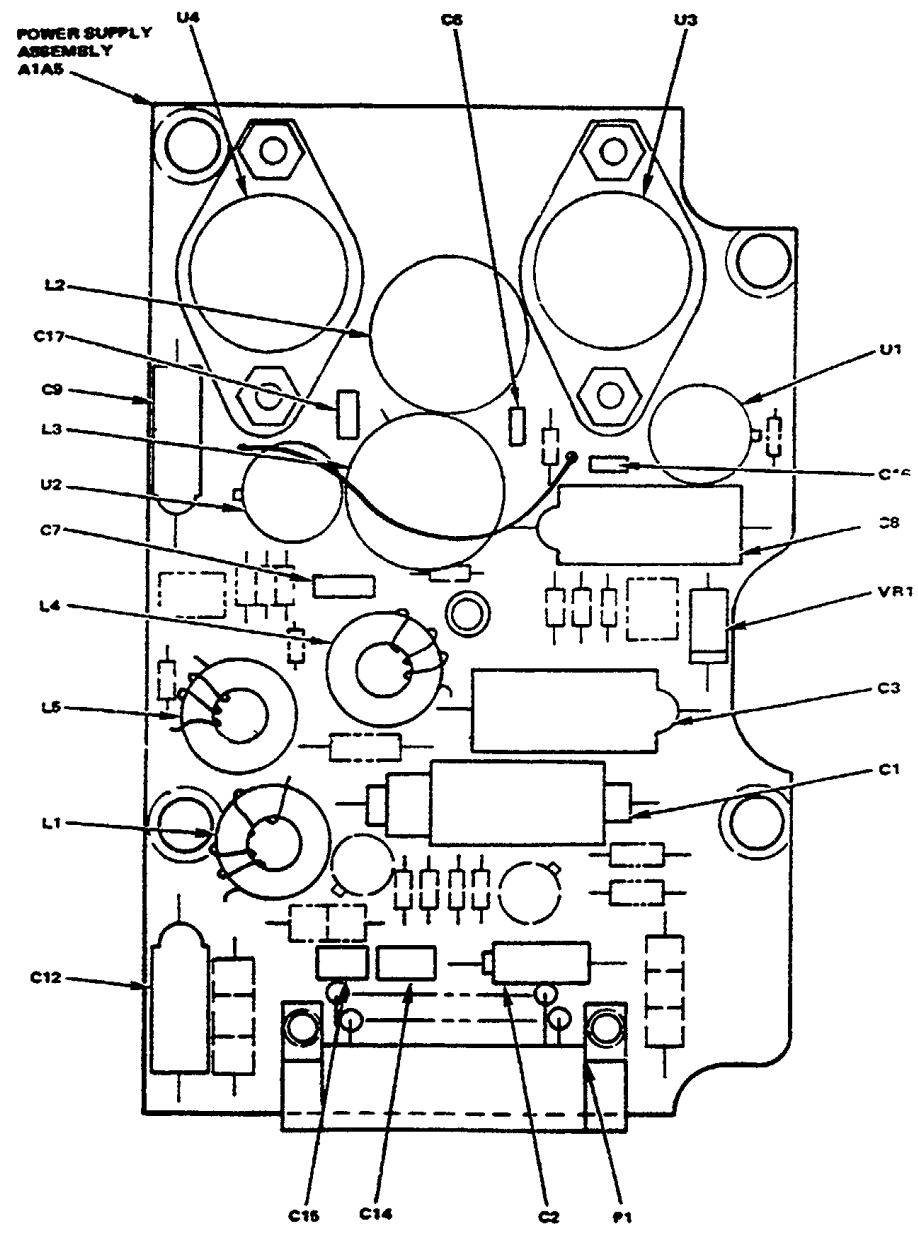


NOTE 4

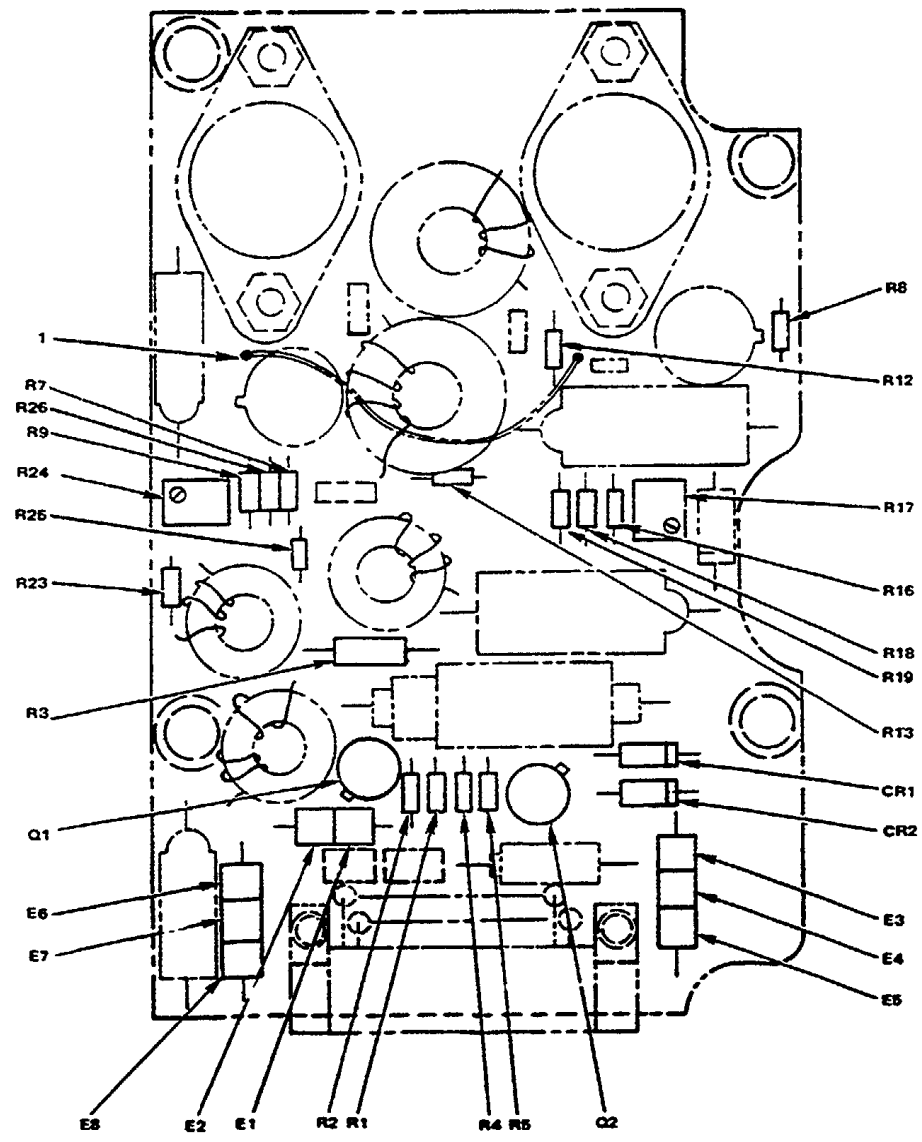
	NORMAL OPERATION	WITH OVERLOAD LATCH ON
TP1	+28V	+28V
TP2	0	+28V
TP3	+28V, 6.5 μSEC -0V, 6.5 μSEC	0V
TP4	+28V, 3 μSEC 10 μSEC	0V
TP6	+12.5V	0 ± 1V
TP7	+6.5V	0 ± 1V
Q1b	+28V	+25.4V
Q2b	+0V	+0.6V

- NOTES UNLESS OTHERWISE SPECIFIED**
- 1 CAPACITANCE VALUES ARE IN MICROFARADS ±10%, 100V
 - 2 RESISTANCE VALUES ARE IN OHMS ±5%, 1/8W
 - 3 * MAY VARY WITH INPUT SUPPLY VOLTAGE
 - 4 OVERLOAD LATCH IS RESET BY TURNING RADIO OFF, THEN ON
 - 5 SEE CHART ON LEFT SIDE.
 - 6 PARTIAL REF DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATION PREFIX WITH A1A5.
 - 7 FOR SIGNAL INPUT/OUTPUT ROUTING REFER TO FIGURE 2-1

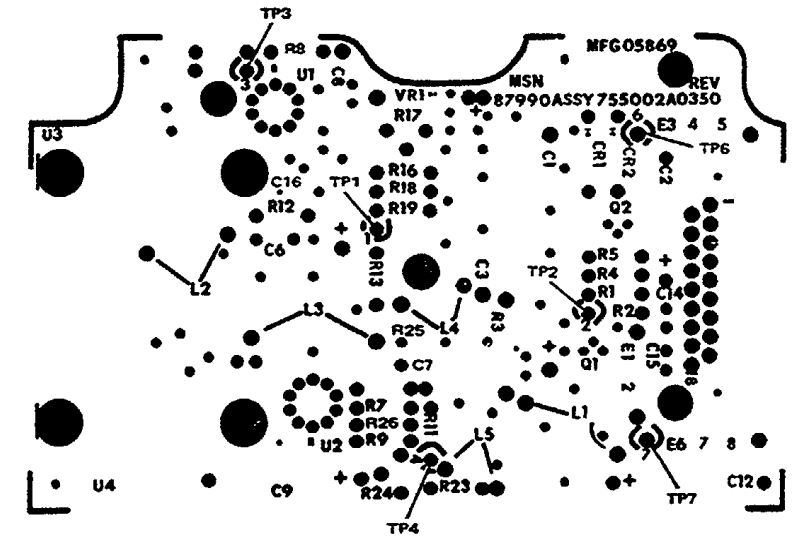
Figure 7-1. Power Supply A1A5 Schematic



A



B



COMPONENT SIDE (TOP) VIEW
NOTE (●) 3 DENOTES TEST POINT 3 ETC

NOTE OTHER POWER SUPPLY CONFIGURATIONS MAY EXIST

Figure 7-2. Power Supply A1A5 Component Location (Sheet 1 of 2)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
<u>A</u>		E1	Core, EM
A1A5	Power Supply Assembly	E2	Core, EM
U4	Microcircuit	E8	Core, EM
C6	Capacitor	E7	Core, EM
U3	Microcircuit	E6	Core, EM
U1	Microcircuit	Q1	Transistor
C16	Capacitor	R3	Resistor
C8	Capacitor	R23	Resistor
VR1	Diode	R25	Resistor
C3	Capacitor	R24	Resistor, Variable
C1	Capacitor	R9	Resistor
P1	Connector, PCB	R26	Resistor
C2	Capacitor	R7	Resistor
C14	Capacitor	1	Strap, Handle
C15	Capacitor		
C12	Capacitor		
L1	Inductor		
L5	Inductor		
L4	Inductor		
C7	Capacitor		
U2	Microcircuit		
L3	Inductor		
C9	Capacitor		
C17	Capacitor		
L2	Inductor		
<u>B</u>			
R8	Resistor		
R12	Resistor		
R17	Resistor, Variable		
R16	Resistor		
R18	Resistor		
R19	Resistor		
R13	Resistor		
CR1	Diode		
CR2	Diode		
E3	Core, EM		
E4	Core, EM		
E5	Core, EM		
Q2	Transistor Mounting Pad		
R5	Resistor		
R4	Resistor		
R1	Resistor		
R2	Resistor		

DISASSEMBLY NOTE

Apply moderate heat to the five hex alien-head cover plate screws to loosen loctite prior to loosening screws.

Figure 7-2. Power Supply A1A5 Component Location (Sheet 2 of 2)

SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Synthesizer Test Extender Cable	...	Figure 3-10C
Audio Input/Keying Adapter	...	Figure 3-11C
RF Extender Cable	...	Figure 3-11B
Kit Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AR/PRC-104	1
VTVM	AN/USM-116	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Dummy Load (50 ohm)	DA-553()/4	1
Watt Meter		
- Power Meter	Hewlett Packard EP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Power Supply, DC	Hewlett Packard EP-6439B	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1
Multimeter	Simpson 260-6P	1

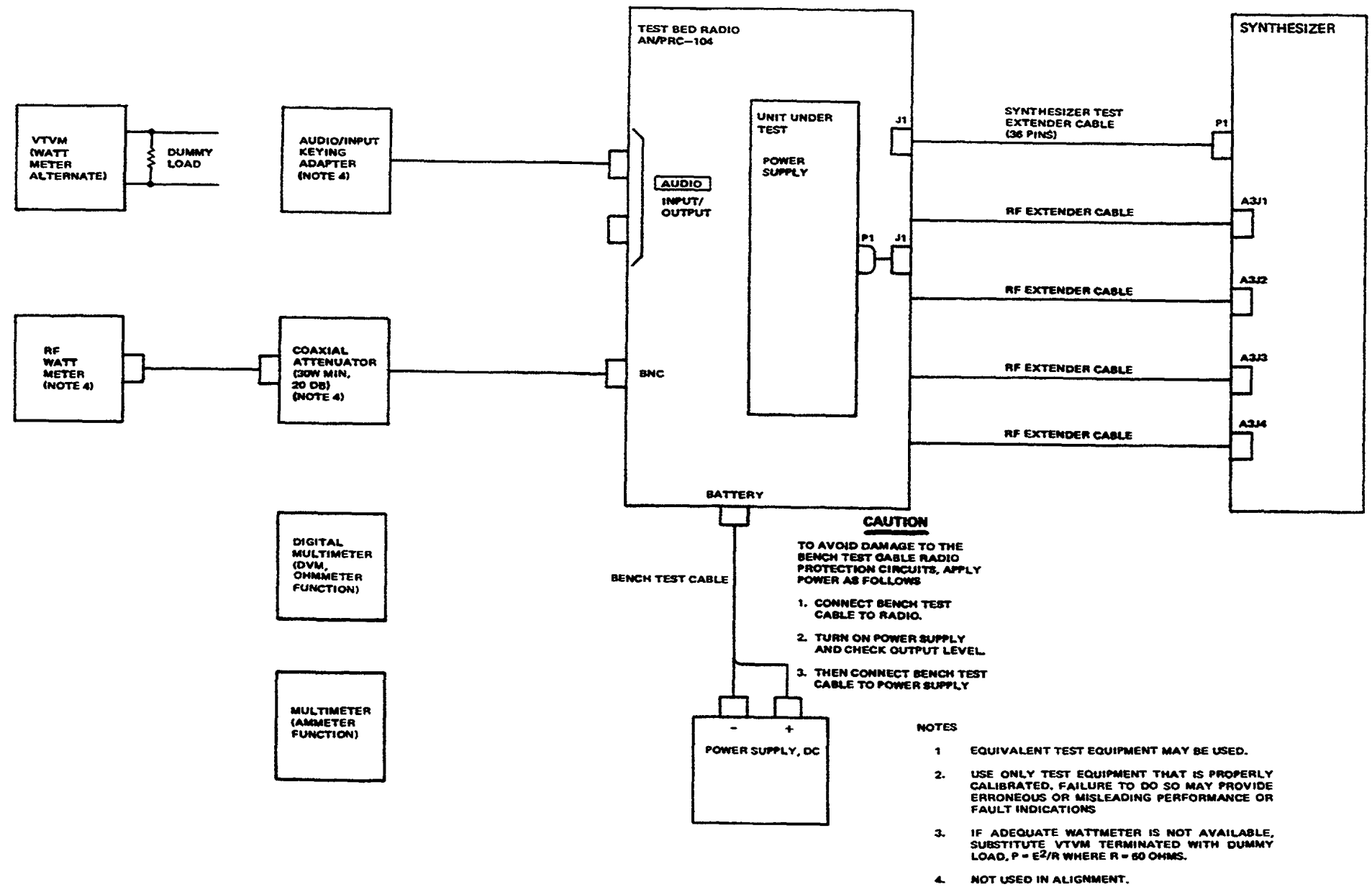


Figure 7-3. Power Supply A1A5 Performance Test and Alignment Setup

POWER SUPPLY PERFORMANCE TEST

- NOTE 1: If volume differs by a small amount, refer to alignment of R17.
 NOTE 2: If voltage differs by a small amount, refer to alignment of R24..
 NOTE 3: Unless otherwise specified, all voltage measurements taken with respect to chassis ground.

