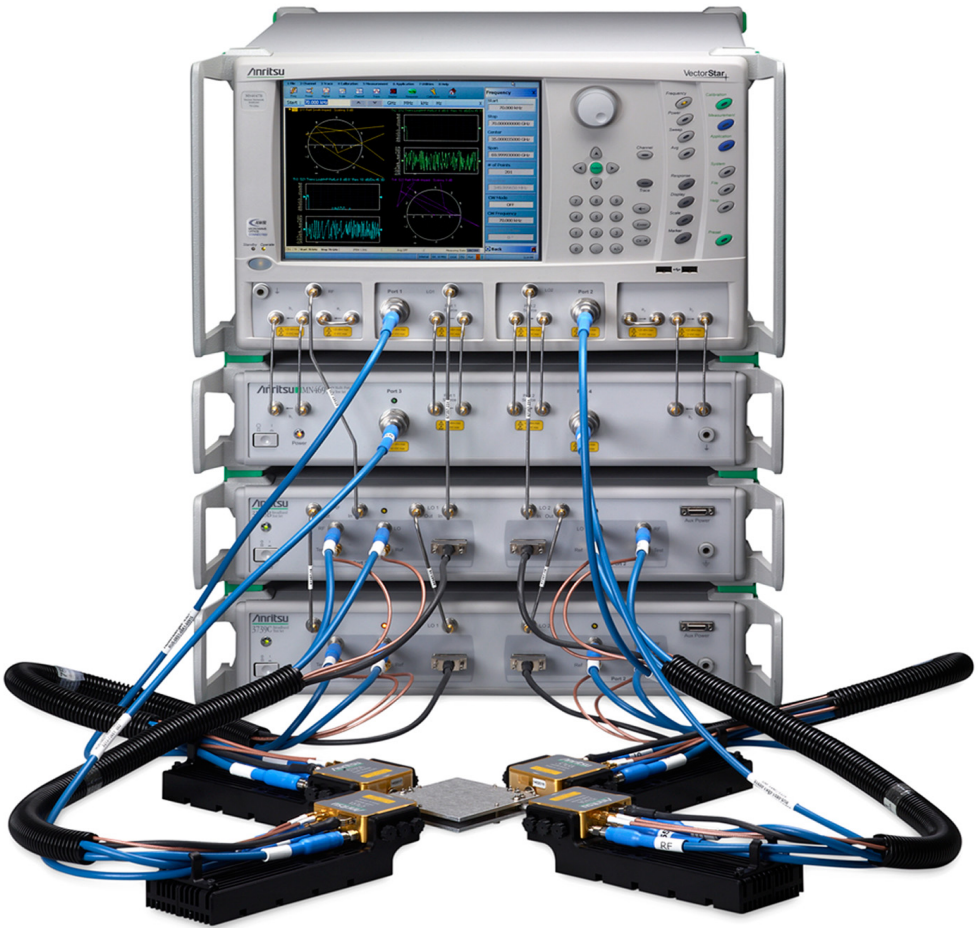
Maintenance Manual

VectorStar™ ME7838x4/ ME7838x4X Series Multiport Broadband Vector Network Analyzers

High-Performance Modular Broadband/Banded mmWave Vector Network Analyzer (VNA) Multiport Measurement System

ME7838A4/A4X, 70 kHz to 110/125 GHz
ME7838D4, 70 kHz to 145 (150) GHz
ME7838E4/E4X, 70 kHz to 110 GHz
ME7838G4, 70 kHz to 220 (226) GHz



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NOTICE

UPDATES

The latest service and sales contact information, and updated documents can be downloaded from the Anritsu Website at: http://www.anritsu.com

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Chapter 1 — General Information

1-1 Introduction

This manual provides general service and maintenance instructions for Anritsu ME7838 Series Multiport Broadband/Millimeter-wave (BB/mmWave) Vector Network Analyzer System. The ME7838 series consists of:

- ME7838A4/A4X mmWave VNA System, 70 kHz to 110/125 GHz
- ME7838D4 mmWave VNA System, 70 kHz to 145 (150) GHz
- ME7838E4/E4X mmWave VNA System, 70 kHz to 110 GHz
- ME7838G4 mmWave VNA System, 70 kHz to 220 (226) GHz

This manual contains procedures for:

- Testing the system for proper operation
- Verifying System Performance, independent of any wafer-probe station
- Troubleshooting the failed system to the failed instrument/module level
- Locating and replacing failed parts in the system test set

Each ME7838 Series Multiport System consists of a combination of the following components, specified by its respective TDS (Technical Data Sheet):

- VectorStar MS464xA/MS464xB Vector Network Analyzer with Option 007 (Receiver Offset), Option 070 (70 kHz Low End Frequency Extension), Option 08x (Modular Broadband Connection Capability)
- MN4697C Multiport Test Set
- 3739A/3739B/3739C Broadband Test Set
- 3736B Test Set
- 3743A/AX/E/EX mmWave Modules
- MA25300A mmWave Modules
- MA25400A mmWave Modules
- 3744A-EE/3744E-EE mmWave Modules
- 3744A-EW/3744E-EW mmWave Modules
- OML/VDI mmWave Modules
- Front and rear panel cables

Throughout this manual, the term “VNA System” will be used interchangeably to refer to ME7838 Series BB/mmWave Vector Network Analyzer System.

1-2 Identification Number

All Anritsu instruments are assigned an unique identification number (up to seven-digit), such as “090201” or “1010222”. This number appears on a decal affixed to the rear panel. For ME7838x4 systems use the number affixed to the rear panel of the MS464xA/B VNA. Please use this identification number during any correspondence with Anritsu Customer Service about Anritsu instruments.

1-3 Contacting Anritsu

To contact Anritsu, please visit: http://www.anritsu.com/en-US/contact-us

From here, you can select the latest sales, service and support contact information in your country or region, provide online feedback, complete a "Talk to Anritsu" form to get your questions answered, or obtain other services offered by Anritsu.

Updated product information can be found on your product page:

http://www.anritsu.com/test-measurement/products/me7838x4

On this web page, you can select various tabs for more information about your instrument. Included is a "Library" tab which contains links to all the latest technical documentation related to this instrument.

1-4 Related Manuals and Documentation

Product Information, Compliance, and Safety

- VectorStar™ Product Information, Compliance, and Safety (PICS) – 10100-00063

VectorStar MS464xA Series Vector Network Analyzer

- MS464xA Series VNA Technical Data Sheet – 11410-00432
- MS464xA Series VNA Operation Manual (OM) – 10410-00266
- MS464xA Series VNA Measurement Guide (MG) – 10410-00269
- MS464xA Series VNA Programming Manual (PM) – 10410-00267
- MS464xA Series VNA Help System (OM, PM, and MG) – 10450-00008
- MS464xA Series VNA Maintenance Manual (MM) – 10410-00268

VectorStar MS464xB Series Vector Network Analyzers

- MS464xB Series VNA Technical Data Sheet – 11410-00611
- MS464xB Series VNA Operation Manual – 10410-00317
- MS464xB Series VNA Measurement Guide – 10410-00318
- MS464xB Series VNA User Interface Reference Manual – 10410-00319
- MS464xB Series VNA Maintenance Manual – 10410-00320
- MS464xB Series VNA Programming Manual – 10410-00322
- MS464xB Series VNA Programming Manual Supplement – 10410-00323
- MS464xB Series VNA User Help System – 10450-00040

VectorStar ME7838 Series 2-Port BB/mmWave VNA Measurement System

- ME7838A Modular BB/mmWave Technical Data Sheet (TDS) – 11410-00593
- ME7838AX/A4X Modular BB/mmWave Technical Data Sheet (TDS) – 11410-02825
- ME7838D Modular BB/mmWave Technical Data Sheet (TDS) –11410-00778
- ME7838E Modular BB/mmWave Technical Data Sheet (TDS) –11410-00767
- ME7838EX/E4X Modular BB/mmWave Technical Data Sheet (TDS) –11410-02827
- ME7838G Modular BB/mmWave Technical Data Sheet (TDS) –11410-01060
- ME7838A Modular BB/mmWave Quick Start Guide (QSG) –10410-00292
- ME7838D/G Modular BB/mmWave Quick Start Guide (QSG) –10410-00732
- ME7838E Modular BB/mmWave Quick Start Guide (QSG) –10410-00729
- ME7838 Series Modular BB/mmWave Installation Guide (IG) –10410-00293

- ME7838x VectorStar Broadband/Banded mmWave Modules (RM) –10410-00311
- ME7838 Series Modular BB/mmWave Maintenance Manual (MM) –10410-00306

VectorStar ME7838x4 Multiport BB/mmWave VNA Measurement System

- ME7838A4 Multiport Broadband VNA Technical Data Sheet (TDS) – 11410-00704
- ME7838AX/A4X Modular BB/mmWave Technical Data Sheet (TDS) – 11410-02825
- ME7838D4 Multiport Broadband VNA Technical Data Sheet (TDS) – 11410-01099
- ME7838E4 Multiport Broadband VNA Technical Data Sheet (TDS) – 11410-01100
- ME7838EX/E4X Modular BB/mmWave Technical Data Sheet (TDS) –11410-02827
- ME7838G4 Multiport Broadband VNA Technical Data Sheet (TDS) – 11410-01196
- ME7838A4/A4X Multiport Broadband VNA Quick Start Guide (QSG) – 10410-00735
- ME7838D4/G4 Multiport Broadband VNA Quick Start Guide (QSG) – 10410-00770
- ME7838E4/E4X Multiport Broadband VNA Quick Start Guide (QSG) – 10410-00771
- ME7838x4 Multiport Broadband VNA Installation Guide (IG) – 10410-00734
- ME7838x4 Multiport Broadband VNA Maintenance Manual (MM) – 10410-00736
- ME7838x Broadband/Banded mmWave Module Reference Manual (RM) – 10410-00311

VectorStar MN469xC Series Multiport VNA Measurement System

- MN469xC Series Multiport VNA Measurement System Technical Data Sheet – 11410-00777
- MN469xC Series Multiport Test Set Installation Guide – 10410-00737
- MN469xC Series Multiport Test Set Quick Start Guide – 10410-00738
- MN469xC Series Multiport Test Set Maintenance Manual – 10410-00730

Calibration, Verification, and System Performance Verification

- MN4765B O/E Calibration Module Technical Data Sheet (TDS) – 11410-00843
- MN4765B O/E Calibration Module Operation Manual (OM) – 10410-00742
- 36585K and 36585V Precision Auto Calibrator (AutoCal™) Module Reference Manual – 10410-00279
- 3650A, 3652A, and 3654D Mechanical Calibration Kit Reference Manual – 10410-00278
- 366X-1 Verification Kits (3666-1 3.5 mm Connectors, 3668-1 K Connectors, 3669B-1 V Connectors) and Performance Verification Software (PVS) User Guide – 10410-00270
- 366X-1 Verification Kit and PVS Quick Start Guide – 10410-00285
- 3656B W1 (1 mm) Calibration/Verification Kit and System Performance Verification Software User Guide for the VectorStar ME7838X/X4 and Lightning ME7808A/B/C BB/mmWave VNA Systems – 10410-00286
- 3656C W1 (1mm) Calibration/Verification Kit and System Performance Verification Software User Guide for the VectorStar ME7838x/x4 BB/mmWave VNA Systems – 10410-00784
- 3659 0.8 mm Calibration/Verification Kit and 2300-580-R System Performance Verification Software User Guide – 10410-00327

Updates to Manuals

For updates to any of the VectorStar Series VNA documentation, visit Anritsu's Web site at:

http://www.anritsu.com/en-us/products-solutions/products/ms4640b-series.aspx

1-5 Electrostatic Discharge (ESD) Prevention

All electronic devices, components, and instruments can be damaged by electrostatic discharge. It is important to take preventative measures to protect the instrument and its internal subassemblies from electrostatic discharge.

An ESD safe work area and proper ESD handling procedures that conform to ANSI/ESD S20.20-1999 or ANSI/ESD S20.20-2007 is mandatory to avoid ESD damage when handling subassemblies or components found in the ME7838 Series BB/mmWave Vector Network Analyzer System.

Take steps to eliminate the static charges built-up on coaxial cables prior to connecting them to the VNA System test ports. This can be done by terminating one end of the cable with the short from the calibration kit and then grounding the outer conductor of the connector of the cables.

1-6 ME7838x4 VNA System Overview

The ME7838x4 Broadband/mmWave (BB/mmWave) VNA System provides single sweep coverage from 70 kHz to 220 GHz for measuring active devices.

The tables below show the basic configuration and major system options for the standard broadband configurations and waveguide band configurations.

- Table 1-1, “ME7838A4 Standard Broadband VNA System Components – MS4647A-based
- Table 1-2, “ME7838A4 Waveguide Band Configuration System Components – MS4640A-based
- Table 1-3, “ME7838A4/A4X Standard Broadband VNA System Components – MS4647B-based
- Table 1-4, “ME7838A4/A4X Waveguide Band Configuration System Components – MS4640B-based
- Table 1-5, “ME7838E4/E4X Standard Broadband VNA System Components – MS4647B-based
- Table 1-6, “ME7838E4/E4X Waveguide Band Configuration System Components – MS4640B-based
- Table 1-7, “ME7838D4 Standard Broadband VNA System Components – MS4647B-based
- Table 1-8, “ME7838G4 Standard Broadband VNA System Components – MS4647B-based

Additional configuration information is available in the relevant system technical data sheet.

ME7838A4 Standard Broadband VNA System Components – MS4647A-Based

Table 1-1. ME7838A4 Standard Broadband VNA System Components – MS4647A-based

Part Number	Name	Specifications
Standard ME7838A4 Configuration		
MS4647A	VectorStar MS4647A Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Test Ports
MS4640A-002	Time Domain Option	
MS4640A-007	Receiver Offset Option	
MS4640A-070	70 kHz Low End Frequency Extension Coverage	Adds VNA low frequency coverage from 70 kHz to 10 MHz
MS4647A-081	Broadband/mmWave Interface Option	Use Option MS4647A-081 with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
3743A	mmWave Modules	70 GHz to 110 (125) GHz 4 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 4 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 4 cables
MS4647A VNA Front Panel Options – Select One (1)		
MS4647A-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2 • If Option 051 is selected, use Option MS4647A-081 above
MS4647A-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software • If Option 061 is selected, use Option MS4647A-081 above
MS4647A-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software • If Option 062 is selected, use Option MS4647A-081 above

ME7838A4 Waveguide Band Configuration System Components – MS4640A-Based

Table 1-2. ME7838A4 Waveguide Band Configuration System Components – MS4640A-based

Part Number	Name	Specifications
Waveguide Band ME7838A4/A4X Configuration		
MS4644A, MS4645A or MS4647A	VectorStar MS4640A Vector Network Analyzer (VNA) with at least 40 GHz Frequency coverage	10 MHz to 40 GHz, 10 MHz to 50 GHz or 10 MHz to 70 GHz
MS4640A-002	Time Domain Option	
MS4640A-007	Receiver Offset Option	
MS464xA-08X	mmWave Interface Option	Select one: • Use Option MS4647A-083 with Option 051, 061, or 062 (selected below) • Use Option MS4645A-083 with Option 051, 061, or 062 (selected below) • Use Option MS4644A-083 with Option 051, 061, or 062 (selected below)
MN4694C or MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
mmWave Module – Select Four (4)		
3744A-EE	mmWave Modules	56 GHz to 95 GHz, WR-12 4 each
3744A-EW	mmWave Modules	65 GHz to 110 GHz, WR-10 4 each
MS4640A VNA Front Panel Options – Select One (1)		
MS464xA-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2 • If Option 051 is selected, use Option MS4647A-081 or MS464xA-083 above
MS464xA-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software • If Option 061 is selected, use Option MS4647A-081 or MS464xA-083 above
MS464xA-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software • If Option 062 is selected, use Option MS4647A-081 or MS464xA-083 above

ME7838A4/A4X Standard Broadband VNA System Components – MS4647B-Based

Table 1-3. ME7838A4/A4X Standard Broadband VNA System Components – MS4647B-based

Part Number	Name	Specifications
Standard ME7838A4/A4X Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Test Ports
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS4640B-070	70 kHz Low End Frequency Extension Coverage	Adds VNA low frequency coverage from 70 kHz to 10 MHz
MS4647B-08X	mmWave Interface Option	Select one: • Use Option MS4647B-081 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS4647B-085 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
3743A/AX	mmWave Modules	70 GHz to 110/125 GHz 4 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 4 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 4 cables
MS4647B VNA Front Panel Options – One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS4647B-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

ME7838A4/A4X Waveguide Band Configuration System Components – MS4640B-Based

Table 1-4. ME7838A4/A4X Waveguide Band Configuration System Components – MS4640B-based

Part Number	Name	Specifications
Waveguide Band ME7838A4 Configuration		
MS4644B, MS4645B or MS4647B	VectorStar MS4640B Vector Network Analyzer (VNA) with at least 40 GHz Frequency coverage	10 MHz to 40 GHz, 10 MHz to 50 GHz or 10 MHz to 70 GHz
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS464xB-08X	mmWave Interface Option	Select one: • Use Option MS464xB-083 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS464xB-085 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
mmWave Module – Select Four (4)		
3744A-EE	mmWave Modules	56 GHz to 95 GHz, WR-12
3744A-EW	mmWave Modules	65 GHz to 110 GHz, WR-10
MS4640B VNA Front Panel Options – Select One (1)		
MS464xB-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS464xB-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS464xB-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

ME7838E4/E4X Standard Broadband VNA System Components – MS4647B-Based

Table 1-5. ME7838E4/E4X Standard Broadband VNA System Components – MS4647B-based

Part Number	Name	Specifications
Standard ME7838E4/E4X Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Test Ports
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS4640B-070	70 kHz Low End Frequency Extension Coverage	Adds VNA low frequency coverage from 70 kHz to 10 MHz
MS4647B-08X	mmWave Interface Option	Select one: • Use Option MS4647B-087 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS4647B-089 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
3743E/EX	mmWave Modules	70 GHz to 110 GHz 4 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 4 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 4 cables
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS4647B-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

ME7838E4/E4X Waveguide Band Configuration System Components – MS4640B-Based

Table 1-6. ME7838E4/E4X Waveguide Band Configuration System Components – MS4640B-based

Part Number	Name	Specifications
Waveguide Band ME7838E4/E4X Configuration		
MS4644B, MS4645B or MS4647B	VectorStar MS4640B Vector Network Analyzer (VNA) with at least 40 GHz Frequency coverage	10 MHz to 40 GHz, 10 MHz to 50 GHz or 10 MHz to 70 GHz
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS464xB-08X	mmWave Interface Option	Select one: • Use Option MS464xB-087 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS464xB-089 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
mmWave Module – Select Four (4)		
3744A-EE	mmWave Modules	56 GHz to 95 GHz, WR-12
3744A-EW	mmWave Modules	65 GHz to 110 GHz, WR-10
MS4640B VNA Front Panel Options – Select One (1)		
MS464xB-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS464xB-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS464xB-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

ME7838D4 Standard Broadband VNA System Components – MS4647B-Based

Table 1-7. ME7838D4 Standard Broadband VNA System Components – MS4647B-based

Part Number	Name	Specifications
Standard ME7838D4 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Test Ports
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS4640B-070	70 kHz Low End Frequency Extension Coverage	Adds VNA low frequency coverage from 70 kHz to 10 MHz
MS4647B-08X	mmWave Interface Option	Select one: • Use Option MS4647B-081 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS4647B-085 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
MA25300A	mmWave Modules	70 GHz to 145 GHz 4 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 4 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 4 cables
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS4647B-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

ME7838G4 Standard Broadband VNA System Components – MS4647B-Based

Table 1-8. ME7838G4 Standard Broadband VNA System Components – MS4647B-based

Part Number	Name	Specifications
Standard ME7838G4 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Test Ports
MS4640B-002	Time Domain Option	
MS4640B-007	Receiver Offset Option	
MS4640B-070	70 kHz Low End Frequency Extension Coverage	Adds VNA low frequency coverage from 70 kHz to 10 MHz
MS4647B-08X	mmWave Interface Option	Select one: • Use Option MS4647B-081 without Option 031, and with Option 051, 061, or 062 (selected below) • Use Option MS4647B-085 with Option 031, and with Option 051, 061, or 062 (selected below)
MN4697C	2U 4-Port Test Set	
3736B	Test Set	With front and rear panel interface cables
3739C	Broadband Test Set	With front and rear panel interface cables
MA25400A	mmWave Modules	70 GHz to 220 GHz 4 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 4 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 4 cables
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators • Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software
MS4647B-062	Active Measurement Suite	4 Attenuators • Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software

1-7 Recommended Test Equipment

The tables below list the recommended test equipment to be used for all maintenance activities for the ME7838x4 VNA System Broadband configurations and Waveguide Band configurations.

- Table 1-9, "Recommended Test Equipment for ME7838A4/A4X/E4/E4X VNA System - Broadband Configuration
- Table 1-10, "Recommended Test Equipment for ME7838A4/A4X/E4/E4X VNA System - Waveguide Band Configuration
- Table 1-11, "Recommended Test Equipment for ME7838D4 VNA System
- Table 1-12, "Recommended Test Equipment for ME7838G4 VNA System

Test Equipment – ME7838A4/A4X/E4/E4X– Broadband Configuration

Table 1-9. Recommended Test Equipment for ME7838A4/A4X/E4/E4X VNA System - Broadband Configuration (1 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Calibration/Verification Kit	Connector Type: W1	Anritsu 3656B/C The 3656C is required for the ME7838A4X/E4XSystems (Includes verification software)	P, T
PC Controller	Configuration: • Intel Core i3 • 4 GB RAM • Windows 7 SP 1 or later • 20 MB Hard-disk free space • 1024x768 Display Resolution • USB 2.0 Type A Port • National Instruments GPIB Controller and Driver	Any	P
Power Meter	Power Range: –30 to +20 dBm Other: GPIB Controllable	Anritsu ML2437A or ML2438A	A, T
Power Meter	Power Range: –30 to +20 dBm Other: GPIB Controllable	Keysight 437, or E4418B, or N1913A with Option 200	A
Power Sensor	Frequency Range: 70 kHz to 70 GHz Power Range: –30 to +20 dBm	Anritsu SC7770	A
Power Sensor	Frequency Range: 5 to 10 GHz Power Range: ~ - 9 dBm	Anritsu MA2474D	A, T
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: –30 to +20 dBm	Keysight W8486A	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	WR-10 Waveguide to W1 female	Anritsu 35WR10WF	A
Adapter	K male to K male	Anritsu 33KK50B/C or K220B	A
Adapter	K male to K female, right angle	Pasternack PE9644	A
Adapter	N male to V female	Pasternack PE9720	A

Table 1-9. Recommended Test Equipment for ME7838A4/A4X/E4/E4X VNA System - Broadband Configuration (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Adapter	N male to K female	Anritsu 34NKF50	T
Directional Coupler	Frequency Range: 5 to 10 GHz Coupling Factor: 13 dB ± 1 dB Connector Type: K female	Krytar 102040013K	A
Spectrum Analyzer	Frequency Range: 5 to 10 GHz	Anritsu MS2720T with Opt. 732	T
RF Cable	Frequency Range: 5 to 10 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T

a.Use Codes: P = Performance Verification; A = Adjustment; T = Troubleshooting

Test Equipment – ME7838A4/A4X/E4/E4X - Waveguide Band Configuration

Table 1-10. Recommended Test Equipment for ME7838A4/A4X/E4/E4X VNA System - Waveguide Band Configuration

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Calibration Kit	WR-10 with Sliding Load WR-12 with Sliding Load	Anritsu 3655W-1 (WR-10) Anritsu 3655E-1 (WR-12)	P
Verification Standard	Precision Waveguide Section	Flann 26443-4122 (WR-12) Flann 26443-4123 (WR-10)	P
Power Meter	Power Range: −30 to +20 dBm Other: GPIB Controllable	Anritsu ML2437A or ML2438A	A, T
Power Meter	Power Range: −30 to +20 dBm Other: GPIB Controllable	Keysight 437, or E4418B, or N1913A with Option 200	A
Power Sensor	Frequency Range: 70 kHz to 70 GHz Power Range: −30 to +20 dBm	Anritsu SC7770	A
Power Sensor	Frequency Range: 5 to 10 GHz Power Range: ~ - 9 dBm	Anritsu MA2474D	A, T
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: −30 to +20 dBm	Keysight W8486A	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	WR-10 Waveguide to W1 female	Anritsu 35WR10WF	A
Adapter	K male to K male	Anritsu 33KK50B/C or K220B	A
Adapter	K male to K female, right angle	Pasternack PE9644	A
Adapter	N male to V female	Pasternack PE9720	A
Adapter	N male to K female	Anritsu 34NKF50	T
Directional Coupler	Frequency Range: 5 to 10 GHz Coupling Factor: 13 dB ± 1 dB Connector Type: K female	Krytar 102040013K	A
Spectrum Analyzer	Frequency Range: 5 to 10 GHz	Anritsu MS2720T with Opt. 732	T
RF Cable	Frequency Range: 5 to 10 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T

a.Use Codes: P = Performance Verification; A = Adjustment; T = Troubleshooting

Test Equipment – ME7838D4

Table 1-11. Recommended Test Equipment for ME7838D4 VNA System

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Calibration/Verification Kit	Connector Type: 0.8 mm	Anritsu 3659 (includes verification software)	P, A, T
PC Controller	Configuration: • Intel Core i3 • 4 GB RAM • Windows 7 SP 1 or later • 20 MB Hard-disk free space • 1024x768 Display Resolution • USB 2.0 Type A Port • National Instruments GPIB Controller and Driver	Any	P
Power Meter	Power Range: –30 to +20 dBm Other: GPIB Controllable	Anritsu ML2437A or ML2438A	A, T
Power Sensor	Frequency Range: 70 kHz to 70 GHz Power Range: –30 to +20 dBm	Anritsu SC7770	A
Power Sensor	Frequency Range: 5 to 10 GHz Power Range: ~ - 9 dBm	Anritsu MA2474D	A, T
Power Meter	Power Range: -30 to +20 dBm Other: GPIB Controllable	Keysight 437, or E4418B, or N1913A with Option 200	A
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: –30 to +20 dBm Other: GPIB Controllable	Keysight W8486A	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	WR-10 Waveguide to W1 female	Anritsu 35WR10WF	A
Power Meter/Power Sensor	Frequency Range: 110 to 170 GHz Power Range: -30 to +20 dBm Other: GPIB Controllable	ELVA-1 DPM-06/20	A
Adapter	Frequency Range: 110 to 145GHz WR-6 Waveguide to 0.8 mm female	Flann Microwave K1612	A
Adapter	K male to K male	Anritsu 33KK50B/C or K220B	A
Adapter	K male to K female, right angle	Pasternack PE9644	A
Adapter	N male to V female	Pasternack PE9720	A
Adapter	N male to K female	Anritsu 34NKF50	T
Directional Coupler	Frequency Range: 5 to 10 GHz Coupling Factor: 13 dB ± 1 dB Connector Type: K female	Krytar 102040013K	A
Spectrum Analyzer	Frequency Range: 5 to 10 GHz	Anritsu MS2720T with Opt. 732	T
RF Cable	Frequency Range: 5 to 10 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T

a.Use Codes: P = Performance Verification; A = Adjustment; T = Troubleshooting

Test Equipment – ME7838G4

Table 1-12. Recommended Test Equipment for ME7838G4 VNA System (1 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Calibration/Verification Kit	Connector Type: 0.8 mm	Anritsu 3659 (includes verification software)	P, A, T
Calibration Kit	Waveguide: WR05	VDI WR5.1CK or OML V05CAL	P, T
Verification Device	Waveguide WR-05, Straight section length: 2 inches	MI-WAVE 690G-2.0/387	P, T
Adapter	0.8 mm male to MA25400A Interface	Anritsu 33.8G50 (Qty. 2)	P, T
Adapter	WR05 Waveguide to MA25400A Interface	Anritsu 35WR5G (Qty. 2)	P, T
Through-line Adapter	MA25400A Interface to MA25400A Interface	Anritsu 33GG50	T
PC Controller	Configuration: • Intel Core i3 • 4 GB RAM • Windows 7 SP 1 or later • 20 MB Hard-disk free space • 1024x768 Display Resolution • USB 2.0 Type A Port • National Instruments GPIB Controller and Driver	Any	P
Power Meter	Power Range: –30 to +20 dBm Other: GPIB Controllable	Anritsu ML2437A or ML2438A	A, T
Power Sensor	Frequency Range: 70 kHz to 70 GHz Power Range: –30 to +20 dBm	Anritsu SC7770	A
Power Sensor	Frequency Range: 5 to 10 GHz Power Range: ~ - 9 dBm	Anritsu MA2474D	A, T
Power Meter	Power Range: -30 to +20 dBm Other: GPIB Controllable	Keysight 437B or E4418B	A
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: –30 to +20 dBm Other: GPIB Controllable	Keysight W8486A	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	WR-10 Waveguide to W1 female	Anritsu 35WR10WF	A
Power Meter/Power Sensor	Frequency Range: 110 to 170 GHz Power Range: -30 to +20 dBm Other: GPIB Controllable	ELVA-1 DPM-06/20	A
Power Meter/ Power Sensor	Frequency Range: 140 to 220 GHz Power Range: -30 to +20 dBm Other: GPIB Controllable	ELVA-1 DPM-05/20	A
Adapter	WR-5 Waveguide to 0.6 mm coaxial flange	Anritsu 35WR5G	A
Adapter	W male to 0.6 mm female coaxial flange	Anritsu 33WG50	A

Table 1-12. Recommended Test Equipment for ME7838G4 VNA System (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Adapter	K male to K male	Anritsu 33KK50B/C or K220B	A
Adapter	K male to K female, right angle	Pasternack PE9644	A
Adapter	N male to V female	Pasternack PE9720	A
Adapter	N male to K female	Anritsu 34NKF50	T
Directional Coupler	Frequency Range: 5 to 10 GHz Coupling Factor: 13 dB ± 1 dB Connector Type: K female	Krytar 102040013K	A
Spectrum Analyzer	Frequency Range: 5 to 10 GHz	Anritsu MS2720T with Opt. 732	T
RF Cable	Frequency Range: 5 to 10 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T

a.Use Codes: P = Performance Verification; A = Adjustment; T = Troubleshooting

Chapter 2 — Replaceable Parts

2-1 Introduction

This chapter provides replaceable parts information for the following items:

- System-level replaceable parts that are unique to ME7838x4/x4X VNA System
- Replaceable parts in Model 3736B Broadband Test Set

Note	This chapter does not include the replaceable parts information for the MS4640A and MS4640B Vector Network Analyzer. For their replaceable parts information, refer to the **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268 and VectorStar MS4640B Series VNA Maintenance Manual – 10410-00320**.

Note	For replaceable parts for the MN469xC Test Set, refer to: • MN469xC Series Multiport Test Set Maintenance Manual – 10410-00730 For replaceable parts for the 3739 Series Test Set, refer to: • ME7838 Series Modular BB/mmWave Maintenance Manual (MM) –10410-00306

2-2 ME7838x4/x4X System Replaceable Parts

Part numbers and description of ME7838x4 system level replaceable parts are shown in Table 2-1. Instruments

Note	There are no serviceable components or subassemblies inside the 3743A/AX/E/EX, 3744A/E, MA25300A, or MA25400A mmWave Modules. The modules must be returned to Anritsu Company for repair. Instruments shipped to European Union countries after 22nd July, 2017 are compliant with the requirements in the RoHS Directive, officially known as Directive 2011/65/EU. Instruments shipped to European Union countries after 22nd July, 2021 are compliant with the requirements in the RoHS amendment, officially known as Directive 2011/65/EU, Amendment 2015/863/EU. RoHS-compliant replacement parts must be used to repair RoHS-compliant instruments.

