MODEL
MS4782A/MS4782D
TEST SET FOR
POWER AMPLIFIER TEST SYSTEM

MAINTENANCE MANUAL

Anritsu

490 JARVIS DRIVE ı MORGAN HILL, CA 95037-2809

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General Information

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Figure 1-1. *Typical MS4782X Test Set*

Chapter 1
General Information

1-1 SCOPE OF MANUAL

This manual provides general service and preventive maintenance information for the ANRITSU MS4782A and MS4782D Test Set for the ME7840A Power Amplifier Test System. It contains procedures for:

- Testing the instrument for proper operation.
- Verifying measurement accuracy and traceability to National Institute of Standards and Technology (NIST).
- Troubleshooting a failed instrument to the exchange subassembly level or the subsystem requiring adjustment.
- Locating and replacing failed parts.

Throughout this manual, the terms "MS4782X" and "Test Set" will be used interchangeably to refer to both Models of MS4782X Test Set, unless otherwise noted.

1-2 INTRODUCTION

This chapter provides a general description of Power Amplifier Test System serial numbers, frequency ranges, and related manuals. It also includes service strategy, available service facilities, and static-sensitive component handling precautions, and a list of recommended test equipment.

1-3 IDENTIFICATION NUMBER

All ANRITSU instruments are assigned a six-digit ID number, such as "401001". This number appears on a decal affixed to the rear panel. Please use this identification number during any correspondence with ANRITSU Customer Service about this instrument.

1-4 ONLINE MANUAL

This manual is available on CD ROM as an Adobe Acrobat™ (*.pdf) file. The file can be viewed using Acrobat Reader™, a free program that is also available on the CD ROM. This file is "linked" such that the viewer can choose a topic to view from the displayed "bookmark" list and "jump" to the manual page on which the topic resides. The text can also be word-searched. A copy of this CD ROM, part number 10920-00035, is provided free of charge with this manual.

1-5 PATS SYSTEM OVERVIEW

The ANRITSU ME7840A Power Amplifier Test System (PATS) is intended for the measurement and real-time graphical display of the following parameters of a power amplifier in the frequency range of 800 MHz to 2.4 GHz:

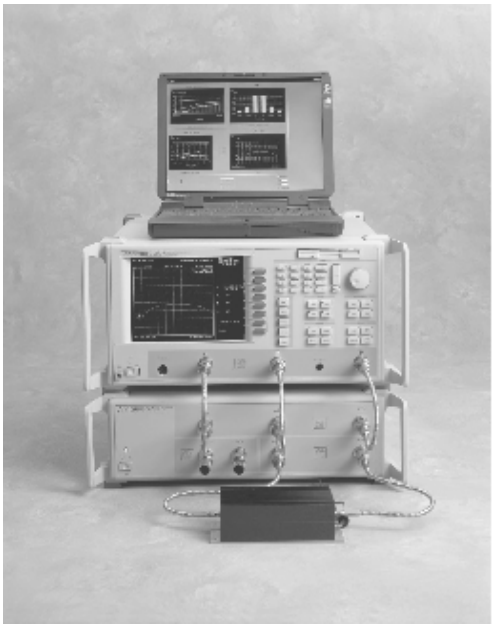
- S-Parameters including Hot S_{22}
- K Factor
- Gain Compression and Phase Distortion
- Intermodulation Distortion
- Harmonics
- Drain Current and Power Added Efficiency (PAE)

PATS is designed to facilitate alignment, tuning and pass/fail testing of the components, modules and subassemblies of a power amplifier as well as the completed amplifier.

1-6 HARDWARE DESCRIPTION

The ME7840A hardware (below) consists of a MS462XC, Direct Receiver Access (DRA) Scorpion, a MS4782X Test Set, a customer supplied Personal Computer (PC), and an optional current probe. The MS462XC is available in two frequency ranges: 10 MHz to 3 GHz or 10 MHz to 6 GHz.

The Test Set is available in two configurations, as described in Table 1-1 The MS4782D is standard, and the MS4782A is Option 2. A block diagram of the PATS is shown in Figure 1-2 and the Option 2 system in Figure 1-1.



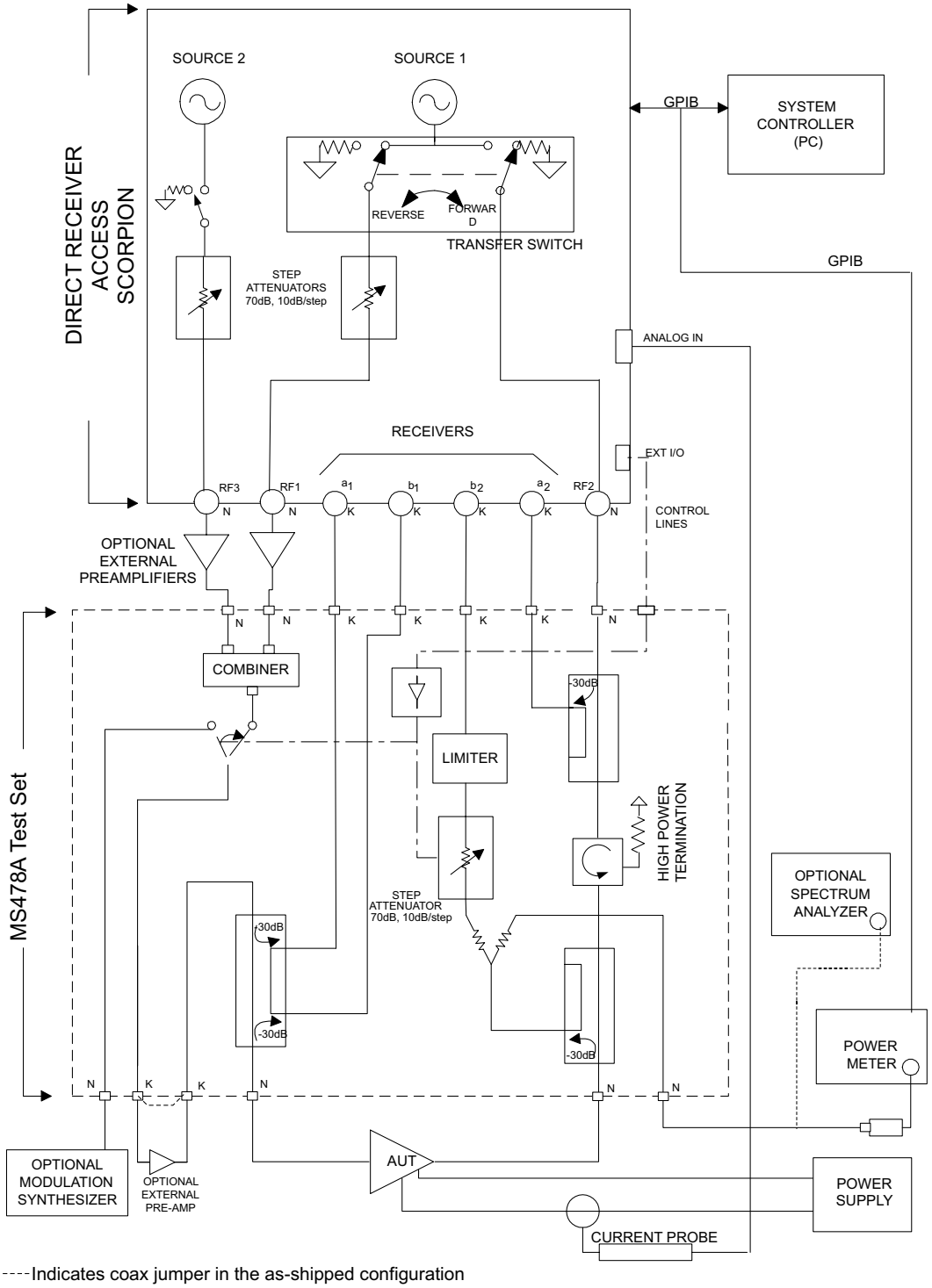


Figure 1-1. *Overall Functional Block Diagram of the Option 2 Power Amplifier Test System (PATS) with MS4782A Test Set*

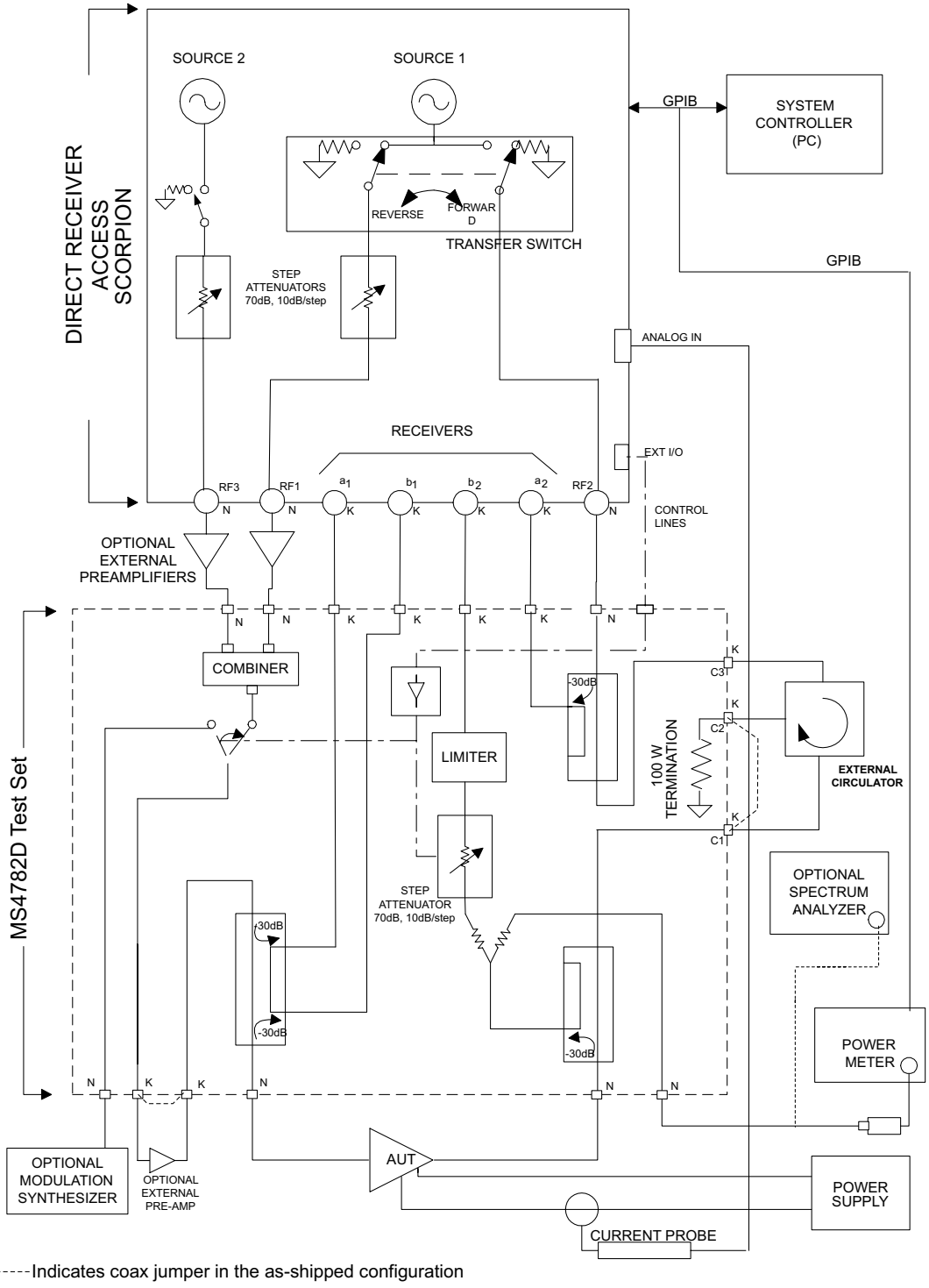


Figure 1-2. *Overall Functional Block Diagram of the Basic Power Amplifier Test System (PATS) with MS4782D Test Set*

Table 1-1. *Test Set Configurations*

Model	Frequency Range (MHz)	Max AUT Power Output (Watts)	Reverse Measurements (S_{22}, Hot S_{22}, S_{12} Possible)	Circulator (at AUT Output Path)
MS4782A	800 to 1000	50	Yes	Internal
MS4782D	800 to 2400 (Note 1)	100 (Note 2)	Yes	External

Notes:

1. This frequency range does not account for any restricting effects caused by use of external circulator.
2. This Max AUT power assumes a minimum isolation of 23 dB provided by external circulator(s). Two circulators may have to be used to provide the required isolation.

1-7 SYSTEM DESCRIPTION

Brief descriptions of the DRA Scorpion (MS462XC) and MS4782X Test Set are given below.

DRA Scorpion

The Scorpion Direct Receiver Access (DRA) version Vector Network Measurement System (VNMS) (Figure 1-2) functions under control of the software residing in the PC through GPIB commands. The software supports tuning and alignment operations by generating real time graphic displays of the measured data on the PC screen.

Under software control, 3rd, 5th and 7th order IMD products can be measured and displayed. Also, the Upper and Lower Side Band (USB & LSB) components of the IMD products are measured and displayed separately.

The DRA Scorpion includes the following capabilities:

- Two internal, independent RF sources. Each source has a range of –15 dBm to +10 dBm. A 0dB to 70dB step attenuator (10 dB / step) is provided for each source resulting in a Power Output range of –85 dBm to +10 dBm from each source.
- Complete built-in capability for IMD measurements. A combiner is provided in the Test Set.
- Internal Transfer Switch enabling S_{22} and Hot S_{22} measurements. The reflectometer set-up is provided in the Test Set.
- Direct access to each of the four receiver channels (two reference channels and two test channels) for maximum flexibility in measuring forward and reverse S-parameters over a wide range of AUT output power. The Test Set provides incident and reflected signal separation.

