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**

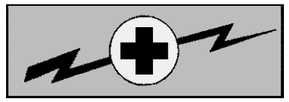
1 **DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL**

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 causalities, 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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NOTE

Maintenance Kit,OA-9169/GRC-213,ls available for Army use In maintaining this equipment.

LIST OF ILLUSTRATIONS

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 Monrnouth, 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-lo 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 an 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
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)
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 Modes	- Slngle 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)
Audio Input Impedance and Level	150 ohms, -56 dbm (voice) or, 6 mv. RMS. 600 ohms, 0 dbm (data) or, 77 v. RMS,
RP Output Power	20w (PEP), 0.25w (PEP) exciter output
RF Output Impedance	50-ohms, unbalanced. Output protected to infinite VSWR due to antenna short or open.
Antenna Tuning	Automatic to 1.5:1 VSWR (3 seconds tuning time, typical)

Characteristic	Description
Power Requirements	20.0 to 32.0 vdc with input at 3.5 amp (24 vdc) for transmit (typical). 200 ma for receive (typical).
Operating Temperature Range	-51°F (-46°C) to +160°F (+71°C)
Environmental	Meets applicable provisions of MIL-STD-810B
Mean Time Between Failure (MTBF)	2500 hours (demonstrated per MIL-STD-785)
Mean Time to Repair (MTTR)	15 minutes (module replacement)
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
Weight	14 pounds (6.36 Kg), including 4.8 AN silver zinc battery (without accessories)
	RECEIVER
Sensitivity	
SSB, Cal, FSK	0.7 v for 10 db SINAD (-110 dbm voice, -70 dbm data)
Selectivity	2.5 kHz Bandwidth at -3 db
SSB, CW, FSR	6.0 kHz Bandwidth at -60 db
Image Rejection	70 db
I.F. Rejection	60 db
Audio Output	25 tow into 500 (nominal)

Characteristic	Description
Audio Distortion	5 percent at 5 mw, 350 to 3000 Hz
Desensitization (signal to degrade SINAD 3 db)	±2.5% to -29 dbm; ±10% to -15 dbm; ±50% to +17 dbm
	TRANSMITTER
RF Output Power	0.3 W (PEP) for RT-1209, 20W (PEP or average) with AM-6874
Intermodulation Distortion (IMD)	-25 db (two equal tones at rated output power
Harmonic Radiation	-50 db
Carrier Suppression	-42 db
Unwanted Sideband Suppression	-45 db
All Other Spurious	-45 to -60 db
Duty Cycle	1 minute continuous keydown, 9:1 transmit/receive ratio
	BATTERY PACK
Battery	Silver-zinc (AgZn), rechargeable 4.8 AH

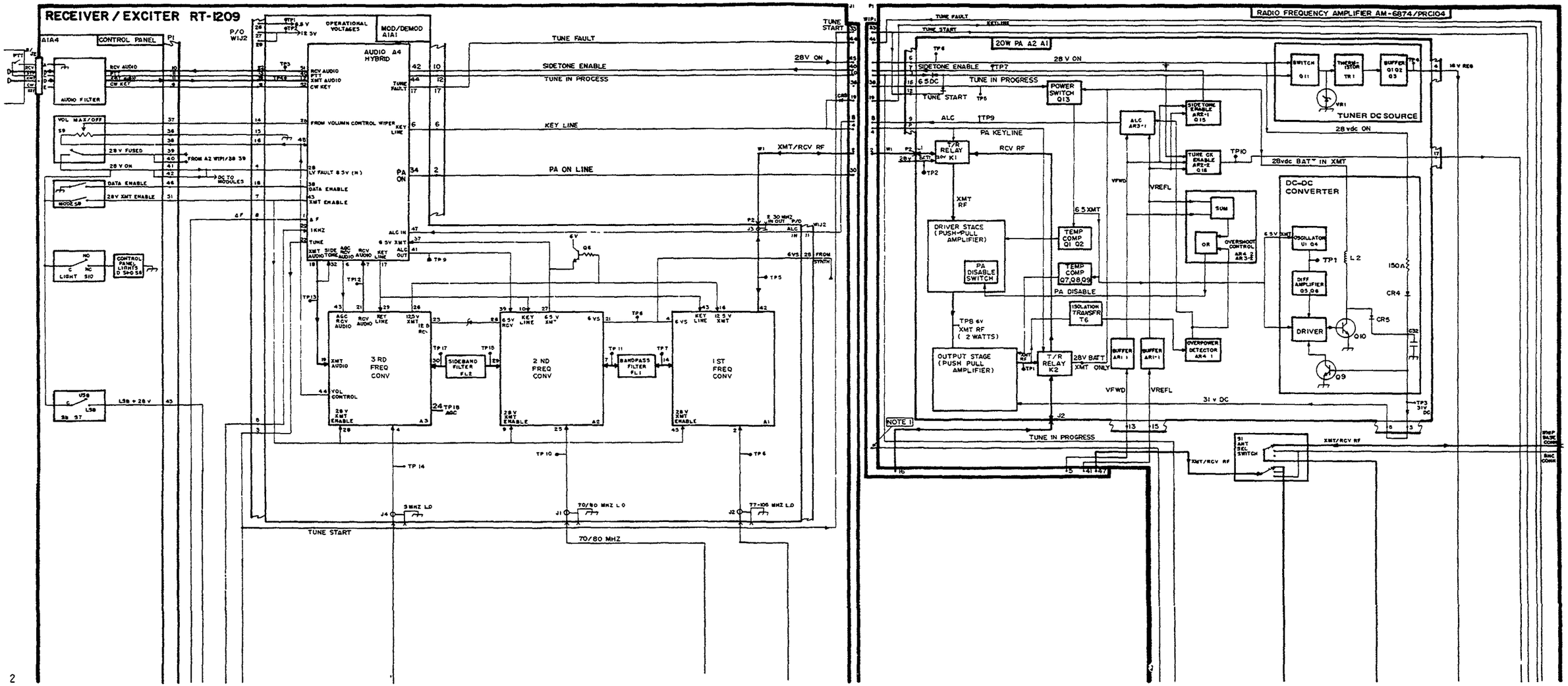


Figure 1-1. Radio Set Block Diagram (Sheet 1 of 2)

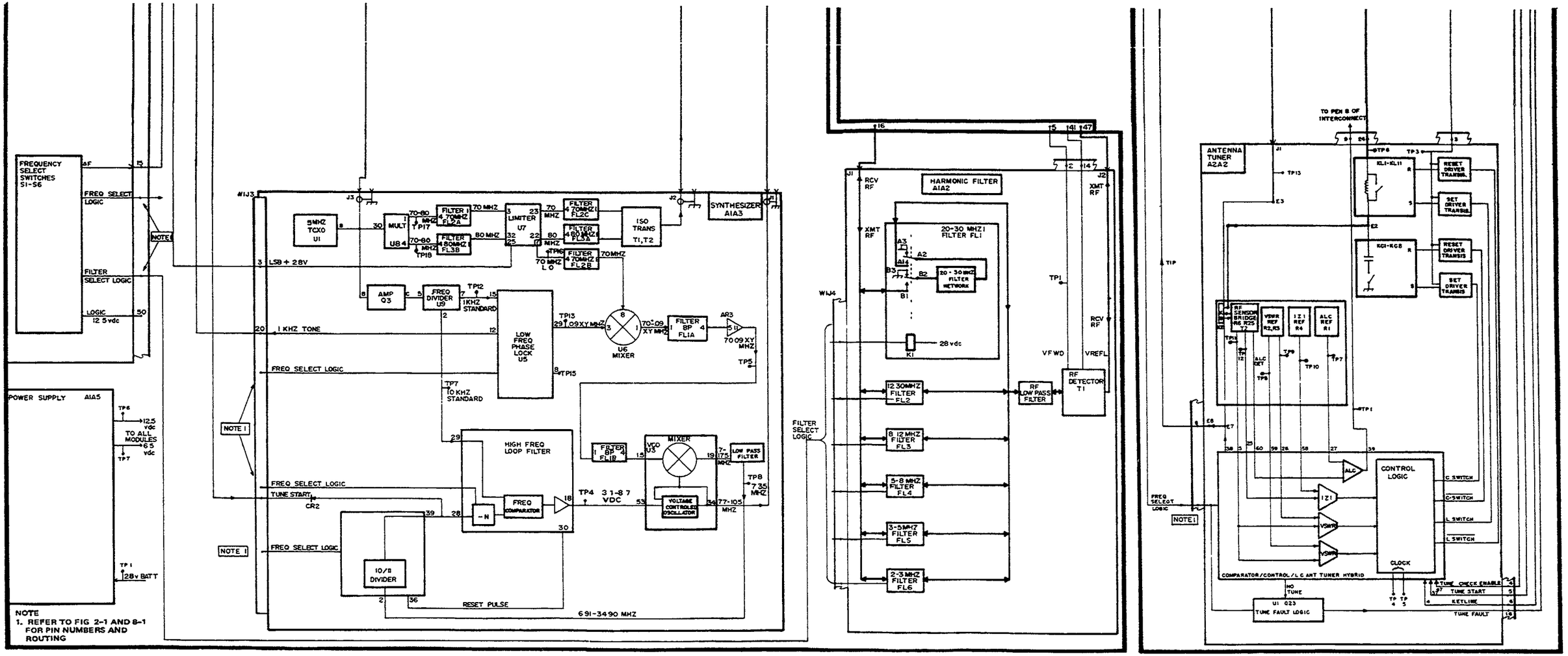


Figure 1-1. Radio Set Block Diagram (Sheet 2 of 2)

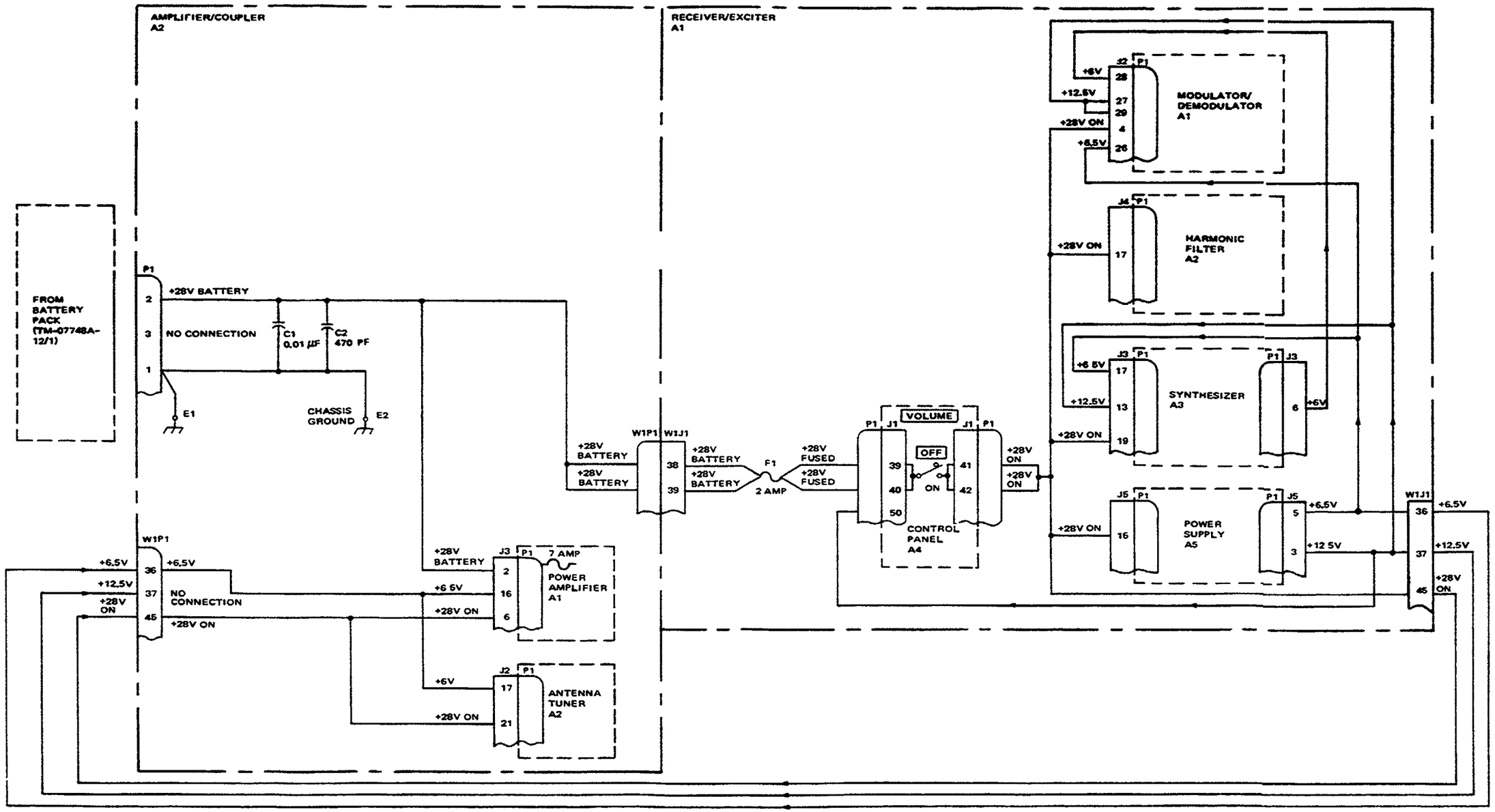


Figure 1-2. Radio Set Power Distribution

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	AN/USM-341	1
(DVM, oh meter function)		
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

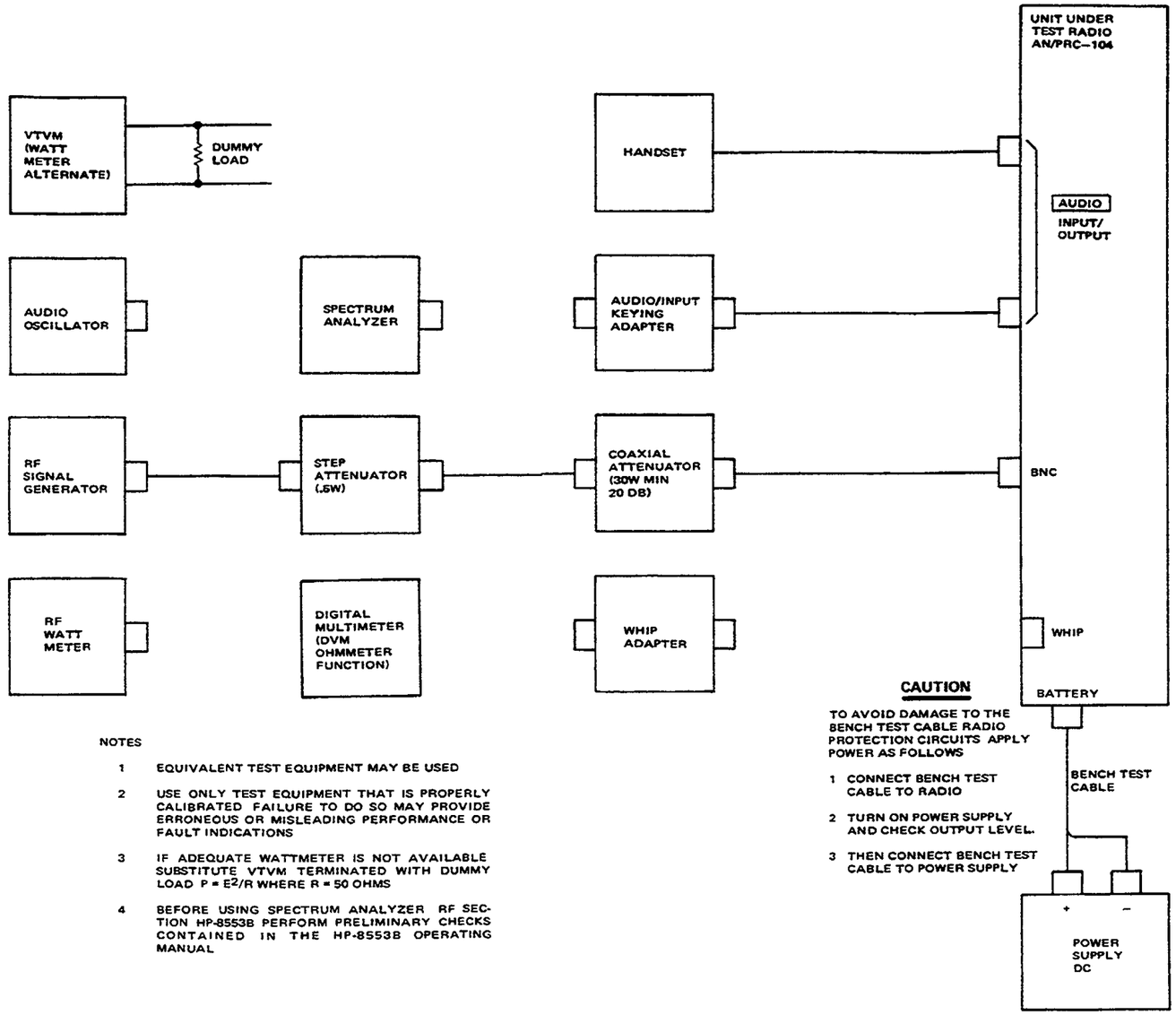


Figure 1-3. Radio Set Performance Test Setup

RADIO SET PERFORMANCE TEST

NOTE 1:

		Radio Set Frequency (kHz)	Sideband	RF Signal Generator Frequency (MHz)
No. 1.	a.	2,221.0	USB	2.2220
	b.	2,221.0	LSB	2.2200
No. 2	a.	3,334.0	USB	3.3350
	b.	3,334.0	LSB	3.3330
No. 3	a.	6,665.0	USB	6.6660
	b.	6,665.0	LSB	6.6640
No. 4	a.	8,889.0	USB	8.8900
	b.	8,889.0	LS	8 .8880
No. 5	a.	15,554.0	USB	15.5550
	b.	15,554.0	LSB	15.5530
No. 6	a.	27,778.0	USB	27.7790
	b.	27,778.0	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 tine to cause tune-up tone when PIT is closed.

NOTE 5: See page 8.

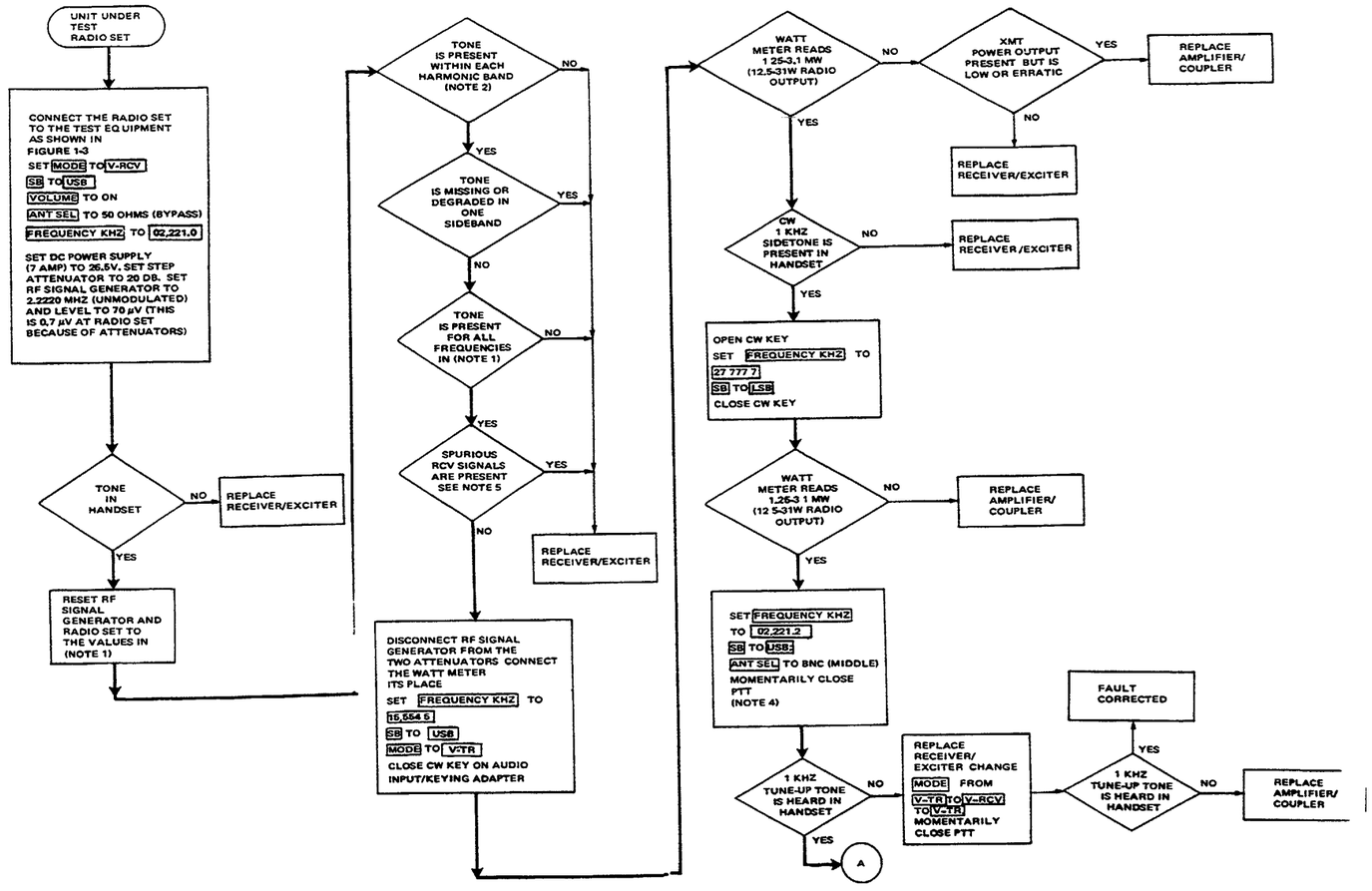


Figure 1-4. Radio Set Performance Test (Sheet 1 of 2)

REVALIDATE

BANDWIDTH	300 KHZ
SCAN (INNER RED)	PER DIV
INPUT ATTEN	20 DB
RANGE	0–110 MHZ
CENTER FREQ	50 MHZ
VIDEO FILTER	100 HZ
SCAN MODE	SINGLE
10 DB LOG	10 DB LOG
SCAN TRIGGER	AUTO
LOG REF	10 DB
LINEAR SENSITIVITY	0
SCAN WIDTH	10 MHZ
SCAN TIME	1 SECOND
STORAGE	STD
INTENSITY	CENTERED

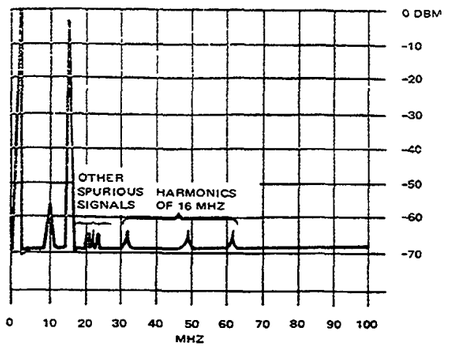


FIG A

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

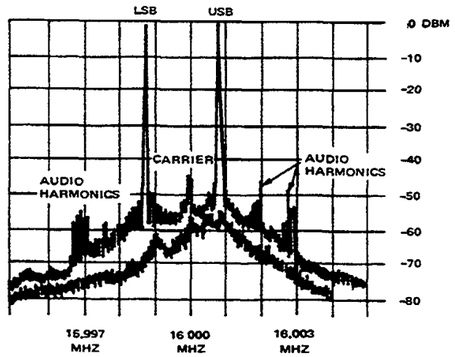


FIG B

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

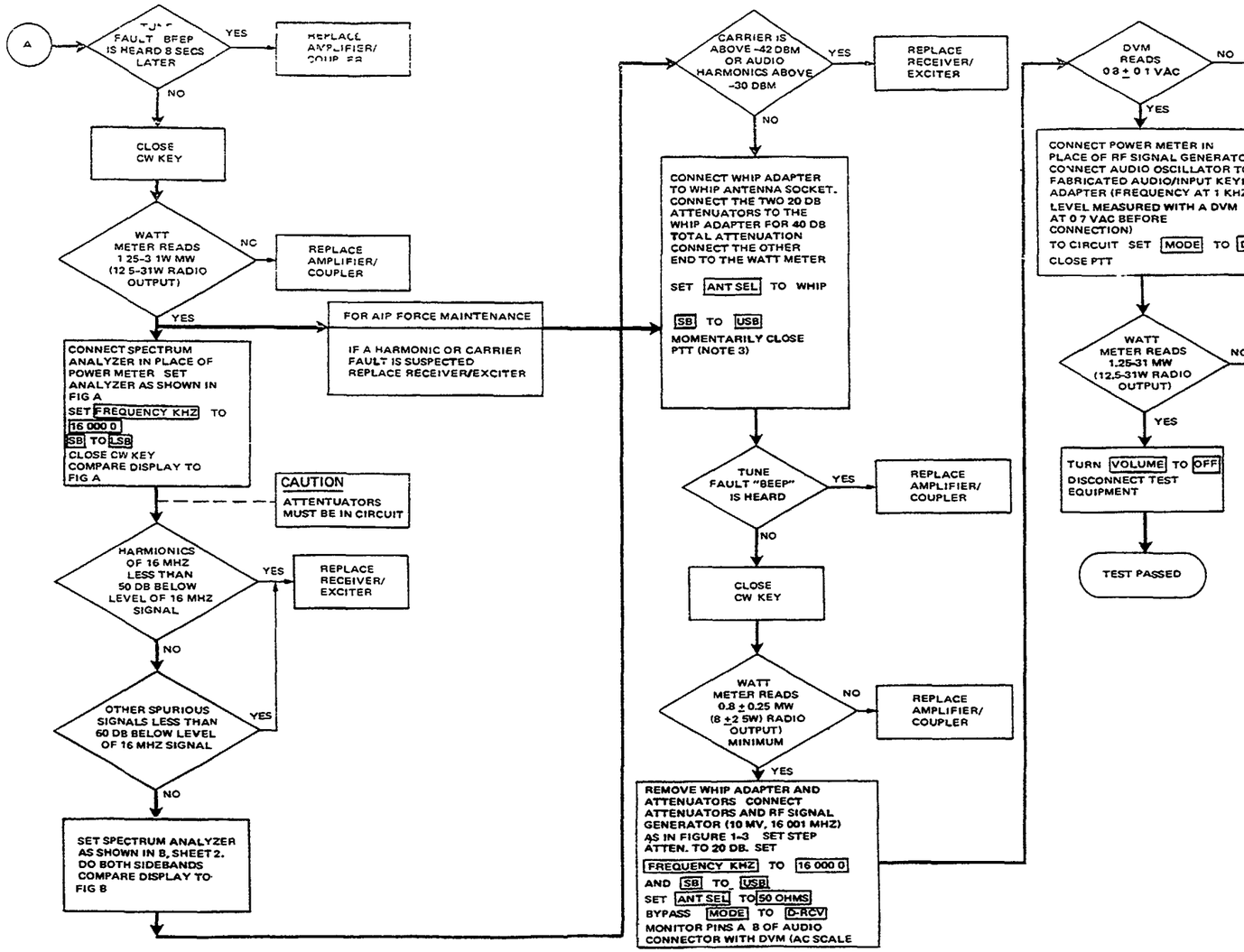


Figure 1-4. Radio Set Performance Test (Sheet 2 of 2)

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	

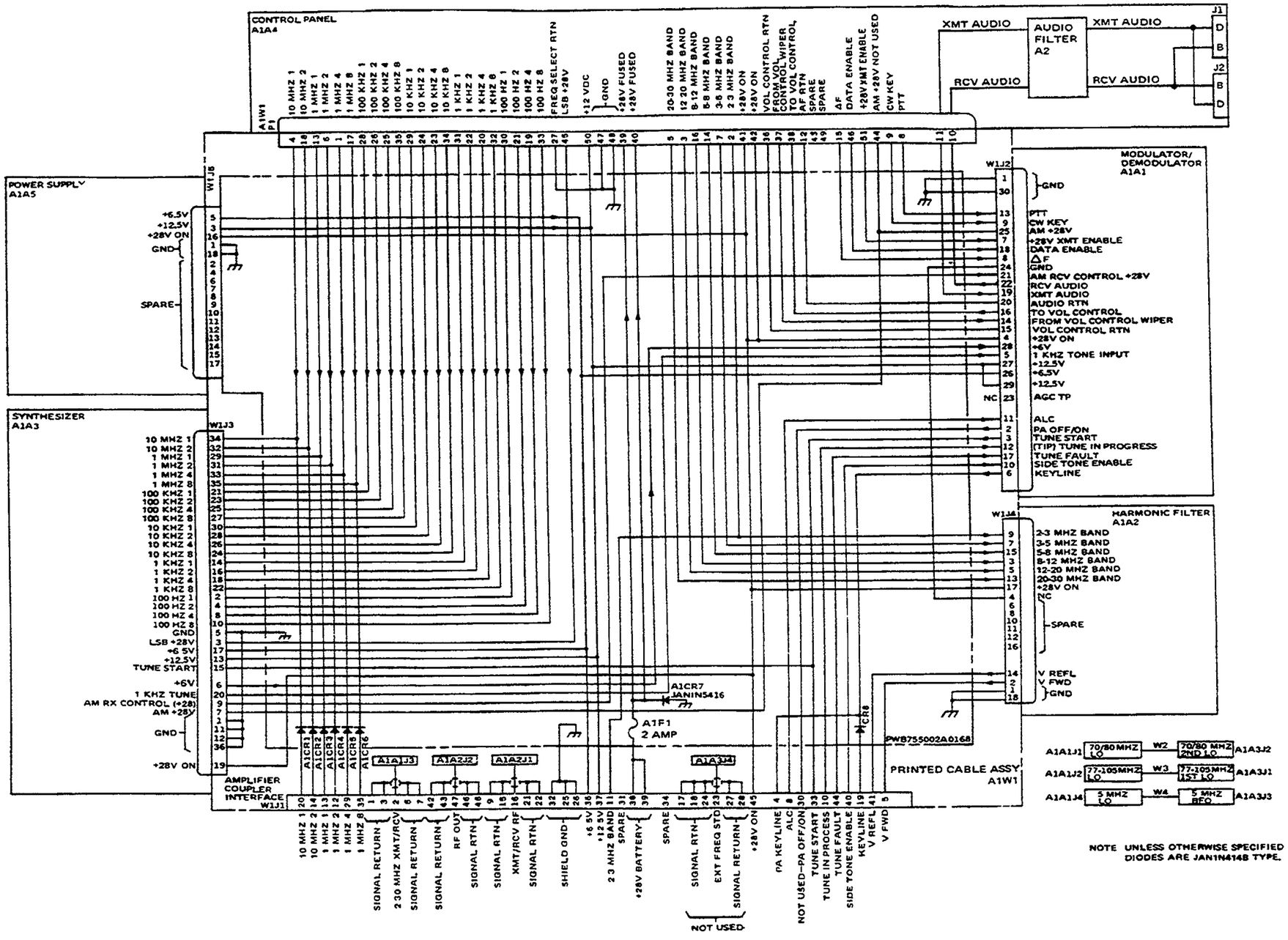
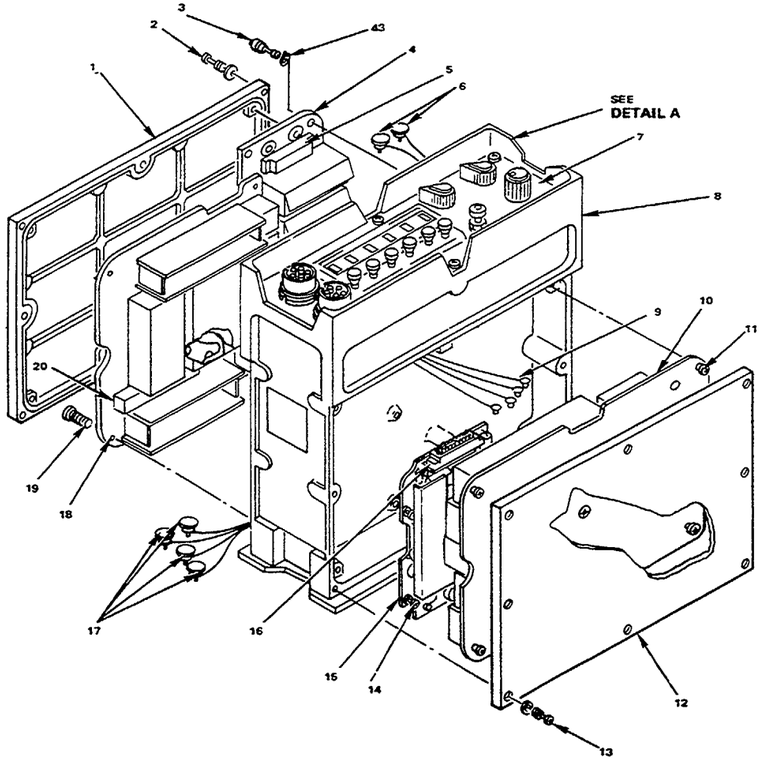
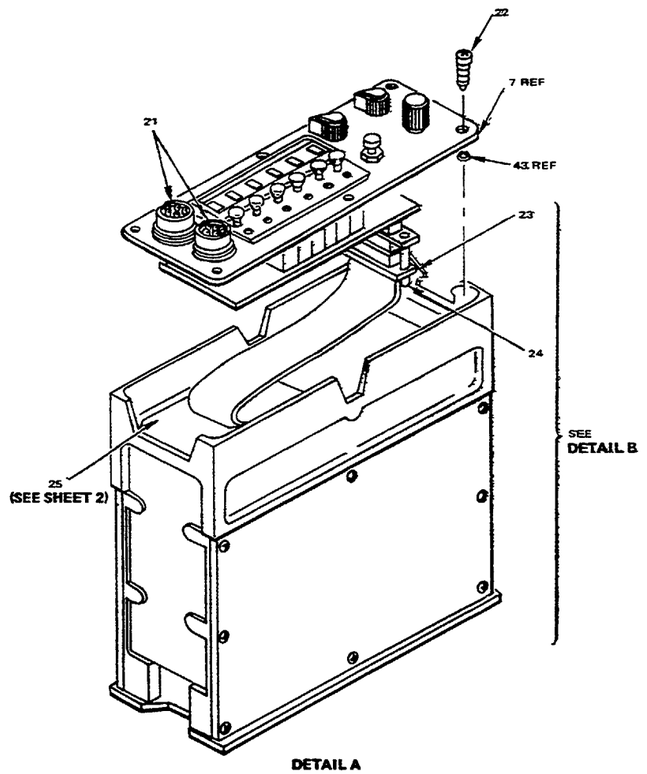


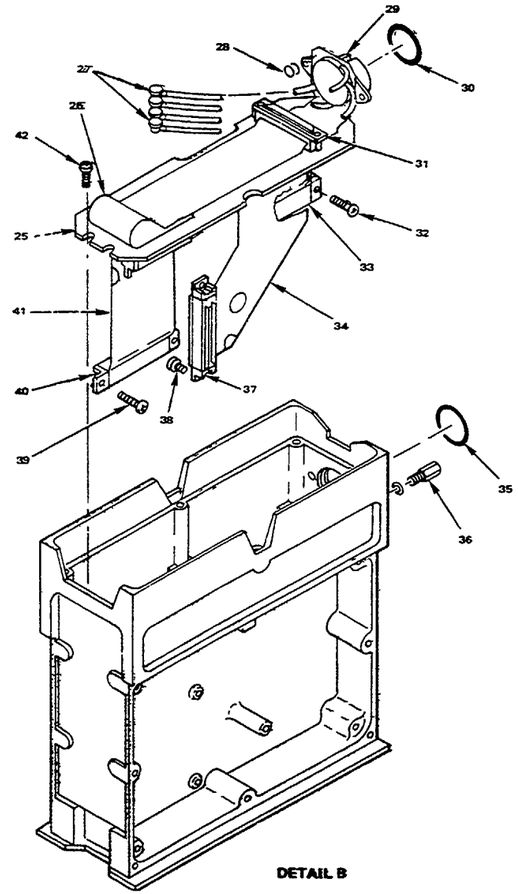
Figure 2-1. Receiver/Exciter A1 Interconnection Schematic

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





DETAIL A

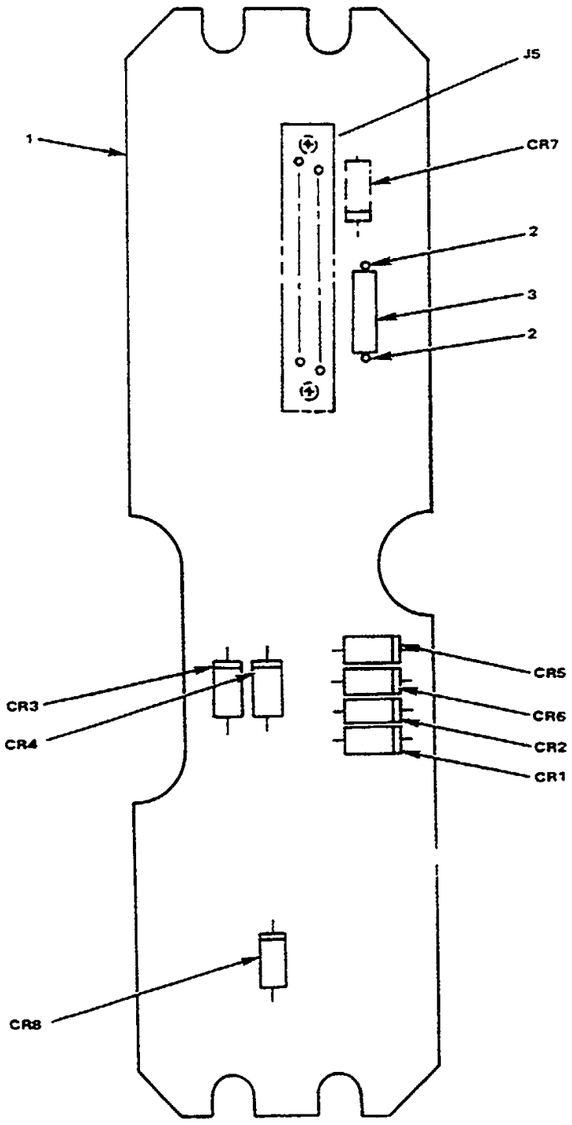


DETAIL B

ITEM	DESCRIPTION
1.	Cover Assembly
2.	Screw, Captive (8 places)
3.	Screw, Captive (4 places)
4.	Harmonic Filter Module A1A2
5.	Multipin Connector (Harmonic Filter Module) A1A2P1
6.	RF Cables A1A2J1(W1P4),1 A1A2J2(W1P3)
7.	Control Panel cover Assembly (Face) A1A4
8.	Receiver/Exciter A1
9.	RF Cables A1A3J3(W4), A1A3J4(W1P5), A1A3J2(W2), A1A3J1(W3)
10.	Synthesizer Module A1A3
11.	Screw, Captive (5 places)
12.	Cover, Assembly
13.	Screw, Captive (8 places)
14.	Screw, Captive (4 places)
15.	Power Supply Module A1A5
16.	Multipin Connector A1A5P1
17.	RF Cables A1A1J1(W2), A1A1J2(W3), A1A1J3(W1P2), A1A1J4(W4)
18.	Modulator/Demodulator Module A1A1
19.	Screw, Captive (4 places)
20.	Multipin Connector A1A1P1
21.	Audio Connector Plugs A1A4J1, J2
22.	Screw, Captive (6 places)
23.	Multipin Connector A1A4P1
24.	Captive Allen Screw (2 places)
25.	Printed Wiring Board
26.	Ribbon Cable Assembly
27.	RF Cables A1A2J2(W1) A1A2J1(W1), A1A2J3(W1), A1A2J4(W1)
28.	Mount mug Nut (2 places)
29.	Jack Receptacle Connector J1
30.	Packing, Preform
31.	Connector, Plug (Multipin) A1A4P1
32.	Mounting Screw (2 places)
33.	Multipin, Connector, A1A2J4
34.	Ribbon Cable Assembly A1W1
35.	Packing, Preform
36.	Connector, Stud
37.	Multipin Connector A1A3J3
38.	Mounting Screw (2 places)
39.	Mounting Screw) (2 places
40.	Multipin Connector A1A1J2
41.	Ribbon Cable Assembly A1W1
42.	Circuit Board Mounting Screws, A1len (4 places)
43.	.020” C Spring Clip (22 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
CR4	Diode
CR3	Diode

TM-07748A-45/3

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

SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

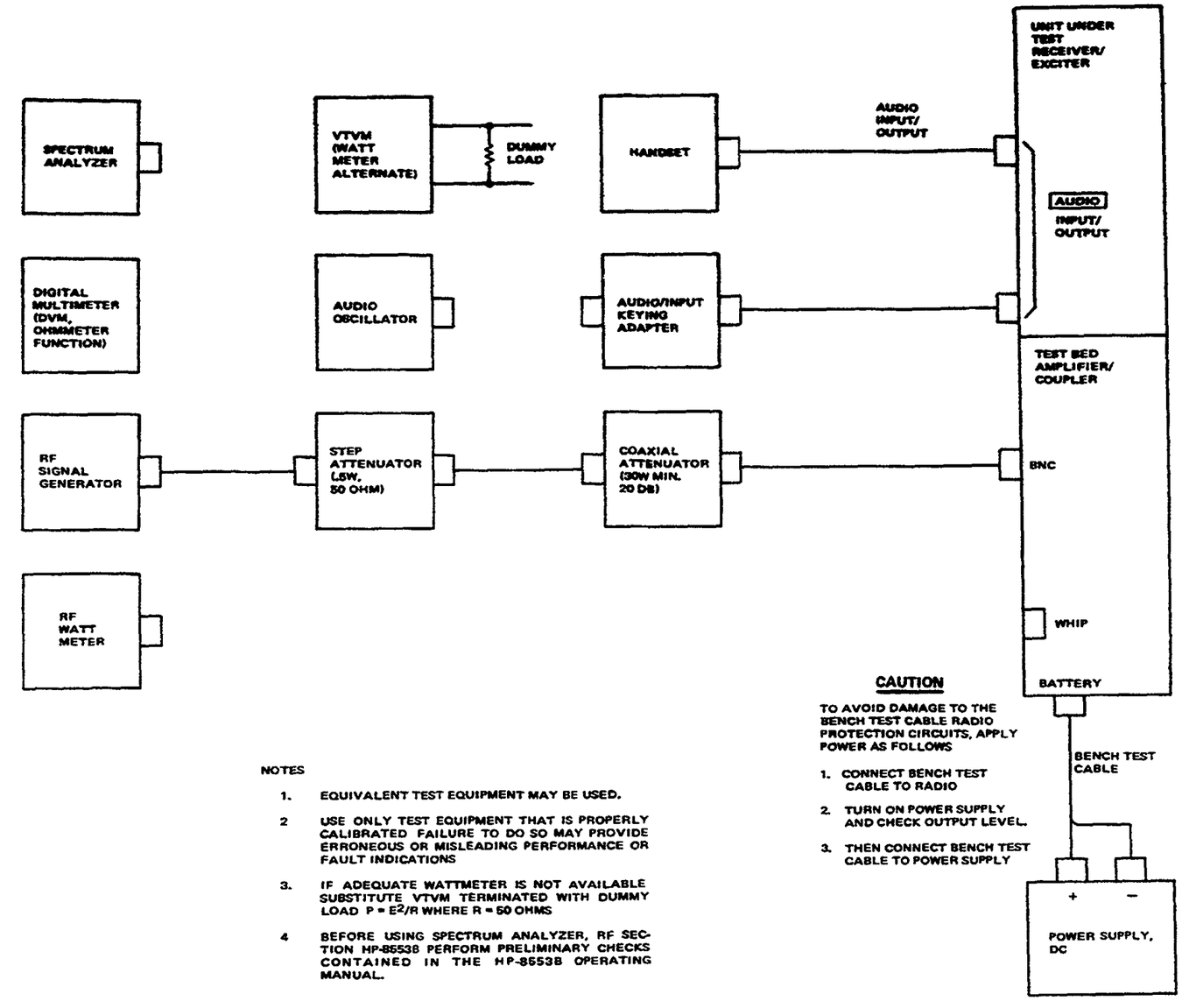
Description	Part Number	Reference
Audio Input/Keying Adapter	•••	Figure 3-11C
Lip Adapter	•••	Figure 3-11D
Kit, Tool, Electronic	TK-100/G	None
Bench Repair Center	Pace PRC-350C	None
Maintenance Kit, Printed Circuit	MR-984/A	None

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

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



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-85538 PERFORM PRELIMINARY CHECKS CONTAINED IN THE HP-8553B OPERATING MANUAL.