Table 2-1. ME7838x4 System Level Replaceable Parts List (1 of 2)

Part Number	Description
3-806-225	BNC male to BNC male Coaxial Cable, 2 ft (~61 cm) 4 per instrument, 1 per replacement kit, RoHS Compliant
3-806-226	mmWave Module Power/Control Cable 4 per instrument, 1 per replacement kit, RoHS Compliant
806-254	K male to K male RF Cable, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit
3-806-254	K male to K male RF Cable, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit, RoHS Compliant
806-256	V male to V male RF Cable, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit
3-806-256	V male to V male RF Cable, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit; RoHS Compliant
3-ND75298	Test IF Cable, SMA male to SSMC male, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit, RoHS Compliant

Table 2-1. ME7838x4 System Level Replaceable Parts List (2 of 2)

Part Number	Description
3-ND75299	Reference IF Cable, SMA male to SSMC male, 3 ft (~91 cm) 4 per instrument, 1 per replacement kit, RoHS Compliant
3-72243-21	a1 IF Cable, SMA male to SMA male, 2 ft (610 mm) Rear panel cable, RoHS Compliant
3-72243-22	b1 IF Cable, SMA male to SMA male, 2 ft. (610 cm) Rear panel cable, RoHS Compliant
3-72243-23	a2 IF Cable, SMA male to SMA male, 2 ft. (610 cm) Rear panel cable, RoHS Compliant
3-72243-24	b2 IF Cable, SMA male to SMA male, 2 ft. (610 cm) Rear panel cable, RoHS Compliant
3-ND81413	I/O Cable Assembly, 2.583 ft (787 mm) Rear panel cable, RoHS Compliant
3-ND81414	VNA/Test Set Inter-connect Cable Set Includes IF and I/O cables 3-72243-21, 3-72243-22, 3-72243-23, 3-72243-24, 3-ND81413 described above, RoHS Compliant
3-ND75338	mmWave Module Interface Cable Set for 3736B and 3739C Includes test port/test set to module cables 3-ND75298, 3-ND75299, 3-806-226, 3-806-254 and 3-806-256 described above; RoHS Compliant
2100-1-R	GPIB Cable, MS464xA/B to MN469xC; RoHS Compliant

2-3 3736B Test Set Replaceable Subassemblies and Parts

Replaceable parts of 3736B Test Set are listed in Table 2-2.

Note

Instruments shipped to European Union countries after 22nd July, 2017 are compliant with the requirements in the RoHS Directive, officially known as Directive 2011/65/EU. Instruments shipped to European Union countries after 22nd July, 2021 are compliant with the requirements in the RoHS amendment, officially known as Directive 2011/65/EU, Amendment 2015/863/EU. RoHS-compliant replacement parts must be used to repair RoHS-compliant instruments.

For a list of the MN469xC Test Set replaceable parts, refer to:
- 10410-00730 – MN469xC Series Multiport Test Set Maintenance Manual

For a list of the 3739C Test Set replaceable parts, refer to:
- 10410-00306 – ME7838 Series Modular BB/mmWave Maintenance Manual

Table 2-2. 3736B Broadband Test Set Replaceable Parts List (1 of 2)

Replacement Part Number	Description
3-40-183	Power Supply; Does not include cable harnesses, see ND73168 or 3-ND73168 below.
3-ND80389	Front Panel Frame Assembly – Including mmWave module power and control interface connectors, Power LED, Port 1 LED and Port 2 LED; RoHS Compliant
ND73168	Power Supply Cable Harness; 71918; Does not include Power Supply, see 3-40-183 above.
3-ND73168	Power Supply Cable Harness; 3-71918; RoHS Compliant; Does not include Power Supply, see 3-40-183 above.
ND80352-RFB	A1 Bias Control PCB Assembly; 3-80120-3

Table 2-2. 3736B Broadband Test Set Replaceable Parts List (2 of 2)

Replacement Part Number	Description
3-ND80352-RFB	A1 Bias Control PCB Assembly; 3-80120-3; RoHS Compliant
ND75883-RFB	A100, A101 Doubler Module; 74094; Does not include 3-803-104 Bias/Control ribbon cable
3-ND75883-RFB	A100, A101 Doubler Module; 3-74094; RoHS Compliant; Does not include 3-803-104 Bias/Control ribbon cable
ND75884-RFB	A103 RF Amplifier Module; consists of: 3-71907-1 – soldered-on cable harness, to A1 PCB Connector P1. 73619 – 8 GHz to 40 GHz Amplifier
3-ND75884-RFB	A103 RF Amplifier Module; consists of: 3-71907-1 – soldered-on cable harness, to A1 PCB Connector P1. 3-73619 – 8 GHz to 40 GHz Amplifier; RoHS Compliant
70242-RFB	A104 SPDT Switch; 0.04 to 40 GHz; Does not include SPDT Switch Control PCB Assembly – ND70926 – 64951- 3 (below).
3-70242-RFB	A104 SPDT Switch; 0.04 to 40 GHz; RoHS Compliant; Does not include SPDT Switch Control PCB Assembly – 3-ND70926 – 3-80736- 3 (below).
ND75885-RFB	A105 RF Amplifier Module; Port 1, consists of: 3-71907-2 – Soldered-on cable harness, to A1 PCB Connector P2. 73619 – 8 GHz to 40 GHz Amplifier
3-ND75885-RFB	A105 RF Amplifier Module; Port 1, consists of: 3-71907-2 – Soldered-on cable harness, to A1 PCB Connector P2. 3-73619 – 8 GHz to 40 GHz Amplifier; RoHS Compliant
ND75886-RFB	A106 RF Amplifier Module; Port 2, consists of: 3-71907-3 – Soldered-on cable harness, to A1 PCB Connector P3. 73619 – 8 GHz to 40 GHz Amplifier
3-ND75886-RFB	A106 RF Amplifier Module; Port 2, consists of: 3-71907-3 – Soldered-on cable harness, to A1 PCB Connector P3. 3-73619 – 8 GHz to 40 GHz Amplifier; RoHS Compliant
ND81416	a1, a2, b1, b2; Coaxial Switch; DC-3000 MHz, SPDT, SMA
3-ND81416	a1, a2, b1, b2; Coaxial Switch; DC-3000 MHz, SPDT, SMA; RoHS Compliant
3-1091-404	A107 Power Divider; RoHS Compliant
3-1091-405	A108, A109 Power Divider; RoHS Compliant
ND70926	SPDT Switch Control PCB Assembly; 64951-3; Does not include M-M ribbon cable for connection to A1 PCB Connector P5. Mounts on top of A104 SPDT Switch – 70242-RFB (above).
3-ND70926	SPDT Switch Control PCB Assembly; 3-80736-3; Does not include M-M ribbon cable for connection to A1 PCB Connector P5. Mounts on top of A104 SPDT Switch – 3-70242-RFB (above).
3-ND80353	Rear Panel Module Bias Switch; with cable harness 3-80186-1; RoHS Compliant Cable harness to A1 PCB Connector P21.
3-ND81472	Rear Panel Single Source/Dual Source Switch; with cable harness 3-80186-2; RoHS Compliant Cable harness to A1 PCB Connector P22.
3-ND73164	Rear Panel Fan Assembly; RoHS Compliant 3-71919 – Soldered-on 165 mm cable, to A1 PCB Connector P9.
K232B	K female to K female Panel Adapter; RoHS Compliant; Five (5) per system, 1 per replacement kit
V232	V female to V female Panel Adapter; RoHS Compliant; Two (2) per system, 1 per replacement kit

2-4 3743A/AX/E/EX and 3744A/E mmWave Module Replaceable Parts

Replaceable parts for 3743A/AX/E/EX and 3744A/E mmWave Modules are listed in Table 2-3:

Table 2-3. 3734A/AX/E/EX and 3744A/E mmWave Module Replaceable Parts List

Replacement Part Number	Description
3-73615	Knurled M2 × 10 mm Screw for mounting mmWave Modules in brackets; 24 per system, 6 per module, 1 per replacement kit; RoHS Compliant
3-ND75332	Heatsink Four (4) per system, 1 per replacement kit; RoHS Compliant

2-5 MA25300A mmWave Module Replaceable Parts

Replaceable parts for MA25300A mmWave Modules are listed in Table 2-4:

Table 2-4. MA25300A mmWave Module Replaceable Parts List

Replacement Part Number	Description
3-76147	Knurled M3 Screw for mounting mmWave Modules in brackets; RoHS Compliant 16 per system, 4 per module, 1 per replacement kit
3-ND80600	Heatsink; RoHS Compliant Four (4) per system, 1 per replacement kit

2-6 MA25400A mmWave Module Replaceable Parts

Replaceable parts for MA25400A mmWave Modules are listed in Table 2-5:

Table 2-5. MA25400A mmWave Module Replaceable Parts List

Replacement Part Number	Description
3-83968	Knurled M3 Screw for mounting mmWave Modules in brackets; RoHS Compliant 16 per system, 4 per module, 1 per replacement kit
3-ND80600	Heatsink; RoHS Compliant Four (4) per system, 1 per replacement kit

Chapter 3 — Performance Verification

3-1 Introduction

This chapter provides procedures to be used to verify the performance of the ME7838x4/x4X VNA System in both Broadband system configuration and mmWave system configuration.

3-2 Calibration and Measurement Conditions

Many external factors affect system measurement integrity to a large extent. They include:

- Extremes in the surrounding environmental conditions
- The condition and stability of the calibration kit
- The condition and stability of the test port connectors of mmWave modules
- The condition and stability of the interconnect coaxial cables linking host VNA, Test Set and mmWave modules

These are all user controlled conditions, and as such, should be evaluated periodically for impact on system performance. If these conditions vary significantly with time, the system verification procedures should be performed more often than the recommended annual cycle.

Standard Conditions

The standard conditions specified below must be observed when performing any of the operations in this chapter – both during calibration and during measurement.

- Warm-up Time:
  - 90 minutes
- Environmental Conditions
  - Temperature
    - 23 °C ± 3 °C, with < 1 °C variation from calibration temperature
  - Relative Humidity
    - 20-50% recommended
  - Error Correction:
    - Perform 12-term calibration

3-3 ME7838A4/A4X/E4/E4X Performance Verification – Broadband

The broadband system configuration verification procedures verify the measurement capability of the VNA, calibration kit, and any required adapters as a system by analyzing the measurement of artifacts that are traceable to national standards laboratories.

Note	Anritsu does not support tests or verification processes for wafer probe equipment. Contact the vendor of the wafer probe equipment if such support is desired.

The procedures are automated by using the Anritsu Broadband VNA System Performance Verification Software in conjunction with the Anritsu 3656B/C Calibration/Verification Kit. The 3656C Calibration/Verification Kit is required for the ME7838A4X.

Note	The use of non-Anritsu calibration/verification kit is not supported.

Performance Verification Software Overview

The Anritsu W1 Connector Broadband VNA System Performance Verification Software is provided on a USB memory device packaged with the Anritsu 3656B/C Calibration/Verification Kit.

The System Performance Verification Software guides the user to do the following:

- Perform a low band full 12-term SOLT calibration on the VNA system for frequencies up to 67 GHz using the 3656B/C Calibration/Verification Kit. The 3656C Calibration/Verification Kit is required for the ME7838A4X
- Measure the S-parameters of the verification standards in the 3656B/C Calibration/Verification Kit
- Verify that the measured values are within the specified measurement uncertainty limits
- Perform a high band full 12-term SSST calibration on the VNA system for frequencies above 67 GHz using the 3656B/C Calibration/Verification Kit
- Measure the S-parameters of the verification standards in the 3656B/C Calibration/Verification Kit
- Verify that the measured values are within the specified measurement uncertainty limits

Verification Result Determination

The software verification process compares the measured S-parameter data of the standards against the original standard data for those devices that was obtained using the Factory Standard Broadband VNA System (At Anritsu). The factory Standard VNA System is traceable through the Anritsu Calibration Laboratory's Impedance Standards. These standards are traceable to NIST through precision mechanical measurements and NIST-approved impedance derivation methods.

The quality of the verification results is very dependent on the degree of care taken by the user in maintaining, calibrating, and using the system. The most critical factors are:

- The stability and quality of the devices in the calibration/verification kit
- The condition of the test port connector on the mmWave modules
- The pin depth of all connectors and the proper torquing of connections. These same factors also affect the VNA system's measurement quality.

Consult the **3656B W1 Calibration/Verification Kit and System Performance Verification Software User Guide – 10410-00286** or the **3656C W1 Calibration/Verification Kit and System Performance Verification Software User Guide – 10410-00784** for proper use, care, and maintenance of the devices in the calibration/verification kit.

3-4 ME7838A4/A4X/E4/E4X System Verification Procedure – Broadband

The broadband system verification procedure is described below. The procedure assumes that the Broadband VNA System Performance Verification Software has been installed to an External Personal Computer with National Instruments GPIB interface running Microsoft Windows Operating System.

Note	The **3656B W1 Calibration/Verification Kit and System Performance Verification Software User Guide - 10410-00286** or the **3656C W1 Calibration/Verification Kit and System Performance Verification Software User Guide – 10410-00784** explains in detail the PC requirements and procedures to be used for the installation and operation of the verification software on the PC.

Equipment Required

- Personal Computer:
  - Microsoft Windows Operating System
  - National Instruments GPIB interface
  - GPIB interface cable
- Anritsu 3656B/C W1 Connector Calibration/Verification Kit

Special Precautions

When performing the procedures in this chapter, observe the following precautions:

- Minimize vibration and movement of the system and attached components.
- Clean and check pin depth and condition of all adapters and calibration components.

Procedure

This procedure assumes that the Broadband VNA System Performance Verification Software has been installed to an External Personal Computer with National Instruments GPIB interface running Microsoft Windows Operating System

1. Using the GPIB interface cable to connect the external computer to the MS4647A/B rear panel system GPIB connector. It is the upper GPIB port labeled **IEEE488.2 GPIB**.

Note	Do not connect to the lower GPIB port labeled **Dedicated GPIB**.

2. Dismount the 3743A/AX/E/EX mmWave modules from the probe station, if required.

Note	If the heatsink has been separated from the module while installing to the probe station, install the module onto its original heatsink.

3. Place the four modules on a leveled surface so that Ports 1 and 2, and Ports 3 and 4 are facing each other.
4. Install the W1 female to female adapter from the 3656B/C Calibration/Verification Kit on the Port 1 3743A/AX/E/EX mmWave Module. This converts Port 1 from a male test port to a female test port.
5. Install the W1 male to female adapter from the 3656B/C Calibration/Verification Kit on the Port 2 3743A/AX/E/EX mmWave Module.
6. Run the Anritsu W1 Connector Broadband VNA System Performance Verification Software on the PC.
7. Follow the directions displayed on the computer to perform calibration.
8. Follow the directions displayed on the computer to perform measurement of the verification standards.
9. If the verification fails, check the connectors of the test ports on the 3743A/AX/E/EX mmWave modules, calibration components, and the verification standards for damage, cleanliness, and proper connection

and torquing. Also check connections of the interconnect RF/IF coaxial cables and their phase stability. These are the most common causes for verification failures.

Note	Due to different calibration methods being required to cover the 110/125 GHz range (SOLT for low band and SSST for high band), the verification is done in two steps – Low band and High band with the break point set to 67 GHz for both 3656B and 3656C calibration kits.

10. Repeat this procedure for Port 3 and Port 4.

3-5 ME7838A4/A4X/E4/E4X Performance Verification - mmWave

The performance of ME7838A4/A4X/E4/E4X mmWave system configuration is verified by looking at the calibrated system residual performance at the waveguide interfaces.

Equipment Required

- Anritsu 3655 Series Waveguide Calibration Kit
  - Extended E Band (WR-12): 3655E-1
  - Extended W Band (WR-10): 3655W-1
- Flann Microwave Precision Waveguide Straight Section
  - Extended E Band (WR-12): 26443-4122
  - Extended W Band (WR-10): 27443-4123

Best Practices for Waveguide Connections

- The flange flat surface around the device waveguide aperture should be free of debris, nicks and scratches. Use appropriate size protective cap to cover the waveguide flange(s) when not in use.
- Through line and shim waveguide channels should be free of debris. Clean pressurized air is permissible to clean the channel. DO NOT use cold spray as the resultant condensation may affect the channel surface.
- DO NOT attempt to clean out the channel of any other waveguide device besides a through line or shim.
- Use only captivated (partially threaded) screws for waveguide connections. The threads should contact ONE flange only when fully tightened. The unthreaded length is critical when inserting shims.
- Carefully observe the threads of waveguide screws before use, especially the starting threads, for nicks and burrs.
- There are two standard hex head sizes for waveguide captivated screws; one is more common than the other – 3/32” or 0.093”.
- Essential tools are a hex head driver for the waveguide screws with a ball joint end and a short right angle hex head wrench. There is no standard torque specification for waveguide screws in this application.
- When mating two waveguide devices, use care that the fixed index pins do not scratch the flat surface of the opposite flange.
- If the Test Ports are precision type flanges, ALWAYS use the removable precision index pins from the calibration kit at every step of the calibration. Note if one end of the pin is beveled, that end projects out of the flange, to facilitate mating. Also note that the precision flange index pin length and the depth of the bore in the flange are not standardized, so mixing parts from different manufacturers may result in a (short) pin being “lost” in a (deep) bore!
- Always use four screws when connecting waveguide devices. It is permissible to use two back side and two front side but both screws on each side must be 180 degrees apart.
- Use extreme care when starting the threading of waveguide screws, especially with aluminum material. Ensure the screw is perpendicular to the flange - this is made difficult when the ball head driver is used and mechanical interferences dictates that it is set at an angle. If the screw starts to bind, STOP and back it out. Discard this particular screw and start with another.
- When mating waveguide devices, the four screws should first be threaded down just until they stop and then backed slightly. Observe closely the two mating surfaces of the waveguide flanges. This is particularly important if the flange are not of the precision type. Make sure that the flange mating surfaces are parallel to each other now and while the screws are subsequently tightened. Move one or both flanges to set the parallel surfaces. If the flanges are not mated properly (cocked), a small gap will be observed at the outside rim of the mating surface circumference.

- The four waveguide screws should be torqued as follows:
  - First, all four screws should be tightened until they just stop (minimum torque) with the mating surfaces parallel as mentioned in the previous bullet point.
  - Any one screw is then tightened to “half” torque.
  - The 180 degrees opposite screw to the first one is tightened to half torque.
  - Next, one of the two remaining screws is tightened to half torque.
  - The last screw (it should be 180 degrees opposite to the one just torqued) is then tightened to half torque.
  - Repeat starting with the first screw and tighten all screws to “full” torque.
- Offset Short Shims have some considerations:
  - If the Test Port flange is not of the precision type, there will be no precision index pins to force the Shim into the correct alignment – it could be 90 degrees circularly off, invalidating the calibration. Verify the waveguide rectangular apertures match.
  - The thickness of the Shim and its Flush Short backing necessitate a longer waveguide captivated screw than for a standard flange. Note that the threaded portion of this screw only threads into the Test Port flange. There must be a minimum of three threads into the Test Port flange when the screw is tightened down – less may damage the flange threads.
  - The Flush Short surface should be free of debris, nicks or scratches, especially in the waveguide aperture mating area.
  - The calibration routine will require two Offset Shims of different thicknesses. Ensure that the correct thickness Offset Shim is attached when called out, or else the calibration will be invalid.
  - Offset Shims are sometimes used in LRL calibrations. In this case, of course, they are inserted between both Test Ports. The captivated screw length required for this application will be different.
- When a Sliding Load is used in the calibration, the load element position is adjusted via a multiple turn knob. There may be “arbitrary” reference marks as to load position. The calibration routine requires six different positions of the load. It is not critical as to the absolute spacing of each position but it is advantageous to use the majority of the load travel distance for all the positions. Prior to using the Sliding Load, determine approximately the travel required for the six positions. Do not over torque the adjustment knob at its travel limits.
- When a captivated screw must be removed (backed out) from a flange (such as when a mating part already has a screw on its end) and it is inserted past its threaded portion loose in the non-threaded section, similar attention must be taken as to when starting the screw. It is important that the screw be perpendicular to the flange as the threads start to catch. This is more difficult when backing out as there is no way to control the required perpendicularity with the hex driver. You may be able to take advantage of the knurls on the head of the captivated screw and start by pressing the free threaded end of the screw back with a finger until it stops at the beginning of the threads and start the revere threading with your fingers. Once the threads are started, the driver can be used. If the threads start binding, STOP, forward, and carefully start over.
- All steps of the calibration process ideally should be completed in the minimum possible elapsed time to minimize uncorrectable errors due to system drift. To help accomplish this, waveguide screws should be applied to all one port calibration devices (terminations, sliding loads and one-piece offset shorts) prior to starting a calibration. The assumption here is that device mating will utilize all four screws from the calibration device side.

3-6 ME7838A4/A4X/E4/E4X System Verification Procedure – mmWave

The mmWave system verification procedure is described below. It verifies the corrected source match and corrected directivity of the ME7838x4 system at the waveguide test port of the mmWave module. The system must be calibrated and the error correction must be applied for these tests.

Note	Precision index pins must be used for all steps and all components used in the procedure.

Procedure

1. Dismount the four mmWave modules (3744A-EE, 3744A-EW) from the probe station, if required.

Note	If the heatsink has been separated from the module while installing to the probe station, install the module onto its original heatsink.

2. Place the four mmWave modules on a leveled surface.
3. Install the precision waveguide sections from the 3655X-1 calibration kit to the test port of each mmWave module.
4. Apply AC power to the system.
5. Allow the system to warm up for at least 90 minutes.
6. On the MS464xA/B VNA, set the start and stop frequency to match the operating range of the mmWave modules installed to the VNA system. For example, set the Start frequency to 65 GHz and the Stop frequency to 110 GHz when 3744A-EW Modules are installed to the VNA system.
7. Set the # of Points to 401.
8. Press the **Avg** key and set the IFBW to 1 kHz.

Measurement Calibration Setup

9. Press the **Calibration** key.
10. Select Cal/kit/AutoCal Characterization.
11. Insert the USB flash drive that contains the Calibration Kit Component Coefficients into one of the USB ports on the MS464xA/B front panel.
12. Select Install Kit/Charac.
13. In the Install window, select Cal Kit, and then click the Browse button.
14. In the Open window, click the Files of Type drop down arrow. Select Lightning Files.
15. Browse to the USB flash drive, select the kit_info.wav file, and then click the Open button to return to the Install window.
16. Click the Open button to install the coefficients.
17. Click Back on the lower section of the right side menu to return to previous menu.
18. Select Calibrate | Manual Cal | 1-Port Cal | Modify Cal Setup | Line Type | Waveguide
19. Select Cal Method | Offset Short (SSLT)
20. Select Edit Cal Params

    The Full One Port Cal dialog box opens.
21. In the Full One Port Cal window (Figure 3-1 on page 3-8), select:
    a. Waveguide Kit - Select WR12 for 3744A-EE and WR10 for 3744A-EW.
    b. Load Type - Sliding Load (For Test Port 1 through Test Port 4).

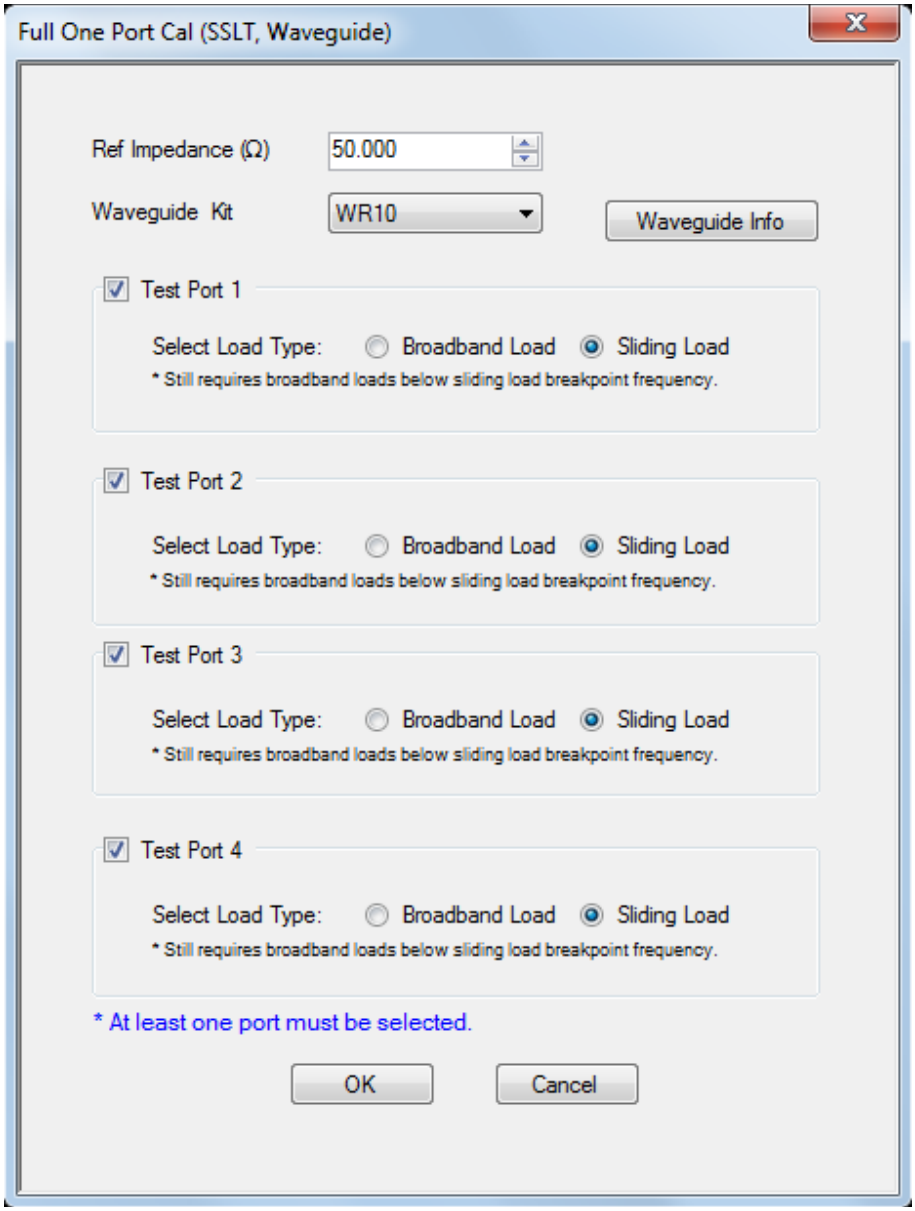


Figure 3-1. Full One Port Cal Setup Window

22. Click the OK button to close the window.

23. Click Back on the lower section of the right side menu to return to the previous menu.

24. Install the waveguide load from the 3655X-1 Calibration Kit to the test port of Port 2 module.

25. Select Port 1 Reflective Devices.

26. Install the thinner shim and the short from the 3655X-1 Calibration Kit to the test port of Port 1 module.

27. Select Short 1 to measure the calibration standard.

28. Remove the shim and the short from Port 1.

29. Install the thicker shim and the short to Port 1.

30. Select Short 2 to measure the calibration standard.

31. Remove the shim and the short from Port 1.

32. Install the waveguide load to Port 1.

33. Select Load to measure the calibration standard.

34. Remove the load from Port 1.

35. Select Sliding Load.

36. Set the vernier knob of the sliding load to 0 and install the sliding load to Port 1.

37. Select Position 1 to measure.

38. Adjust the vernier knob counter-clockwise for a few graduations.

Note	The vernier knob adjustment is not required to be precise. The requirement is to have five, non-equal distances for the next five positions when the sliding is measured during calibration.

39. Select Position 2 to measure.

40. Adjust the vernier knob counter-clockwise to a new position.

41. Select Position 3 to measure.

42. Adjust the vernier knob counter-clockwise to a new position.

43. Select Position 4 to measure.

44. Adjust the vernier knob counter-clockwise to a new position.

45. Select Position 5 to measure.

46. Adjust the vernier knob counter-clockwise to a new position.

47. Select Position 6 to measure.

48. Click Back on the lower section of the right side menu to return to the previous menu.

49. Remove the sliding load and install the load to Port 1.

50. Select Port 2 Reflective Devices.

51. Install the thinner shim and the short from the 3655X-1 Calibration Kit to the test port of Port 2 module.

52. Select Short 1 to measure the calibration standard.

53. Remove the shim and the short from Port 2.

54. Install the thicker shim and the short to Port 2.

55. Select Short 2 to measure the calibration standard.

56. Remove the shim and the short from Port 2.

57. Install the waveguide load to Port 2.

58. Select Load to measure the calibration standard.

59. Remove the load from Port 2.

60. Select Sliding Load.

61. Set the vernier knob of the sliding load to 0 and install the sliding load to Port 2.

62. Select Position 1 to measure.

63. Adjust the vernier knob counter-clockwise for a few graduations.

Note	The vernier knob adjustment is not required to be precise. The requirement is to have five, non-equal distances for the next five positions when the sliding is measured during calibration.

64. Select Position 2 to measure.

65. Adjust the vernier knob counter-clockwise to a new position.

66. Select Position 3 to measure.

67. Adjust the vernier knob counter-clockwise to a new position.

68. Select Position 4 to measure.

69. Adjust the vernier knob counter-clockwise to a new position.

70. Select Position 5 to measure.

71. Adjust the vernier knob counter-clockwise to a new position.

72. Select Position 6 to measure.

73. Click Back on the lower section of the right side menu to return to the previous menu.

74. Remove the sliding load from Port 2.

75. Click Back on the lower section of the right side menu to return to the previous menu.

76. Install the waveguide load from the 3655X-1 Calibration Kit to the test port of Port 4 module.

77. Select Port 3 Reflective Devices.

78. Install the thinner shim and the short from the 3655X-1 Calibration Kit to the test port of Port 3 module.

79. Select Short 1 to measure the calibration standard.

80. Remove the shim and the short from Port 3.

81. Install the thicker shim and the short to Port 3.

82. Select Short 2 to measure the calibration standard.

83. Remove the shim and the short from Port 3.

84. Install the waveguide load to Port 3.

85. Select Load to measure the calibration standard.

86. Remove the load from Port 3.

87. Select Sliding Load.

88. Set the vernier knob of the sliding load to 0 and install the sliding load to Port 3.

89. Select Position 1 to measure.

90. Adjust the vernier knob counter-clockwise for a few graduations.

Note	The vernier knob adjustment is not required to be precise. The requirement is to have five, non-equal distances for the next five positions when the sliding is measured during calibration.

91. Select Position 2 to measure.

92. Adjust the vernier knob counter-clockwise to a new position.

93. Select Position 3 to measure.

94. Adjust the vernier knob counter-clockwise to a new position.

95. Select Position 4 to measure.

96. Adjust the vernier knob counter-clockwise to a new position.

97. Select Position 5 to measure.

98. Adjust the vernier knob counter-clockwise to a new position.

99. Select Position 6 to measure.

100. Click Back on the lower section of the right side menu to return to the previous menu.

101. Remove the sliding load and install the load to Port 3.

102. Select Port 4 Reflective Devices.

103. Install the thinner shim and the short from the 3655X-1 Calibration Kit to the test port of Port 4 module.

104. Select Short 1 to measure the calibration standard.

105. Remove the shim and the short from Port 4.

106. Install the thicker shim and the short to Port 4.

107. Select Short 2 to measure the calibration standard.

108. Remove the shim and the short from Port 4.

109. Install the waveguide load to Port 4.

110. Select Load to measure the calibration standard.

111. Remove the load from Port 4.

112. Select Sliding Load.

113. Set the vernier knob of the sliding load to 0 and install the sliding load to Port 4.

114. Select Position 1 to measure.

115. Adjust the vernier knob counter-clockwise for a few graduations.

Note	The vernier knob adjustment is not required to be precise. The requirement is to have five, non-equal distances for the next five positions when the sliding is measured during calibration.

116. Select Position 2 to measure.

117. Adjust the vernier knob counter-clockwise to a new position.

118. Select Position 3 to measure.

119. Adjust the vernier knob counter-clockwise to a new position.

120. Select Position 4 to measure.

121. Adjust the vernier knob counter-clockwise to a new position.

122. Select Position 5 to measure.

123. Adjust the vernier knob counter-clockwise to a new position.

124. Select Position 6 to measure.

125. Click Back on the lower section of the right side menu to return to the previous menu.

126. Remove the sliding load from Port 4.

127. Select Done to complete the calibration.

Port 1 Directivity Verification

128. Select Tr1 | Trace | Trace Max. The VNA should display the S_{11} measurement trace.

129. Select Display | Trace Format | Log Mag.

130. Connect the Flann precision waveguide straight section (Flann 26443-4122 for WR-12, Flann 27443-4123 for WR-10) to Port 1 Module and leave one end open.