MS4782X Test Set

The Series MS4782X Test Set contains a Wilkinson type combiner that combines the two RF signals from Ports 1 and 3 (RF1 & RF3) of the Scorpion. External preamplifiers can optionally be provided at the

combiner input to boost the input RF power to the amplifier-under-test (AUT). The combiner has power input rating of 30-Watts maximum when terminated with a VSWR of 1.2:1. For an open or short at the combiner output, the combiner input power rating is 0.5 Watts maximum.

The output of the combiner is fed to a source selection switch that enables one of the following to be applied to the AUT:

- The combined signal from the Scorpion sources.
- A modulated signal from an optional external modulation synthesizer.

A provision for the insertion of an optional external pre-amplifier (after the combiner and source selection switch) is also provided. Refer to Chapter 7, “Preamplifier Operations,” for details.

The test set includes a bi-directional coupler at the input of the AUT that separates the incident signal from the reflected signal. The power rating of this bi-directional coupler is 100 watts average. The –30 dB portion of the incident and reflected signals are applied to the Scorpion reference port a_1 and test port b_1, respectively, for S_{11} measurement. The S_{11} measurement determined by the DRA Scorpion is simply the ratio of the reflected signal to the incident signal.

The amplified output of the AUT is fed to a high power coupler in the test set. The power rating of this coupler is also 100-watts average. The –30 dB coupled arm of this coupler is routed to the test port b_2 of the Scorpion through a 6 dB resistive divider and a 0-dB to 70-dB step attenuator (10dB/step). A limiter is also provided in this path provide added protection for the Scorpion reference channel .

The divider enables the connections of a power meter or Spectrum Analyzer, when desired, to measure the AUT b_2 output.

The through arm of the 100-W coupler is routed to a high power (100-Watt) termination through a circulator. In the MS4782A Test Set, the circulator is internal and has a rating of 100 watts average. This circulator has an isolation specification of 20-dB minimum. This means that the AUT output power is attenuated by 20 dB (plus other losses) before reaching the Scorpion port 2. Since the maximum (no-damage) power level for this port is 27 dBm (0.5 watt), this establishes the maximum AUT output power at 50 watts.

In the MS4782D Test Set, the circulator is external as shown in Figure 1-2. In selecting an external circulator, the following criteria should be used.

- *Power rating:* Should be no less than the power output of the amplifier-under-test (AUT). It should be noted that a 100 watt termination is provided in the Test Set for the termination port of the external circulator.
- *Bandwidth:* Should be sufficiently wide to cover the frequency band of the AUT.
- *Isolation:* Should be no less than (P_o -27 dB), where P_o is the power output in dBm of the AUT. Thus for Po = 47 dBm (50 watts), a 20 dB isolation is required. For a P_o greater than 47 dBm up to 50 dBm (100 watts), two circulators in series can be used.

Where S_{22} or Hot S_{22} measurements are not required, power amplifiers with up to 100 watts average output power can be tested with the MS4782D Test Set without any circulator by connecting the through arm of the output coupler directly to the 100 watt termination (Port C1 connected to Port C2 on the rear. The unit is shipped from the factory with this loop jumper.)

For S_{22} measurements, the transfer switch located within the Scorpion routes the source 1 output signal to the output port of the AUT via Port 2 (RF2) of the Scorpion. A separate 100-watt coupler in the test set applies the –30 dB portion of this incident signal to the Scorpion reference port a_2. The –30 dB portion of the signal reflected from the AUT output port is applied to the Scorpion test port b_2 by means of the AUT output coupler.

The PATS calibration is performed with the test set in place, at the connectors where AUT will be connected directly. Therefore, the test set components and cables are included in the calibration loop and their effects are calibrated out, resulting in correct and accurate measurements of the AUT.

The software supplied by ANRITSU supports operator control of the source selection switch and step attenuator in the test set. This control is achieved through the parallel TTL control lines available at the Scorpion rear panel “External I/O” connector. The GPIB commands from the PC to the Scorpion set the TTL control lines to the desired states.

Connectors and Ports

On the front panel of the Model MS4622/3C DRA Scorpion three Type N (female) connectors are provided for Ports 1, 2 and 3.

Port 1 provides RF source 1 when the transfer switch is in the forward position, and is terminated in 50 ohms to ground when the transfer switch is in the reverse position.

Port 2 provides RF source 1 when the transfer switch is in the reverse position, and is terminated in 50 ohms to ground when the transfer switch is in the forward position.

Port 3 is allocated to RF source 2. Under independent control, port 3 provides RF source 2, or is terminated in 50 ohms to ground.

On the rear of the unit, four SMA connectors (Figure 1-) are provided for Reference ports a_1 and a_2 and Test Ports b_1 and b_2. The front of the unit as well as all other mechanical specifications is the same as the model MS4623B.

On the MS4782D Test Set, three additional SMA connectors provide for connecting an external circulator. If reverse measurements (S_{22} and Hot S_{22}) are not desired, then a circulator is not required. Instead, a through line should be connected between connectors C1 and C2 (Figure 1-). The MS4782A is shipped from the factory with this through line in place.

1-8 SERVICE CENTERS

ANRITSU Company offers a full range of repair and calibration services at fully staffed and equipped service centers throughout the world. Table 2-1, located on page 2-2, lists all ANRITSU services centers.

1-9 STATIC SENSITIVE COMPONENT HANDLING PROCEDURES

The Test Set contains components that can be damaged by static electricity. Figure 1-2 illustrates the precautions that should be followed when handling static-sensitive subassemblies and components. If followed, these precautions will minimize the possibilities of static-shock damage to these items.

1-10 RECOMMENDED TEST EQUIPMENT

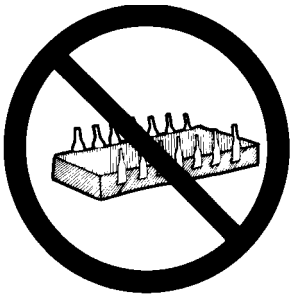
Table 1-2 lists the recommended test equipment to be used for all maintenance activities for the MS4782X models. Note the “Use” codes listed in the right hand column of the table. These codes list the applicable maintenance activities for the equipment listed.

Table 1-2. *Recommended Test Equipment*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USE**
Power Meter		ANRITSU ML2437A or MS2438A	P
Power Sensor		ANRITSU MA2472A	P
GPIB Cable	IEEE 488-2 compliant	ANRITSU 2100-2, or equivalent	P
Offset Termination	SC5237 6 dB Return Loss SC5270 20 dB Return Loss	ANRITSU SC5237 ANRITSU SC5270	P
Termination	Return Loss 35 dB, DC to 3 GHz	ANRITSU 28L50LF	OT
Power Divider		ANRITSU 11N50B	P
Adapter		ANRITSU 34NN50A	P
Adapter		ANRITSU 34NFNF50 ANRITSU 34SFSF50 ANRITSU 34NKF50	O, T
Thru Line		ANRITSU 3670NN50-2 or 15NN50-0.6B	P
Thru Line	Phase stable Length: 4 feet (2 each)	GORE PhaseFlex™ Part number EJD01D010480	O, T
Calibration Kit		ANRITSU 3653 or 3753LF	P,O

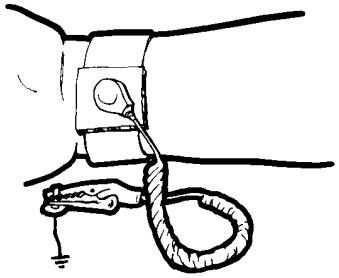
** USE CODES:
- A Adjustment / Internal Hardware Calibration
- O Operational Testing
- P Performance Verification
- T Troubleshooting

1. Do not touch exposed contacts on any static sensitive component.



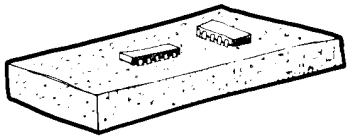
2. Do not slide static sensitive component across any surface.

3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.

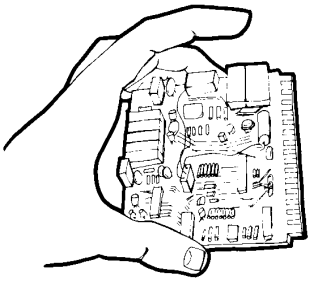


4. Wear a static-discharge wristband when working with static sensitive components.

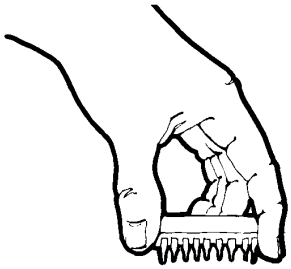
5. Label all static sensitive devices.



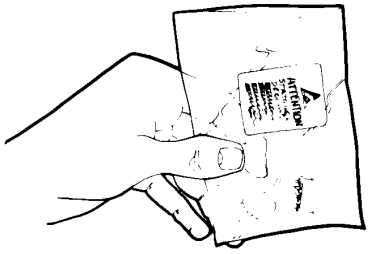
6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies – never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

10. ADDITIONAL PRECAUTIONS:

- Keep workspaces clean and free of any objects capable of holding or storing a static charge.
- Connect soldering tools to an earth ground.
- Use only special anti-static suction or wick-type desoldering tools.

Figure 1-2. *Static Sensitive Component Handling Procedures*

Chapter 2
Replaceable Parts

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Table 2-1. *Anritsu Service Centers*

UNITED STATES

ANRITSU COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 776-8300
1-800-ANRITSU
FAX: 408-776-1744

ANRITSU COMPANY
10 New Maple Ave., Unit 305
Pine Brook, NJ 07058
Telephone: (201) 227-8999, 1-800-ANRITSU
FAX: 201-575-0092

ANRITSU COMPANY
1155 E. Collins Blvd
Richardson, TX 75081
Telephone: 1-800-ANRITSU
FAX: 972-671-1877

AUSTRALIA

ANRITSU PTY. LTD.
Unit 3, 170 Foster Road
Mt Waverley, VIC 3149
Australia
Telephone: 03-9558-8177
FAX: 03-9558-8255

BRAZIL

ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440, Sala 2401
CEP22250-040, Rio de Janeiro, RJ, Brasil
Telephone: 021-527-6922
FAX: 021-53-71-456

CANADA

ANRITSU INSTRUMENTS LTD.
215 Stafford Road, Unit 102
Nepean, Ontario K2H 9C1
Telephone: (613) 828-4090
FAX: (613) 828-5400

FRANCE

ANRITSU S.A
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: 016-09-21-550
FAX: 016-44-61-065

GERMANY

ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf, Germany
Telephone: 0211-968550
FAX: 0211-9685555

INDIA

MEERA AGENCIES (P) LTD.
A-23 Hauz Khas
New Delhi 110 016
Telephone: 011-685-3959
FAX: 011-685-2275

ISRAEL

TECH-CENT, LTD.
4 Raul Valenberg St
Tel-Aviv 69719
Telephone: (03) 64-78-563
FAX: (03) 64-78-334

ITALY

ANRITSU Sp.A
Roma Office
Via E. Vittorini, 129
00144 Roma EUR
Telephone: (06) 50-99-711
FAX: (06) 50-22-4252

KOREA

ANRITSU CORPORATION LTD.
14F, Hyunjuk Bldg
832-41 Yeoksam-Dong
Kangnam-Ku
Seoul South Korea 150 010
Telephone: 02-553-6603
FAX: 02-553-6604, 02-553-6605

JAPAN

ANRITSU CUSTOMER SERVICE LTD.
1800 Onna Atsugi-shi
Kanagawa-Prf. 243 Japan
Telephone: 0462-96-6688
FAX: 0462-25-8379

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ANRITSU (SINGAPORE) PTE LTD.
6 New Industrial Road #06-01/02
Hoe Huat Industrial Bldg
Singapore 536199
Telephone: 282-2400
FAX: 282-2533

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ETECSA
12 Surrey Square Office Park
330 Surrey Avenue
Ferndale, Randburt, 2194
South Africa
Telephone: 011-27-11-787-7200
FAX: 011-27-11-787-0446

SWEDEN

ANRITSU AB
Botivid Center
Fittja Backe 1-3
S145 84 Stockholmn
Telephone: (08) 534-707-00
FAX: (08) 534-707-30

TAIWAN

ANRITSU CO., LTD.
6F, No. 96, Section 3
Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
Telephone: (02) 515-6050
FAX: (02) 509-5519

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ANRITSU LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 015-82-4332003
FAX: 015-82-731303

Chapter 2
Replaceable Parts

2-1 INTRODUCTION

This chapter provides replaceable parts information for both MS4782X models. The major replaceable Test Set assemblies and parts are listed in Table 2-2 . The locations of these assemblies/parts are shown in Figure 2-1.

2-2 EXCHANGE ASSEMBLY PROGRAM

ANRITSU maintains a module exchange program for selected subassemblies. If a malfunction occurs in one of these subassemblies, the defective item can be exchanged. Upon receiving your request, ANRITSU will ship the exchange subassembly to you, typically within 24 hours. You then have 45 days in which to return the defective item. All exchange subassemblies or RF assemblies are warranted for 90 days from the date of shipment, or for the balance of the original equipment warranty, whichever is longer.

NOTE

When sending a failed assembly to the factory for exchange, a copy of the Service Log *must always* accompany the failed assembly. This copy may be a printout, or a saved disk copy. Due to the importance of the service log information to the ANRITSU factory Service Engineers, the exchange prices are only valid if the service log data is included with the failed assembly.

Please have the exact model number and serial number of your unit available when requesting this service, as the information about your unit is filed according to the instrument's model and serial number. For more information about the program, contact your local sales representative or call ANRITSU Customer Service direct (refer to paragraph 2-4.

2-3 REPLACEABLE SUBASSEMBLIES AND PARTS

Table 2-2 lists the major replaceable subassemblies and parts for the MS4782X. These assemblies/parts are presently covered by the ANRITSU exchange assembly program.