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.

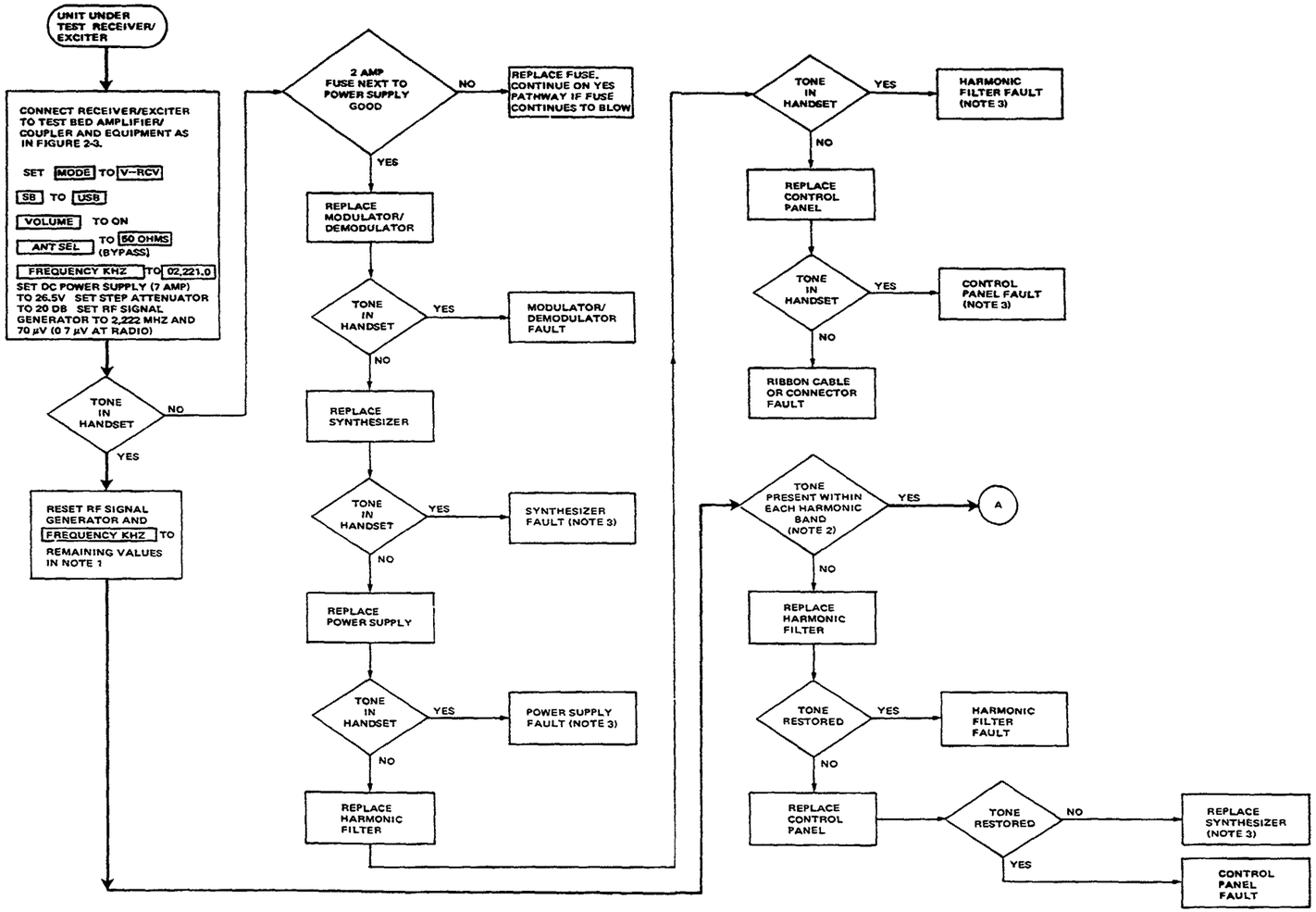
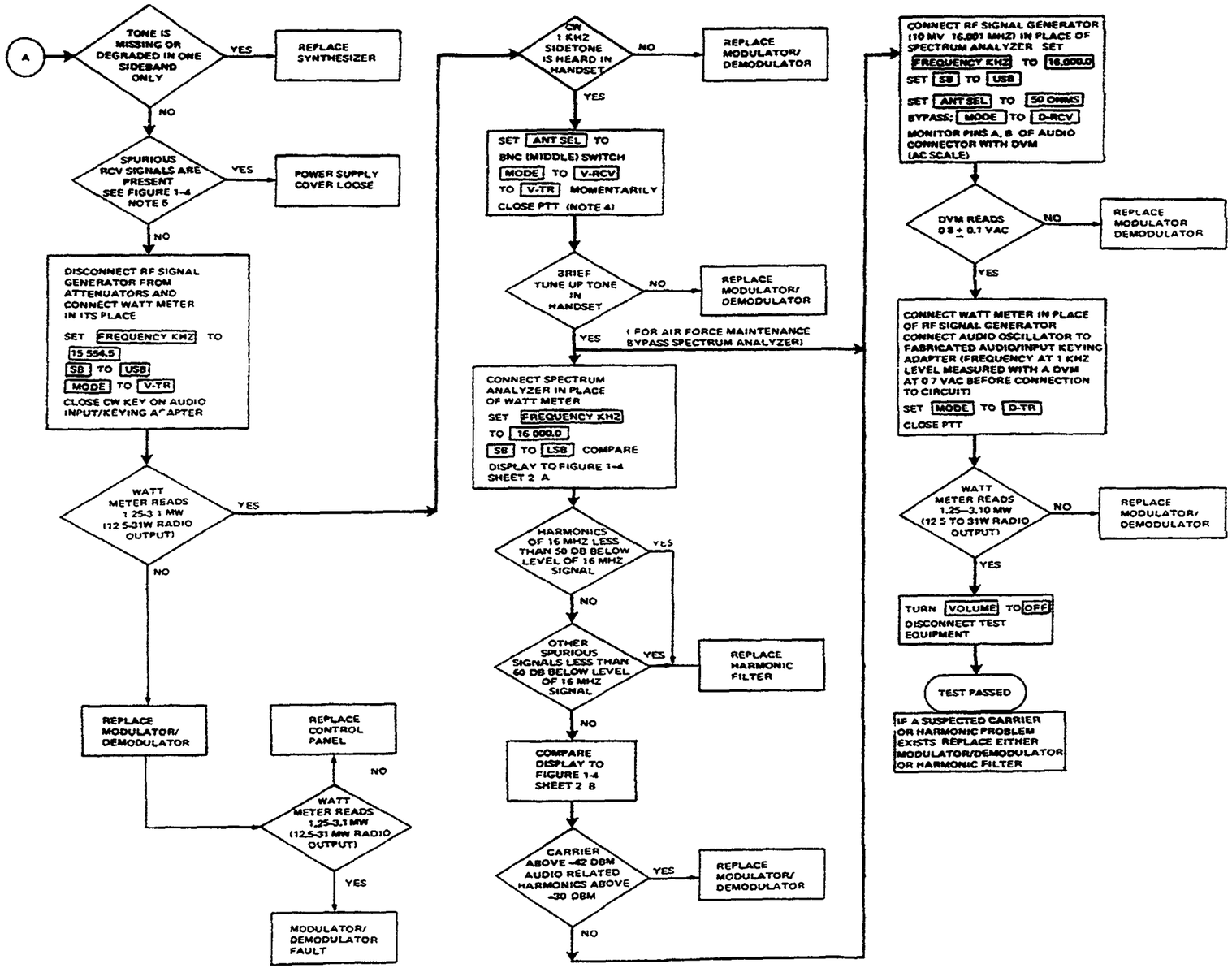
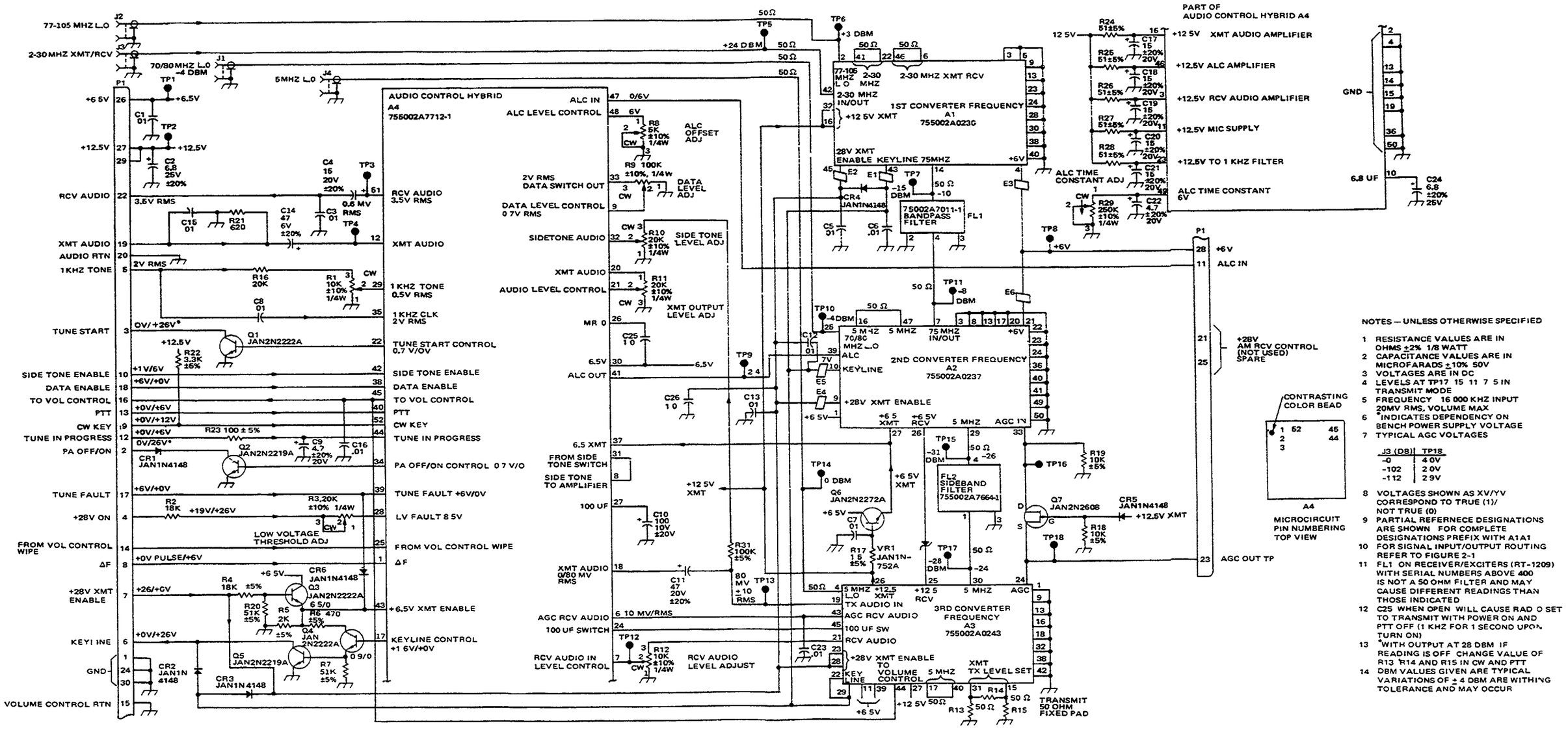


Figure 2-4. Receiver/Exciter A1 Performance Test (Sheet 1 of 2)

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





NOTES — UNLESS OTHERWISE SPECIFIED

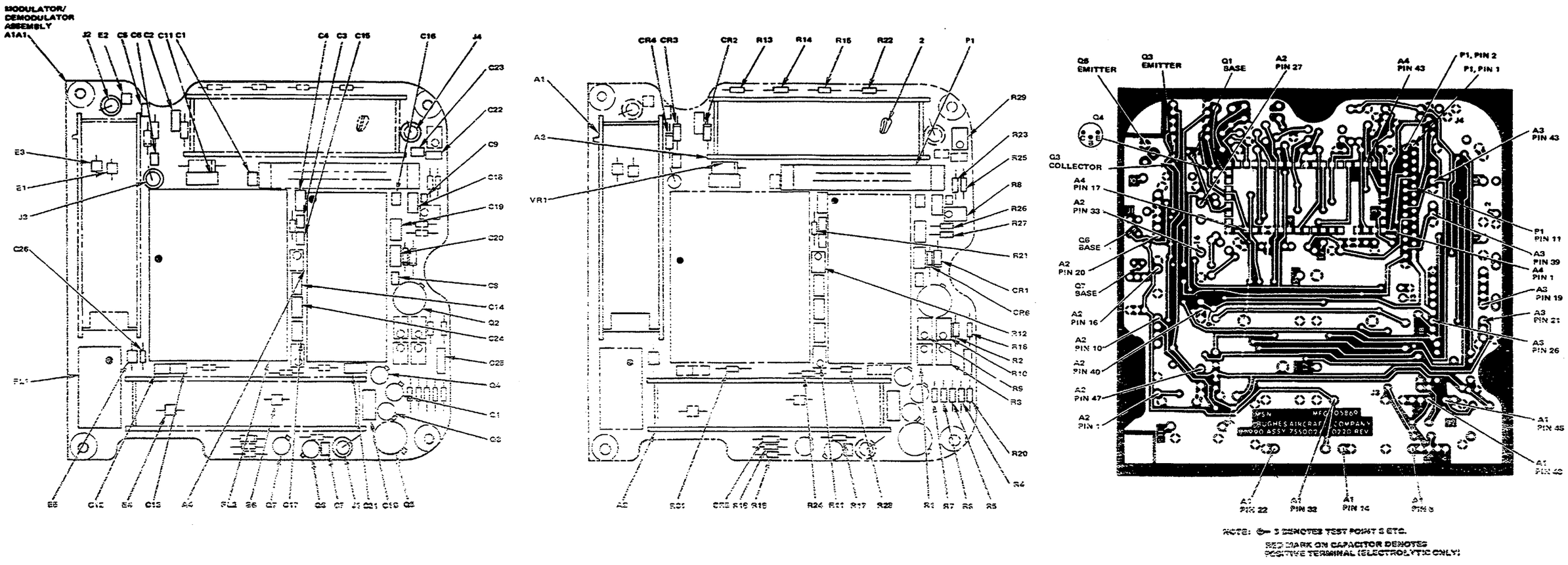
1. RESISTANCE VALUES ARE IN OHMS ±2% 1/8 WATT
2. CAPACITANCE VALUES ARE IN MICROFARADS ±10% 50V
3. VOLTAGES ARE IN DC
4. LEVELS AT TP17 15 11 7 5 IN TRANSMIT MODE
5. FREQUENCY 16 000 KHZ INPUT 20MV RMS, VOLUME MAX
6. *INDICATES DEPENDENCY ON BENCH POWER SUPPLY VOLTAGE
7. TYPICAL AGC VOLTAGES

J3 (DB)	TP18
-0	4 0V
-102	2 0V
-112	2 9V

8. VOLTAGES SHOWN AS XV/YV CORRESPOND TO TRUE (1)/ NOT TRUE (0)
9. PARTIAL REFERNECE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATIONS PREFIX WITH A1A1
10. FOR SIGNAL INPUT/OUTPUT ROUTING REFER TO FIGURE 2-1
11. FL1 ON RECEIVER/EXCITERS (RT-1209) WITH SERIAL NUMBERS ABOVE 400 IS NOT A 50 OHM FILTER AND MAY CAUSE DIFFERENT READINGS THAN THOSE INDICATED
12. C25 WHEN OPEN WILL CAUSE RAD O SET TO TRANSMIT WITH POWER ON AND PTT OFF (1 KHZ FOR 1 SECOND UPON TURN ON)
13. *WITH OUTPUT AT 28 DBM IF READING IS OFF CHANGE VALUE OF R13 R14 AND R15 IN CW AND PTT
14. DBM VALUES GIVEN ARE TYPICAL VARIATIONS OF ± 4 DBM ARE WITHING TOLERANCE AND MAY OCCUR

Figure 3-1. Modulator/Demodulator A1A1 Schematic

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



A

B

ITEM	DESCRIPTION A
A1A	Modulator/Demodulator Assembly
J2	Connector, Coaxial, RF
E2	Core, EM
C5	Capacitor
C6	Capacitor
C2	Capacitor
C11	Capacitor
C1	Capacitor
C4	Capacitor
C3	Capacitor
C15	Capacitor
C16	Capacitor
J4	Connector, Coaxial, RF
C23	Capacitor
C22	Capacitor
C9	Capacitor
C18	Capacitor
Cl9	Capacitor
C20	Capacitor
C8	Capacitor
C14	Capacitor
Q2	Transistor
C24	Capacitor
C25	Capacitor
Q4	Transistor Mounting Pad
Q1	Transistor
Q3	Transistor
Q5	Transistor
C10	Capacitor
C21	Capacitor
J1	Connector, Coaxial, RF
C7	Capacitor
Q6	Transistor
C17	Capacitor
Q7	Transistor
E6	Core, EM
FL2	Filter, Bandpass
A4	Microcircuit
C13	Capacitor
E4	Core, EM
C12	Capacitor
E5	Core, EM
FL1	Filter, Bandpass
C26	Capacitor
J3	Connector, Coaxial, RF
E1	Core, EM
E3	Core, EM

ITEM	DESCRIPTION B
CR4	Diode
CR3	Diode
CR2	Diode
R13	Resistor
R14	Resistor
R15	Resistor
R22	Resistor
2	Strap, Handle
P1	Connector, Receptacle
R29	Resistor Variable
R23	Resistor
R25	Resistor
R8	Resistor, Variable
R26	Resistor
R27	Resistor
R21	Resistor
CR1	Diode
CR6	Diode
R12	Resistor Variable
R16	Resistor
R2	Resistor
R10	Resistor Variable
R9	Resistor Variable
R3	Resistor, Variable
R20	Resistor
R4	Resistor
R5	Resistor
R6	Resistor
R7	Resistor
R1	Resistor, Variable
R28	Resistor
R17	Resistor
R11	Resistor Variable
R24	Resistor R19 Resistor
R18	Resistor
CR5	Diode
R31	Resistor
A2	Converter, Second Freq.
VR1	Diode
A3	Converter, Third Freq
A1	Converter, First Freq

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

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

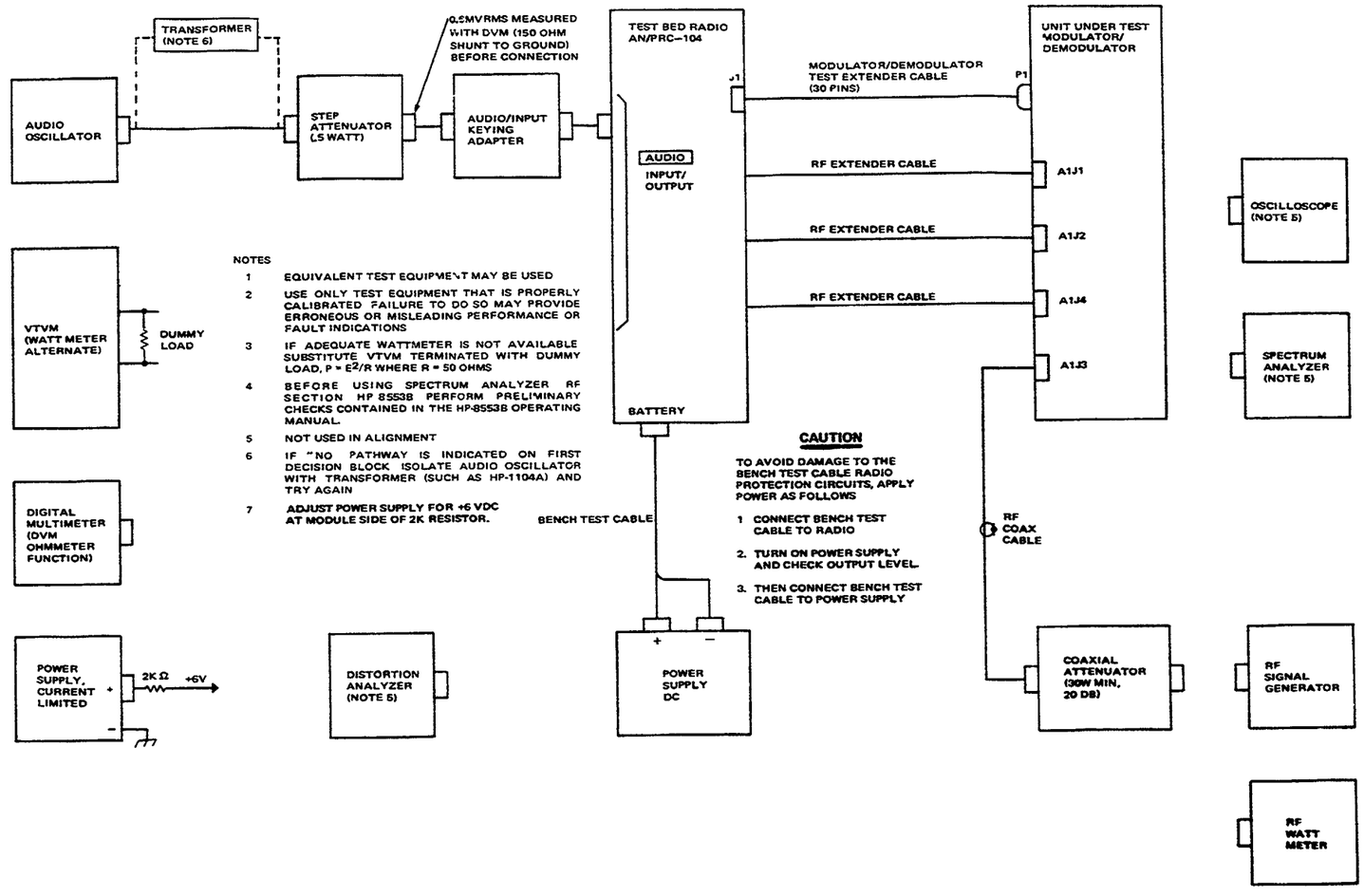
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

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 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
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 20 db, 30w min., 50 ohm	Narda 765-20	1
150-Ohm Resistor	...	1
500-Ohm Resistor	...	I
2000-Ohm Resistor		



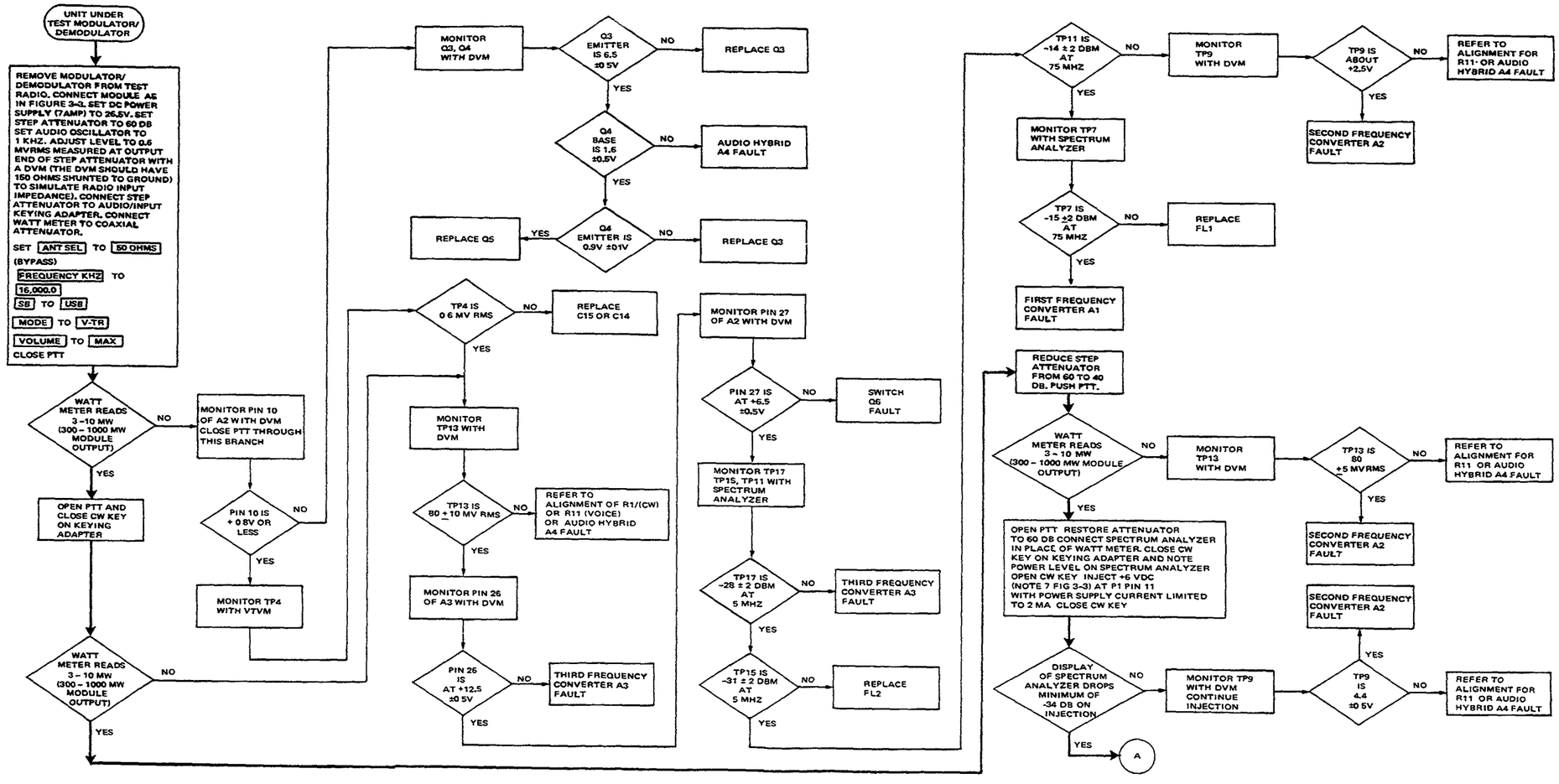
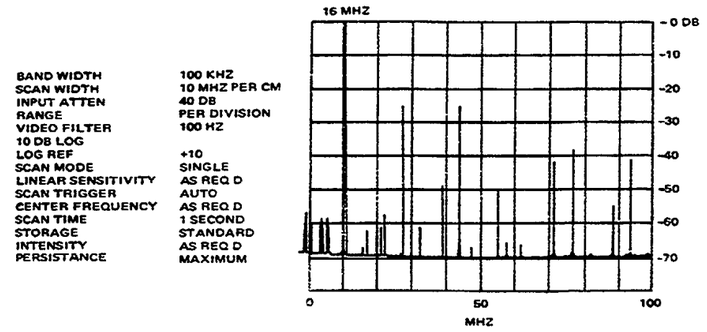
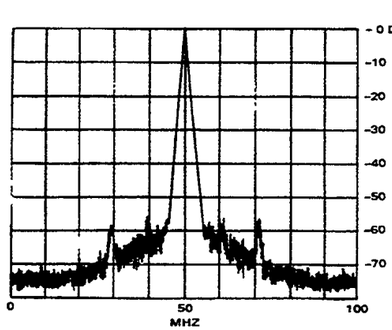


Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 1 of 4)

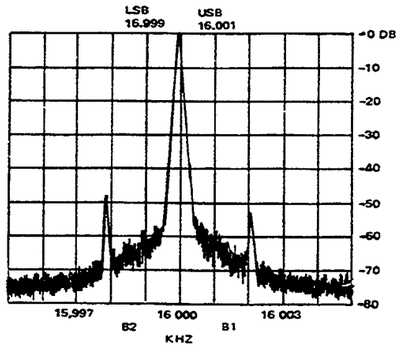


BAND WIDTH	100 KHZ
SCAN WIDTH	10 MHZ PER CM
INPUT ATTEN	40 DB
RANGE	PER DIVISION
VIDEO FILTER	100 HZ
10 DB LOG	
LOG REF	+10
SCAN MODE	SINGLE
LINEAR SENSITIVITY	AS REQ D
SCAN TRIGGER	AUTO
CENTER FREQUENCY	AS REQ D
SCAN TIME	1 SECOND
STORAGE	STANDARD
INTENSITY	AS REQ D
PERSISTANCE	MAXIMUM

(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
10 DB LOG	
LOG REF	+10
SCAN MODE	SINGLE
CENTER FREQUENCY	16 001
VIDEO FILTER	10 HZ
SCAN TRIGGER	AUTO
LINEAR SENSITIVITY	AS REQ D
STORAGE	STANDARD
INTENSITY	AS REQ D
PERSISTANCE	MAXIMUM



(FIGURE B) B1-B16 MHZ UPPER SIDEBAND CENTER FREQUENCY 16 001 82 - 15.999 MHZ LOWER SIDEBAND

NOTE
UNLESS OTHERWISE SPECIFIED

ALL VOLTAGE MEASUREMENTS TAKEN WITH RESPECT TO CHASSIS GROUND

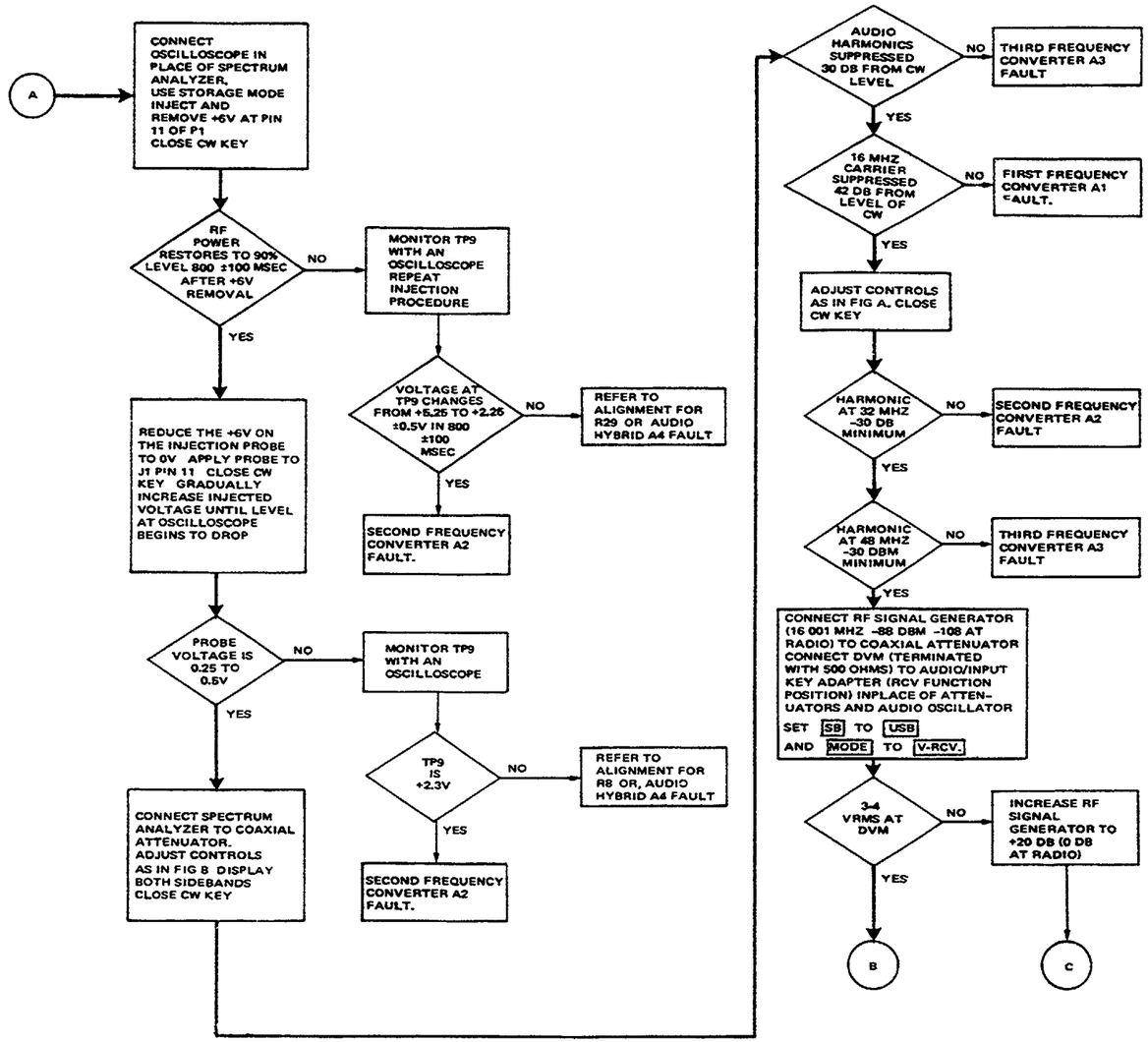


Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 2 of 4)