Note	Ensure that the open end of the waveguide straight section is **not** facing any RF reflective surface.

131. Select Scale | Auto Scale Active Trace.

132. Select Marker.

133. Click Mkr 1, Mkr 2, and Mkr 3 to turn these markers On.

134. Using the mouse to move Mkr 1 and Mkr 2 to adjacent peaks of the ripple with the greatest negative trough (or the adjacent troughs if the ripple has the greatest positive peak) in the frequency band of interest as shown in Figure 3-2, "Markers Positioning for Directivity Verification".

Figure 3-2. Markers Positioning for Directivity Verification

135. Position Mkr 3 to the bottom of the trough (or to the top of the peak if the ripple has the greatest position peak).

136. Sum the magnitude values of Mkr 1 and Mkr 3 at the peaks (or troughs) and divide the result by two. This is the average value of the tow peaks (or troughs). Refer to the example formula below:

Average Value = (Mkr 1 + Mkr 3)/2

137. Calculate the peak-to-peak ripple value (absolute difference of the Mkr 3 value and the average value) as follows:

$dB_{p\text{-}p}$ = |Mkr 2 value – Average Value|

138. On the RF measurement chart in Figure 3-4 on page 3-16, find the "REF ± X Pk to Pk Ripple dB" value closest to the calculated value in step 137.

139. Find the corresponding "X dB Below Reference" value, the "Ref + X" value and the "Ref – X" value of the "REF ± X Pk to Pk Ripple dB" value on the RF measurement chart.

140. Use the following formula to calculate the directivity:

For ripple with a negative trough –

Directivity = X dB Below Reference value + |Mkr 2 value| – |Ref – X value|

For ripple with a positive peak –

Directivity = X dB Below Reference value + |Mkr 2 value| + |Ref + X value|

Example:

Assuming Mkr 1 = –15.9634 dB, Mkr 2 = –17.452 dB, and Mkr 3 = –15.641 dB then,

Average Value = ((-15.9634 dB) + (-15.641 dB))/2 = -15.8022 dB

dB_{p-p} = |-17.452 dB - (-15.8022 dB)| = 1.6498 dB

RF Chart closest value = 1.7430 dB

RF Chart corresponding X dB Below Reference value = 20 dB

RF Chart corresponding |Ref - X value| = 0.9151 dB

Directivity = 20 dB + 17.452 dB - 0.9151 dB = 36.5369 dB

141. Record the calculated directivity value into the Port 1 Measured column of Table A-1, "Directivity" on page A-2.

Port 2 Directivity Verification

142. Remove the waveguide straight section from Port 1 Module and install it to Port 2 Module. Select Response and then select S22.

143. Repeat Step 131 through Step 140.

144. Record the calculated Directivity value into Port 2 Measured column of Table A-1 on page A-2.

Port 3 Directivity Verification

145. Remove the waveguide straight section from Port 2 module and install it to Port 3 module. Select Response and then select S33.

146. Repeat Step 131 through Step 140.

147. Record the calculated Directivity value into Port 3 Measured column of Table A-1 on page A-2.

Port 4 Directivity Verification

148. Remove the waveguide straight section from Port 3 module and install it to Port 4 module. Select Response and then select S44.

149. Repeat Step 131 through Step 140.

150. Record the calculated Directivity value into Port 4 Measured column of Table A-1 on page A-2.

Port 1 Source Match Verification

151. Connect a flush short to the open end of the Flann precision waveguide straight section (Flann 26443-4122 for WR-12, Flann 27443-4123 for WR-10) and install them to Port 1. Select Response and then S11.

152. Select Scale | Auto Scale Active Trace.

Note

There may be secondary, higher order frequency ripples and/or noise present on the display. Application of Smoothing is permissible to reduce the high frequency ripple and noise to help measure the main ripple amplitude. Follow these guidelines:

- Use up to 3% Smooth or the percentage when the peak-to-peak amplitude of the main ripple just starts to decrease, whichever comes first.
- Setting fractional amount of Smoothing (e.g. 2.5%) will help find a good setting.
- Turn off Smoothing after the measurement is done.

153. Select Marker.

154. Click Mkr 1, Mkr 2, and Mkr 3 to turn these markers On.

155. Using the mouse to move Mkr 1 and Mkr 3 to adjacent peaks of the ripple with the greatest negative trough (or the adjacent troughs if the ripple has the greatest positive peak) in the frequency band of interest. See Figure 3-3, “Marker Positioning for Source Match Verification” on page 3-14.

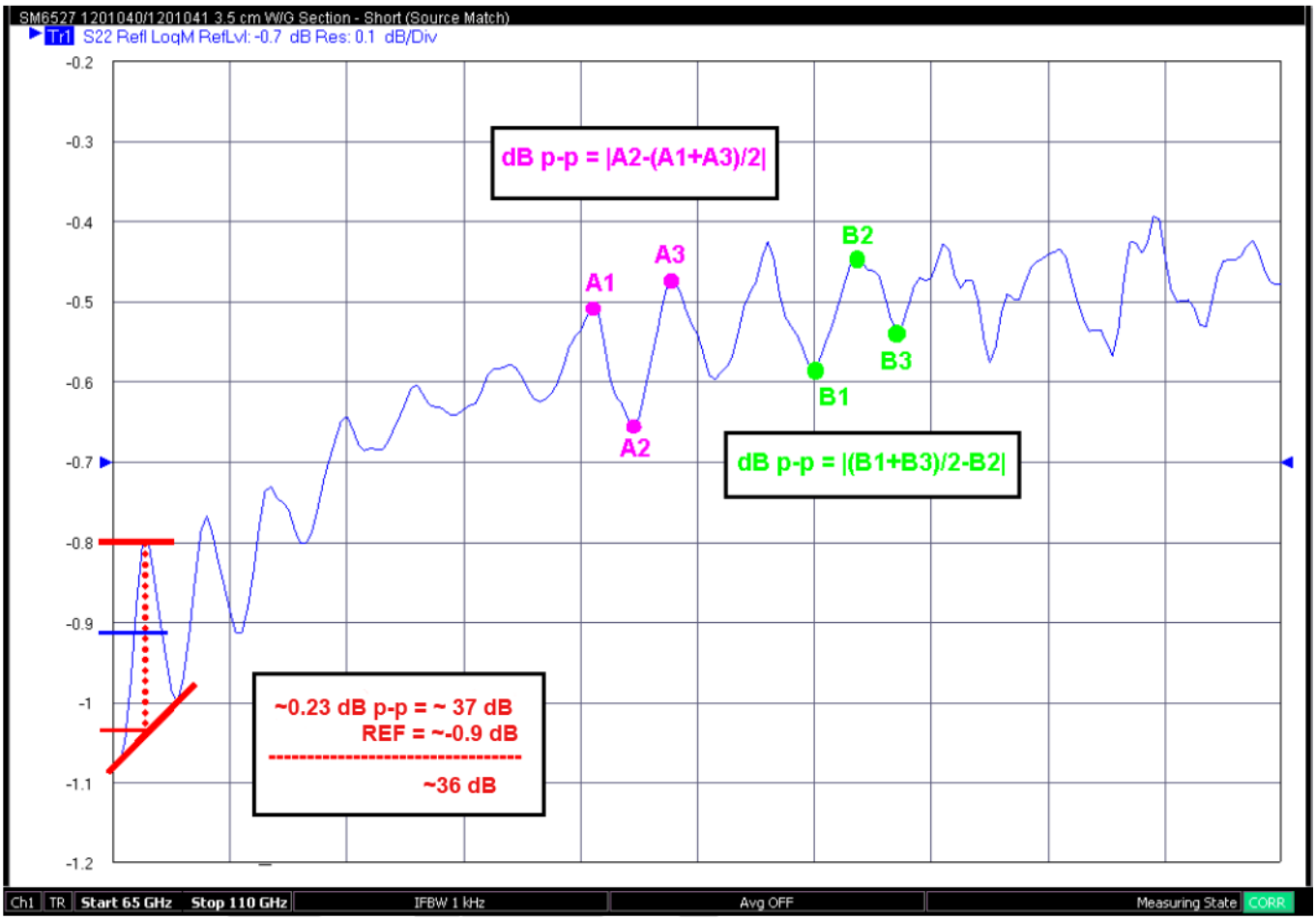


Figure 3-3. Marker Positioning for Source Match Verification

156. Sum the magnitude values of Mkr 1 and Mkr 3 at the peaks (or troughs) and divide the result by two. This is the average value of the tow peaks (or troughs). Refer to the example formula below:

Average Value = (Mkr 1 + Mkr 3)/2

157. Calculate the peak-to-peak ripple value (absolute difference of the Mkr 2 value and the average value) as follows:

$dB_{p\text{-}p}$ = |Mkr 2 value – Average Value|

158. On the RF measurement chart in Figure x, find the "REF ± X Pk to Pk Ripple dB" value closest to the calculated value in step 85.

159. Find the corresponding "X dB Below Reference" value, the "Ref + X" value and the "Ref – X" value of the "REF ± X Pk to Pk Ripple dB" value on the RF measurement chart.

160. Use the following formula to calculate the source match:

For ripple with a negative trough –

Source Match = X dB Below Reference value + |Mkr 2 value| – |Ref – X value|

For ripple with a positive peak –

Source Match = X dB Below Reference value + |Mkr 2 value| + |Ref + X value|

161. Record the calculated Source Match value into Port 1 Measured column of Table A-2, "Source Match" on page A-2.

162. Disconnect the Flann precision waveguide section with the mounted flush short from Port 1 module.

Port 2 Source Match Verification

163. Install the Flann precision waveguide section with the mounted flush short to Port 2 module.

164. Select Response and then S_{22}.

165. Repeat Step 152 through Step 160.

166. Record the calculated Source Match value into Port 2 Measured column of Table A-2 on page A-2.

167. Disconnect the Flann precision waveguide section with the mounted flush short from Port 2 module.

Port 3 Source Match Verification

168. Install the Flann precision waveguide section with the mounted flush short to Port 3 module.

169. Select Response and then S_{33}.

170. Repeat Step 152 through Step 160.

171. Record the calculated Source Match value into Port 3 Measured column of Table A-2 on page A-2.

172. Disconnect the Flann precision waveguide section with the mounted flush short from Port 3 module.

Port 4 Source Match Verification

173. Install the Flann precision waveguide section with the mounted flush short to Port 4 module.

174. Select Response and then S_{44}.

175. Repeat Step 152 through Step 160.

176. Record the calculated Source Match value into Port 4 Measured column of Table A-2 on page A-2.

177. Disconnect the Flann precision waveguide section with the mounted flush short from Port 4 module.

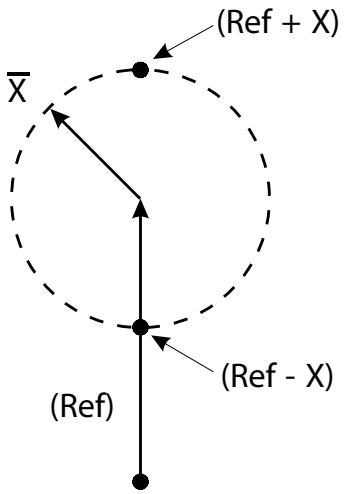
The first three columns are conversion tables for return loss, reflection coefficient, and SWR.

The last four columns are values for interactions of a small phasor X with a large phasor (unity reference) expressed in dB related to the reference.

The RF Measurement Chart can be used to determine the uncertainty due to bridge/autotester VNA directivity. The "X dB Below Reference" column represents the difference between the directivity and the measured reflection (return loss). The "Ref + X dB" and "Ref – X dB" values are 360°. Therefore, the peak-to-peak ripple (1 ± X) is the total measurement uncertainty caused by the error signal.

For example, if a 30 dB return loss is measured with a 40 dB directivity autotester, the X dB Below Reference value is 10 dB. The Ref + X dB value is 2.3866 dB and the Ref – X dB value is 3.3018 dB.

The actual return loss is between 27.6134 dB (– 30 + 2.3866) and 33.3018 dB (– 30 – 3.3018). The peak-to-peak ripple on a swept measurement will be 5.6884 dB. If the error and directivity signals are equal, the Ref + X dB value equals 6 dB (voltage doubling causes a 6 dB change) and the Ref – X dB value becomes infinite, since the two signals are equal in amplitude and 180° out of phase (zero voltage).



Phasor Interaction

SWR	Reflection Coefficient	Return Loss (dB)	Relative to Unity Reference			
			X dB Below Reference	Ref + X (dB)	Ref - X (dB)	Ref ± X Pk to Pk Ripple (dB)
17.3910	0.8913	1	1	5.5350	-19.2715	24.8065
8.7242	0.7943	2	2	5.0780	-13.7365	18.8145
5.8480	0.7079	3	3	4.6495	-10.6907	15.3402
4.4194	0.6310	4	4	4.2489	-8.6585	12.9073
3.5698	0.5623	5	5	3.8755	-7.1773	11.0528
3.0095	0.5012	6	6	3.5287	-6.0412	9.5699
2.6146	0.4467	7	7	3.2075	-5.1405	8.3480
2.3229	0.3981	8	8	2.9108	-4.4096	7.3204
2.0999	0.3548	9	9	2.6376	-3.8063	6.4439
1.9250	0.3162	10	10	2.3866	-3.3018	5.6884
1.7849	0.2818	11	11	2.1567	-2.8756	5.0322
1.6709	0.2512	12	12	1.9465	-2.5126	4.4590
1.5769	0.2239	13	13	1.7547	-2.2013	3.9561
1.4985	0.1995	14	14	1.5802	-1.9331	3.5133
1.4326	0.1778	15	15	1.4216	-1.7007	3.1224
1.3767	0.1585	16	16	1.2778	-1.4988	2.7766
1.3290	0.1413	17	17	1.1476	-1.3227	2.4703
1.2880	0.1259	18	18	1.0299	-1.1687	2.1986
1.2528	0.1122	19	19	0.9237	-1.0337	1.9574
1.2222	0.1000	20	20	0.8279	-0.9151	1.7430
1.1957	0.0891	21	21	0.7416	-0.8108	1.5524
1.1726	0.0794	22	22	0.6639	-0.7189	1.3828
1.1524	0.0708	23	23	0.5941	-0.6378	1.2319
1.1347	0.0631	24	24	0.5314	-0.5661	1.0975
1.1192	0.0562	25	25	0.4752	-0.5027	0.9779
1.1055	0.0501	26	26	0.4248	-0.4466	0.8714
1.0935	0.0447	27	27	0.3796	-0.3969	0.7765
1.0829	0.0398	28	28	0.3391	-0.3529	0.6919
1.0736	0.0355	29	29	0.3028	-0.3138	0.6166
1.0653	0.0316	30	30	0.2704	-0.2791	0.5495
1.0580	0.0282	31	31	0.2414	-0.2483	0.4897
1.0515	0.0251	32	32	0.2155	-0.2210	0.4365
1.0458	0.0224	33	33	0.1923	-0.1967	0.3890
1.0407	0.0200	34	34	0.1716	-0.1751	0.3467
1.0362	0.0178	35	35	0.1531	-0.1558	0.3090
1.0322	0.0158	36	36	0.1366	-0.1388	0.2753
1.0287	0.0141	37	37	0.1218	-0.1236	0.2454
1.0255	0.0126	38	38	0.1087	-0.1100	0.2187
1.0227	0.0112	39	39	0.0969	-0.0980	0.1949
1.0202	0.0100	40	40	0.0864	-0.0873	0.1737
1.0180	0.0089	41	41	0.0771	-0.0778	0.1548
1.0160	0.0079	42	42	0.0687	-0.0693	0.1380
1.0143	0.0071	43	43	0.0613	-0.0617	0.1230
1.0127	0.0063	44	44	0.0546	-0.0550	0.1096
1.0113	0.0056	45	45	0.0487	-0.0490	0.0977
1.0101	0.0050	46	46	0.0434	-0.0436	0.0871
1.0090	0.0045	47	47	0.0387	-0.0389	0.0776
1.0080	0.0040	48	48	0.0345	-0.0346	0.0692
1.0071	0.0035	49	49	0.0308	-0.0309	0.0616
1.0063	0.0032	50	50	0.0274	-0.0275	0.0549
1.0057	0.0028	51	51	0.0244	-0.0245	0.0490
1.0050	0.0025	52	52	0.0218	-0.0218	0.0436
1.0045	0.0022	53	53	0.0194	-0.0195	0.0389
1.0040	0.0020	54	54	0.0173	-0.0173	0.0347
1.0036	0.0018	55	55	0.0154	-0.0155	0.0309
1.0032	0.0016	56	56	0.0138	-0.0138	0.0275
1.0028	0.0014	57	57	0.0123	-0.0123	0.0245
1.0025	0.0013	58	58	0.0109	-0.0109	0.0219
1.0022	0.0011	59	59	0.0097	-0.0098	0.0195
1.0020	0.0010	60	60	0.0087	-0.0087	0.0174

Figure 3-4. RF Measurement Chart

3-7 ME7838D4 System Verification Procedure

The broadband system verification procedure is described below. The procedure assumes that the Broadband VNA System Performance Verification Software has been installed to an External Personal Computer with National Instruments GPIB interface running Microsoft Windows Operating System.

Equipment Required

- Personal Computer:
- Microsoft Windows Operating System
- National Instruments GPIB interface
- GPIB interface cable
- Anritsu 3659 0.8mm Connector Calibration/Verification Kit

Special Precautions

When performing the procedures in this chapter, observe the following precautions:

- Minimize vibration and movement of the system and attached components.
- Clean and check pin depth and condition of all adapters and calibration components.

Procedure

1. Using the GPIB interface cable to connect the external computer to the MS4647B rear panel system GPIB connector. It is the upper GPIB port labeled IEEE488.2 GPIB.

2. Dismount the MA25300A mmWave modules from the probe station, if required.

3. Place the modules on a leveled surface so that Ports 1 and 2, and Ports 3 and 4 are facing each other.

4. Install the 0.8 mm female to female adapter from the 3659 Calibration/Verification Kit on the Port 1 MA25300A mmWave Module. This converts Port 1 from a male test port to a female test port.

5. Install the 0.8 mm male to female adapter from the 3659 Calibration/Verification Kit on the Port 2 MA25300A mmWave Module.

6. Run the Anritsu 0.8 mm Connector Broadband VNA System Performance Verification Software on the PC.

7. Follow the directions displayed on the computer to perform calibration.

8. Follow the directions displayed on the computer to perform measurement of the verification standards.

9. Repeat the procedure for Ports 3 and Port 4.

10. If the verification fails, check the connectors of the test ports on the MA25300A mmWave modules, calibration components, and the verification standards for damage, cleanliness, and proper connection and torquing. Also check connections of the interconnect RF/IF coaxial cables and their phase stability. These are the most common causes for verification failures.

Note	The 3659 0.8 mm Calibration/Verification Kit and System Performance Verification Software User Guide – 10410-00327 explains in detail the Personal Computer requirements and procedures to be used for the installation and operation of the verification software on the PC.

Note	Do not connect to the lower GPIB port labeled Dedicated GPIB.

Note	If the heatsink has been separated from the module while installing to the probe station, install the module onto its original heatsink.

Note	Since different calibration methods are required to cover the 145 GHz range (SOLT for low band and SSST for high band), the verification is done in two steps – Low band and High band with the break point set to 80 GHz.

3-8 ME7838G4 Performance Verification

The ME7838G4 system is verified using two procedures:

- ME7838G4 0.8 mm coaxial system verification
- ME7838G4 WR05 Waveguide system verification

Note	Anritsu does not support tests or verification processes for wafer probe equipment. Contact the vendor of the wafer probe equipment if such support is desired.

ME7838G4 0.8 mm Coaxial System Verification

This procedure is used to verify the measurement capability of the VNA, calibration kit, and any required adapters as a system from 70 kHz to 145 GHz by analyzing the measurement of artifacts that are traceable to International System of Units (SI) via national metrology institutes.

The procedures are automated by using the Anritsu 0.8 mm Connector Broadband VNA System Performance Verification Software in conjunction with the Anritsu 3659 Calibration/Verification Kit.

Note	The use of non-Anritsu calibration/verification kit is not supported.

Performance Verification Software Overview

The Anritsu 0.8 mm Connector Broadband VNA System Performance Verification Software is provided on a USB memory device packaged with the Anritsu 3659 Calibration/Verification Kit.

The System Performance Verification Software guides the user to do the following:

- Perform a low-band full 12-term SOLT calibration on the VNA system for frequencies up to 80 GHz using the 3659 Calibration/Verification Kit
- Measure the S-parameters of the verification standards in the 3659 Calibration/Verification Kit
- Verify that the measured values are within the specified measurement uncertainty limits
- Perform a high-band full 12-term SSST calibration on the VNA system for frequencies above 80 GHz using the 3659 Calibration/Verification Kit
- Measure the S-parameters of the verification standards in the 3659 Calibration/Verification Kit
- Verify that the measured values are within the specified measurement uncertainty limits

Verification Result Determination

The software verification process compares the measured S-parameter data of the standards against the original standard data for those devices that was obtained using the Factory Standard Broadband VNA System (At Anritsu). The factory Standard VNA System is traceable through the Anritsu Calibration Laboratory's Impedance Standards. These standards are traceable to International System of Units (SI) through precision mechanical measurements, microwave theory impedance derivation methods, and electrical impedance comparison measurements.

The quality of the verification results is very dependent on the degree of care taken by the user in maintaining, calibrating, and using the system. The most critical factors are:

- The stability and quality of the devices in the calibration/verification kit
- The condition of the test port connector on the mmWave modules
- The pin depth of all connectors and the proper torquing of connections. These same factors also affect the VNA system's measurement quality.

Consult the **3659 0.8 mm Connector Calibration/Verification Kit System Performance Verification Software User Guide – 10410-00327** for proper use, care, and maintenance of the devices in the calibration/verification kit.

ME7838G4 WR05 Waveguide System Verification

This procedure is used to verify the measurement capability of the VNA, calibration kit, and any required adapters as a system from 140 GHz to 220 GHz by analyzing the S-parameter measurements of a specified waveguide device.

3-9 ME7838G4 System Verification Procedure – 0.8 mm Coaxial

The 0.8 mm coaxial system verification procedure is described below. The procedure assumes that the 0.8 mm Connector VNA System Performance Verification Software has been installed to an External Personal Computer with National Instruments GPIB interface running Microsoft Windows Operating System.

Equipment Required

- Personal Computer:
  - Microsoft Windows Operating System
  - National Instruments GPIB interface
  - GPIB interface cable
- Anritsu 3659 0.8 mm Connector Calibration/Verification Kit
- Anritsu 33.8G50 0.8 mm male to MA25400A Adapters (Qty. 2)

Special Precautions

When performing the procedures in this chapter, observe the following precautions:

- Minimize vibration and movement of the system and attached components.
- Clean and check pin depth and condition of all adapters and calibration components.

Procedure

1. Using the GPIB interface cable to connect the external computer to the MS4647B rear panel system GPIB connector. It is the upper GPIB port labeled **IEEE488.2 GPIB**.

Note	Do not connect to the lower GPIB port labeled **Dedicated GPIB**.

2. Dismount the MA25400A mmWave modules from the probe station, if required.

Note	If the heatsink has been separated from the module while installing to the probe station, install the module onto its original heatsink.

3. Un-install the wafer probes from both modules and then install 33.8G50 Adapters to both modules. This converts the test port of both modules to 0.8 mm male coaxial connector.

4. Place the modules on a leveled surface so that Ports 1 and 2, and Ports 3 and 4 are facing each other.

5. Install the 0.8 mm female to female adapter from the 3659 Calibration/Verification Kit on the Port 1 MA25400A mmWave Module. This converts Port 1 from a male test port to a female test port.

6. Install the 0.8 mm male to female adapter from the 3659 Calibration/Verification Kit on the Port 2 MA25400A mmWave Module.

7. Run the Anritsu 0.8 mm Connector Broadband VNA System Performance Verification Software on the PC.

8. Follow the directions displayed on the computer to perform calibration.

9. Follow the directions displayed on the computer to perform measurement of the verification standards.

10. Repeat the procedure for Ports 3 and Port 4.

11. If the verification fails, check the connectors of the test ports on the MA25400A mmWave modules, calibration components, and the verification standards for damage, cleanliness, and proper connection and torquing. Also check connections of the interconnect RF/IF coaxial cables and their phase stability. These are the most common causes for verification failures.

Note	Since different calibration methods are required to cover the 145 GHz range (SOLT for low band and SSST for high band), the verification is done in two steps—Low band and High band—with the breakpoint set to 80 GHz.

3-10 ME7838G4 System Verification Procedure – WR05 Waveguide

The WR05 waveguide system verification procedure is described below.

Equipment Required

- VDI WR5.1CK or OML V05CAL Waveguide Calibration Kit
- Anritsu 35WR5G WR05 to MA25400A Adapters (Qty 2)
- MI-WAVE 690G-2.0/387 2 inch WR05 Waveguide Straight Section (Needed if using OML cal kit. Not needed if using VDI cal kit, since VDI cal kit includes a 2-inch section.)

Procedure

1. Dismount the MA25400A modules from the probe station, if required.

Note	If the heatsink has been separated from the module while installing to the probe station, install the module onto its original heatsink.

2. Un-install wafer probes from both modules and then install 35WR5G adapters to Port 1 and Port 2 modules.
3. Place both mmWave modules on a leveled surface.
4. On the VNA, set the start and stop frequency to 140 GHz and 220 GHz respectively.
5. Set the # of Points to 401.
6. Select Averaging and set the IFBW to 100 Hz.

Measurement Calibration

7. Select Calibration.
8. Select Calibrate | Manual Cal | 2-Port Cal | Modify Cal Setup | Line Type | Waveguide
9. Select Cal Method | LRL/LRM
10. Select Edit Cal Params
11. Set up the TWO PORT CAL SETUP (LRL/LRM, Waveguide) window (Figure 3-5) as follows:
    a. Cutoff Frequency: 115.696 GHz
    b. Select Port Pair for Cal A: 1-4
    c. Reference Plane Location: Ends of Line 1
    d. Line Length Representation: Phy. Length
    e. Cal Device X: Line
    f. Device X Phy. Length (mm): 0
    g. Cal Device Y: Line
    h. Device Y Phy. Length (mm): 0.569 for OML V05CAL or 0.533 for VDI WR5.1CK Cal Kit
    i. Reflection Type: Short-like
    j. Short-like Offset Length (mm): 0

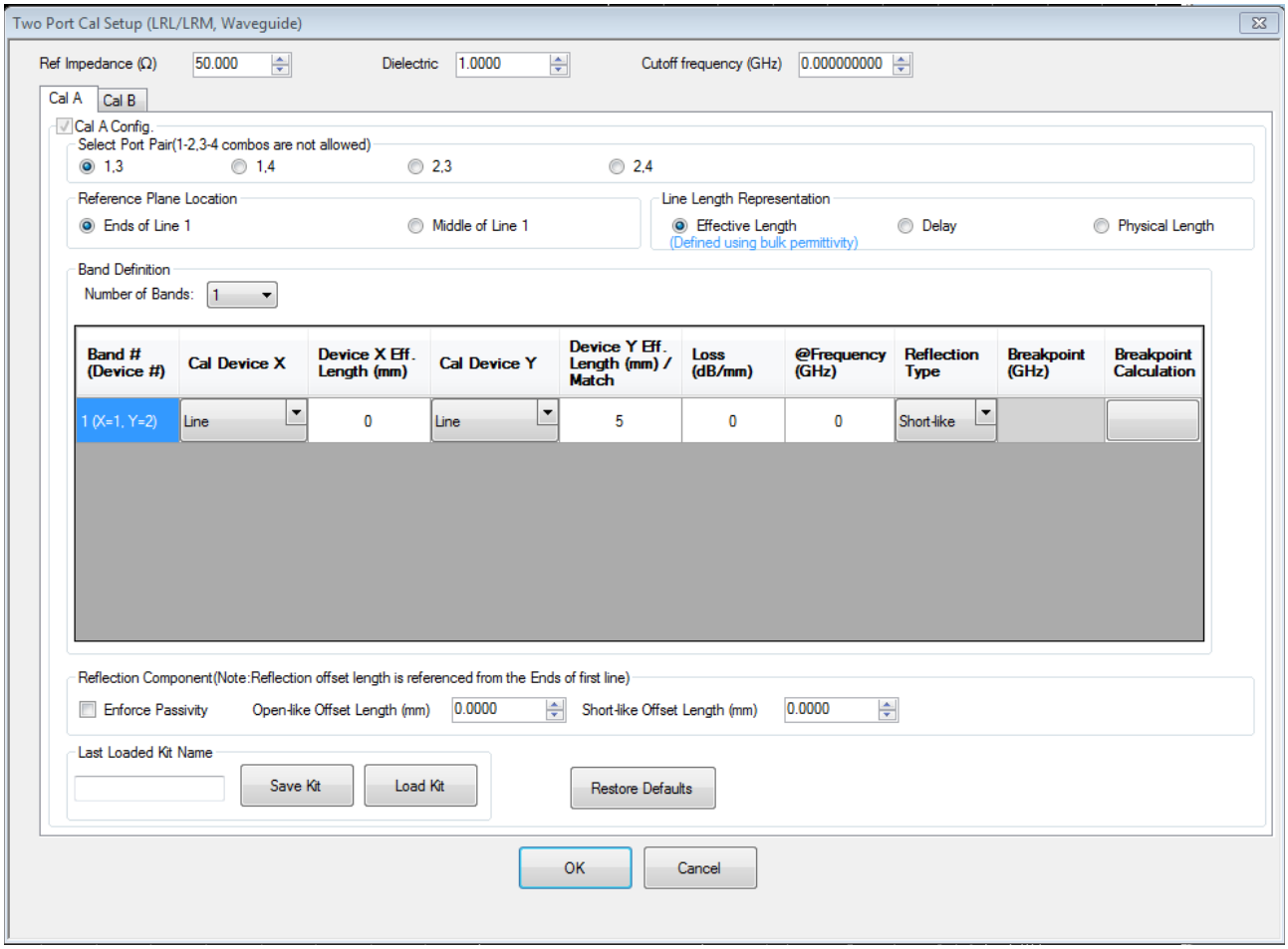


Figure 3-5. Two Port Cal Setup (LRL/LRM, Waveguide) Window Setup

Note that the values described in the procedure have not yet been entered in this image.

12. Click the OK button to close the dialog.

13. Click Back on the lower section of the right side menu to return to the previous menu.

14. Select Port 1-4 Reflective Device

15. Install the Flush Short from the WR05 Calibration Kit to Port 1 module and select Port 1 Short-like to measure the short.

16. Move the Flush Short from Port 1 module to Port 4 module and select Port 4 Short-like to measure the short.

17. Remove the Flush Short from Port 4 module.

18. Click Back on the lower section of the right side menu to return to the previous menu.

19. Select Port 1-4 Lines/Matches

20. Install the 0.569 mm shim if using the OML cal kit, or install the 0.533 mm shim if using the VDI cal kit, between Port 1 and Port 4 modules.

21. Select Device 2 Line to measure.

22. Remove the cal kit shim.

23. Connect Port 1 module to Port 4 module.

24. Select Device 1 Line to measure.

25. Click Back on the lower section of the right side menu to return to the previous menu.

26. Select Done to complete the calibration.

Waveguide Device S-parameters Measurements:

27. Select Tr1 | Display | Trace Format | Log Mag

28. Select Tr2 | Display | Trace Format | Log Mag

29. Select Tr3 | Display | Trace Format | Log Mag

30. Select Tr4 | Display | Trace Format | Log Mag

31. Install the MI-WAVE WR05 Straight Section between ports 1 and 4 if calibrating with the OML cal kit. If calibrating with the VDI cal kit a 2-inch waveguide section is included in the cal kit, which can be used to connect ports 1 and 4.