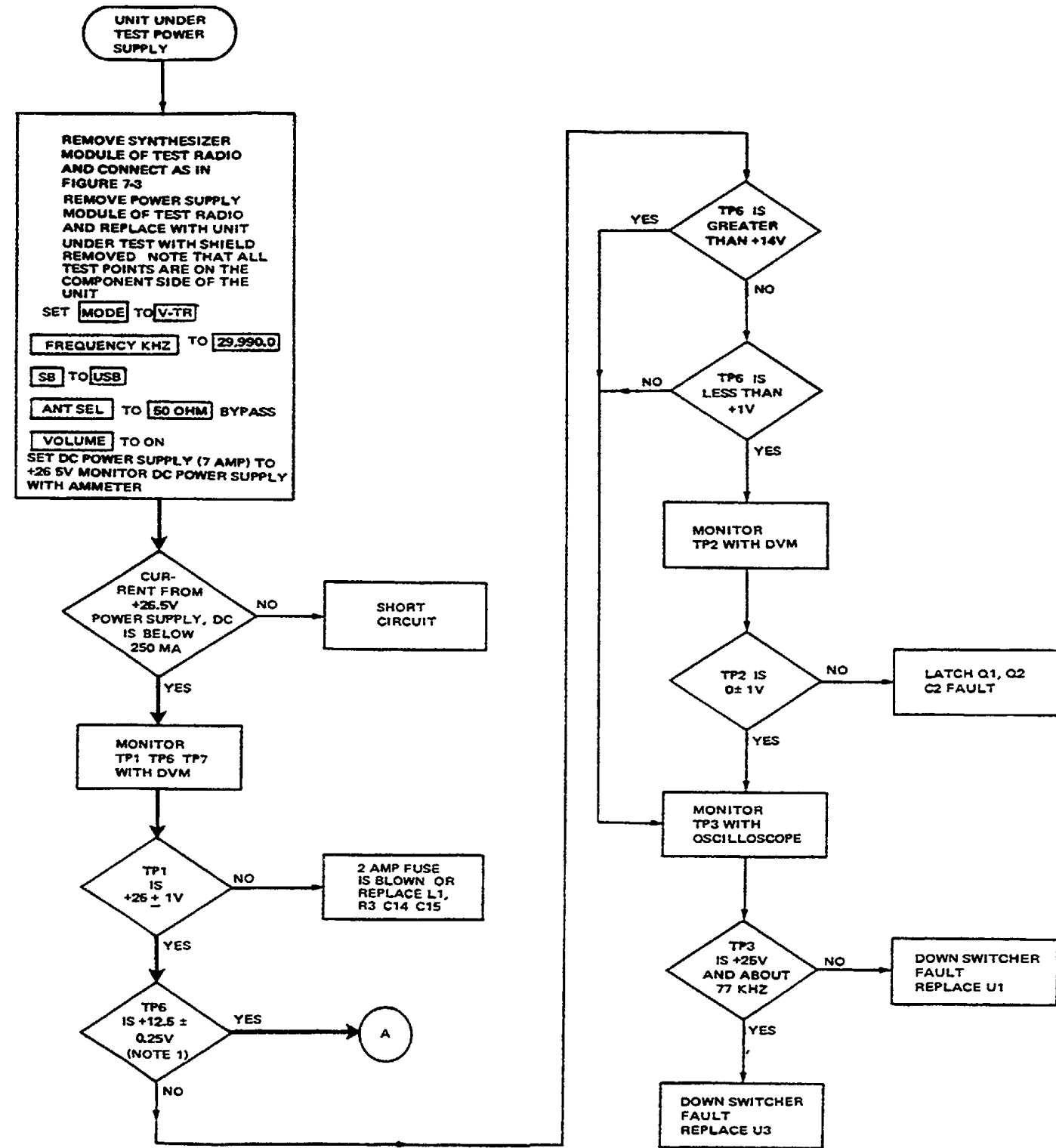


Figure 7-4. Power Supply A1A5 Performance Test (Sheet 1 of 2)

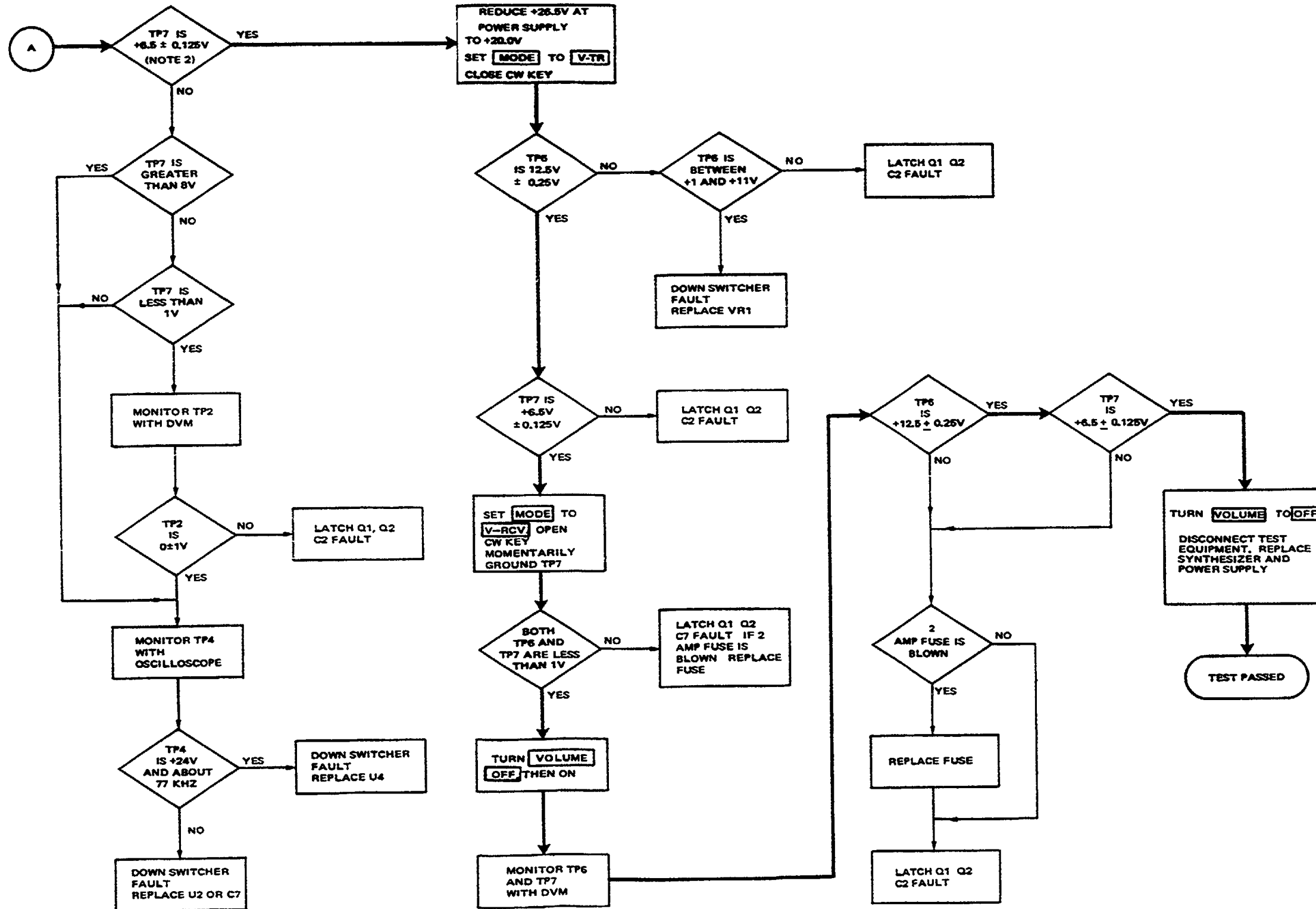


Figure 7-4. Power Supply A1A5 Performance Test (Sheet 2 of 2)

POWER SUPPLY A1A5 ALIGNMENT

The alignment procedure is to be used in either of these situations: (1) the performance test calls a potentiometer out of adjustment, or (2) one of the following is replaced:

1. Timers U1, U2
2. Switching Regulators U3, U4
3. Diode VR1
4. Capacitors C6, C7

The procedure consists of a preliminary setup and an adjustment procedure.

PRELIMINARY SETUP

1. Remove the synthesizer and the power supply from the receiver/exciter.
2. Plug the power supply (unit to be aligned) into the test bed radio.
3. Except for the keying adapter and watt meter, connect the test radio, cables, adapters and test equipment as shown in figure 7-3. Set the power supply (7 amp) to +26.5v.
4. Set the following test radio controls as follows:
 - a. FREQUENCY KHz to 29,990.0
 - b. SB to USB
 - c. ANT/SEL to 50 OHM (bypass)
 - d. MODE to V-TR
 - e. VOLUME to on

ADJUSTMENT

1. Monitor the voltage at TP7 of the module and adjust R24 to obtain +6.50v.
2. Monitor the voltage at TP6 of the module and adjust R17 to obtain +12.50v.
3. Turn the radio off and disconnect the test equipment.

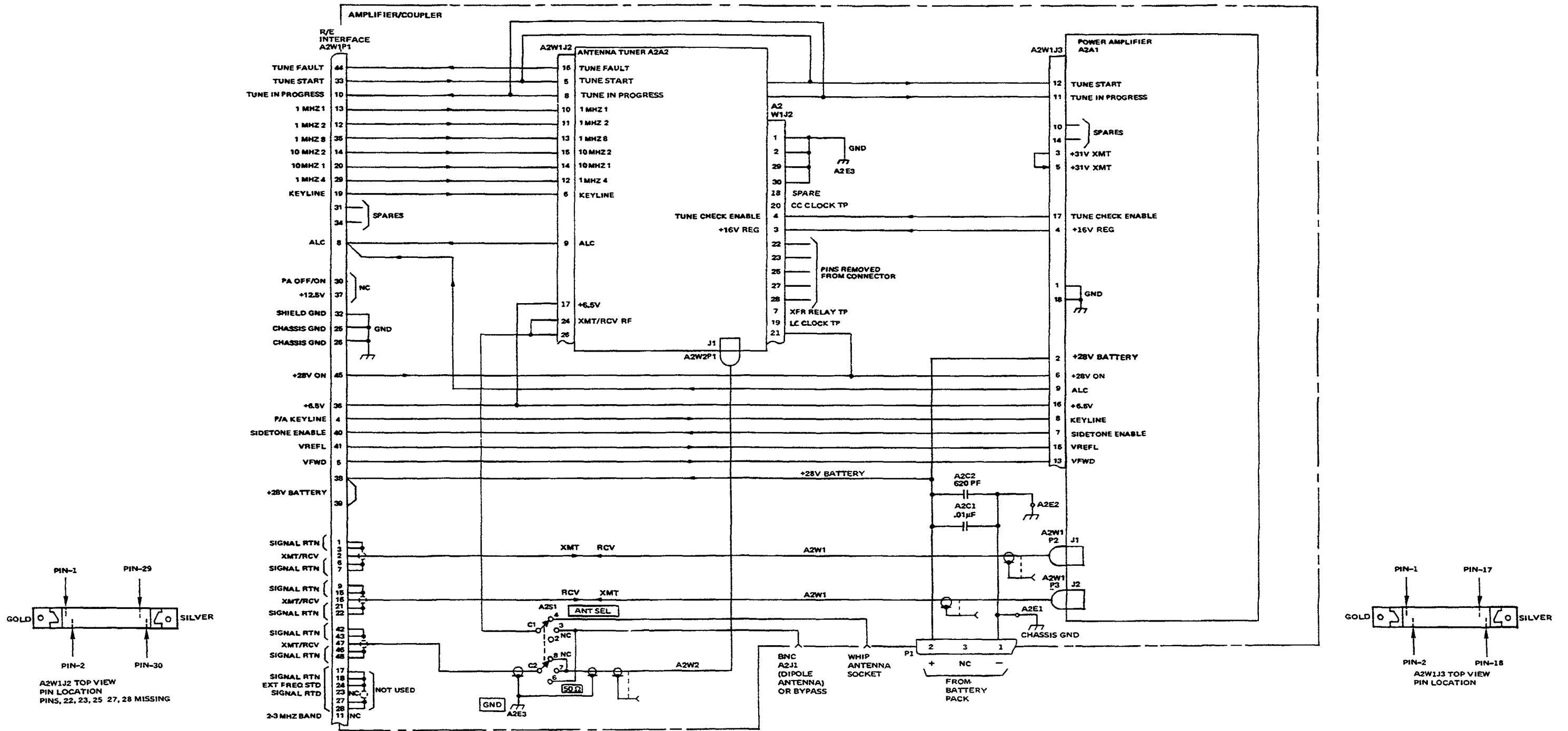


Figure 8-1. Amplifier/Coupler A2 Schematic

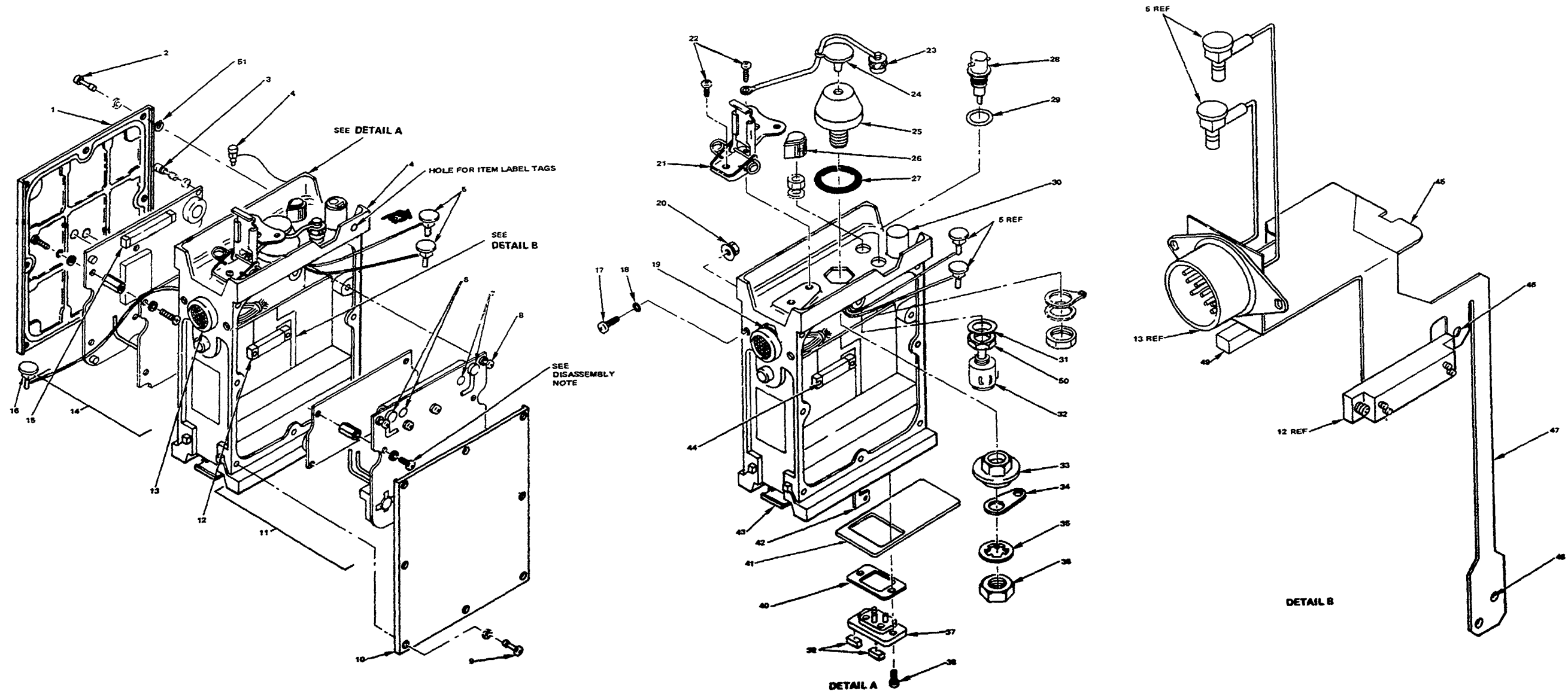


Figure 8-2. Amplifier/Coupler A2 Component Location (Sheet 1 of 2)

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	Cover Assembly	38.	Screw (2 places)
2.	Screw, Captive (8 places)	39.	Capacitor (2 places)
3.	Screw, Captive (4 places)	40.	Gasket
4.	Amplifier/Coupler	41.	Gasket
	Housing A2	42.	Terminal
5.	RF Cables A1J1 (W1P1),	43.	Latch
	A1J2 (W1P3)	44.	Mounting Screw (2 places)
6.	Marker	45.	Ribbon Cable Support
7.	Marker	46.	Terminal
8.	Screw, Captive (4 places)	47.	Ribbon Cable Assembly
9.	Screw, Captive (8 places)		A2111
10.	Cover Assembly	48.	Terminal
11.	Power Amplifier	49.	Multipin Connector,
	Module A2A1		A2W1J2
12.	Multipin Connection	50.	Hex Nut
	A2W1J3	51.	.020- C Spring Clip
13.	Connector Receptacle		(16 places)
	A2W1P1		
14.	Antenna Tuner Module		
	Assembly A2A2		
15.	Multipin Connector		
	A2A2P1		
16.	RF Cable A2J1(W2P1)		
17.	Screw (2 places)		
18.	Self-Sealing O-ring,		
	Part of Screws (2 places)		
19.	Packing, Preform		
20.	Nut (2 places)		
21.	Latch		
22.	Screw, Allen (2 places)		
23.	Connector Cover		
24.	Antenna Cover		
25.	Antenna Mount, upper		
26.	Knob, Antenna Select		
27.	Packing, Preform		
28.	Connector, BNC A2J1		
29.	Packing, Preform		
30.	Post, Ground A2E3		
31.	Gasket		
32.	Switch, Antenna Select		
	A2S1		
33.	Antenna Mount, Lower		
34.	Terminal Lug A2E4		
35.	Lockwasher		
36.	Nut		
37.	Connector, Battery A2P1		

DISASSEMBLY NOTE

Heat screw prior to removal to loosen loctite.