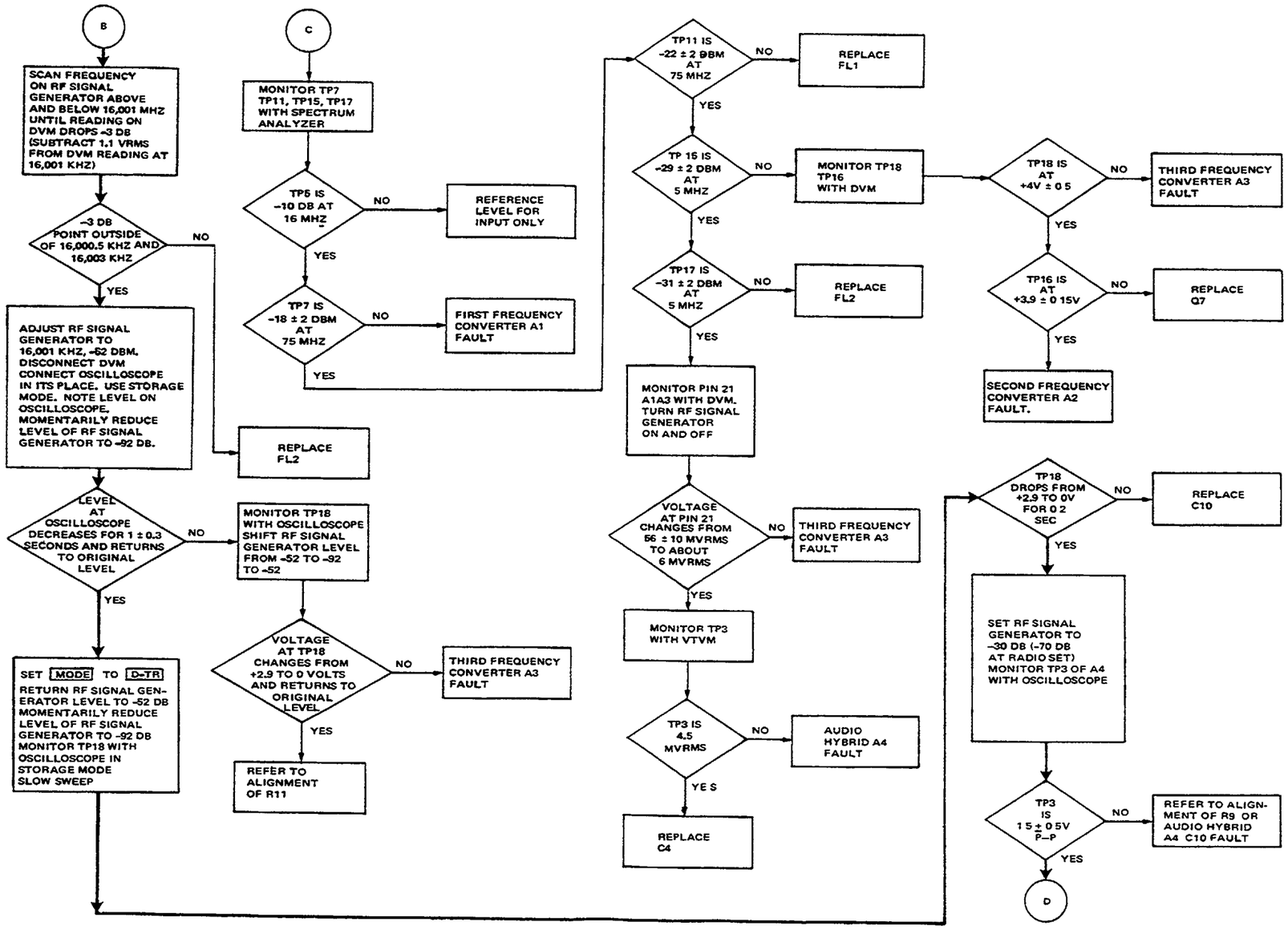
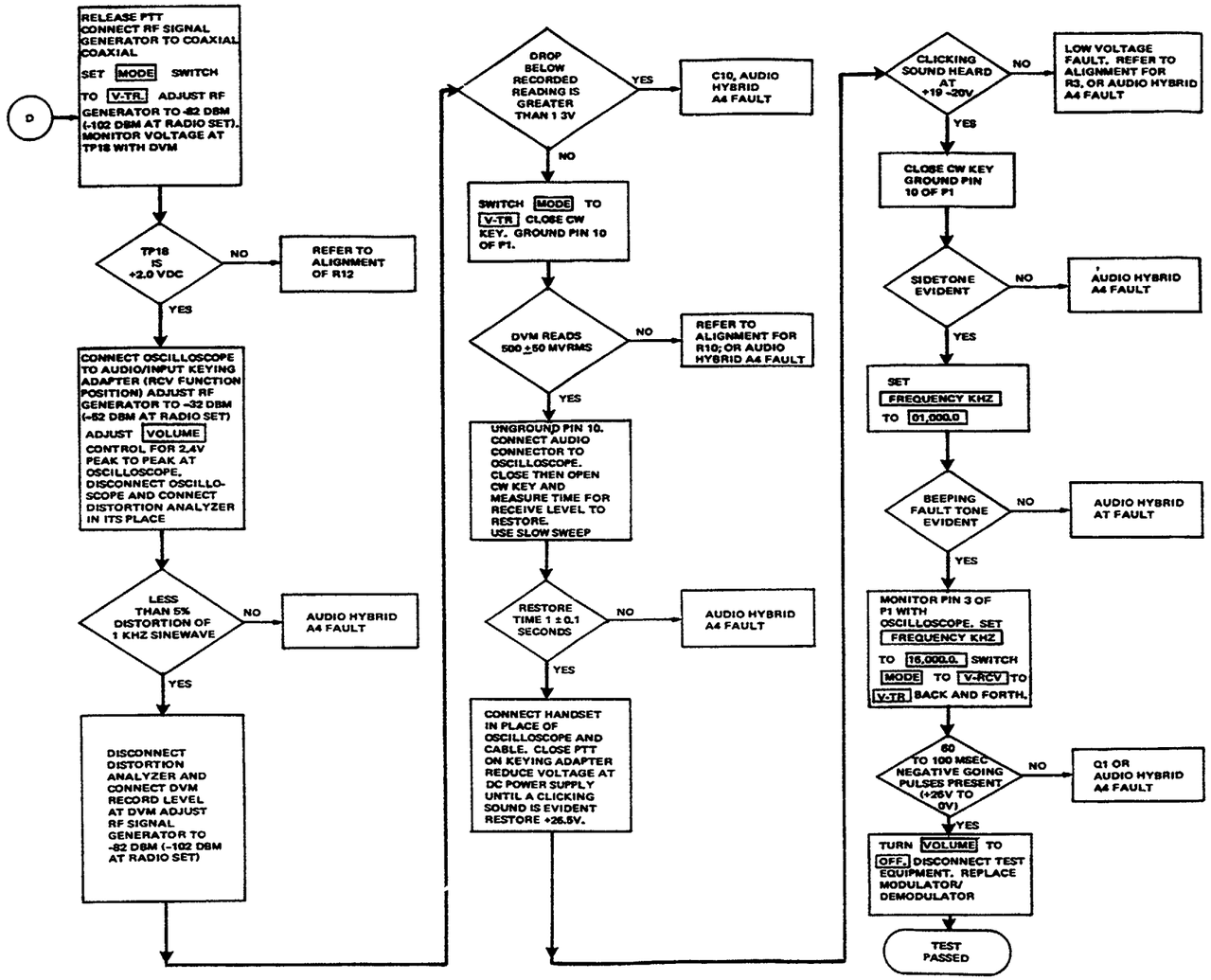


Figure 3-4. Modulator/Demodulator A1A1 Performance Test (Sheet 3 of 4)

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



MODULATOR/ DEMODULATOR A1A1 ALIGNMENT

The alignment procedure is to be used an 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 do 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 out- put 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 ALIGMENT, R29

1. Monitor A1J3 via the coaxial atten- uator with the oscilloscope in storage mode.

2. Turn off radio set. Connect a 2K resistor in series with the positive out- put 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 ALIGMENT, 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 ALIGMENT, 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 ALIGMENT, 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	Resistor Values (OHMs)		
DB	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

Ω OHMs	Military No.
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

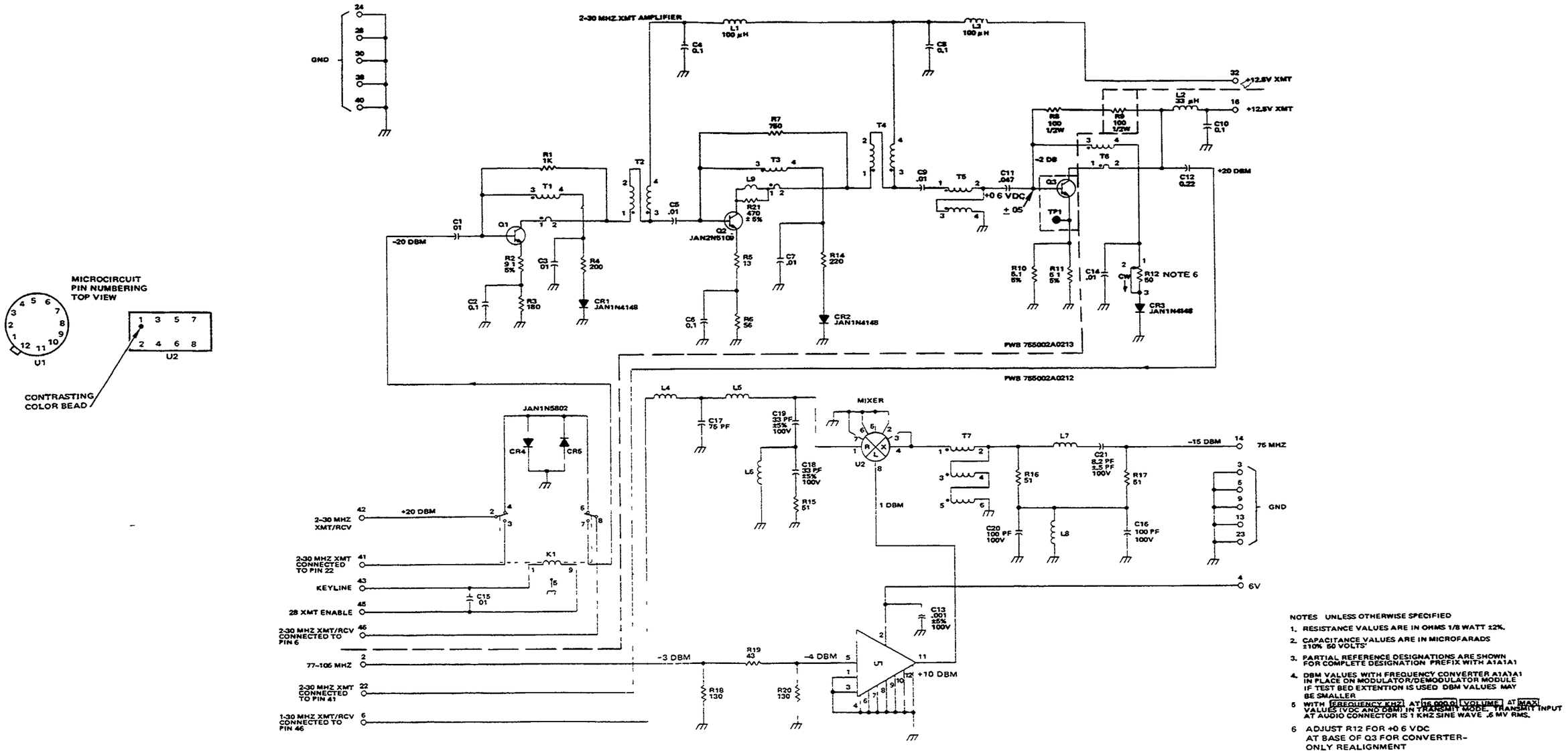
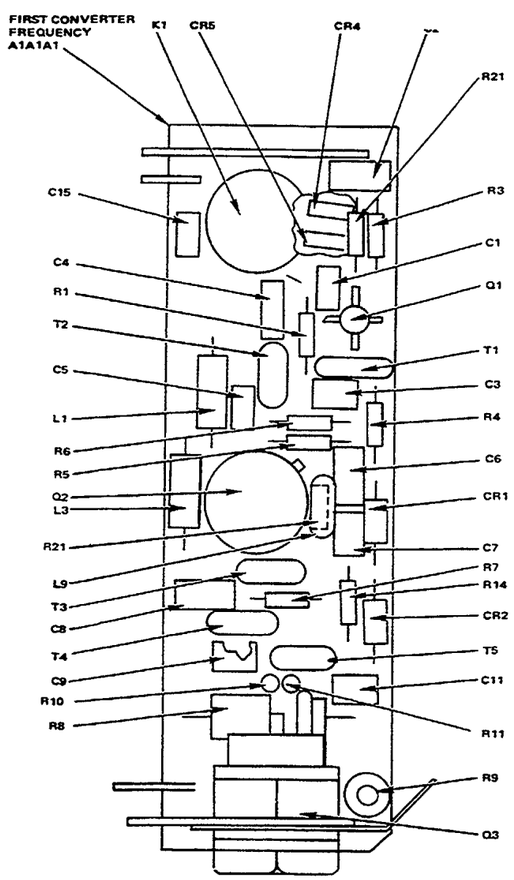
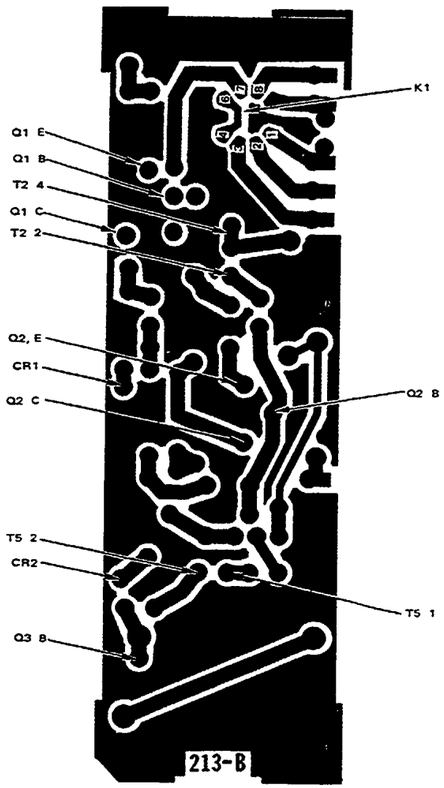


Figure 3-5. First Frequency Converter A1A1A1 Schematic

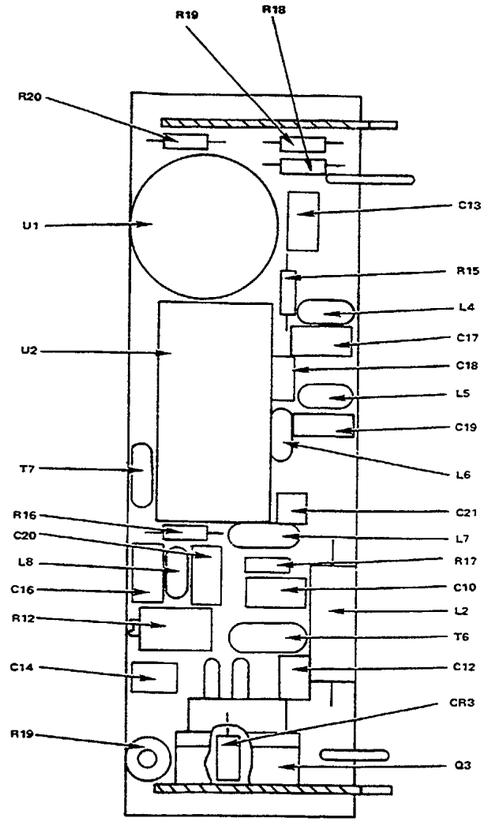
Figure 3-6. First Frequency Converter A!A!A! Component Location (Sheet 1 of 2)



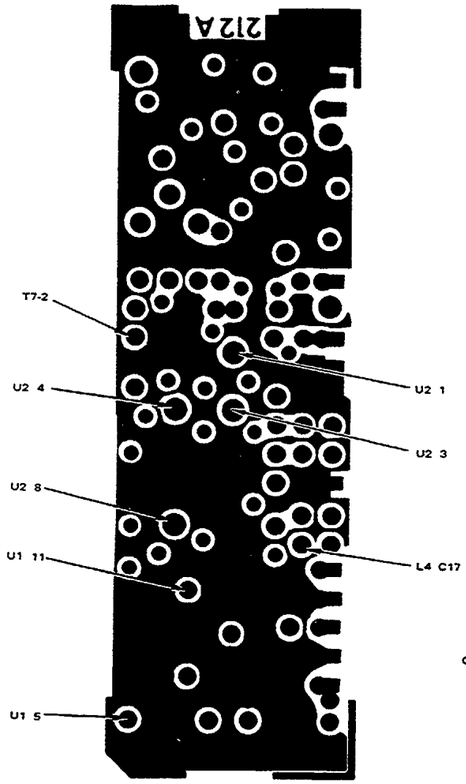
A-1



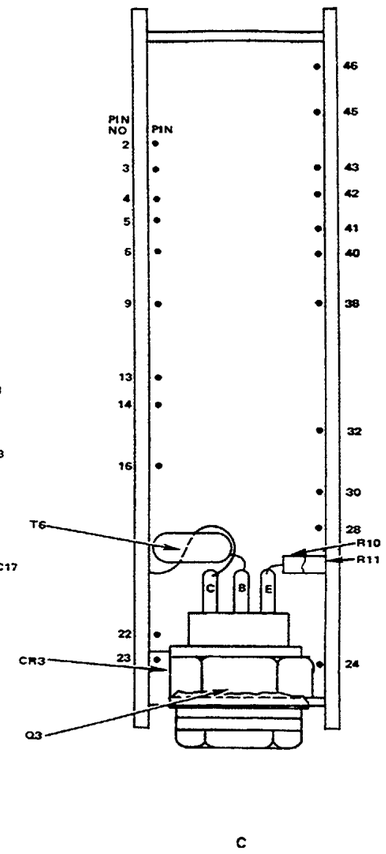
A-2
POINTS OF TEST



B-1



B-2 POINTS OF TEST



C

ITEM	DESCRIPTION
	A-1
A1A1A1	First Frequency Converter (755002A0230)
K1	Relay, Electromagnetic
CR5	Diode
CR4	Diode
C2	Capacitor
R21	Resistor
R3	Resistor
C1	Capacitor
Q1	Transistor
T1	Inductor
C3	Capacitor
R4	Resistor
C6	Capacitor
CR1	Diode
C7	Capacitor
R7	Resistor
R14	Resistor
CR2	Diode
T5	Transformer, RF
C11	Capacitor
R11	Resistor
R9	Resistor
Q3	Transistor
R8	Resistor
R10	Resistor
C9	Capacitor
T4	Transformer
C8	Capacitor
T3	Inductor
L9	Inductor
R21	Resistor
L3	Coil, RF
Q2	Transistor
R5	Resistor
R6	Resistor
L1	Coil, RF
C5	Capacitor
T2	Transformer, RF
R1	Resistor
C4	Capacitor
C15	Capacitor

ITEM	DESCRIPTION
	B-1
R20	Resistor
R19	Resistor
R18	Resistor
C13	Capacitor
R15	Resistor
L4	Inductor
C17	Capacitor
C18	Capacitor
L5	Inductor
C19	Capacitor
L6	Inductor
C21	Capacitor
L7	Inductor
R17	Resistor
C10	Capacitor
L2	Coil, RF
T6	Inductor
C12	Capacitor
CR3	Diode
Q3	Transistor
R19	Resistor
C14	Capacitor
R12	Resistor
C16	Capacitor
L8	Inductor
C20	Capacitor
R16	Resistor
T7	Transformer
U2	Mixer, RF
U1	Amplifier, RF

	C
R10	Resistor
R11	Resistor
Q3	Transistor
CR3	Diode
T7	Inductor

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

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

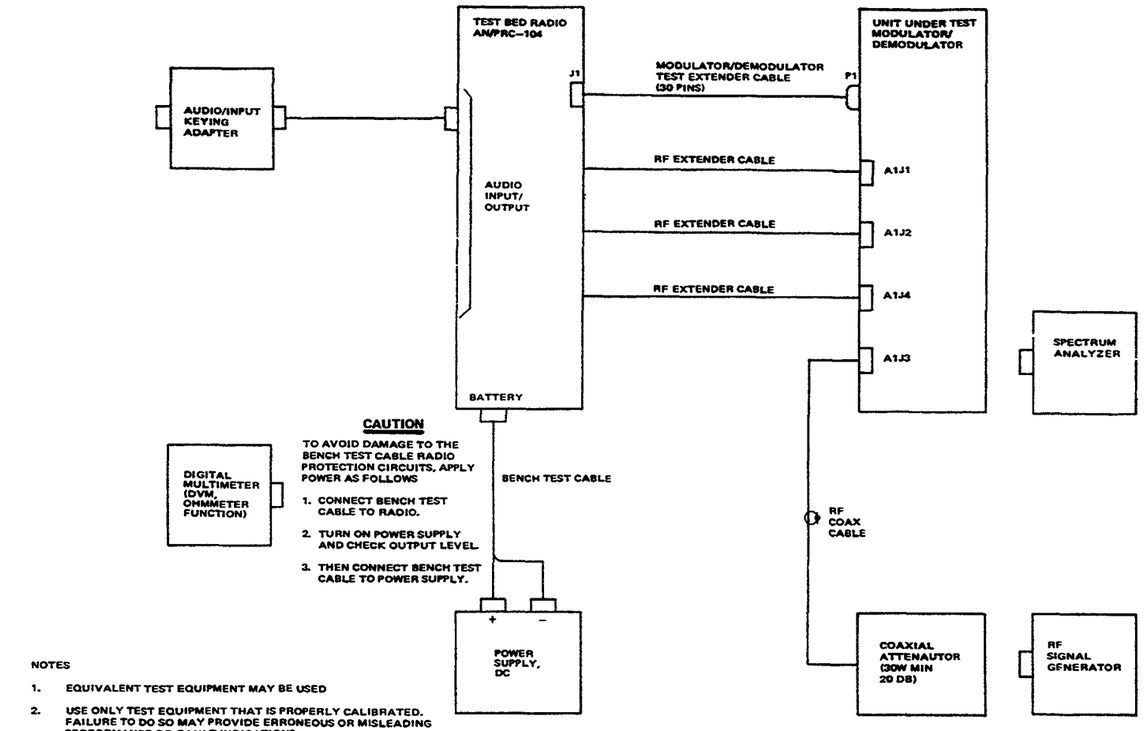
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

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



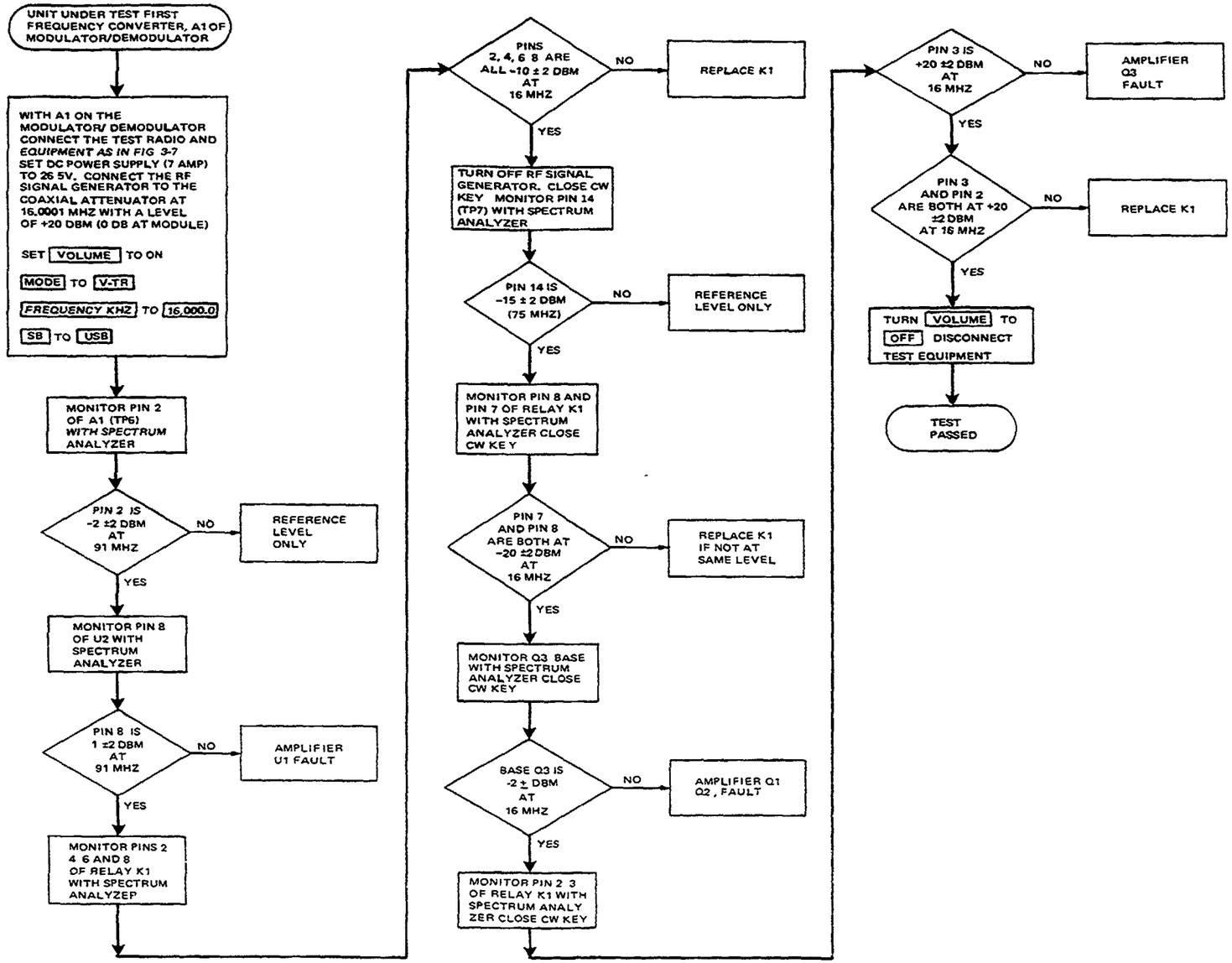


Figure 3-8. First Frequency Converter A1A1A1 Performance test

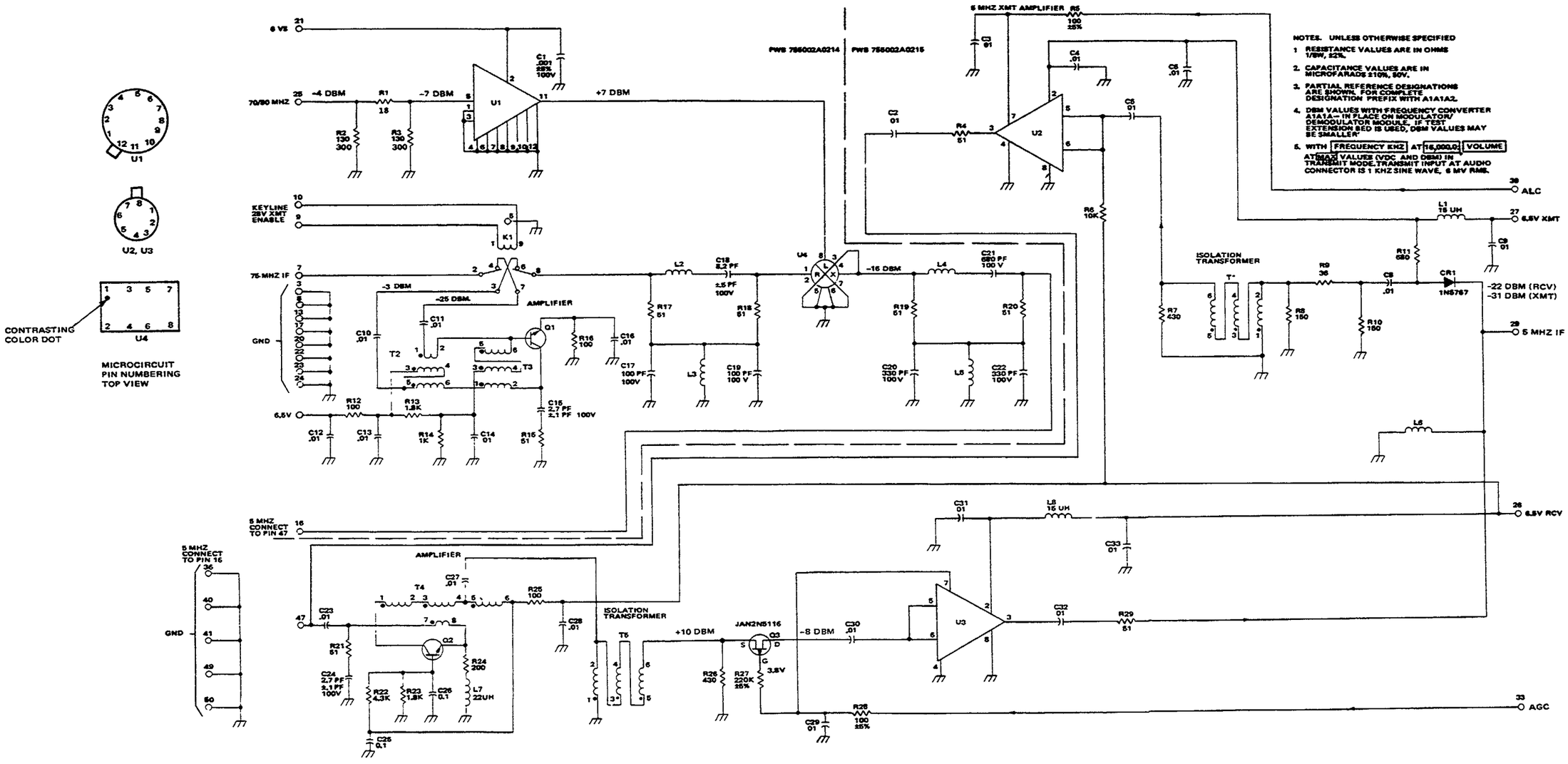
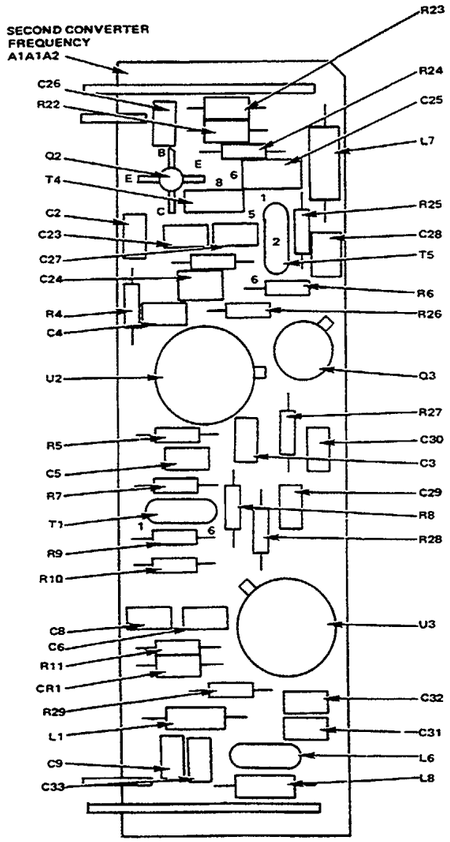
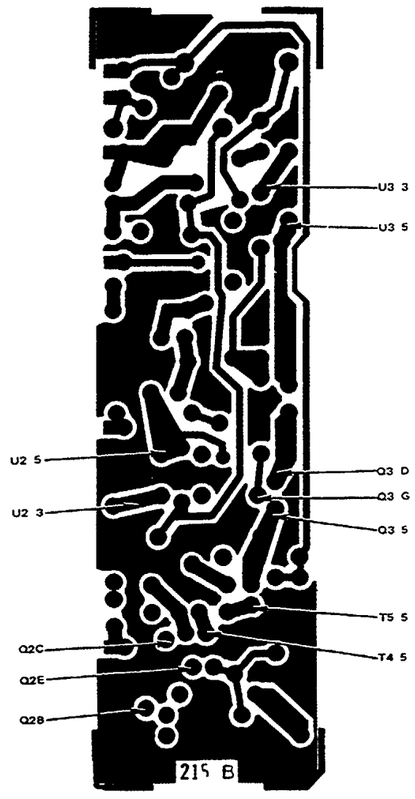


Figure 3-9. Second Frequency Converter A1A1A2 Schematic

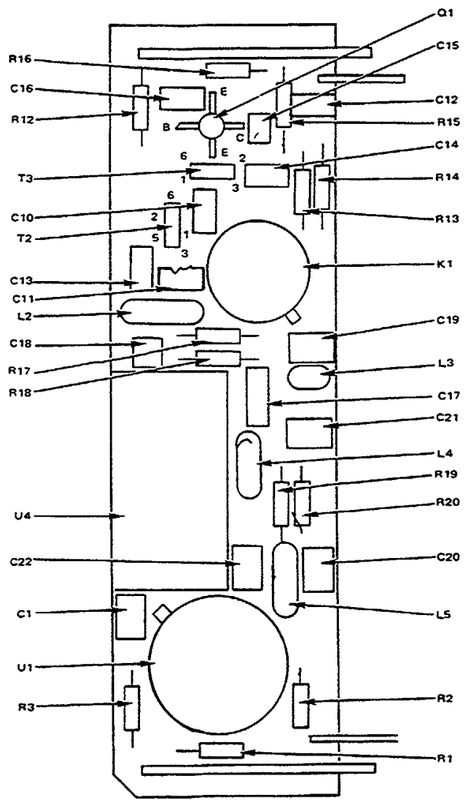
Figure 3-10. Second Frequency Converter A1A1A2 Component Location (Sheet 1 of 2)



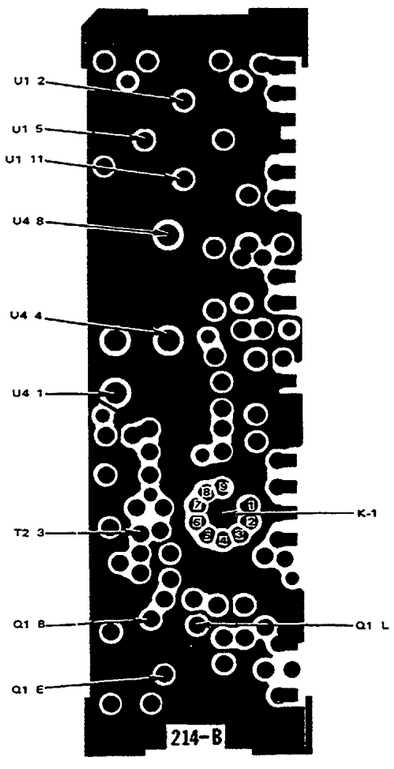
A -1



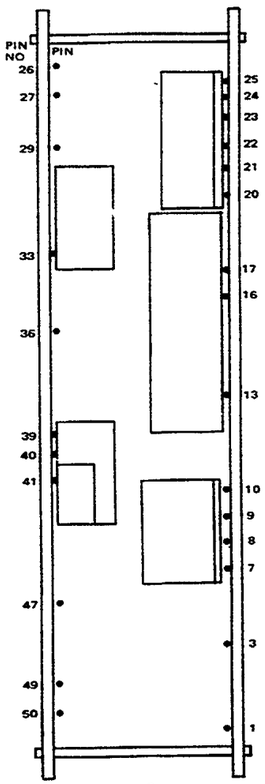
A-2
POINTS OF TEST



B-1



B-2
POINTS OF TEST

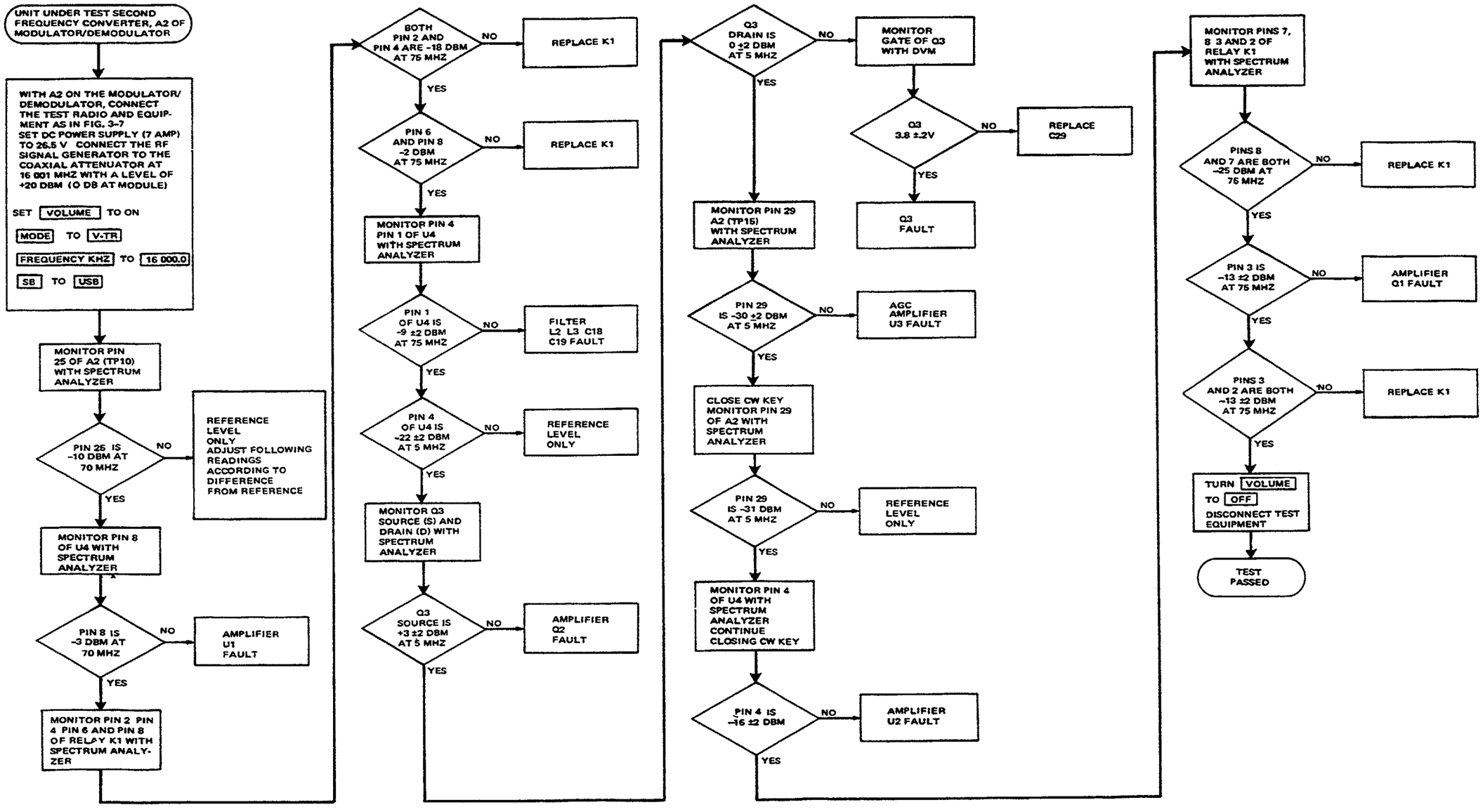


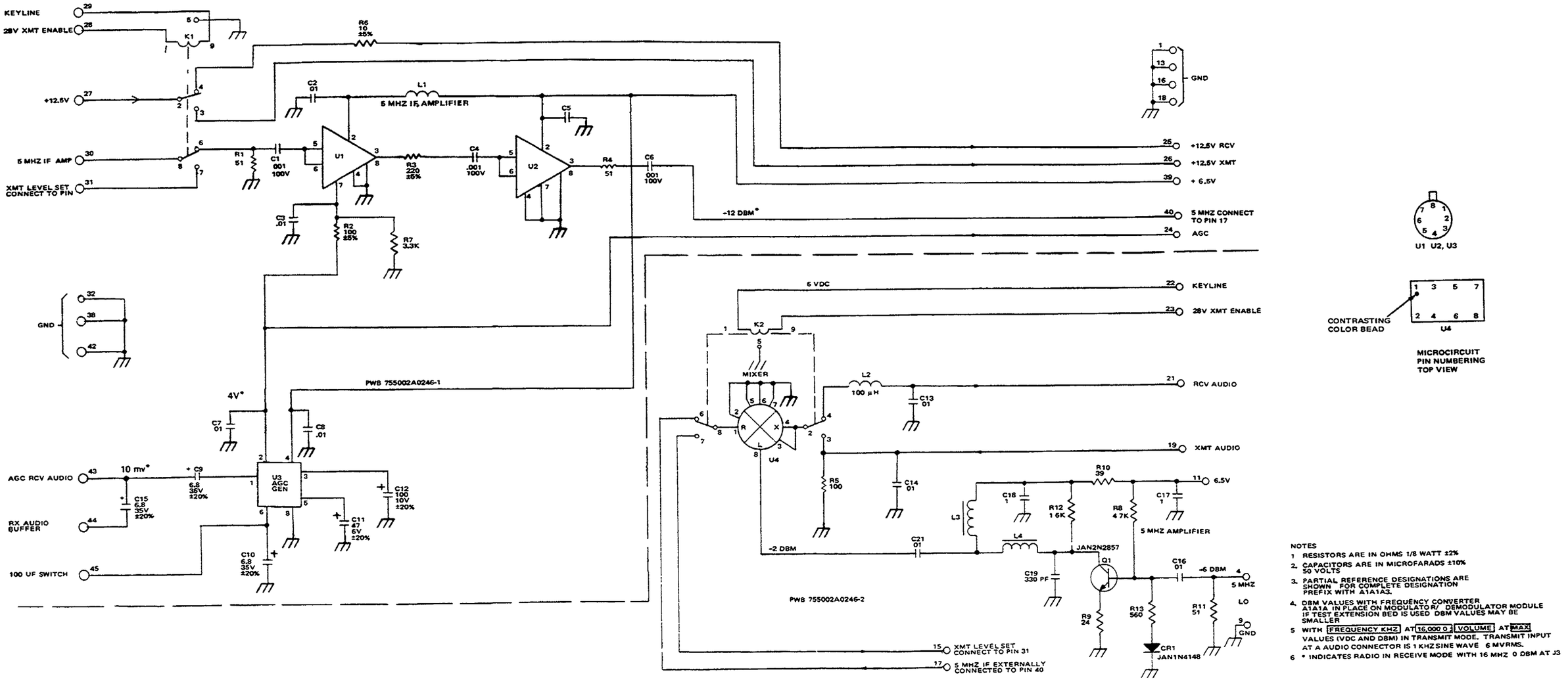
C

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

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

Figure 3-11. Second Frequency Converter A1A1A2 Performance Test



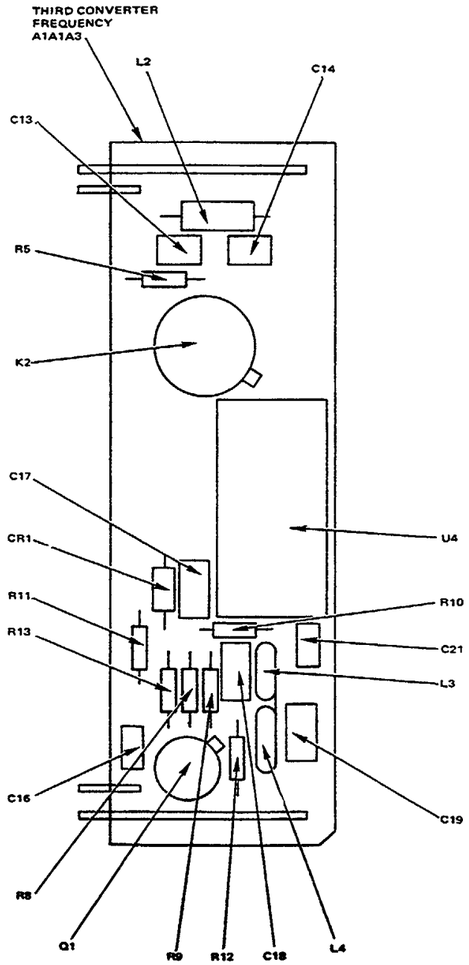


NOTES

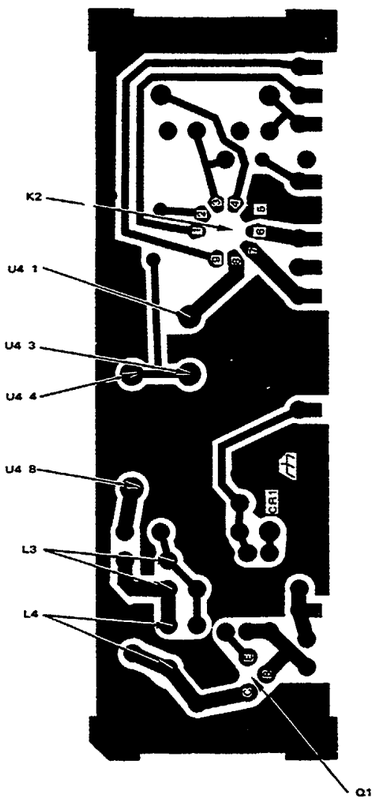
1. RESISTORS ARE IN OHMS 1/8 WATT ±2%
2. CAPACITORS ARE IN MICROFARADS ±10% 50 VOLTS
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH A1A1A3.
4. DBM VALUES WITH FREQUENCY CONVERTER A1A1A IN PLACE ON MODULATOR/ DEMODULATOR MODULE IF TEST EXTENSION BED IS USED DBM VALUES MAY BE SMALLER
5. WITH [FREQUENCY KHZ] AT [16,000 0] [VOLUME] AT [MAX] VALUES (VDC AND DBM) IN TRANSMIT MODE. TRANSMIT INPUT AT A AUDIO CONNECTOR IS 1 KHZ SINE WAVE 6 MVRMS.
6. * INDICATES RADIO IN RECEIVE MODE WITH 16 MHZ 0 DBM AT J3