32. Select Calibration | CALIBRATION | Cal Options | Sec. Match Correction On

33. Verify that S11 and S44 are better than -10 dB and verify that S41 and S14 are better than -2 dB.

34. Record the measured values to Table A-3, "S-Parameter Measurements Results.

35. Repeat Step 2 to Step 32 for Port 2 and Port 3.

36. Verify that S22 and S33 are better than -10 dB and verify that S23 and S32 are better than -2 dB.

37. Record the measured values to Table A-3, "S-Parameter Measurements Results.

Chapter 4 — Theory Of Operation

4-1 Introduction

This chapter provides a brief functional description of the ME7838x4/x4X Broadband/mmWave VNA system. It also briefly describes the operation of each major instrument or assembly.

4-2 System Description

ME7838x4 Broadband/mmWave Vector Network Analyzer System is a four port ratio measurement system used to measure complex vector signal characteristics of devices and systems up to 220 GHz, depending on the mmWave Modules being used.

The VNA System performs complex vector signal measurements by sourcing a stimulus signal to the Device Under Test (DUT) that is connected to at least one test port of the four mmWave Modules (or connected to one or more wafer probes that are linked to the test port connectors of the modules). The instrument measures the DUT response, which consists of reflected and/or transmitted (attenuated or amplified) signals at the connectors of the DUT (or at where the wafer probes contacted the DUT). The reflected and/or transmitted signals and a sample of the stimulus signal are down converted to intermediate frequency (IF) signals.

These IF signals are then converted into digital information and processed by a Digital Signal Processor (DSP) in the VectorStar MS464xA/B Series VNA to determine the real and imaginary vector components of the signal being measured. The information is then normalized for the desired S-parameter and presented to the user via the front panel color LCD display of the VNA.

4-3 System Components

The ME7838x4 Broadband/mmWave VNA System consists of the following major components:

ME7838x4/x4X Broadband Systems

The ME7838x4/x4X Broadband Multiport system consists of the following components:

- MS4647A (ME7838A4/D4/E4) or MS4647B VNA (required for ME7838A4X/E4X/G4) with Option 007 (Receiver Offset), Option 070 (70 kHz Low End Frequency Extension), Option 051 (Front Panel Loops), or 061/062 (Active Measurement Suite), and Option 08x (Modular Broadband Connection Capability)
- MN4697C Multiport Test Set
- 3736B Broadband Test Set
- 3739C Broadband Test Set
- Four mmWave Modules - Refer to Section 1-6 “ME7838x4 VNA System Overview” on page 1-4 for model numbers of available mmWave modules.
- Front and rear panel cables

ME7838x4 Banded Systems

The ME7838x4 Banded Multiport system consists of the following components:

- MS4644A or MS4644B with Options 7 and Option 8x; Higher Frequency VNA models can also be used.
- MN4694C Multiport Test Set; MN4697C is required for Higher Frequency VNA models
- 3736B Broadband Test Set
- 3739C Broadband Test Set
- Four 3744A-EE, 3744A-EW, or four OML/VDI mmWave Modules
- Front and rear panel cables

Figure 4-1 shows the ME7838x4/x4X VNA Broadband system configuration and illustrates the interconnections among the VNA, Test Set, and mmWave Modules. For detailed connection diagrams, refer to the **VectorStar ME7838x4/x4X Multiport Broadband VNA Installation Guide** – 10410-00734.

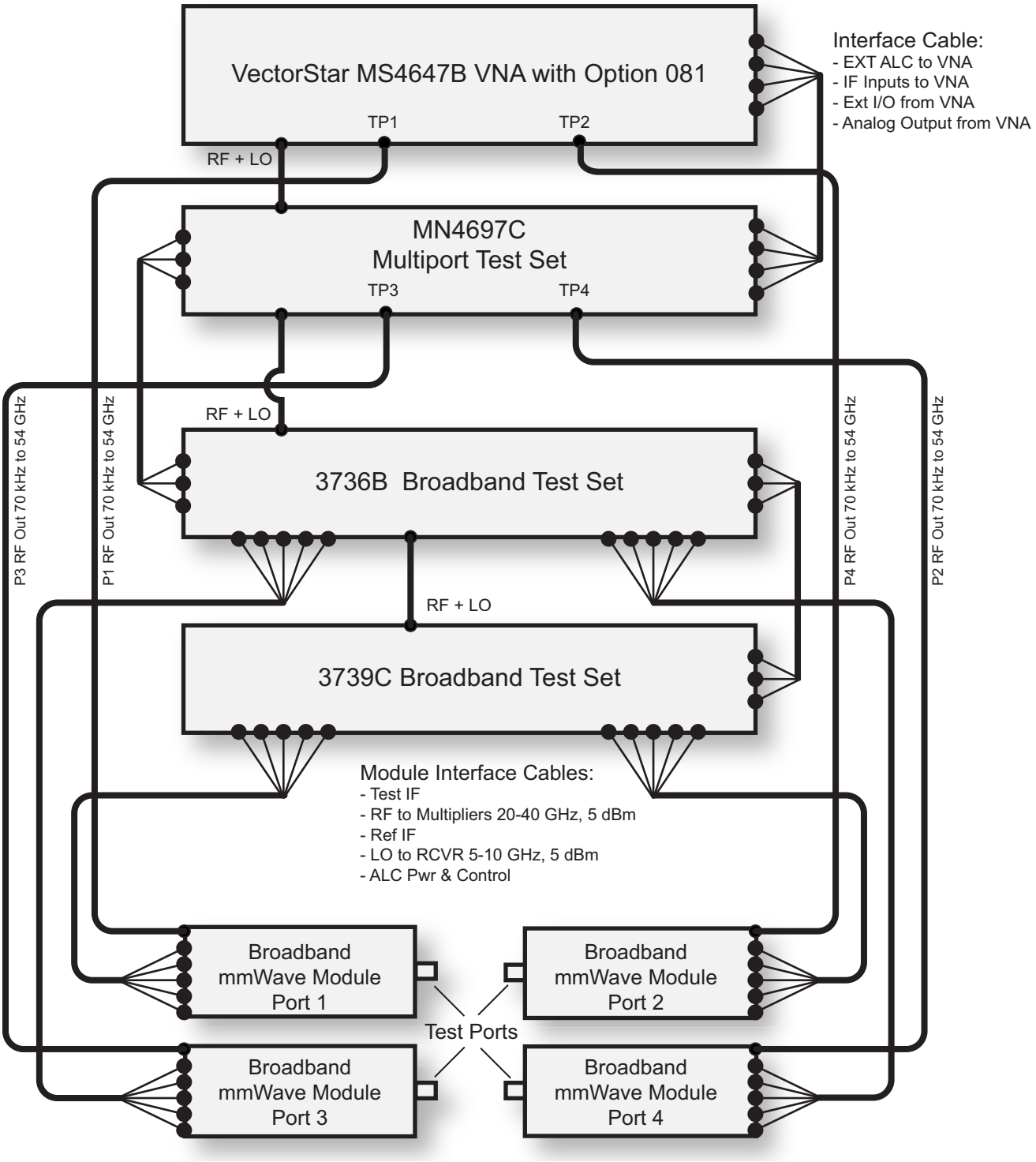


Figure 4-1. ME7838x4/x4X VNA System Interconnections

4-4 Functional Description of System Components

This section contains brief descriptions of each system components.

VectorStar MS464xA/B Vector Network Analyzer

The VectorStar MS464xA/B VNA together with the MN469xC four port test set perform the following tasks:

- Controlling the operation of the entire ME7838x4 Broadband/mmWave VNA system
- Providing stimulus signal for frequencies below 54 GHz in Broadband configuration
- Handling complex vector signal measurements for frequencies up to 30 GHz in Broadband configuration
- Providing the RF signal to be multiplied in the mmWave modules to generate the stimulus signal for operation 54 GHz and above
- Providing two LO signals to the mmWave Modules required for frequency conversion operation above 30 GHz
- Processing the Reference and Test IF signals from the mmWave Modules

Figure 4-2 shows the components in the MS4647A/B that are essential for the operation of the ME7838x4 Broadband/mmWave VNA System.

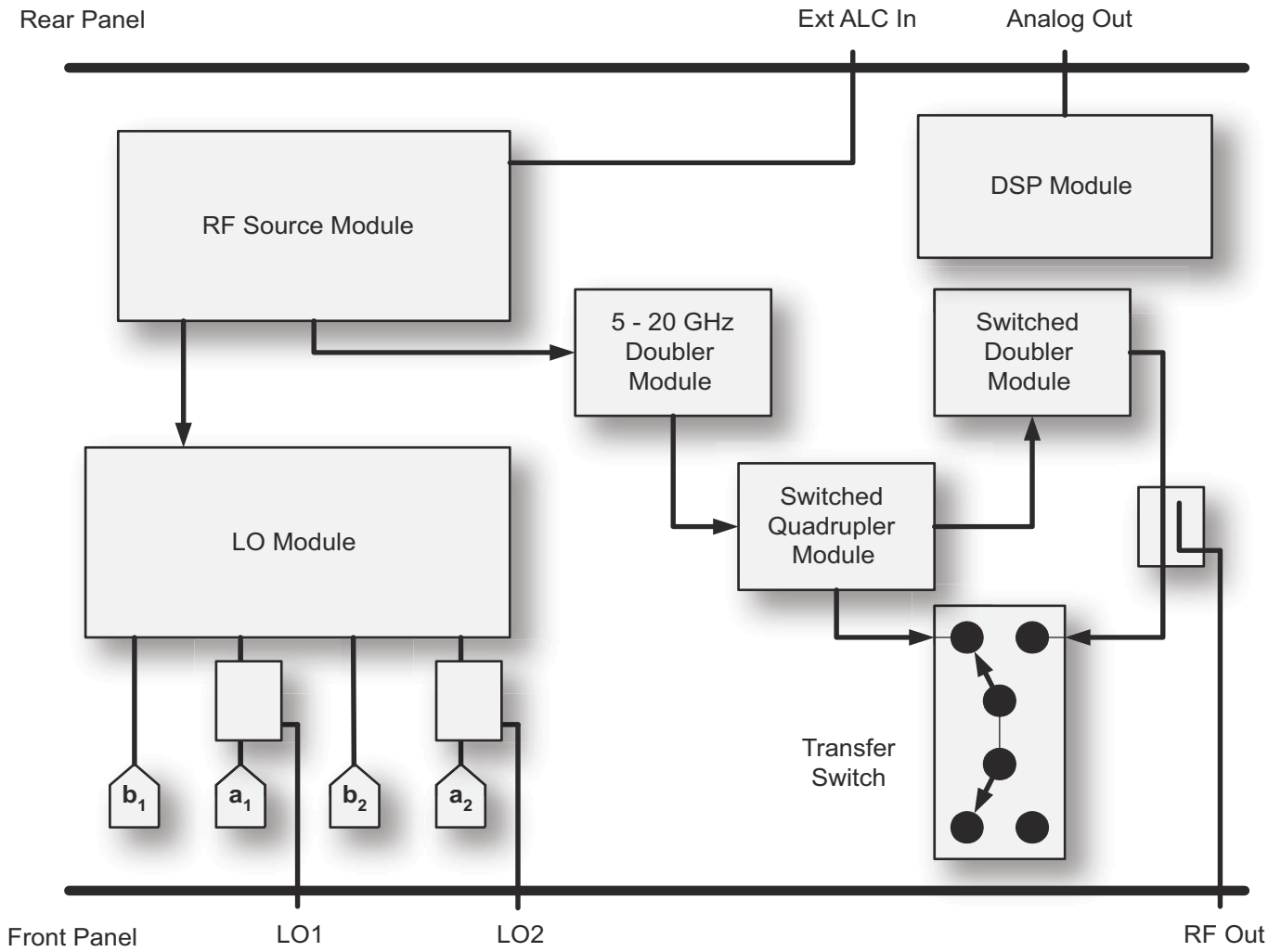


Figure 4-2. MS4647A/B Option 080/081 Block Diagram

For MS464xA with Option 080/081/082/083:

- The typical power output level of both LO1 and LO2 Ports is +6 dBm from 5 to 10 GHz.
- The minimum power output level of the RF Port is +2 dBm with signal frequency varying from 26 to 40 GHz when the instrument is set in Modular/BB mode and sweeping from 54 GHz to 110 GHz.

For MS464xB with Option 080/081/082/083/084/085/086/087/088/089:

- The typical power output level of both LO1 and LO2 Ports is +6 dBm from 5 GHz to 10 GHz. for A, E, and D systems. The LO frequency ranges up to ~19 GHz and the power levels are in the 10-12 dBm range for G systems
- When the instrument is set in Modular/BB mode and sweeping from 54 GHz to 220 GHz, the minimum output levels of the RF port are:
- -3 dBm from 8 to 10 GHz
- 0 dBm from 10 to 20 GHz
- +3 dBm from 20 to 27 GHz
- +2 dBm from 27 to 40 GHz

MN469xC Multiport Test Set

The Anritsu MN469xC Multiport Test Set provides multiple test port capabilities for the Anritsu VectorStar ME7838x4.

The MN469xC Test Set contains a switch matrix and switch matrix controller that facilitates multiple test port connections to the device under test. The test set is controlled by the connected VectorStar VNA (except for power on/off) via the IEEE-488 General Purpose Interface Bus (GPIB).

The VectorStar VNA sends switch control commands via the GPIB bus to the GPIB to Parallel Digital Interface PCB Assembly in the test set. The logic in this PCB is translated by the 4-Port Test Set Control PCB to the appropriate levels at any given time to control each one of the SPDT RF switches in the test set.

The MN469xC test set contains eight SPDT RF switches. Four switches, A4, A5, A6 and A7, operate in low band frequencies below 2.5 GHz. Four switches, A12, A13, A18 and A19, operate in high band frequencies from 2.5 GHz and beyond.

Any one or two test ports may be selected for forward and/or reverse measurements. There is an LED above each test port (Ports 3 and 4). When the connection paths are set via GPIB commands, the test port LEDs will light according to the connections. A lit LED under a test port indicates that it is selected as an active test port. There is an LED next to the Power switch. When AC power is first applied, the Power LED will light.

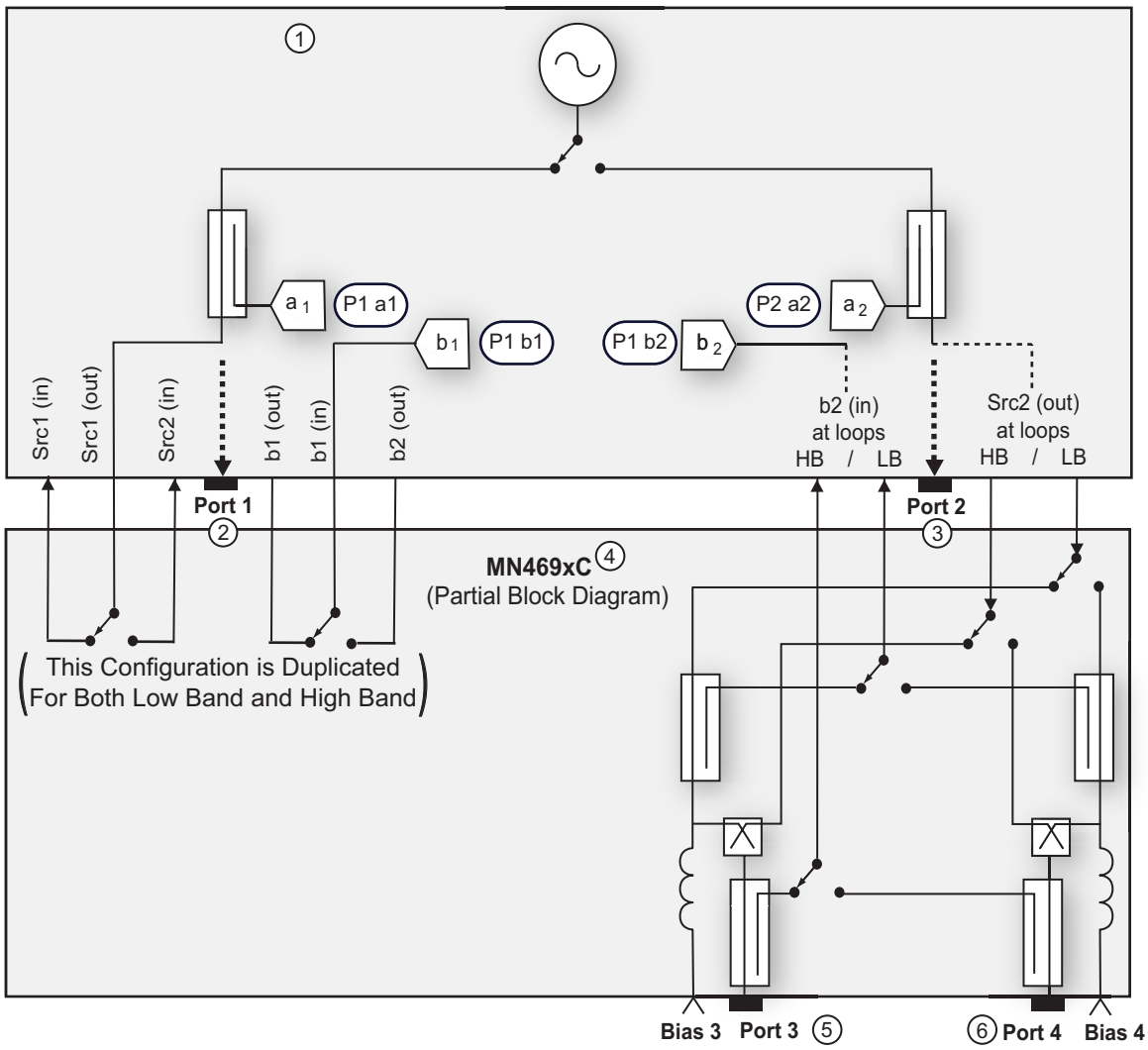


Figure 4-3. MN469xC Multiport Test Set Block Diagram

3736B Broadband Test Set

The 3736B Broadband Test Set (Figure 4-4) performs the following tasks:

- Decoding the control logic sent from the MS464xA/B VNA
- Switching the RF signal between Port 3 and Port 4
- Leveling control of LO signals
- Amplifying RF and LO signals
- Multiplexing various level detector signals to MS464xA/B VNA
- Providing DC power for two mmWave Modules
- Passing IF signals from the Port 1 through Port 4 mmWave Modules to MS464xA/B VNA
- Passing RF signal from the VNA to the 3739C when the VNA is in a single source configuration.
- Passing LO signals from the VNA to the 3739C
- Option 3736B-003 adds the capability to switch the module bias to higher voltage to support longer mmWave Interface cables which is required for applications such as Antenna measurements.
- A VNA Source Switch mounted at the rear panel provides the ability to internally configure the 3736B for use with either a Single Source MS464xA/B, or a Dual Source MS464xB (with Option 031 installed).

NOTE 1: RF from VNA when VNA is in both Single Source or Dual Source configuration (Option 031)

NOTE 2: RF to 3739C test set when VNA is in Single Source configuration
Port terminated when VNA is in Dual Source configuration (Option 031)

NOTE 3: ALC from 3739C test set when VNA is in Single Source configuration
No connection when VNA is in Dual Source configuration (Option 031)

NOTE 4: ALC to VNA Ext In ALC1 when VNA is in Single Source configuration
ALC to VNA Ext In ALC2 when VNA is in Dual Source configuration (Option 031)

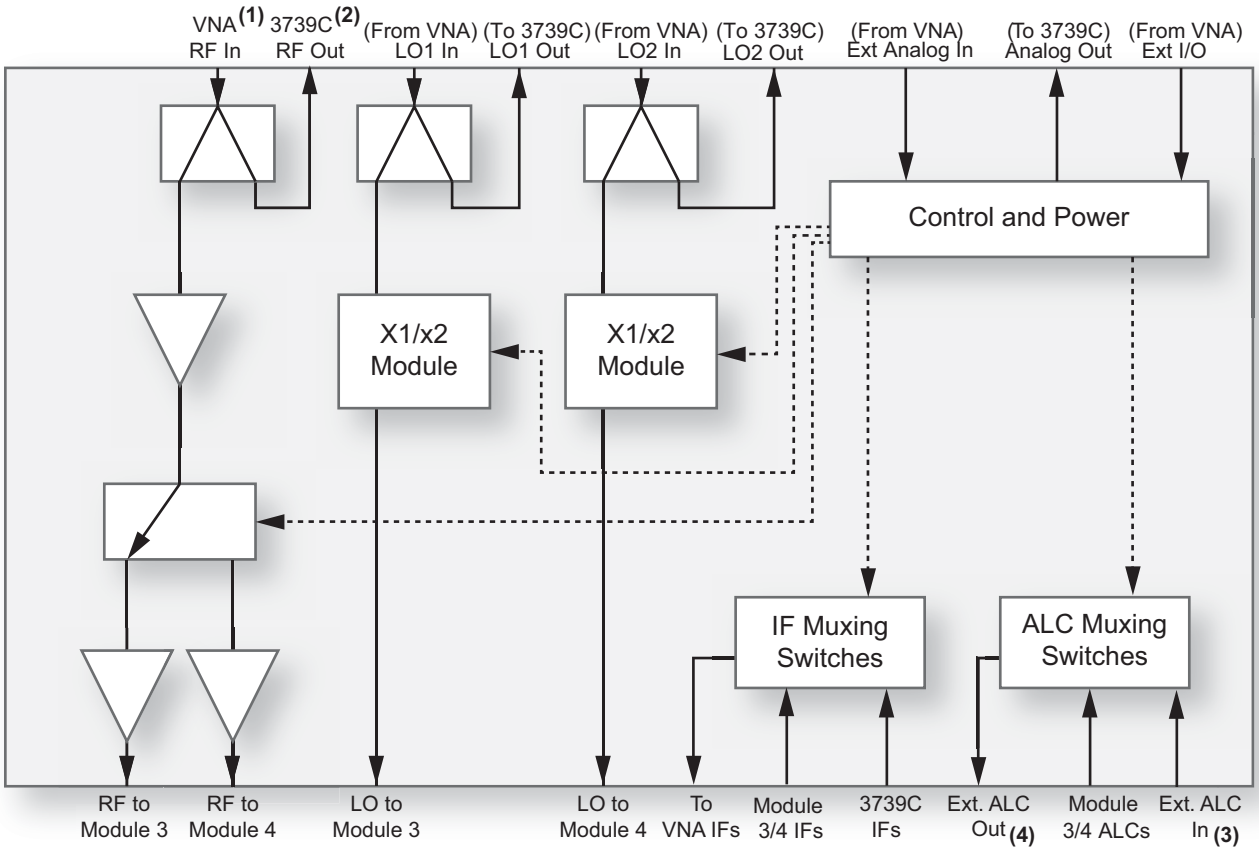


Figure 4-4. 3736B Broadband Test Set Block Diagram

3739C Broadband Test Set

The 3739C Broadband Test Set (Figure 4-5) performs the following tasks:

- Decoding the control logic sent from the MS464xA/B VNA
- Switching the RF signal between Port 1 and Port 2
- Leveling control of LO signals
- Amplifying RF and LO signals
- Multiplexing various level detector signals to MS464xA/B VNA to be passed to the 3736B test set
- Providing DC power for two mmWave Modules
- Passing IF signals from mmWave Modules to the 3736B Test Set
- Option 3739C-003 adds the capability to switch the module bias to higher voltage to support longer mmWave Interface cables which is required for applications such as Antenna measurements.

NOTE 1: RF from 3736B test set when VNA is in Single Source configuration
RF from VNA RF1 when VNA is in Dual Source configuration (Option 031)

NOTE 2: Signal passed from VNA through 3736B test set to 3739C test set

NOTE 3: ALC to 3736B test set when VNA is in Single Source configuration
ALC to VNA Ext In ALC1 when VNA is in Dual Source configuration (Option 031)

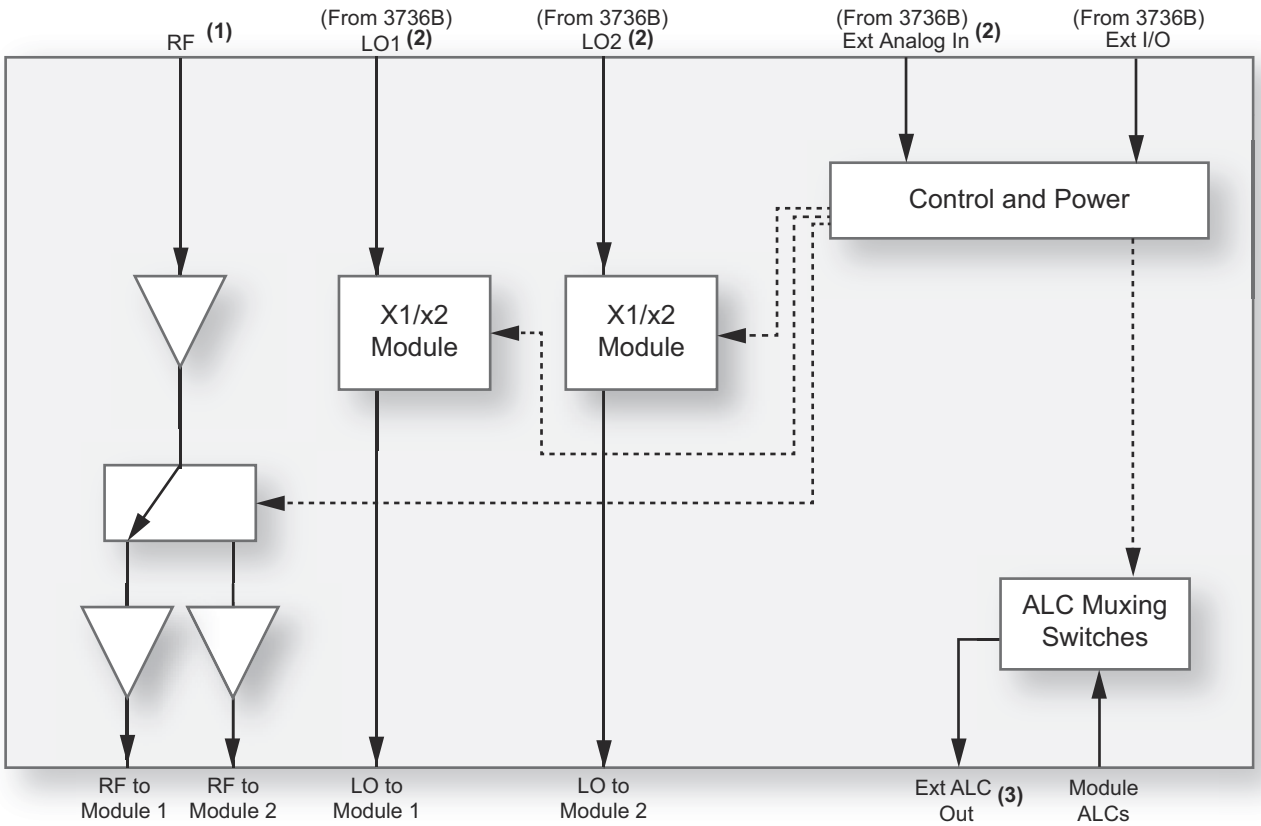


Figure 4-5. 3739C Broadband Test Set Block Diagram

Test Set Drive Characteristics

Port 1 through Port 4 LO Out ports have minimum power output at 5 to 10 GHz of +6 dBm in Modular/BB mode (used when Anritsu 3743/3744 and MA25400A Series modules are installed) and at 8 to 22 GHz of +17 dBm in mmWave mode (used when OML/VDI mmWave modules are installed). For MA25400A modules, the LO runs over approximately 5-19 GHz with power levels of between 6 and 12 dBm.

Port 1 through Port 4 RF Out ports have minimum power output at 26 to 40 GHz of +5 dBm in Modular/BB mode and at 8 to 22 GHz of +16 dBm in mmWave mode.

3743A/AX Broadband mmWave Module

The 3743A/AX mmWave Module performs the following tasks:

- Passing stimulus signals below 54 GHz from the MS4647A or MS4647B VNA to the W1 Connector Test Port
- Passing 70 kHz to 30 GHz test signals from the W1 Connector Test Port to the MS4647A or MS4647B VNA
- Generating stimulus signals for operation 54 GHz and above
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting test signals to IF for operation above 30 GHz

3743E/EX Broadband mmWave Module

The 3743E/EX mmWave Module performs the following tasks:

- Passing stimulus signals below 54 GHz from the MS4647A VNA to the W1 Connector Test Port
- Passing 70 kHz to 30 GHz test signals from the W1 Connector Test Port to the MS4647A VNA
- Generating stimulus signals for operation 54 GHz and above
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting test signals to IF for operation above 30 GHz

3744A-EE Banded mmWave Module

The 3744A-EE mmWave Module performs the following tasks:

- Generating 56 to 95 GHz stimulus signals for operation
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting 56 to 95 GHz test signals to IF for operation

3744A-EW Banded mmWave Module

The 3744A-EW mmWave Module performs the following tasks:

- Generating 65 to 110 GHz stimulus signals for operation
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting 65 to 110 GHz test signals to IF for operation

3744E-EW mmWave Module

The 3744E-EW mmWave Module performs the following tasks:

- Generating 65 to 110 GHz stimulus signals for operation
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting 65 to 110 GHz test signals to IF for operation

MA25300A mmWave Module

The MA25300A mmWave Module performs the following tasks:

- Passing stimulus signals below 54 GHz from the MS4647B VNA to the 0.8mm Connector Test Port
- Passing 70 kHz to 30 GHz test signals from the 0.8mm Connector Test Port to the MS4647B VNA
- Generating stimulus signals for operation 54 GHz and above
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting test signals to IF for operation above 30 GHz

MA25400A mmWave Module

The MA25400A mmWave Module performs the following tasks:

- Passing stimulus signals below 54 GHz from the MS4647B VNA to the 0.6mm Coaxial Flange Test Port
- Passing 70 kHz to 30 GHz test signals from the 0.6mm Coaxial Flange Test Port to the MS4647B VNA
- Generating stimulus signals for operation 54 GHz and above
- Generating LO Level Detector outputs
- Generating Source Level Detector outputs
- Converting test signals to IF for operation above 30 GHz

4-5 ME7838A4/A4X System Operation - Broadband Configuration

This section describes the system operation of the ME7838A4/A4X Broadband VNA System.

Stimulus Signal Generation

For operation in the frequencies below 54 GHz range, the MS4647A or MS4647B VNA outputs a stimulus signal from its test port and feeds, possibly via the MN469xC four port test set, the 3743A/AX mmWave Module via coaxial cable. The 3743A/AX Module then outputs the stimulus signal to the Device Under Test (DUT) via its W1 Connector test port. For operation in frequencies 54 GHz and above, the MS4647A or MS4647B VNA outputs an RF signal to the 3736B and 3739C Test Set.

In the 3739C test set, the RF signal is amplified and then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch and fed to the Port 1 and Port 2 3743A/AX mmWave Modules.

In the 3736B test set, the RF signal is amplified and then routed to the Port 3 RF Output or Port 4 RF Output via a transfer switch and fed to the Port 3 and Port 4 3743A/AX mmWave Modules.

In the 3743A/AX mmWave Module, the frequency of the RF signal is either doubled or tripled and then output to the DUT.

For operation between 54 GHz and 80 GHz, the frequency of the RF signal is doubled in the module. For operation between 80 and 125 GHz, the frequency of the RF signal is tripled.

Test Signal Processing

For operation in frequencies up to 30 GHz, the reflected/transmitted test signal received at the W1 connector test port of the 3743A/AX Module is then fed back to the test port of the MS4647A or MS4647B VNA and/or MN469XC four port test set for further signal processing.

Note	For signal processing details of the MS464xA VNA refer to the **MS4640A Series VNA Maintenance Manual - 10410-00268**, **Chapter 6 - Theory of Operation**. For signal processing details of the MS464xB VNA refer to the **MS4640B Series VNA Maintenance Manual - 10410-00320**, **Chapter 2 - Theory of Operation**.

For operation above 30 GHz, the MS4647A or MS4647B VNA outputs two LO signals to the 3736B/3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to the LO output ports and fed to the 3743A/AX mmWave Modules.

In the 3743A/AX mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3736B/3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the W1 connector test port of the 3743A/AX module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3736B Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739C Test Set. The IF signals pass through the broadband test sets and are fed to the IF Inputs of the MS4647A or MS4647B VNA for further signal processing.