Table 2-2. *Replaceable Subassemblies*

Part Number	Description	Where used
1000-50	A7 Circulator, 800 to 1000 MHz, 50W	MS4782A internal, MS4782D external
1000-52	A7 Circulator, 1.8 to 2.5 GHz, 50W	MS4782D external
1000-53	A7 Circulator, 1.8 to 2.5 GHz, 79W	MS4782D external
1015-51	A8 High Power Termination	MS4782A and MS4782D
ND55507	A10 SPDT Switch Assembly	MS4782A and MS4782D
1091-305	A4 Combiner	MS4782A and MS4782D
1091-307	A1 Coupler	MS4782A and MS4782D
1091-307	A2 Coupler	MS4782A and MS4782D
1091-307	A3 Coupler	MS4782A and MS4782D
1091-308	Dual Coupler	MS4782A and MS4782D
1K50A	A5A2 RF Limiter	MS4782A and MS4782D
339H40998A	A5 Step Attenuator	MS4782A and MS4782D
40-133	A6 Power Supply	MS4782A and MS4782D
43045-3	A9 System Control PCB Assy	MS4782A and MS4782D
K240B	A5A1Power Divider	MS4782A and MS4782D
ND55508	Fan Assembly	MS4782A and MS4782D

2-4 PARTS ORDERING INFORMATION

All parts listed in Table 2-2 may be ordered from your local ANRITSU service center (Table 2-1, page 2-2). Or, they may be ordered directly from the factory at the following address:

ANRITSU Company
ATTN: Customer Service
490 Jarvis Drive
Morgan Hill, CA 95037-2809

Telephone: (408)-778-2000
FAX: (408)-778-0239

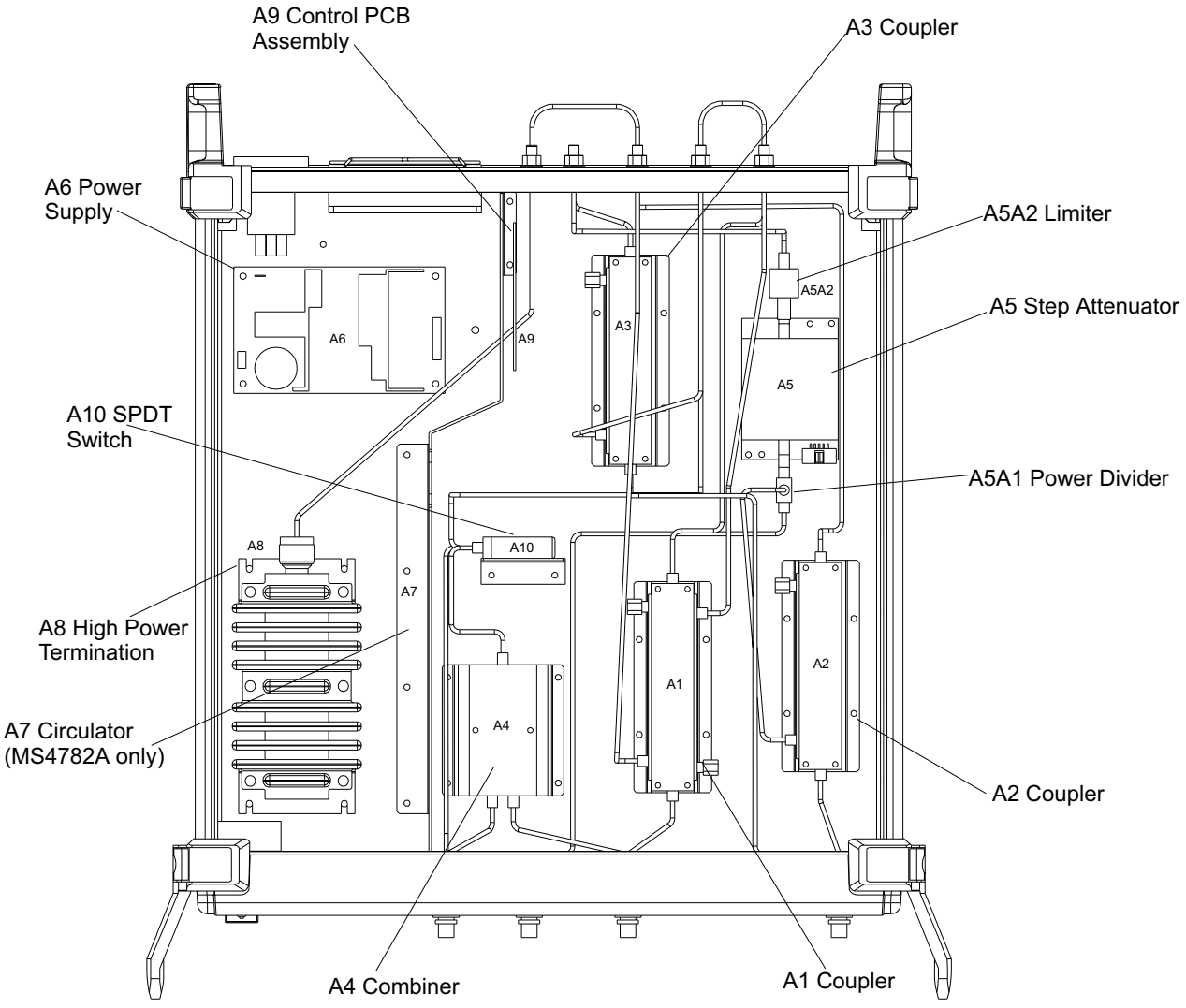

Figure 2-1. *Major Assemblies Location Diagram (Top View)*

Chapter 3
Performance Verification Procedure

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Chapter 3
Performance Verification Procedure

3-1 *INTRODUCTION*

The following are the specific tests that should be used to verify the performance of the Power Amplifier Test System (PATS). This is the same procedure that appears in the system OMM, ME7840A Operation and Maintenance Manual.

- Source Output Level Accuracy Test
- Return Loss Measurement Confidence Test
- System Dynamic Range Test
- Receiver Magnitude Display Linearity Test

3-2 *CONVENTIONS*

In the tests in this chapter, instructions will direct use front panel hard keys and softkeys. The hard keys and softkeys will appear in a different typeface. For example:

Step 1. Press the Utility key and select:

DIAGNOSTICS
TROUBLESHOOTING
MORE
VERIFY ALC CALIBRATON

The Utility key is a front panel hard key and DIAGNOSTICS, TROUBLESHOOTING, MORE, and VERIFY ALS CALIBRATION are all softkeys.

3-3 TEST EQUIPMENT

The following equipment is required to perform the verification procedures.

- ANRITSU Model ML243XA Power Meter
- ANRITSU Model MA247XA Power Sensor
- ANRITSU Model 3653 or 3753LF N connector Calibration Kit
- ANRITSU Model SC5237 6 dB Offset Termination
- ANRITSU Model SC5270 20 dB Offset Termination
- ANRITSU Model 11N50B Power Divider

- ANRITSU Model 3670NN50-2 Cable
- ANRITSU Model 34NN50A Adapter
- ANRITSU 2100-2 GPIB cable

3-4 SOURCE OUTPUT ACCURACY

This test verifies the source output accuracy of the MS462XC. The test procedure uses the Power ALC Verification built-in function of the MS462XC Basic Measurement software.

Setup:

Step 1. Connect a GPIB cable between the power meter GPIB connector and the MS462XC dedicated GPIB connector, as shown in Figure 3-1.

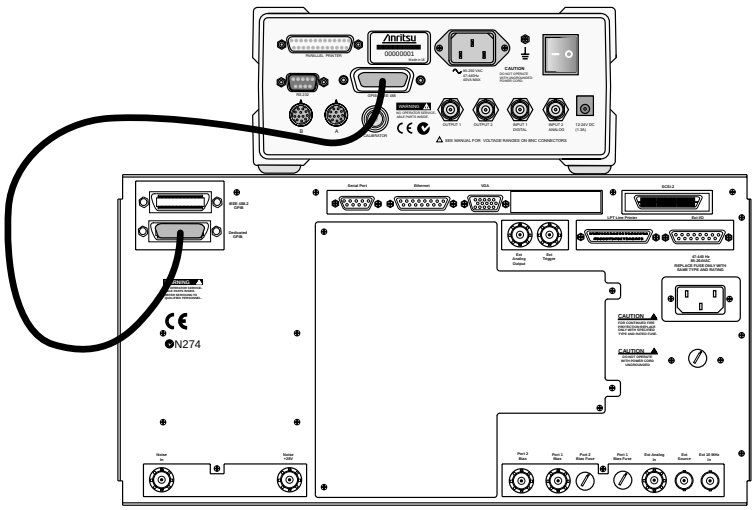

Figure 3-1. *ML2430A Series Power Meter GPIB connection to the MS462XX Vector Network Measurement System*

Step 2. Turn on the MS462XC VNMS and allow it to warm-up at least one hour.

Test Procedure

Step 1. Disconnect cables between MS462XC Port 1 and Port 1 of MS4782 Test Set and between Port 3 of MS462XC and Port 3 of MS4782 Test Set.

Step 2. Press Utility key and select:

DIAGNOSTICS
TROUBLESHOOTING
MORE
VERIFY ALC CALIBRATON

Step 3. Calibrate and zero the power sensor.

Step 4. Connect power sensor to MS462XC Port 1 and select START VERIFICATION softkey.

Step 5. Verify that Source 1 passes this test.

Note

The worst case test result will be displayed on the screen when the instrument fails this test only. The failed test result is also recorded in the Service Log.

Step 6. Press the SELECT SOURCE soft key to select 2

Step 7. Connect power sensor to MS462XC Port 3 and select START VERIFICATION soft key.

Caution

The TROUBLESHOOTING function must be properly exited to restore normal measurement operation.

Step 8. Verify that Source 2 passes this test.

Step 9. Select the menu soft key as follows to exit the TROUBLESHOOTING mode:

RETURN
RETURN
FINISHED, RECOVER FROM TROUBLESHOOTING

Step 10. Reconnect cables between MS462XC Port 1 and Port 1 of MS4782 Test Set and between Port 3 of MS462XC and Port 3 of MS4782 Test Set.

3-5 RETURN LOSS CONFIDENCE TEST

This test verifies the accuracy of return loss measurements.

Setup: Set up the Test Set as described below.

Step 1. Turn on the MS462XC VNMS and MS4782X Test Set and allow them to warm up for 30 minutes.

Step 2. Press Default key then 0 key.

Step 3. Press Seq key and select:

TTL I/O.
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 4. Change the value from 0 to 8.

Step 5. Select:

RETURN
RETURN

Step 6. Press Display key and select:

DISPLAY MODE
SINGLE CHANNEL
RETURN

Step 7. Press Ch 4 key and then Display key.

Step 8. Select:

GRAPH TYPE
LOG MAGNITUDE

Step 9. Press Ch 1 key and select LOG MAGNITUDE.

Test Procedure: Insert the Calibration Component Coefficients disk into the MS462XC floppy disk drive.

Step 1. Press Cal key and select:

COMPONENT UTILTIES
INSTALL KIT INFO FROM FLOPPY DISK
RETURN

Step 2. Follow the prompts and select:

PERFORM CAL: 2 PORT
CAL METHOD: STANDARD
LINE TYPE: COAXIAL
SELECT CALIBRATION TYPE: REFLECTION ONLY – PORT 1 ONLY
FREQUENCY RANGE OF CALIBRATION: 800 MHz TO 2400 MHz
SELECT CALIBRATION DATA POINTS: NORMAL
DATA POINTS: 401 POINTS
PORT 1 CONNECTOR TYPE: N (F)
LOAD TYPE: BROADBAND LOAD

Step 3. Select START CAL soft key to begin calibration.

Step 4. Install calibration device per instruction on the display. Select the appropriate soft key to measure the calibration device.

Step 5. When the "CALIBRATION SEQUENCE COMPLETED" message is displayed, press the Enter key to continue.

Step 6. Connect SC5237 6 dB Offset Termination to Test Port 1 of MS4782 Test Set. Record the measured value in Table 3-3 and verify the measured S_{11} value is 6 ±0.4 dB. Remove SC5237 Termination.

Step 7. Connect SC5270 20 dB Offset Termination to Test Port 1 of MS4782 Test Set. Record the measured value in Table 3-3 and verify the measured S_{11} value is 20 ± 1.0 dB. Remove SC5270 Termination.

Step 8. For MS4782D with no circulator installed, skip steps 8 to 15.

Step 9. Press Cal key.

Step 10. Follow the prompts and select:

PERFORM CAL: 2 PORT
CAL METHOD: STANDARD
LINE TYPE: COAXIAL
SELECT CALIBRATION TYPE: REFLECTION ONLY – PORT 2 ONLY
FREQUENCY RANGE OF CALIBRATION: See below:

Model	Frequency Range
MS4782A	800 MHz to 1000 MHz
MS4782D w/1000-50 Circulator	800 MHz to 1000 MHz
MS4782D w/1000-52 Circulator or 1000-53 Circulator	1.8 GHz to 2.4 GHz

SELECT CALIBRATION DATA POINTS: NORMAL
DATA POINTS: 401 POINTS
PORT 2 CONNECTOR TYPE: N (F)
LOAD TYPE: BROADBAND LOAD

Step 11. Select START CAL soft key to begin calibration.

Step 12. Install calibration device per instruction on the display. Select the appropriate soft key to measure the calibration device.

Step 13. When the "CALIBRATION SEQUENCE COMPLETED" message is displayed, press the Enter key to continue.

Step 14. Connect SC5237 6 dB Offset Termination to Test Port 2 of MS4782 Test Set. Record the measured value in Table 3-3 and verify the measured S_{22} value is 6 ± 0.4 dB. Remove SC5237 Termination.

Step 15. Connect SC5270 20 dB Offset Termination to Test Port 2 of MS4782

Test Set. Record the measured value in Table 3-3 and verify the measured S_{22} value is 20 ± 1.0 dB. Remove SC5270 Termination.

Table 3-3. *Offset Terminator Specifications*

Offset Termination	Measured S_{11} Value	Measured S_{22} Value*	Specification
SC5237			6 ±0.4 dB
SC5270			20 ±1.0 dB
* Do not apply to MS4782D with no circulator installed			

3-6 SYSTEM DYNAMIC RANGE

This test verifies the PATS system dynamic range.

Test Procedure:

Step 1. Press Default key then 0 key of MS462XC to reset the system.