Figure 8-2. Amplifier/Coupler A2 Component Location (Sheet 2 of 2)

SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Audio Input/Keying Adapter	...	Figure 3-11C
Whip Adapter	...	Figure 3-11D
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
VTVM	AN/USM-116	1
Dummy Load (50 ohm)	DA-553()/4	1
Attenuator, Step 10-db steps, 0.5w, 50 ohm	CN-1128/U	1
Watt Meter		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Power Supply, DC	Hewlett Packard HP-6439B	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1

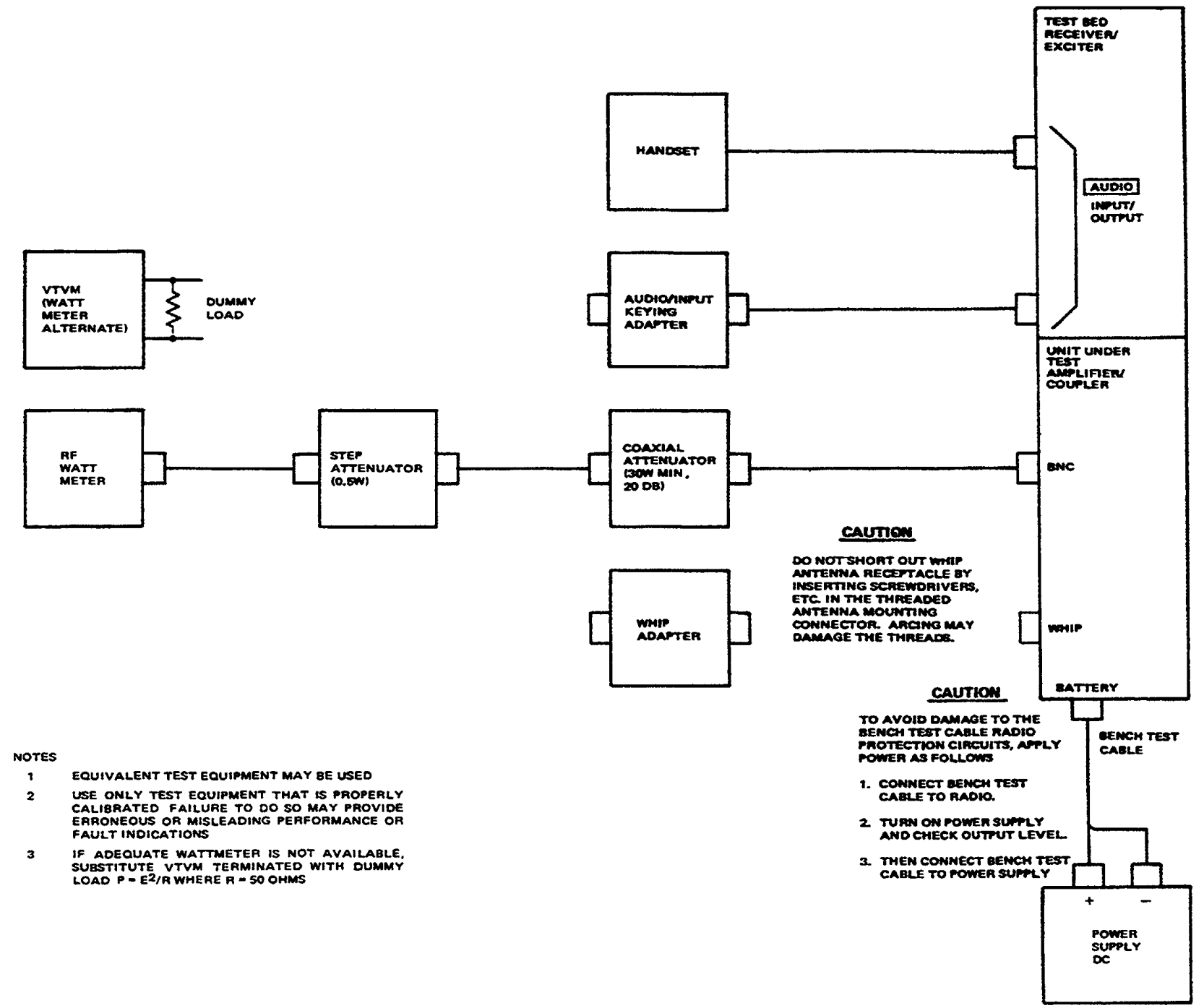


Figure 8-3. Amplifier/Coupler A2 Performance Test Setup

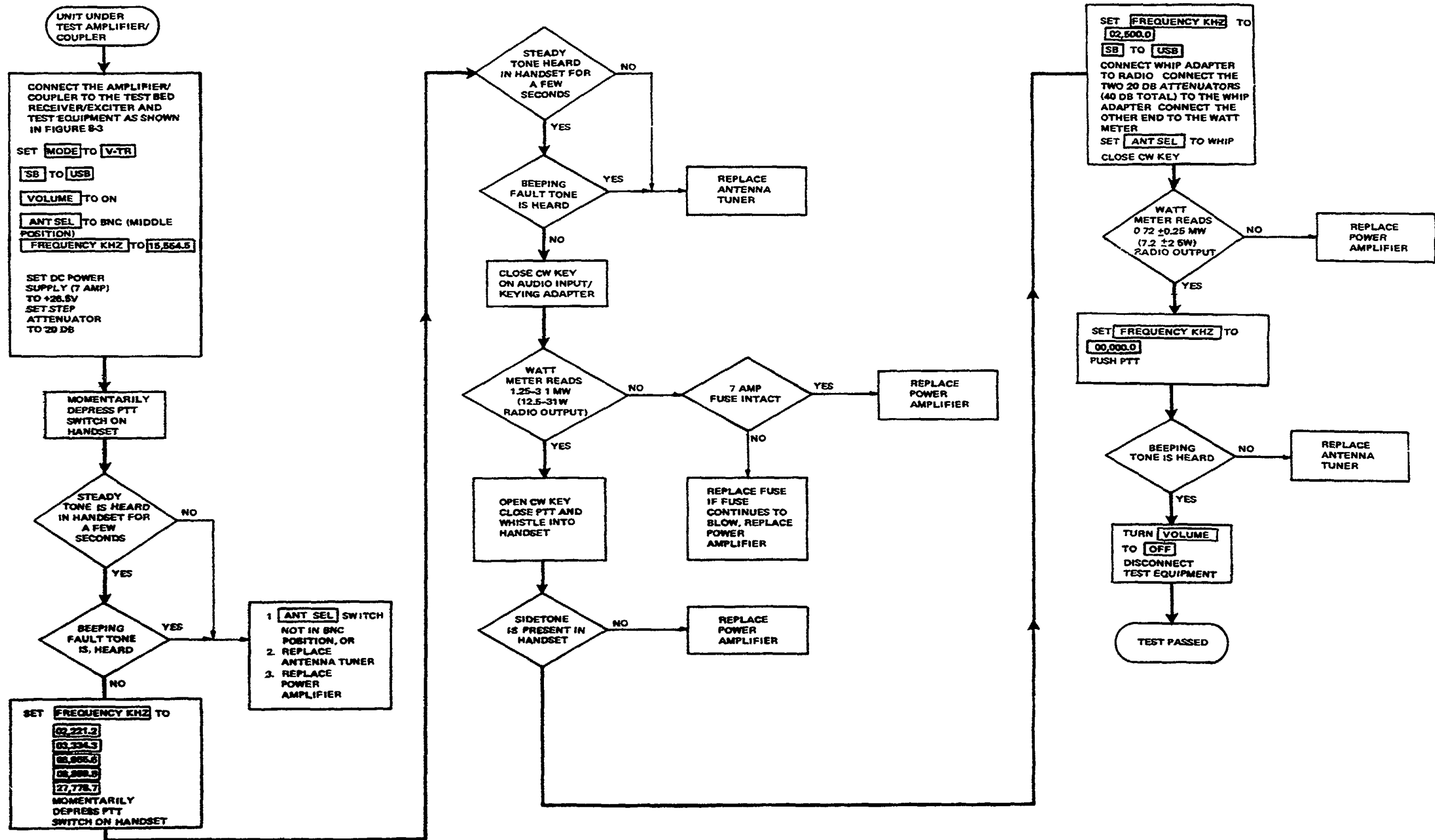


Figure 8-4. Amplifier/Coupler A2 Performance Test

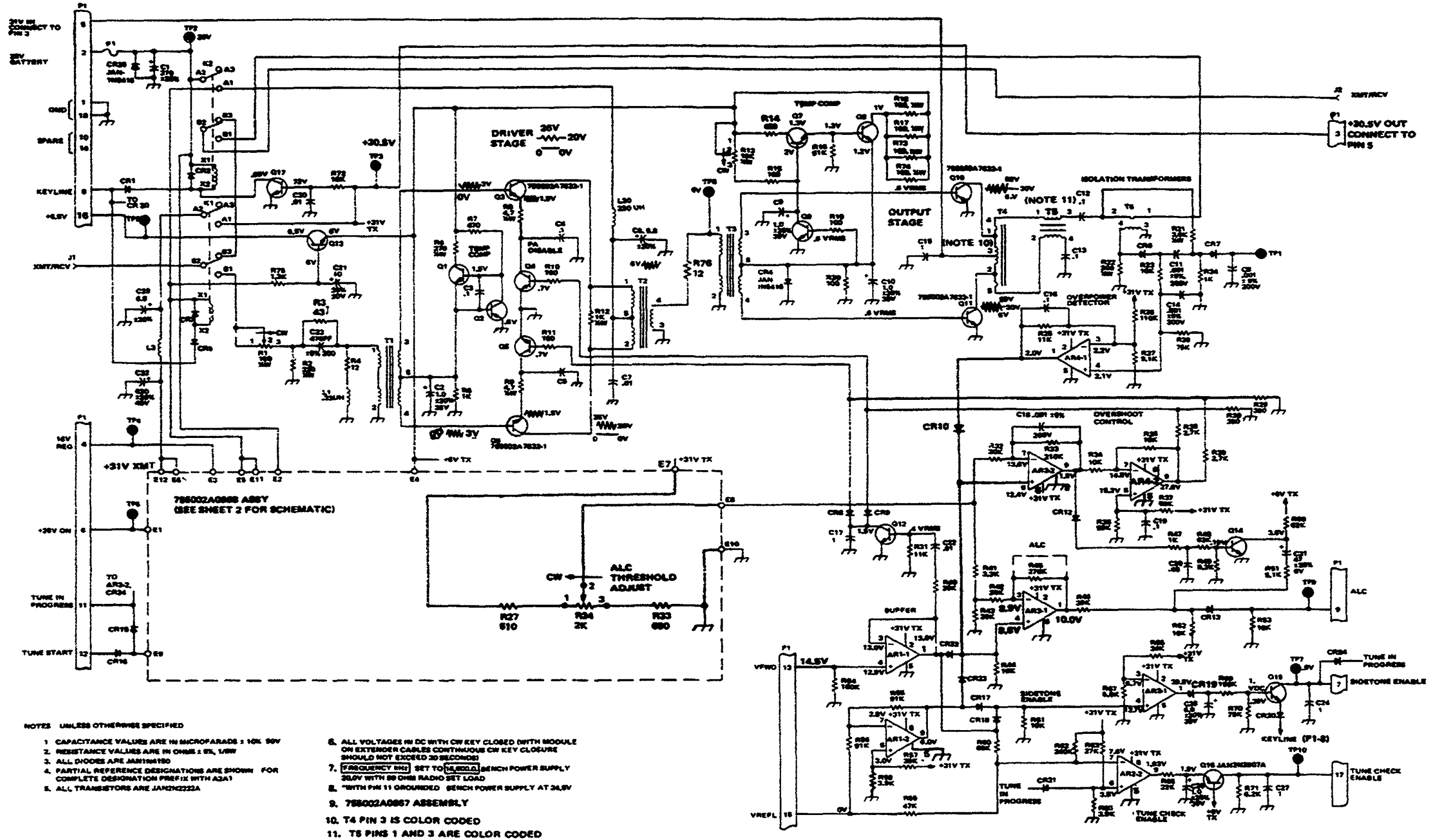


Figure 9-1. Power Amplifier A2A1 Schematic (Sheet 1 of 2)

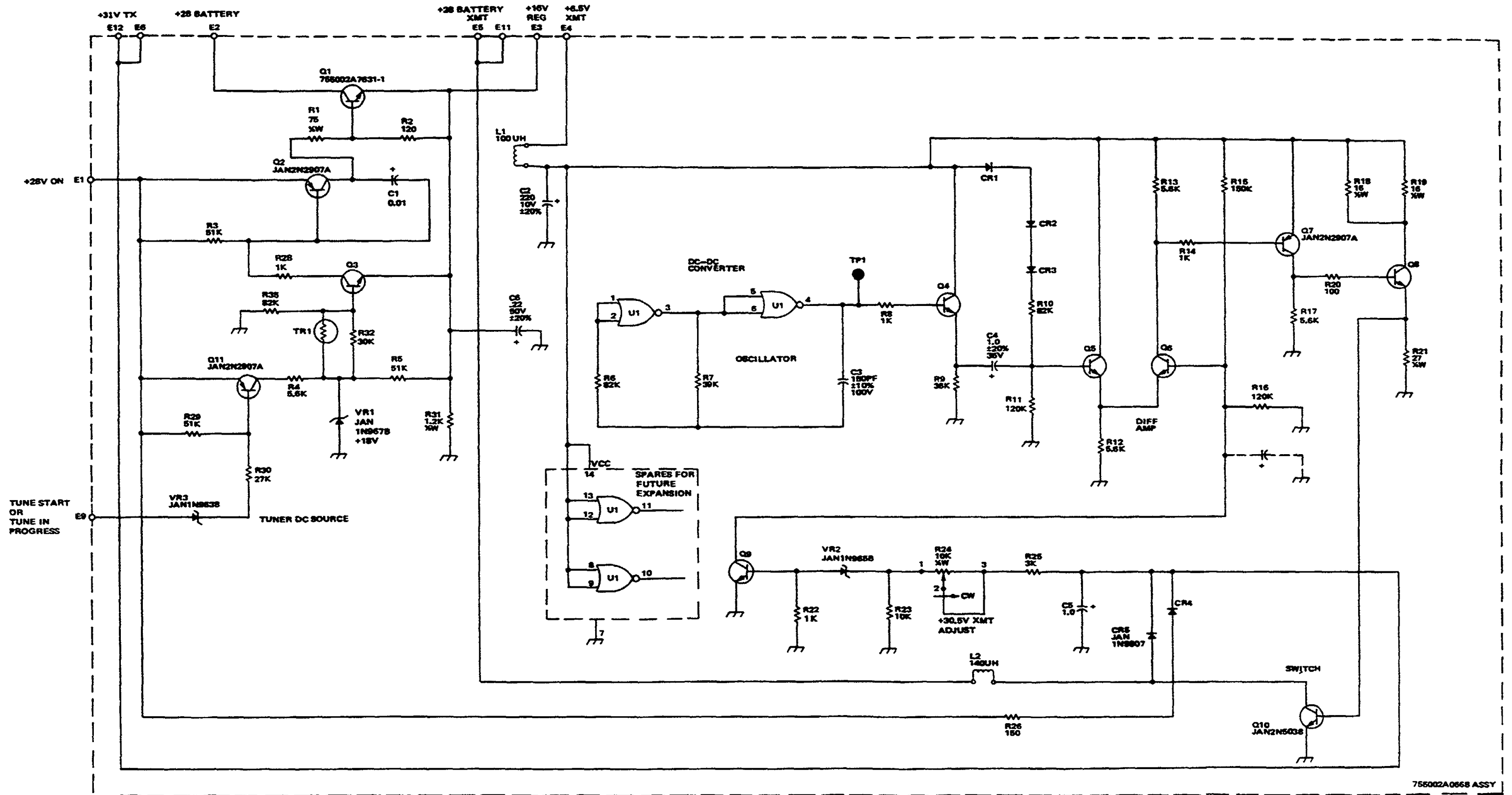


Figure 9-1. Power Amplifier A2A1 Schematic (Sheet 2 of 2)