4-6 ME7838A4/A4X System Operation - Waveguide Band Configuration

This section describes the system operation of the Waveguide Band ME7838A4/A4X VNA System.

Stimulus Signal Generation

The MS464xA or MS464xB VNA outputs an RF signal to the 3736B Test Set (and 3739C Test Set with if the MS464xB is equipped with Option 031).

In the 3739C test set, the RF signal is amplified and then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch and fed to the Port 1 and Port 2 3744A mmWave Modules.

In the 3736B test set, the RF signal is amplified and then routed to the Port 3 RF Output or Port 4 RF Output via a transfer switch and fed to the Port 3 and Port 4 3744A mmWave Modules.

In the 3744A mmWave Module, the frequency of the RF signal is either doubled or tripled and then output to the DUT.

For operation between 56 GHz and 80 GHz, the frequency of the RF signal is doubled in the module. For operation between 80 and 110 GHz, the frequency of the RF signal is tripled.

Test Signal Processing

The MS464xA or MS464xB VNA outputs two LO signals to the 3736B/3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to LO output ports and fed to the 3744A mmWave Modules.

In the 3744A mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3736B/3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the Waveguide test port of the 3744A module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3736B/3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739C Test Set. The IF signals pass through the 3736B/3739C Test Set and are fed to the IF Inputs of the MS464xA/B VNA for further signal processing.

4-7 ME7838E4/E4X System Operation – Broadband Configuration

This section describes the system operation of the ME7838E4 Broadband VNA System.

Stimulus Signal Generation

For operation in the frequencies below 54 GHz range, the MS4647B VNA outputs a stimulus signal from its test port and feeds directly to the 3743E/EX mmWave Module via coaxial cable. The 3743E/EX Module then outputs the stimulus signal to the Device Under Test (DUT) via its W1 Connector test port.

For operation in frequencies 54 GHz and above, the MS4647B VNA outputs an RF signal to the 3739B or 3739C Test Set.

In the test set, the RF signal is amplified. It is then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch and fed to the 3743E/EX mmWave Modules.

In the 3743E/EX mmWave Module, the frequency of the RF signal is either doubled or tripled and then output to the DUT.

For operation between 54 GHz and 80 GHz, the frequency of the RF signal is doubled in the module. For operation between 80 and 110 GHz, the frequency of the RF signal is tripled.

Test Signal Processing

For operation in frequencies up to 30 GHz, the reflected/transmitted test signal received at the W1 connector test port of the 3743E/EX Module is then fed back to the test port of the MS4647B VNA for further signal processing.

For operation above 30 GHz, the MS4647B VNA outputs two LO signals to the 3739B or 3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to Port 1 LO Output or Port 2 LO Output and fed to the 3743E/EX mmWave Modules.

In the 3743E/EX mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3739B or 3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the W1 connector test port of the 3743E/EX module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3739B or 3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739B or 3739C Test Set. The IF signals pass through the 3739B or 3739C Test Set and are fed to the IF Inputs of the MS4647B VNA for further signal processing.

Note	In the **MS4640B Series Microwave Vector Network Analyzer Maintenance Manual** –10410-00320, refer to Chapter 2 – Theory of Operation for signal processing details

4-8 ME7838E4/E4X System Operation – Waveguide Band Configuration

This section describes the system operation of the Waveguide Band ME7838E4/E4X VNA System.

Stimulus Signal Generation

The MS464xB VNA outputs an RF signal to the 3739B or 3739C Test Set.

In the test set, the RF signal is then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch after it is amplified and fed to the 3744E mmWave Modules.

In the 3744E mmWave Module, the frequency of the RF signal is either doubled or tripled and then output to the DUT.

For operation between 56 GHz and 80 GHz, the frequency of the RF signal is doubled in the module. For operation between 80 and 110 GHz, the frequency of the RF signal is tripled.

Test Signal Processing

The MS464xB VNA outputs two LO signals to the 3739B or 3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to Port 1 LO Output or Port 2 LO Output and fed to the 3744E mmWave Modules.

In the 3744E mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3739B or 3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the Waveguide test port of the 3744A module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3739B or 3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739B or 3739C Test Set. The IF signals pass through the 3739B or 3739C Test Set and are fed to the IF Inputs of the MS464xB VNA for further signal processing.

4-9 ME7838D4 System Operation

This section describes the system operation of the ME7838D4 Broadband VNA System.

Stimulus Signal Generation

For operation in the frequencies below 54 GHz range, the MS4647B VNA outputs a stimulus signal from its test port and feeds directly to the MA25300A mmWave Module via coaxial cable. The MA25300A Module then outputs the stimulus signal to the Device Under Test (DUT) via its 0.8mm Connector test port.

For operation in frequencies 54 GHz and above, the MS4647B VNA outputs an RF signal to the 3739C Test Set.

In the test set, the RF signal is amplified. It is then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch and fed to the MA25300A mmWave Modules.

In the MA25300A mmWave Module, the frequency of the RF signal is doubled, tripled, or doubled and then tripled, and then output to the DUT.

- For operation between 54 GHz and 80 GHz, the frequency of the RF signal is doubled in the module.
- For operation between 80 and 110 GHz, the frequency of the RF signal is tripled.
- For operation between 110 and 145 GHz, the frequency of the RF signal is doubled and then tripled.

Test Signal Processing

For operation in frequencies up to 30 GHz, the reflected/transmitted test signal received at the 0.8mm connector test port of the MA25300A Module is then fed back to the test port of the MS4647B VNA for further signal processing.

For operation above 30 GHz, the MS4647B VNA outputs two LO signals to the 3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to Port 1 LO Output or Port 2 LO Output and fed to the MA25300A mmWave Modules.

In the MA25300A mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the 0.8mm connector test port of the MA25300A module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739C Test Set. The IF signals pass through the 3739C Test Set and are fed to the IF Inputs of the MS4647B VNA for further signal processing.

Note	In the **MS4640B Series Microwave Vector Network Analyzer Maintenance Manual** –10410-00320, refer to Chapter 2 – Theory of Operation for signal processing details.

4-10 ME7838G4 System Operation

This section describes the system operation of the ME7838G4 Broadband VNA System.

Stimulus Signal Generation

For operation in the frequencies below 54 GHz range, the MS4647B VNA outputs a stimulus signal from its test port and feeds directly to the MA25400A mmWave Module via coaxial cable. The MA25400A Module then outputs the stimulus signal to the Device Under Test (DUT) via its 0.6mm coaxial flange test port.

For operation in frequencies 54 GHz and above, the MS4647B VNA outputs an RF signal to the 3739C Test Set.

In the test set, the RF signal is amplified. It is then routed to the Port 1 RF Output or Port 2 RF Output via a transfer switch and fed to the MA25400A mmWave Modules.

In the MA25400A mmWave Module, the frequency of the RF signal is doubled, tripled, or doubled and then tripled, or double, doubled and then tripled, and then output to the DUT.

- For operation between 54 GHz and 80 GHz, the frequency of the RF signal is doubled in the module.
- For operation between 80 and 110 GHz, the frequency of the RF signal is tripled.
- For operation between 110 and 153 GHz, the frequency of the RF signal is doubled and then tripled.
- For operation between 153 and 226 GHz, the frequency of the RF signal is doubled, doubled and then tripled.

Test Signal Processing

For operation in frequencies up to 30 GHz, the reflected/transmitted test signal received at the 0.6mm coaxial flange test port of the MA25400A Module is then fed back to the test port of the MS4647B VNA for further signal processing.

For operation above 30 GHz, the MS4647B VNA outputs two LO signals to the 3739C Test Set. The LO signals are amplified (and attenuated, if required). It is then routed to Port 1 LO Output or Port 2 LO Output and fed to the MA25400A mmWave Modules.

In the MA25400A mmWave Module, a sample of the stimulus signal is down-converted to intermediate frequency (IF) using the LO signal from the 3739C Test Set. The output is the Reference IF signal.

The reflected/transmitted test signal received at the 0.6mm coaxial flange test port of the MA25400A module is coupled to the test channel down-converter which converts the test signal to IF signal using the LO signal from the 3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739C Test Set. The IF signals pass through the 3739C Test Set and are fed to the IF Inputs of the MS4647B VNA for further signal processing.

Chapter 5 — Adjustment

5-1 Introduction

This chapter contains adjustment procedures that are used to restore the calibration of the ME7838x4 and ME7838x4X VNA systems related to the RF leveling at the Coax or Waveguide Test Port and the stability of sampling system of the Broadband mmWave modules. The procedures are:

- LO Level Calibration (ME7838A4/E4)
- LO Level Calibration (ME7838A4X/E4X/D4/G4)
- ALC Level Calibration

Use these procedures after the 3739C Broadband Test Set has been repaired, or the mmWave Modules have been repaired or replaced.

Note	For the ME7838A4/E4 systems, all LO and ALC calibrations are performed while the instrument is in a 2-port configuration. The VNA and the 3739C test set and modules for Port 1 and Port 2 should first be configured as a two port system (Refer to the **ME7838 Series Installation Guide** – 10410-00293), and then the procedures herein should be followed. The ME7838A4X/E4X/D4/G4 LO and ALC calibrations are performed with the system in the 4-port configuration.

Note	Section 5-2 “LO Level Calibration (ME7838A4/E4)” or Section 5-3 “LO Level Calibration (ME7838A4X/E4X/D4/G4)”must be performed prior to performing the ALC Level Calibration. ALC calibration is described in Section 5-4 “ALC Level Calibration” on page 5-12 below.

4-Port to 2-Port Conversion Hints

On the rear panel, the following connection changes are needed:

- Disconnect the GPIB cable from the GPIB port of MN469xC.
- Disconnect the eight semi-rigid cables between the VNA and the MN469xC and re-install the original four VNA rear panel loop cables to the VNA.
- Disconnect the IF/AUX cable harnesses between the 3736B and 3739C at the end of the 3739C Test Set and leave the harnesses connecting to the 3736B dangling.
- Disconnect the IF/AUX cable harnesses between the VNA and 3736B at the end of the 3736B Test Set and then connect the harnesses to the 3739C.
- Disconnect the Ext Analog In cable and Ext ALC Out cable from the 3739C and leave them connecting to the 3736B dangling.

Note	For VNA with Option 31, Dual Source, leave the Ext ALC Out cable connecting to Ext In ALC 1 connector of the VNA dangling.

- Disconnect the Analog Out cable between the VNA and 3736B at the end of the 3736B and reconnect it to Ext Analog In connector of the 3739C.
- Disconnect the Ext ALC Out cable between the VNA and 3736B at the end of the 3736B and reconnect it to the Ext ALC Out connector of the 3739C.

On the rear panel, the following connection changes are needed:

- Disconnect the eight semi-rigid cables between the VNA and MN469xC and re-install the original four VNA front panel loop cables to the VNA.

- For VNA with Option 31, disconnect the two semi-rigid cables between the VNA and both test sets. Install a flexible coaxial cable between the RF2 port of the VNA and the RF port of the 3739C.

5-2 LO Level Calibration (ME7838A4/E4)

The LO Level Calibration is used to insure that an optimal LO level is applied to the mmWave Module.

Perform this calibration procedure if:

- Any of the following RF components are replaced in the 3739C Test Set:
  - A100 Port 1 Doubler Module - ND75883-RFB or 3-ND75883-RFB
  - A1 Bias Control PCB Assembly - ND80352-RFB or 3-ND80352-RFB
- The main RF Source Module is replaced in the MS464xA or MS464xB VNA.

Equipment Required

- Anritsu ML2437A or ML2438A Power Meter
- Anritsu MA2474D Power Sensor
- Anritsu 33KK50B/C or K220B K(m) to K(m) Adapter
- Pasternack PE9644 K (m) to K (f) Right Angle Adapter
- Krytar 102040013K Directional Coupler

Procedure

1. Configure the ME7838A4/E4 as an ME7838A/E 2-port system. Refer to the **VectorStar ME7838 Series System Installation Guide** - 10410-00293 for interconnect instructions.

2. Install a GPIB interface cable between the power meter GPIB port and the Dedicated GPIB port of the MS464xA/B VNA.

3. Turn on the power meter and allow it to warm up at least 30 minutes.

4. Connect the power sensor to the Calibrator port of the power meter and calibrate the power sensor.

5. Turn on the MS464xA/B VNA and 3739C Test Set and allow them to warm up at least 30 minutes.

6. Install the K(m) to K(m) Adapter to the RF In port of the Directional Coupler. Refer to Figure 5-1.

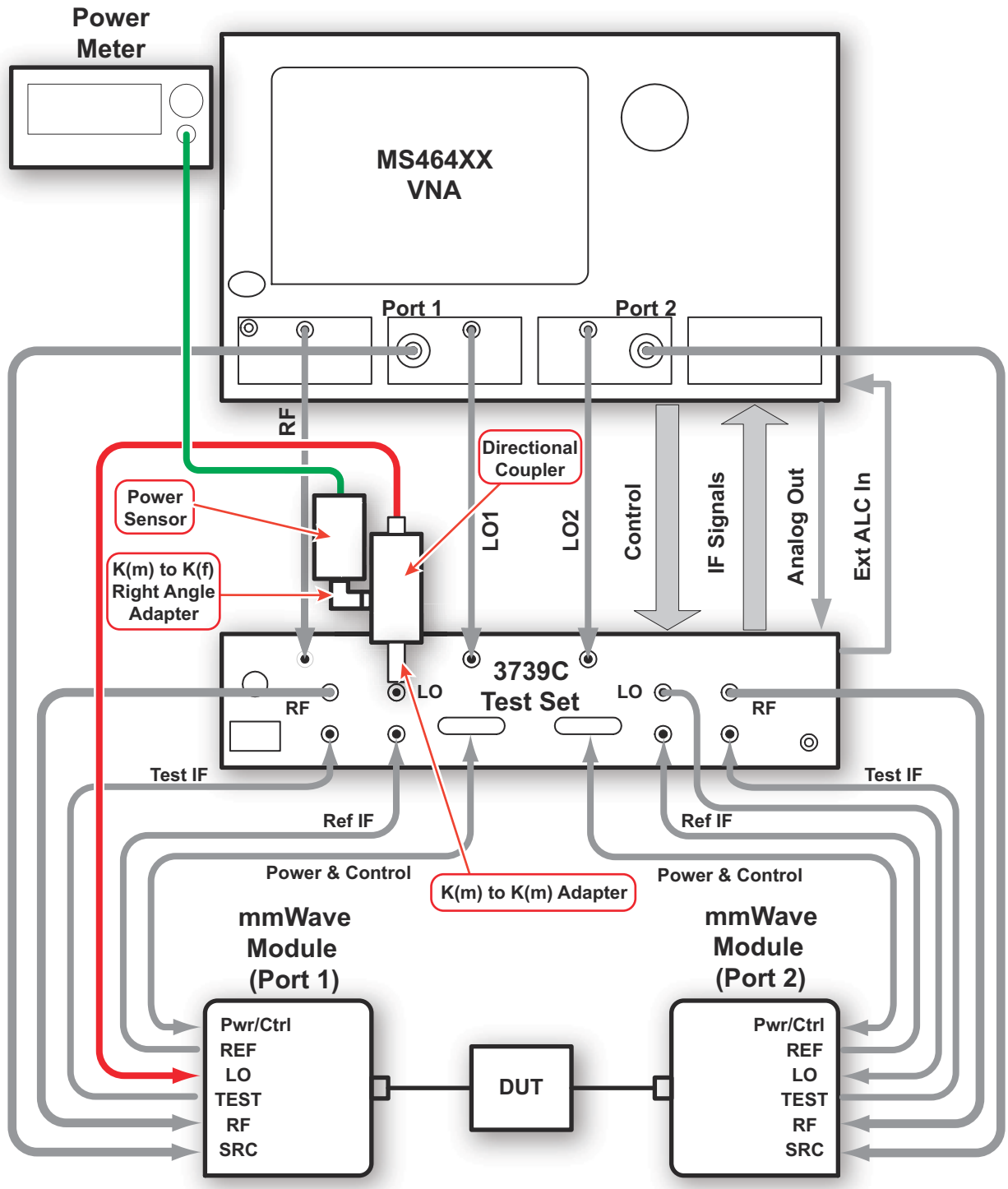


Figure 5-1. LO Level Cal Setup (Broadband Configuration shown)

7. Disconnect the LO cable from the Port 1 LO connector of the 3739C Test Set.

8. Connect the Coaxial Directional Coupler with the Adapter to the Port 1 LO connector of the Test Set.

9. Connect the LO cable to the RF Out port of the Coaxial Directional Coupler.

10. Connect the power sensor to the Coupling Port of the Directional Coupler.

11. On the MS464xA/B VNA, select System and then Diagnostics.

12. The Diagnostics Access dialog box appears providing an entry field to enter the diagnostics access password as shown below in Figure 5-2.

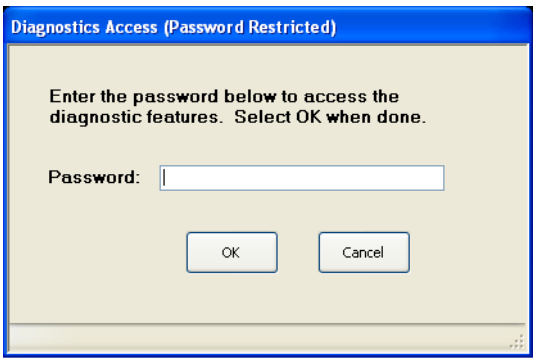


Figure 5-2. DIAGNOSTICS ACCESS Dialog Box

13. Enter the password CajaNueva in the Password field and click OK.

14. The Diagnostics Menu appears as shown in Figure 5-3.

Figure 5-3. DIAGNOSTICS Menu

15. Select Hardware Cal to access the Hardware Cal Menu as shown in Figure 5-4.

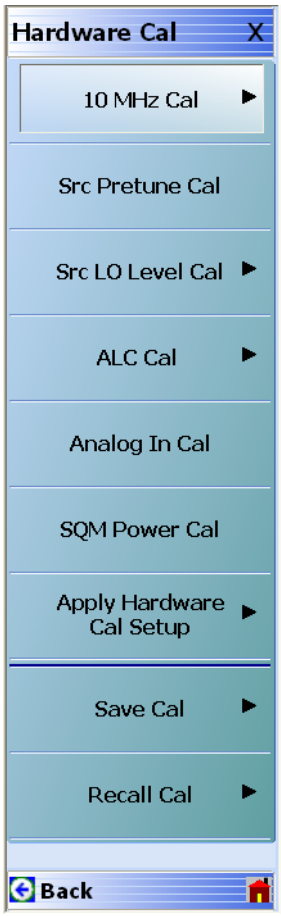


Figure 5-4. HARDWARE CAL Menu

16. Select Src LO Level Cal and the LO Level Cal Menu appears as shown in Figure 5-5.

Figure 5-5. LO LEVEL CAL Menu

17. Select BB/mmWave [3739] LO Level Cal or BB to 220 GHz [3739] LO Level Cal as appropriate and the Modular LO Level Cal dialog box as shown in Figure 5-6 appears.

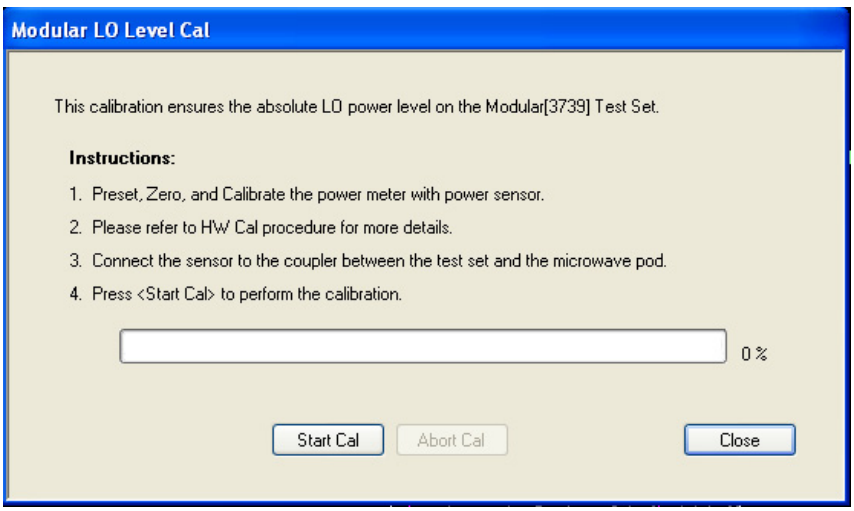


Figure 5-6. Modular LO LEVEL CAL Dialog Box

18. Click the Start Cal button to start the calibration.

19. After the calibration is complete, remove the Power Sensor and Directional Coupler from the Port 1 LO connector of the 3739C Test Set and re-connect the LO cable.

5-3 LO Level Calibration (ME7838A4X/E4X/D4/G4)

The LO Level Calibration is used to insure that an optimal LO level is applied to the mmWave Module.

Perform this calibration procedure if:

- Any of the following RF components are replaced in the 3739C Test Set:
  - A100 Port 1 Doubler Module – ND75883-RFB or 3-ND75883-RFB
  - A1 Bias Control PCB Assembly – ND80352-RFB or 3-ND80352-RFB
- The main RF Source Module is replaced in the MS464xB VNA.

Equipment Required

- Anritsu ML2437A or ML2438A Power Meter
- Anritsu MA2474D Power Sensor
- Anritsu 33KK50B/C or K220B K(m) to K(m) Adapter
- Pasternack PE9644 K (m) to K (f) Right Angle Adapter
- Krytar 102040013K Directional Coupler

Procedure

1. Install a GPIB interface cable between the power meter GPIB port and the Dedicated GPIB port of the MS464xB VNA.
2. Turn on the power meter and allow it to warm up at least 30 minutes.
3. Connect the power sensor to the Calibrator port of the power meter and calibrate the power sensor.
4. Turn on the MS4647B VNA and MN4697C, 3736B, and 3739C Test Sets and allow them to warm up at least 30 minutes.
5. Install the K(m) to K(m) Adapter to the RF In port of the Directional Coupler. Refer to Figure 5-7.

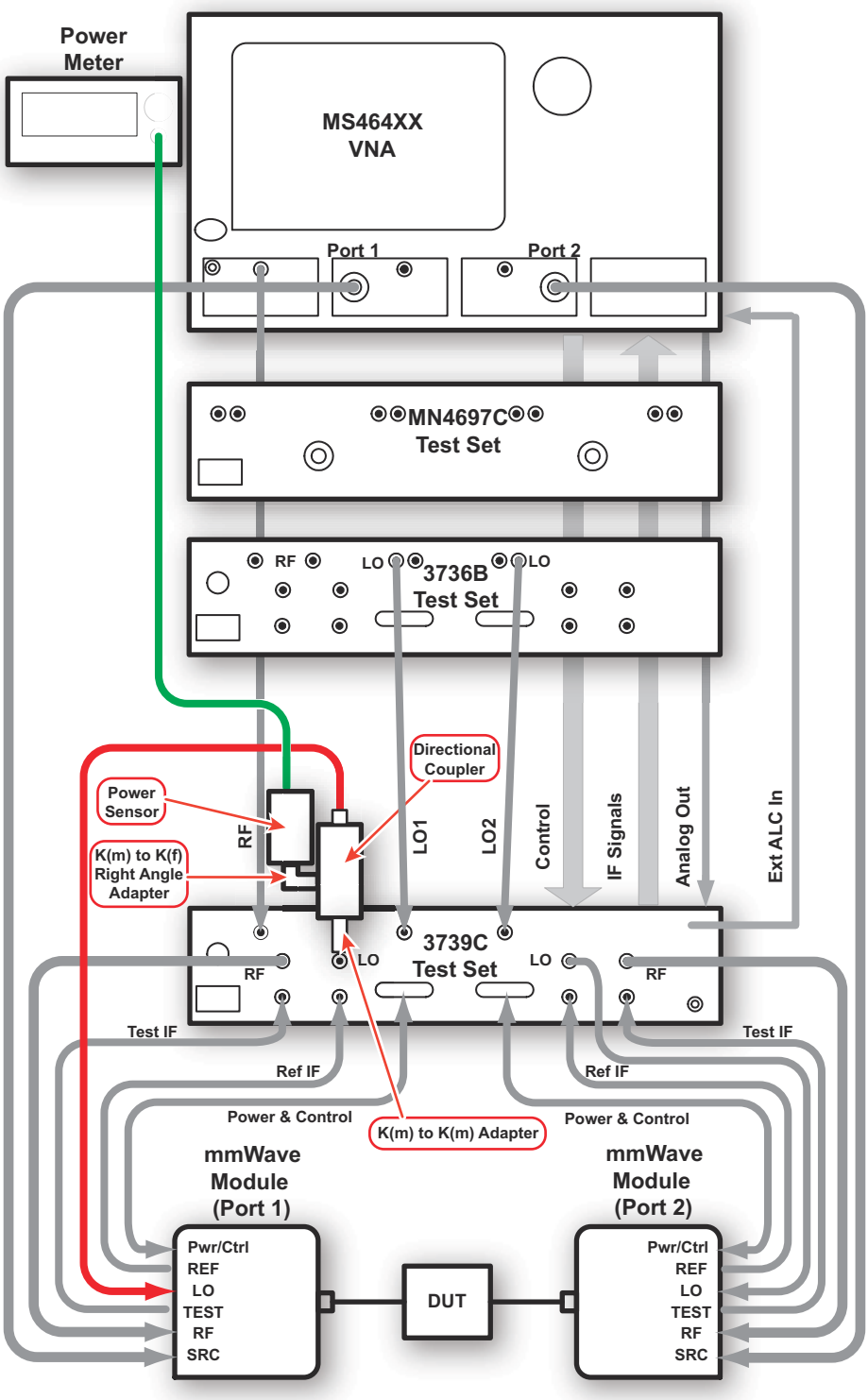


Figure 5-7. LO Level Cal Setup (Broadband Configuration shown without Port 3 and Port 4 for clarity)

6. Disconnect the LO cable from the Port 1 LO connector of the 3739C Test Set.

7. Connect the Coaxial Directional Coupler with the Adapter to the Port 1 LO connector of the Test Set.

8. Connect the LO cable to the RF Out port of the Coaxial Directional Coupler.

9. Connect the power sensor to the Coupling Port of the Directional Coupler.
10. On the MS464xB VNA, select System and then Diagnostics.
11. The Diagnostics Access dialog box appears, providing an entry field to enter the diagnostics access password as shown below in Figure 5-8. The password is CajaNueva.

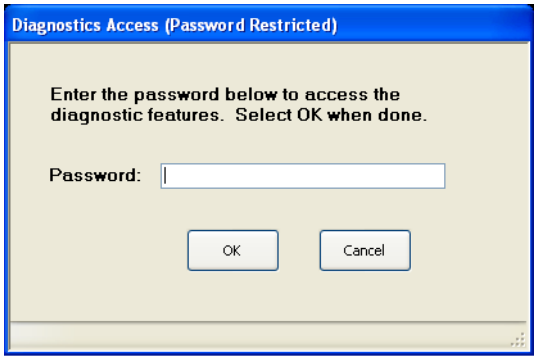


Figure 5-8. DIAGNOSTICS ACCESS Dialog Box

12. Enter the password CajaNueva in the Password field and click OK.
13. The Diagnostics Menu appears as shown in Figure 5-9.

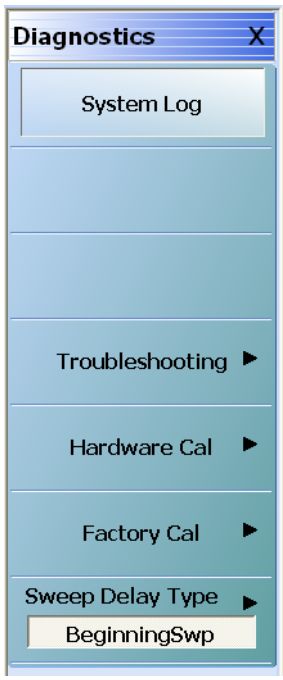


Figure 5-9. DIAGNOSTICS Menu

14. Select Hardware Cal to access the Hardware Cal Menu as shown in Figure 5-10.

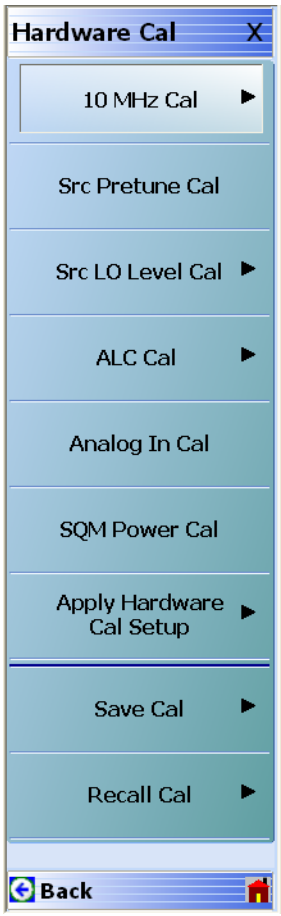


Figure 5-10. HARDWARE CAL Menu

15. Select Src LO Level Cal and the LO Level Cal Menu appears as shown in Figure 5-11.

Figure 5-11. LO LEVEL CAL Menu

16. Select BB/mmWave [3739] LO Level Cal and the Modular LO Level Cal dialog box as shown in Figure 5-12 appears.

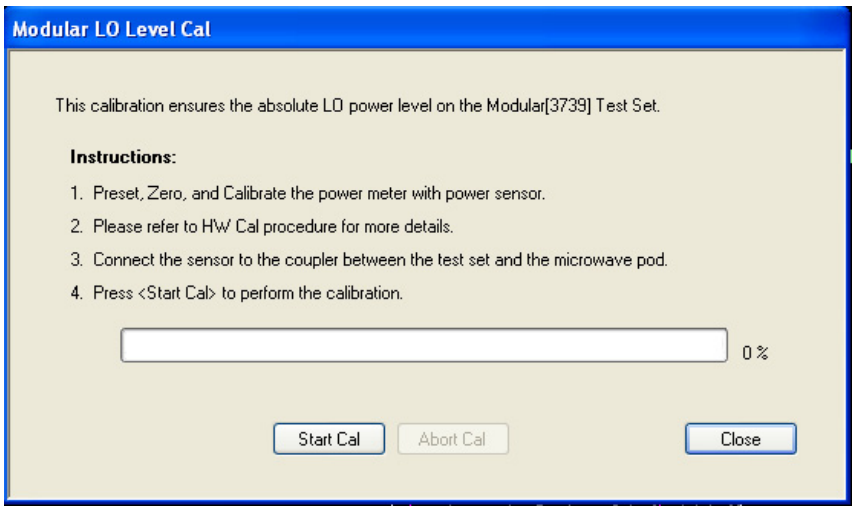


Figure 5-12. Modular LO LEVEL CAL Dialog Box

17. Click the Start Cal button to start the calibration.

18. After the calibration is complete, remove the Power Sensor and Directional Coupler from the Port 1 LO connector of the 3739C Test Set and re-connect the LO cable.

5-4 ALC Level Calibration

Note	The ME7838A4/E4 systems do an ALC Calibration on Ports 1 and 2 with the system in the 2-port configuration used for their LO Cal. The ME7838A4X/E4X/D4/G4 does an ALC Calibration on all four ports with the system in a 4-port configuration.

The ALC Level Calibration is used to insure that the RF output power can be leveled across the entire operating frequency range at the test port of the mmWave Module.

There are three ALC Level Calibrations. They are:

- Base ALC Calibration
- IF Leveling Calibration – Band 1 (54 to 70 GHz), Band 2 (70 to 125 GHz) and Band 3 (125 to 145 GHz for MA25300A; 125 to 170 GHz for MA25400A), and Band 4 (170 to 220 GHz)
- RF Leveling Calibration – Band 1 (54 to 70 GHz), Band 2 (70 to 125 GHz) and Band 3 (125 to 145 GHz for MA25300A; 125 to 170 GHz for MA25400A), and Band 4 (170 to 220 GHz)

These calibrations can either be performed individually by selecting the respective calibration button (i.e. Base ALC Cal, IF Leveling Cal, or RF Leveling Cal) or be performed as a single calibration by selecting the IF/RF/Base ALC Cal button.