Step 2. Press Seq key.

Step 3. Select:

TTL I/O.
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 4. Change the value from 0 to 8.

Step 5. Select:

RETURN
RETURN

Step 6. Press Ch 3 key.

Step 7. Press Display key and select:

DISPLAY MODE
SINGLE CHANNEL
RETURN
GRAPH TYPE
LOG MAGNITUDE
RETURN

Step 8. Press Cal key.

Step 9. Follow the prompts and select::

PERFORM CAL: 2 PORT
CAL METHOD: STANDARD
LINE TYPE: COAXIAL
SELECT CALIBRATION TYPE: TRANSMISSION FREQUENCY RESPONSE
PATH: FORWARD PATH (S_{21})
USE OF ISOLATION IN CALIBRATION: INCLUDE
FREQUENCY RANGE: 800 MHz TO 2400 MHz
SELECT CALIBRATION DATA POINTS: NORMAL
DATA POINTS: 401 POINTS
TEST SIGNAL/PORT 1 POWER: 10 dBm

Step 10. After the selections are complete, press the START CAL soft key to begin calibration.

Step 11. Install calibration device per instruction on the display. Select the appropriate soft key to measure. Connect a cable between Test Port 1 and Test Port 2 of MS4782X Test Set when the software prompts for a throughline on the display.

Step 12. When the "CALIBRATION SEQUENCE COMPLETED" message is displayed, press the Enter key to continue.

Step 13. Press Avg key and select:

SELECT I.F. BANDWIDTH
I.F. BW 10 Hz

Step 14. Remove the through cable between Test Port 1 and Test Port 2 of MS4782X Test Set and connect terminations to both ports.

Step 15. Press Display key and then select SCALE.

Step 16. Set REFERENCE VALUE to -80.

Step 17. Verify that the trace is less than -80 dB.

3-7 RECEIVER DISPLAY LINEARITY

This test verifies the magnitude display linearity of the receiver.

NOTE

Zero and calibrate Power Sensor prior to connecting to the power divider.

Setup: Set up the test equipment as described below.

Step 1. Set up the test equipment as shown in Figure 3-2

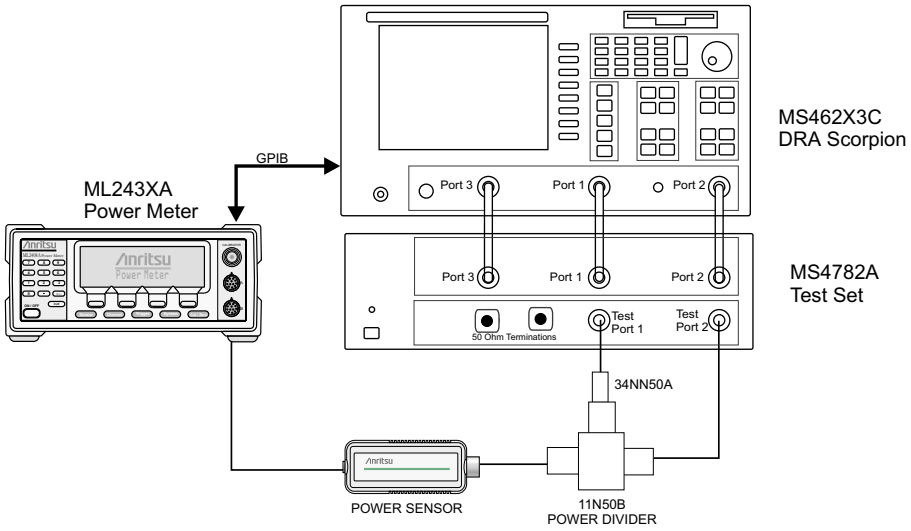

Figure 3-2. *Receiver Magnitude Display Linearity Test Setup*

Step 2. Allow the system to warm up for at least one hour.

Step 3. Press Default key then 0 key.

Step 4. Press Seq key and select:

TTL I/O
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 5. Change the value from 0 to 8.

Step 6. Select:

RETURN
RETURN

Step 7. Press Freq key.

Step 8. Change START FREQUENCY to 800 MHz and STOP FREQUENCY to 1 GHz.

Step 9. Toggle C.W. MODE OFF soft key to C.W. MODE ON.

Step 10. Change C.W. Frequency to 1 GHz.

Step 11. Press Config key and select:

DATA POINTS
POINTS DRAW IN C.W. – 51 POINT(S)

Step 12. Press Avg key and select:

SELECT I.F. BANDWIDTH
I. F. BW 10 Hz

Step 13. Press Power key and select SOURCE 1 SETUP.

Note
Ensure that the Power Sensor Cal Factor is set for 1 GHz. Refer to the ML24XXA Operational Manual.

Step 14. Adjust SOURCE 1 POWER so that the power meter readout is 0 dBm ± 0.1 dB.

Step 15. Press Ch 3 key.

Step 16. Press Meas key and select USER DEFINED.

Step 17. Change RATIO to b2/1.

Step 18. Select S21/USER 1 soft key to use user defined parameter.

Step 19. Press Display key and select:

GRAPH TYPE
LOG MAGNITUDE
RETURN
TRACE MEMORY

Step 20. Allow the trace to sweep twice. Select:

STORE DATA TO MEMORY
VIEW DATE (/) MEMORY

Step 21. Press Marker key and select MARKER READOUT.

Step 22. Use the soft key to turn on Marker 1. Then use the numeric data entry key to change POINT to 25.

Step 23. Press Marker key again.

Step 24. Use the soft key to SCREEN DISPLAY ON.

Step 25. Press Power key and select SOURCE 1 SETUP.

Step 26. Set PORT 1 ATTN to 10 dB. Record the Power Meter Readout and the Marker 1 Readout to the table on next page. Repeat this step for other PORT 1 ATTN setting listed in the table.

Step 27. Verify if the difference of the two measured values are within specifications (Table 3-4).

Table 3-4. *Receiver Magnitude Display Linearity Specifications*

PORT 1 ATTN Setting (dB)	Power Meter Reading	MS462XC Marker 1 Reading	Difference Between Two Readings	Specification
10				≤0.3 dB
20				≤0.3 dB
30				≤0.3 dB
40				≤0.3 dB
50				≤0.3 dB
60				≤0.3 dB

Chapter 4
Troubleshooting

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Chapter 4
Troubleshooting

4-1 INTRODUCTION

The tests in this section provide a method of testing the MS4782X Test Set for proper operation. These tests are intended to be used as a troubleshooting tools for checking the operational functionality of the components in the MS4782X.

4-2 OPERATIONAL CHECK

Operational Tests for the MS4782X consists of the following:

- Combiner Check
- Coupler Check
- Test Channel Step Attenuator Check
- Internal Termination Resistance Check

Caution

Prior to performing these tests, the MS462XC must be verified to be in good condition.

4-3 COMBINER CHECK

This test checks whether the Combiner functions properly.

Equipment Required: Anritsu ML243XA Power Meter
Anritsu MA2472A Power Sensor
Anritsu 2100-2 GPIB Interface Cable
Anritsu 34NFNF50 Adapter
Anritsu 3670NN50-2 Through cable or Anritsu 15NN50-0.6B cable

Setup: Set up the equipment as shown in Figure-4-1

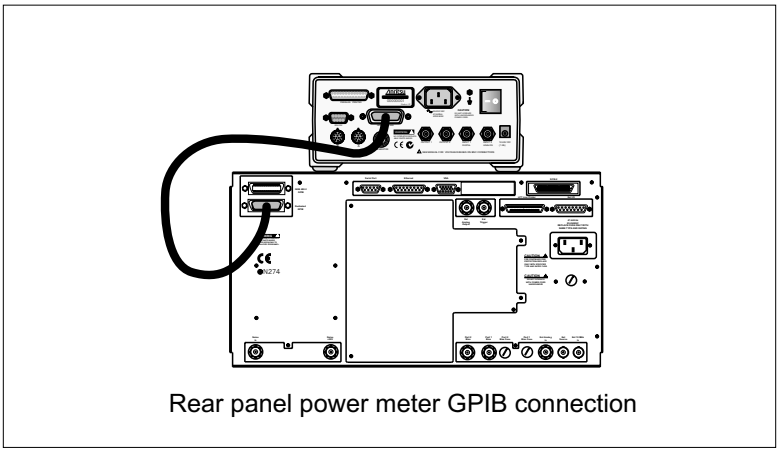
Step 1. Turn on the ML243XA Power Meter, MS462XC Vector Network Measurement System and the MS4782X Power Amplifier Test Set. Allow warm up 30 minutes.

Step 2. Press Default key and then 0 key to reset the MS462XC.

Step 3. Change the START frequency to 800 MHz.

Step 4. Change the STOP frequency to 2400 MHz.

Step 5. Press Seq key.



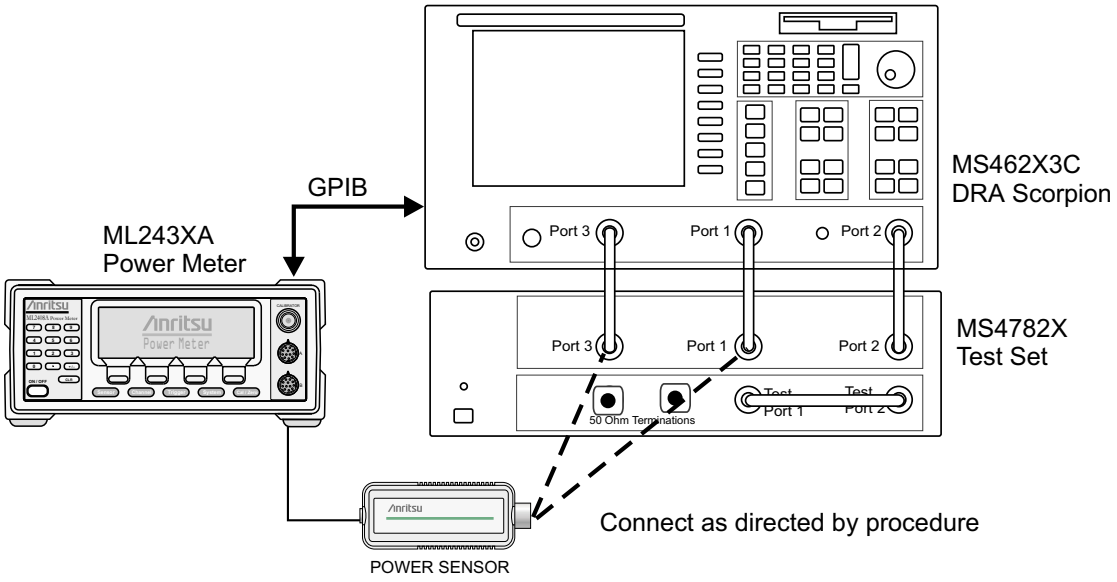


Figure 4-1. *Test Equipment Setup for Combiner Check*

Step 6. Select:

TTL I/O
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 7. Change the value from 0 to 8.

Step 8. Select:

RETURN
RETURN

Step 9. Press Display key.

Step 10. Select:

DISPLAY MODE
SINGLE CHANNEL
RETURN
GRAPH TYPE
LOG MAGNITUDE
RETURN

Step 11. Press Meas key.

Step 12. Select:

MORE
S23
MORE
USER DEFINED
CHANGE RATIO
b2 (Tb)
1
S23/USER 6
RETURN

Step 13. Press Ch 3 key and then Display key.

Step 14. Select:

GRAPH TYPE
LOG MAGNITUDE
RETURN

Step 15. Press Meas key.

Step 16. Select:

MORE
S21
MORE
USER DEFINED

CHANGE RATIO
b2 (Tb)
1
S21/USER 1
RETURN

Step 17. Press Config key.

Step 18. Select:

DATA POINTS
201 MAX PTS

Step 19. Disconnect the N male connector of the interconnect RF cable from "To Port 1" front panel connector. Refer to Figure 4-1.

Step 20. Zero and calibrate the power sensor. Install the 34NFNF50 adapter to the input of the Power Sensor.

Step 21. Connect the Power Sensor to the end of the RF cable.

Step 22. Press Power key.

Step 23. Select:

SOURCE 1 SETUP
FLAT TEST PORT POWER CAL
POWER TARGET 0.00 dBm
BEGIN CAL

Step 24. After the calibration is complete, remove the power sensor from the RF cable and reconnect the cable to "To Port 1" front panel connector.

Step 25. Disconnect the N male connector of the interconnect RF cable from "To Port 2" front panel connector. Refer to Figure 4-1.

Step 26. Connect the power sensor to the end of the RF cable.

Step 27. Press Power key.

Step 28. Select:

SOURCE 2 SETUP
FLAT TEST PORT POWER CAL
POWER TARGET 0.00 dBm
BEGIN CAL

Step 29. After the calibration is complete, remove the power sensor from the RF cable and reconnect the cable to "To Port 2" front panel connector.

Test Procedure:

Step 1. Connect a through cable between Test Port 1 and Test Port 2 of the MS4782X Test Set.

Step 2. Press Display key.

Step 3. Select:

TRACE MEMORY

Step 4. Allow the trace to sweep twice.

Step 5. Select:

STORE DATA TO MEMORY
DISK OPERATIONS
SAVE MEMORY TO HARD DISK
CREATE NEW FILE

Step 6. Enter “COMBTST” as file name and select DONE to save the data to hard disk.

Step 7. Press CH1 key.

Step 8. Press Display key.

Step 9. Select:

TRACE MEMORY
DISK OPERATIONS
RECALL MEMORY FROM HARD DISK
COMBTST NRM
VIEW DATA (/) MEMORY

Step 10. Verify that the displayed trace is within a 1 dB window.

Step 11. If this test fails, replace the A4 combiner. Refer to Figure-4-2.