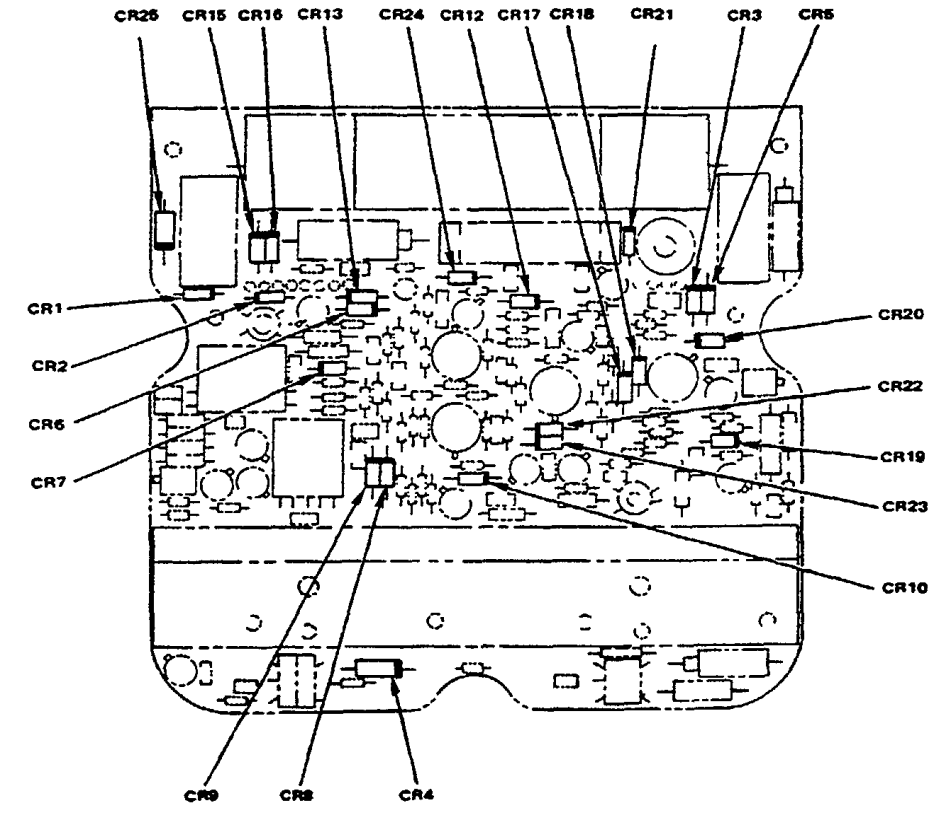
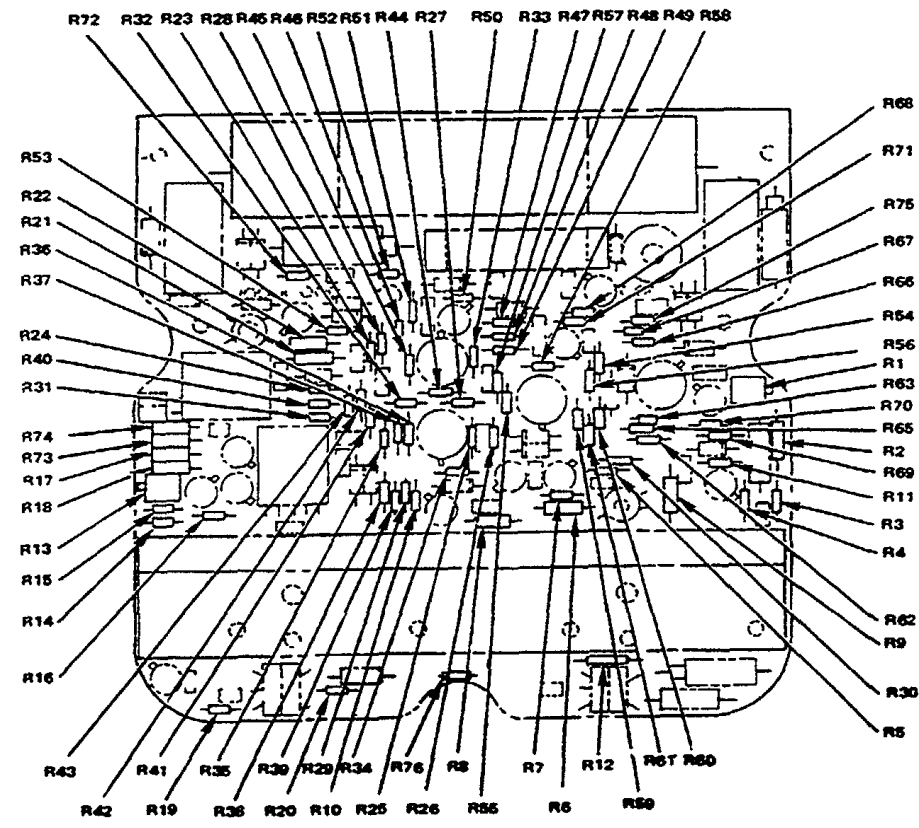
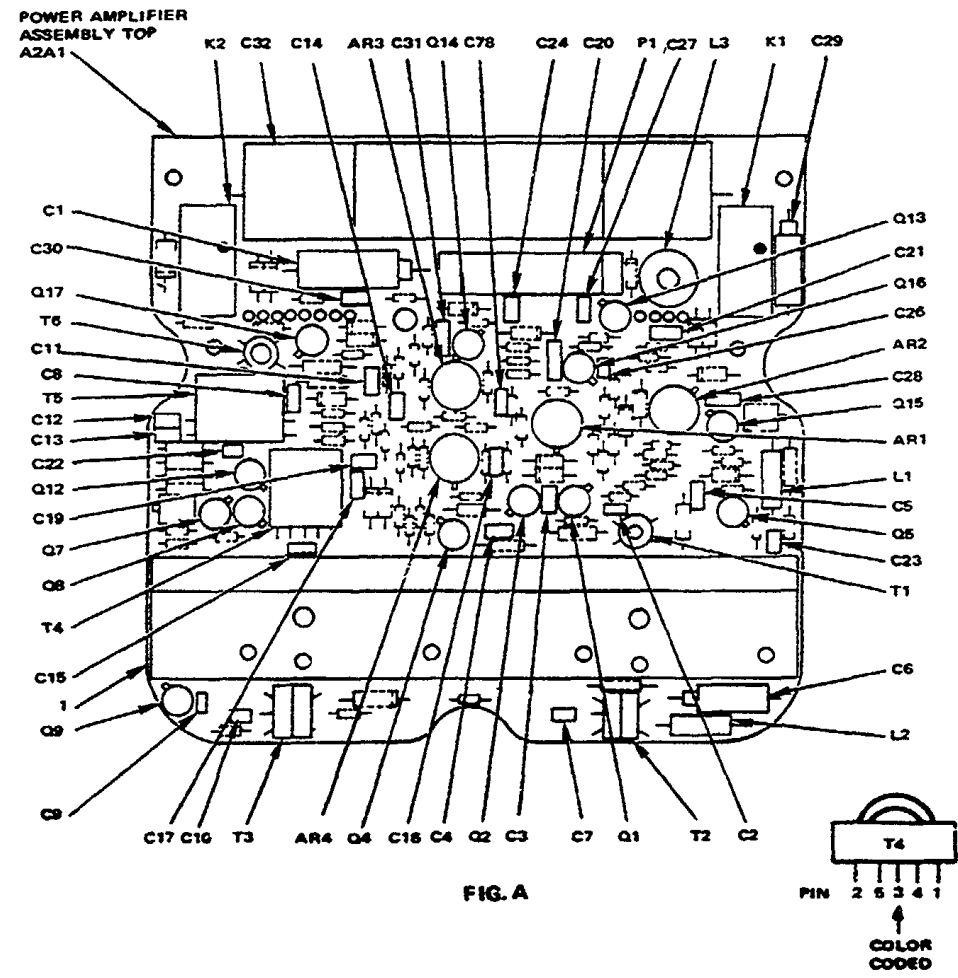
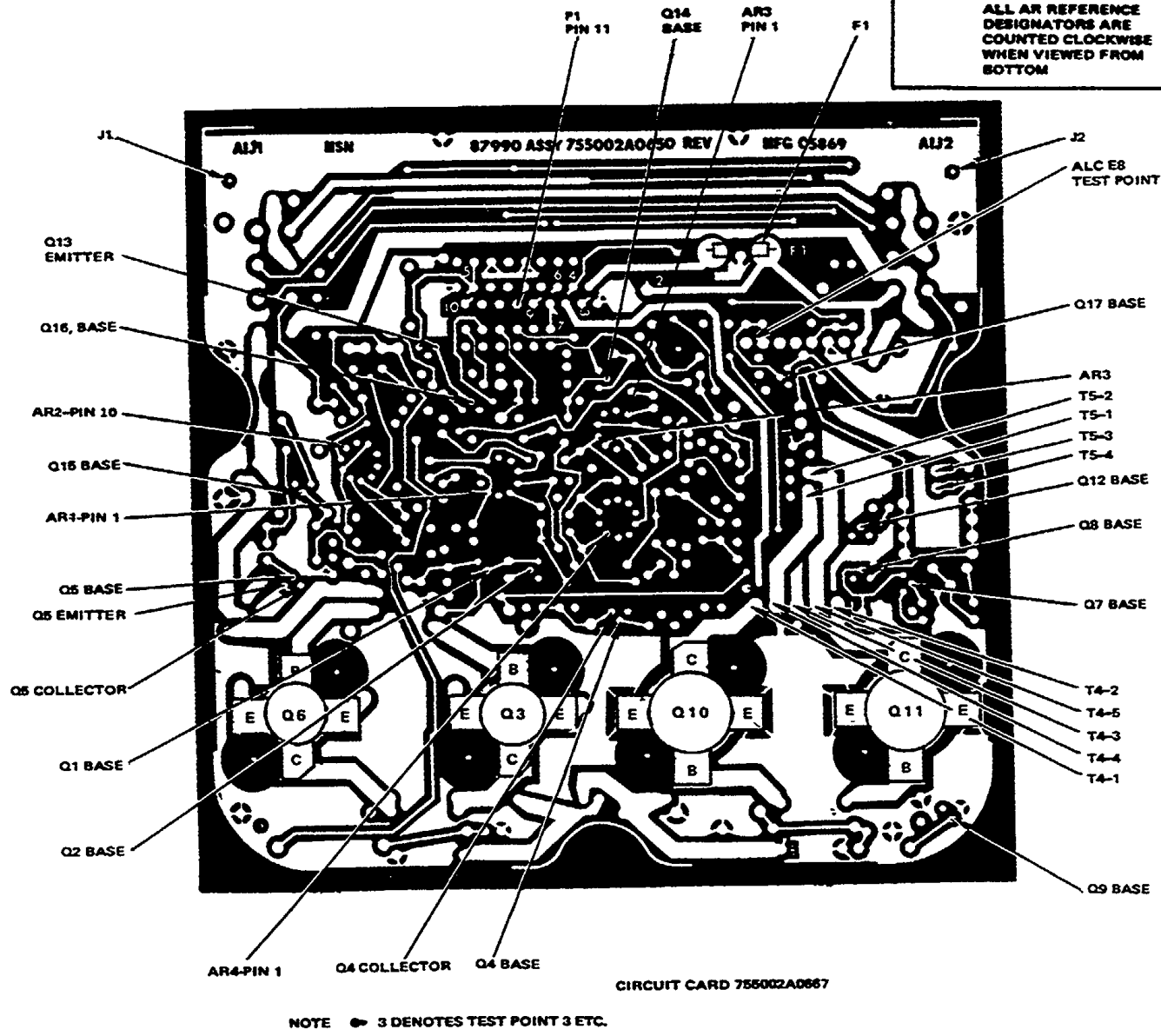
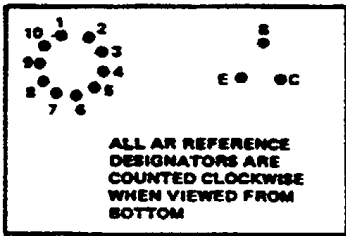
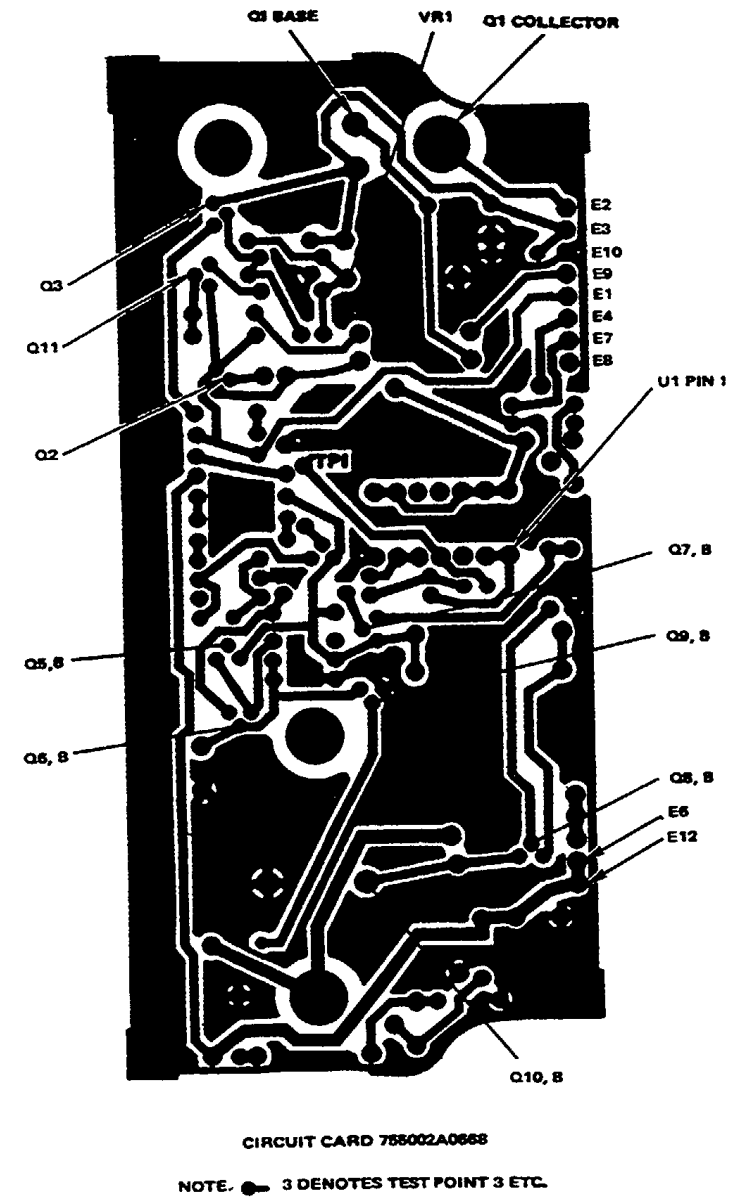
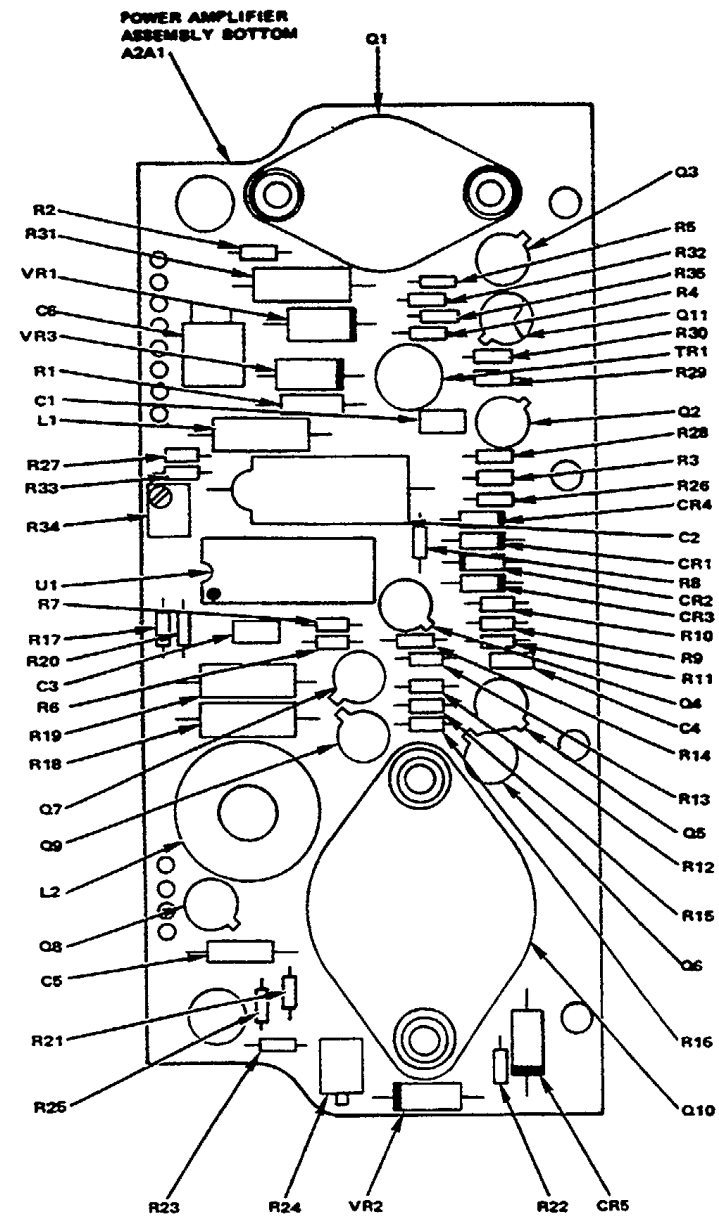


Figure 9-2. Power Amplifier A2A1 Component Location (Sheet 1 of 3)



POINTS OF TEST



POINTS OF TEST

Figure 9-2. Power Amplifier A2A1 Component Location (Sheet 2 of 3)

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
A (Top board)		T4	Transformer	R65	Resistor	C		D (Bottom Board)		R21	Resistor
A2A1	Power Amplifier Assembly	Q8	Transistor	R2	Resistor	CR25	Diode	A2A1	Power Amplifier Assembly	C5	Capacitor
K2	Relay	Q7	Transistor	R69	Resistor	CR15	Diode	Q1	Transistor Insulator	Q8	Transistor
C32	Capacitor	C19	Capacitor	R11	Resistor	CR16	Diode	Q3	Transistor	L2	Inductor
C14	Capacitor	Q12	Transistor	R3	Resistor	CR13	Diode	R5	Resistor	Q9	Transistor
AR3	Microcircuit	C22	Capacitor	R4	Resistor	CR24	Diode	R32	Resistor	Q7	Transistor
C31	Capacitor	C13	Capacitor	R62	Resistor	CR12	Diode	R35	Resistor	R18	Resistor
Q14	Transistor	C12	Capacitor	R9	Resistor	CR17	Diode	R4	Resistor	R19	Resistor
C78	Capacitor	T5	Transformer	R30	Resistor	CR18	Diode	Q11	Transistor	R6	Resistor
C24	Capacitor	C8	Capacitor	R5	Resistor	CR21	Diode	R30	Resistor	C3	Capacitor
C20	Capacitor	C11	Capacitor	R60	Resistor	CR3	Diode	TR1	Resistor	R20	Resistor
P1	Connector	T6	Transformer	R61	Resistor	CR5	Diode	R29	Resistor	R17	Resistor
C27	Capacitor	Q17	Transistor	R59	Resistor	CB20	Diode	Q2	Transistor	R7	Resistor
L3	Inductor	C30	Capacitor	R12	Resistor	CR22	Diode	R28	Resistor	U1	Microcircuit
K1	Relay	C1	Capacitor	R6	Resistor	CR19	Diode	R3	Resistor	R34	Resistor
C29	Capacitor	B		R7	Resistor	CR23	Diode	R26	Resistor	R33	Resistor
Q13	Transistor	R72	Resistor	R55	Resistor	CR10	Diode	CR4	Diode	R27	Resistor
C21	Capacitor	R32	Resistor	R8	Resistor	CB4	Diode	C2	Capacitor	L1	Coil
Q16	Transistor	R23	Resistor	R26	Resistor	CR8	Diode	CB1	Diode	C1	Capacitor
C26	Capacitor	R28	Resistor	R76	Resistor	CR9	Diode	R8	Resistor	R1	Resistor
AR2	Microcircuit	R25	Resistor	R25	Resistor	CR7	Diode	VR3	Diode	C6	Capacitor
C28	Capacitor	R28	Resistor	R34	Resistor	CR6	Diode	CR2	Diode	VR1	Diode
Q15	Transistor	R45	Resistor	R10	Resistor	CR2	Diode	R10	Resistor	R31	Resistor
AR1	Microcircuit	R46	Resistor	R29	Resistor	CR1	Diode	R9	Resistor	R2	Resistor
L1	Coil	R52	Resistor	R20	Resistor			R11	Resistor		
C5	Capacitor	R51	Resistor	R39	Resistor			Q4	Transistor		
Q5	Transistor	R44	Resistor	R38	Resistor			C4	Capacitor		
C23	Capacitor	R27	Resistor	R35	Resistor			R14	Resistor		
T1	Transformer	R50	Resistor	R19	Resistor			R13	Resistor		
C6	Capacitor	R33	Resistor	R41	Resistor			Q5	Transistor		
L2	Coil	R47	Resistor	R42	Resistor			R12	Resistor		
C2	Capacitor	R57	Resistor	R43	Resistor			R15	Resistor		
T2	Transformer	R48	Resistor	R16	Resistor			Q6	Transistor		
Q1	Transistor	R49	Resistor	R14	Resistor			R16	Resistor		
C7	Capacitor	R58	Resistor	R15	Resistor			Q10	Transistor		
C3	Capacitor	R68	Resistor	B13	Resistor			CR5	Diode		
Q2	Transistor	R71	Resistor	R18	Resistor			R22	Resistor		
C4	Capacitor	R75	Resistor	R17	Resistor			VR2	Diode		
C16	Capacitor	R67	Resistor	R73	Resistor			R24	Resistor		
Q4	Transistor	R66	Resistor	R74	Resistor			B23	Resistor		
AR4	Microcircuit	R54	Resistor	R31	Resistor			R25	Resistor		
T3	Transformer	R56	Resistor	R40	Resistor						
C10	Capacitor	R1	Resistor	R24	Resistor						
C17	Capacitor	R63	Resistor	R37	Resistor						
C9	Capacitor	R70	Resistor	R36	Resistor						
Q9	Transistor			R21	Resistor						
1	Heat Sink			R22	Resistor						
C15	Capacitor			R53	Resistor						