Figure 3-12. Third Frequency Converter A1A1A3 Schematic

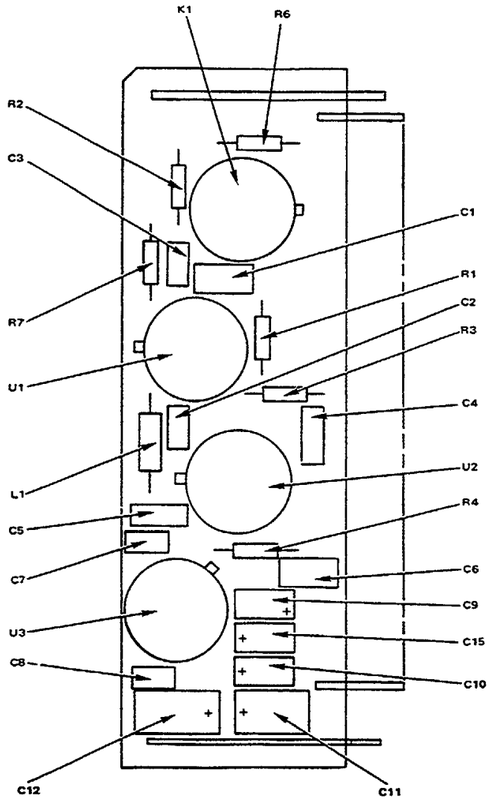
Figure 3-13. Third Frequency Converter A1A1A3 Components Location (Sheet 1 of 2)



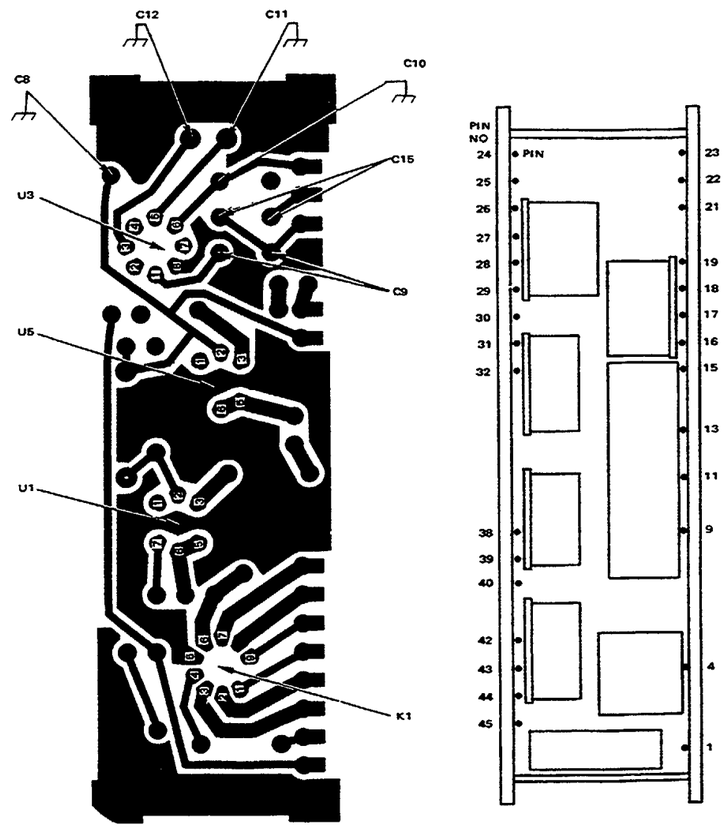
A-1



A-2
POINTS OF TEST



B-1



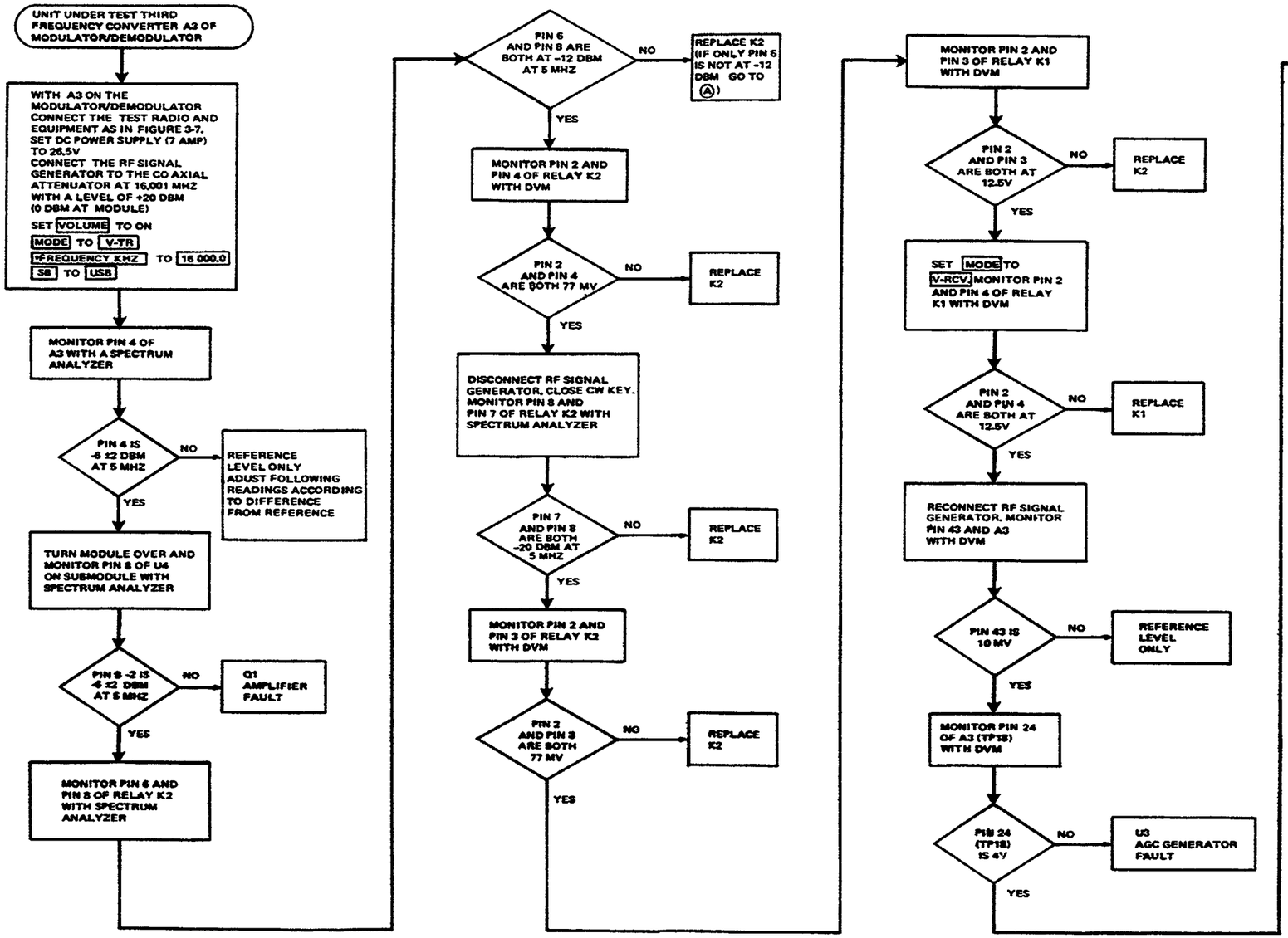
B-2
POINTS OF TEST

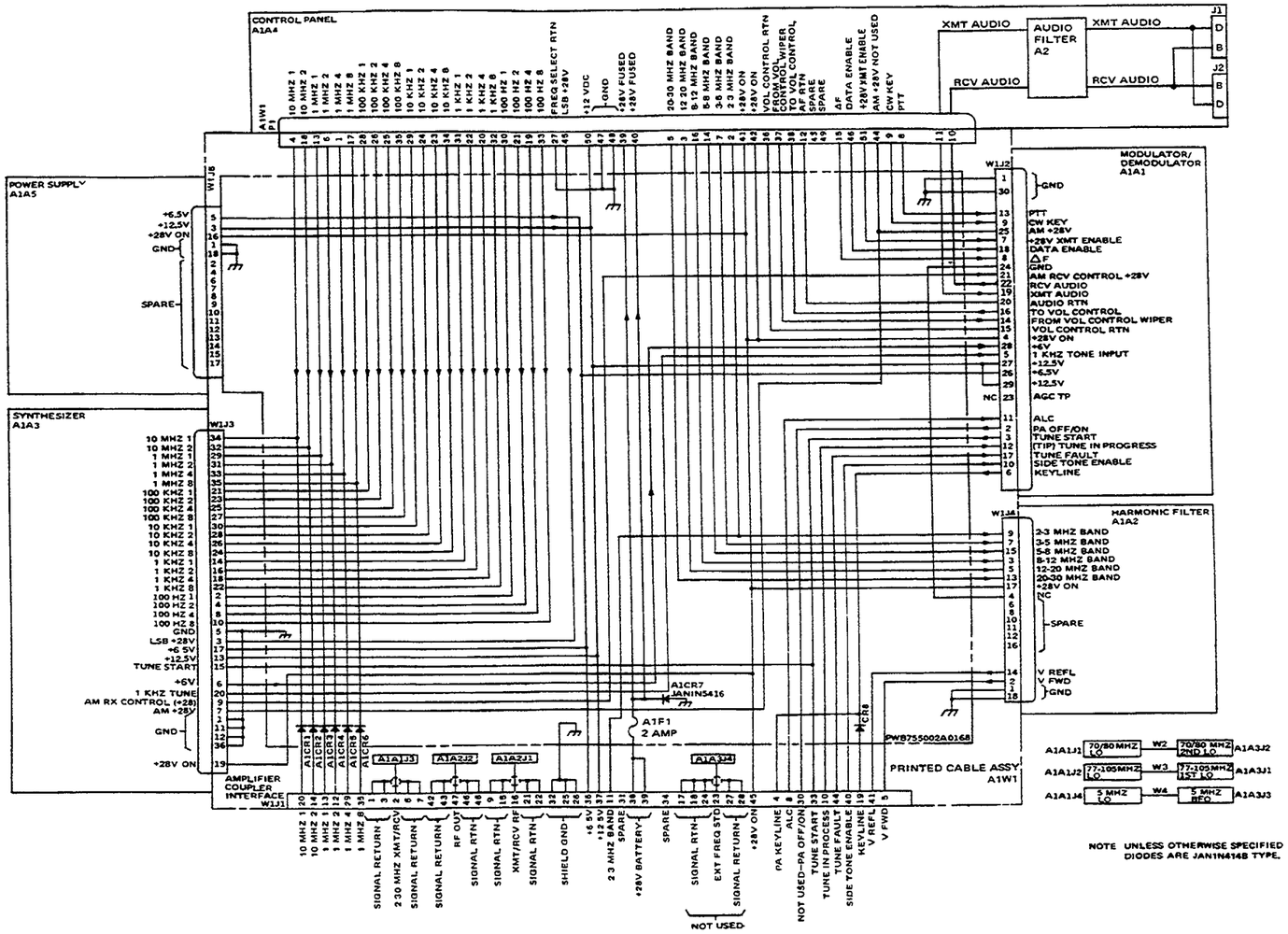
ITEM	Description
	A-1
A1A1A3	Third Frequency Converter (755002A0343)
L2	Coil, RF
C14	Capacitor
U4	Mixer, RF
R10	Resistor
C21	Capacitor
L3	Inductor
C19	Capacitor
L4	Inductor
C18	Capacitor
R12	Resistor
R9	Resistor
Q1	Transistor
R8	Resistor
C16	Capacitor
R13	Resistor
R11	Resistor
CR1	Diode
C17	Capacitor
K2	Relay, Electromagnetic
R5	Resistor
C13	Capacitor

ITEM	DESCRIPTION
	B-1
K1	Relay, Electromagnetic
R6	Resistor
C1	Capacitor
R1	Resistor
C2	Capacitor
R3	Resistor
C4	Capacitor
U2	Microcircuit
R4	Resistor
C6	Capacitor
C9	Capacitor
C15	Capacitor
C10	Capacitor
C11	Capacitor
C12	Capacitor
C8	Capacitor
U3	Microcircuit
C7	Capacitor
C5	Capacitor
L1	Coil, RF
U1	Microcircuit
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





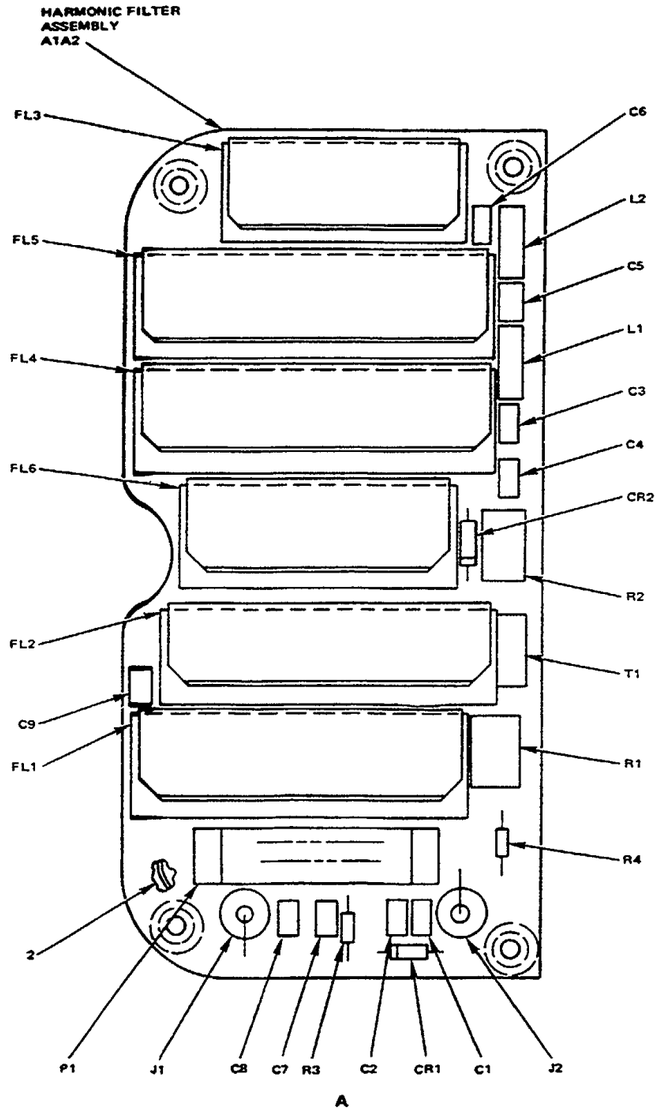
NOTES: UNLESS OTHERWISE SPECIFIED

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

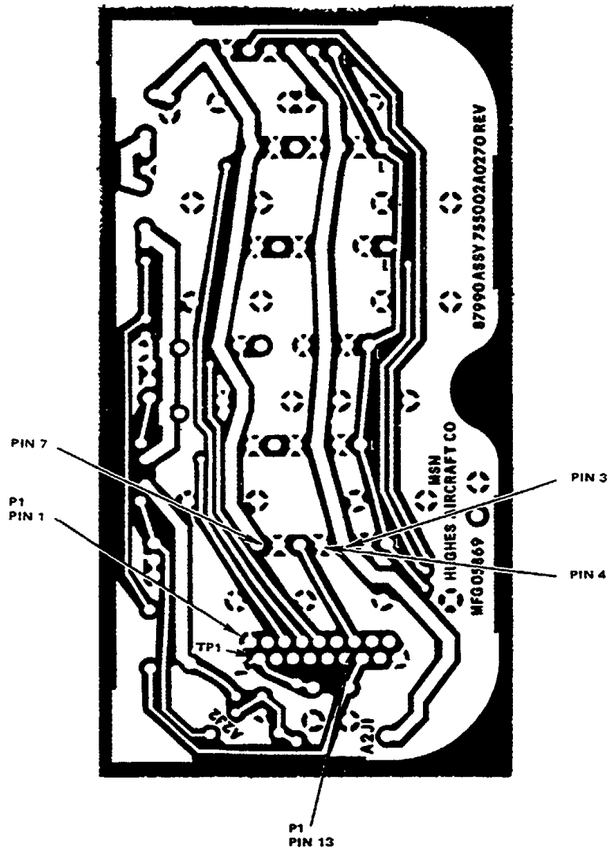
Figure 4-1. Harmonic Filter A1A2 Schematic.

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



A



NOTE ← 3 DENOTES THAT POINT 3 ETC.

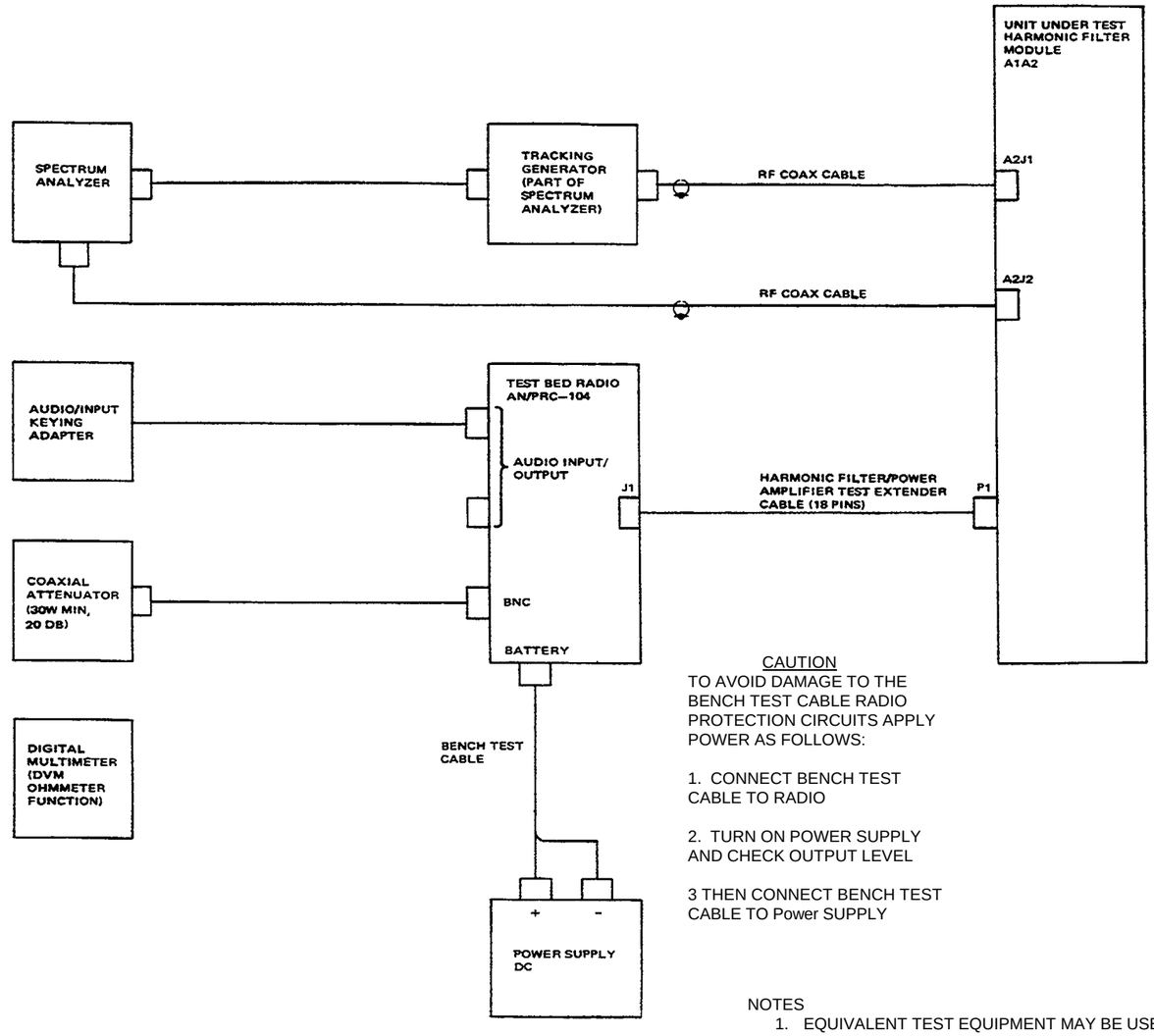
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

Description	Part Number	Reference
Harmonic Filter/Power Amplifier Test Extender Cable	•••	Figure 3-1OD
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



CAUTION

TO AVOID DAMAGE TO THE BENCH TEST CABLE RADIO PROTECTION CIRCUITS APPLY POWER AS FOLLOWS:

1. CONNECT BENCH TEST CABLE TO RADIO

2. TURN ON POWER SUPPLY AND CHECK OUTPUT LEVEL

3 THEN CONNECT BENCH TEST CABLE TO Power SUPPLY

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 BEFORE USING SPECTRUM ANALYZER RF SECTION HP-85538 PERFORM PRELIMINARY CHECKS CONTAINED IN THE HP-H553B OPERATING MANUAL

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	O dbm	Same

Each filter can legitimately be checked by at taching 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

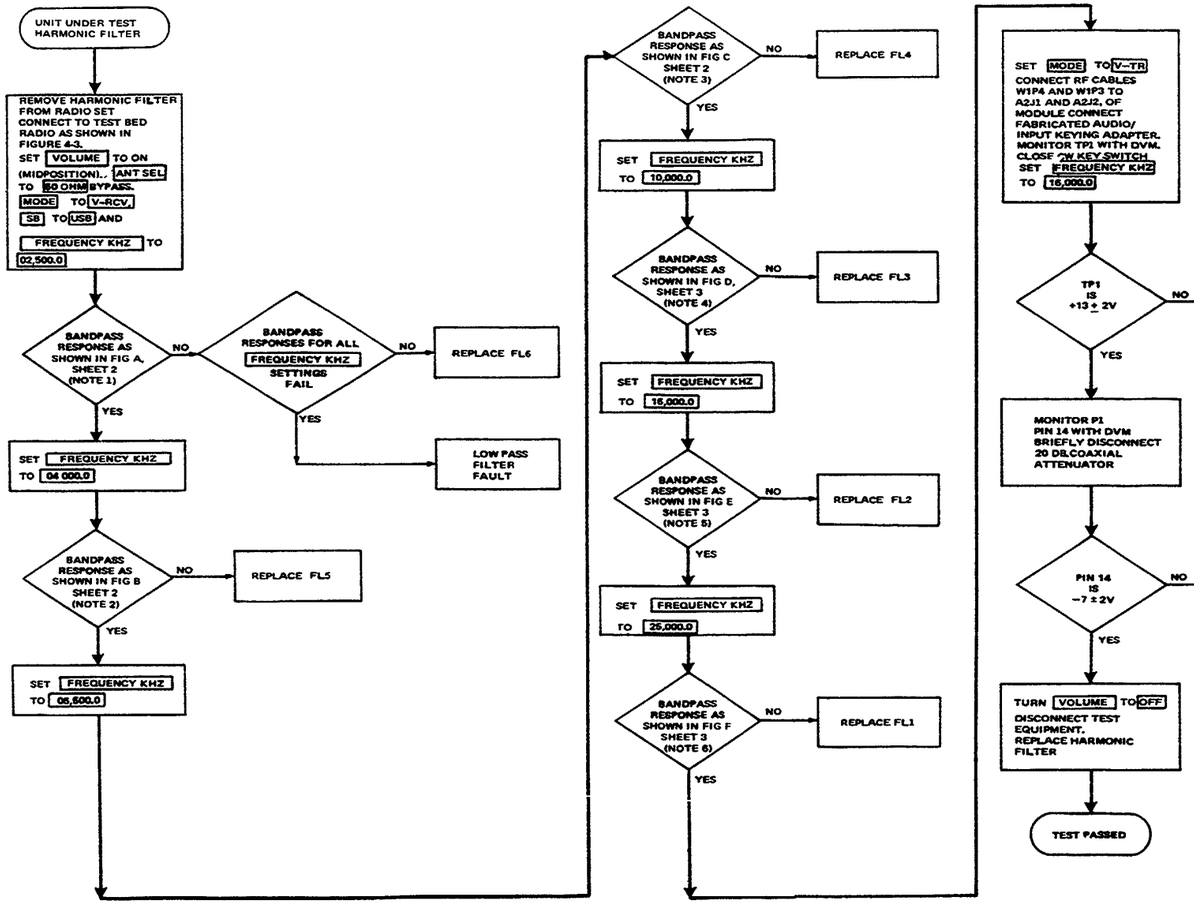
NOTE 3: Scan width is 0.5 MHz, center frequency is 6,500 KHz

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

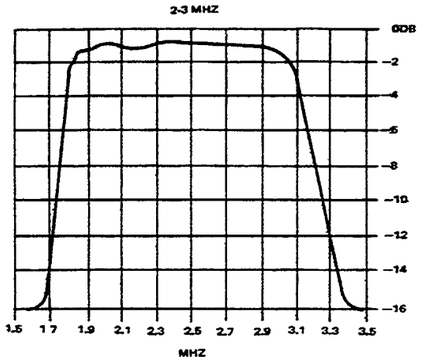
NOTE 5: Scan width is 2 MHz, center frequency is 16,000 KHz, scan time 10 ms

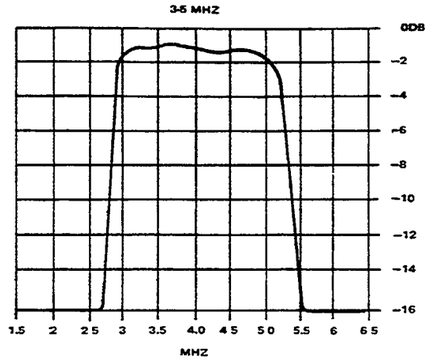
NOTE 6: Scan width is 5 MHz, center frequency is 25,000 KHz, scan time 20 ms

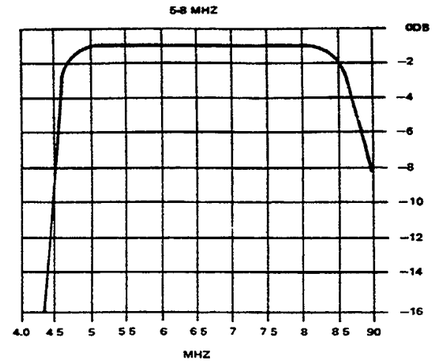
NOTE 7: Unless otherwise specified, all voltage measurements taken with respect to chassis ground.



NARROW BAND FILTER RESPONSES







SPECTRUM ANALYZER SETTINGS IN PERFORMANCES TEST NOTES.

WIDE BAND FILTER RESPONSES

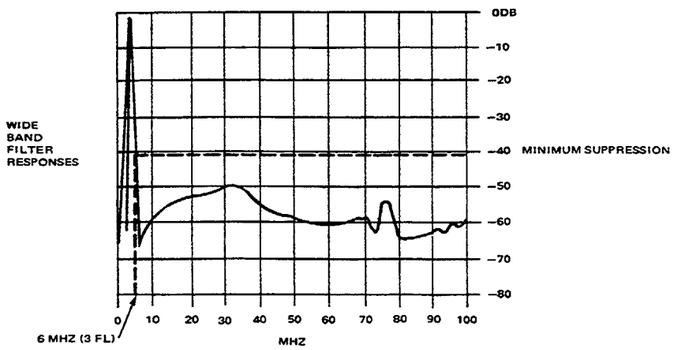


FIG A

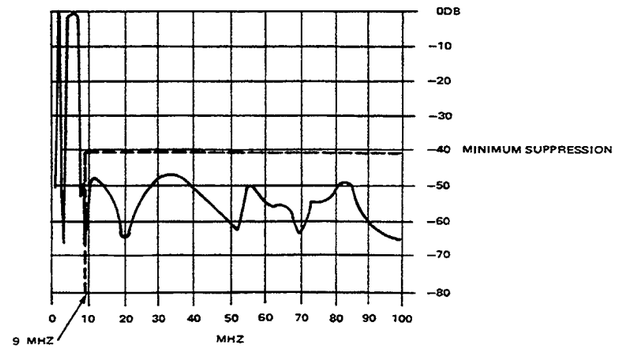


FIG B

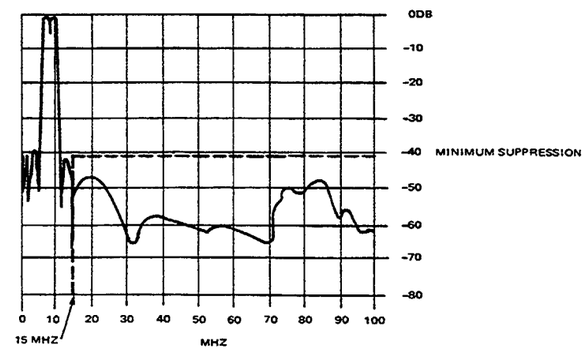
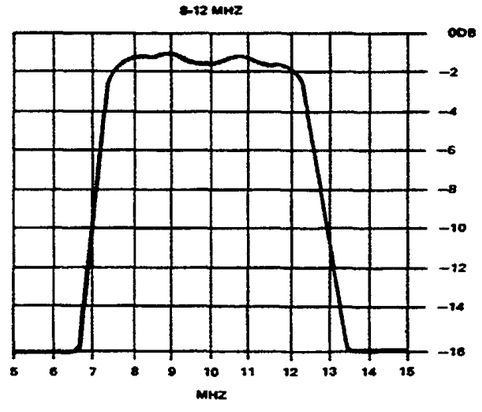
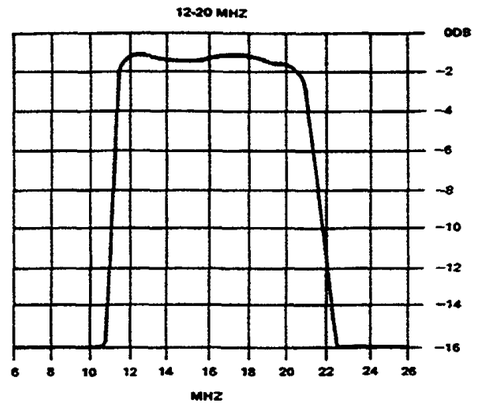


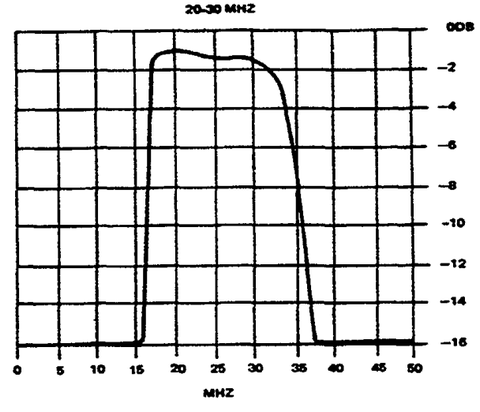
FIG C

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

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







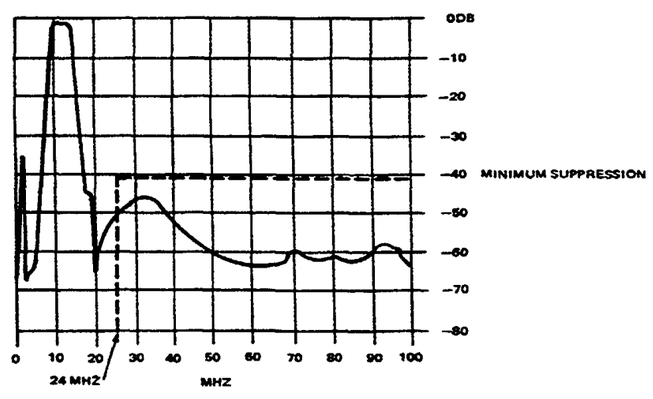


FIG D

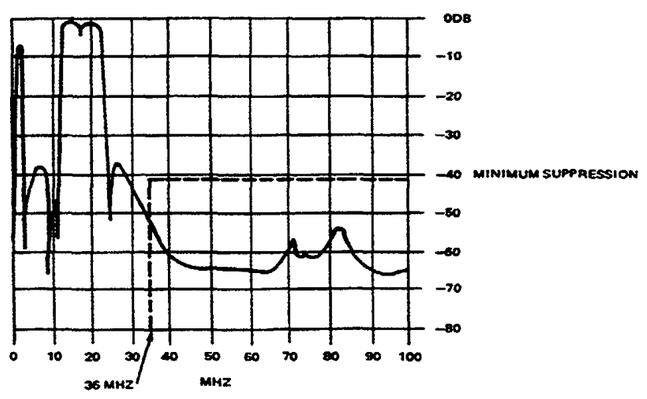


FIG E

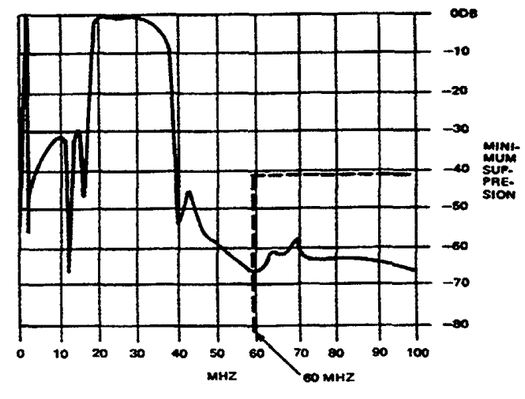


FIG F

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	

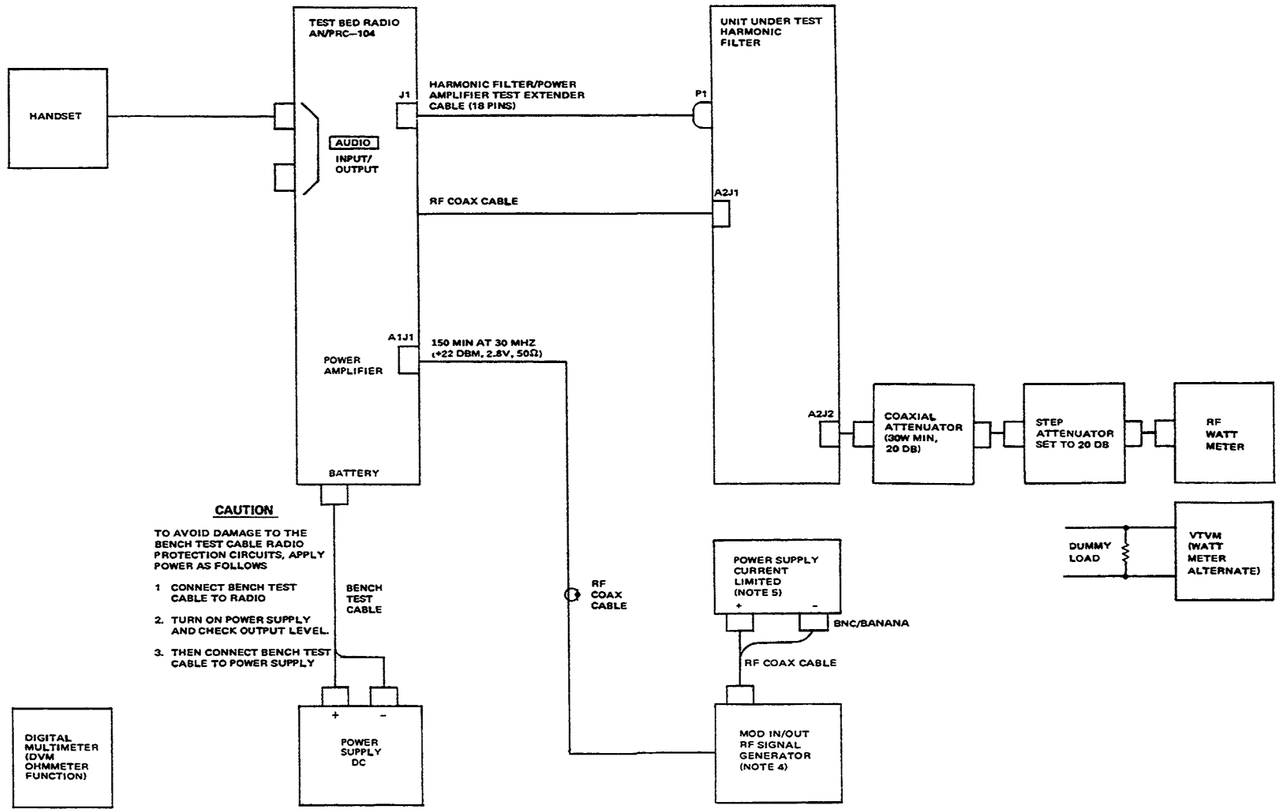


Figure 4-5. Harmonic Filter A1A2 Alignment Setup.