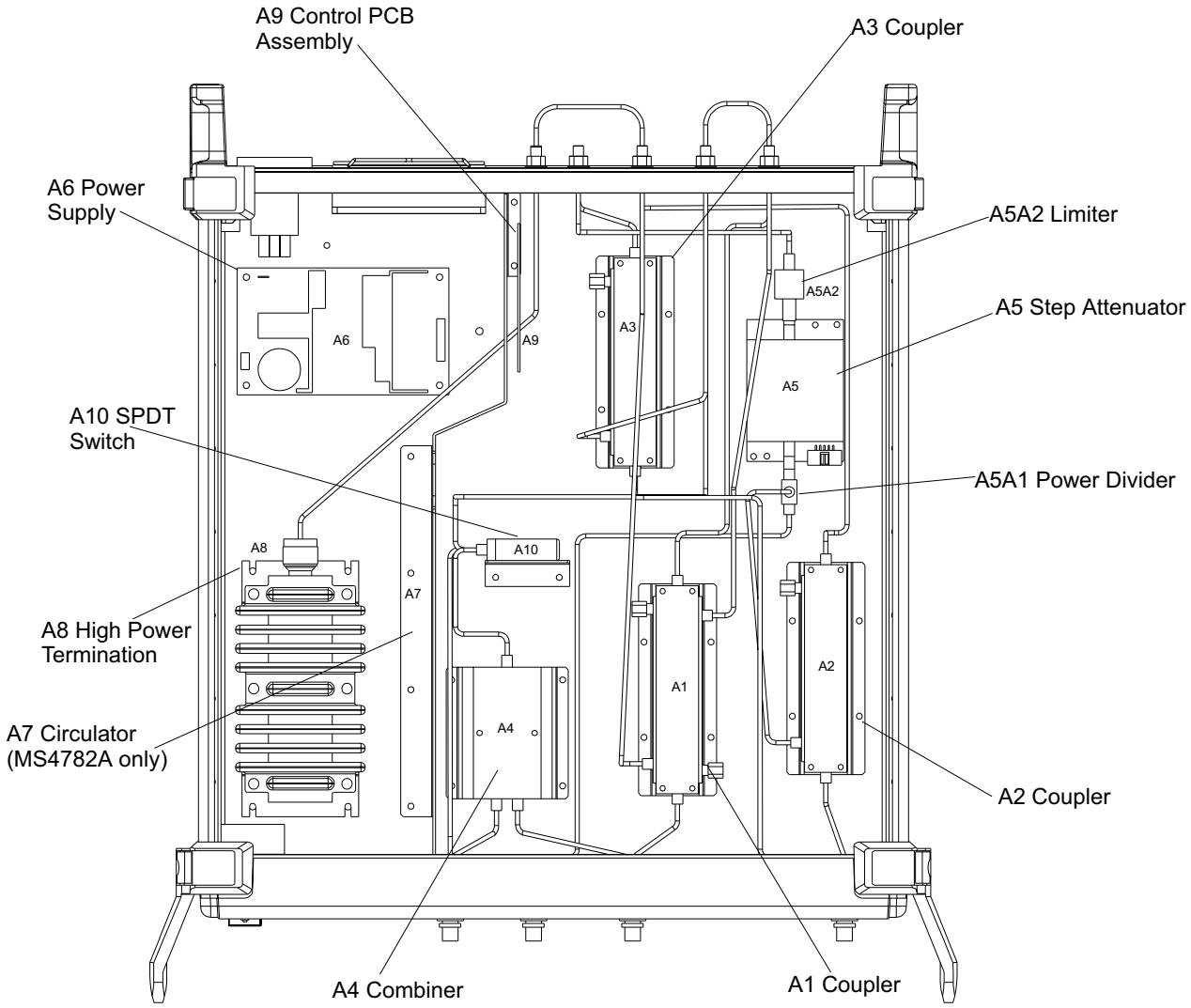


Figure 4-2. *Major Assemblies Location Diagram (Top View)*

4-4 COUPLER CHECK

This test checks whether the Port 1 and Port 2 Couplers function properly.

Equipment Required: Gore PhaseFlexTM cables (p/n EJD01D01048.0) or equivalent (2 each)
Anritsu 34SFSF50 Adapter or equivalent
Anritsu 34NKF50 Adapters (2 each) or equivalent
Anritsu 28N50LF Termination or equivalent
Anritsu 28L50LF Termination or equivalent

Setup: Setup the test equipment as described below.

Step 1. Disconnect all inter-connect RF cables between the MS462XC Vector Network Measurement System and the MS4782X Power Amplifier Test Set.

Note
Do not disconnect the cable connected between Ext I/O port of the MS462XC and Control In port of the MS4782X.

Step 2. Connect the MS462XC as shown in Figure 4-3.

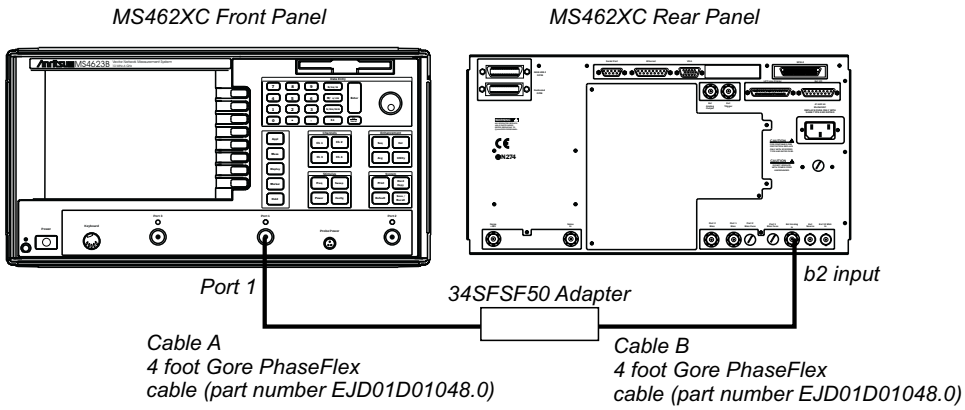


Figure 4-3. *Coupler Check Test Setup*

Step 3. Connect a through cable between the C1 and C2 connector ports of the MS4782X.

Step 4. Turn on the MS462XC Vector Network Measurement System and the MS4782X Test Set. Allow warm up 30 minutes.

Step 5. Press Default key and then 0 key to reset the MS462XC.

Step 6. Change the START frequency to 800 MHz.

Step 7. Change the STOP frequency to 2400 MHz.

Step 8. Press Ch3 key and then Display key.

Step 9. Select:

DISPLAY MODE
SINGLE CHANNEL
RETURN
GRAPH TYPE
LOG MAGNITUDE
RETURN

Step 10. Press Meas key.

Step 11. Select:

MORE
S21
MORE
USER DEFINED
CHANGE RATIO
b2 (Tb)
1
S21/USER 1
RETURN

Step 12. Press Power key.

Step 13. Select:

SOURCE 1 SETUP
PORT 1 ATTN 2*10 dB (0 – 70)

Step 14. Verify the PORT 1 POWER is below –15 dBm. Adjust SOURCE 1 POWER control if necessary.

Step 15. Connect the two cables together with the 34SFSF50 Adapter.

Step 16. Press Display key.

Step 17. Select:

TRACE MEMORY

Step 18. Allow the trace to sweep twice. Select:

STORE DATA TO MEMORY
VIEW DATA (/) MEMORY

Step 19. Disconnect the connection between cable A and cable B at the adapter.

Test Procedure:

Step 1. Disconnect the Ext Pre-Amp RF loop cable between the Input and Output connectors.

Step 2. Connect cable A, cable B and termination to the connector ports as stated in Table 4-1.

Table 4-1. *Troubleshooting Connections*

Tests	Cable A (from Port 1 of MS462XC)	Cable B (to b1 Input of MS462XC)	Termination	Insertion Loss
A	Ext Pre-Amp Output connector of MS4782X	a1 Output connector of MS4782X	Test Port 1 Connector	≤ 33 dB
B	Test Port 1 connector of MS4782X	b1 Output connector of MS4782X	Ext Pre-Amp Output connector of MS4782X	≤ 33 dB
C	Test Port 2 connector of MS4782X	Aux Out connector of MS4782X	b2 Output connector and To Port 2 Connector of MS4782X	≤40 dB
D	To Port 2 connector of MS4782X	a2 Output connector of MS4782X	C3 connector of MS4782D	≤ 33 dB

Step 3. Refer to Figure 4-4 and Figure 4-5 for connector locations.

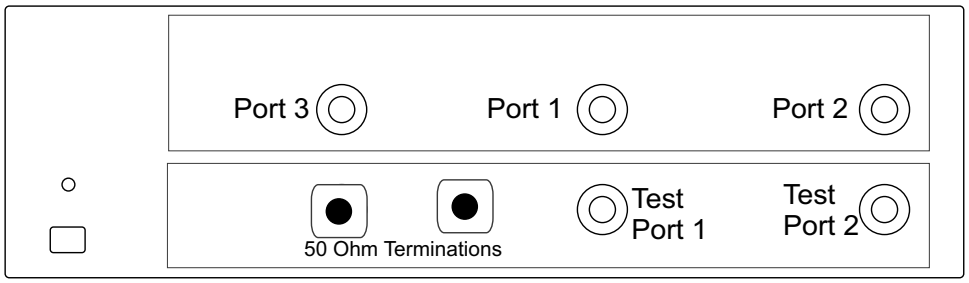


Figure 4-4. *Test Set Front Panel*

Step 4. Verify that the insertion loss in the corresponding path is within the tolerance as stated in Table 4-1.

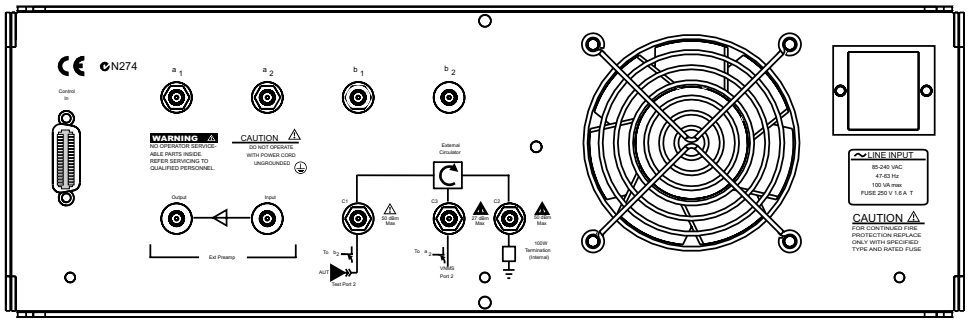


Figure 4-5. *Test Set Rear Panel*

Step 5. Repeat the test for the rest of the signal paths stated in Table 4-1.

Step 6. Reconnect all the inter-connect RF cables between the MS462XC Vector Network Measurement System and MS4782X Test Set. Also reconnect the Ext Pre Amp RF loop cable.

Step 7. If Test A or Test B fails, replace A1 Port 1 Coupler (Figure 4-2).

Step 8. If Test C fails, replace:

- A2 Port 2 Coupler
- A5A1 K240B Power Splitter

Step 9. If Test D fails, replace A3 Coupler.

4-5 TEST CHANNEL STEP ATTEN. CHECK

This test checks whether the Test Channel Step Attenuator functions properly.

Setup: Turn on the MS462XC Vector Network Measurement System and the MS4782X Test Set and allow warm up 30 minutes.

Step 1. Press Default key and then 0 key.

Step 2. Press Seq key.

Step 3. Select:

TTL I/O
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 4. Change the value from 0 to 8.

Step 5. Select:

RETURN
RETURN

Step 6. Press Display key.

Step 7. Select:

DISPLAY MODE
SINGLE CHANNEL
RETURN

Step 8. Press Ch 3 key and then Display key.

Step 9. Select:

GRAPH TYPE
LOG MAGNITUDE
RETURN

Step 10. Press Avg key.

Step 11. Select:

SELECT I.F. BANDWIDTH
I. F. BW 10 Hz

Test Procedure:

Step 1. Connect a through cable between Test Port 1 and Test Port 2.

Step 2. Select:

TRACE MEMORY

Step 3. Allow the trace to sweep twice. Select:

STORE DATA TO MEMORY
VIEW DATA (/) MEMORY
RETURN

Step 4. Select:

SCALE
10 dB/DIV

Step 5. Press Seq key.

Step 6. Select:

TTL I/O
PARALLEL OUT SETUP
SET PARALLEL OUT PORT (0-255)

Step 7. Change the SET PARALLEL OUT PORT value to 9.

Step 8. Verify whether the displayed S21 trace is within the range specified in Table 4-2.

Table 4-2. *Step Attenuator Specifications*

PARALLEL OUT PORT VALUE	Corresponding Step Attenuator Setting	Expected Range
9	10 dB	10 ± 1 dB
10	20 dB	20 ± 1 dB
12	40 dB	40 ± 2 dB

Step 9. Repeat Steps 7 and step 8 for the other PARALLEL OUT PORT values in Table-4-2.

Step 10. If the test results are out of the expected range, replace:

- Step Attenuator
- Limiter

4-6 INT. TERM. RESISTANCE CHECK

This test checks whether the internal high power termination has been overpowered.

Test Procedure:

Step 1. For MS4782D, measure the DC resistance of the termination between the center conductor and the outer conductor of the Internal Termination Input connector (C2) on the rear panel.

For the MS4782A:
Remove the cable between the termination and the internal circulator. Measure the DC resistance between the center conductor and the outer conductor of the termination connector.

Step 2. Verify that the measured value is 50 ±5 ohms.

Step 3. If the measured value is out of the expected range, replace the termination (Figure 4-2).

4-7 TROUBLESHOOTING

The following paragraphs provide suggestions for troubleshooting certain test set components.

If Test Set Does Not Power Up Check as follows:

Step 1. If the MS4782X Test Set does not power up when connected to an AC power source and the Power key is pressed, perform the power supply checks described below.

WARNING

Harzardous voltages are presented inside the instrument when AC line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels. Troubleshooting or repair procedures should only be performed by service personnel who are fully aware of the potential hazards.

Line Source And Interface Checks Check as follows:

Step 1. Verify that AC power source is providing stable power at the correct line voltage.

Note

The MS4782X is designed to automatically sense and operate with AC line voltage in the range of 85 – 264 VAC, with a frequency of 47 – 63 Hz.