Figure 9-2. Power Amplifier A2A1 Component Location (Sheet 3 of 3)

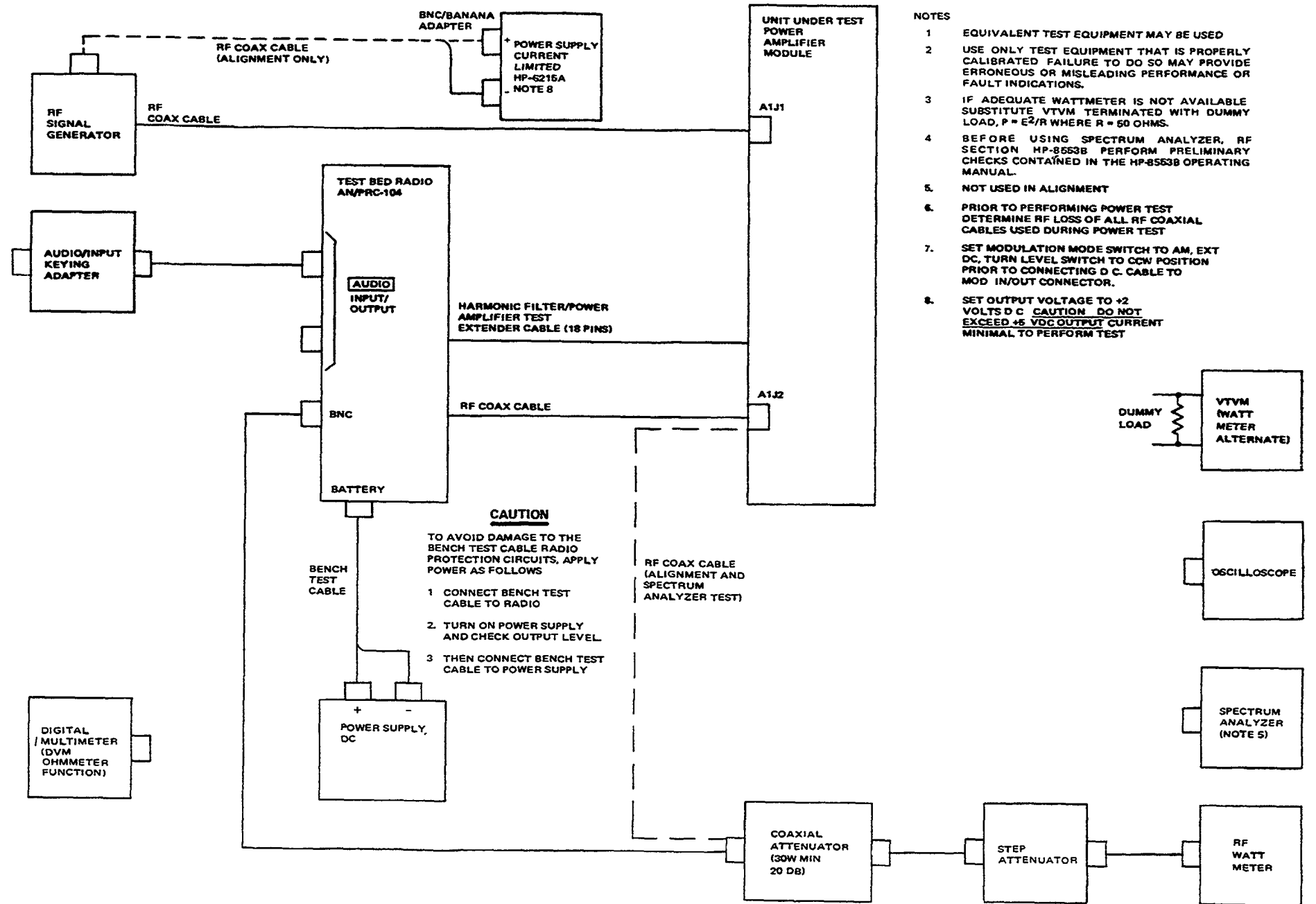
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Harmonic Filter/Power Amplifier Test Extender Cable	...	Figure 3-10D
Audio Input/Keying Adapter	...	Figure 3-11C
RF Coax Cable	...	Figure 3-11A
Kit, Tool, Electronic	TR-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
VTVM	AN/USM-116	1
Signal Generator, RF	AN/USM-323	1
Oscilloscope	Hewlett Packard PP-1741A	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Attenuator, Step 10-db steps, 0.5w, 50 ohm	CN-1128/U	1
Dummy Load (50 ohm)	DA-553()/4	1
Watt Meter		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Spectrum Analyzer	Hewlett Packard HP-141-T	1
- High Resolution IF Section	Hewlett Packard HP-8552B	1
- RF Section	Hewlett Packard HP-8553B	1
- Tracking Generator	Hewlett Packard HP-8443A	1
- High Impedance Probe	Hewlett Packard HP-1121A	1
Power Supply, DC	Hewlett Packard HP-6439B	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1



- NOTES
- EQUIVALENT TEST EQUIPMENT MAY BE USED
 - USE ONLY TEST EQUIPMENT THAT IS PROPERLY CALIBRATED FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OR FAULT INDICATIONS.
 - IF ADEQUATE WATTMETER IS NOT AVAILABLE SUBSTITUTE VTVM TERMINATED WITH DUMMY LOAD, $P = E^2/R$ WHERE R = 50 OHMS.
 - BEFORE USING SPECTRUM ANALYZER, RF SECTION HP-8553B PERFORM PRELIMINARY CHECKS CONTAINED IN THE HP-8553B OPERATING MANUAL.
 - NOT USED IN ALIGNMENT
 - PRIOR TO PERFORMING POWER TEST DETERMINE RF LOSS OF ALL RF COAXIAL CABLES USED DURING POWER TEST
 - SET MODULATION MODE SWITCH TO AM, EXT DC, TURN LEVEL SWITCH TO CCW POSITION PRIOR TO CONNECTING D.C. CABLE TO MOD IN/OUT CONNECTOR.
 - SET OUTPUT VOLTAGE TO +2 VOLTS D.C. CAUTION DO NOT EXCEED +5 VDC OUTPUT CURRENT MINIMAL TO PERFORM TEST

Figure 9-3. Power Amplifier A2A1 Performance Test and Alignment Setup

POWER AMPLIFIER PERFORMANCE TEST

NOTE 1: TP8 voltage should be between 2.8 and 9.8v peak to peak when FREQUENCY is between 2 and 16 MHz. TP8 voltage should be between 10.6 and 36.4v peak to peak when frequency is between 17 and 30 MHz.

NOTE 2: A negative voltage (-7.5v) may be injected at Pin 5 of P1 to test AR2-2, Q16 without using rf drive.

NOTE 3: Unless otherwise specified, all voltage measurements taken with respect to chassis ground.

NOTE 4: All points of test for this troubleshooting branch on 755002A0668 board.

HARMONICS TOLERANCE
 FIRST - 10 DB MIN
 SECOND - 30 DB MIN
 THIRD - 30 DB MIN
 FOURTH - 30 DB MIN
 FIFTH - 30 DB MIN
 WITH RESPECT TO CARRIER

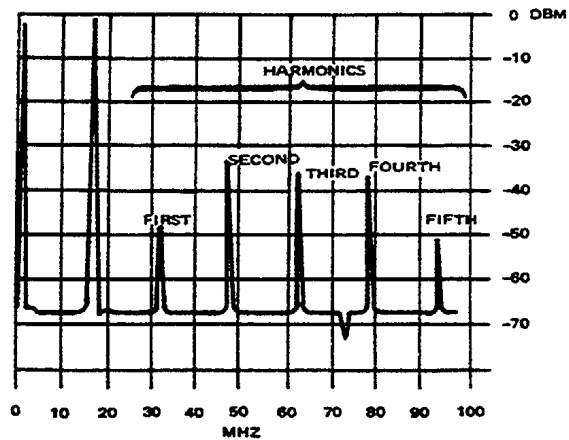


FIG. A

SANDWIDTH 300 KHZ
 SCAN WIDTH 10 MHZ
 INPUT ATTENUATOR 40 DB
 SCAN TIME DIV 0.5 SEC
 LOG REF LEVEL +10
 LINEAR SENSITIVITY 0
 VIDEO FILTER 100 HZ
 SCAN MODE SINGLE
 10 DB LOG 10 DB LOG
 SCAN TRIGGER AUTO
 CENTER FREQUENCY 50 MHZ
 SCAN (INNER RED) PER DIV
 RANGE MHZ 0-110
 STORAGE STD
 INTENSITY CENTERED
 PERSISTENCE 90 - 180°
 TIME 50°

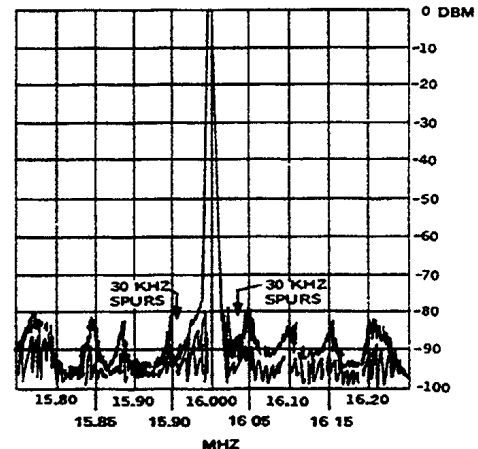


FIG. B

SANDWIDTH 1 KHZ
 SCAN WIDTH 0.05 MHZ
 INPUT ATTN 10 DB
 RANGE MHZ 0-110
 CENTER FREQ 16 MHZ
 VIDEO FILTER 10 KHZ
 SCAN MODE SINGLE
 10 DB LOG 10 DB LOG
 SCAN TRIGGER AUTO
 LOG REF -20
 LINEAR SENSITIVITY 0
 SCAN (INNER RED) PER DIV
 SCAN TIME DIV 0.5 SEC
 STORAGE STD
 INTENSITY CENTERED
 PERSISTENCE 90 - 180°
 TIME 90°

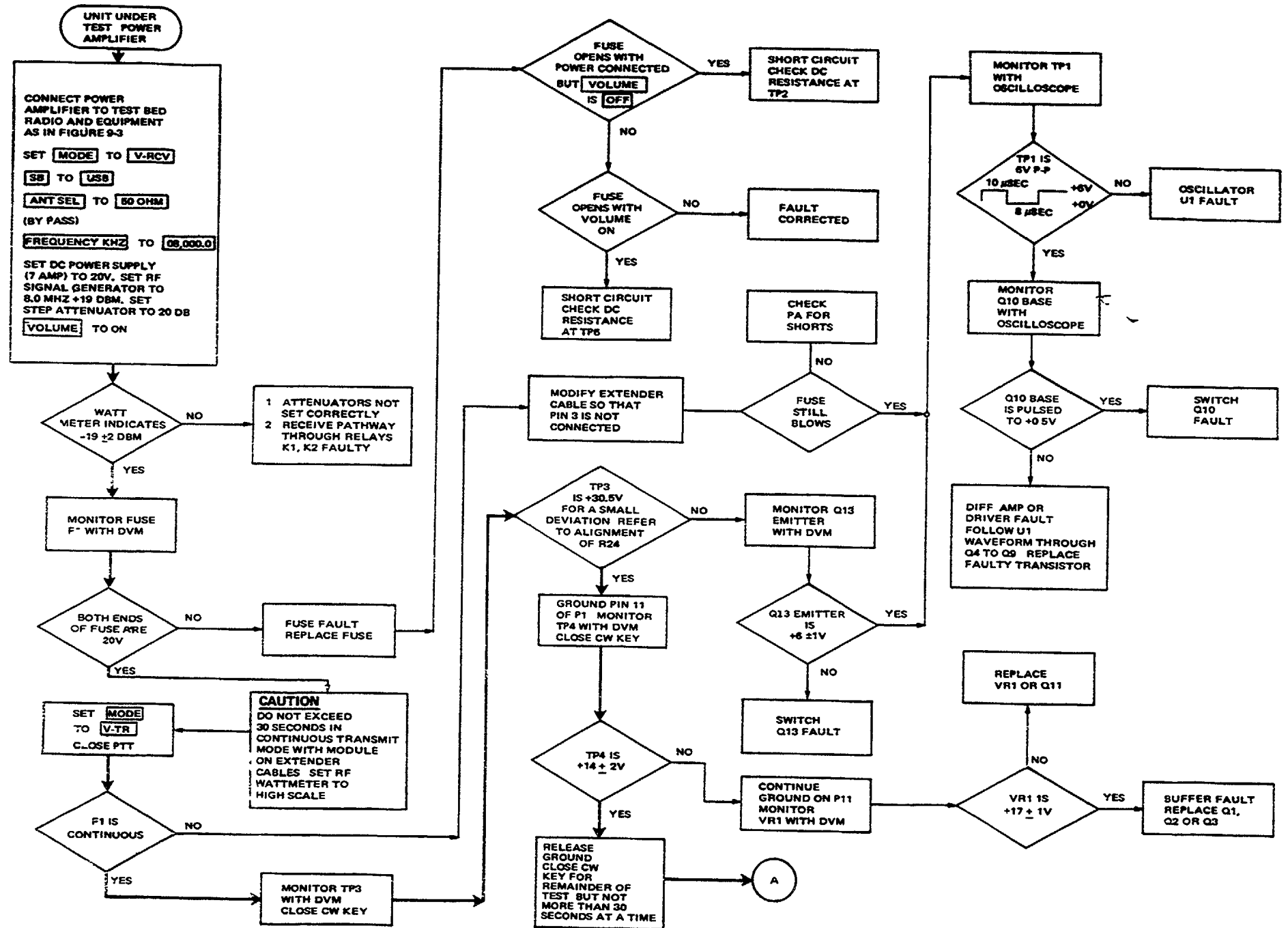


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 1 of 3)

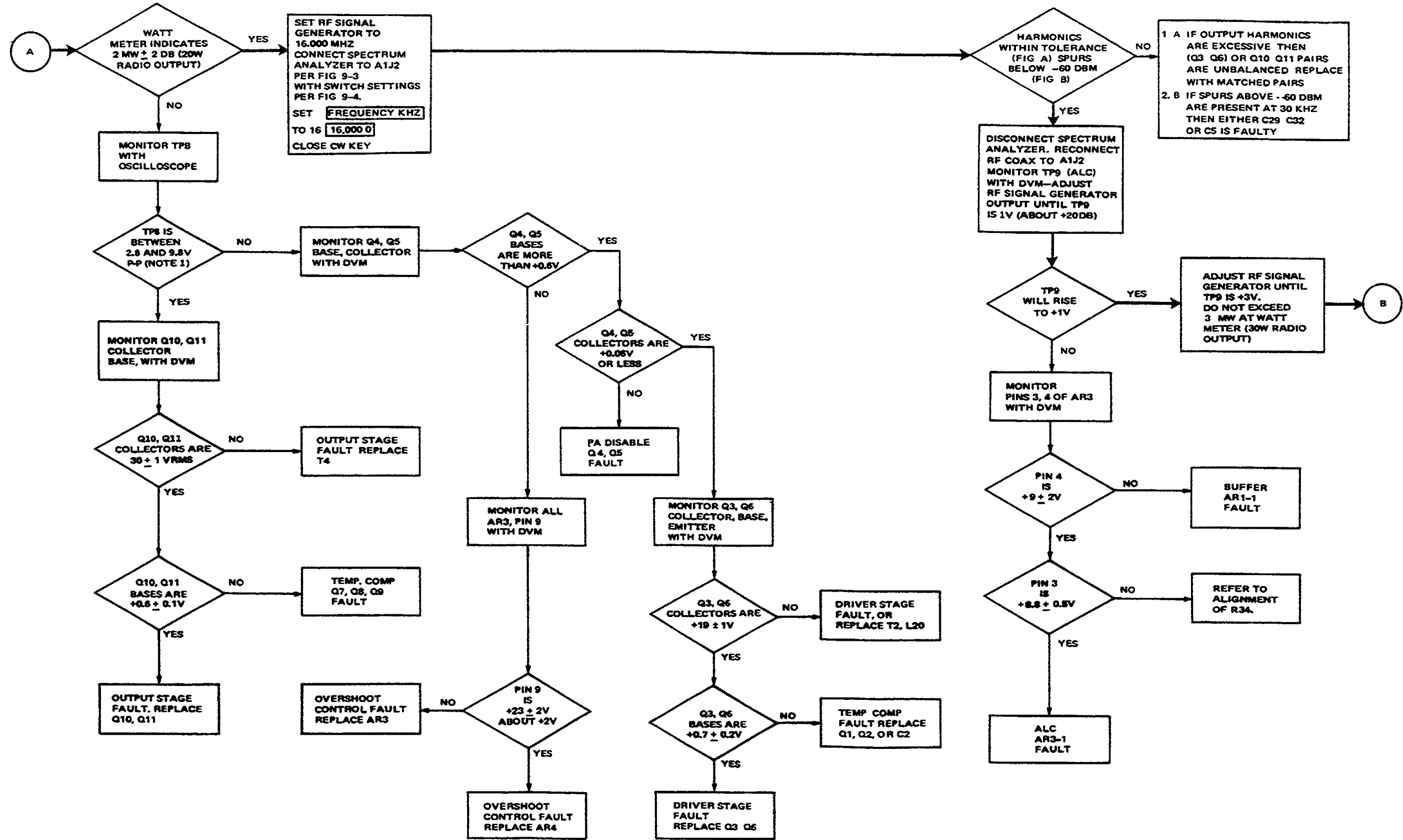


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 2 of 3)