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 = E2/R WHERE R = 5O OHMS
4. 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
5. SET OUTPUT VOLTAGE TO +2 VOLTS D.C. CAUTION DO NOT EXCEED +5VDC SET CURRENT REGULATION TO MINIMUM REQUIRED TO PERFORM ALIGNMENT

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 m odule 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.

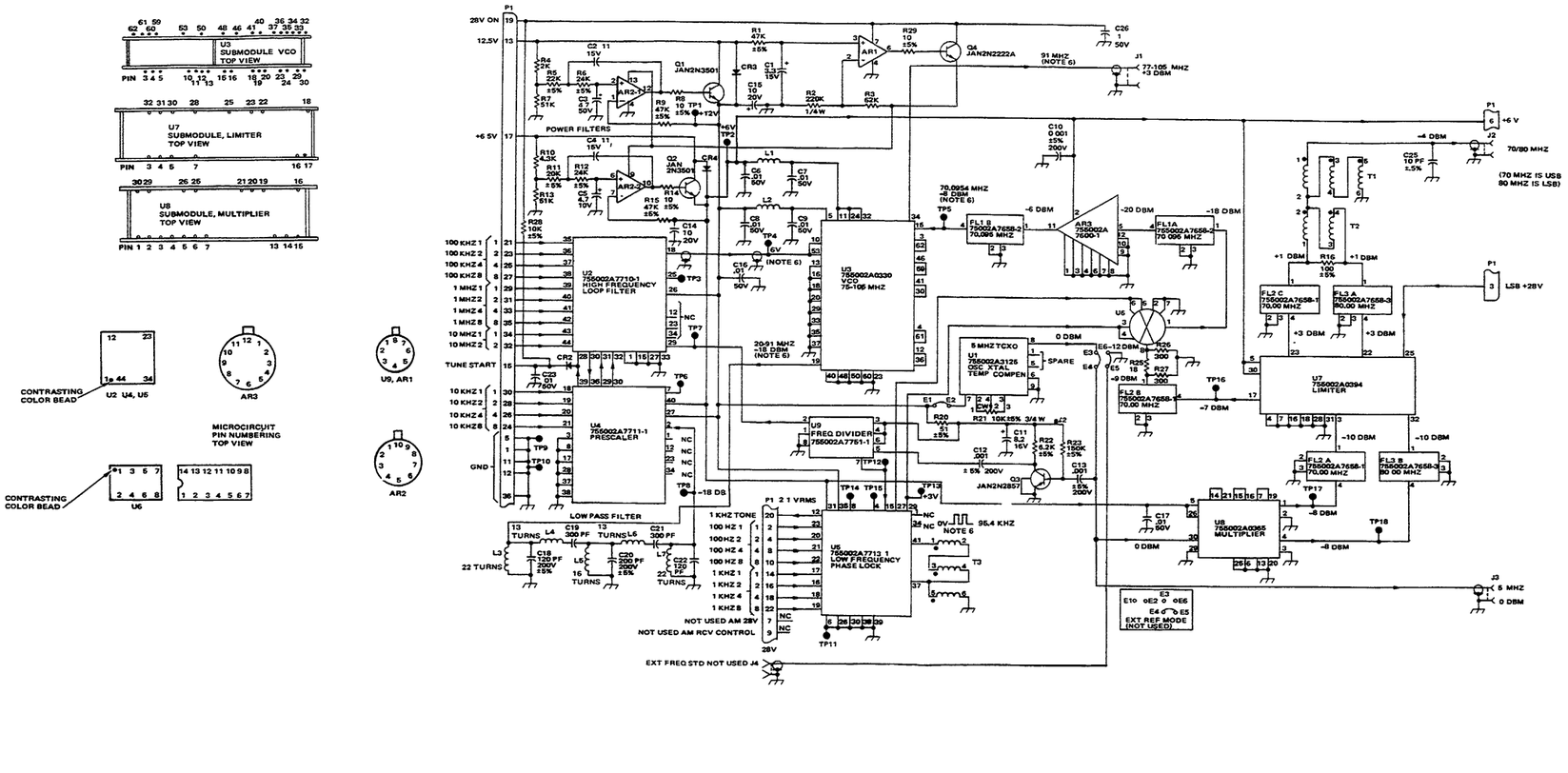
3. Adjust R1 to obtain +14.5 ±0.1 vdc at TP1 of the module with 20 watts module output

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% l 00 V
2. RESISTANCE VALUES ARE IN OHMS 1/IIW
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

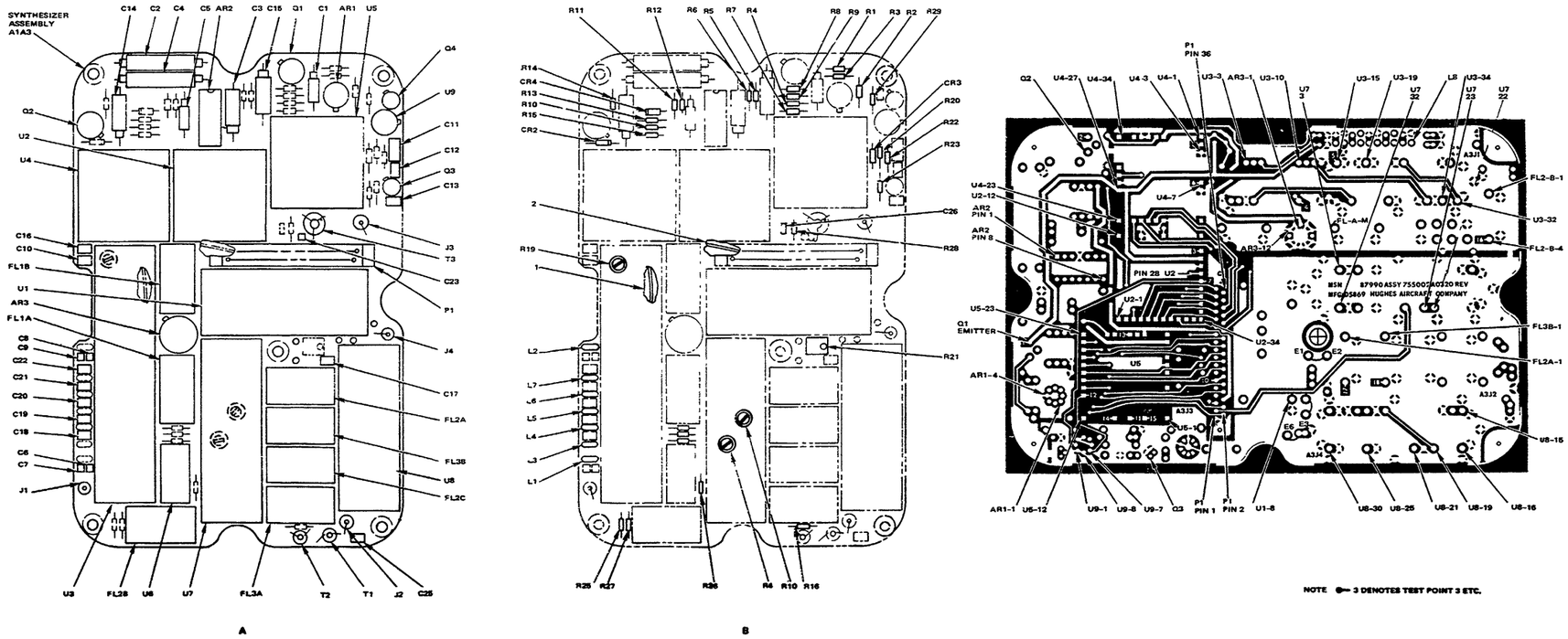


Figure 5-2. Synthesizer A1A3 Component Location (Sheet 1 of 2)

ITEM	DESCRIPTION
	A
A1A3	Synthesizer Assembly
C14	Capacitor
C2	Capacitor
C4	Capacitor
C5	Capacitor
AR2	Microcircuit
C3	Capacitor
C15	Capacitor
Q1	Transistor
C1	Capacitor
AR1	Microcircuit
U5	Microcircuit
Q4	Transistor
U9	Microcircuit
C11	Capacitor
C12	Capacitor
Q3	Transistor
C13	Capacitor
J3	Connector, Coaxial RF
T3	Transformer, RF
C23	Capacitor
P1	Connector, Receptacle
J4	Connector, Coaxial RF
C17	Capacitor
FL2A	Filter, Bandpass
FL3B	Filter, Bandpass
U8	Frequency Multiplier Assembly
FL2C	Filter, Bandpass
C25	Capacitor
J2	Connector, Coaxial RF
T1	Transformer RF
T2	Transformer RF
FL3A	Filter, Bandpass
U7	Limiter, Amplitude
U6	Mixer, Radio
FL2B	Filter, 8andpass
U3	Oscillator, Volume, Control
J1	Connector, Coaxial RF
C7	Capacitor
C6	Capacitor
C18	Capacitor
C19	Capacitor
C20	Capacitor
C21	Capacitor
C22	Capacitor
C9	Capacitor
C8	Capacitor
FL1A	Filter, Bandpass
AR3	Amplifier, RF
U1	Oscillator, Crystal, Temp.

ITEM	DESCRIPTION
FL1B	Filter, Bandpass
C10	Capacitor
C16	Capacitor
U4	Microcircuit
U2	Microcircuit
Q2	Transistor
	B
R11	Resistor
R12	Resistor
R6	Resistor
R5	Resistor
R7	Resistor
R4	Resistor
R8	Resistor
R9	Resistor
R1	Resistor
R3	Resistor
R2	Resistor
R29	Resistor
CR3	Diode
R20	Resistor
R22	Resistor
R23	Resistor
C26	Capacitor
R28	Resistor
R21	Resistor, Variable
R16	Resistor
U7R10	Resistor, Variable
U7R4	Resistor, Variable
R26	Resistor
R27	Resistor
R25	Resistor
L1	Inductor
L3	Inductor
L4	Inductor
L5	Inductor
L6	Inductor
L7	Inductor
L2	Inductor
1	Cable Assembly, RF
U3R19	Resistor, Variable
2	Strap, Handle
CR2	Diode
R15	Resistor
R10	Resistor
R13	Resistor
CR4	Diode
R14	Resistor

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

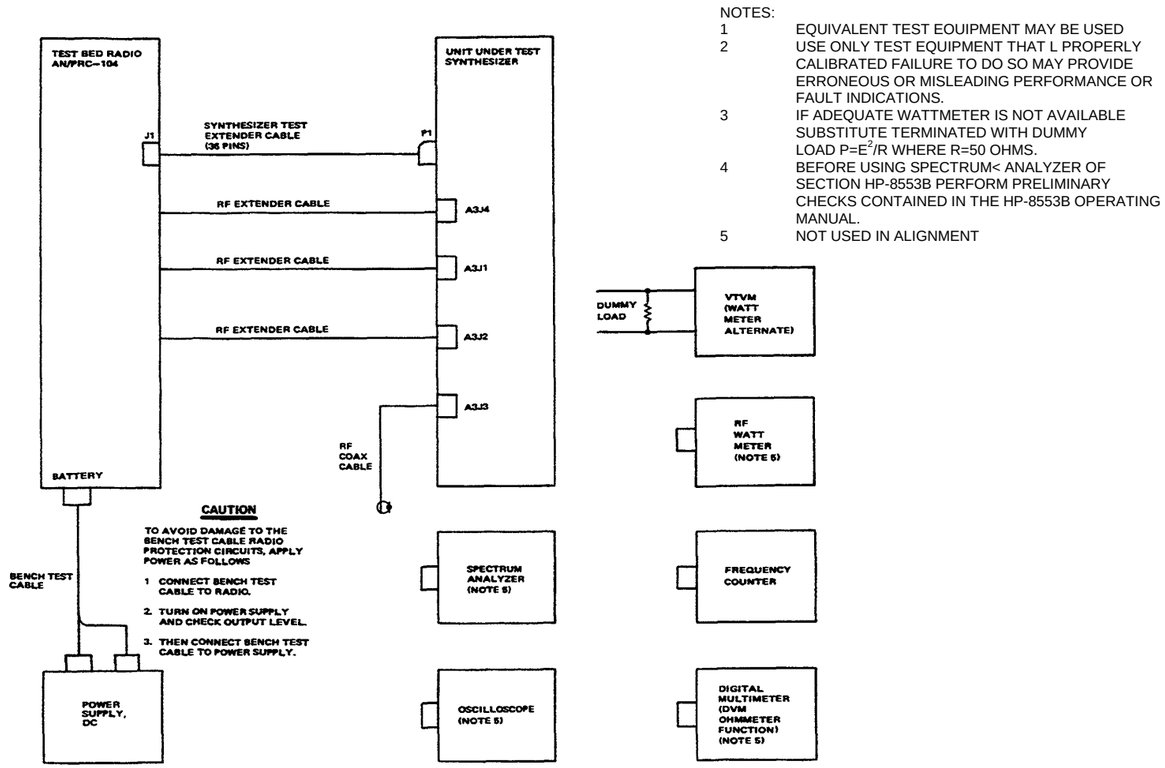
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

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 EOUIPMENT 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 Tome	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.

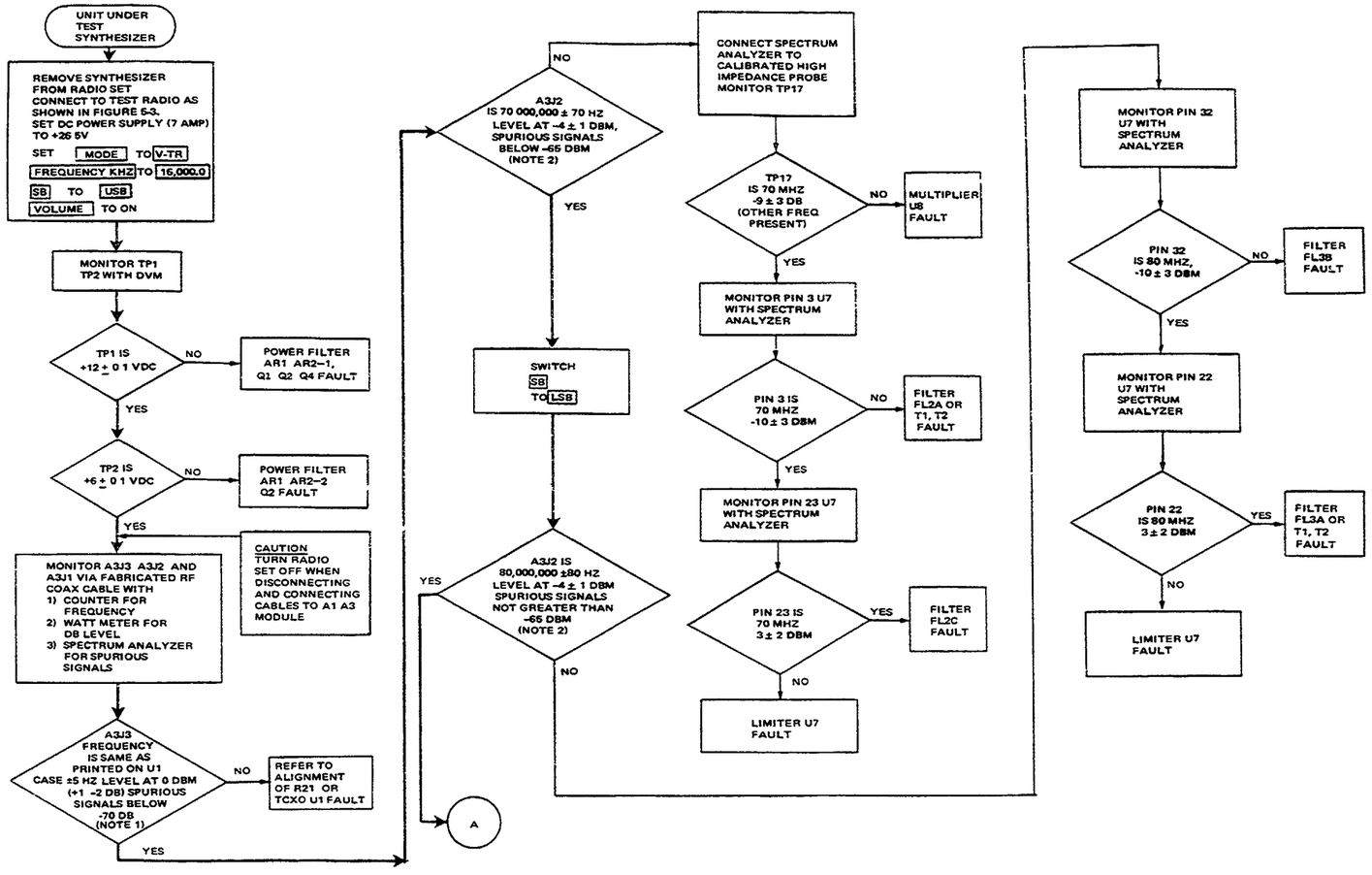
NOTE 4: Spurious signal applies between 60 and 110 MHz. TP5 frequency is 70,090,000 Hz + XY, where X is 1 kHz frequency kHz digit and Y is 100 Hz frequency Hz digit. Set spectrum analyzer as in Note 2, except that the center frequency is 91 MHz.

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.



TM-07748A-45/3

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

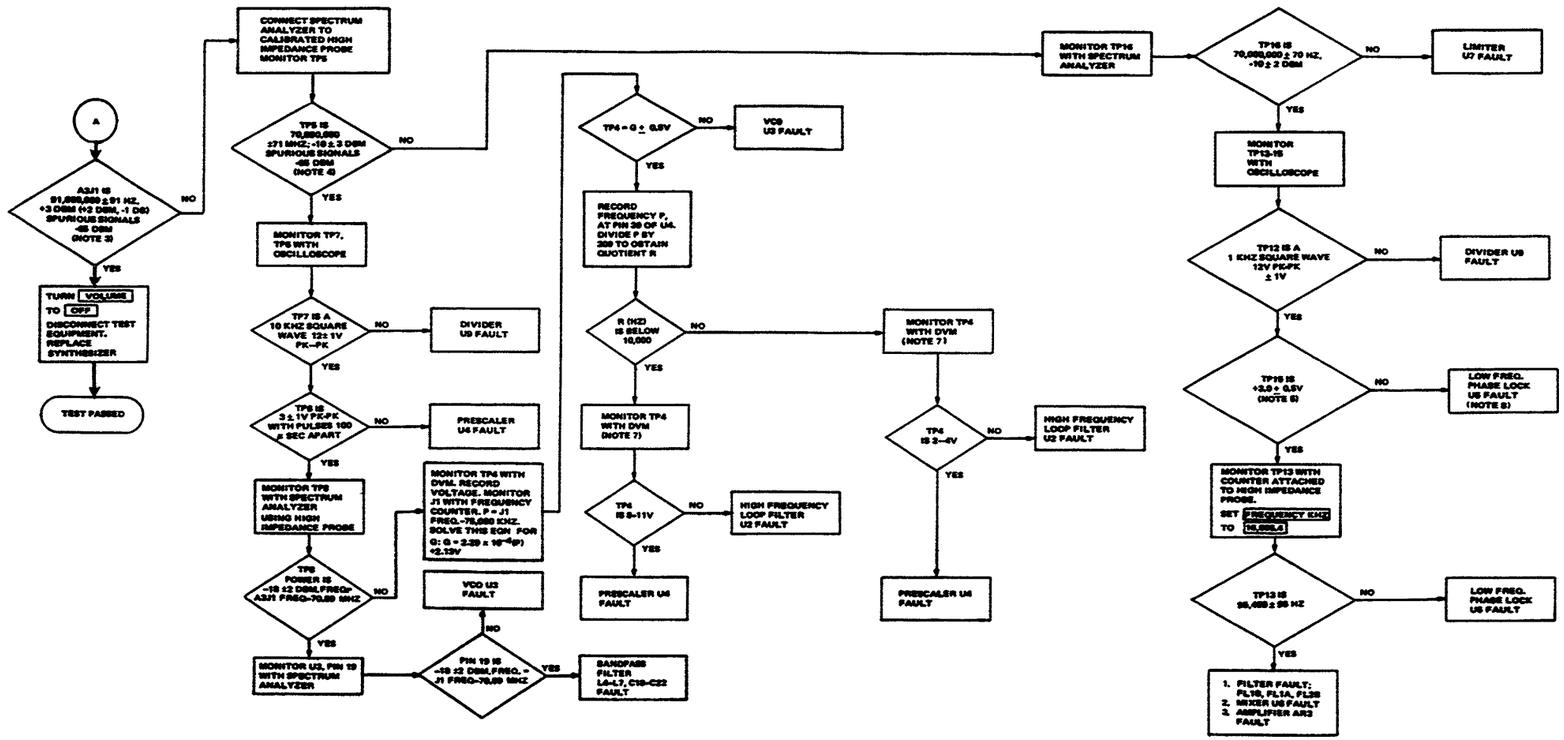


Figure 5-4. Synthesizer A1A3 Performance Test (Sheet 2 of 2)

SYNTHESIZER A1A3 ALIGNMENT

The alignment procedure is to be used whenever TCXO U1, VCO U3, or 1lmlter 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 ±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 ±0.1 dbm.
9. Disconnect the test equipment.

NOTES: UNLESS OTHERWISE SPECIFIED
1. DIODES ARE JAN1N4148.
2. RESISTANCE VALUES ARE IN OHMS ±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 ±10%.
7, VOLTAGES WITH FREQUENCY KHZ SET TO 02.500.0.

NOTE 8. SWITCH S1 BCD LOGIC

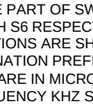
DIAL SETTING	OUTPUT PIN					
	2	1	X	A	B	C
0	0	0	-	0	NC	1
1	0	1	-	1	NC	1
2	1	0	-	1	NC	0

1 = OPEN(+12V PULLUP)
0 = GND
- = NORMALLY OPEN, MONENTARILY 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	-
2	0	0	1	0	-
3	0	0	1	1	-
4	0	1	0	0	-
5	0	1	0	1	-
6	0	1	1	0	-
7	0	1	1	1	-
8	1	0	0	0	-
9	1	0	0	1	-

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



U1, U2
MICROCIRCUIT
PIN NUMBERING
TOP VIEW

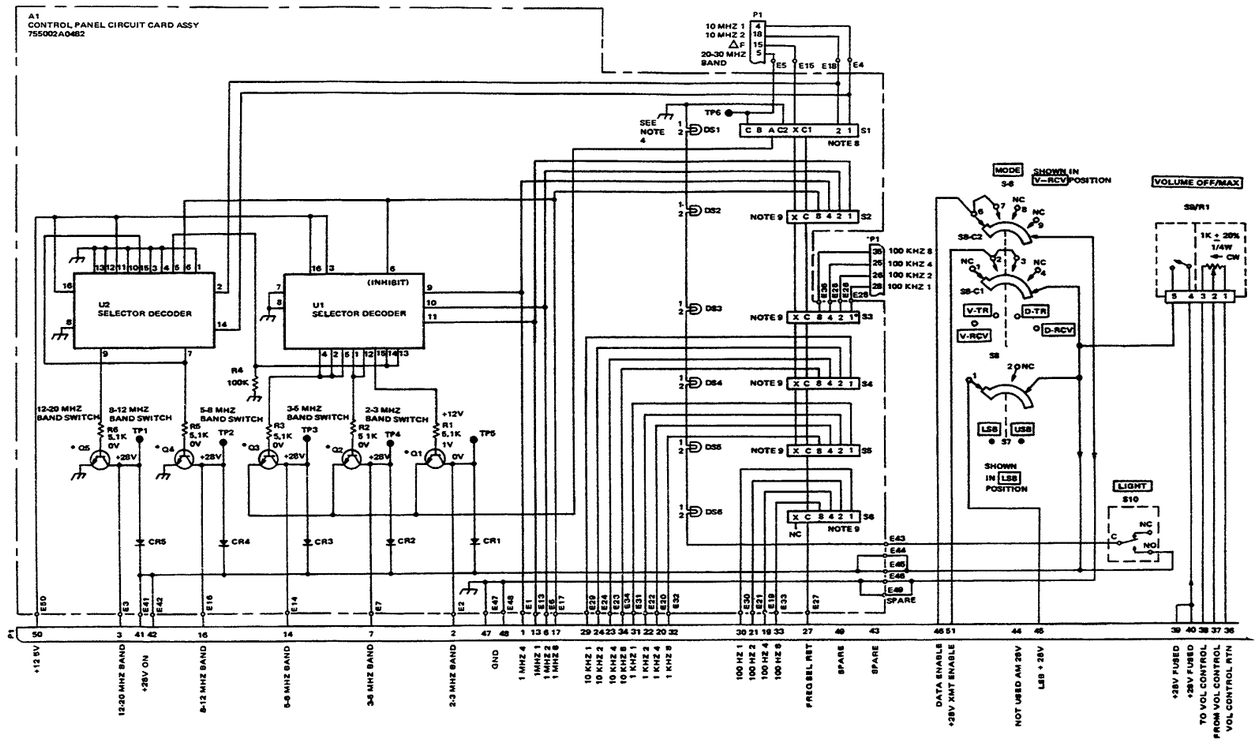


Figure 6-1. Control Panel A1A4 Schematic (Sheet 1 of 2)

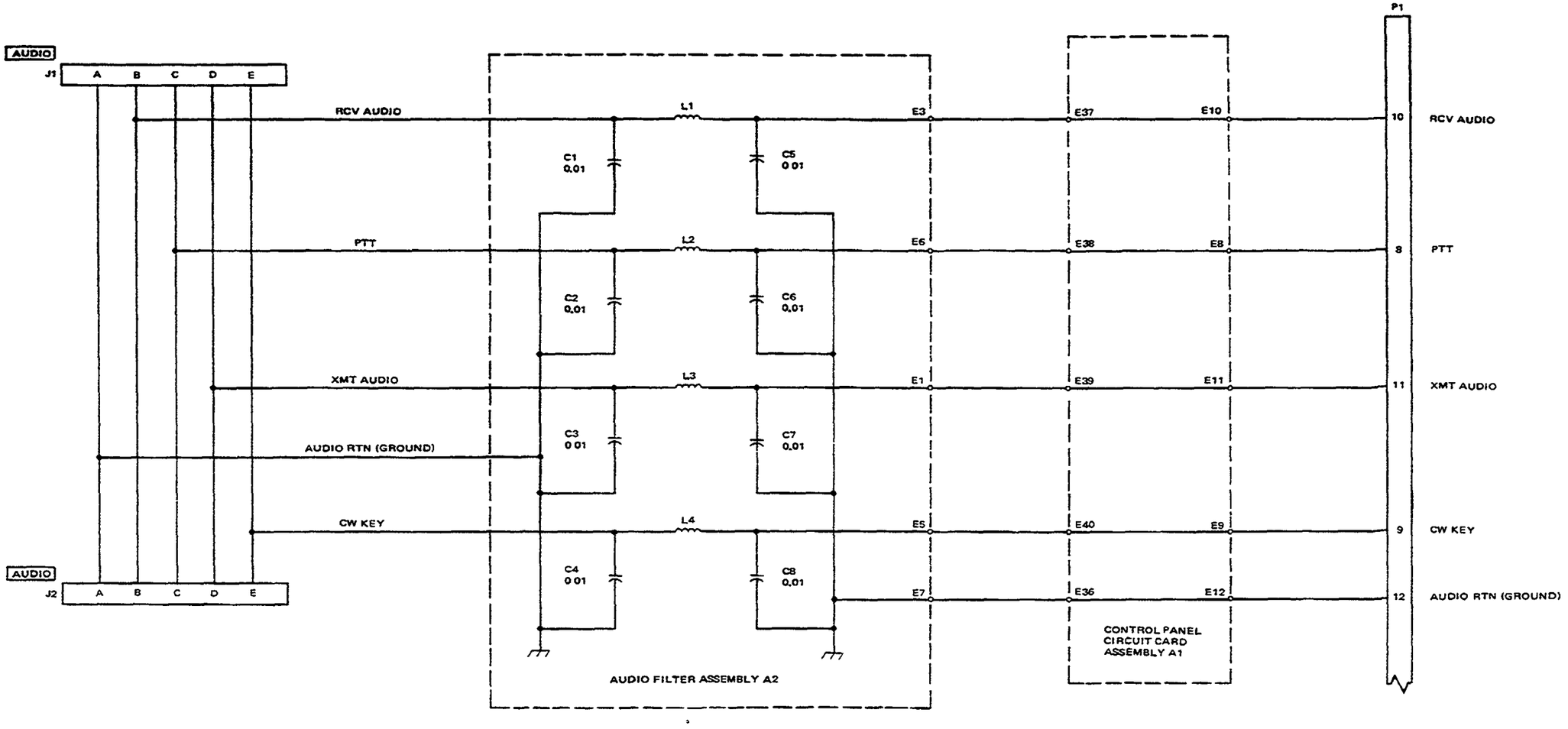


Figure 6-1. Control Panel A1A4 Schematic (Sheet 2 of 2)

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)

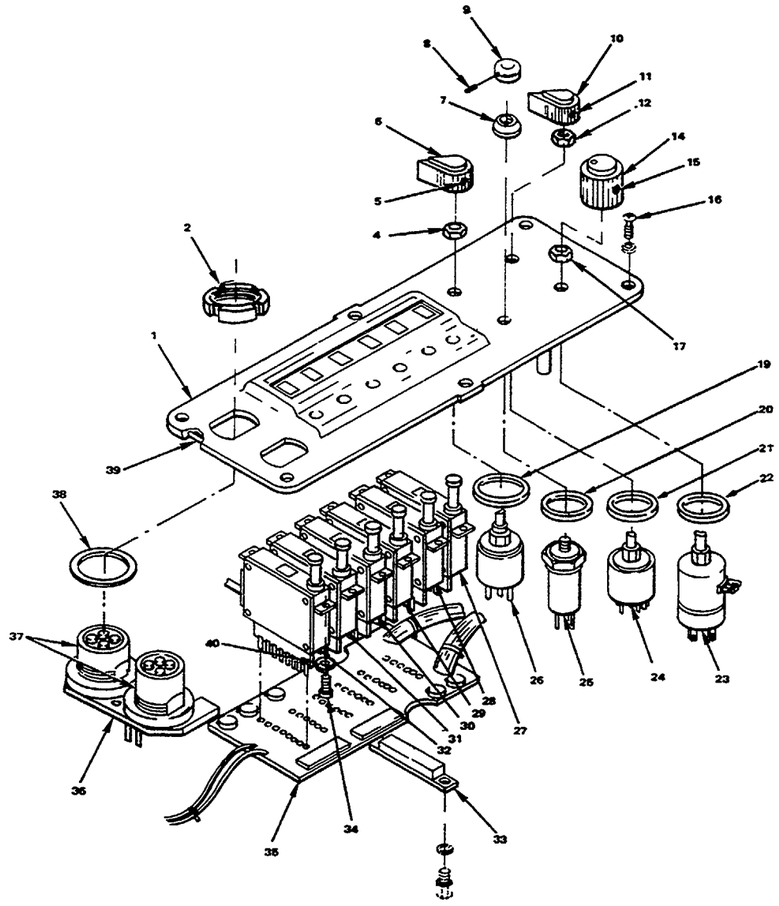
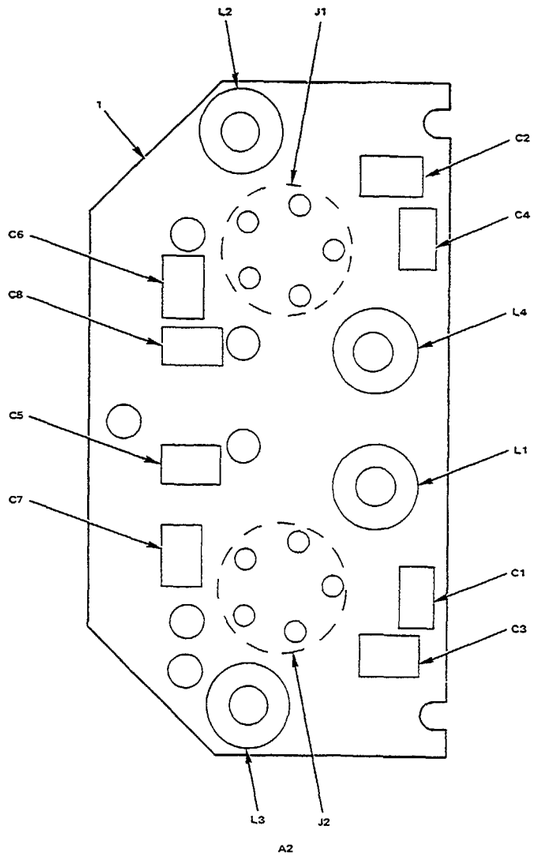
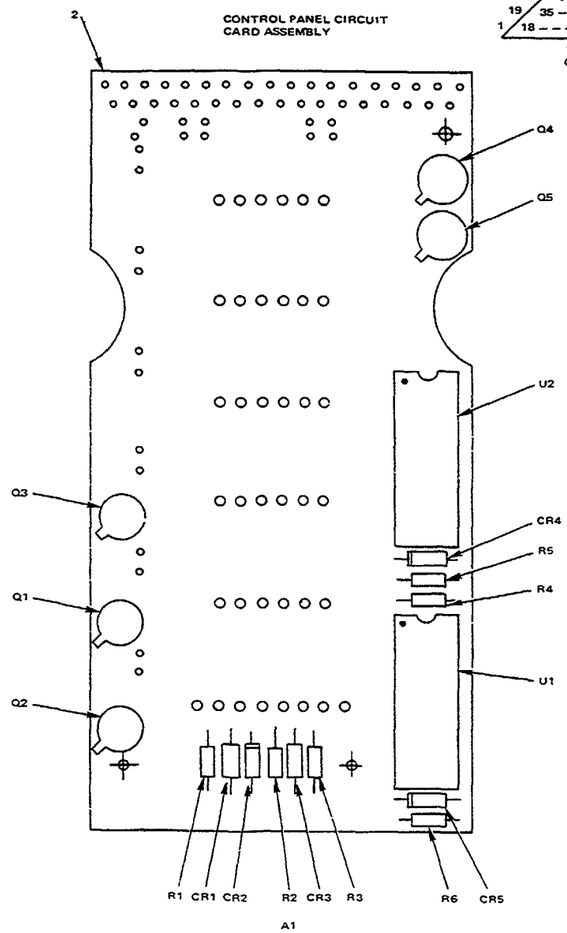


Figure 6-2. Control Panel A1A4 Component Location (Sheet 1 of 2)

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





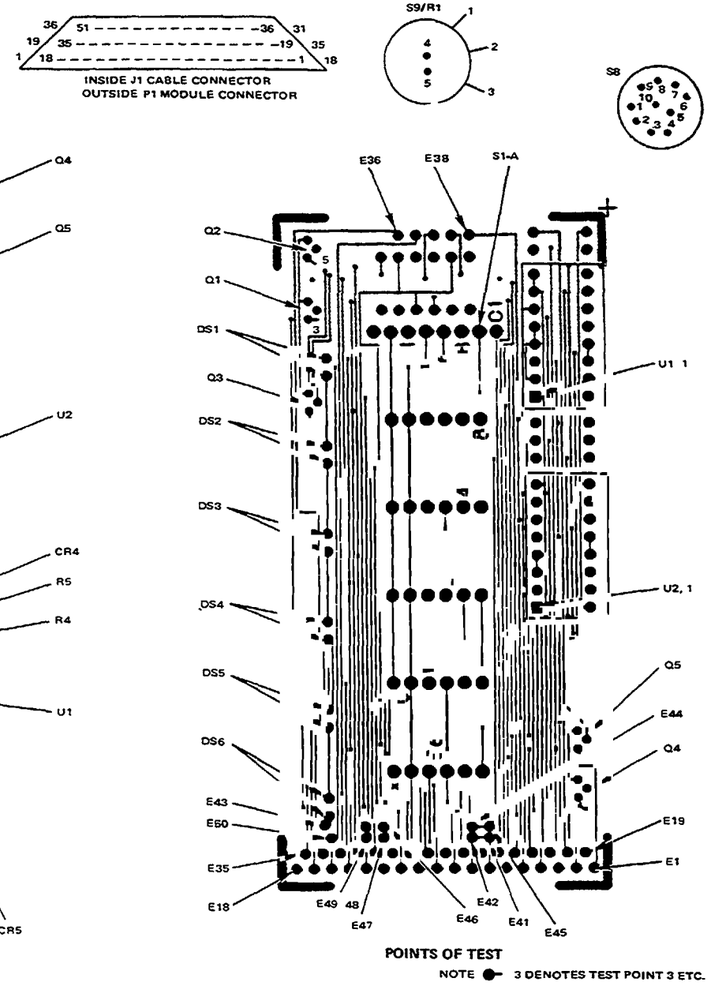


Figure 6-2. Control Panel A1A4 Component Location (Sheet 2 of 2)

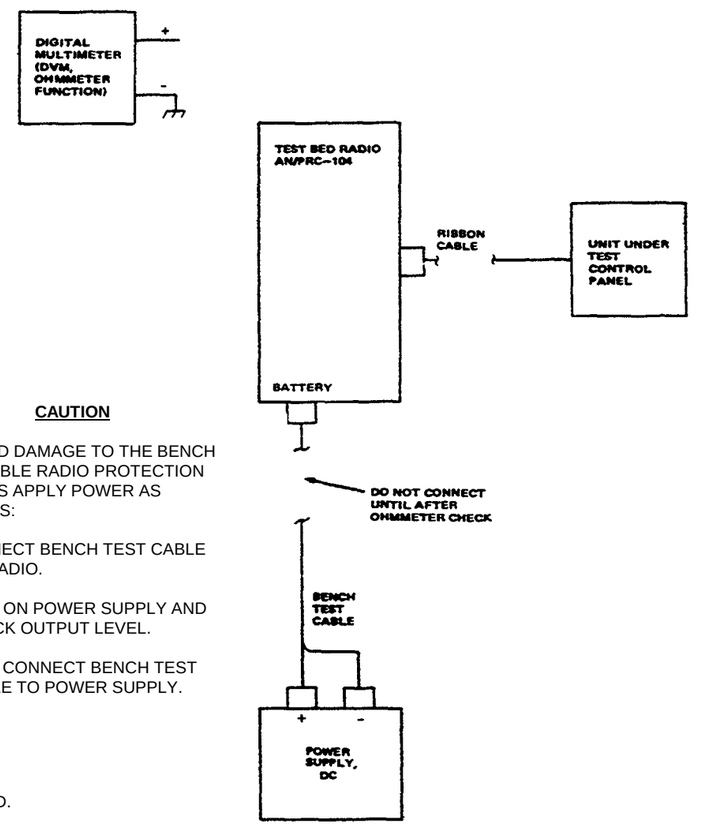
Figure 6-3. Control Panel A1A4 Performance Test Setup

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



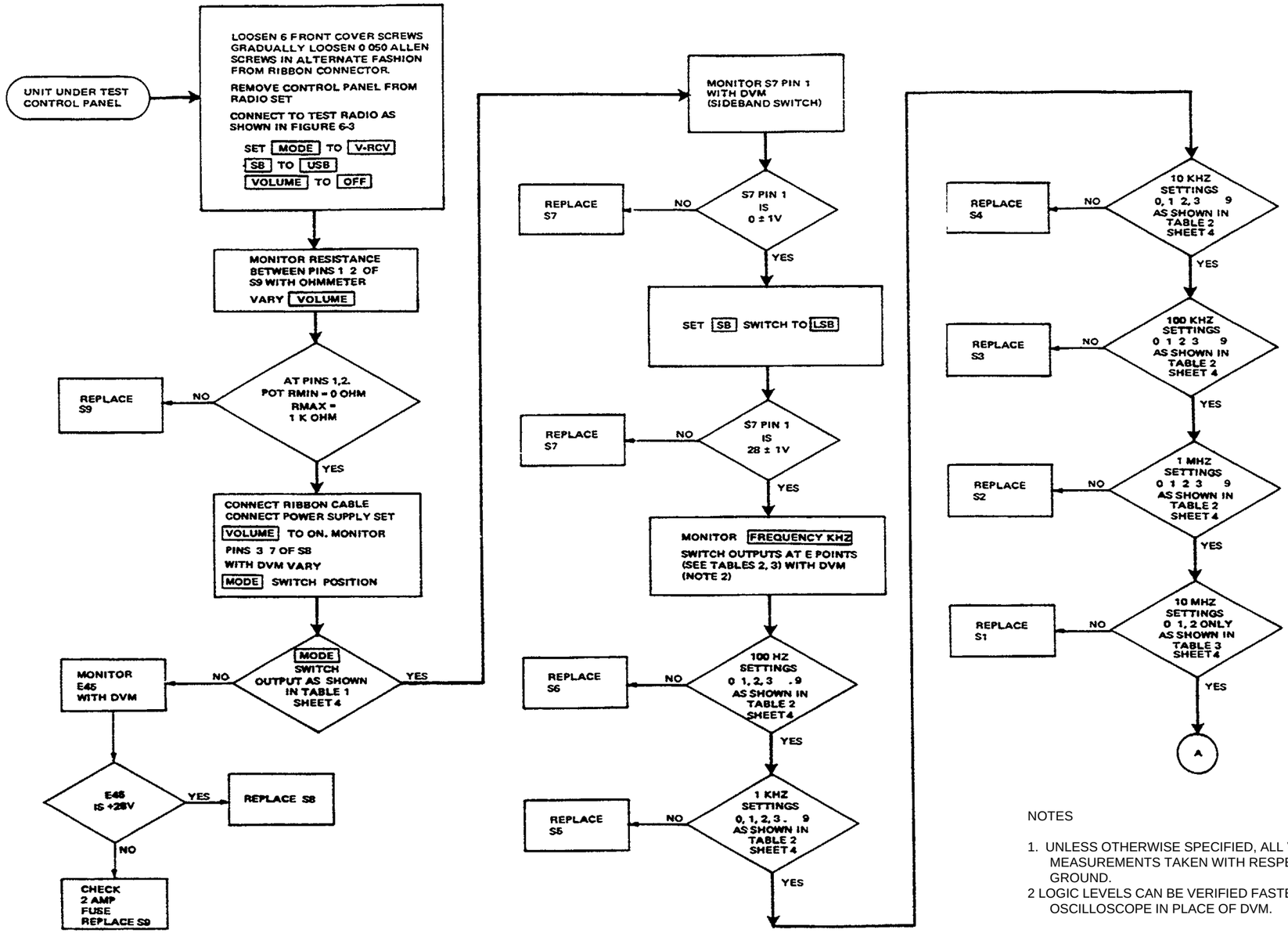
CAUTION

TO AVOID DAMAGE TO THE BENCH TEST CABLE RADIO PROTECTION CIRCUITS APPLY POWER AS FOLLOWS:

1. CONNECT BENCH TEST CABLE TO RADIO.
2. TURN ON POWER SUPPLY AND CHECK OUTPUT LEVEL.
3. THEN CONNECT BENCH TEST CABLE TO POWER SUPPLY.