Perform the following calibration procedure if the MS464xx VNA was repaired or if the MS464xx VNA port cable was replaced:

- Base ALC Calibration

Perform the following calibration procedures if the mmWave module has been swapped, repaired, or replaced:

- IF Leveling Calibration – Band 1 (54 to 70 GHz), Band 2 (70 to 125 GHz) and Band 3 (125 to 145 GHz for MA25300A; 125 to 170 GHz for MA25400A), and Band 4 (170 to 220 GHz)
- RF Leveling Calibration – Band 1 (54 to 70 GHz), Band 2 (70 to 125 GHz) and Band 3 (125 to 145 GHz for MA25300A; 125 to 170 GHz for MA25400A), and Band 4 (170 to 220 GHz)

Equipment Required

- Anritsu ML2437A or ML2438A Power Meter
- Anritsu SC7770 Power Sensor
- Anritsu 33WFVF50 W1 female to V female Adapter
- Anritsu 33W.8F50 W1 male to 0.8 mm female Adapter (Included with 3659 Calibration Kit)
- Keysight 437B, E4418B, or N1913A with Option 200 Power Meter
- Keysight W8486A WR-10 Waveguide Power Sensor
- Anritsu 35WR10WF WR-10 Waveguide to W1 female Adapter
- ELVA-1 DPM-06/20 Power Meter with Power Sensor (For MA25300A and MA25400A only)
- Flann Microwave K1612 WR-06 Waveguide to 0.8 mm female Coaxial Connector Adapter (For MA25300A only)
- ELVA-1 DPM-05/20 Power Meter with Power Sensor (For MA25400A only)
- Anritsu 33.8G50 0.8 mm male to MA25400A Adapter (For MA25400A only)
- Anritsu 35WR5G WR05 to MA25400A Adapter (For MA25400A only)

Setup Procedure

Note	For 3744A-EE and 3744A-EW modules, disconnect the Waveguide adapter at the test port prior to performing the ALC calibration. Re-install the adapter after the calibration is complete.

1. If the system is an ME7838A4/E4, then configure the ME7838A4/E4 as an ME7838A 2-port system. Refer to the **VectorStar ME7838 Series System Installation Guide** – 10410-00293 for interconnect instructions.
2. If the system is an ME7838A4X/E4X/D4/G4, then configure the ME7838A4X/E4X/D4/G4 as an ME7838x 4-port system. Refer to the **VectorStar ME7838x4 Series System Installation Guide** – 10410-00734 for interconnect instructions.
3. If the mmWave Modules are MA25400A, install 33.8G50 Adapter to the test port of the MA25400A Module at **Port 1** and install 35WR5G Adapter to the test port of the MA25400A Module at **Port 2**.
4. Turn on the MS464xx VNA and 3739X Test Set and allow them to warm up at least 30 minutes. While the system is warming up, proceed to Step 5.
5. Install a GPIB interface cable between the Anritsu ML243XA power meter GPIB port and the **Dedicated GPIB** port of the MS464xx VNA.
6. Install a GPIB interface cable between the GPIB port of the Keysight 437B, E4418B, or N1913A power meter and the **Dedicated GPIB** port of the MS464xx VNA.
7. If the mmWave Modules are MA25300A or MA25400A, install a GPIB interface cable between ELVA-1 DPM-06/20 Power Meter GPIB port and the **Dedicated GPIB** port of the MS464xx VNA
8. If the mmWave Modules are MA25400A, install a GPIB interface cable between ELVA-1 DPM-05/20 Power Meter GPIB port and the **Dedicated GPIB** port of the MS464xx VNA
9. Install the Anritsu SC7770 power sensor to the Anritsu ML2437A or ML2438A power meter.
10. Install the Keysight W8486A power sensor to the Keysight 437B, E4418B, or N1913A power meter.
11. If the GPIB Address of the Keysight Power Meter has not been changed to 15, do the following:
    a. For Keysight 437B Power Meter:
        a. Power on the power meter.
        b. Press the **SPECIAL** key (**SHIFT** + **PRESET/LOCAL**)
        c. Press the up or down arrow key until the display reads 4 HP-IB ADRS.
        d. Press the **ENTER** key. The display will read ADDRESS 13.
        e. Press the up, down, left, or right keys until ADDRESS 15 is displayed.
        f. Press the **ENTER** key.
    b. For Keysight E4418B Power Meter:
        a. Power on the power meter.
        b. Press System | Inputs key and select Remote Interface, Configure Interface, and GPIB.
        c. Press the GPIB Addr softkey.
        d. Use the up, down, left, or right key to modify the displayed values until 15 is displayed.
        e. Press the **Enter** key to confirm the choice.
    c. For Keysight N1913A Power Meter:
        a. Power on the power meter.
        b. Press System key and select Remote Interfaces.
        c. Use the arrow keys to highlight GPIB Address entry field.
        d. Press **Select** key and then use the numeric keypad to enter 15 as GPIB Address.

e. Press the **Enter** key.

f. Press System key and select Remote Interfaces, 1 of 2, and Command Set.

g. Select HP 437B as the Interface Language.

12. If the mmWave Modules are MA25300A, install the Flann Microwave K1612 WR06 Waveguide to 0.8 mm female Adapter to the ELVA-1 WR06 170 GHz Power Sensor.

13. If the GPIB Address of ELVA-1 DPM-06/20 Power Meter has not been changed to 17, do the following:

a. Power on the ELVA-1 DPM-06/20 Power Meter.

b. On the MS464xx, Select: System | Remote Interface | Power Meter

c. Select: Configure D-Band Power Meter

d. Click the Configure button. This change the D-Band Power Meter GPIB Address to 17.

Note	The default GPIB address on the ELVA-1 EPM-06/20 Power Meter is 4. Once the meter has been configured by VectorStar, the address changes to 17 and the meter does not need to be configured again.

14. If the GPIB Address of ELVA-1 DPM-05/20 Power Meter has not been changed to 18, do the following:

a. Power on the ELVA-1 DPM-05/20 Power Meter.

b. On the MS464xx, Select: System | Remote Interface | Power Meter

c. Select: Configure G-Band Power Meter

d. Click the Configure button. This change the G-Band Power Meter GPIB Address to 18.

Note	The default GPIB address on the ELVA-1 EPM-05/20 Power Meter is 4. Once the meter has been configured by VectorStar, the address changes to 18 and the meter does not need to be configured again.

15. Turn on power meters, if not done previously, and allow them to warm up at least 30 minutes.

16. Connect the Anritsu SC7770 power sensor to the Calibrator port of the ML243XA power meter and calibrate the power sensor.

17. Disconnect the power sensor from the power meter Calibrator port and install the 33WFVF50 W1 female to V female adapter to the Anritsu SC7770 power sensor. If the mmWave modules are MA25300A or MA25400A, also install the 33W.8F50 adapter to the 33WFVF50 adapter.

18. Connect the Keysight W8486A power sensor to the Calibrator port of the Keysight 437B, E4418B, or N1913A power meter and calibrate the power sensor.

19. Install the 35WR10WF adapter to the Keysight W8486A power sensor.

20. On the MS464xx VNA, select System and then Diagnostics.

21. The Diagnostics Access dialog box appears providing an entry field to enter the diagnostics access password as shown below in Figure 5-13. The password is CajaNueva.

Figure 5-13. DIAGNOSTICS ACCESS Dialog Box

22. Select Hardware Cal to access the Hardware Cal menu as shown in Figure 5-14.

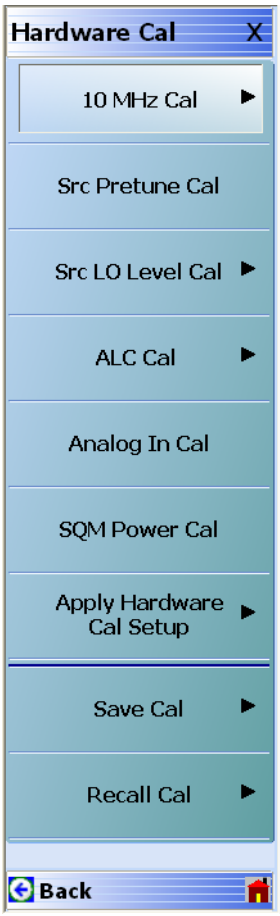


Figure 5-14. HARDWARE CAL Menu

23. Select ALC Cal; the ALC Level Cal menu appears as shown in Figure 5-15.

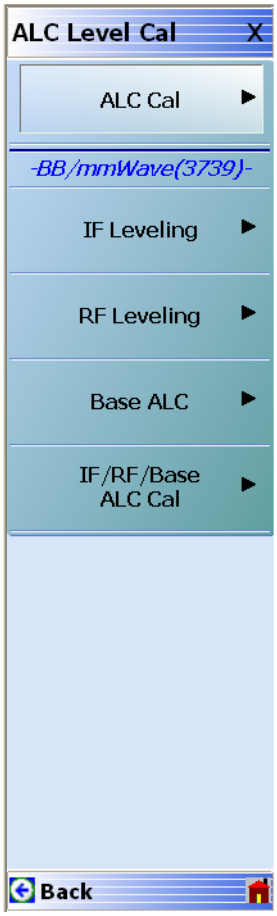


Figure 5-15. ALC LEVEL CAL Menu

ALC Calibration Procedure - Broadband Configuration

1. Select IF/RF/Base ALC Cal and the ALC[3739-All] menu appears as shown in Figure 5-15.

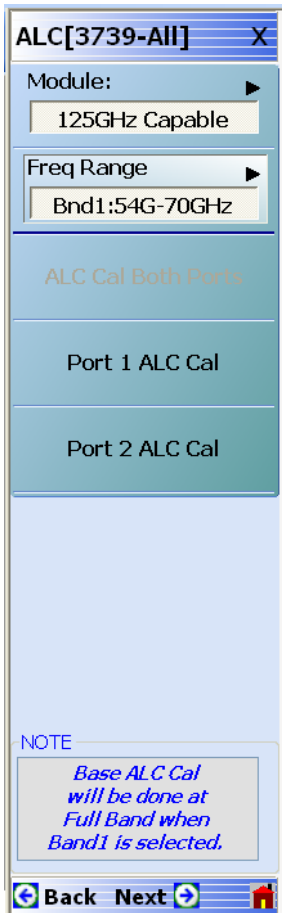


Figure 5-16. ALC[3739-All] Menu (2-port)

2. If the mmWave Modules are MA25300A, change Module to 145 GHz Capable.
3. If the mmWave Modules are MA25400A change Module to 220GHz Capable.

Port 1 ALC Calibration

4. Confirm that Freq Range displays Bnd1:54G-70GHz. If not, select Freq Range and select Band 1.
5. Connect the Anritsu SC7770 power sensor to the Test Port of the mmWave Module at Port 1.
6. Select Port 1 ALC Cal.
7. Click the Start Cal button to start the calibration.
8. When calibration is complete, disconnect the Anritsu SC7770 power sensor and connect the Keysight W8486A power sensor to the Test Port of the Millimeter Module at Port 1.
9. Change the Freq Range to Bnd2:70G-125GHz.
10. Select Port 1 ALC Cal.
11. Click the Start Cal button to start the calibration.
12. Skip to Step 32 if the mmWave Modules are not MA25300A or MA25400A.
13. Connect the ELVA DPM-06/20 110-170 GHz Power Sensor to the Test Port of the mmWave Module at Port 1.

14. Change the Freq Range to Bnd3:125G-145GHz.
15. Select Port 1 ALC Cal.
16. Click the Start Cal button to start the calibration.
17. Disconnect the ELVA DPM-06 Power Sensor from Port 1.
18. Connect the ELVA DPM-05 140-220 GHz Power Sensor to the Test Port of the mmWave Module at Port 1.
19. Change the Freq Range to Band4: 145GHz-220GHz. Select Port 1 ALC Cal
20. Click the Start Cal button to start the calibration.
21. Disconnect the ELVA DPM-05 Power Sensor from Port 1.

Port 2 ALC Calibration

22. Connect the ELVA DPM-05 140-220 GHz Power Meter to the Test Port of the mmWave module at Port-2.
23. Select Port 2 ALC Cal.
24. Click the Start button to start the calibration.
25. When the Calibration is complete, disconnect the Elva DPM-05 Power Sensor from Port 2.
26. Change the Freq Range to Band 3: 125GHz-145GHz.
27. Connect the ELVA DPM-06 Power Sensor to the Test Port of the mmWave Module at Port 2.
28. Select Port 2 ALC Cal.
29. Click the Start Cal button to start the calibration.
30. When the calibration is complete, disconnect the ELVA DPM-06 Power Sensor from Port 2.
31. Change the Freq Range to Bnd2:70G-125GHz.
32. Connect the Keysight W8486A power sensor to the Test Port of the Millimeter Module at Port 2.
33. Select Port 2 ALC Cal.
34. Click the Start Cal button to start the calibration.
35. When calibration is complete, remove the Keysight W8486A power sensor from the Test Port of the Millimeter Module at Port 2.
36. Install the Anritsu SC7770 power sensor to the Test Port of the mmWave Module at Port 2.
37. Change the Freq Range to Bnd1:54G-70GHz.
38. Select Port 2 ALC Cal.
39. Click the Start Cal button to start the calibration.
40. The ALC Calibration is now complete. For an ME7838A4X/E4X/D4/G4 system, continue to do Ports 3 and 4.

ME7838A4X/E4X/D4/G4 Port 3 and 4 ALC Calibration

41. Select IF/RF/Base ALC Cal and the ALC[3739-All] menu appears as shown in Figure 5-18.
42. For the MA25300A mmWave Modules, change Module to 145GHz Capable, or for the MA25400A mmWave Modules, change Module to 220GHz Capable.

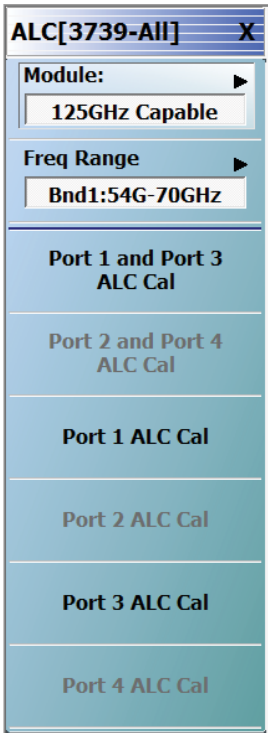


Figure 5-17. ALC[3739-All] Menu (4-port)

43. Repeat Step 4 through Step 42, using Port 3 and Port 4 in place of Port 1 and Port 2.

ALC Calibration Procedure - Banded mmWave Configuration

Note	Remove the Waveguide Adapter prior to performing the ALC Calibration. Refer to the adapter installation instructions in Chapter 5, Waveguide Adapter Kit Instructions, of **VectorStar Broadband/Banded mmWave Modules Reference Manual** – 10410-00311.

Port 1 IF Leveling Calibration

1. Select IF Leveling. The ALC [3739-IF] menu as shown in Figure 5-18 on page 5-20 will appear.
2. Connect the Anritsu SC7770 power sensor to the Test Port of the mmWave Module at Port 1.
3. Ensure that Freq Range displays Bnd1:54G-70GHz. If not, select Freq Range and select Band 1.
4. Select Port 1 ALC Cal.
5. Click the Start Cal button to start the calibration.
6. After calibration is complete, disconnect the Anritsu SC7770 power sensor from the mmWave Module at Port 1.
7. Change the Freq Range to Bnd2:70G-125GHz.
8. Connect the Keysight W8486A power sensor to the Test Port of the mmWave Module at Port 1.
9. Select Port 1 ALC Cal.
10. Click the Start Cal button to start the calibration.

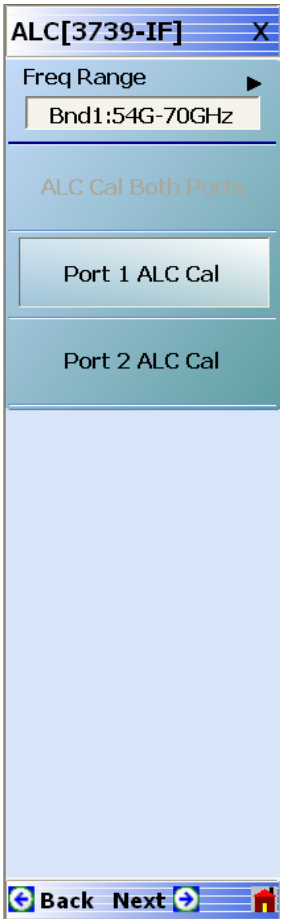


Figure 5-18. ALC [3739-IF] Menu

Port 1 RF Leveling Calibration

11. Select Back and then RF Leveling. The ALC [3739-RF] menu as shown in Figure 5-19 on page 5-21 will appear.

12. Connect the Keysight W8486A power sensor to the Test Port of the mmWave Module at Port 1.

13. Select Port 1 ALC Cal.

14. Click the Start Cal button to start the calibration.

15. When the calibration is complete, disconnect the Keysight W8486A power sensor.

16. Connect the Anritsu SC7770 power sensor to the Test Port of the 3743A/3744A Module at Port 1.

17. Change Freq Range to Bnd1:54G-70GHz.

18. Select Port 1 ALC Cal.

19. Click the Start Cal button to start the calibration.

20. After calibration is complete, disconnect the Anritsu SC7770 power sensor from the mmWave Module at Port 1.

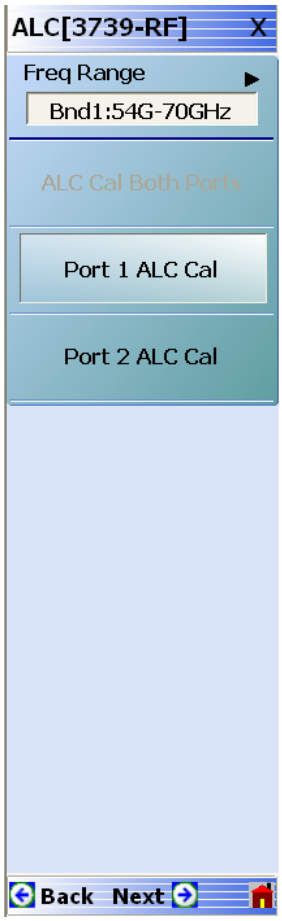


Figure 5-19. ALC [3739-RF] Menu

Port 2 RF Leveling Calibration

21. Connect the Anritsu SC7770 power sensor to the W1 Test Port of the mmWave Module at Port 2.

22. Select Port 2 ALC Cal.

23. Click the Start Cal button to start the calibration.

24. After calibration is complete, disconnect the Anritsu SC7770 power sensor from the mmWave Module at Port 2.

25. Connect the Keysight W8486A power sensor to the Test Port of the mmWave Module at Port 2.

26. Change the Freq Range to Bnd2:70G-125GHz.

27. Select Port 2 ALC Cal.

28. Click the Start Cal button to start the calibration. Wait until the calibration is complete.

Port 2 IF Leveling Calibration

29. Select Back and then IF Leveling.

30. Select Port 2 ALC Cal.

31. Click the Start Cal button to start the calibration.

32. After calibration is complete, disconnect the Keysight W8486A power sensor from the mmWave Module at Port 2.

33. Change the Freq Range to Bnd1:54G-70GHz.

34. Connect the Anritsu SC7770 power sensor to the Test Port of the mmWave Module at Port 2.

35. Select Port 2 ALC Cal.

36. Click the Start Cal button to start the calibration.

37. The ALC Calibration is now complete.

38. Install the waveguide adapters back to the mmWave modules. For the ME7838D4/G4 systems these steps can be repeated for Port 3 and Port 4.

Chapter 6 — Troubleshooting

6-1 Introduction

This chapter provides information about troubleshooting tests that can be used to check the ME7838x4 or ME7838x4X VNA system for proper operation. These tests are intended to be used as a troubleshooting tool for identifying the faulty ME7838x4 system component, whether it be within the MS469xB VNA, the MN469xC Multiport Test set, the 3736B Test Set, or the 3739C Broadband Test Set.

Instructions on checking the functionality of internal components and sub-assemblies within each system component depends on whether the fault has been isolated to the VNA or one of the three test sets:

- For troubleshooting instructions for the **3736B** Test Set, refer to Section 6-7 “3736B Test Set Troubleshooting” in this chapter.
- For troubleshooting instructions for the **MS464xA VNA**, refer to 10410-00268 – MS4640B VectorStar Maintenance Manual.
- For troubleshooting instructions for the **MS464xB VNA**, refer to 10410-00320 – MS4640B VectorStar Maintenance Manual.
- For troubleshooting instructions for the **MN469xC** Test Set, refer to 10410-00730 – MN469xC Multiport Test Set Maintenance Manual.
- For troubleshooting instructions for the **3739C** Test Set refer to 10410-00306 – ME7838 Series Modular BB/mmWave Maintenance Manual.

6-2 General Safety Warnings

Many of the troubleshooting procedures presented in this chapter require the removal of instrument covers to gain access to subassemblies and modules. When using these procedures, please observe the warning and caution notices.

Warning	Hazardous voltages are presented inside the instrument when AC line power is connected. Before removing any covers, turn off the instrument via the Main power switch on the front panel and unplug the AC power cord.

Caution	Many assemblies and modules in the ME7838x4 Test Set contain static-sensitive components. Improper handling of these assemblies and modules may result in damage to the assemblies and modules. Always observe the static-sensitive component handling precautions.

Caution	To provide protection for the rear panel connectors, when the top cover is removed, the rear feet should be reattached onto the chassis after removing the top cover.

6-3 Troubleshooting Overview

The ME7838x4 VNA System consists of the following major components:

- MS464xA/B Series VectorStar VNA
- MN469xC Test Set
- 3736B Test Set
- 3739C Test Set
- mmWave Modules (4 each)

A good understanding of the ME7838x4 VNA System operation is an important aid to troubleshoot system failures. Refer to Section 4-4 “Functional Description of System Components” on page 4-3, Section 4-5 “ME7838A4/A4X System Operation - Broadband Configuration” on page 4-10, and Section 4-6 “ME7838A4/A4X System Operation - Waveguide Band Configuration” on page 4-10.

It is also imperative to isolate whether the system fault is in the MS4640 Series VectorStar VNA, the MN469xC Test Set, the 3736B Test Set, the 3739C Test Set, or the mmWave Modules.

Suggested Troubleshooting Strategy

The suggested troubleshooting steps for ME7838x4 Broadband/mmWave VNA System are as follows:

- Ensure that the VNA and Test Sets can be powered up.
- Ensure that no setup and installation errors exist (e.g. cabling error and cable connection). Refer to the VectorStar ME7838x4 Multiport Broadband/mmWave VNA System Installation Guide – 10410-00734.
- Isolate the fault to a system components (e.g. VNA, one of the Test Sets, or mmWave Module) using a process of elimination. Refer to Section 6-4 “General Troubleshooting of the ME7838x4 System”.

Note	The critical information to know is the sweep direction and frequency at which the fault occurs.

6-4 General Troubleshooting of the ME7838x4 System

This section provides general troubleshooting procedures of the ME7838x4 VNA System to isolate the problem to a particular component of the system, i.e., the VNA or a module or one of the test sets. It assumes that setup and installation errors have been eliminated.

VNA/Module/Test Set Fault Isolation

1. Ensure that the system is sweeping in the system specified frequency range (e.g.70 kHz to 110 GHz for ME7838x4 Broadband configuration, 56 to 94 GHz for Banded mmWave configuration using the 3744A-EE modules).

   The strategy is to measure a thru between ports 1 and 2 and then a thru between ports 3 and 4 as a construct for isolating the problem. If this doesn't reveal anything, then the user can go to different thrus (like between Ports 1 and 4, and between Ports 2 and 3). A trace setup with all 16 S-parameters allows the user to move between connections and still have the relevant parameters on-screen.

   Using this strategy, the user can isolate the problem further by determining whether the fault occurs only with one particular driving port, with one particular receiving module, or with multiple sources/receivers.

2. Set up traces 1 through 16 as follows:
   - Trace 1 set to S11
   - Trace 2 set to S12
   - Trace 3 set to S13
   - Trace 4 set to S14
   - Trace 5 set to S21
   - Trace 6 set to S22
   - Trace 7 set to S23
   - Trace 8 set to S24
   - Trace 9 set to S31
   - Trace 10 set to S32
   - Trace 11 set to S33
   - Trace 12 set to S34
   - Trace 13 set to S41
   - Trace 14 set to S42
   - Trace 15 set to S43
   - Trace 16 set to S44
3. If the fault occurs at all frequencies and both sweeps, you can assume that the fault lies in the MS464xA/B VNA or the MN469xC. For troubleshooting information:
   - Refer to Chapter 4 of the **VectorStar MS4640A Series VNA Maintenance Manual** – 10410-00268 or,
   - Refer to Chapter 5 of the **VectorStar MS4640B Series VNA Maintenance Manual** – 10410-00320 or,
   - Refer to Chapter 4 of the **VectorStar MN469xC Series Maintenance Manual** – 10410-00730.
4. If the fault occurs at any frequency below 30 GHz, you can assume that the fault lies in the MS464xA/B VNA or the MN469xC test set.

   To isolate between these two, going back to 2-port operation on the VNA may help. Close the application, turn off the test set, restart the application and re-insert the loops on the VNA. Conduct thru and non-ratio-parameter tests as described for the MS464xA/B alone.

5. If the fault occurs at any frequency starting at 30 GHz or above, do the following:
   a. Perform the "Troubleshooting Test – VNA RF Source and LO Power Level Checks" on page 6-5.
      - If the RF, LO1 or LO2 power level is low, then the fault lies in the MS464xA/B VNA.
   b. Perform the "Troubleshooting Test - Non-Ratio Power Level Check" on page 6-7.
      - If the fault is shown on A1 trace at frequency above 54 GHz, the fault lies in the mmWave Module connected to Port 1 or the 3739C Test Set. If the fault is below 54 GHz, the fault lies in the MS464xA/B VNA for Broadband configuration.
      - If the fault is shown on B1 trace at frequency starting at 30 GHz or above, the fault lies in the mmWave Module connected to Port 1 or the 3739C Test Set; assuming that the MS464xA/B VNA has passed the VNA Source and LO Power Level Check.
      - If the fault is shown on A2 trace at frequency above 54 GHz, the fault lies in the mmWave Module connected to Port 2 or the 3739C Test Set. If the fault is below 54 GHz, the fault lies in the MS4647A/B VNA for Broadband configuration.
      - If the fault is shown on B2 trace at frequency starting at 30 GHz or above, the fault lies in the mmWave Module connected to Port 2 or the 3739C Test Set; assuming that the MS464xA/B VNA has passed the VNA Source and LO Power Level Check.
   c. Repeat the "Troubleshooting Test - Non-Ratio Power Level Check" for a3, b3, a4, b4 and the associated ports:
      - If the fault is shown on A3 trace at frequency above 54 GHz, the fault lies in the mmWave Module connected to Port 3 or the 3736B Test Set. If the fault is below 54 GHz, the fault lies in the MS464xA/B VNA for Broadband configuration.
      - If the fault is shown on B3 trace at frequency starting at 30 GHz or above, the fault lies in the mmWave Module connected to Port 3 or the 3736B Test Set; assuming that the MS464xA/B VNA has passed the VNA Source and LO Power Level Check.
      - If the fault is shown on A4 trace at frequency above 54 GHz, the fault lies in the mmWave Module connected to Port 4 or the 3736B Test Set. If the fault is below 54 GHz, the fault lies in the MS4647A/B VNA for Broadband configuration.
      - If the fault is shown on B4 trace at frequency starting at 30 GHz or above, the fault lies in the mmWave Module connected to Port 4 or the 3736B Test Set; assuming that the MS464xA/B VNA has passed the VNA Source and LO Power Level Check.
6. If the fault is in the 3736B Test Set, refer to "3736B Test Set Troubleshooting" on page 6-9 for procedures to further isolate the problem.
7. If the fault is in the 3739C Test Set, refer to **ME7838 Series Modular BB/mmWave Maintenance Manual** – 10410-00306 for procedures to further isolate the problem.
8. If the fault is in the MN469xC Test Set, refer to the **MN469xC Series Multiport Test Set Maintenance Manual** – 10410-00730 for procedures to further isolate the problem.

6-5 Troubleshooting Test – VNA RF Source and LO Power Level Checks

The VNA Source and LO Power Level Check verifies that sufficient levels of source power are supplied to the 3736B Test Set (and 3739C Test Set with Option 031), and that sufficient levels of LO power are supplied to the 3736B Test Set.

Note	This test assumes that the ME7838x4 system is assembled per the **ME7838x4 Multiport Broadband VNA Installation Guide** – 10410-00734.

Equipment Required

- Anritsu ML2437A or ML2438A Power Meter
- Anritsu MA2474D Power Sensor
- Anritsu MS2720T with Opt. 732 Spectrum Analyzer
- Anritsu 34NKF50 Adapter
- Anritsu 15KK50-1.0A RF Cable

Preliminary Steps

1. Turn on the Power Meter and allow it to warm up at least 30 minutes.

2. Calibrate the power sensor.

3. Disconnect the cables connected to RF (or RF2 on MS464xB with Option 31), LO1 and LO2 ports on the MS464xA/B VNA.

RF Port Output Level Check

4. Set the VNA Start Frequency to 54 GHz and Stop Frequency of the ME7838x4 VNA system.

5. Turn on CW Mode. Leave the system at the default power level.

6. Connect the power sensor to the RF port of the MS464xA/B VNA.

7. Vary the CW Frequency and monitor the output to see if the power level is at the expected level per Table 6-1.

Note	Set the Cal Factor on the power meter to match the RF port output frequency.

8. If the output level is unexpectedly low, the fault lies in the MS464xA/B VNA.

Table 6-1. Expected VNA RF Output Level

VNA Set Freq	RF Port Output Freq	Expected Power Level
54 GHz	27 GHz	+2 dBm
68 GHz	34 GHz	+2 dBm
80 GHz	40 GHz	+2 dBm
80.1 GHz	26.7 GHz	+2 dBm
95 GHz	31.7 GHz	+2 dBm
110 GHz	36.7 GHz	+2 dBm
120 GHz	20 GHz	0 dBm
140 GHz	23.4 GHz	0 dBm
160 GHz	13.33 GHz	0 dBm
180 GHz	15 GHz	0 dBm
220 GHz	16.67 GHz	0 dBm

These values are typical for A, E and D systems, since the default power is lower in G systems, the RF drive may be lower as well.

LO1 Port Output Level Check

9. On the VNA, set CW Frequency to 54 GHz.

10. Connect the 34NKF50 Adapter to the Spectrum Analyzer RF In port.

11. Connect a RF cable between the Adapter at the Spectrum Analyzer RF In port and the LO1 port of the MS464xA/B VNA.

12. On the Spectrum Analyzer, set the Reference Level to +15 dBm, Start frequency to 4 GHz and Stop frequency to 11 GHz.

13. On the VNA, vary the CW Frequency and monitor the output with the Spectrum Analyzer to see if the power level is > +3.2 dBm.

Note	The LO frequency varies between 5 and 10 GHz.