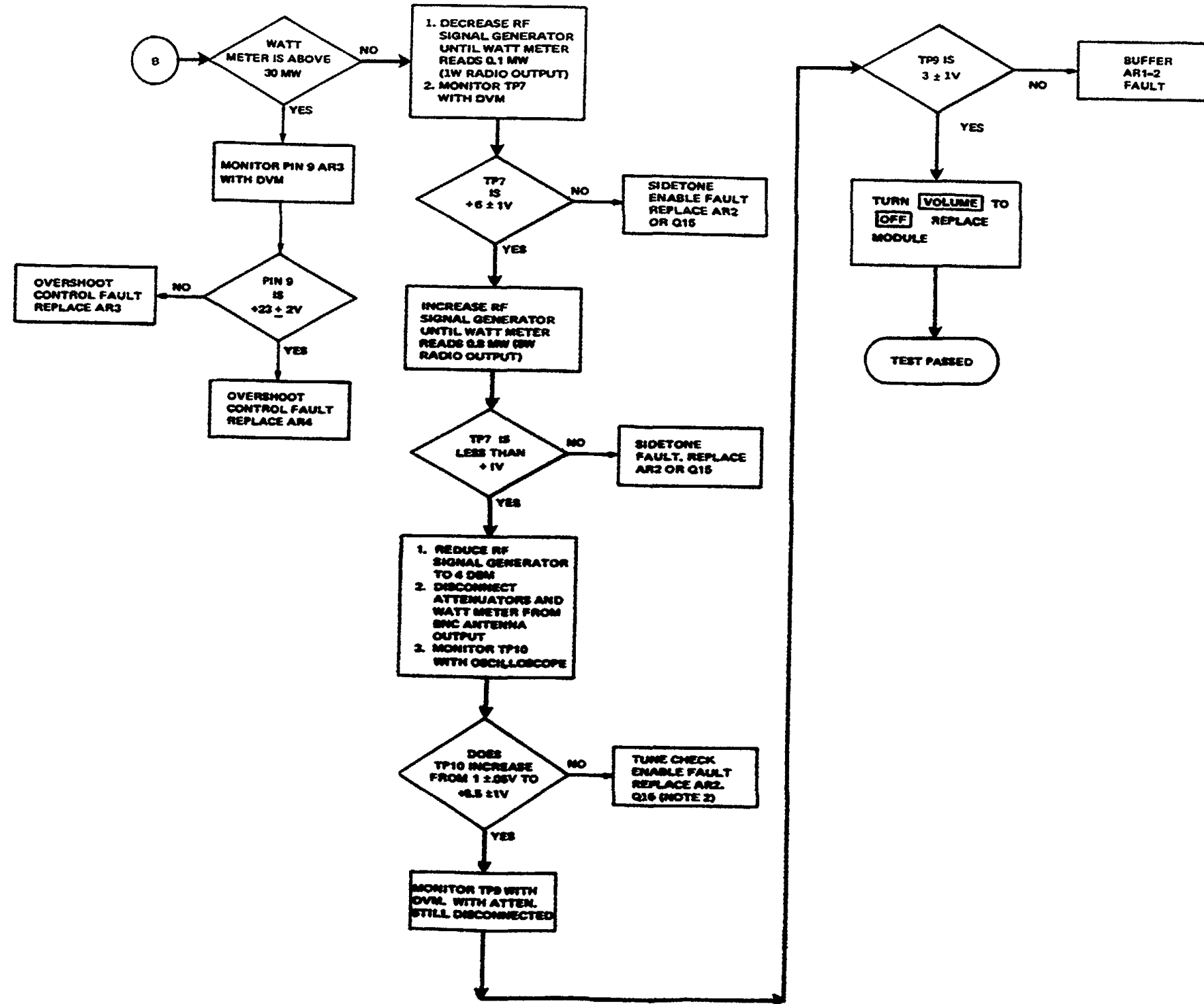


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 3 of 3)

POWER AMPLIFIER A2A1 ALIGNMENT

The alignment procedure is to be used in either of these situations: (1) the performance test calls a potentiometer out of adjustment, or (2) one of the following is replaced:

1. Overshoot Control AR3, AR4
2. ALC, AR3
3. Buffers ART, AR2
4. Power Transistors Q3, Q6, Q10, Q11
5. Transformers T1, T2, T3, T4, T5
6. DC-DC Converter

The procedure consists of a preliminary setup and an adjustment procedure.

PRELIMINARY SETUP

1. Remove the power amplifier from the amplifier/coupler. Connect the test setup as shown in figure 9-3, however, to not connect the of coax cable at this time. The of coax cable connected at A1J2 will be connected directly to the coaxial attenuator.
2. Set dc power supply (7 amp) to +24.5 vdc. Set step attenuator to 10 db.
3. Set ANT SEL to 50 ohm (bypass), VOLUME to on. FREQUENCY KHZ to 29, 999.1, SB to USB, MODE TO V-TR.

ADJUSTMENTS

1. Monitor TP-3 with DVM, close PTT. On bottom board adjust R24 for +30.5 + 0.5 vdc. Open PTT.
2. On the 18 pin extender cable remove the jumper lead between the two test points. Insert a dc ammeter in place of the jumper and select a range of at least 100ma. Ensure that positive lead is inserted into test point closest to the connector on the PA module. Close PTT only long enough to adjust R13 (top board) for a reading of 90ma.
3. Adjust the rf signal generator to 29.9999 MBz at +22 dbm (150 mw). Refer to Note 7 on figure 9-3. Connect the rf coax cable to A1J1 and the rf signal generator. Adjust R1, GAIN ADJUST (topboard), for a reading of 27 mw on the power meter.
4. With DVM, monitor E8. Close PTT, adjust R34 (bottom board) for a reading of +13.5 + 0.5 vdc.
5. Open PTT, disconnect test equipment.

R1 = GAIN ADJUST
 R13 = BIAS ADJUST
 R24 = +30.5 VDC ADJUST
 R34 = ALC REFERENCE ADJUST

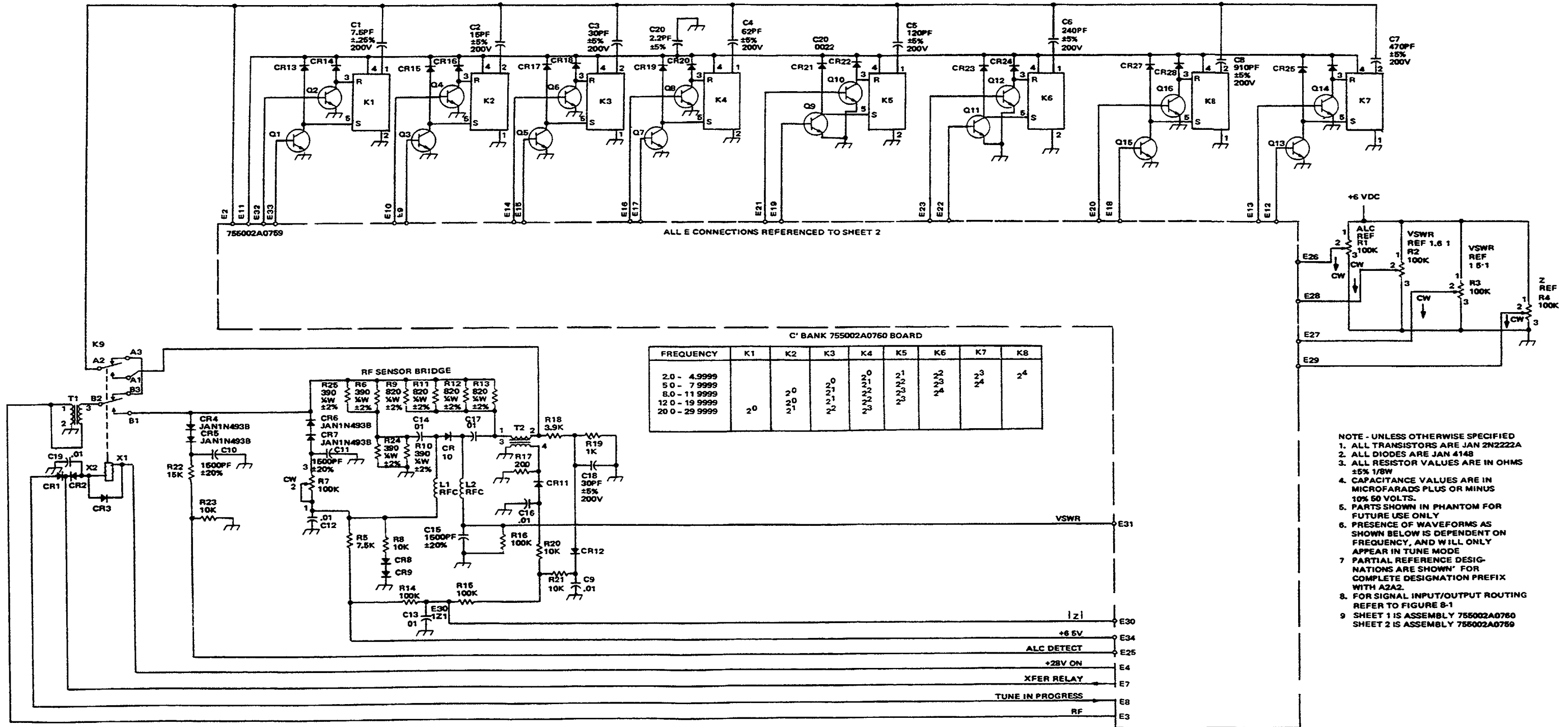


Figure 10-1 Antenna Tuner A2A2 Schematic (Sheet 1 of 2)

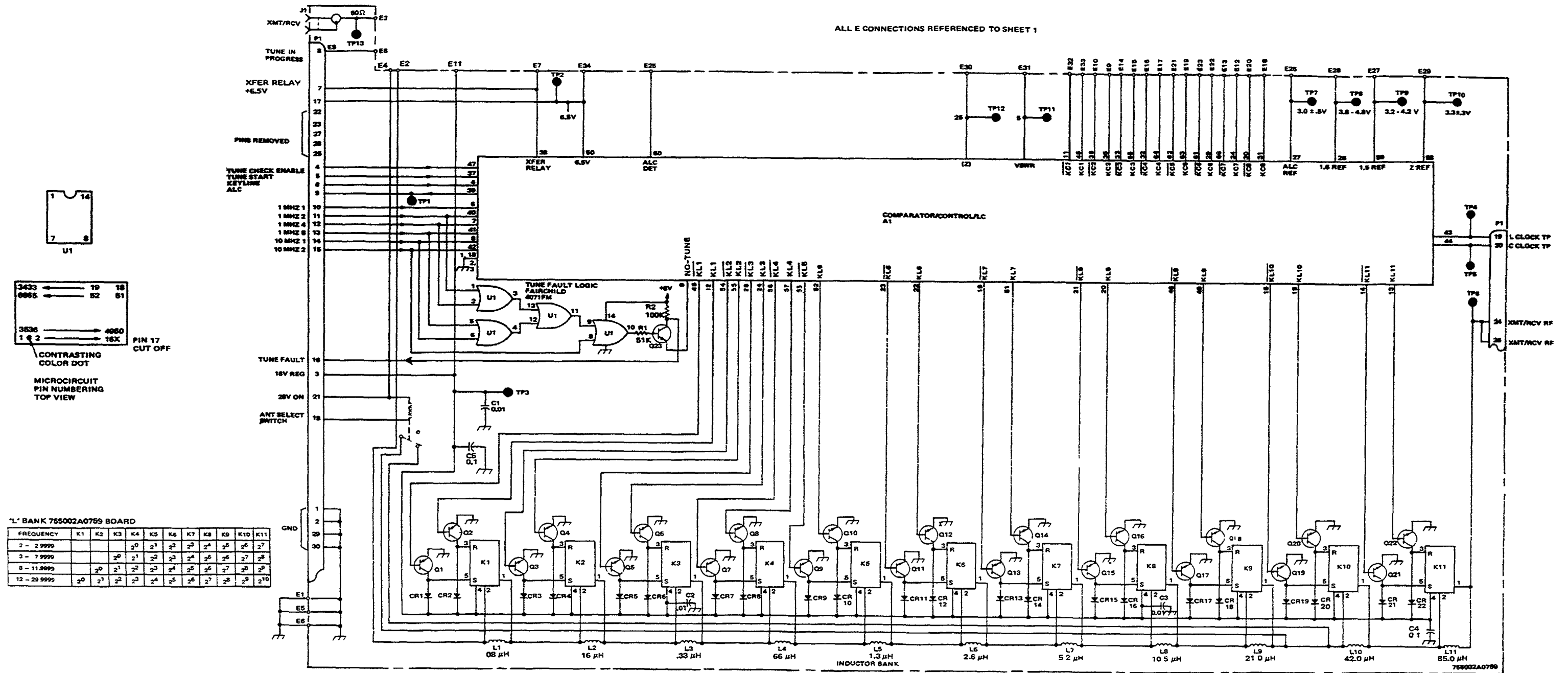


Figure 10-1 Antenna Tuner A2A2 Schematic (Sheet 2 of 2)

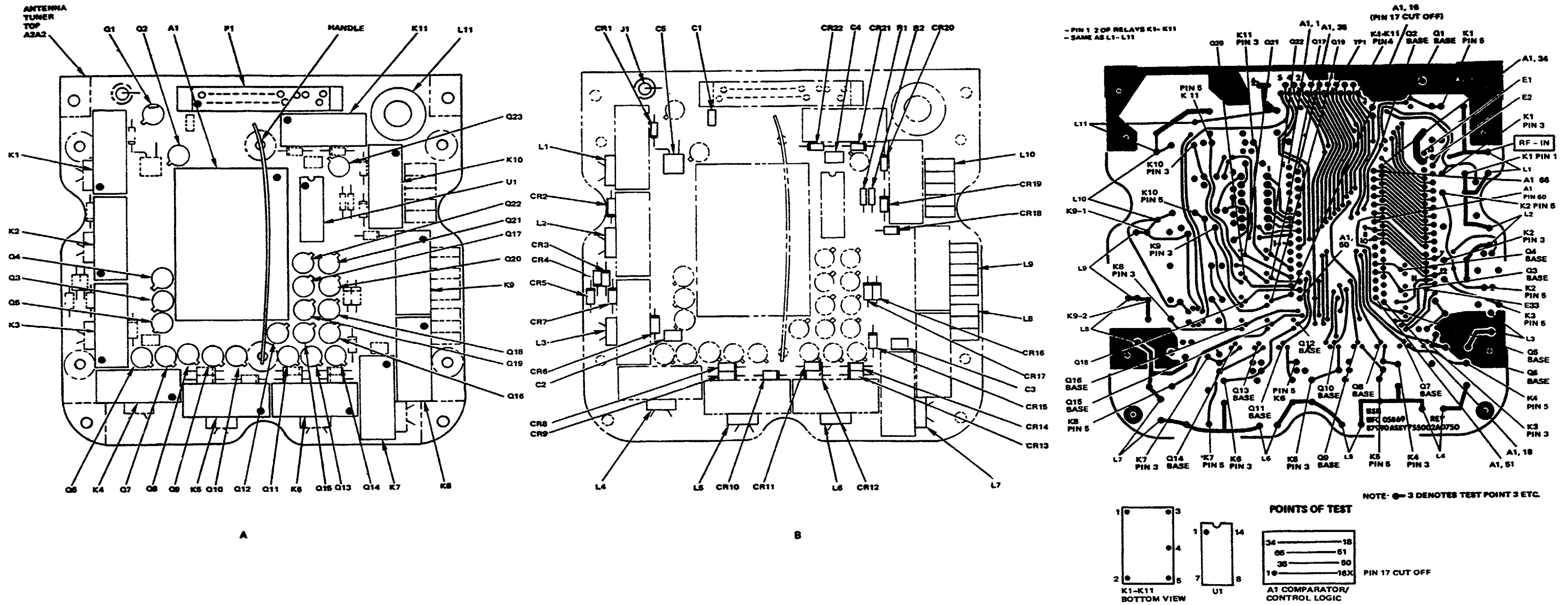


Figure 10-2. Antenna Tuner A2A2 Component Location (Sheet 1 of 3)

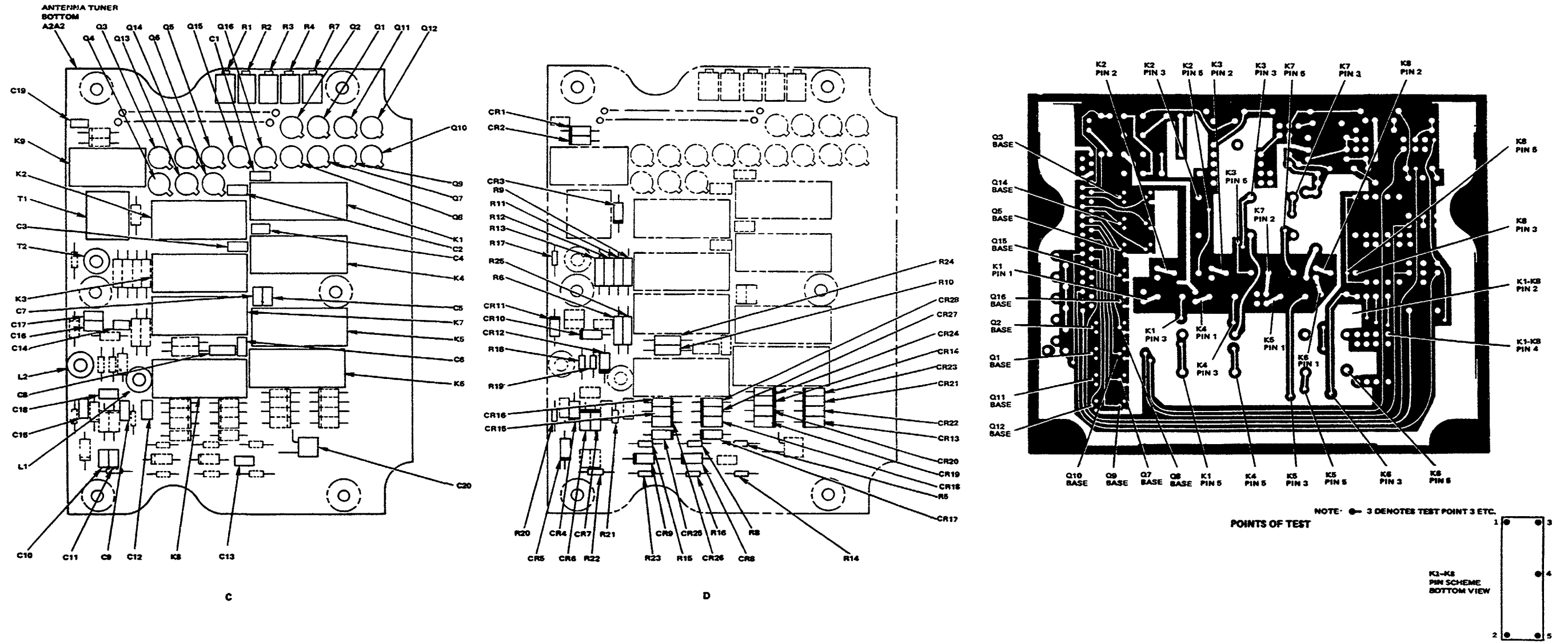


Figure 10-2. Antenna Tuner A2A2 Component Location (Sheet 2 of 3)