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.

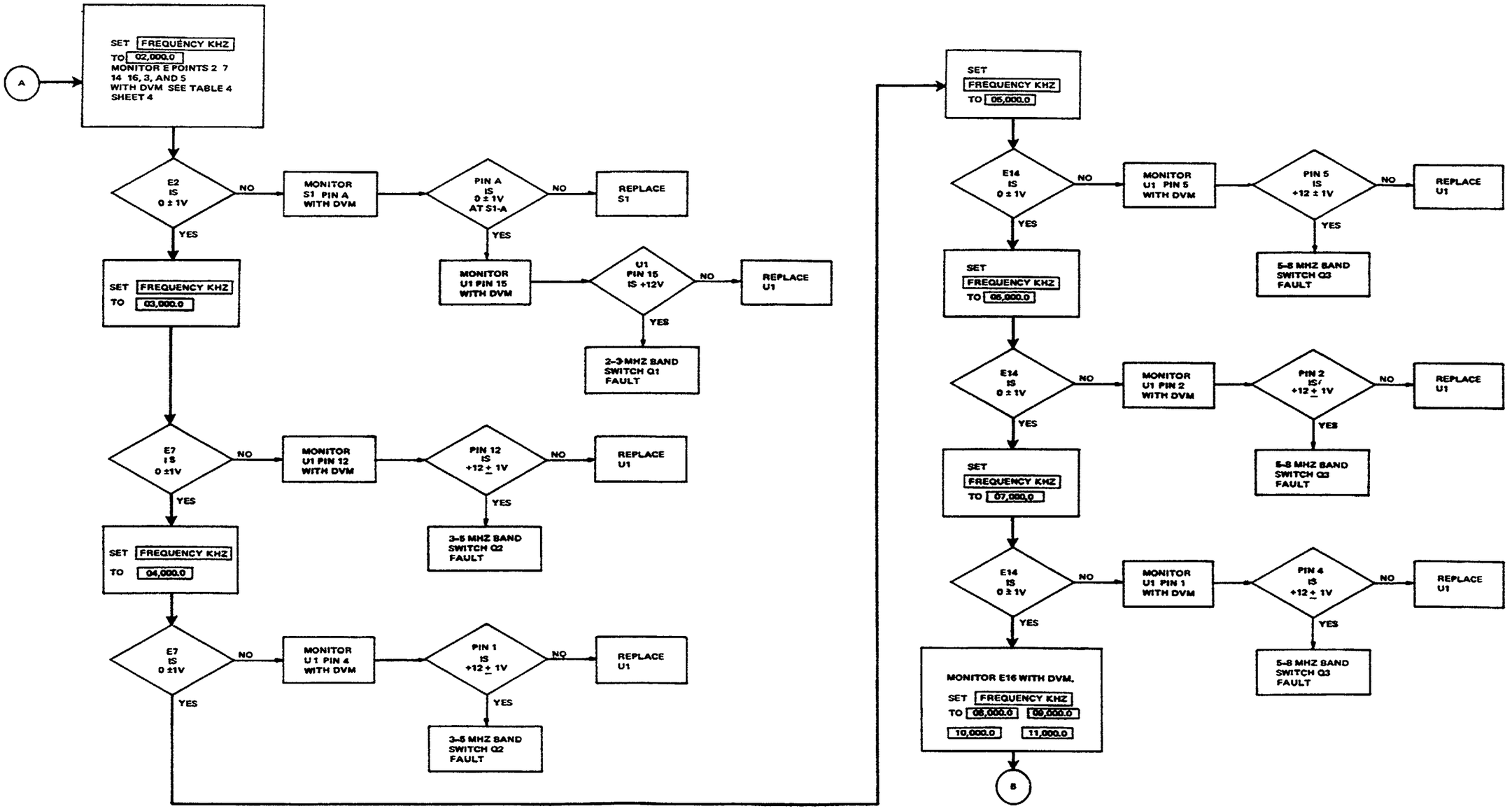


NOTES

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)



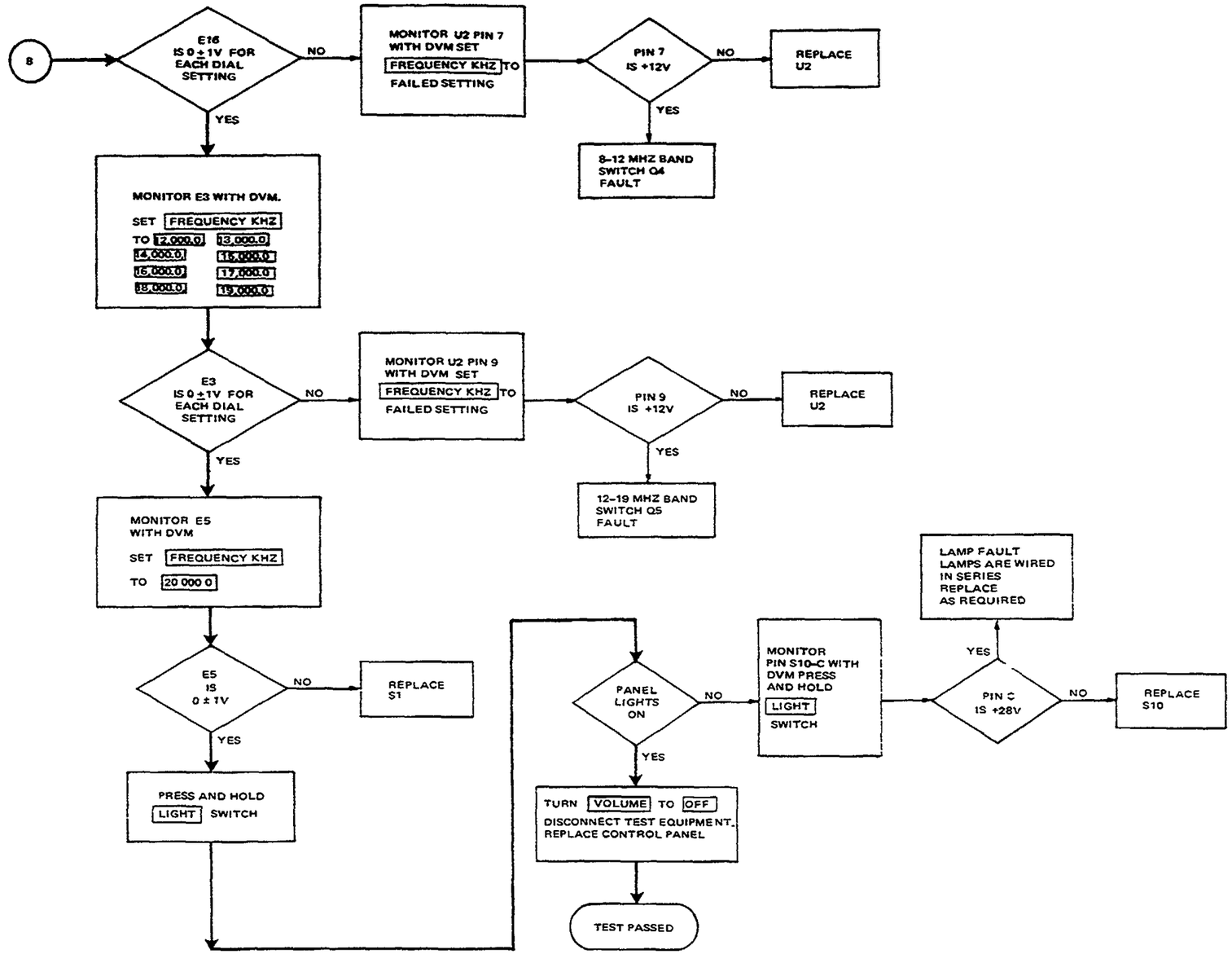


Figure 6-4. Control Panel A1A4 Performance Test (Sheet 3 of 4)

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 2. FREQUENCY SELECT LOGIC

	E Points			
100 Hz Switch (S6)	33	19	21	30
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	Voltages ±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

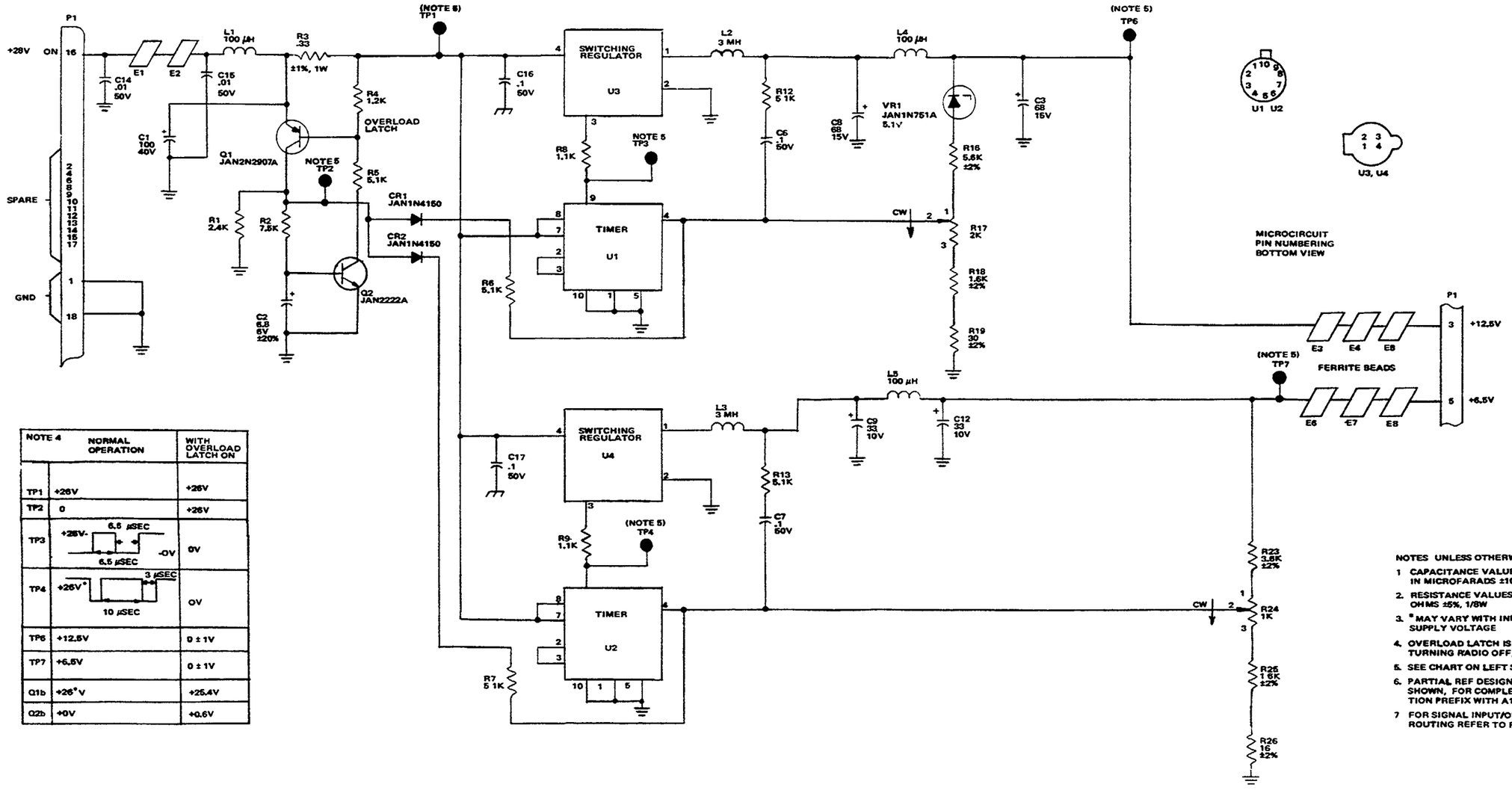
TABLE 3. 10 MHZ FREQUENCY SELECT LOGIC

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

TABLE 4. BAND SWITCH DECODER OUTPUT

		HARMONIC FILTER BAND SWITCH LOGIC OUTPUT																											
Freq. in MHz		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	2
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 = Ground, □ = +28 ±1v

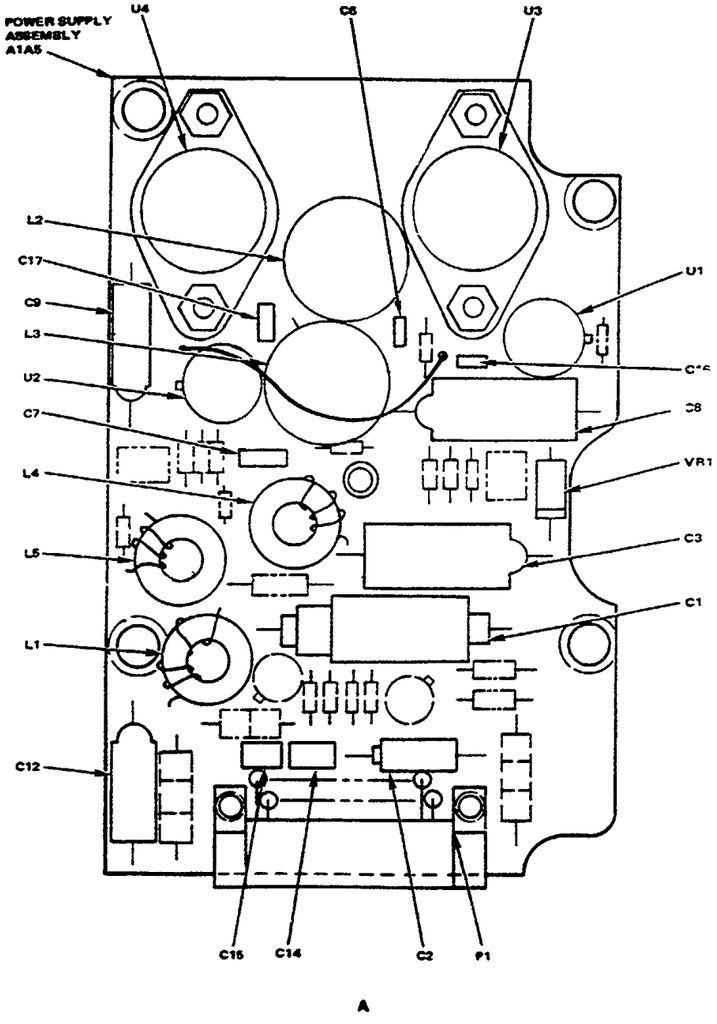


NOTE 4	NORMAL OPERATION	WITH OVERLOAD LATCH ON
TP1	+26V	+26V
TP2	0	+26V
TP3	+26V, 6.5 µSEC, -0V, 6.5 µSEC	0V
TP4	+26V*, 3 µSEC, 10 µSEC	0V
TP6	+12.5V	0 ± 1V
TP7	+6.5V	0 ± 1V
Q1b	+26*V	+25.4V
Q2b	+0V	+0.6V

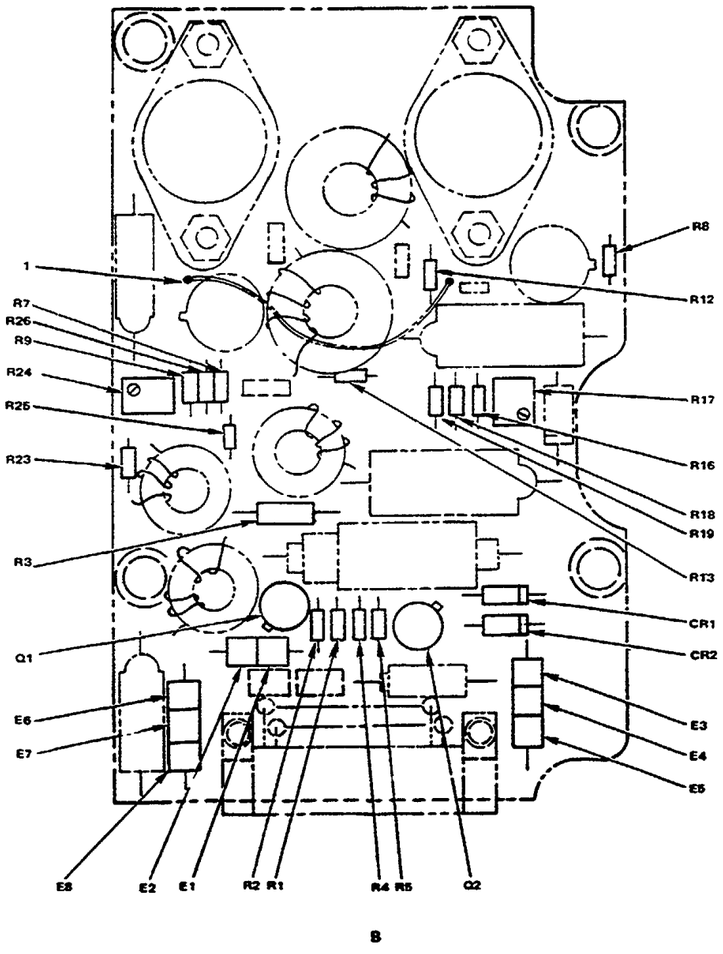
NOTES UNLESS OTHERWISE SPECIFIED

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

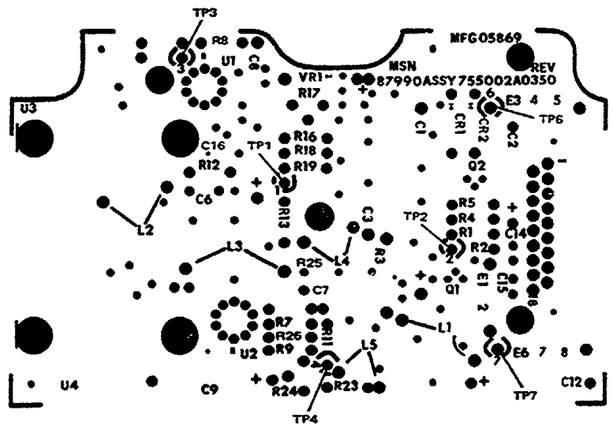
Figure 7-1. Power Supply A1A5 Schematic



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
	A
A1A5	Power Supply Assembly
U4	Microcircuit
C6	Capacitor
U3	Microcircuit
U1	Microcircuit
C16	Capacitor
C8	Capacitor
VR1	Diode
C3	Capacitor
C1	Capacitor
P1	Connector, PCB
C2	Capacitor
C14	Capacitor
C15	Capacitor
C12	Capacitor
L1	Inductor
L5	Inductor
L4	Inductor
C7	Capacitor
U2	Microcircuit
L3	Inductor
C9	Capacitor
C17	Capacitor
L2	Inductor
	B
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

ITEM	DESCRIPTION
E1	Core, EM
E2	Core, EM
E8	Core, EM
E7	Core, EM
E6	Core, EM
Q1	Transistor
R3	Resistor
R23	Resistor
R25	Resistor
R24	Resistor, Variable
R9	Resistor
R26	Resistor
R7	Resistor
1	Strap, Handle

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

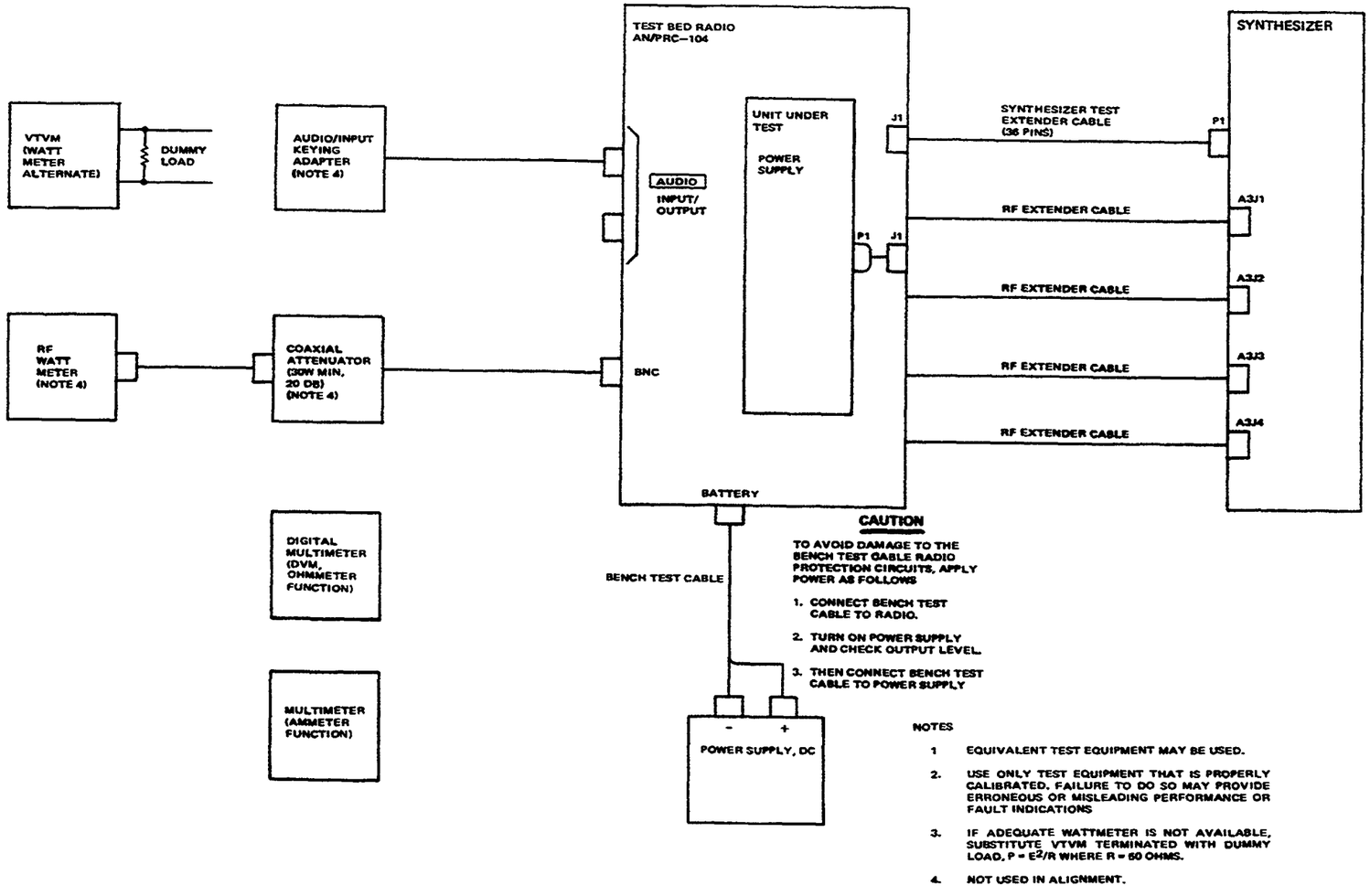


Figure 7-3. Power Supply A1A5 Performance Test and Alignment Setup

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.

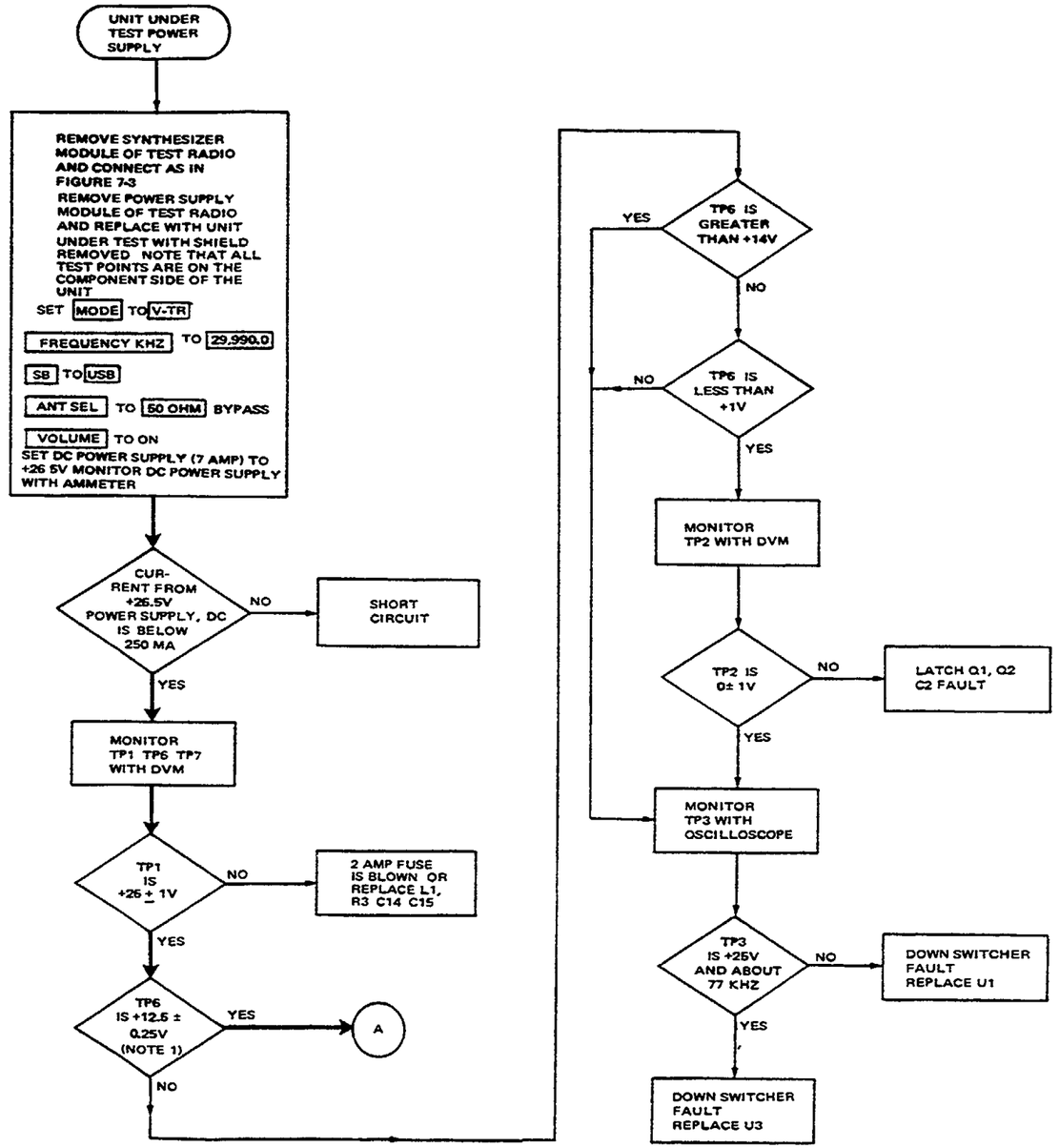


Figure 7-4. Power Supply A1A5 Performance Test (Sheet 1 of 2)

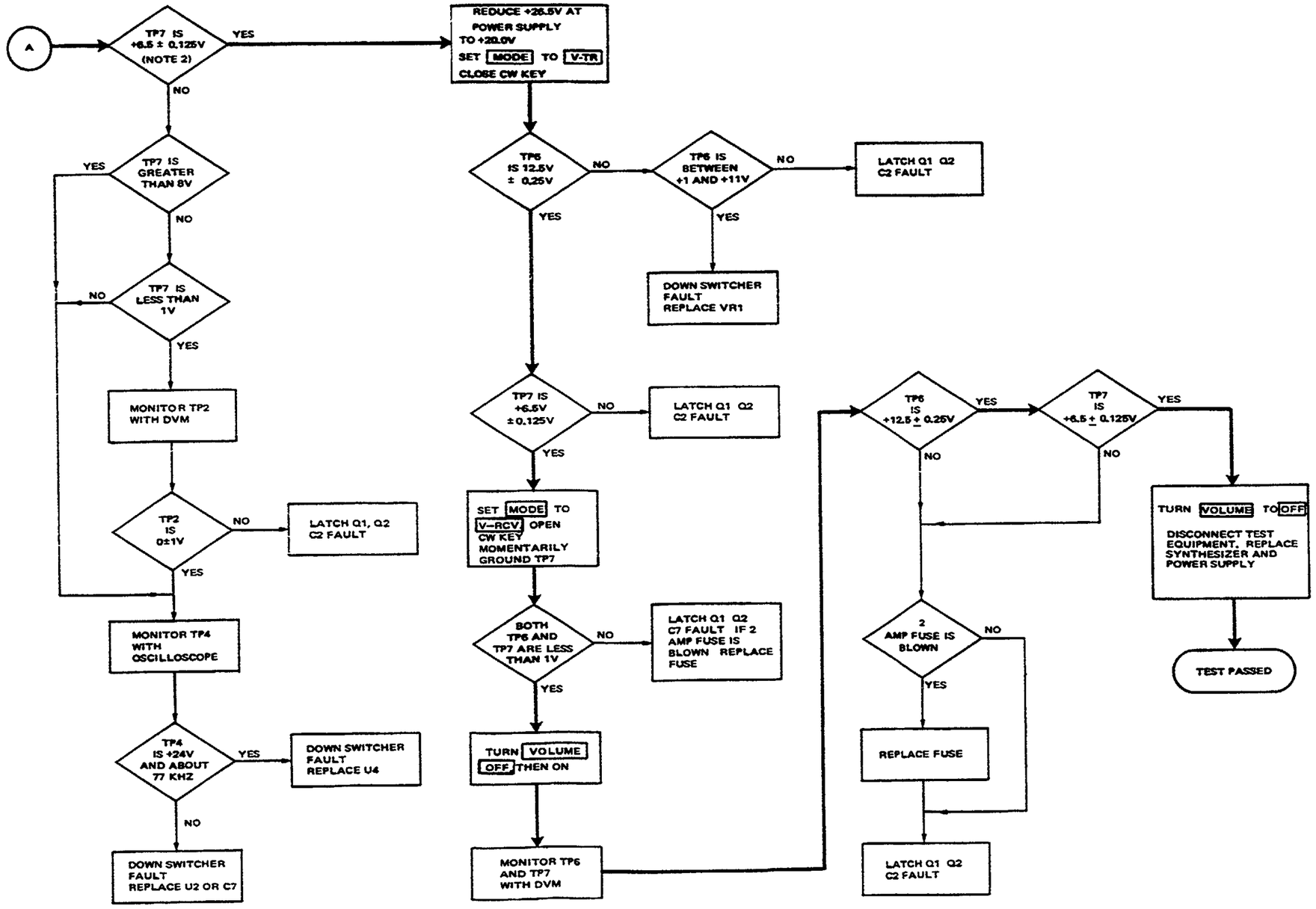


Figure 7-4. Power Supply A1A5 Performance Test (Sheet 2 of 2)

POWER SUPPLY A1A5 ALIGNMENT

The alignment procedure is to be used in either of these situations: (1) the performance test calls a potentlometer 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 sad watt meter, connect the test radio, cables, adapters and test equipment as shown in figure 7-3. Set the do 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.