Step 2. Verify that power input cord is in good condition.

Step 3. Verify that the power line fuse is installed, that it is not blown (open), and that it is the correct value (1.6A, Slow blow, part number 631-81).

Power Supply Voltage Check Check as follows:

Step 1. Turn off the Test Set, and disconnect the power cord from the instrument. Ensure all external cable connections to the Test Set front and rear panel are also disconnected.

Step 2. Remove the top cover.

Step 3. Reconnect the power cord to the Test Set and turn it on.

Step 4. Using DMM or oscilloscope, measure the DC power supply voltage listed in Table 4-3.

Table 4-3. *Power Supply Voltages*

Measured Pin	Common Pin	DC Supply Voltage
TP2	TP1	+5 ± 0.05V
TP3	TP1	+24 ± 2.4 V
TP4	TP1	+15 ± 0.9 V

Step 5. Connect the DMM or oscilloscope to the TEST POINTS on the Controller PCB assembly (Figure 4-1).

Step 6. If any of the DC voltage tests fails, replace the A6 DC power supply. Refer to Figure-4-6 Part Location Diagram.

If the PATS Fails the Return Loss Confidence Tests Check as follows:

Step 1. Use a different Calibration Kit for measurement calibration and repeat the Return Loss Confidence Test. This step determines whether the Calibration Kit is the cause of the failure.

Step 2. Verify the performance of the MS462XC per Chapter 3 of the MS462XX Maintenance Manual (part number 10410-00205). This step determines whether the MS462XC is the cause of the failure.

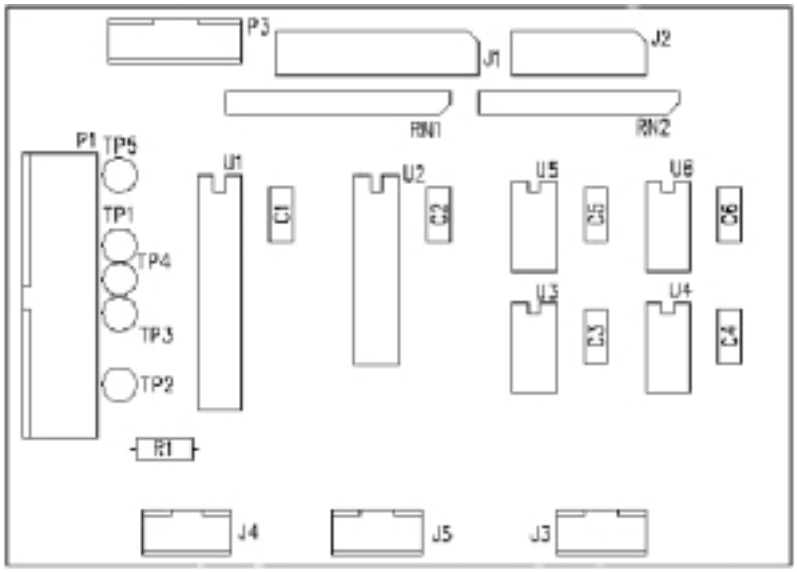


Figure 4-6. *A6 Power Supply Parts Location Diagram*

Step 3. Perform Coupler Check (page 4-9).

If the PATS Fails the System Dynamic Range Test Check as follows:

Step 1. Verify the performance of the MS462XC per Chapter 3 of the MS462XX Maintenance Manual (part number 10410-00205). This step determines whether the MS462XC is the cause of the failure.

Step 2. Perform Test C of the Coupler Check (page 4-11).

If the PATS Fails the Receiver Display Linearity Test Check as follows:

Step 1. Verify the performance of the MS462XC per Chapter 3 of the MS462XX Maintenance Manual (part number 10410-00205). This step determines whether the MS462XC is the cause of the failure.

Step 2. Perform Test C of the Coupler Check (page 4-11).

Chapter 5
Remove and Replace Procedures

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Chapter 5
Remove and Replace Procedures

5-1 INTRODUCTION

This chapter provides procedures for removing and reinstalling the replaceable subassemblies listed in Chapter 2, Table 2-2.

5-2 EQUIPMENT REQUIRED

All procedures in this chapter require the use of either a #1 or #2 size Phillips type screw driver. Most procedures require the use of a 5/16 inch wrench and the Anritsu 01-201 (8 in./pounds) Torque Wrench.

5-3 COVERS

Troubleshooting operations require removal of the top cover. Replacement of some Test Set assemblies and parts require removal of all covers. The following procedure describes this process.

NOTE

It is only necessary to loosen the Test Set handle assemblies to remove the top, bottom, or side covers. However, if the front panel is to be removed, remove the handle assemblies at this time.

Preliminary:

- ❑ Switch the Test Set power off and remove the power cord.

Procedure:

Step 1. Loosen (or remove) the right and left handle assemblies, as follows:

- ■ Place the Test Set on its top (bottom-side up).
- ■ Loosen/remove the screws at the sides of the handle assemblies.
- ■ If removing handles, pull them away from unit and set aside.

CAUTION

The green headed screws have Metric threads.

Step 2. To remove the top cover:

- ■ Place the Test Set in normal (top-side up) position.

- Remove the feet from the two top corners at the rear of the Test Set (Figure 5-1).

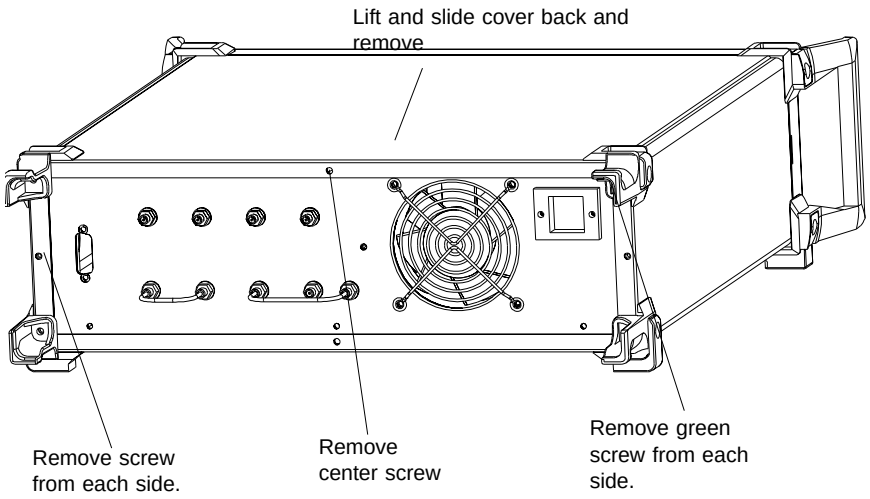

Figure 5-1. *Top/Bottom Cover Removal*

- Remove the center screw from rear of the top cover.
- Lift and slide the top cover away from the Test Set.

Step 3. To remove the bottom cover:

- Place the Test Set on its top (bottom-side up).
- Remove the feet from the two bottom corners at the rear of the Test Set.
- Remove the center screw from rear of the bottom cover.
- Lift and slide the top cover away from the Test Set.

Step 4. To remove the left cover:

- Place the Test Set on its right side.
- Remove the feet from the two left-side corners at the rear of the Test Set.
- Remove the center screw from the left cover (Figure 5-2).

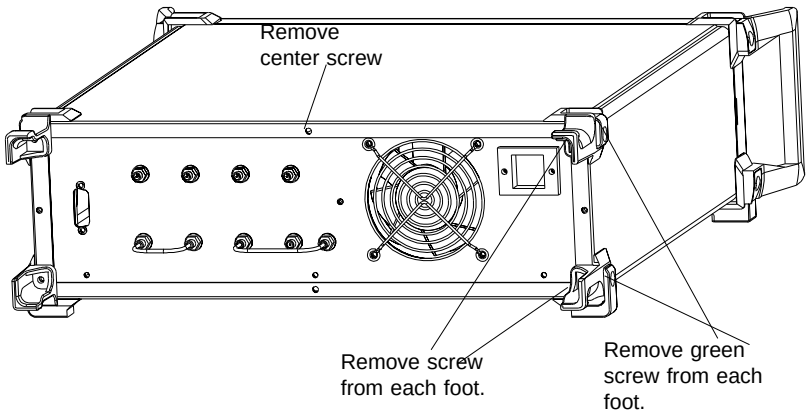

Figure 5-2. *Side Cover Removal*

- Lift and slide the side cover away from the Test Set.

Step 5. To remove the right cover:

- Place the Test Set its left side.
- Remove the feet from the two right-side corners at the rear of the Test Set.
- Remove the center screw from rear of the right side cover.
- Lift and slide the side cover away from the Test Set.

To replace the instrument covers, perform the steps above in the reverse order.

5-4 A1, A2, A3 COUPLER

This paragraph provides a procedure for removing and replacing the A1, A2, or A3 Coupler.

Step 1. Remove top cover (paragraph 5-3).

Step 2. Disconnect the three connectors (Figure 5-3).

Step 3. Remove four screws.

Step 4. Remove coupler.

To replace coupler, reverse the order in the removal procedure.

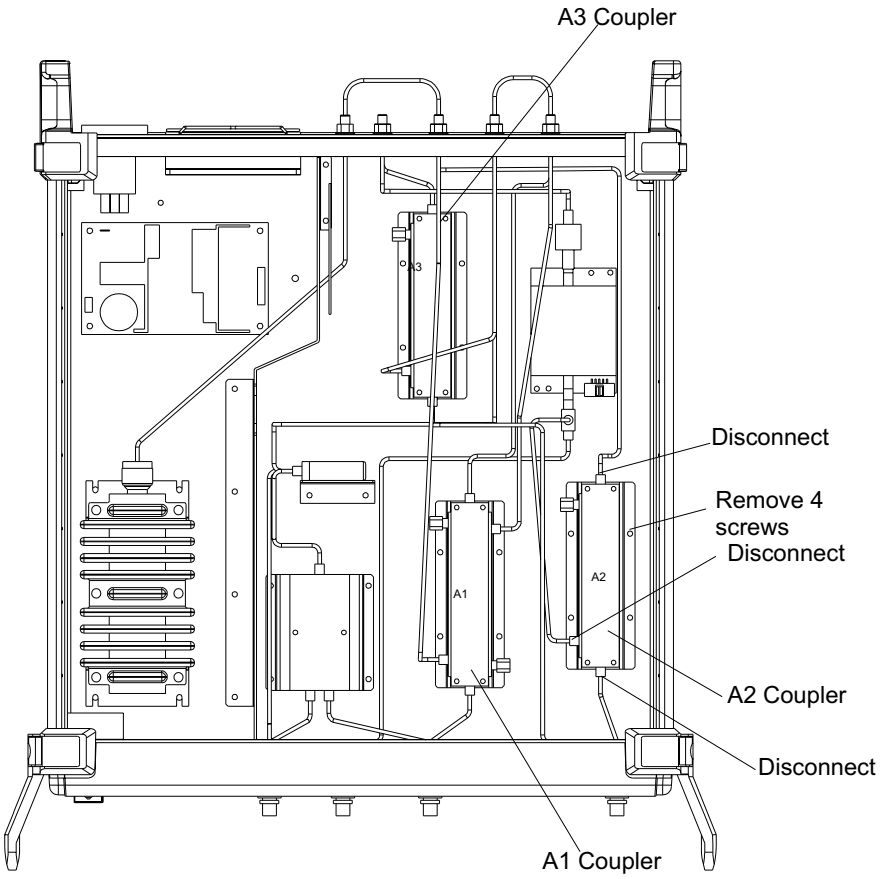

Figure 5-3. *A1, A2, or A3 Coupler Removal*

5-5 A4 COMBINER

This paragraph provides a procedure for removing and replacing the A4 Combiner.

Step 1. Remove top cover (paragraph 5-3).

Step 2. Disconnect the three connectors (Figure 5-4).

Step 3. Remove four screws.

Step 4. Remove combiner.

Step 5. To replace combiner, reverse the order in the removal procedure.

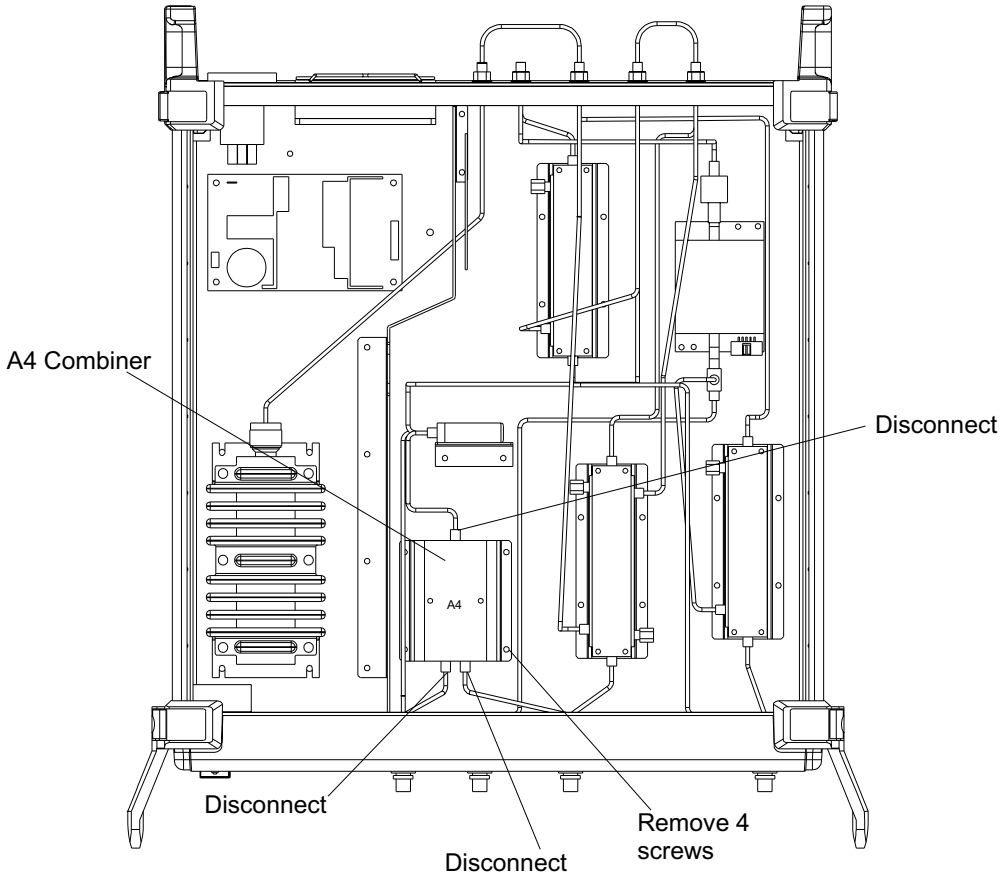

Figure 5-4. *A4 Combiner Removal*

5-6 A5 STEP ATTENUATOR

This paragraph provides a procedure for removing and replacing the A5 Step Attenuator and A5A2 RF Limiter.