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
	A						
A2A2	Antenna Tuner Assembly TOP	CR21	Diode	R3	Resistor	CR14	Diode
Q1	Transistor	R1	Resistor	R4	Resistor	CR23	Diode
Q2	Transistor	R2	Resistor	R7	Resistor	CR21	Diode
A1	Microcircuit	CR20	Diode	Q2	Transistor	CR22	Diode
P1	Connector	L10	Coil	Q1	Transistor	CR13	Diode
	Handle	CR19	Diode	Q11	Transistor	CR20	Diode
K11	Relay	CR18	Diode	Q12	Transistor	CR19	Diode
L11	Coil	L9	Coil	Q10	Transistor	CR18	Diode
Q23	Transistor	L8	Coil	Q9	Transistor	R5	Resistor
K10	Relay	CR16	Diode	Q7	Transistor	CR17	Diode
U1	Microcircuit	CR17	Diode	Q8	Transistor	R14	Resistor
Q22	Transistor	C3	Capacitor	K1	Relay	R8	Resistor
Q21	Transistor	CR15	Diode	C2	Capacitor	CR8	Diode
Q17	Transistor	CR14	Diode	C4	Capacitor	R16	Resistor
Q20	Transistor	CR13	Diode	K4	Relay	CR26	Diode
R9	Relay	L7	Coil	C5	Capacitor	CR25	Diode
Q18	Transistor	CR12	Diode	R7	Relay	R15	Resistor
Q19	Transistor	L6	Coil	K5	Relay	CR9	Diode
Q16	Transistor	CR11	Diode	C6	Capacitor	R23	Resistor
K8	Relay	CR10	Diode	K6	Relay	R21	Resistor
R7	Relay	L5	Coil	C20	Capacitor	R22	Resistor
Q14	Transistor	L4	Coil	C13	Capacitor	CR7	Diode
Q13	Transistor	CR9	Diode	K8	Relay	CR6	Diode
Q15	Transistor	CR8	Diode	C12	Capacitor	CR4	Diode
K6	Relay	C2	Capacitor	C9	Capacitor	CR5	Diode
Q11	Transistor	CR6	Diode	C11	Capacitor	R20	Resistor
Q12	Transistor	L3	Coil	C10	Capacitor	CR15	Diode
Q10	Transistor	CR7	Diode	L1	Inductor	CR16	Diode
R5	Relay	CR5	Diode	C15	Capacitor	R19	Resistor
Q9	Transistor	CR4	Diode	C18	Capacitor	R18	Resistor
Q8	Transistor	CR3	Diode	C8	Capacitor	CR12	Diode
Q7	Transistor	L2	Coil	L2	Inductor	CR10	Diode
K4	Relay	CR2	Diode	C14	Capacitor	CR11	Diode
Q6	Transistor	L1	Coil	C16	Capacitor	B6	Resistor
K3	Relay			C17	Capacitor	R25	Resistor
Q5	Transistor		C	C7	Capacitor	R17	Resistor
Q3	Transistor	A2A2	Antenna Tuner Assembly BOTTOM	K3	Relay	R13	Resistor
Q4	Transistor	Q4	Transistor	T2	Inductor	R12	Resistor
K2	Relay	Q3	Transistor	C3	Capacitor	R11	Resistor
K1	Relay	Q13	Transistor	T1	Transformer	R9	Resistor
		Q14	Transistor	K2	Relay	CR3	Diode
		Q6	Transistor	K9	Relay	CR2	Diode
		Q5	Transistor	C19	Capacitor	CR1	Diode
		Q15	Transistor				
		C1	Capacitor		D		
CB1	Diode	Q16	Transistor	R24	Resistor		
J1	Connector	R1	Resistor	R10	Resistor		
C5	Capacitor	R2	Resistor	CR28	Diode		
C1	Capacitor			CR27	Diode		
CR22	Diode			CR24	Diode		
C4	Capacitor						

Figure 10-2. Antenna Tuner A2A2 Component Location (Sheet 3 of 3)

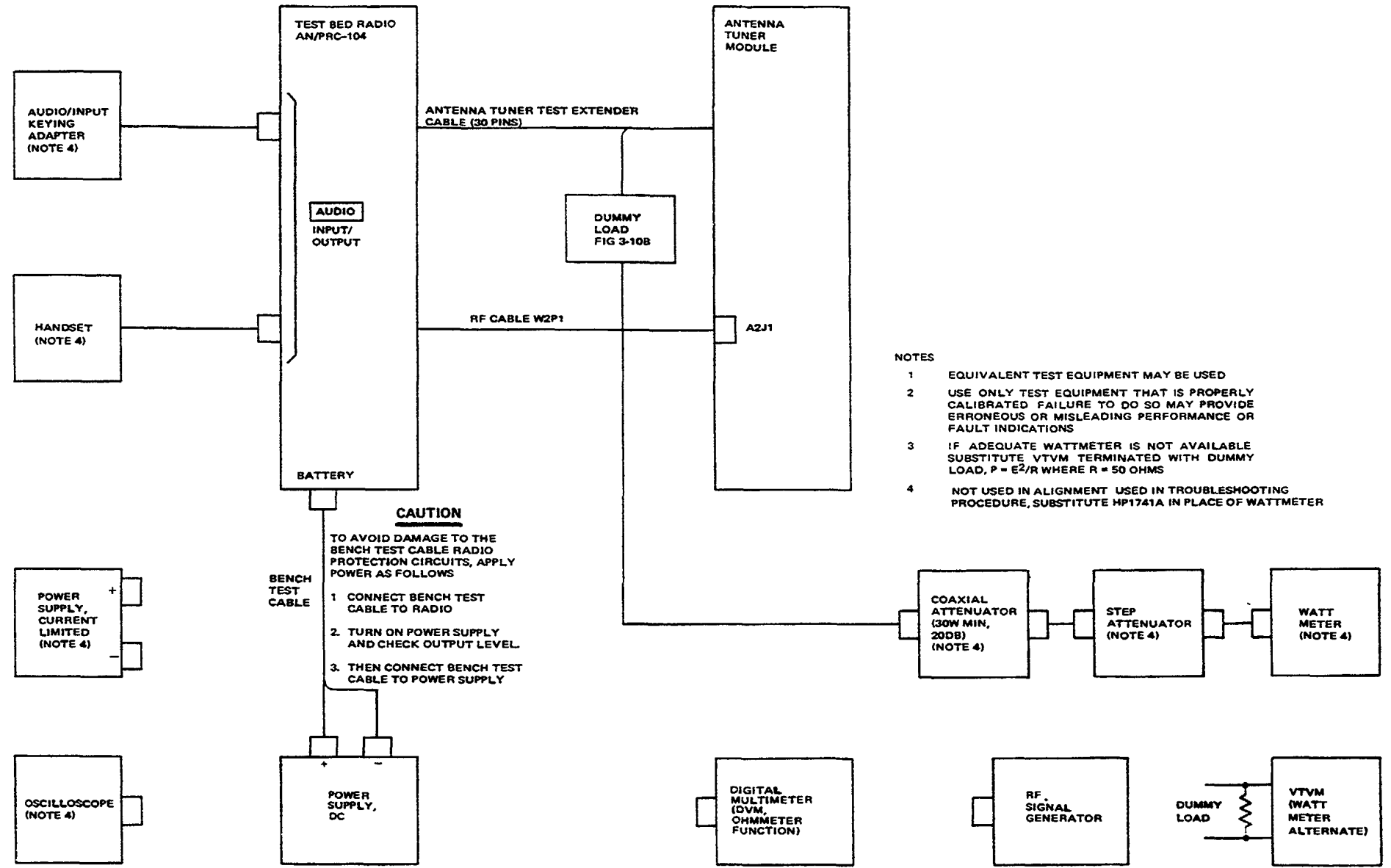
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Antenna Tuner Test Extender Cable	...	Figure 3-10B
Audio Input/Keying Adapter	...	Figure 3-11C
Kit, Tool, Electronic	TR-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MK-984/A	None

NOTE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Radio Set, Test Bed	AN/PRC-104	1
VTVM	AN/USM-116	1
Signal Generator, RF	AN/USM-323	1
Oscilloscope, Storage	Hewlett Packard HP-1741A	1
Digital Multimeter (DVM, ohmmeter function)	AN/USM-341	1
Attenuator, Step 10-db steps, 0.5w, 50 ohm	CN-1128/U	1
Dummy Load (50 ohm)	DA-553()/4	1
Watt Meter		
- Power Meter	Hewlett Packard HP-435A	1
- Thermocouple Power Sensor	Hewlett Packard HP-8482A	1
Power Supply, Current Limited	Hewlett Packard HP-6215A	1
Power Supply, DC	Hewlett Packard HP-6439B	1
Attenuator, Coaxial 20 db, 30w min., 50 ohm	Narda 765-20	1



- NOTES
- 1 EQUIVALENT TEST EQUIPMENT MAY BE USED
 - 2 USE ONLY TEST EQUIPMENT THAT IS PROPERLY CALIBRATED FAILURE TO DO SO MAY PROVIDE ERRONEOUS OR MISLEADING PERFORMANCE OR FAULT INDICATIONS
 - 3 IF ADEQUATE WATTMETER IS NOT AVAILABLE SUBSTITUTE VTVM TERMINATED WITH DUMMY LOAD, $P = E^2/R$ WHERE $R = 50$ OHMS
 - 4 NOT USED IN ALIGNMENT USED IN TROUBLESHOOTING PROCEDURE, SUBSTITUTE HP1741A IN PLACE OF WATTMETER

Figure 10-3. Antenna Tuner A2A2 Performance test Setup

ANTENNA TUNER PERFORMANCE TEST

NOTE 1: Changing the MODE switch from V-TR to V-RCV to V-TR causes a tune start signal to be routed from the modulator/demodulator. This will cause all capacitive and inductive elements to be removed from the rf pathway. When PIT or CW key is closed, the inductors and capacitors are added.

NOTE 2: A voltage difference of 1.5 vac or greater across the coil indicates that the relay is open. The coil is then in the rf pathway. After a time start, and before PTT is closed, all coil relays should be closed.

NOTE 3: If a coil is replaced, be sure that its inductance is exactly (11 percent) one-half of next larger coil.

NOTE 4: Unless otherwise specified, all voltage measurements taken with respect to ground.

NOTE 5: Hybrid binary count faults can be investigated in the following way:

1. Monitor TP10 with DVM and record voltage measurement.
2. Set TP10 to 0v (this disables comparator) by adjusting R4.
3. Monitor bases of S and R driver transistors for RL1 thru E111 and compare waveforms to those of a functional module (see that the "L" count is performed properly).
4. Set TP10 to +6v by adjusting R4.
5. Monitor TP8 and TP9 with DVM and record voltage measurement.
6. Set TP8 and TP9 to +0v (this disables comparator) by adjusting R2 and R3, respectively.
7. Monitor bases of S and R driver transistors for KC1 thru KC8 and compare waveforms to those of a functional module (see that the "C" count is performed properly).
8. Reset TP8, TP9, TP10 to the values recorded in steps 1 and 5.

NOTE 6: Component failures due to untraceable faults require special handling at a factory or depot location using a test fixture and a vector impedance meter. If performance is not satisfactory, and a tune-fault does not occur, then refer module to fifth echelon repair level.

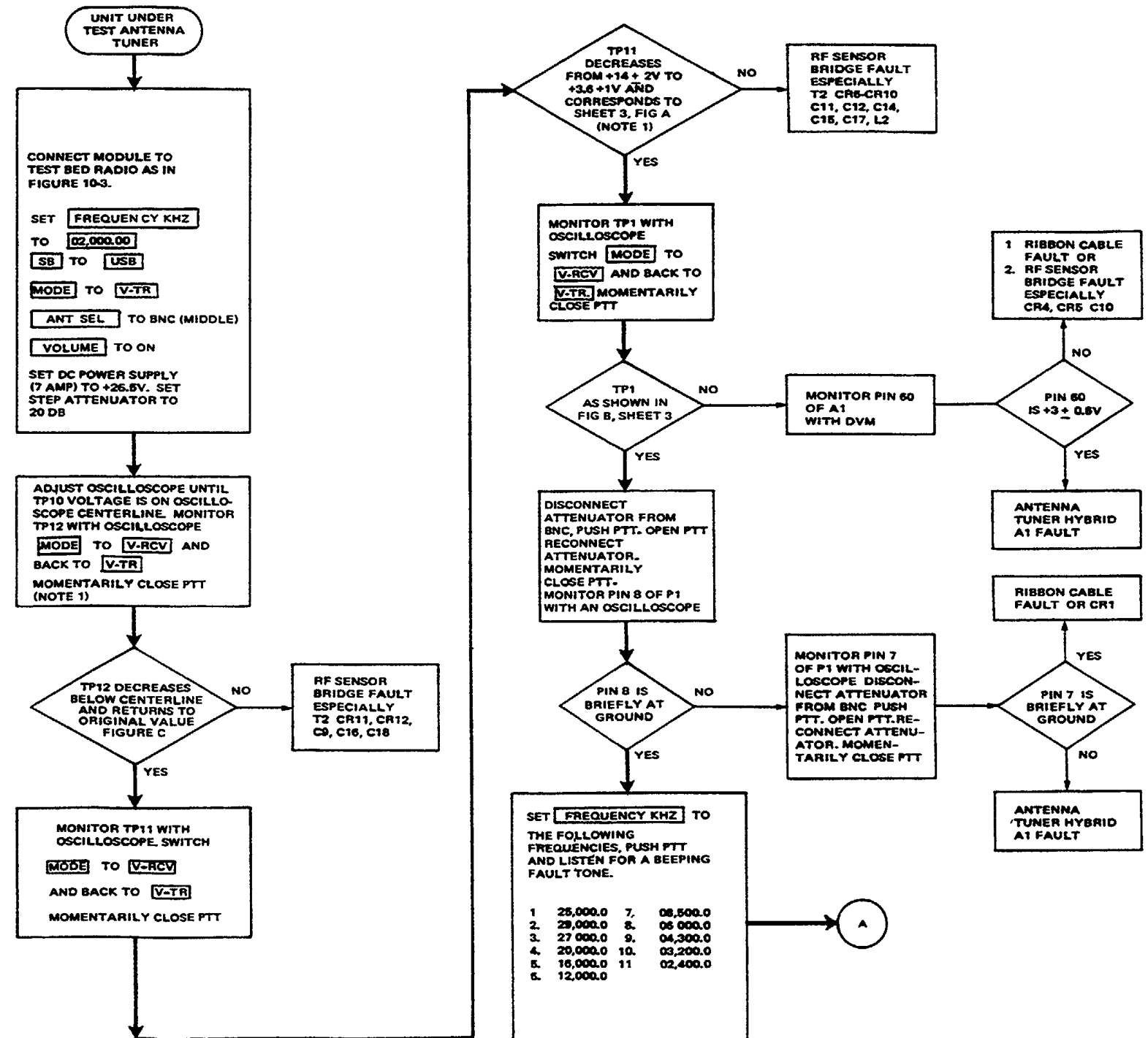


Figure 10-4. Antenna Tuner A2A2 Performance Test (Sheet 1 of 3)