14. If the output is unexpectedly low, the fault lies in the MS464xA/B VNA.

LO2 Port Output Level Check

15. Disconnect the RF Cable from the LO1 port of the VNA and connect it to the LO2 port.

16. Set CW frequency to 54 GHz.

17. Vary the CW Frequency and monitor the output with the Spectrum Analyzer to see if the power level is > +3.2 dBm

18. If the output is unexpectedly low, the fault lies in the MS464xA/B VNA.

6-6 Troubleshooting Test - Non-Ratio Power Level Check

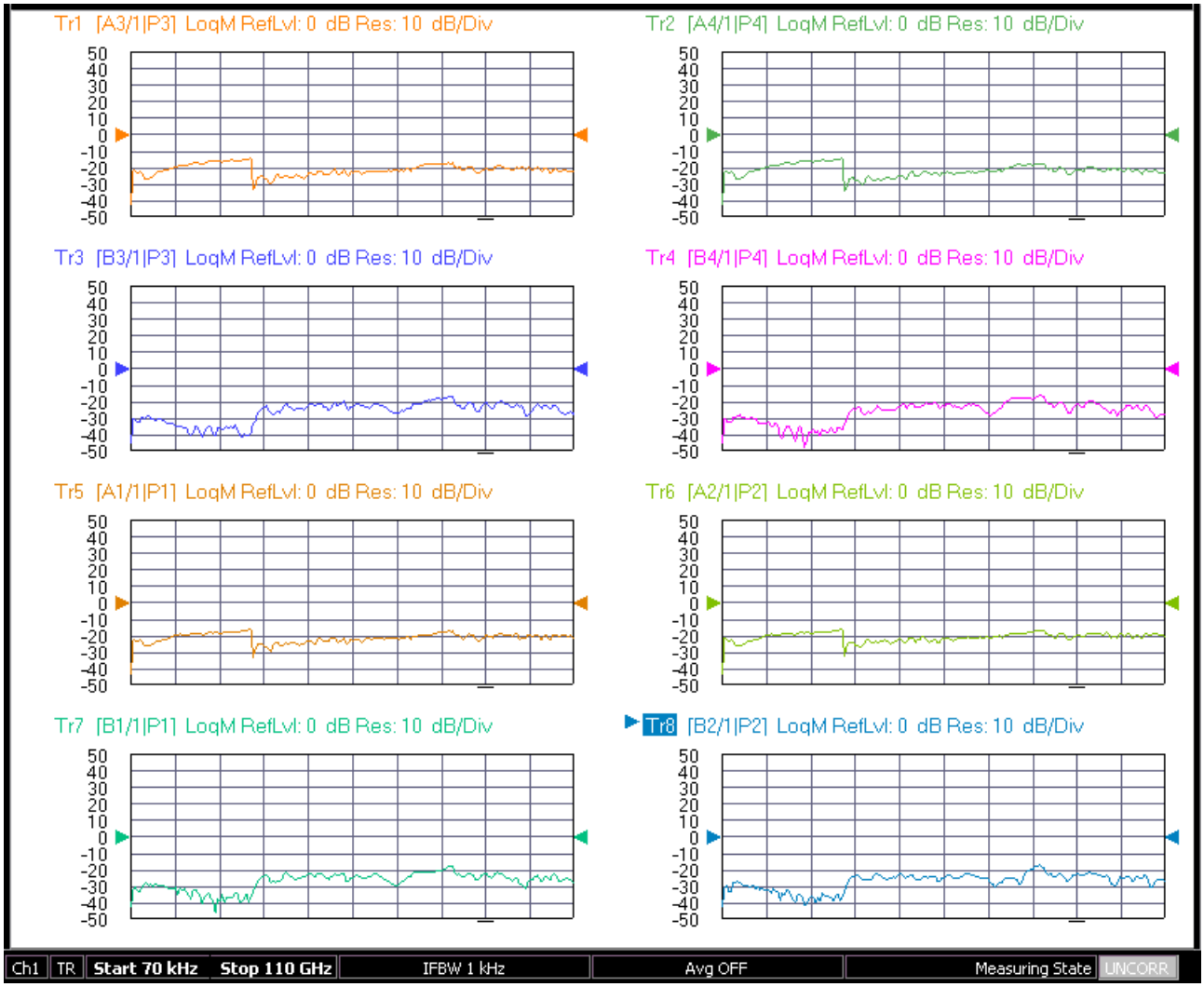
The Non-Ratio Power Level Check is very useful to isolate which of the four VNA receiver channels is faulty.

Equipment Required

- Anritsu 3656B/C Calibration/Verification Kit (For ME7838A4/A4X and ME7838E4/E4X)
- Anritsu 3659 Calibration/Verification Kit (For ME7838D4 and ME7838G4)
- Anritsu 3655E-1 WR-12 Calibration Kit (For ME7838A4/E4 Banded mmWave configuration)
- Anritsu 3655W-1 WR-10 Calibration Kit (For ME7838A4/E4 Banded mmWave configuration)
- VDI WR5.1CK or OML V05CAL WR05 Waveguide Calibration Kit (For ME7838G4)
- Anritsu 33.8G50 0.8 mm male to MA25400A Adapters (Qty. 2) (For ME7838G4)
- Anritsu 35WR5G WR05 to MA25400A Adapters (Qty 2) (For ME7838G4)

Procedure

1. Ensure that the system is sweeping the system's specified frequency range (e.g. 70 kHz to 110 GHz for ME7838x4 Broadband configuration), with Trace 1 set to S11, Trace 2 set to S12, Trace 3 set to S21, Trace 4 set to S22, Trace 5 set to S33, Trace 6 set to S34, Trace 7 set to S43, and Trace 8 set to S44.
2. Select Trace 1 and then select Display | Trace Format. Set Trace Format to Log Mag.
3. Select Response | User-defined. The User-defined menu appears.
4. Set Numerator to A3, Denominator to 1, and Driver Port to Port 3.
5. Use a mouse to move the Reference Line to one graticule below top scale.
6. Repeat Steps 2 through 5 for Trace 2, setting Numerator to A4, Denominator to 1 and Driver Port to Port 4.
7. Repeat Steps 2 through 5 for Trace 3, setting Numerator to B3, Denominator to 1 and Driver Port to Port 3.
8. Repeat Steps 2 through 5 for Trace 4, setting Numerator to B4, Denominator to 1 and Driver Port to Port 4.
9. Repeat Steps 2 through 5 for Trace 5, setting Numerator to A1, Denominator to 1 and Driver Port to Port 1.
10. Repeat Steps 2 through 5 for Trace 6, setting Numerator to A2, Denominator to 1 and Driver Port to Port 2.
11. Repeat Steps 2 through 5 for Trace 7, setting Numerator to B1, Denominator to 1 and Driver Port to Port 1.
12. Repeat Steps 2 through 5 for Trace 8, setting Numerator to B2, Denominator to 1 and Driver Port to Port 2.
13. Connect shorts or opens to all ports on the mmWave Modules (in the case of the ME7838G4, just leave the coaxial flange ports open).
14. Observe whether any portions of these traces show any abnormality (e.g. very low power level). Typical traces are shown in Figure 6-1 on page 6-8 showing response for Port 1 through Port 4.



Shorts on MS464xB VNA Port 1 and Port 2, and on MN469xC Port 3 and Port 4

Figure 6-1. Typical VNA Eight-Trace Display of Non-Ratioed Parameters

Note that levels may be ~8 dB lower for G systems since the default power is lower.

6-7 3736B Test Set Troubleshooting

This section provides general troubleshooting procedures of the 3736B Test Set.

Note	Before beginning, ensure the rear panel switches on the 3736B rear panel are set appropriately: **VNA Source Switch:** Set to **SINGLE** if the VNA is a Single Source MS464xA/B. Set to **DUAL** if the VNA is a MS464xB with Option 031 Dual Source installed. **Module Interface Cable Length Switch:** Option 3736B-003 Switch (if installed) should be set to **EXTENDED** if cable length to the modules is 2 meters to 5 meters in length. The switch should be set to **STANDARD** if the cable length to the modules is 2 meters or less.

General Troubleshooting Steps

The suggested troubleshooting steps for 3736B Test Set are as follows:

1. Verify that the DC voltages from the power supply are at the expected level. Refer to the "3736B Power Supply DC Check" on this page.
2. Verify that the DC bias voltages of RF components and fan assembly are present on the Test Set Bias Control PCB Assembly. Refer to "3736B A1 Bias Control PCB DC Bias Check" on page 6-11.
3. Verify that the power level of the Port 1 LO port and Port 2 LO port are at the expected level. Refer to "3736B Test Set RF and LO Port Power Level Check" on page 6-12.

Note	If RF port and LO port power levels are at their expected level, then the fault most likely lies in the mmWave Module that is connected to the respective port.

3736B Power Supply DC Check

This procedure verifies that the expected DC voltages from the power supply are present.

Equipment Required

- Digital Multimeter

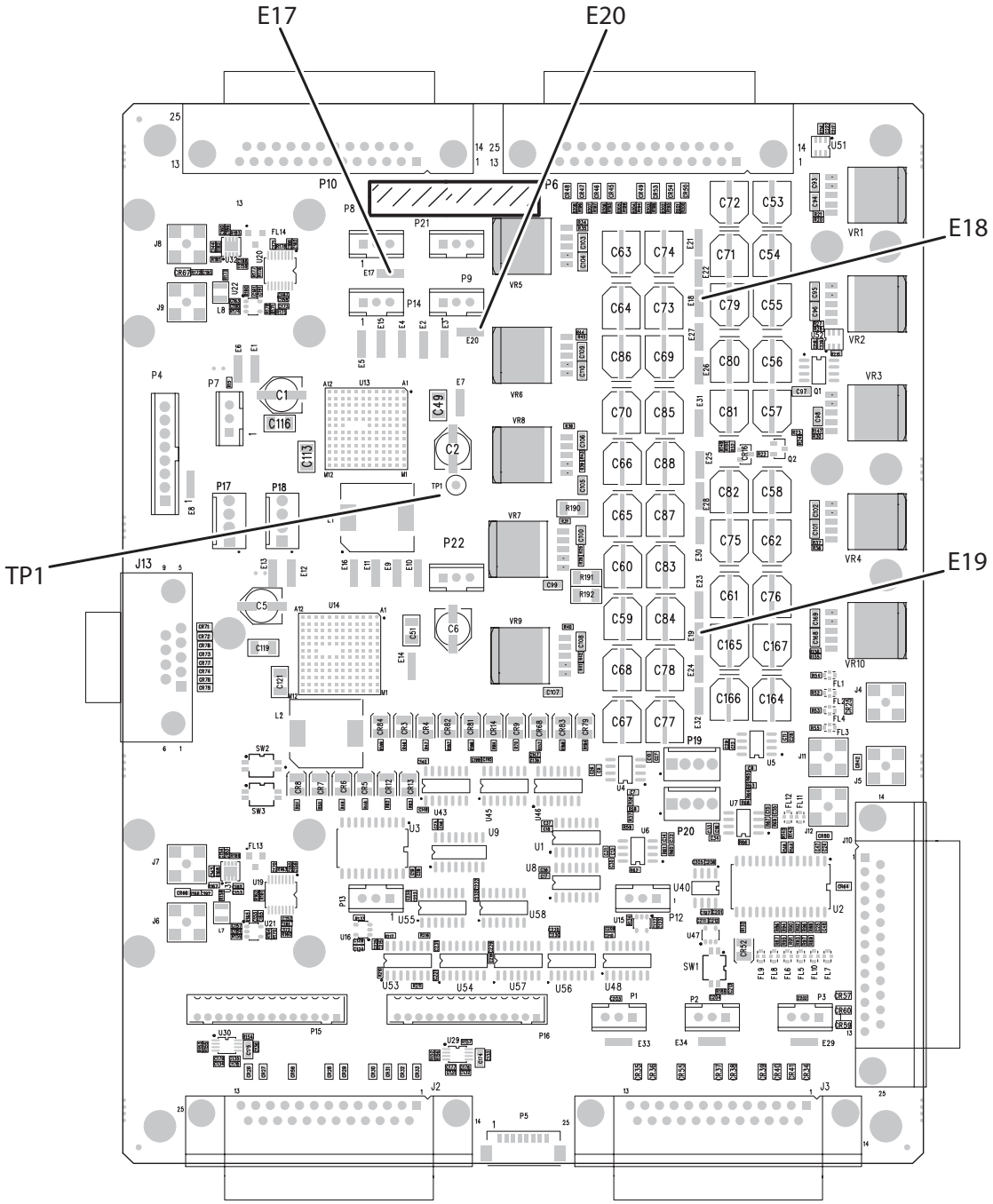
Procedure

1. Turn off the 3736B Test Set and unplug the AC power cord.
2. Remove the top cover of the 3736B Test Set.
3. Remove the stiffener plate.
4. Connect the Test Set to AC power and turn the unit back on.
5. On the A1 Bias Control PCB Assembly, measure the DC voltages at the test points shown in Table 6-2 and verify if they are at the expected level. Refer to Figure 6-2 on page 6-10 for locations of test points.

Table 6-2. Power Supply Expected DC Voltages

Test Point	Common	Expected Voltage
E17	**TP1**	+5 V
E18	**TP1**	+12 V
E19	**TP1**	–12 V
E20	**TP1**	+12 V

6. If any of the voltages are not present, replace the power supply.



Voltage Test Points – E17, E18, E19, and E20; Common Test Point – TP1

Figure 6-2. Locations of Power Supply Voltage Test Points on 3736B A1 Board

3736B A1 Bias Control PCB DC Bias Check

This procedure verifies that the expected DC Bias voltages of RF components and fan assembly are present on the A1 Bias Control PCB located on the 3736B Test Set chassis.

Equipment Required

- Digital Multimeter

Procedure

1. Turn off the 3736B Test Set and unplug the AC power cord.
2. Remove the top cover of the 3736B Test Set.
3. Remove the stiffener plate.
4. Unplug the cable harnesses connected to the connectors listed in Table 6-3
5. Connect the Test Set to AC power and turn the unit back on.
6. Use a digital multimeter to measure the DC voltages presented at each connector. Refer to Figure 7-3, "3736B Test Set – Parts Locations" on page 7-5 for connector locations.

Table 6-3. RF Component/Fan Bias Voltage Check

Connector	Function	Common (Pin)	Measure (Pin)	Expected DC Voltage
P1, P2 & P3	RF Input Amp Bias	3	2	–2.2 V
		3	1	+6 V
P5	SPDT Bias	1	3	–11 V
		1	4	+11 V
		1	5	+5 V
		1	6	–5 V
P9	Fan Bias	2	3	+12 V
P15 & P16	Doubler Module	2	4	–11 V
		2	5	+8 V
		2	6	–6 V
		2	8	+5 V
		2	12	–5 V
		2	14	+5 V

7. If any of the voltage is not present, replace the A1 Bias Control PCB Assembly.

3736B Test Set RF and LO Port Power Level Check

The Test Set Port Power Level Check verifies that sufficient levels of RF power and LO power are supplied to the mmWave Modules.

Equipment Required

- Anritsu ML2437A or ML2438A Power Meter
- Anritsu MA2474D Power Sensor
- Anritsu MS2720T with Opt. 732 Spectrum Analyzer
- Anritsu 34NKF50 Adapter
- Anritsu 15KK50-1.0A RF Cable

Preliminary Steps

1. Turn on the Power Meter and allow it to warm up at least 30 minutes.
2. Calibrate the power sensor.
3. Disconnect the cables connected to Port 1 RF port, Port 1 LO port, Port 2 RF port and Port 2 LO port on the 3736B Test Set.

RF Port Output Level Check

4. Set the VNA Start Frequency to 54 GHz and Stop Frequency to the top frequency of the ME7838x4 VNA system.
5. Press the **Trace** key and set # of Trace to 1, Trace Max, Trace Format to Log Mag and Trace 1 to S11.
6. Turn on CW Mode.
7. Connect the power sensor to the Port 1 RF port of the 3736B Test Set.
8. Vary the CW Frequency and monitor the output to see if the power level is at the expected level per Table 6-4.

Note	Set the Cal Factor on the power meter to match the RF port output frequency.

Table 6-4. Expected Test Set RF Output Level

VNA Set Freq	RF Port Output Freq	Expected Power Level
54 GHz	27 GHz	+3 dBm
68 GHz	34 GHz	+3 dBm
80 GHz	40 GHz	+3 dBm
80.1 GHz	26.7 GHz	+3 dBm
95 GHz	31.7 GHz	+3 dBm
110 GHz	36.7 GHz	+3 dBm
120 GHz	20 GHz	0 dBm

9. Set the VNA Trace 1 to S22.
10. Connect the power sensor to the Port 2 RF port of the 3736B Test Set.
11. Repeat Step 8.
12. If the output level is unexpectedly low, disconnect the RF cable from the input of the SPDT switch, check if the power level at the open end of the cable is low, then take the following actions:

a. If the output is low, replace the RF Amplifier.

b. If the output is not low, replace the SPDT switch.

c. If replacing the SPDT switch does not fix the fault, replace the Switch Control PCB assembly mounted on top of the SPDT switch.

Port 1 LO Port Output Level Check

13. On the VNA, set CW Frequency to 54.1 GHz.

14. Connect the 34NKF50 Adapter to the Spectrum Analyzer RF In port.

15. Connect a RF cable between the Adapter at the Spectrum Analyzer RF In port and the Port 1 LO port of the 3736B Test Set.

16. On the Spectrum Analyzer, set the Reference Level to +15 dBm, Start frequency to 4 GHz and Stop frequency to 11 GHz.

17. On the VNA, vary the CW Frequency and monitor the output with the Spectrum Analyzer to see if the power level is ~ –9 dBm.

Note	The LO frequency varies between 5 and 10 GHz.

18. If the output is unexpectedly low, replace Port 1 LO Doubler Module.

Port 2 LO Port Output Level Check

19. Disconnect the Spectrum Analyzer Input RF Cable from the Port 1 LO port of the 3736B Test Set and connect it to the Port 2 LO port.

20. Set CW frequency to 54.1 GHz.

21. Vary the CW Frequency and monitor the output with the Spectrum Analyzer to see if the power level is ~ –9 dBm.

22. If the output is unexpectedly low, replace the Port 2 LO Doubler Module.

6-8 3739C Test Set Troubleshooting

For troubleshooting instructions for the **3739C** Test Set refer to the Troubleshooting chapter in 10410-00306 – ME7838 Series Modular BB/mmWave Maintenance Manual.

6-9 MN469xC Test Set Troubleshooting

For troubleshooting instructions for the **MN469xC** Test Set, refer to the Troubleshooting chapter in 10410-00730 – MN469xC Multiport Test Set Maintenance Manual.

Chapter 7 — Removal and Replacement Procedures for 3736B

7-1 Introduction

This chapter provides procedures for removing and re-installing the replaceable components and sub-assemblies in the 3736B Test Set.

Note	For removal and replacement procedures for the MN469xC Test Set, refer to: • **MN469xC Series Multiport Test Set Maintenance Manual** – 10410-00730 For removal and replacement procedures for the 3739C Test Set, refer to: • **ME7838 Series Modular BB/mmWave Maintenance Manual** – 10410-00306

7-2 Required Tools

- **Anritsu 01-201 8mm (5/16") Torque Wrench** or equivalent rated at 0.9 N · m (8 lbf·in) for SMA, K, and V connectors
- **Anritsu 01-204 8 mm (5/16") End Wrench** or equivalent
- **Anritsu 01-511 4 mm Torque Wrench** or equivalent rated at 0.22 N·m (2 lbf·in) for 3743A Module SSMC connectors
- **4 mm (5/32") End Wrench** for mmWave Module SSMC connectors
- Small flat-blade **screwdriver**
- Phillips screwdriver

7-3 Disassembly – Power, Disconnect, and Covers

Use this procedure to prepare the 3736B Test Set for removal and replacement procedures for all of its replaceable components. Other than the front and rear panel cables, all replacement components require this common disassembly procedure.

1. Prepare a clean and static free work area. Make sure the work area is well grounded. Cover the work surface with a soft, clean anti-static mat.
2. Provide all personnel with appropriate anti-static grounding wrist straps and similar equipment.
3. Power down the VNA and all Test Sets.
4. Disconnect the rear panel cables between VNA, the MN469xC Multiport Test Set, 3736B Test Set, and the 3739C Test Set. Disconnect the Power Cables from the AC source.
5. When the mmWave Modules were originally shipped, each module was calibrated and labeled with the appropriate VNA Port Number. Make a note as to which port each module is connected.
6. Disconnect the front panel cables between the VNA/Test Sets and the mmWave Modules.
7. Set the mmWave Modules and the Port-to-Module connection note aside in a secure, clean, and anti-static environment.

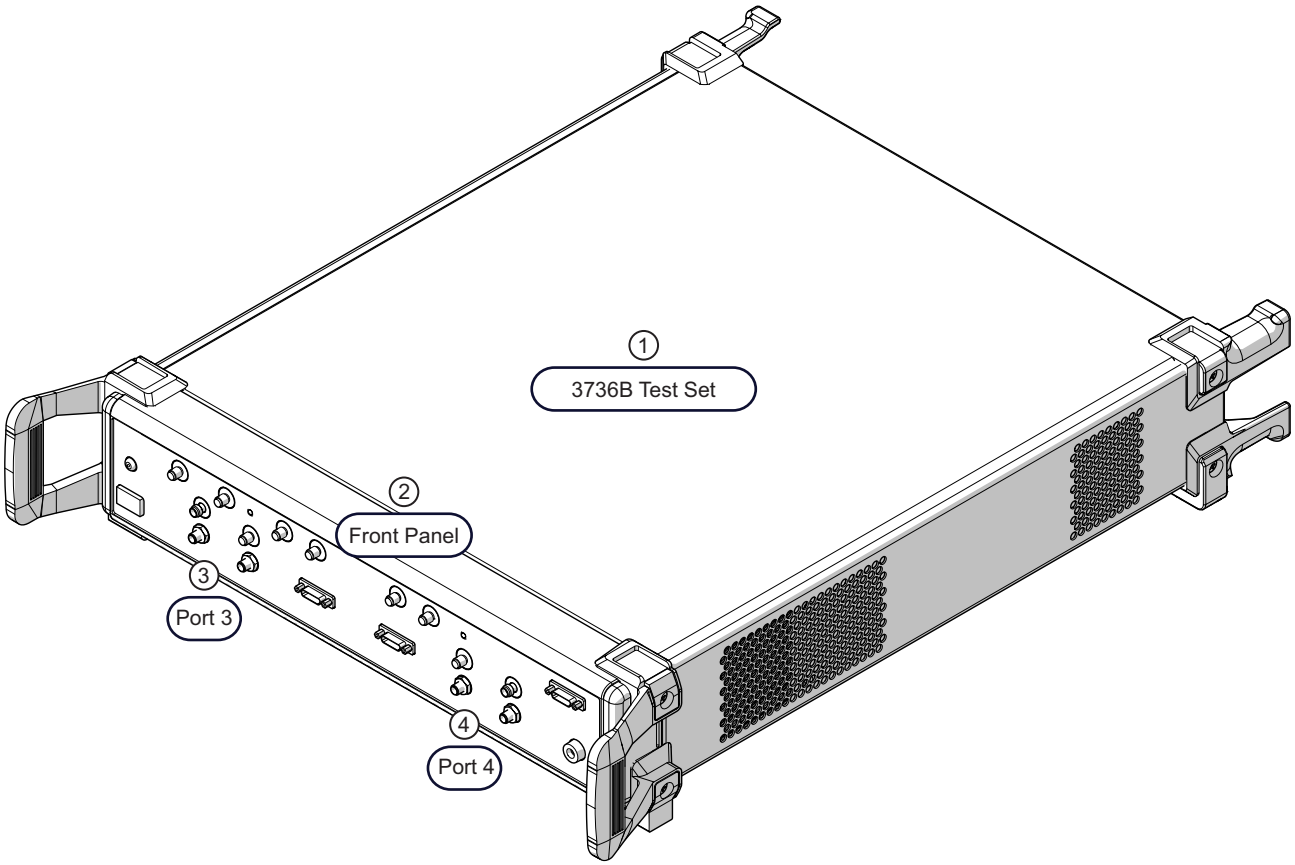
8. Make sure all VNA front and rear panel cables have been disconnected. Remove VNA and the MN469xC from the top of the Test Set.

Caution

The weight of a fully equipped MS464xA/B VNA is greater than 28 kg (57.3 pounds). Use two (2) or more people to lift and move the VNA. There is a risk of back injury if this instrument is moved by one person. Make sure that any equipment carts can safely carry the instrument weight.

9. Set the VNA, the 3739xand MN469xC aside in a secure, clean, and anti-static environment.

10. Move the 3736B Test Set to the repair area.

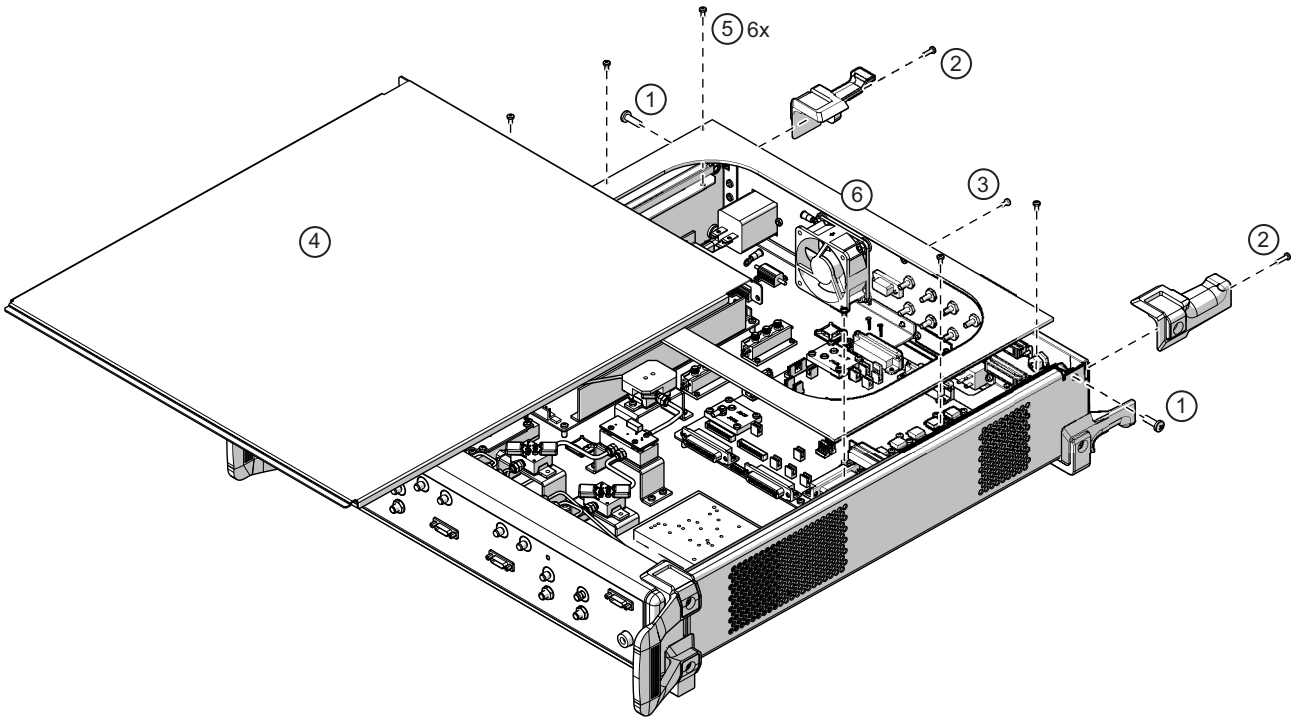


1. 3736B Test Set – With Top Cover, Front Handles, and Rear Feet attached to unit.
2. Front Panel Assembly
3. Port 3 Connectors – RF, LO, Power, Test, and Ref – Power Switch and LED to left.
4. Port 4 Connectors – Power, LO, RF, Ref, and Test – Ground plug to right.

Figure 7-1. 3736B Broadband Test Set

11. Remove the top cover and stiffener plate described in Figure 7-2.

Caution	To provide protection for the rear panel connectors, when the top cover is removed, the rear feet should be reattached onto the chassis after removing the top cover.



1. Remove the side screws that secure the upper rear feet to the chassis.
2. Remove the end screws that secure the upper rear feet to the chassis and remove the feet.
3. Remove the middle end screw that secures the top cover to the chassis.
4. Remove the top cover.
5. Remove the six (6) stiffener plate screws.
6. Remove the stiffener plate.
7. Reattach the rear feet to the chassis.

Figure 7-2. 3736B Test Set – Initial Disassembly and Removing Top Cover

7-4 Reassembly – Covers, Reconnect, and Power

1. If the rear feet were reattached to protect the rear connectors, remove them once again. See Figure 7-2 on page 7-3.
2. If the front handles were reattached to protect the front connectors, remove them once again.
3. Install the stiffener plate.
4. Install the top cover. The cover inserts under the front panel and fastens in place with three screws.
5. Reattach and tighten the front handles.
6. Reattach and tighten the rear feet.
7. Move the Test Set to the VNA and place the Test Set as required.
8. Using at least two people, place the VNA on top of the Test Set.

Caution

The weight of a fully equipped MS464xB VNA is greater than 28 kg (57.3 pounds). Use two (2) or more people to lift and move the VNA. There is a risk of back injury if this instrument is moved by one person. Make sure that any equipment carts can safely carry the instrument weight.

9. For instructions to reassemble and reconnect the ME7838x4 system cables, refer to the **VectorStar ME7838x4 Multiport Broadband VNA Installation Guide** – 10410-00734.

7-5 Replaceable Parts – Chassis Locations

The general location of all chassis internal components is shown in Figure 7-3 below.

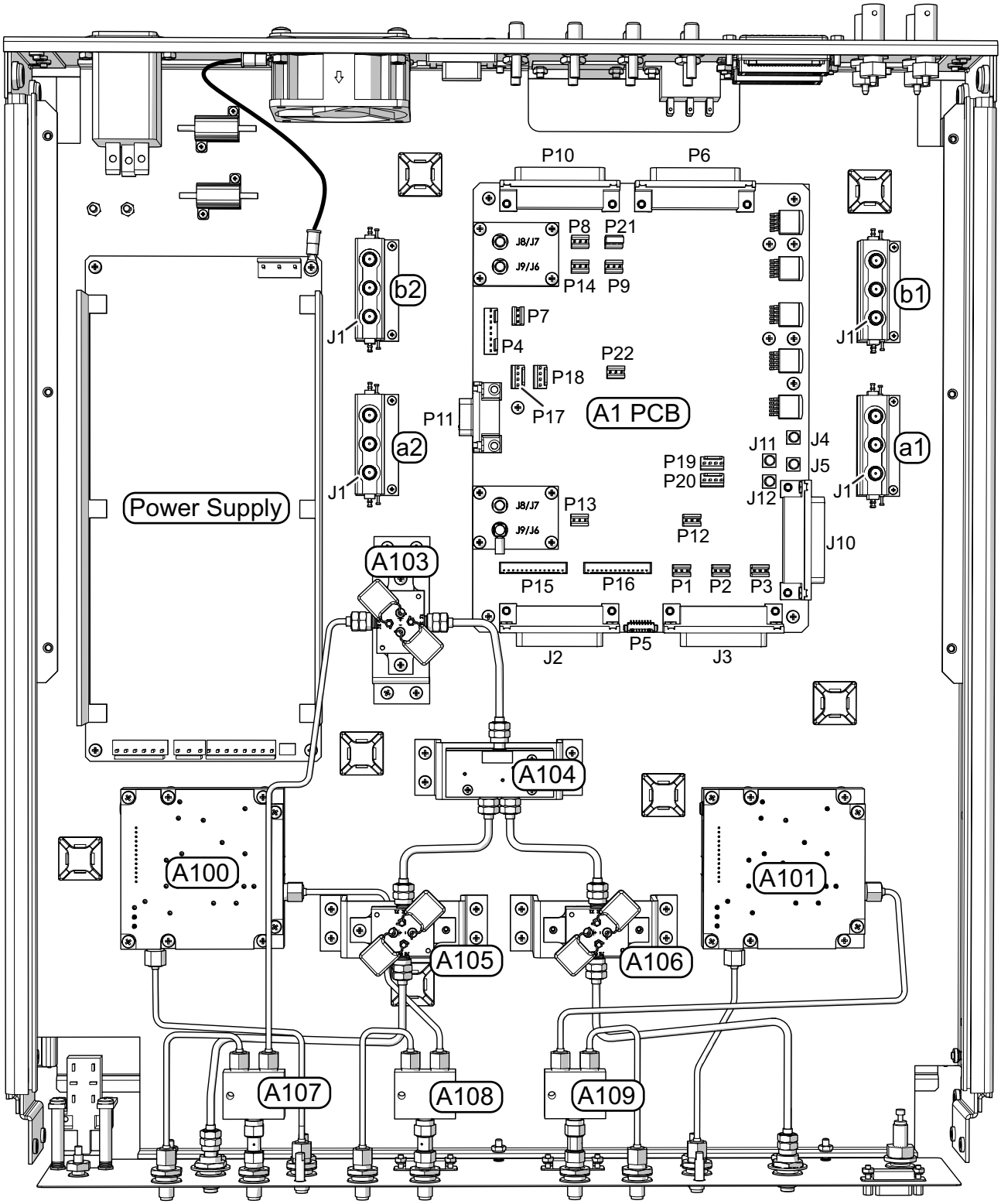


Figure 7-3. 3736B Test Set – Parts Locations (1 of 2)

A1 Bias Control PCB Assembly - ND80352-RFB/3-ND80352-RFB

Power Supply Module - 3-40-183

Power Supply Harness - ND73168/3-ND73168 (Not shown)

A100 Doubler Module, Port 1 - ND75883-RFB/3-ND75883-RFB

A101 Doubler Module, Port 2 - ND75883-RFB/3-ND75883-RFB

A103 RF Amplifier Module, 8 GHz to 40 GHz - ND75884-RFB/3-ND75884-RFB - With soldered-on cable harness.