Step 1. Remove top cover (paragraph 5-3).

Step 2. Disconnect the A5A2 RF Limiter from the step attenuator (Figure 5-5).

Step 3. Disconnect the fixed attenuator from the step attenuator.

Step 4. Disconnect the ribbon-cable connector from the step attenuator.

Step 5. Remove two screws.

Step 6. Remove step attenuator.

To replace step attenuator, reverse the order in the removal procedure.

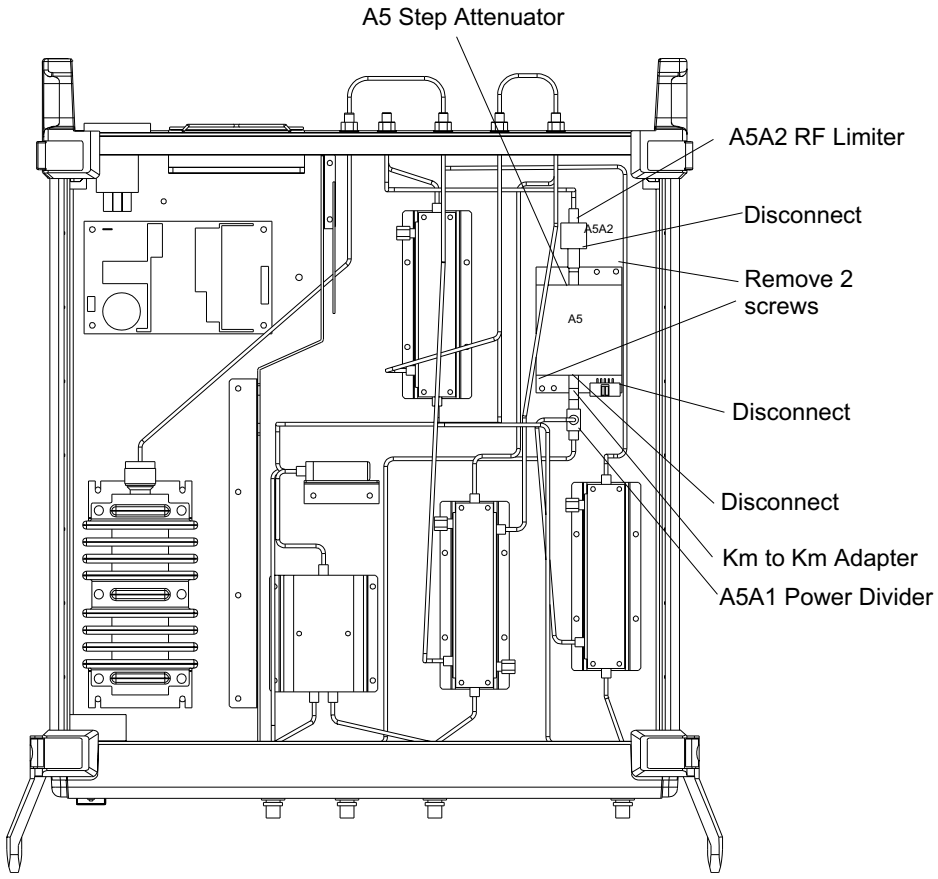

Figure 5-5. *A5 Step Attenuator Removal*

5-7 A6 POWER SUPPLY

This paragraph provides a procedure for removing and replacing the A6 Power Supply.

Step 1. Remove top cover and bottom covers (paragraph 5-3).

Step 2. Disconnect three wiring connectors from power supply (Figure 5-6).

Step 3. Set Test Set on its front handles.

Step 4. Grasp the the power supply to hold it in place while removing the four screws from the underside (Figure 5-7).

Step 5. Remove power supply

To replace power supply, reverse the order in the removal procedure.

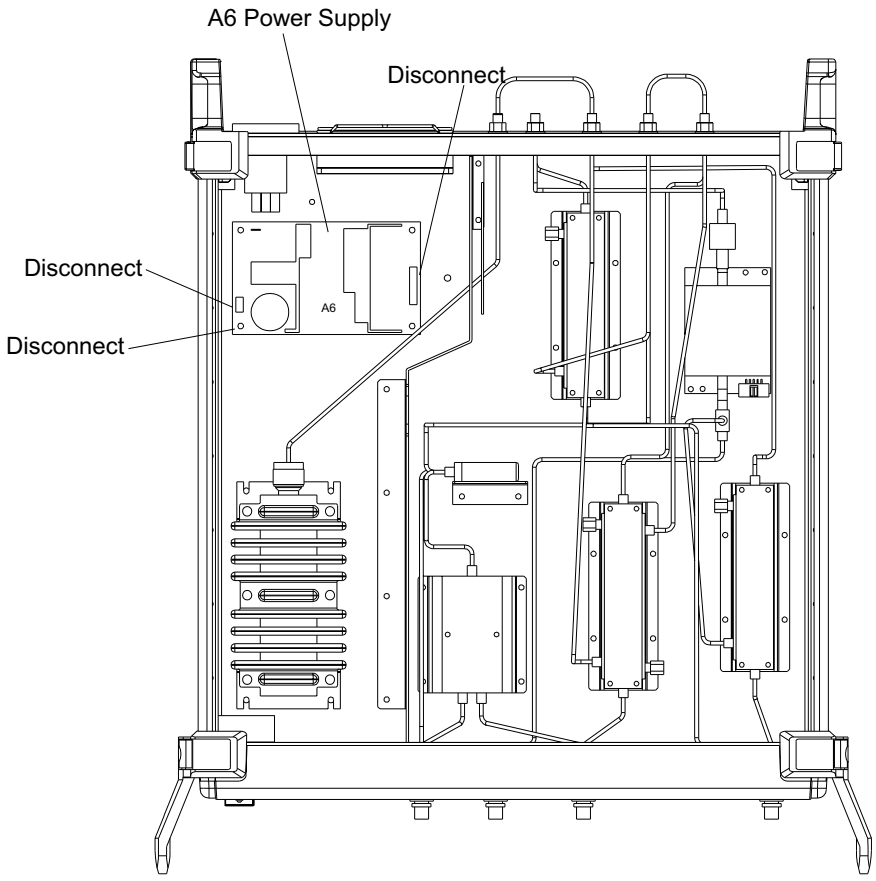

Figure 5-6. *A6 Power Supply Removal (Bottom View)*

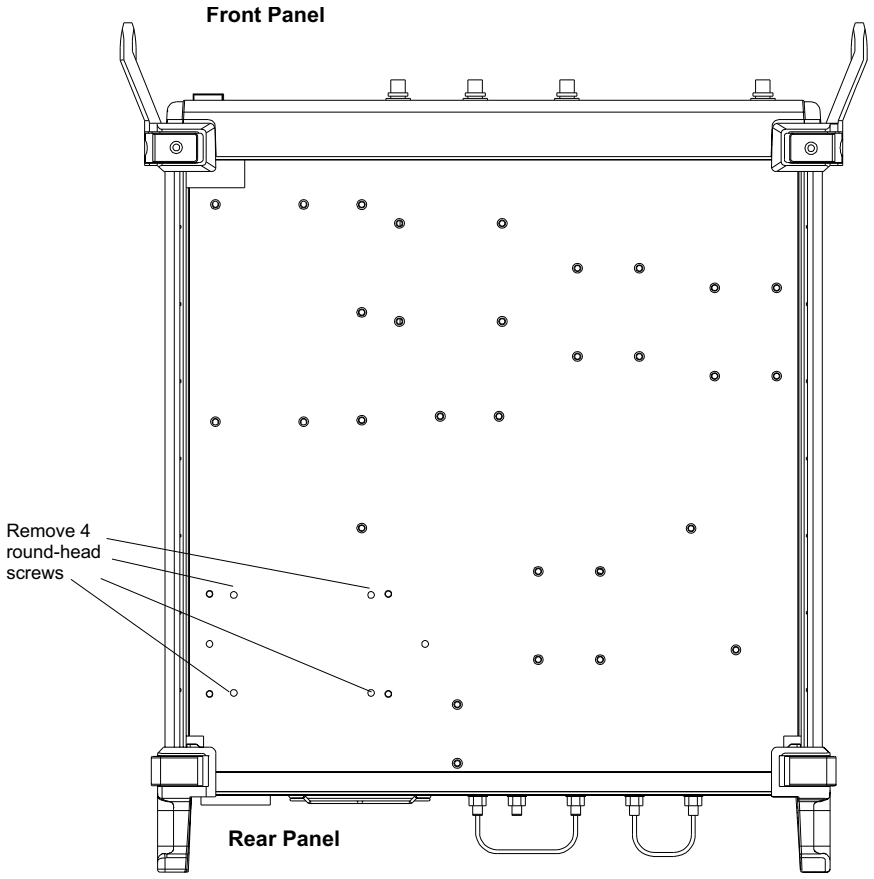

Figure 5-7. *A6 Power Supply Removal (Bottom View)*

5-8 A7 CIRCULATOR (MS4782A)

This paragraph provides a procedure for removing and replacing the A7 Circulator on the MS4782A Test Set.

Step 1. Remove top cover cover (paragraph 5-3).

Step 2. Disconnect semirigid cables in three places (Figure 5-8).

Step 3. Remove four mounting screws.

Step 4. Remove circulator and bracket.

Step 5. Remove circulator from bracket.

Step 6. To replace high power termination, reverse the order in the removal procedure.

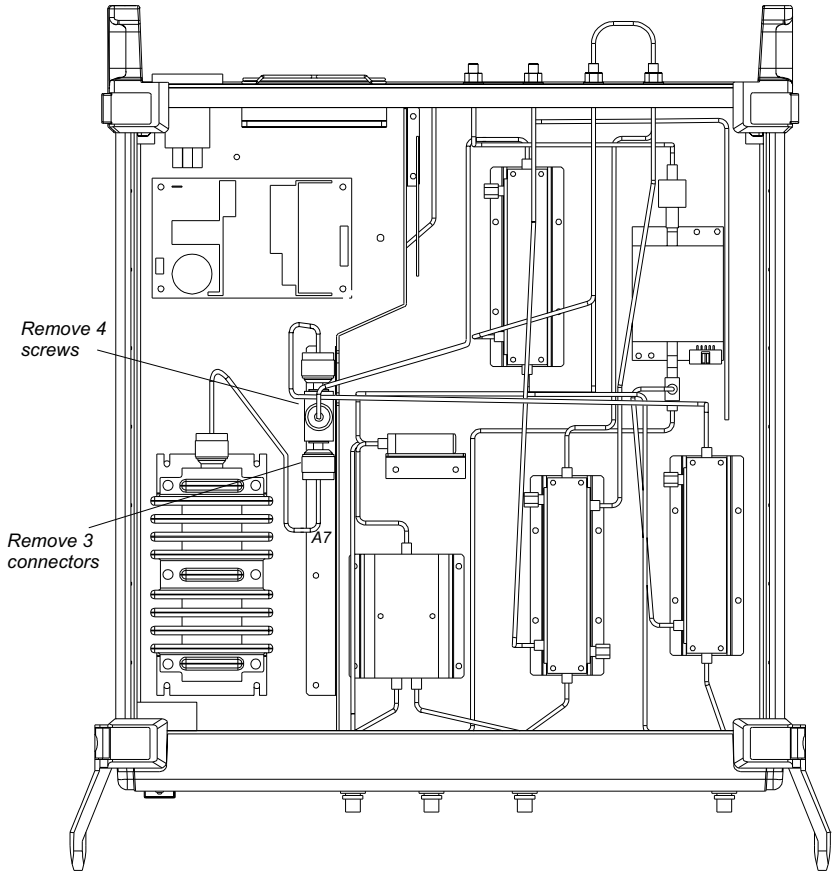

Figure 5-8. *A7 Circulator Removal*

5-9 A8 HIGH POWER TERMINATION

This paragraph provides a procedure for removing and replacing the A8 High Power Termination.

Step 1. Remove top cover (paragraph 5-3).

Step 2. Disconnect the cable connector from the termination (Figure 5-9).

Step 3. Remove the four screws, and remove the termination.

To replace high power termination, reverse the order in the removal procedure.