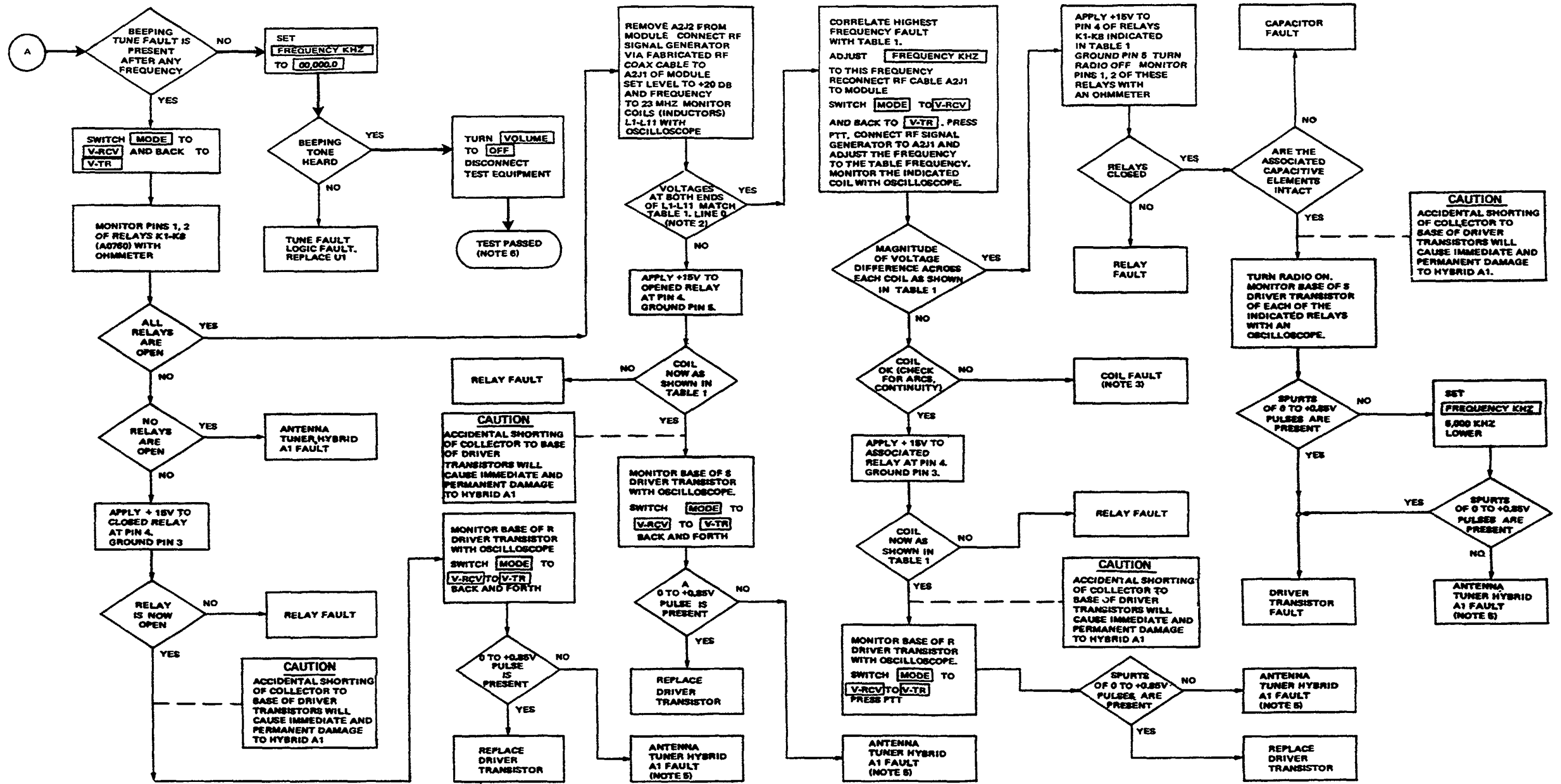
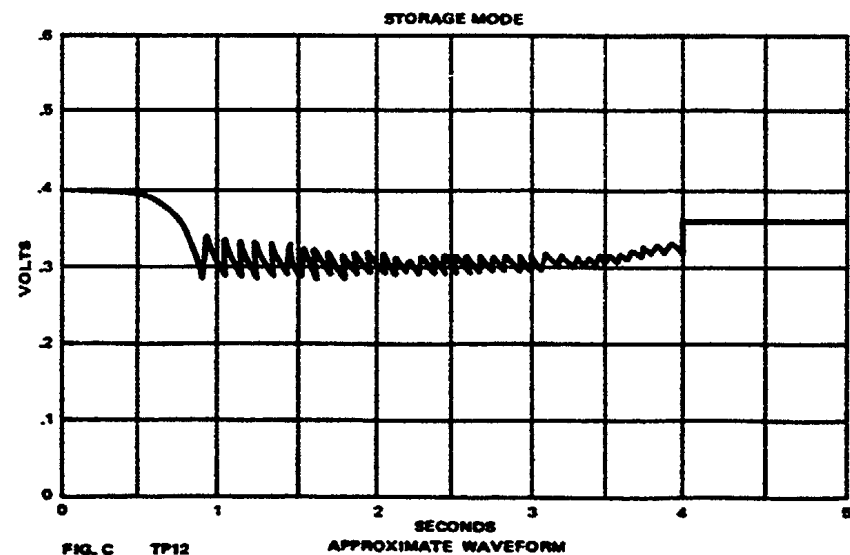
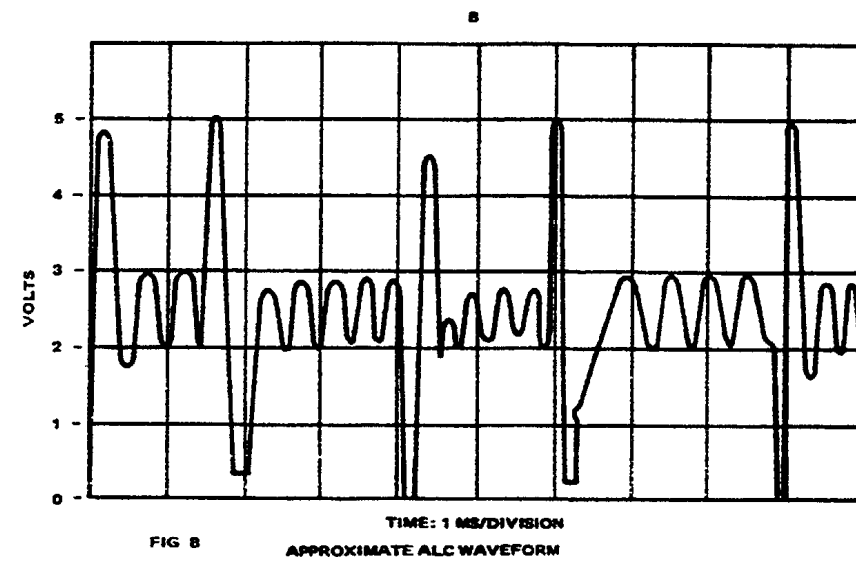
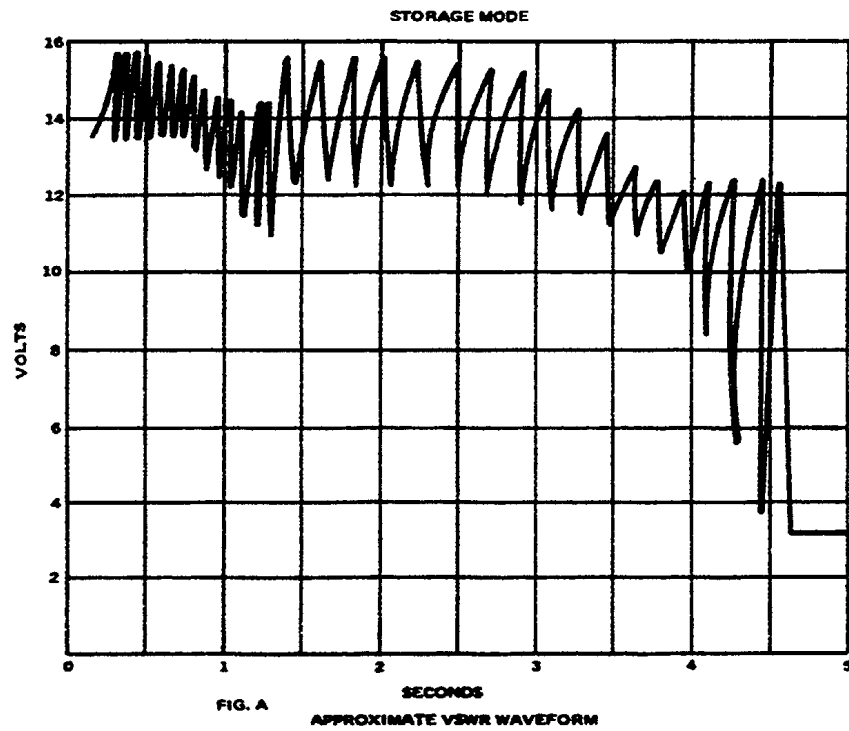


Figure 10-4. Antenna Tuner A2A2 Performance Test (Sheet 2 of 3)



HP-1741A WITH $10 \times$ PROBE V/DIV 0.1 TIME/DIV 0.5 SEC
SWEEP VERNIER 1-2 O'CLOCK TRIGGER LEVEL 1 O'CLOCK
AUTO NORM TO NORM POS NEG TO POS

TABLE 1
INDUCTORS (COILS) L1-L11 ARE IN PARALLEL WITH RELAYS K1-K11. TO DETERMINE WHETHER A GIVEN RELAY IS OPEN OR CLOSED, THE IMPEDENCE OF THE INDUCTOR (COIL) IS MEASURED AT A HIGH FREQUENCY BY CHECKING THE VOLTAGE DIFFERENCE ACROSS THE INDUCTORS (COILS). THESE ARE SOME TYPICAL PEAK-TO-PEAK COIL VOLTAGES, WHERE A/B IS COIL IN VOLTS/COIL OUT VOLTS (WITH RESPECT TO GROUND). A VOLTAGE DIFFERENCE OF 1.5V OR GREATER INDICATES AN OPEN RELAY.
*INDICATES CRITICAL RELAY FOR EACH FREQUENCY. IF CRITICAL RELAY IS CLOSED, TRY OTHER FREQUENCIES TO SEE IF IT WILL OPEN. IF IT WILL NOT OPEN AT ALL, IT IS FAULTY.

FAULT FREQUENCY CORRESPONDS TO FREQUENCY KHZ AND RF SIGNAL GENERATOR FREQUENCY FOR COIL AND RELAY CHECK

CAPACITIVE RELAYS TO CHECK FOR EACH FREQUENCY

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	K1	K2	K3	K4	K5	K6	K7	K8
0. 23,000	3/3	3/3.5	3.5/3.8	3.8/4	4/4.5	4.5/4.8	4.5/5	5/5.5	5.5/6	6/6	6/6.2	0	0	0	0	0	0	0	0
1. 25,000	10/8*	8/8	8/6*	5/5.5								x	x	x					
2. 29,000	10/9.5	9.5/7*	7/7									x	x	x					
3. 27,000		10/10	10/4.5*	8.5/4.5								x	x	x					
4. 20,000			6/6	6/15*	15/15									x	x	x			
5. 16,000				7/5	6/23*	23/23								x	x	x			
6. 12,000					5/5	8/35*	35/35							x	x	x			
7. 06,500						3.5/3.5	3.5/40*	40/40							x	x	x		
8. 06,000						2.5/2.5	2.5/18*	18/18							x	x	x		
9. 04,300							14/14	14/80*	80/80							x	x	x	
10. 03,200								27/27	27/80*	80/80						x	x	x	
11. 02,400									30/30	30/80*						x	x	x	

x - CHECK THESE RELAYS BY APPLYING +15V TO PIN 4 AND GROUND PIN 5.
o - OPEN RELAY

Figure 10-4. Antenna Tuner A2A2 Performance Test (Sheet 3 of 3)

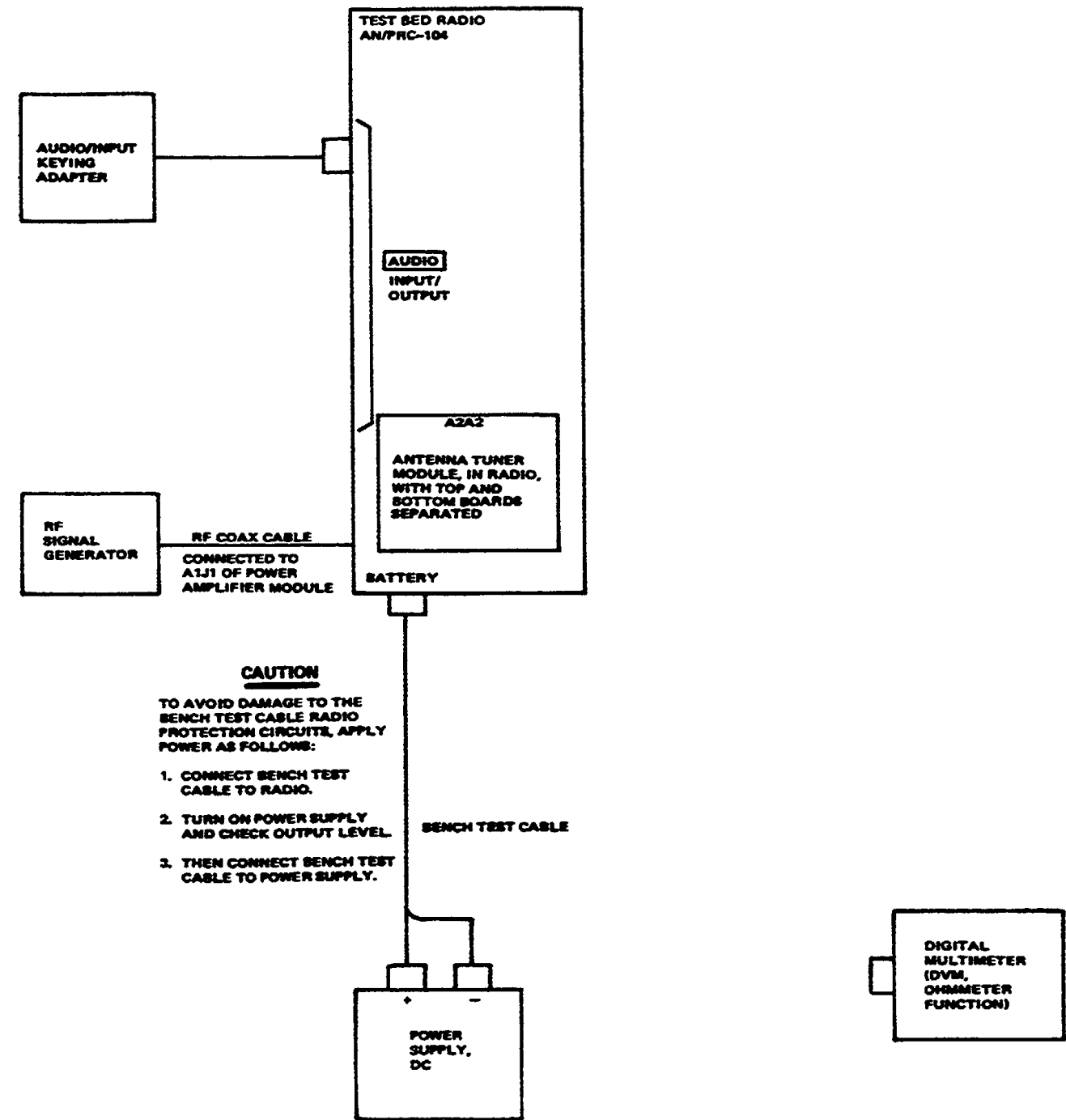
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Reference
100-Ohm Load	Figure 3-11E
130-Ohm Load	Figure 3-11F
RF Coax Cable	Figure 3-11A
Audio Input/Keying Adapter	Figure 3-11C

NONE: Referenced figures are in TM 11-5820-919-40-1.

TEST EQUIPMENT

Name	Designation	Quantity
Ratio Set, Test Bed	AN/PRC-104	1
Signal Generator, RF	AN/USM-323	1
Digital Multimeter (DVM ohmmeter function)	AN/USM-341	1
Power Supply, DC	Hewlett-Packard HP-6439B	1



ANTENNA TUNER A2A2 ALIGNMENT

The alignment procedure is to be used in either of these situations: (1) the performance test calls a potentiometer out of adjustment, or (2) one of the following is replaced:

1. Comparator/Control Hybrid A1
2. RF Sensor Bridge

The procedure consists of a preliminary setup and adjustment procedure. The adjustment procedure can be shortened by adjusting R1, R2, B3 and R4 to the values given in step 13 below. The complete procedure need only be run if work has been done on the rf Sensor Bridge.

PRELIMINARY SETUP

1. Connect test radio as in figure 10-5.
2. Connect an rf signal generator to the input of the power amplifier module at A1J1. Set the level to -100dbm and the frequency to 2.000 MHz.
3. Remove the antenna tuner module from the test bed radio. Separate the two halves of the antenna tuner module which is to be aligned, except for the interconnecting ribbon cable.
4. Plug the antenna tuner module to be aligned into the test bed radio.
5. Connect the 100 ohm load (figure 3-11E, TM 11-5820-919-40-1 to the radio set BNC connector.
6. Set the radio control to the following:
 - a. FREQUENCY KHz to 02,000.0
 - b. MODE to V-TR
 - c. SB to USB
 - d. VOLUME to on
 - e. ANT SEL to BNC

ADJUSTMENT

1. Close CW KEY and switch MODE to V-RCV and back to V-TR. This generates a tune start pulse.
2. Ground (continuously) E7 of ribbon cable.
3. Increase level of rf signal generator until TP13 is +10v rms. This corresponds to 2 watts in a 50-ohm system.
4. Measure the dc output of the Z sensor at TP12. Record voltage at TP12.
5. Adjust R4 until the Z comparator reference voltage, TP10, is the same as that measured in step 4.
6. Replace the 100 load with the 130-ohm load (figure 3-11-F, TM 11-5820-919-40-1).
7. Adjust the rf signal generator so that the voltage at TP13 varies between +7 ant +14v (+7v = 1 watt, +14v = 4 watts) and measure the output of the vswr detector at TP11. But, do not stay at the 4-watt level for any length of time.
8. Adjust the level compensation resistor, R7, for minimum variation in do output of TP11 as performed in step 7.
9. Once R7 is adjusted, adjust the rf signal generator so that TP13 is +10v rms, Note the voltage at TP11.

ADJUSTMENT (cont)

10. Adjust B3 until the 1.5 vswr reference voltage, TP9, is the same as that noted in step 9.
11. Adjust B2 until the 1.6 vswr reference voltage at TP8 is +10.6v higher than that of TP9.
12. Adjust B1 until the voltage at TP7 is +3.0v.
13. The following are typical settings after alignment:


ALC REM	R1	TP7	+3.0v
1.6 REP	R2	TP8	+4.3v
1.5 REP	R3	TP9	+3.7v
ZREF	R4	TP10	+3.3v
14. Turn radio off and disconnect test equipment. Reassemble the two boards of the antenna tuner module being very careful to avoid pinching the ribbon cable.

APPENDIX A

REFERENCES

AR 55-38	Reporting of Transportation Discrepancies in Shipments
AR 735-11-2	Reporting of Item and Packaging Discrepancies
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms
DA Pam 738-750	The Army Maintenance Management System (TAMMS)
TM 11-582919-24P	Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List for Radio Set AN/PRC-104A
TM 11-5820-919-24P	General Support Maintenance Manual Radio Set AN/PRC-104A
TM 740-90-1	Administrative Storage of Equipment
TM 750-244-2	Procedures for Destruction of Electronic Material to Prevent Enemy Use (Electronics Command)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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