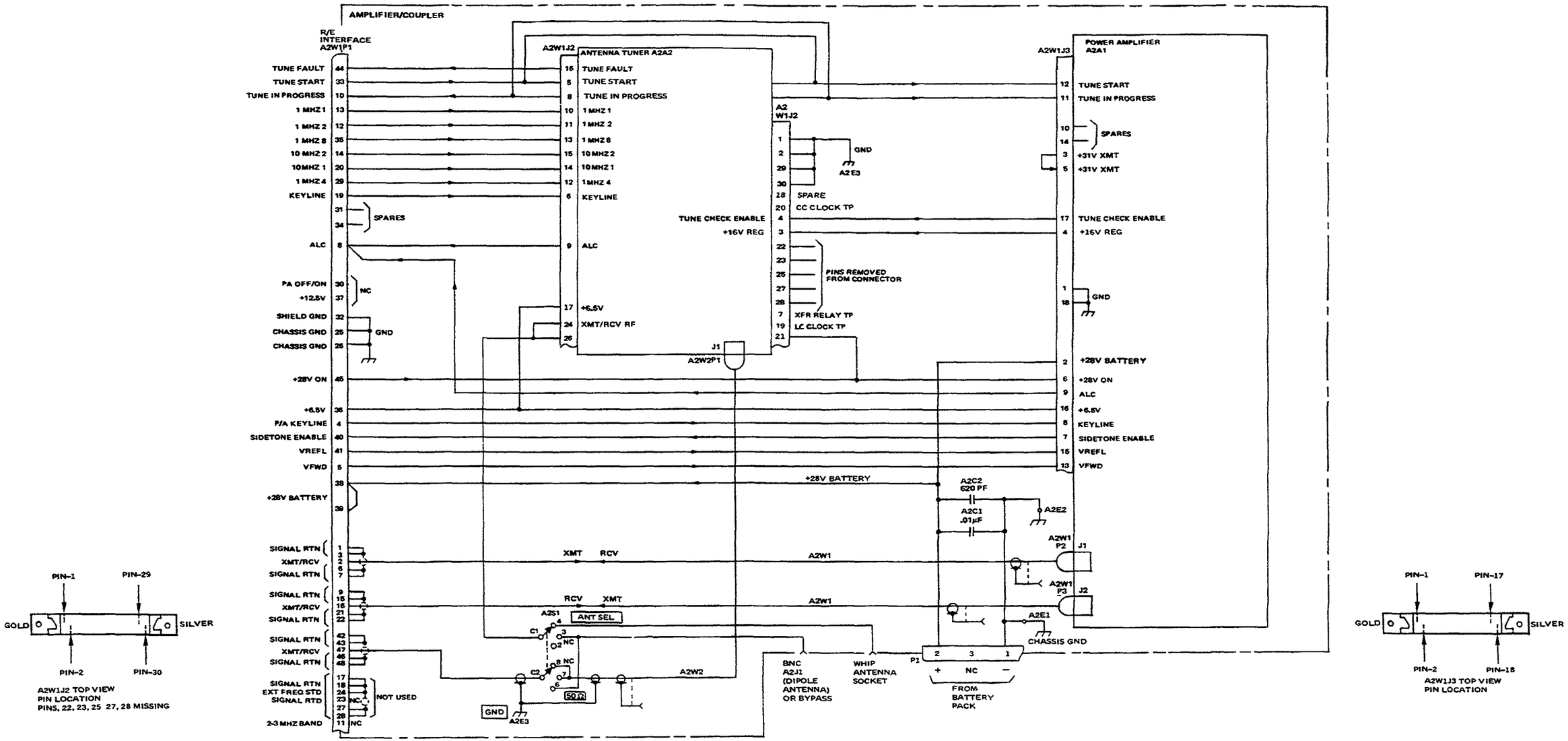


Figure 8-1. Amplifier/Coupler A2 Schematic

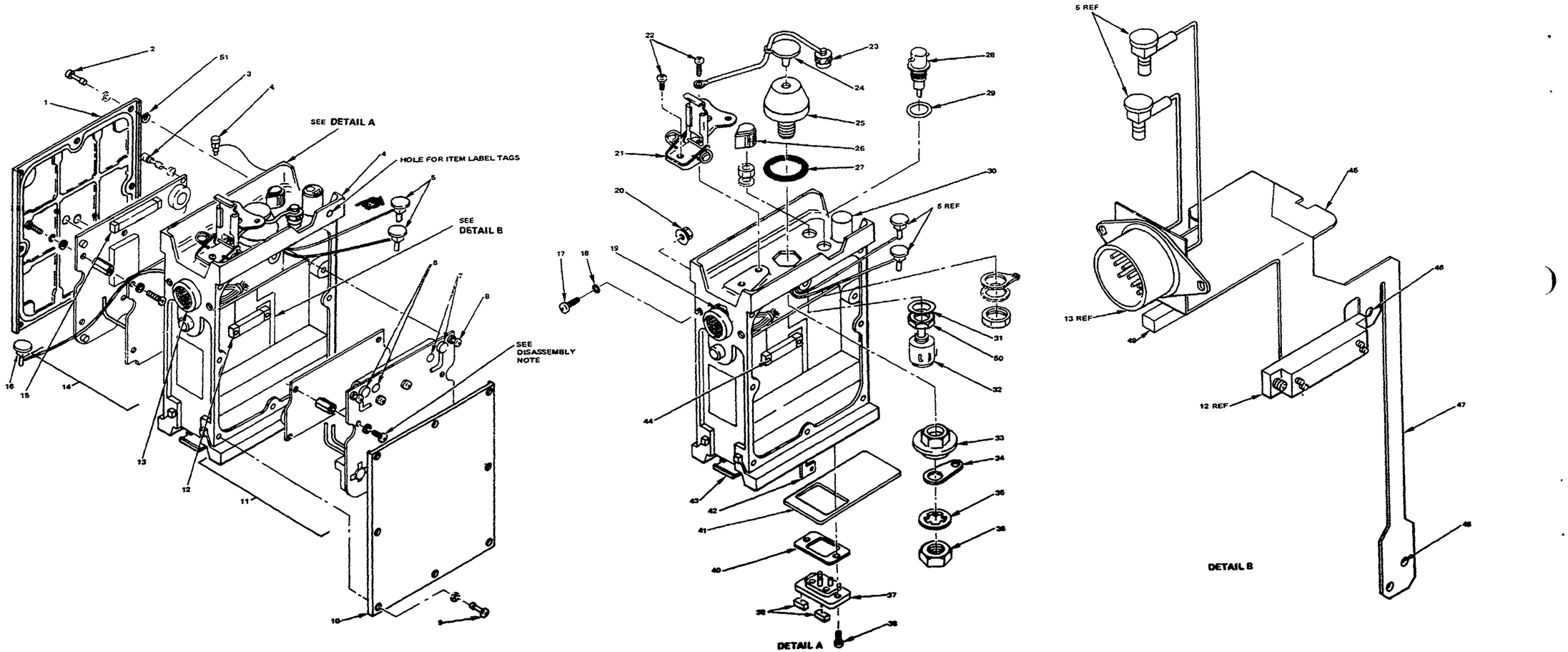


Figure 8-2. Amplifier/Coupler A2 Component Location (Sheet 1 of 2)

ITEM	DESCRIPTION
1.	Cover Assembly
2.	Screw, Captive (8 places)
3.	Screw, Captive (4 places)
4.	Amplifier/Coupler Housing A2
5.	RF Cables A1J1 (W1P1), A1J2 (W1P3)
6.	Marker
7.	Marker
8.	Screw, Captive (4 places)
9.	Screw, Captive (8 places)
10.	Cover Assembly
11.	Power Amplifier Module A2A1
12.	Multipin Connection A2W1J3
13.	Connector Receptacle A2W1P1
14.	Antenna Tuner Module Assembly A2A2
15.	Multipin Connector A2A2P1
16.	RF Cable A2J1(W2P1)
17.	Screw (2 places)
18.	Self-Sealing 0-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

ITEM	DESCRIPTION
38.	Screw (2 places)
39.	Capacitor (2 places)
40.	Gasket
41.	Gasket
42.	Terminal
43.	Latch
44.	Mounting Screw (2 places)
45.	Ribbon Cable Support
46.	Terminal
47.	Ribbon Cable Assembly A2111
48.	Terminal
49.	Multipin Connector, A2W1J2
50.	Hex Nut
51.	.020- C Spring Clip (16 places)

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

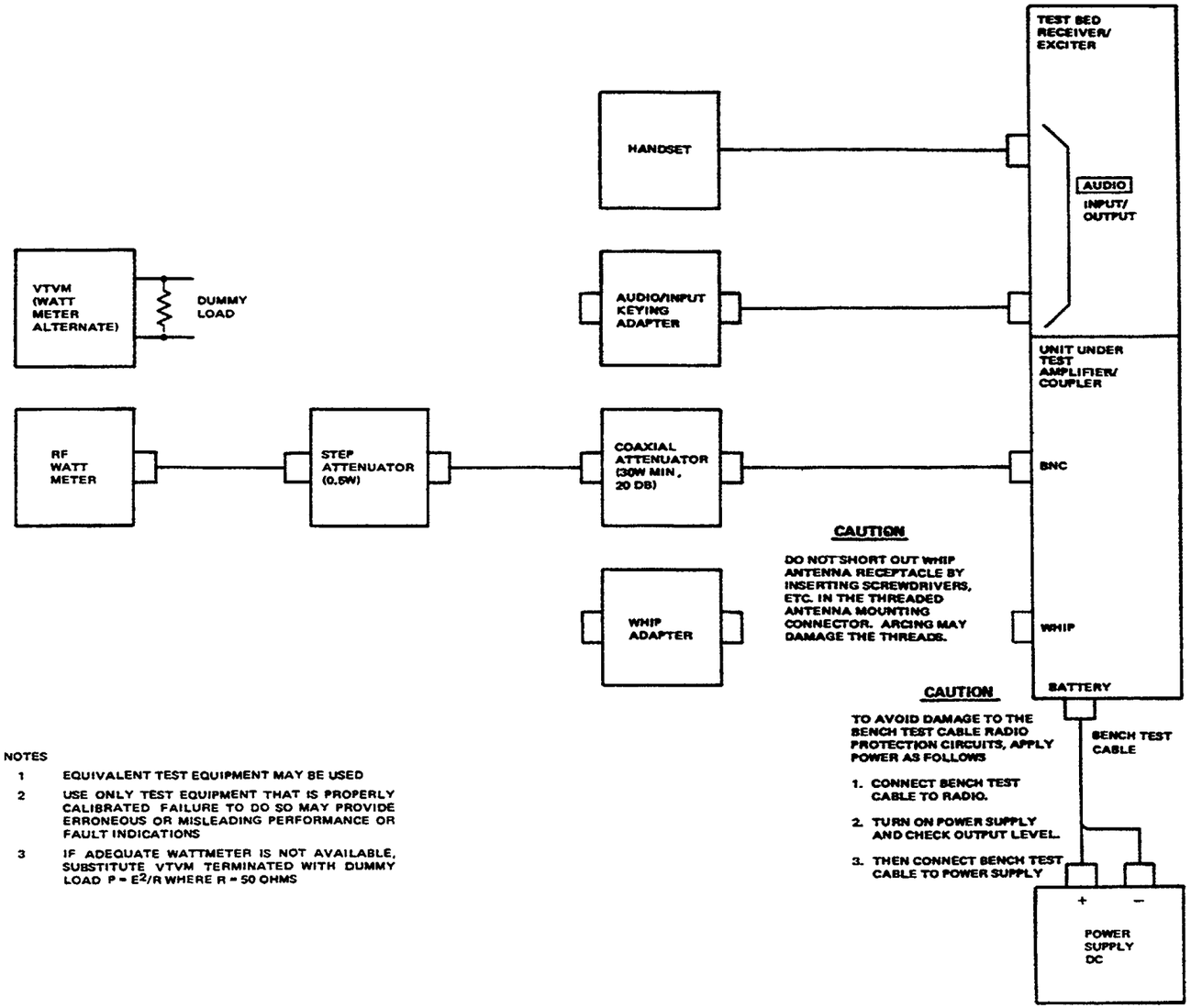


Figure 8-3. Amplifier/Coupler A2 Performance Test Setup

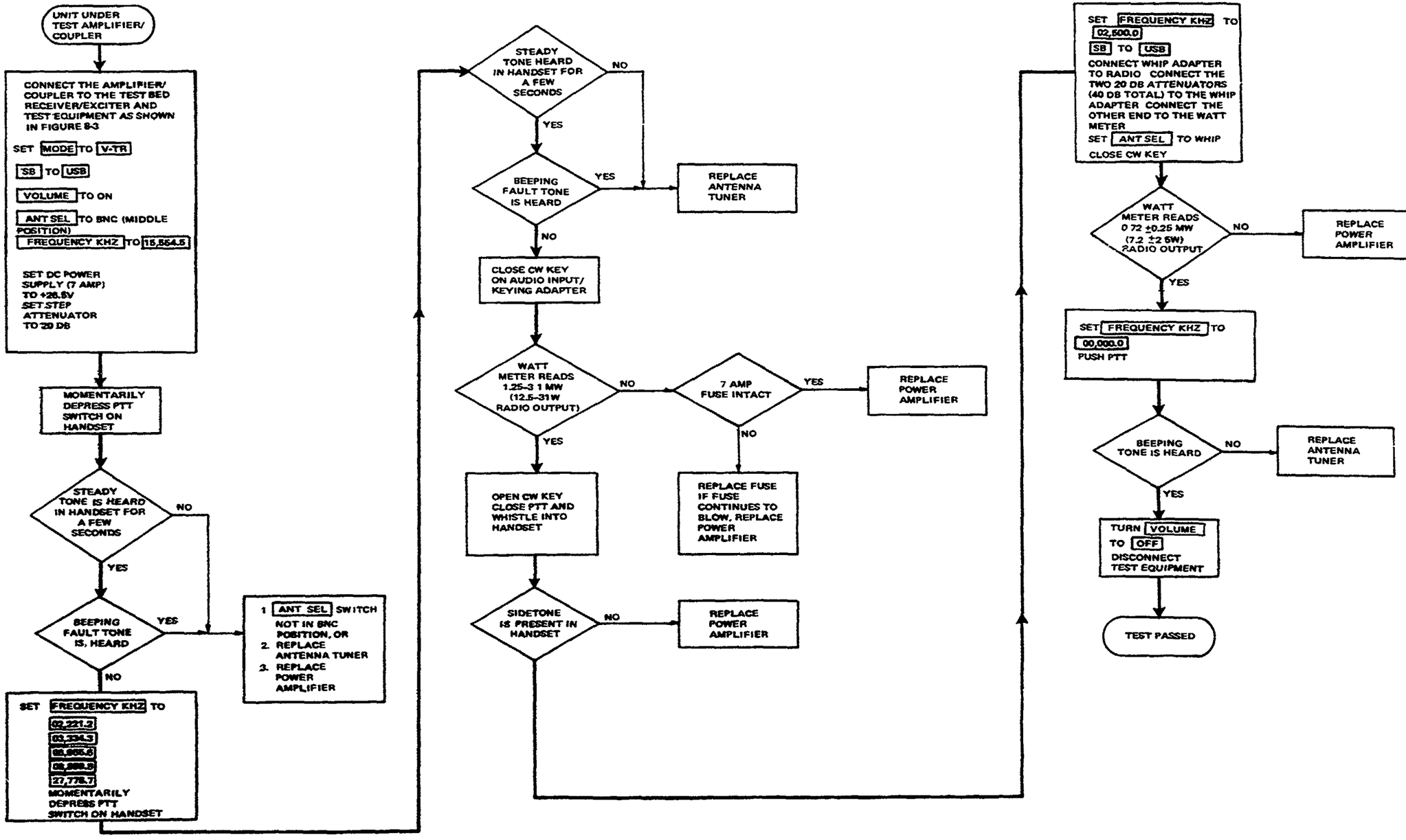
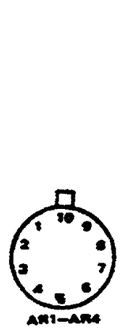
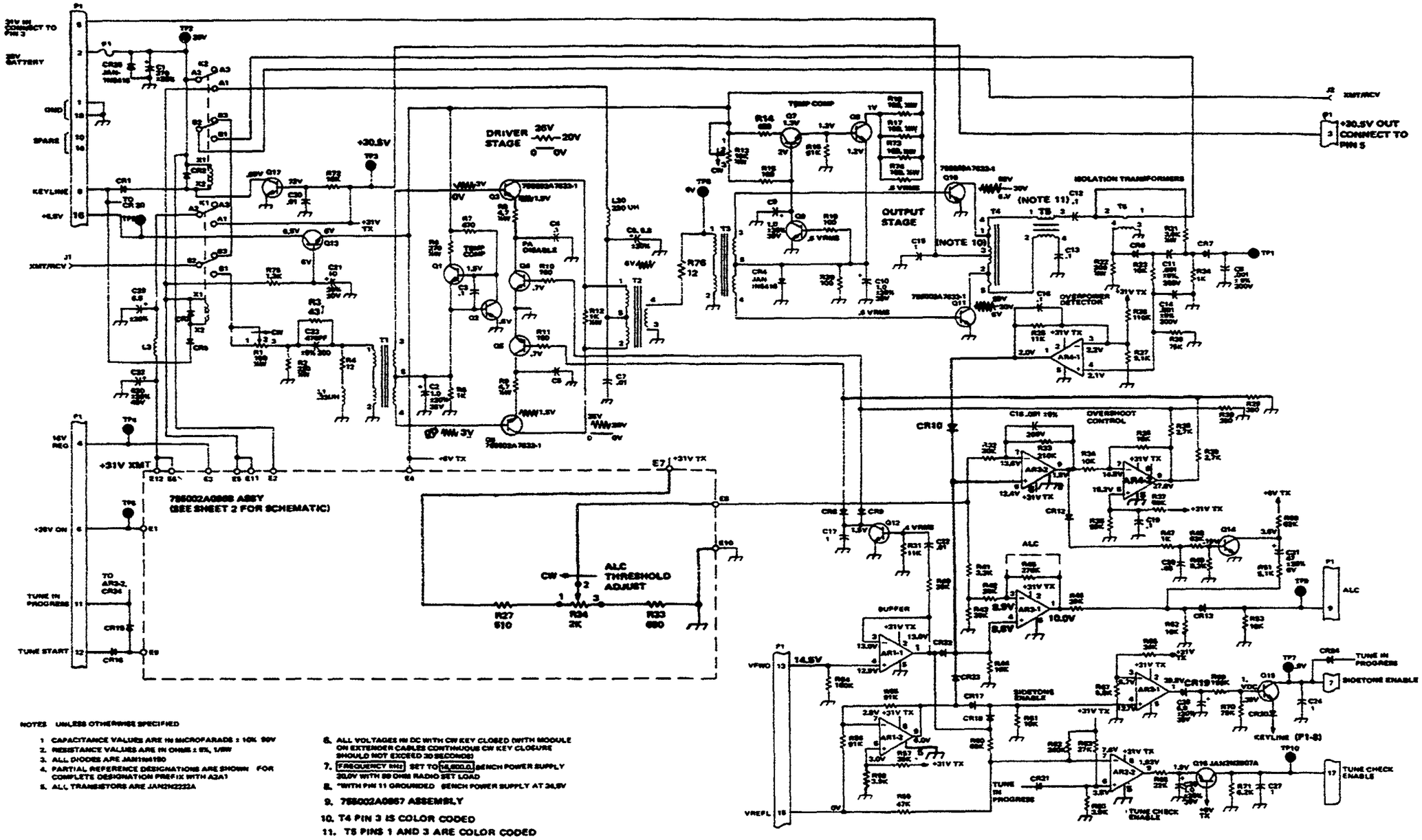


Figure 8-4. Amplifier/Coupler A2 Performance Test





NOTES UNLESS OTHERWISE SPECIFIED

1. CAPACITANCE VALUES ARE IN MICROFARADS ± 10% 50V
2. RESISTANCE VALUES ARE IN OHMS ± 5%, 1/8W
3. ALL DIODES ARE JAN1N4150
4. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH A2A1
5. ALL TRANSISTORS ARE JAN2N2222A
6. ALL VOLTAGES IN DC WITH CW KEY CLOSED (WITH MODULE ON EXTENDER CABLES CONTINUOUS CW KEY CLOSURE SHOULD NOT EXCEED 30 SECONDS)
7. FREQUENCY (MHz) SET TO 14.800.0, BENCH POWER SUPPLY 30.0V WITH 50 OHM RADIO SET LOAD
8. *WITH PIN 11 GROUNDED BENCH POWER SUPPLY AT 24.5V
9. 7555002A0667 ASSEMBLY
10. T4 PIN 3 IS COLOR CODED
11. T5 PINS 1 AND 3 ARE COLOR CODED

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

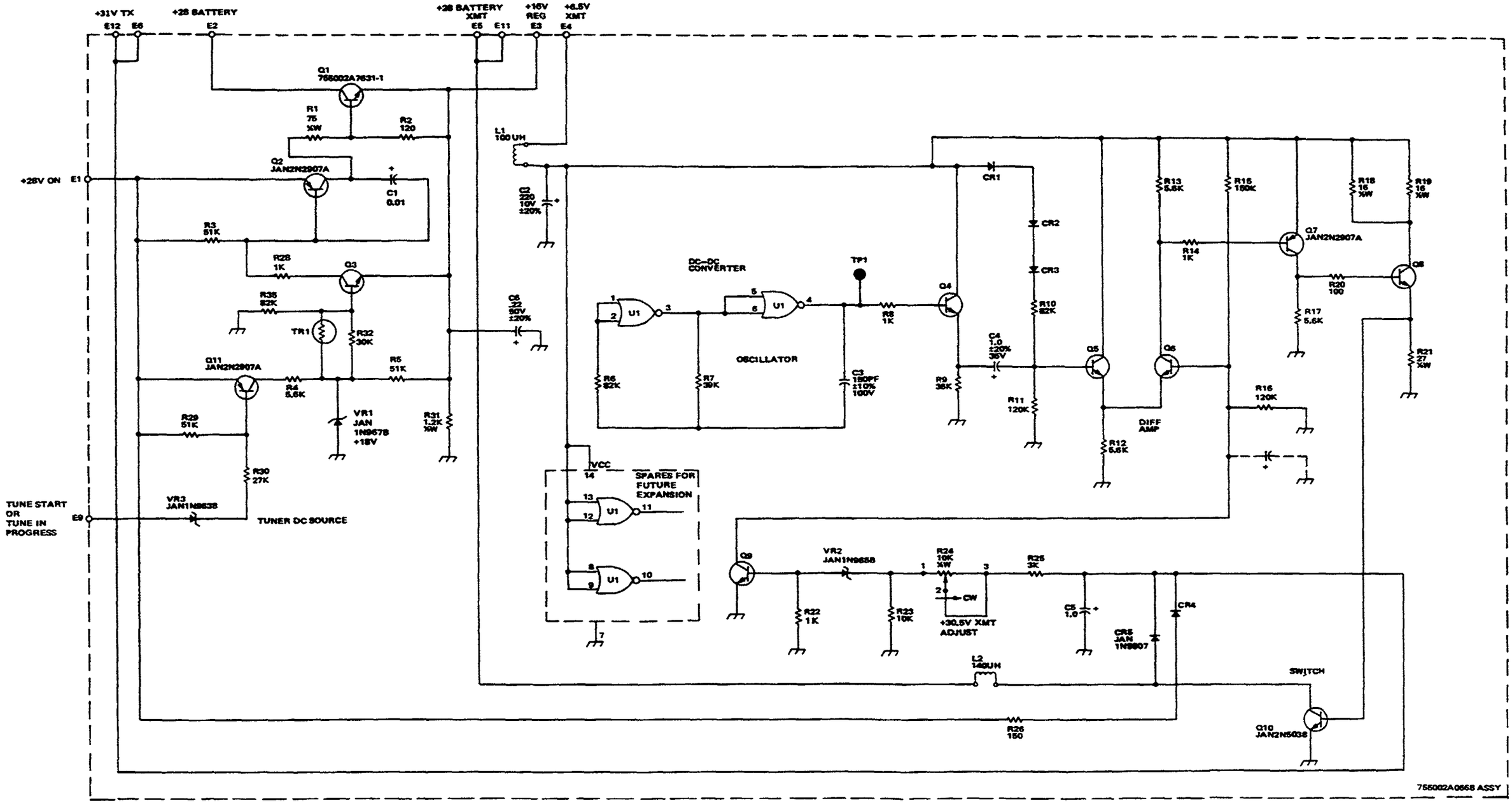


Figure 9-1. Power Amplifier A2A1 Schematic (Sheet 2 of 2)

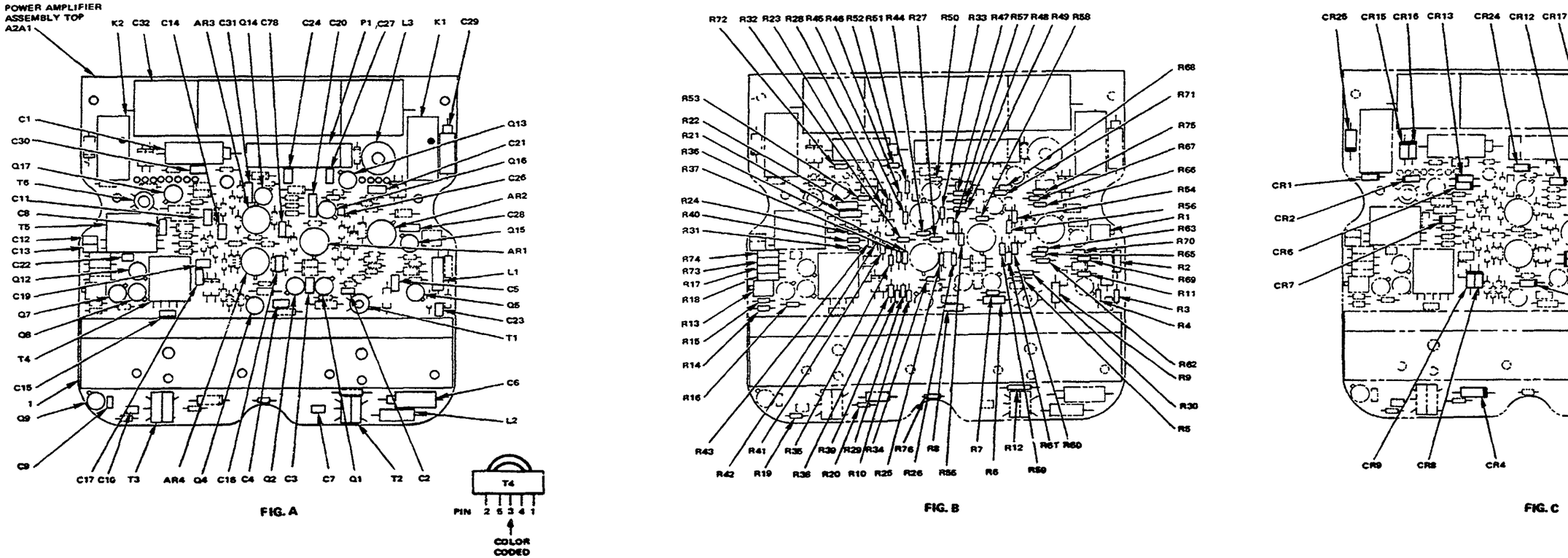
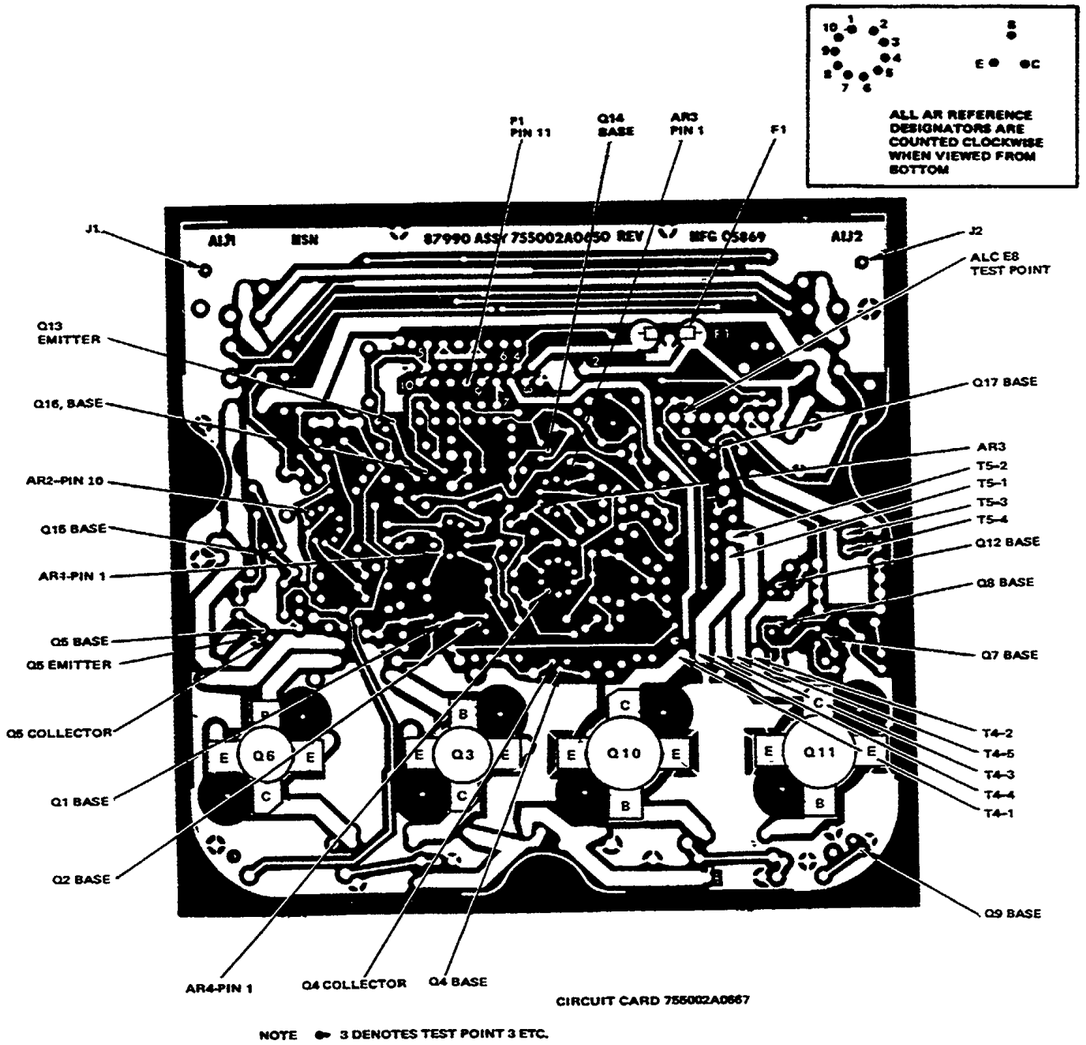


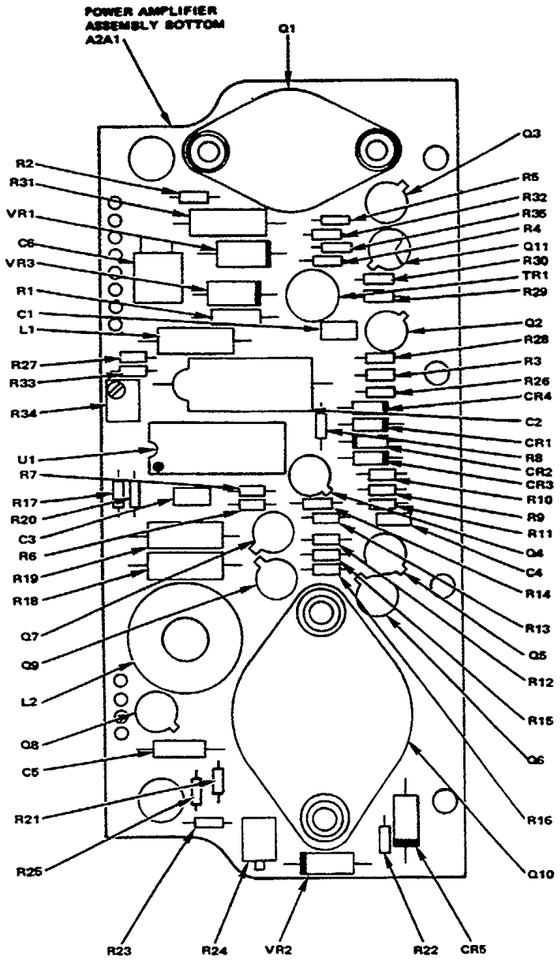
Figure 9-2. Power Amplifier A2A1 Component Location (Sheet 1 of 3)

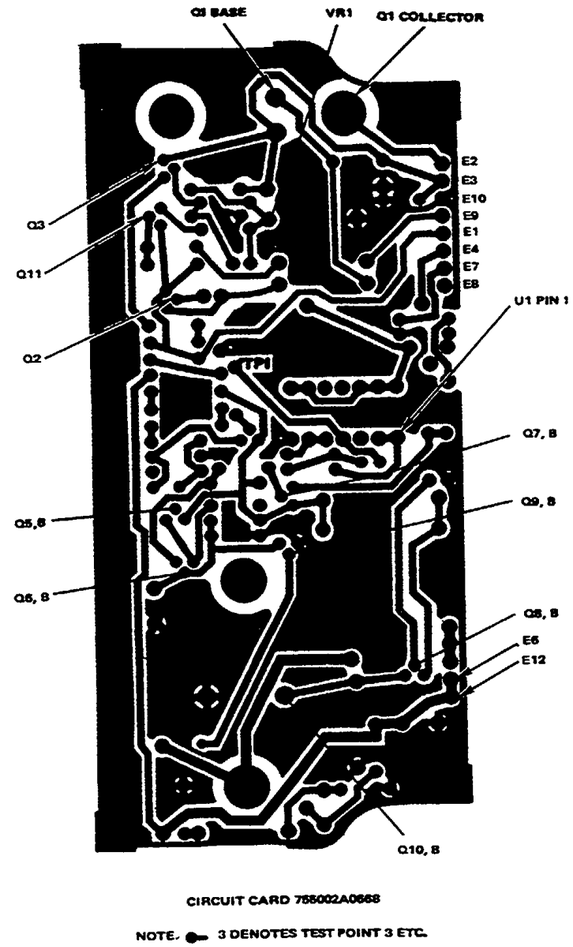


CIRCUIT CARD 755002A0667

NOTE ● 3 DENOTES TEST POINT 3 ETC.

POINTS OF TEST





CIRCUIT CARD 755002A0668

NOTE ● 3 DENOTES TEST POINT 3 ETC.

POINTS OF TEST

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

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

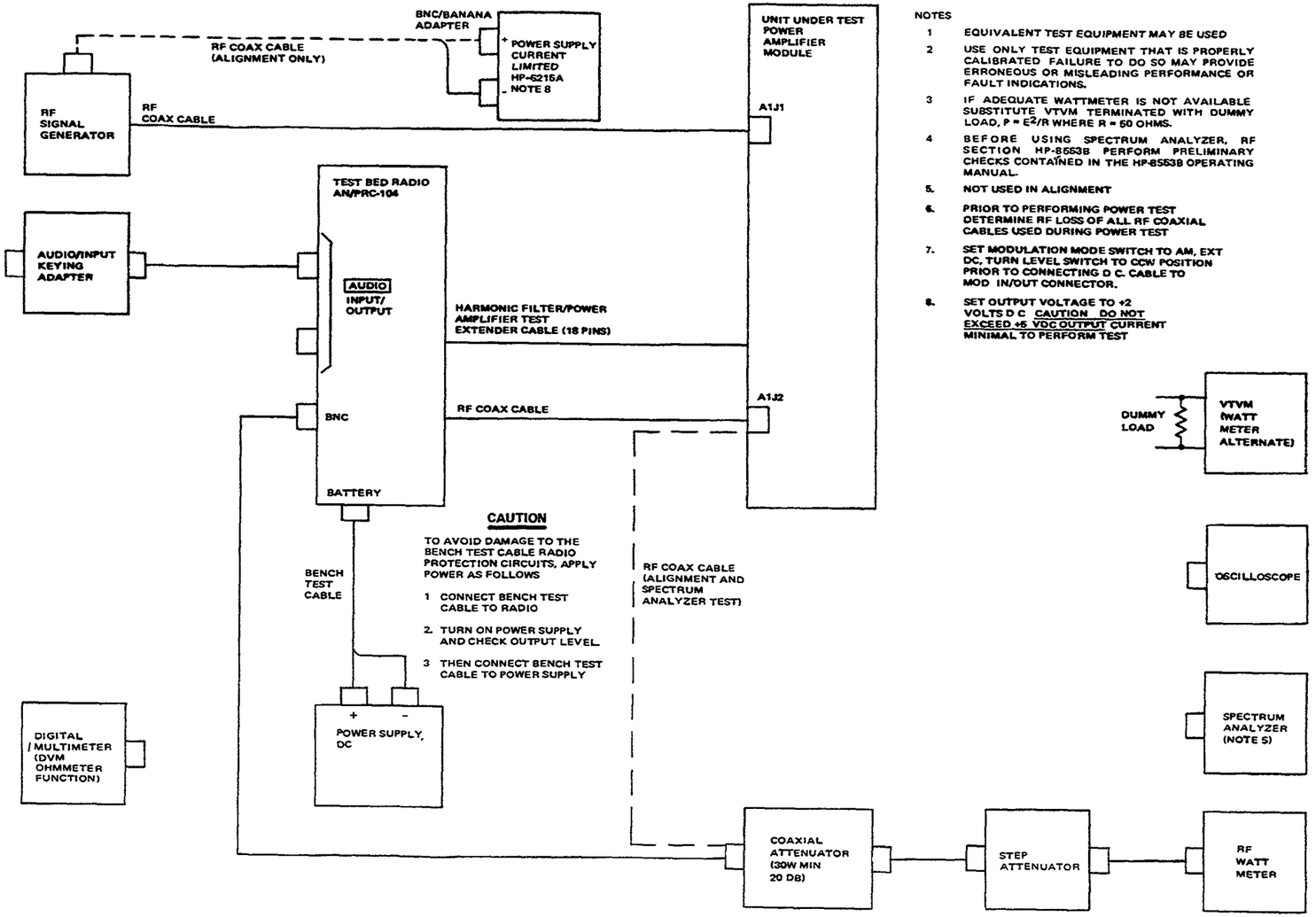


Figure 9-3. Power Amplifier A2A1 Performance Test and Alignment Setup

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

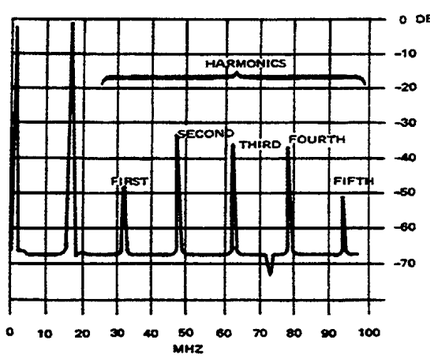


FIG. A

BANDWIDTH	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	90°

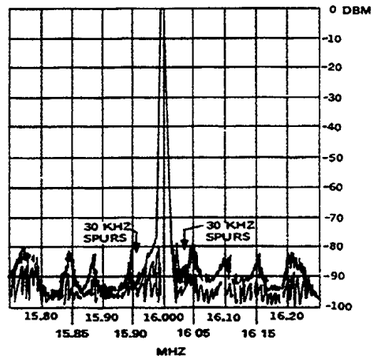


FIG. B

BANDWIDTH	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°

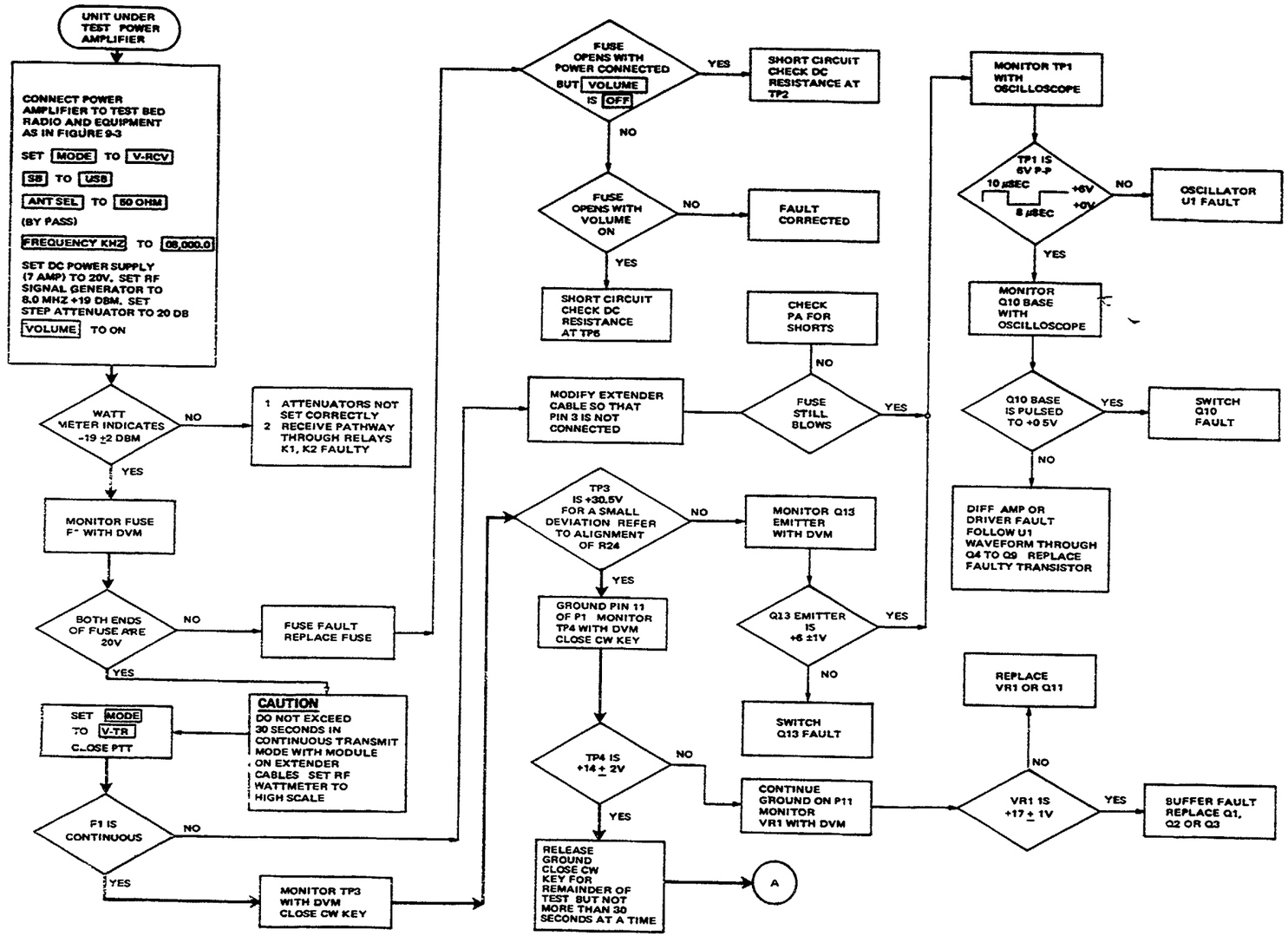


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 1 of 3)

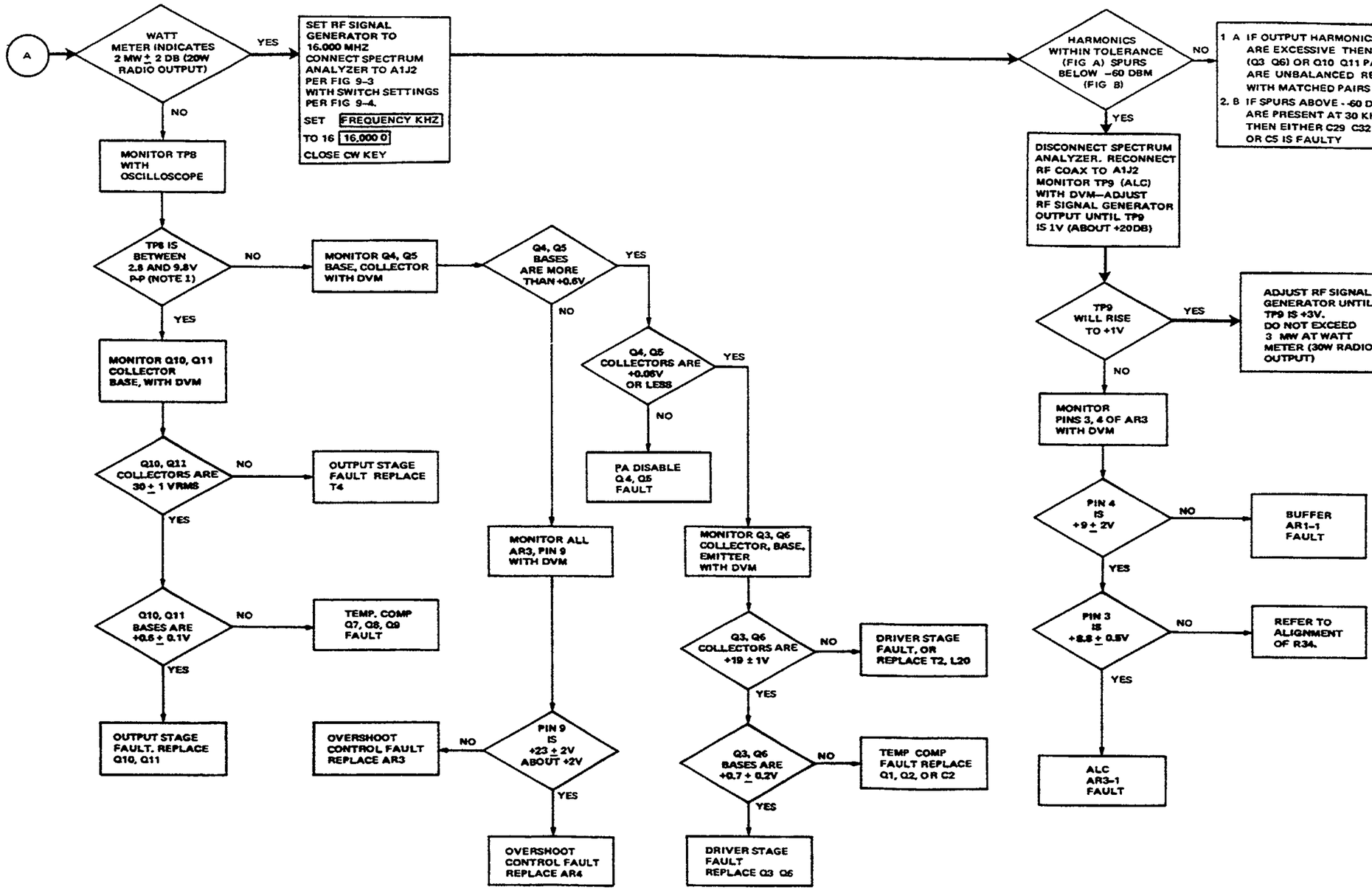


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 2 of 3)

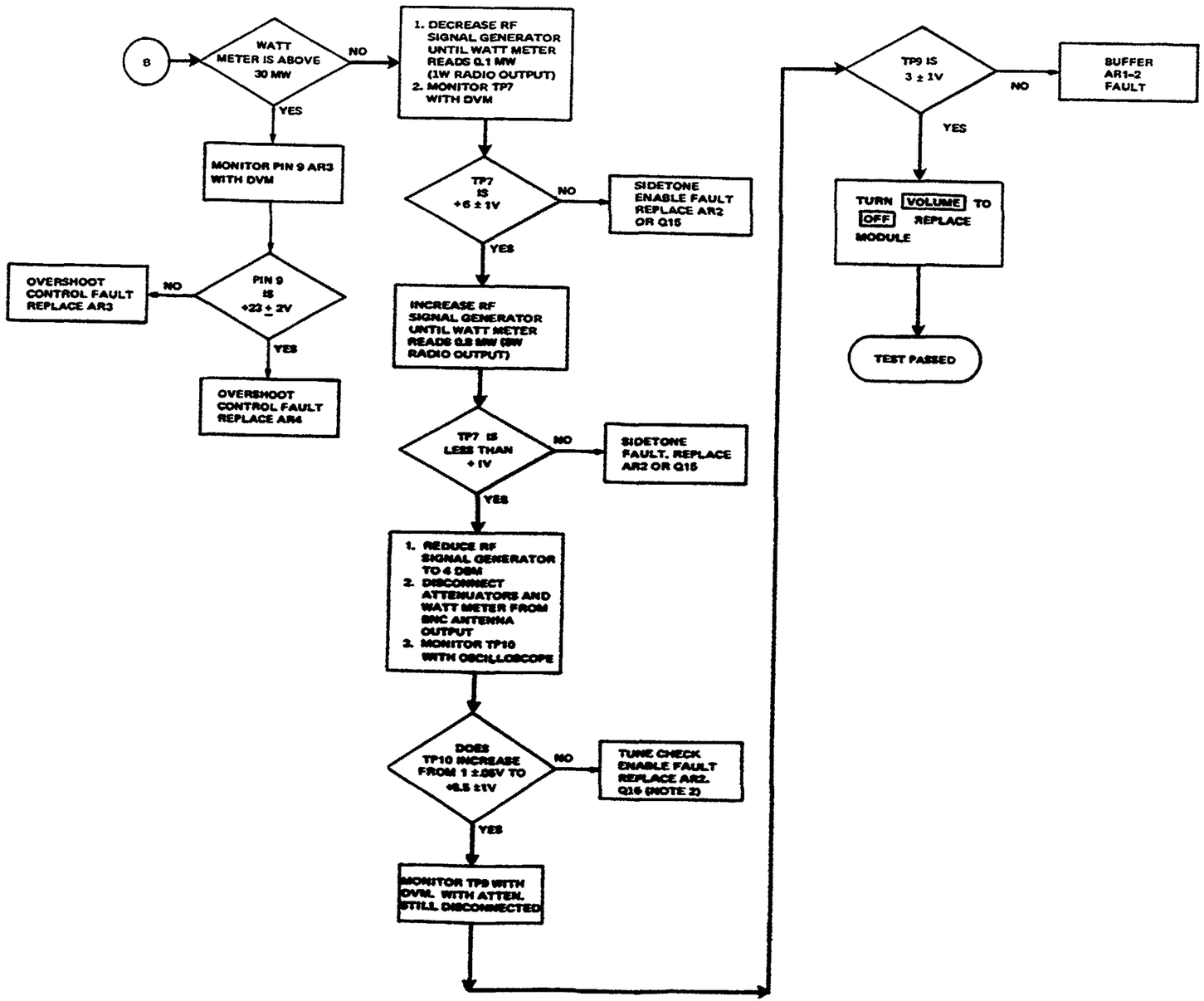


Figure 9-4. Power Amplifier A2A1 Performance Test (Sheet 3 of 3)

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.