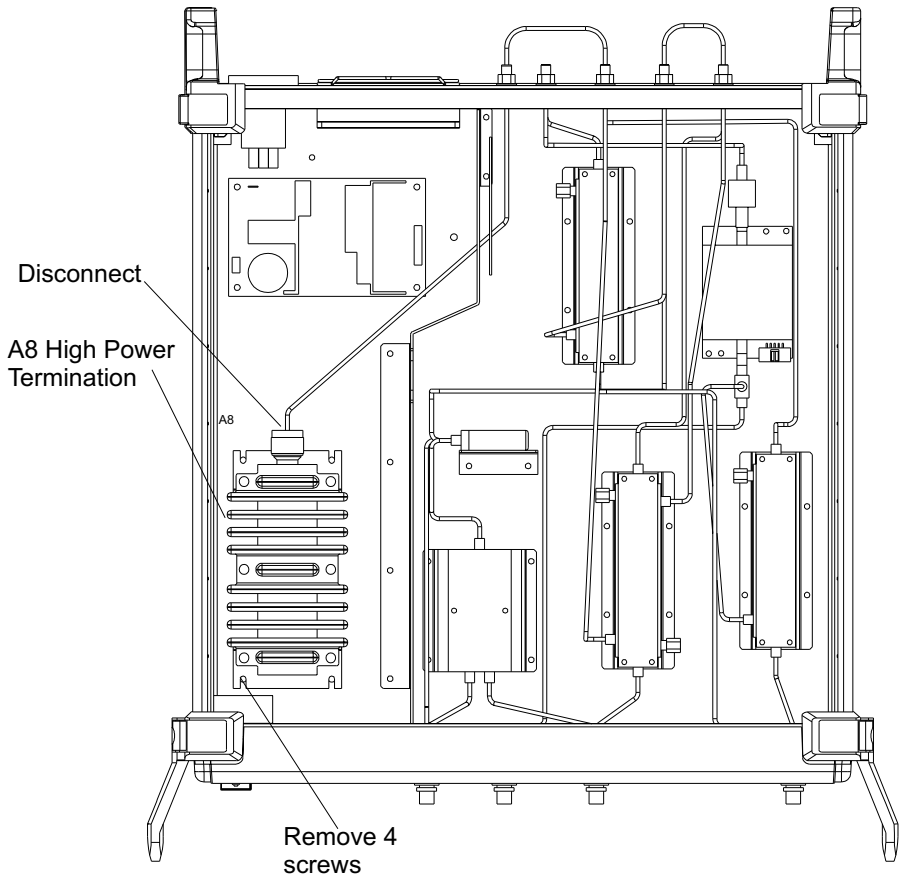

Figure 5-9. *A8 High Power Termination Removal*

5-10 A9 SYSTEM CONTROL PCB

This paragraph provides a procedure for removing and replacing the A9 System Control PCB.

Step 1. Remove top cover (paragraph 5-3).

Step 2. Disconnect six wiring connectors from the A9 PCB (Figure 5-10).

Step 3. Remove the four corner screws, and remove the A9 PCB.

To replace A9 PCB, reverse the order in the removal procedure.

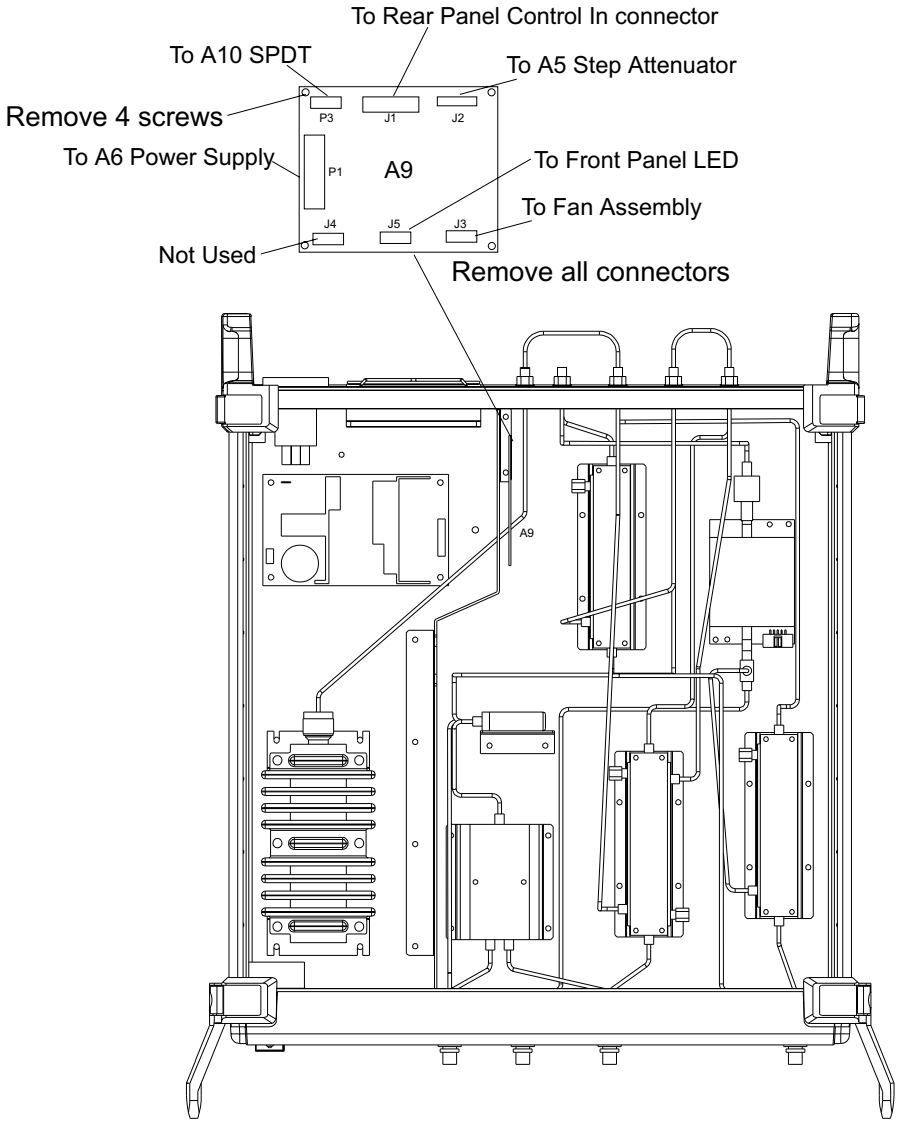

Figure 5-10. *A9 System Control PCB Removal*

5-11 FAN ASSEMBLY

This paragraph provides a procedure for removing and replacing the rear panel fan assembly.

Step 1. Remove top, bottom, and both side covers (paragraph 5-3).

Step 2. Remove four thumb nuts holding fan guard in place (Figure 5-11).

Step 3. Remove fan guard.

Step 4. With Test Set right-side up, remove the center screws from each side (Figure 5-12).

Step 5. Carefully lower the rear panel to gain access to the four fan corner screws.

Step 6. Remove the four screws, and lift the fan out.

To replace fan, reverse the order in the removal procedure.

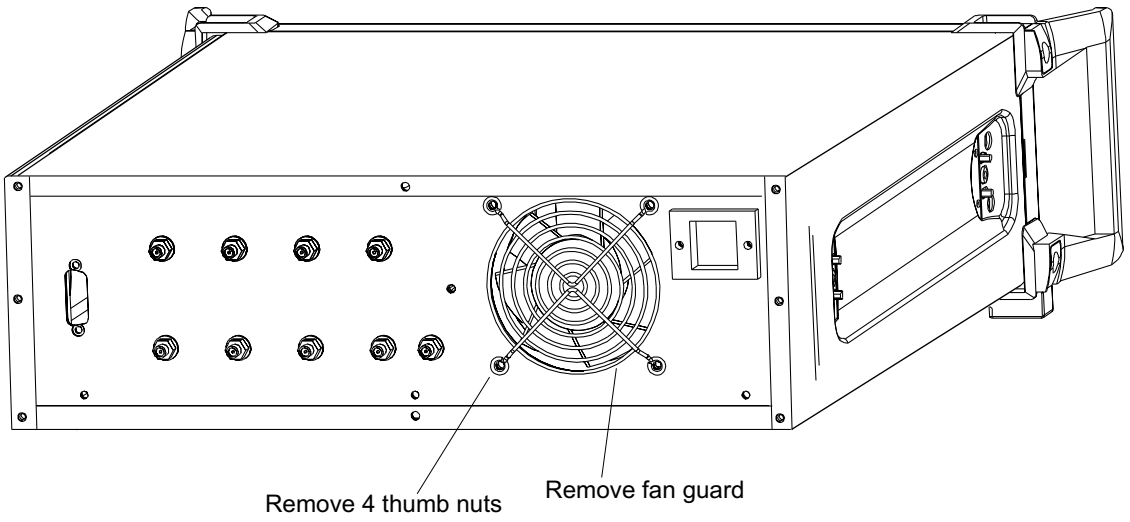

Figure 5-11. *Fan Guard Removal*

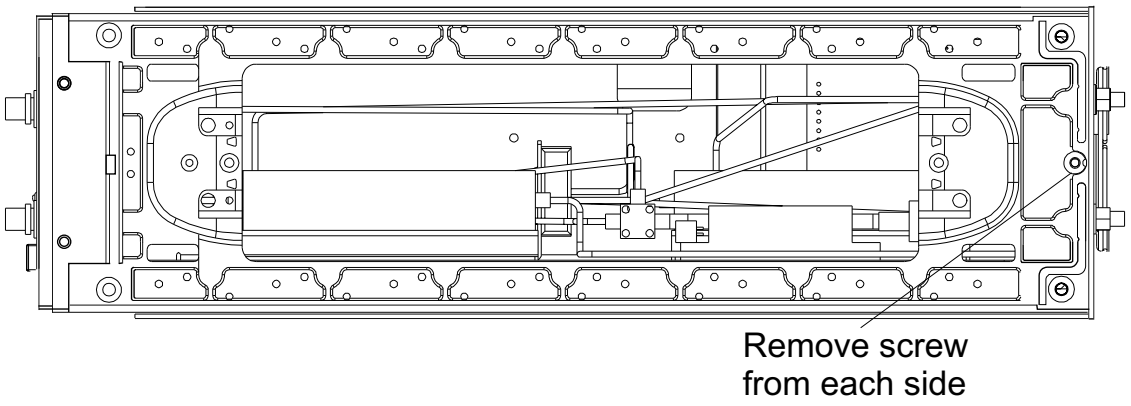

Figure 5-12. *A5 Step Attenuator Removal*

Appendix A
Connector Maintenance Check Procedures

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Appendix A
Connector Maintenance Check Procedures

A-1 INTRODUCTION

This appendix provides general, precautionary information and instructions pertaining to precision connectors.

A-2 PRECAUTIONS

The following paragraphs are precautionary notes relating to maintenance considerations for precision connectors

Pin Depth Problems

Based on ANRITSU precision components returned for repair, destructive pin depth of mating connectors is the major cause of failure in the field. When a precision component is mated with a connector having a destructive pin depth, damage will likely occur to the precision component's connector. A connector is considered to have destructive pin depth when the center pin is too long in respect to the connector's reference plane (Figure C-1).

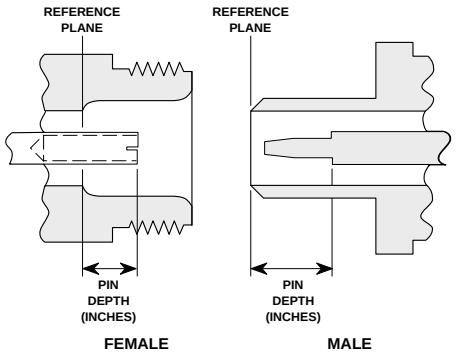

Figure A-1. *N Connector Pin Depth Definition*

Before mating an unknown or new device with your Test Set Port connectors or calibration devices, always measure the pin depth of the device's connectors. Use a ANRITSU Pin Depth Gauge, or equivalent, for these measurements (Figure C-2). Also, measure the connector pin-depth of a device when intermittent or degraded performance is suspected.

Gauging sets for measuring the pin-depth of precision connectors are available from your nearest ANRITSU Service center, or from the factory. Instructions for measuring connector pin-depth are included with the gauging set(s).

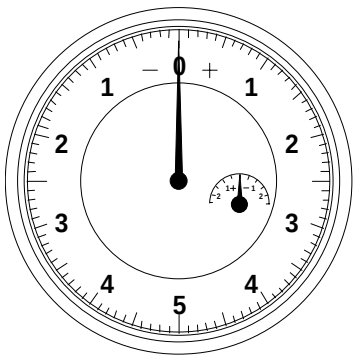

Figure A-2. *Pin Depth Gauge*

Pin-Depth Tolerance

The center pin of a precision connector has a tolerances measured in mils (one mil = 1/1000 inch). The connectors of test devices may not be precision types and they may not have the proper pin-depth. These connectors should be measured before mating to ensure suitability.

When gauging pin depth, if the connector being measured indicates out of tolerance in the "+" region of the gauge (Table C-1), the center pin is too long. *Mating under this condition will likely damage the mating connector.* On the other hand, if the test device connector indicates out of tolerance in the "–" region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

Table A-1. *Connector Pin-Depth Tolerance*

Port/ Conn. Type	Pin Depth (MILS)	Gauge Reading
GPC-7	+0.000 –0.003	Same As Pin Depth
N Male	20 –0.000 7 +0.004	20 +0.000 7 –0.004
N Female	20 –0.004 7 +0.000	Same As Pin Depth
3.5 mm Male, Female	–0.000 +0.002	
K Male, Female	+0.0000 –0.0035	
V Male	+0.000 to –0.001	
V Female	+0.000 to –0.001	

Avoid Over Torquing Connectors

Over-torquing connectors is destructive; it may damage the connector center pin. Finger-tight is usually sufficient, especially on Type N connectors. Should it be necessary to use a wrench to tighten SMA or WSMA connectors, use a torque wrench that breaks at 8 inch-pounds. As a general rule, *never use pliers to tighten connectors.*

Teflon Tuning Washers

The center conductor on many precision connectors contains a small teflon tuning washer located near the point of mating (interface). This washer compensates for minor impedance discontinuities at the interface. The washer's location is critical to the connector's performance. *Do not disturb it.*

Avoid Mechanical Shock

Precision connectors are designed to withstand years of normal bench handling. Do not drop or otherwise treat them roughly. They are laboratory-quality devices, and like other such devices, they require careful handling.

Keep Connectors Clean

The precise geometry that makes a precision connector's high performance possible can be disturbed by dirt and other contamination ad-

hering to connector interfaces. When not in use, keep the connectors covered.

Visual Inspection Precision connectors should be inspected periodically. Check for the following:

- Bent or broken center pin
- Damaged threads
- Other bent or damaged connector parts
- Dirt or foreign material in connector cavity.

A-3 *REPAIR/ MAINTENANCE*

ANRITSU recommends that no maintenance other than cleaning be attempted by the customer. Any device with a suspected defective connector should be returned to ANRITSU for repair and/or service when needed.

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