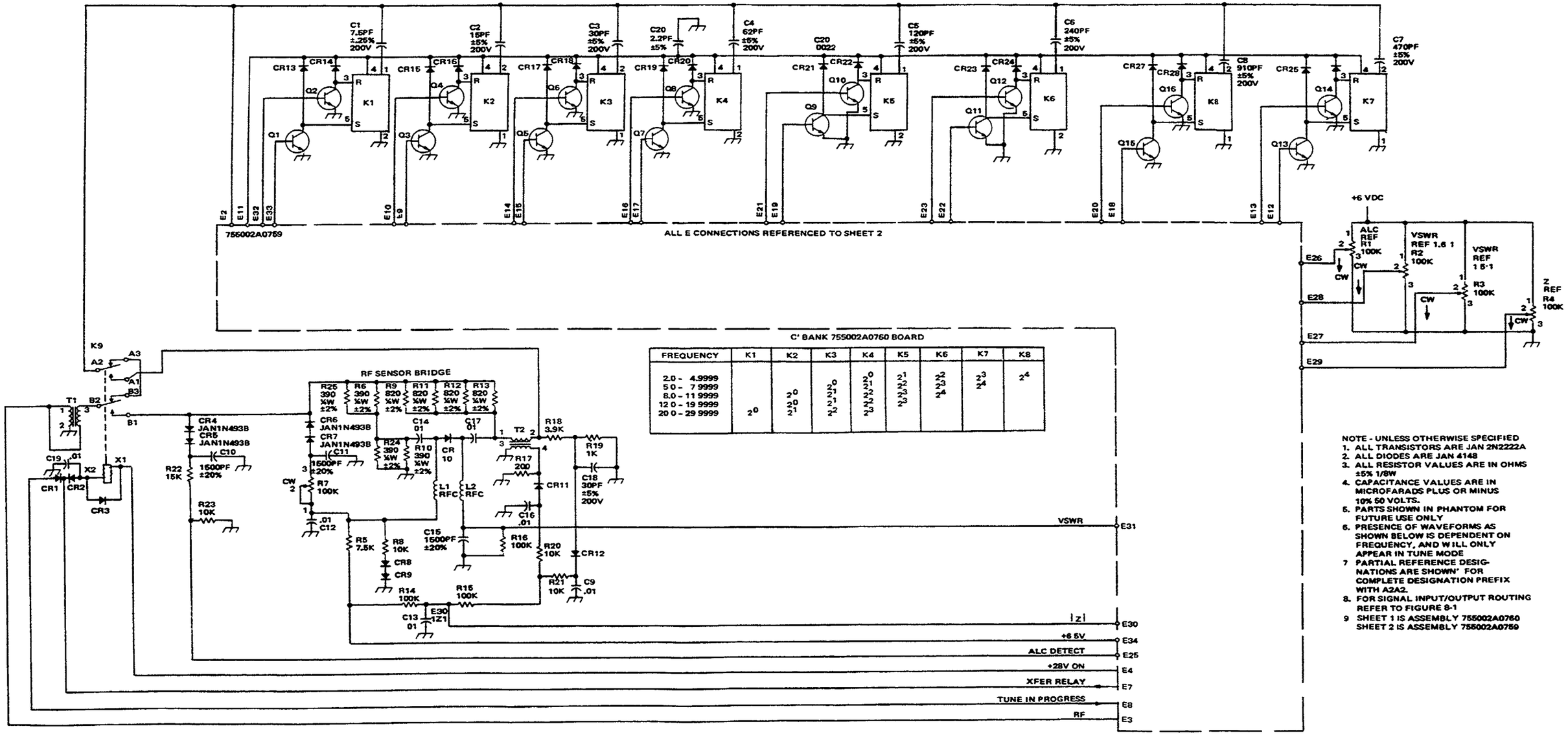
2. On the 18 pin extender cable remove the jumper lead between the two test points. Insert a dc ammeter in place of the jumper and select a range of at least 100ma. Ensure that positive lead is inserted into test point closest to the connector on the PA module. Close PTT only long enough to adjust R13 (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.

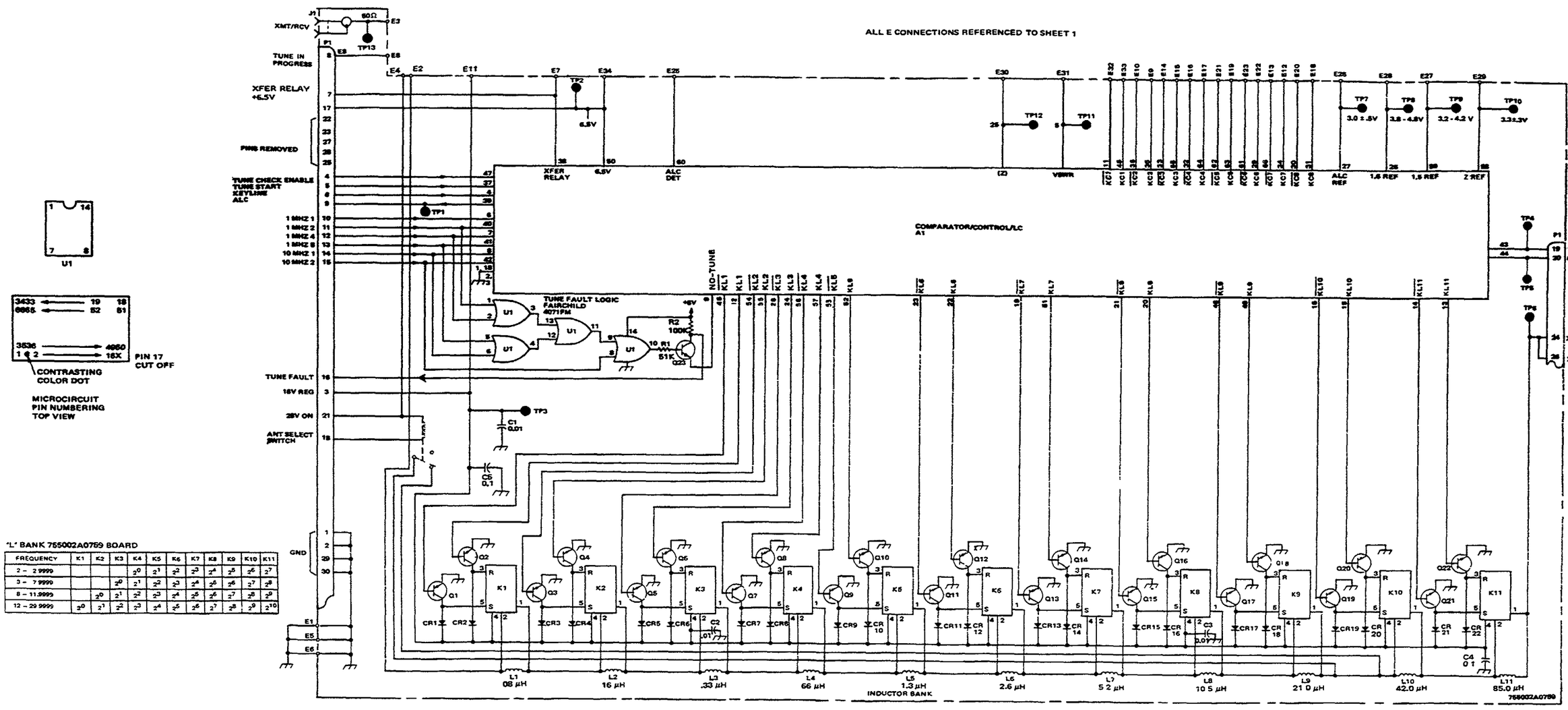
5. Open PTT, disconnect test equipment.

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



NOTE - UNLESS OTHERWISE SPECIFIED
1. ALL TRANSISTORS ARE JAN 2N2222A
2. ALL DIODES ARE JAN 4148
3. ALL RESISTOR VALUES ARE IN OHMS ±5% 1/8W
4. CAPACITANCE VALUES ARE IN MICROFARADS PLUS OR MINUS 10% 50 VOLTS.
5. PARTS SHOWN IN PHANTOM FOR FUTURE USE ONLY
6. PRESENCE OF WAVEFORMS AS SHOWN BELOW IS DEPENDENT ON FREQUENCY, AND WILL ONLY APPEAR IN TUNE MODE
7. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN' FOR COMPLETE DESIGNATION PREFIX WITH A2A2.
8. FOR SIGNAL INPUT/OUTPUT ROUTING REFER TO FIGURE 8-1
9. SHEET 1 IS ASSEMBLY 755002A0760 SHEET 2 IS ASSEMBLY 755002A0759

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



"L" BANK 755002A0759 BOARD

FREQUENCY	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11
2 – 2.9999				2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7
3 – 7.9999			2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8
8 – 11.9999		2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9
12 – 29.9999	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}

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

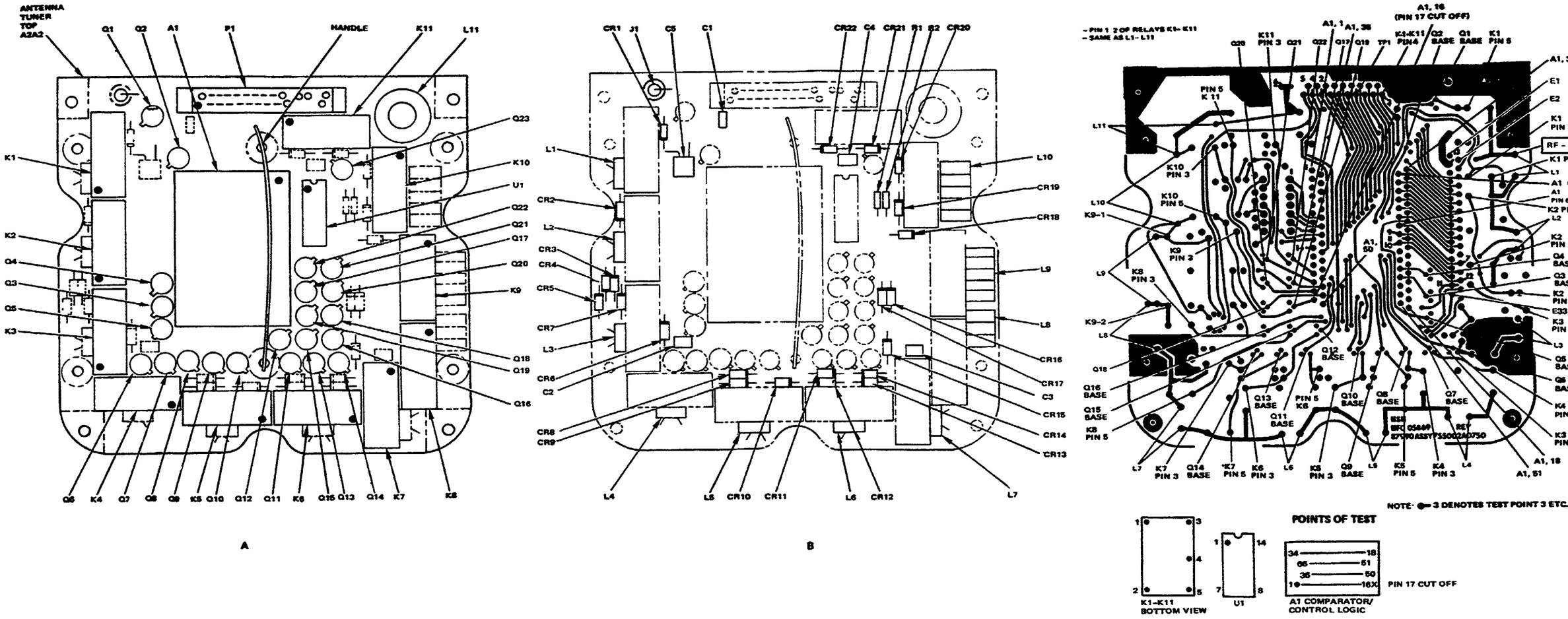


Figure 10-2. Antenna Tuner A2A2 Component Location (Sheet 1 of 3)

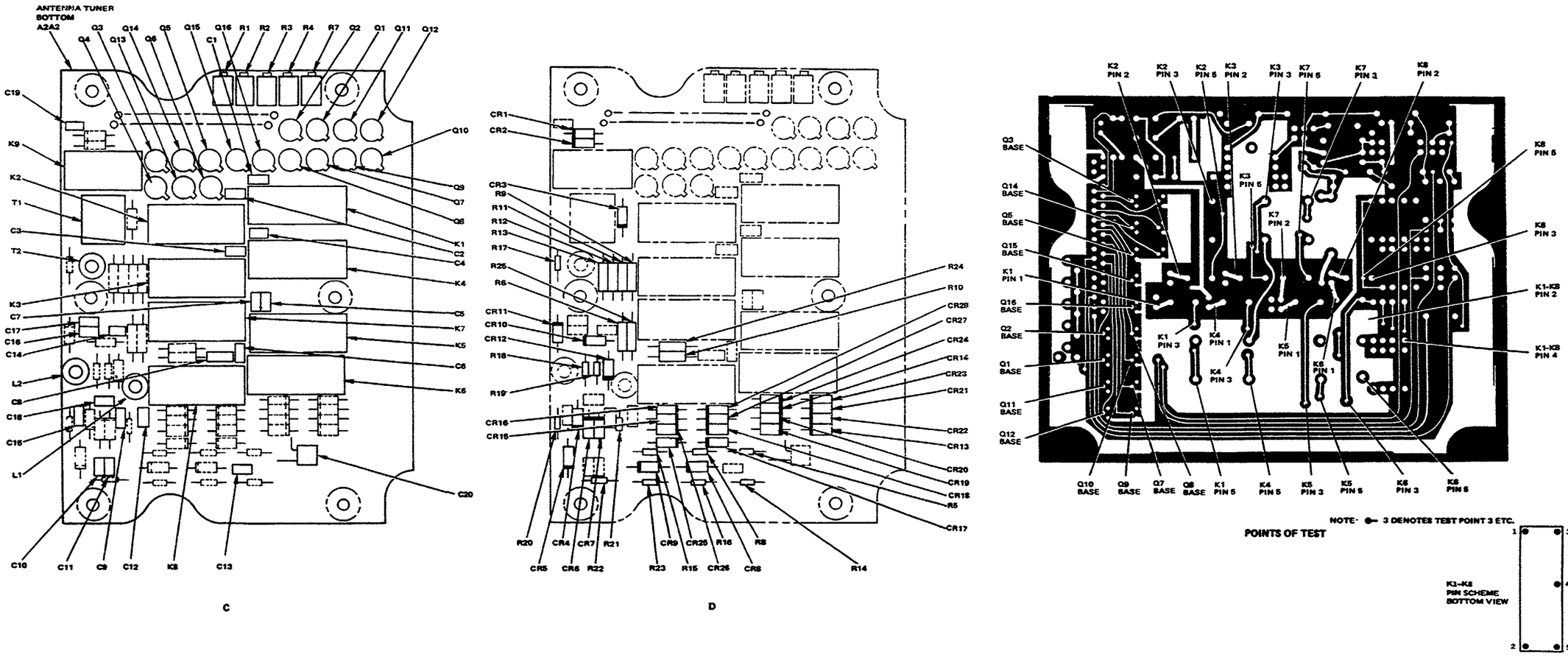


Figure 10-2. Antenna Tuner A2A2 Component Location (Sheet 2 of 3)

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

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

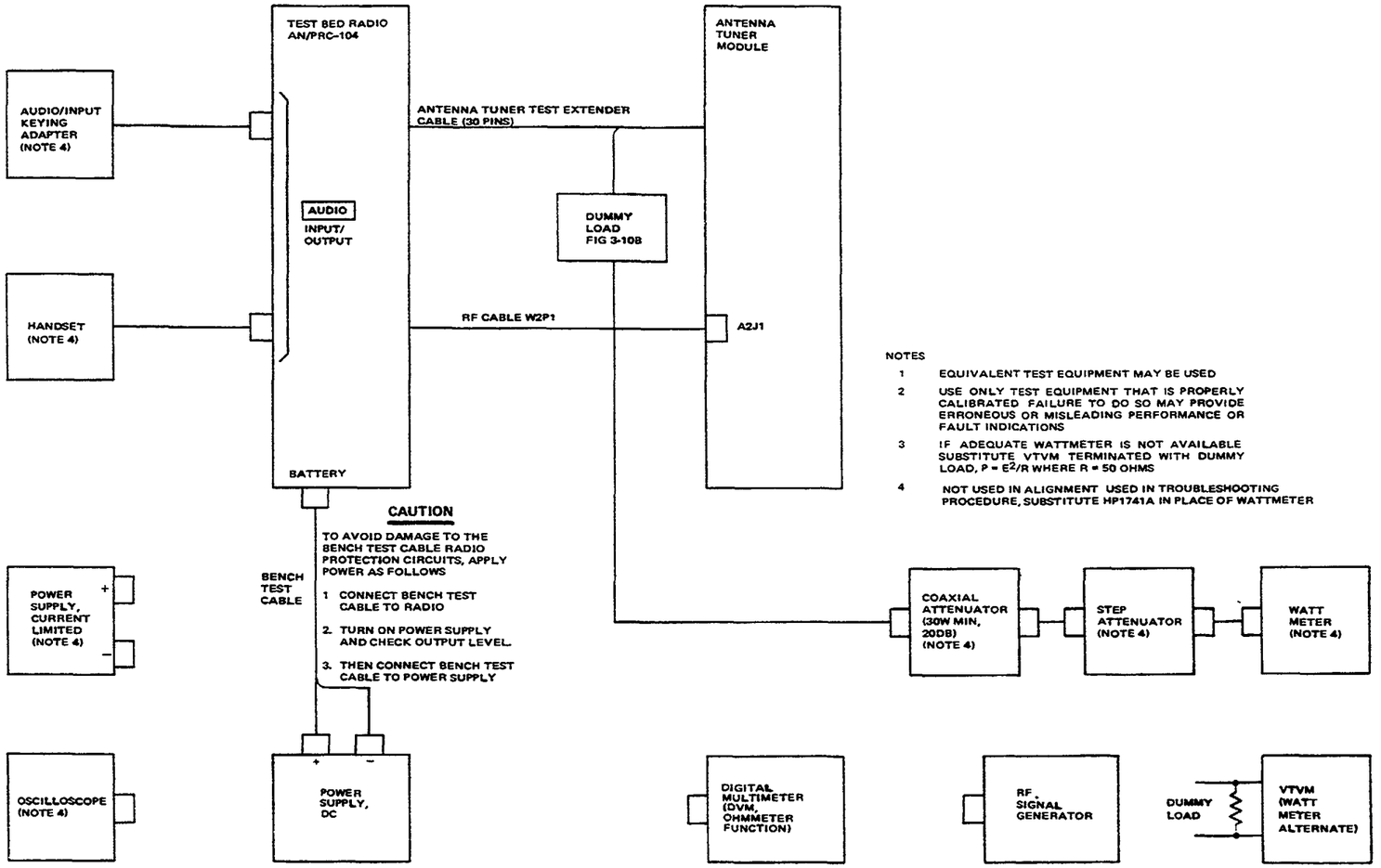


Figure 10-3. Antenna Tuner A2A2 Performance test Setup

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 came pare 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 coca not occur, then refer module to fifth echelon repair level.

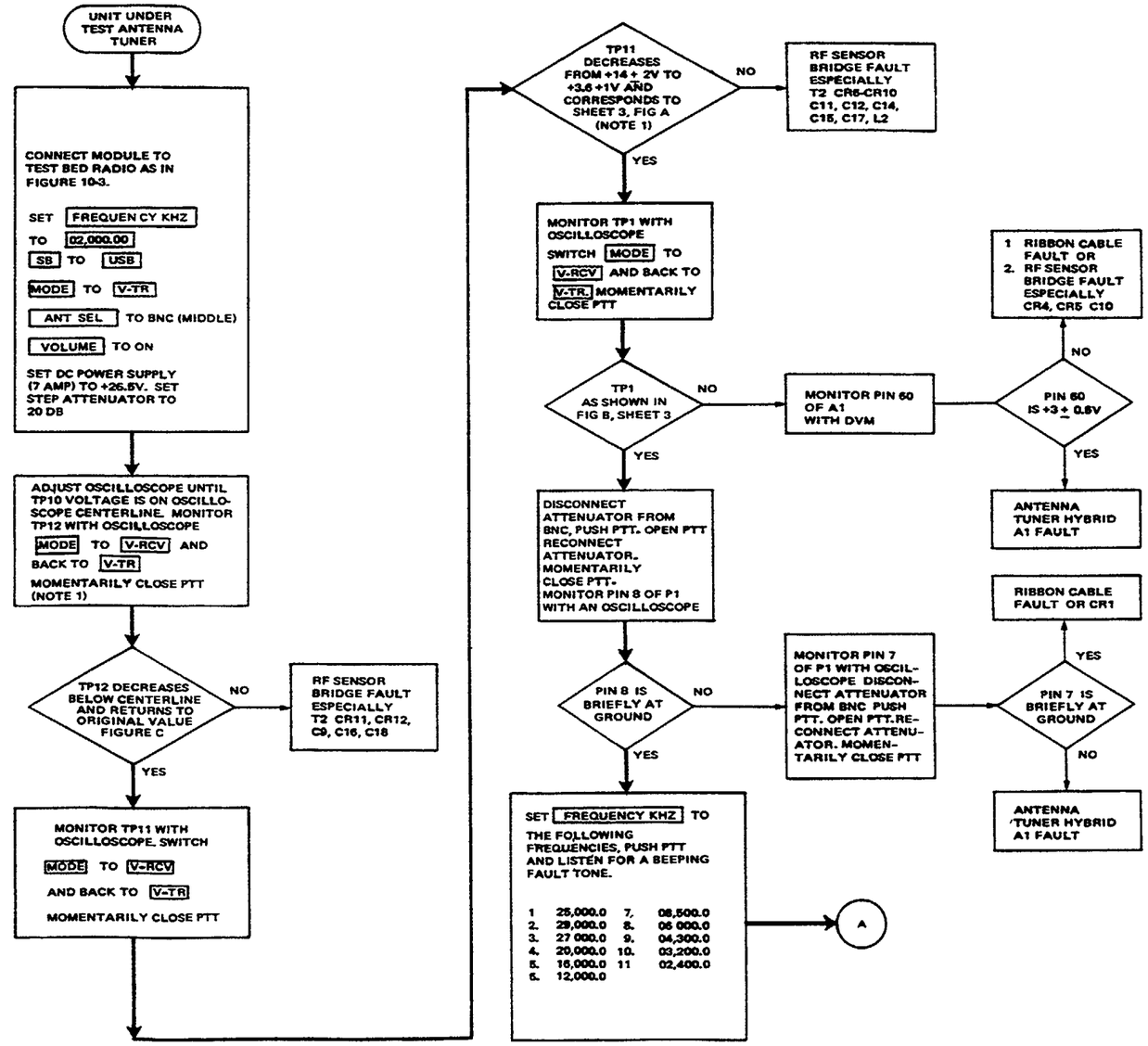


Figure 10-4. Antenna Tuner A2A2 Performance Test (Sheet 1 of 3)

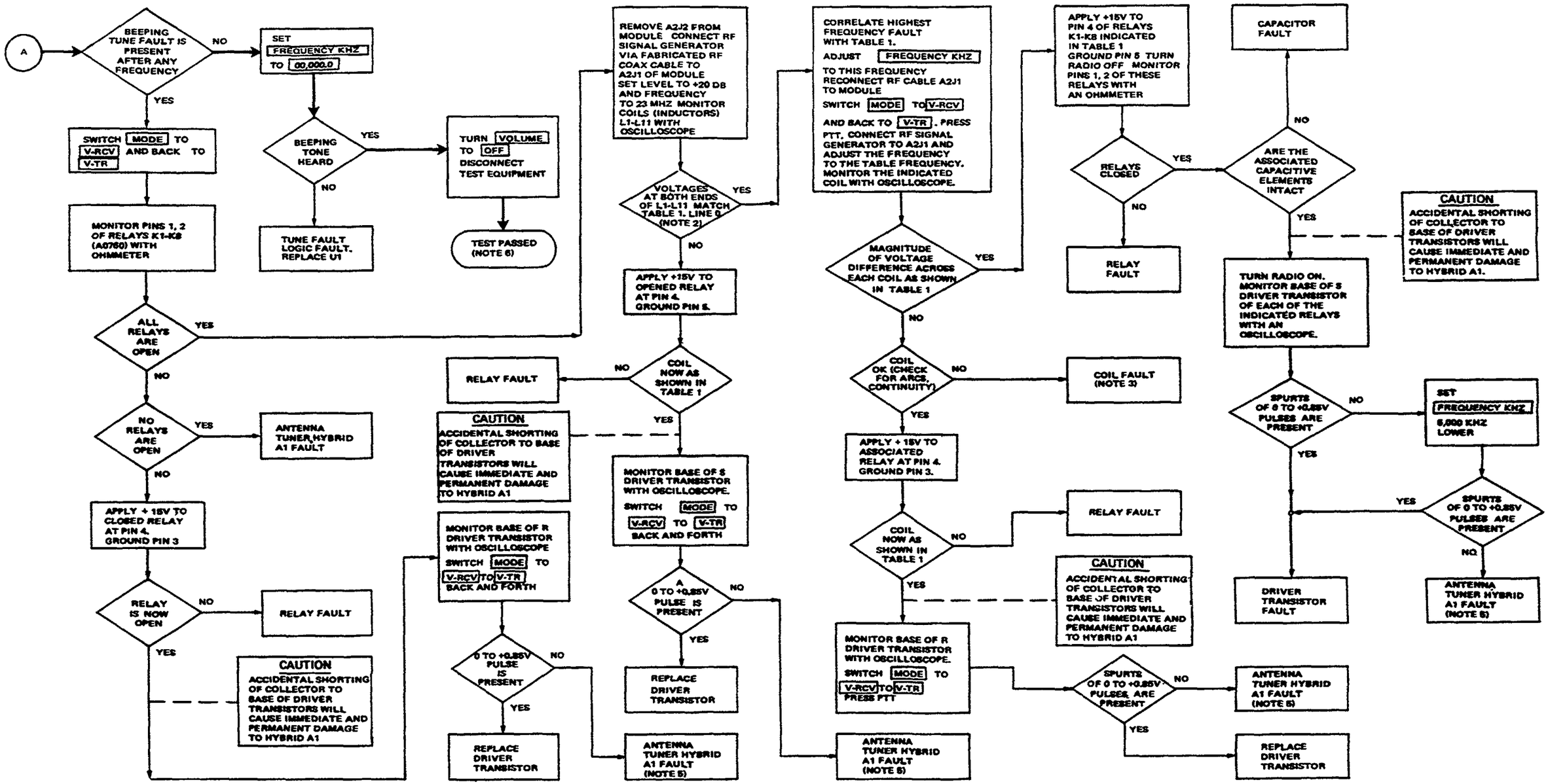


Figure 10-4. Antenna Tuner A2A2 Performance Test (Sheet 2 of 3)

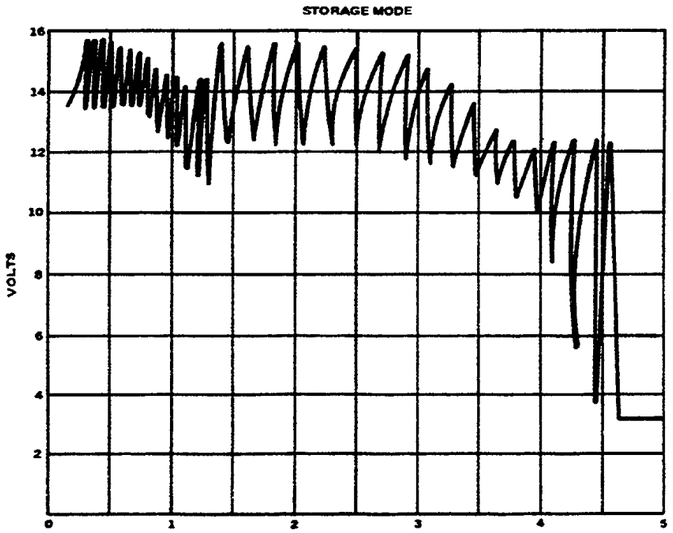
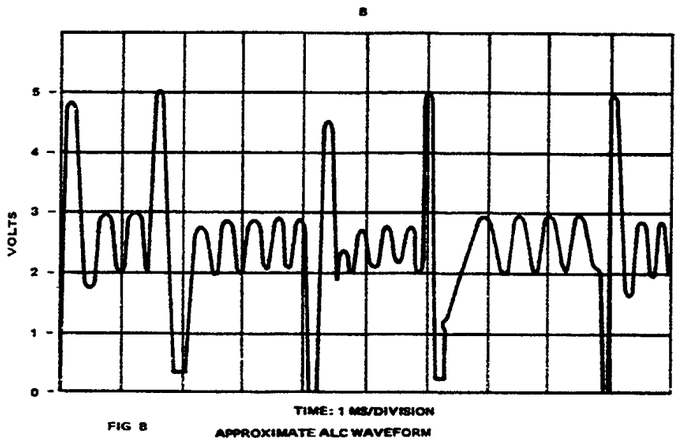


FIG. A
APPROXIMATE VSWR WAVEFORM



TIME: 1 MS/DIVISION

FIG B
APPROXIMATE ALC WAVEFORM

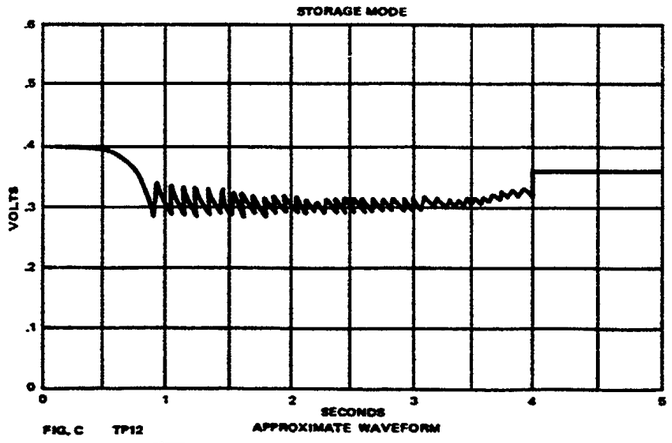


FIG. C TP12
APPROXIMATE WAVEFORM

HP-1741A WITH 10:1 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	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	CAPACITIVE RELAYS TO CHECK FOR EACH FREQUENCY 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	4.6/5	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				7/6	6/23*	23/23									X	X	X		
6. 12,000					5/5	5/35*	35/35								X	X	X		
7. 08,500						3.5/3.5	3.5/40*	40/40								X	X	X	
8. 05,000							2.5/2.5	2.5/15*	15/15							X	X	X	
9. 04,300								14/14	14/60*	60/60							X	X	X
10. 03,200									27/27	27/50*	50/50						X	X	X
11. 02,400										30/30	30/60*						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)

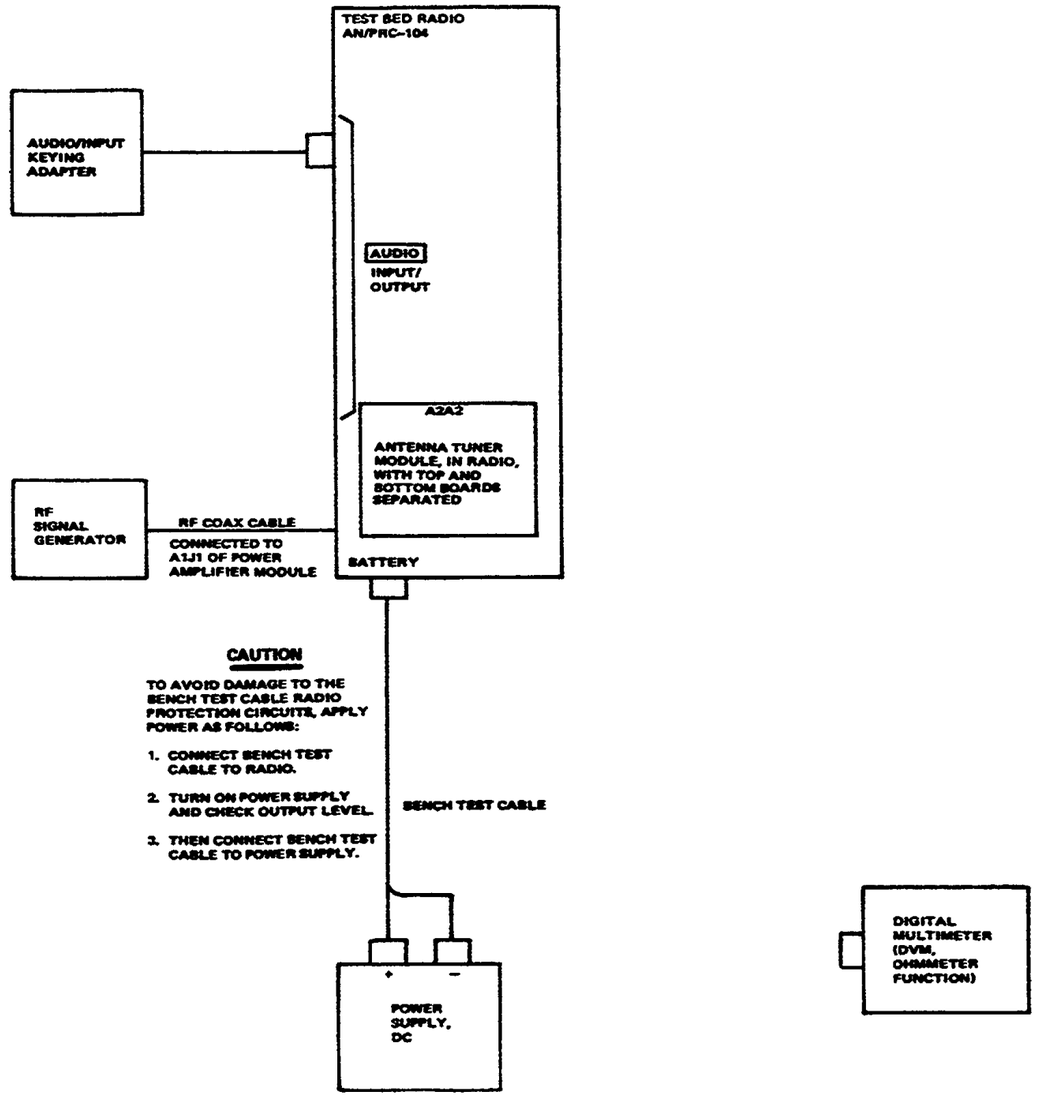
SPECIAL TOOLS, MATERIALS, AND FABRICATED TEST CABLES AND FIXTURES

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 tine.

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
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