A104, SPDT Switch Module, 0.04 to 40 GHz - 70242-RFB/3-70242-RFB

SPDT Switch Control PCB Assy - ND70926-RFB/3-ND70926-RFB - Mounts on top of A104. Control cable connects to A1- P15.

A105 RF Amplifier Module, 8 GHz to 40 GHz - ND75885-RFB/3-ND75885-RFB - With soldered-on cable harness.

A106 RF Amplifier Module, 8 GHz to 40 GHz - ND75886-RFB/3-ND75886-RFB - With soldered-on cable harness.

A107 Power Divider, 4-40 GHZ - 3-1091-404

A108 Power Divider, 5-18 GHZ - 3-1091-405

A109 Power Divider, 5-18 GHZ - 3-1091-405

a1, a2, b1, b2 - Coaxial Switch - DC-3000 MHz, SPDT, SMA - ND81416/3-ND81416 - 3-1021-35

Figure 7-3. 3736B Test Set – Parts Locations (2 of 2)

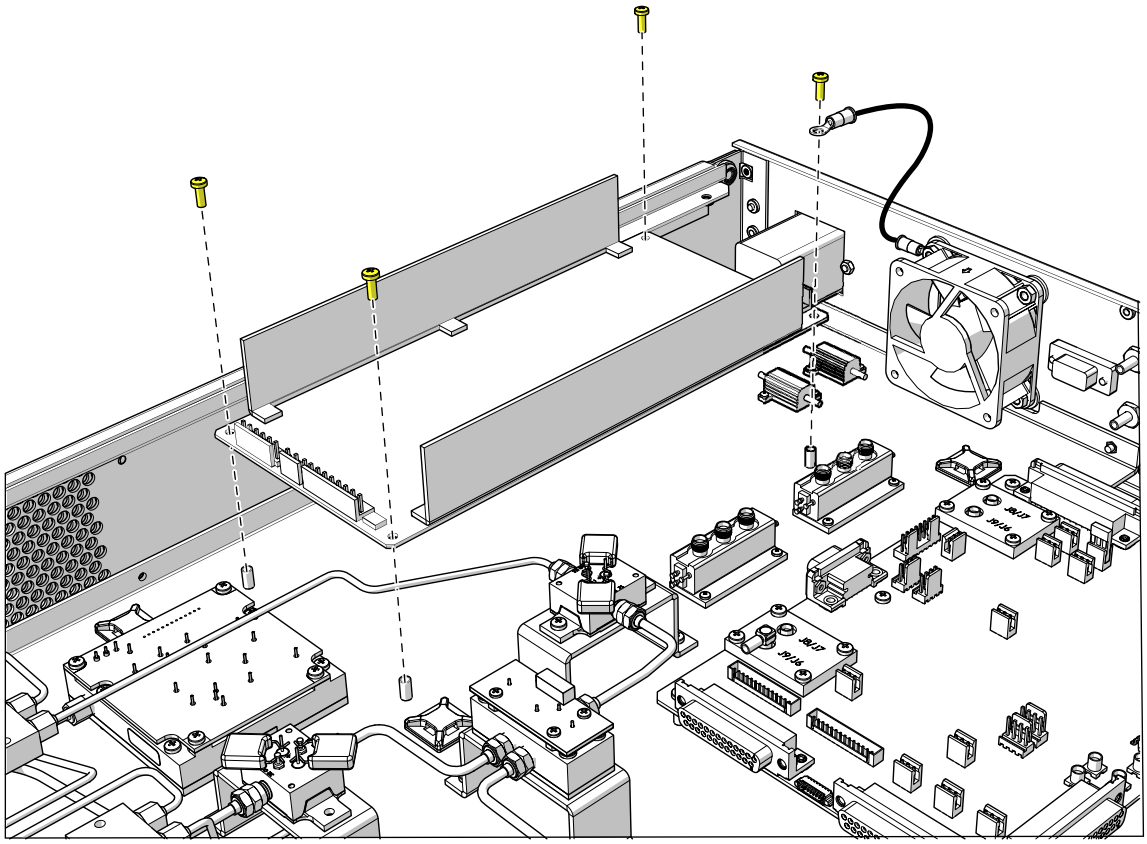
7-6 Power Supply – 3-40-183

Use this procedure to replace the Power Supply Module and/or the Power Supply Cable Harness. The Power Supply location is shown above in Figure 7-3, “3736B Test Set – Parts Locations” on page 7-5.

Replacement Parts

- Power Supply Module – 3-40-183
- Power Supply Cable Harness – ND73168 – 71918

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the Power Supply as illustrated in Figure 7-6.



1. On the front of the power supply, disconnect the Power Supply Cable Harness – ND73168 – 71918 from the power supply.
2. If the Power Supply Cable Harness is being replaced, disconnect the other end from connector P4 on the A1 PCB.
3. At the rear of the power supply, disconnect the 3 Pin Connector which connects to the rear panel AC Distribution Module and front panel Power Switch.
4. Remove the four Phillips pan head mounting screws and remove the power supply.
5. Installation is reverse of removal. Ensure the ground wire from the fan chassis screw is reconnected to the power supply board under its mounting screw.

Figure 7-4. Power Supply Replacement

A representative Power Supply module is shown in Figure 7-5. The installed version may differ slightly in appearance and color. The mounting and connector locations will be the same.

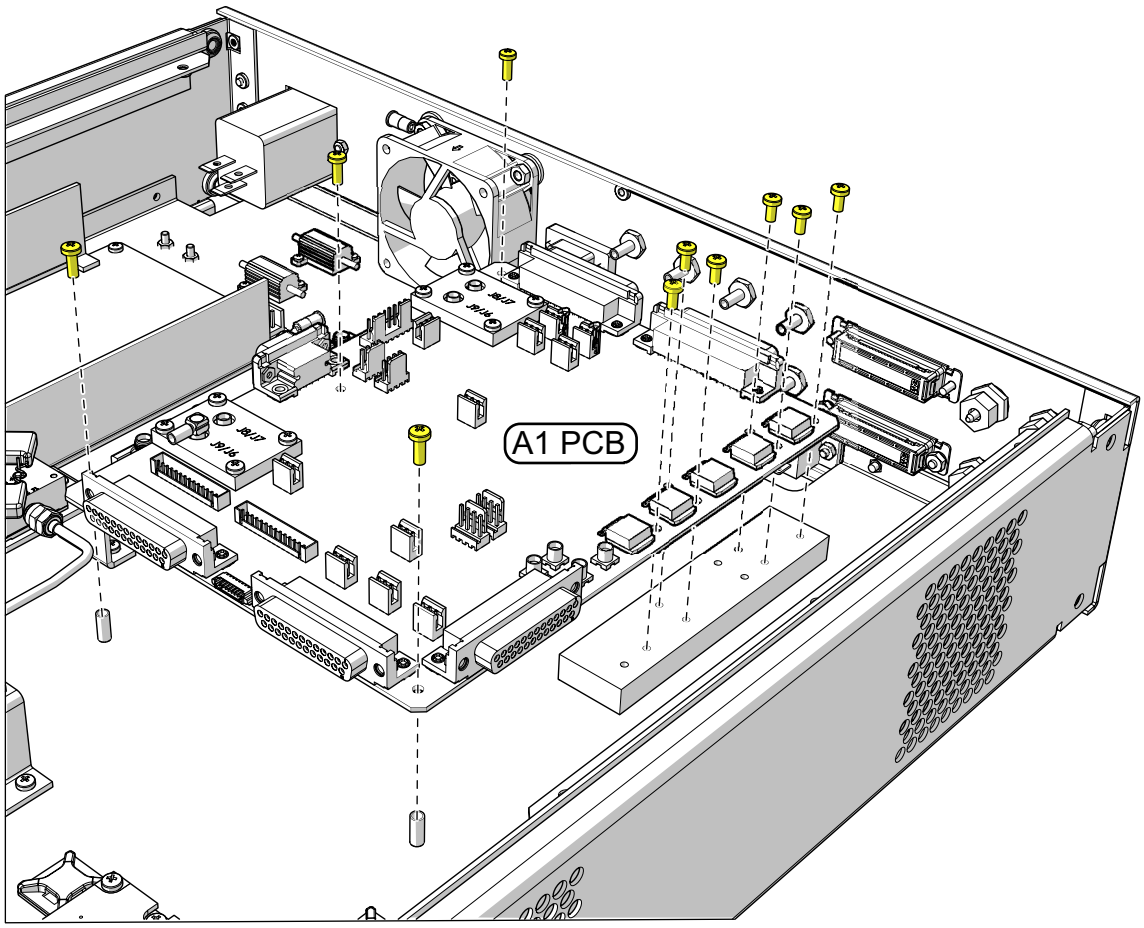
Figure 7-5. Power Supply Module – 3-40-183

7-7 A1 Bias Control PCB Assembly

Use this procedure to replace A1 Bias Control PCB Assembly. The A1 PCB location is shown in Figure 7-3, “3736B Test Set – Parts Locations” on page 7-5.

Replacement Part: 3736B A1 Bias Control PCB Assembly – ND80352-RFB/3-ND80352-RFB

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the A1 PCB as illustrated in Figure 7-6.



1. Disconnect all cables attached to the A1 PCB. Leave the other ends of the cables attached to their destination connectors. 2. Remove the ten (10) pan head Phillips M3 × 8 mm A1 PCB mounting screws.	3. Installation is reverse of removal. Refer Table 7-1 on page 7-10 below for a list of all A1 PCB Cable Connections

Figure 7-6. A1 PCB Replacement

Table 7-1. 3736B A1 Bias Control PCB Assembly – Connector and Cable Connections

A1 PCB Connector	Cable To Location
J2	To Front Panel – Port 1 Power/Signal Connector
J3	To Front Panel – Port 2 Power/Signal Connector
J4	To Rear Panel – External Analog Out BNC Connector
J5	To Rear Panel – External ALC Out BNC Connector
J6	To Rear Panel – External a1 IF Connector
J7	To Front Panel – Port 1 Ref (a1) IF Connector
J8	To Rear Panel – External a2 IF Connector
J9	To Front Panel – Port 2 Ref (a2) Connector
J10	To Front Panel – AUX I/O Connector
P1	To A103 RF Amplifier Module
P2	To A105 RF Amplifier Module
P3	To A106 RF Amplifier Module
P4	To Power Supply Cable Harness
P5	To A104 SPDT Switch Module
P6	To Rear Panel – External I/O Connector
P7	To Front Panel – Power Switch Cable Harness
P8	To Power Supply Load Resistors
P9	To Rear Panel – Fan Assembly
P12	To Front Panel – Port 2 LED
P13	To Front Panel – Port 1 LED
P14	To Power Supply Load Resistors
P15	To A100 Doubler Module, Port 1
P16	To A101 Doubler Module, Port 2
P17	To b2 SPDT Coaxial Switch Module
P18	To a2 SPDT Coaxial Switch Module
P19	To b1 SPDT Coaxial Switch Module
P20	To a1 SPDT Coaxial Switch Module
P21	To Rear Panel – Normal/Boost Switch
P22	To Rear Panel – Single Source/Dual Source Switch

7-8 Module Replacement

This section provides a general summary of the obtaining access to modules, removal from the chassis, installing the replacement module, and reassembling the adjacent modules. The general module location is shown above in Figure 7-3, "3736B Test Set – Parts Locations" on page 7-5.

General Module Removal Procedure

This is the general procedure to remove a module from the chassis, either to replace it, or to provide access to another deeper dwelling module.

1. Loosen the RF connections on either side of the module.
2. If necessary, remove the bracket-to-chassis hardware.
3. Disconnect the RF connections on either side of the module.
4. If equipped, disconnect the soldered-on cable from the A1 PCB assembly. Leave the cable attached to the module.
5. Note the orientation of the module connectors for input and output.
6. Remove the module assembly from the chassis.

General Module Installation Procedure

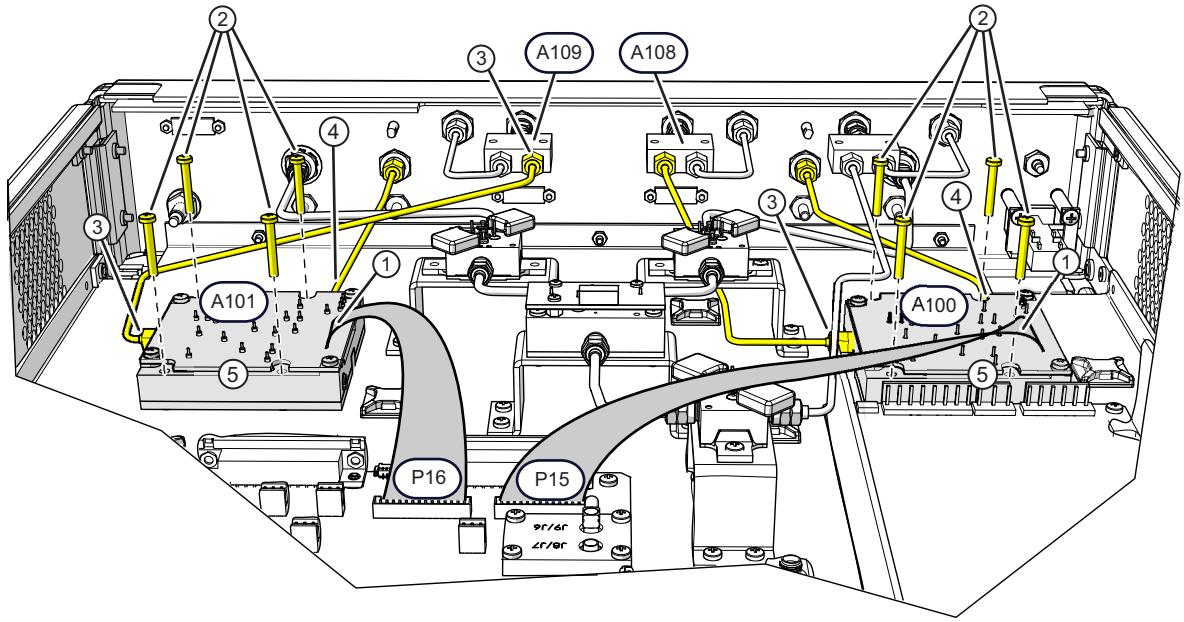
Use this procedure to re-install a module or module/bracket assembly into the chassis.

1. If equipped, place the module assembly into the chassis, observing the correct input/output orientation of the module connectors.
2. Align and loosely connect the input/output RF connectors, making sure each is correctly aligned and threaded.
3. Loosely insert the bracket-to-chassis mounting hardware.
4. Tighten and then torque the RF connectors. Most RF connections use a 8 mm (5/16") Torque End Wrench set to 0.9 N·m (8 lbf·in).
5. Tighten the bracket-to-chassis mounting hardware.
6. If equipped, connect the soldered-on module cable to the appropriate A1 PCB connector.
7. If a semi rigid coaxial cable was undone to access the module, reconnect it by aligning carefully, threading, and then torque as described above.

A100 and A101 – ND75883-RFB/3-ND75883-RFB Doubler Modules

Replacement Part: Doubler Module – ND75883-RFB/3-ND75883-RFB

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. The A100 and A101 Modules are replaced as shown in Figure 7-7.



A101:
Doubler Module Connects to Port LO 2

1. Disconnect the ribbon cable from the module.
2. Remove the four (4) M3 x 0.5 x 20 mm pan head phillips module mounting screws.
3. Disconnect the semi-rigid cable coupling nut at the A109 connector.
4. Disconnect the semi-rigid cable coupling nut at A101-J2 connector.
5. Remove the module with the J1 semirigid cable still connected.
6. Transfer the semi-rigid cable to J1 of the new A101 module but do not tighten the coupling nut.
7. Install the new module and connect the coupling nuts but do not tighten.
8. Install and tighten the four (4) mounting screws.
9. Torque each coupling nut to 0.9 N·m (8 lbf·in) using two 8 mm (5/16”) wrenches using one to hold the connector body and the other to torque the cable hex nut.

A100:
Doubler Module Connects to Port LO 1

1. Disconnect the ribbon cable from the module.
2. Remove the four (4) M3 x 0.5 x 20 mm pan head phillips module mounting screws.
3. Disconnect the semi-rigid cable coupling nut at the A100 J1 connector.
4. Disconnect the semi-rigid cable coupling nut at the A100-J2 connector.
5. Remove the module.
6. Install the new module and connect the coupling nuts but do not tighten.
7. Install and tighten the four (4) mounting screws.
8. Torque each coupling nut to 0.9 N·m (8 lbf·in) using two 8 mm (5/16”) wrenches using one to hold the connector body and the other to torque the cable hex nut.

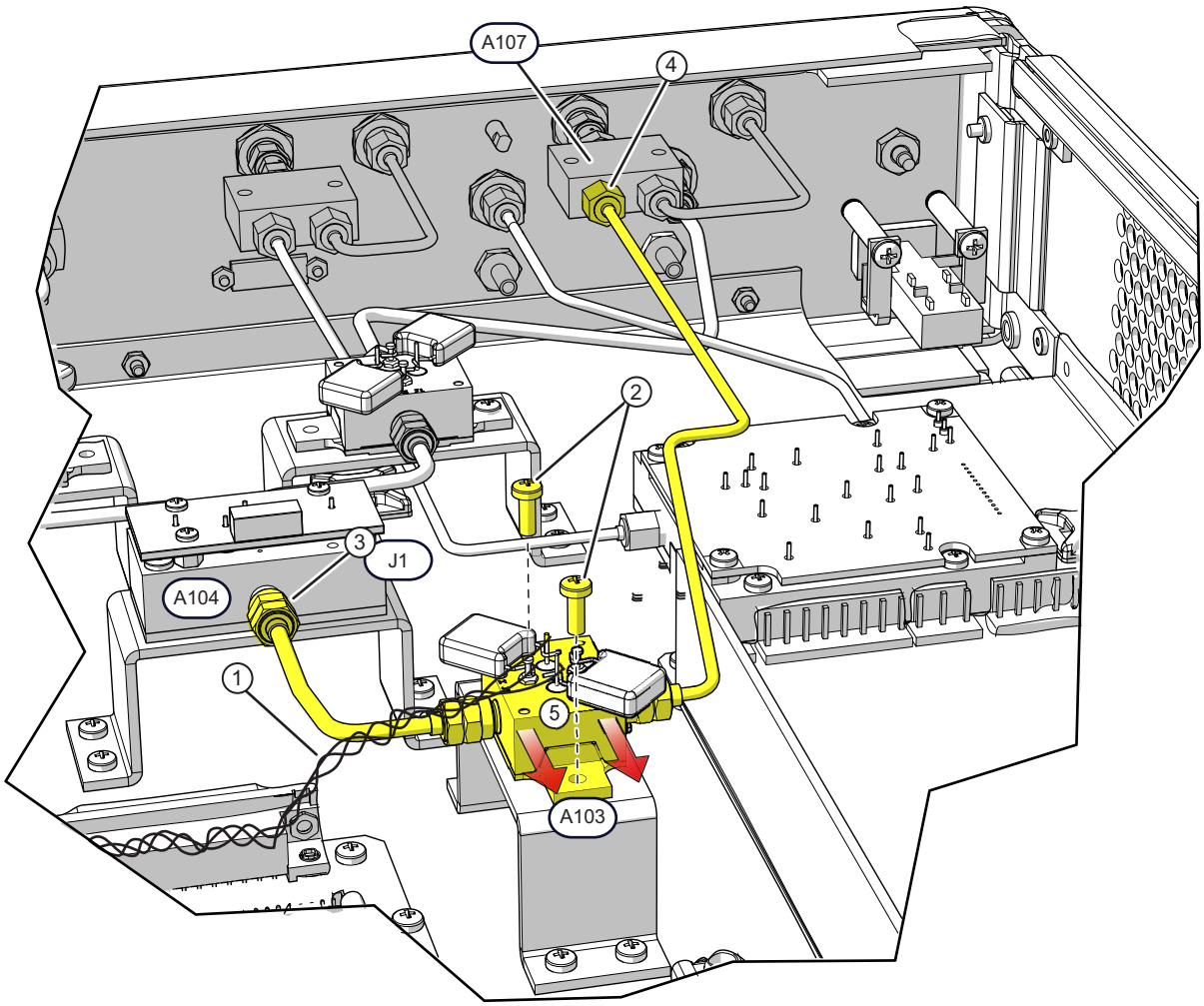
Figure 7-7. A100 and A101 Doubler Module Replacement Detail

A103 – ND75884-RFB/3-ND75884-RFB RF Amplifier Module

Replacement Part: RF Amplifier Module – ND75884-RFB/3-ND75884-RFB

The A103 module connects between the A107 Power Divider Connector and the A104 SPDT Switch. The replacement module comes with a soldered-on cable harness that connects to A1 PCB Connector P1.

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the Power Supply as illustrated in Figure 7-8.



1. Disconnect the module power cable from P1 at A1 PCB.
2. Remove the two (2) M3 x 0.5 x 8 mm module mounting screws.
3. Disconnect the semi-rigid cable coupling nut from A104 switch input J1.
4. Disconnect the semi-rigid cable coupling nut from the A107 connector.
5. Remove the module with semi-rigid cables attached.
6. Transfer the semi-rigid cables to J1 and J2 of the new A103 module but do not yet tighten the coupling nuts.
7. Install the assembly then align and connect the coupling nuts to A104 and A107 but do not tighten.
8. Install the two (2) module mounting screws finger tight but do not yet tighten.
9. Torque each cable coupling nut to 0.9 N·m (8 lbf·in).
10. Tighten the two (2) module mounting screws.
11. 1 Connect power cable to connector P1 at A1 PCB.

Figure 7-8. A103 RF Amplifier Module Replacement Detail

A105 – ND75885-RFB/3-ND75885-RFB and A106 – ND75886-RFB/3-ND75886-RFB Amplifier Modules

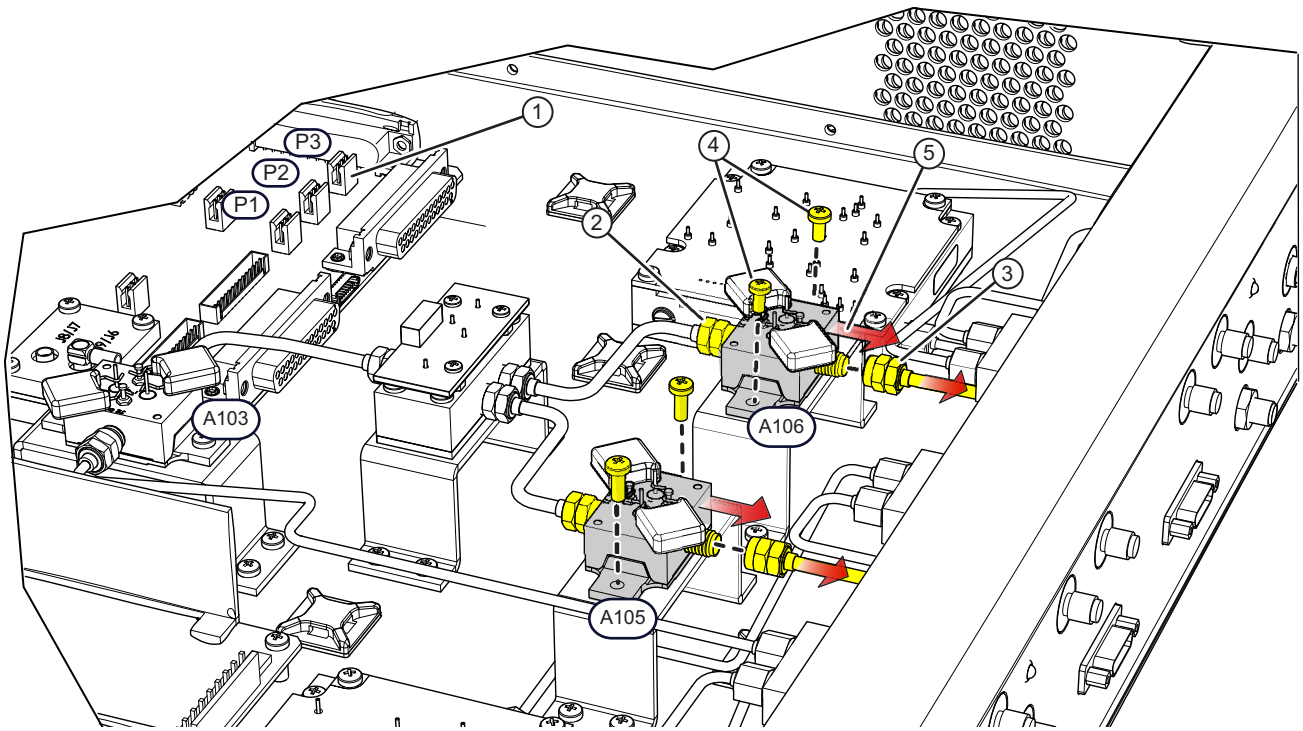
Replacement Parts:

- **RF Amplifier Module – ND75885-RFB/3-ND75885-RFB**
- **RF Amplifier Module – ND75886-RFB/3-ND75886-RFB**

On Port 1, A105 Module connects between the A104 SPDT Switch and the Front Panel Port 1 RF Output Connector. The replacement module comes with a soldered-on cable harness that connects to A1 PCB – P2.

On Port 2, A106 Module connects between the A104 SPDT Switch and the Front Panel Port 2 RF Output Connector. The replacement module comes with a soldered-on cable harness that connects to A1 PCB – P3.

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the Power Supply as illustrated in Figure 7-9.



This procedure is applicable to both A105 and A106.

1 – If replacing A105, disconnect the module power cable from A1 PCB connector P2. If replacing A106, disconnect the module power cable from connector P3.

2 – Loosen the semi-rigid cable coupling nut at amplifier input J1.

3 – Disconnect the semi-rigid cable coupling nut from the amplifier J2 output and bend the cable enough to provide enough clearance to disconnect the J1 input.

4 – Remove the two (2) M3 x 0.5 x 8 mm module mounting screws.

5 – Remove the module.

6 – Insert the new module then align and attach the J1 input semi-rigid coupling nut, but do not tighten.

7 – Align and reconnect the semi-rigid cable coupling nut to the amplifier J2 output but do not tighten.

8 – Install the two (2) module mounting screws finger tight; do not tighten yet.

9 – Torque each coupling nut to 0.9 N·m (8 lbf·in) using an 8 mm (5/16”) torque wrench.

10 – Tighten the two (2) module mounting screws.

11 – Connect the module power cable to connector P2 (A105) or P3 (A106).

Figure 7-9. A105 and A106 RF Amplifier Module Replacement Detail

A104 SPDT Switch Module – 70242-RFB/3-70242-RFB and Bracket Assembly

The A104 Switch Module Assembly connects between the A103 RF Amplifier output, and A105 and A106 amplifier inputs. For replacement detail, see Figure 7-10 and Figure 7-11.

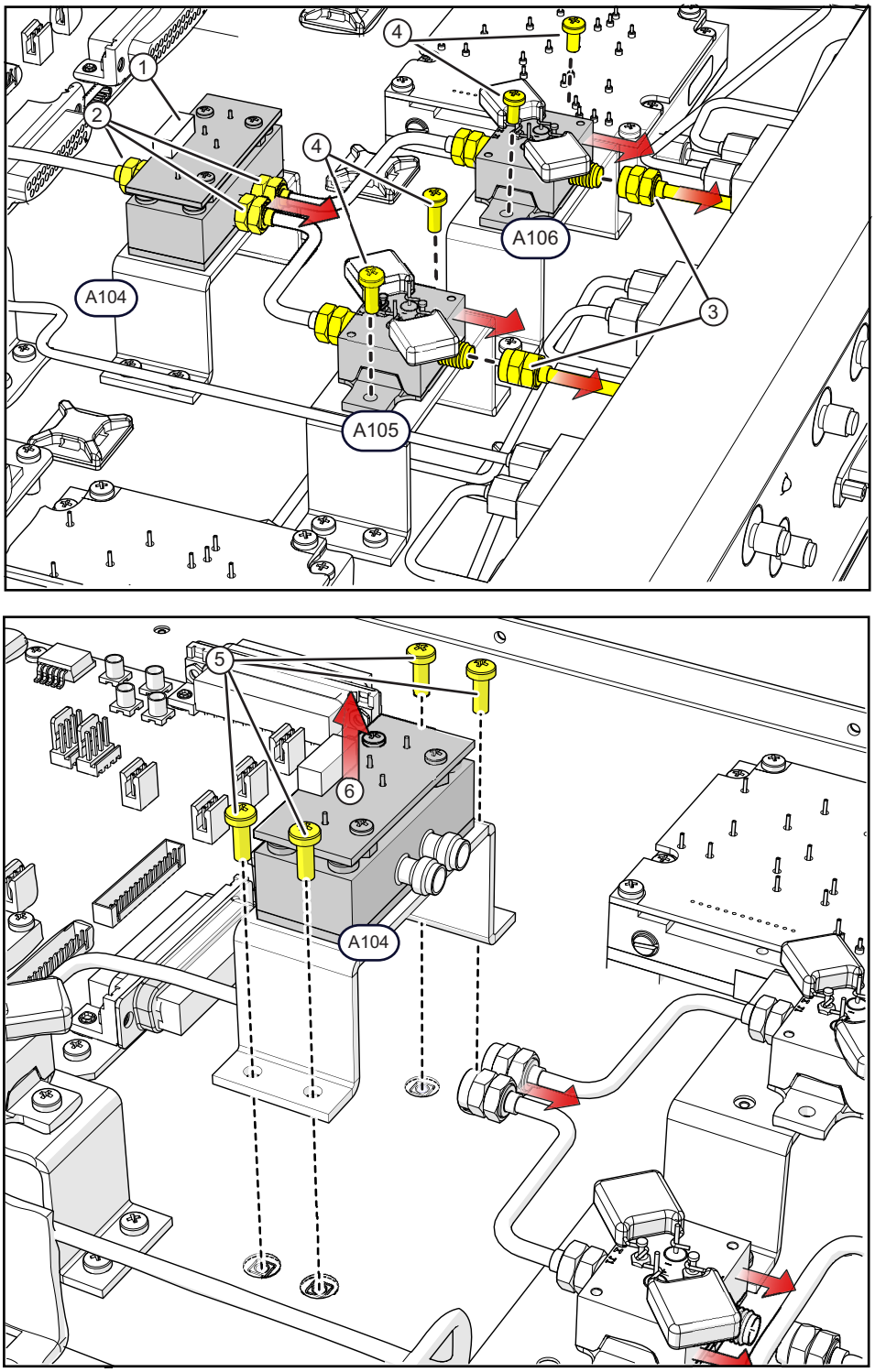


Figure 7-10. A104 Module and Bracket Replacement Detail (1 of 2)

1 – Disconnect the module ribbon cable from the A104 module PCB connector P1.

2 – Loosen the semi-rigid cable coupling nuts at A104 switch J1 input and J2 and J3 outputs.

3 – Disconnect the semi-rigid cable coupling nuts from both A105 and A106 amplifier J2 outputs and bend each cable enough to provide enough clearance to disconnect cables at the switch output ports.

4 – Remove the A105 and A106 amplifier module mounting screws and slide both modules toward the front panel while disconnecting the cables at the two A104 output ports.

5 – Remove the four (4) A104 bracket-to-chassis mounting screws, finish disconnecting the cable at switch A104 and then remove the module.

6 – Transfer the Switch Control PCB to the replacement switch module. See Figure 7-11 for A104 assembly detail.

7 – Insert the new A104 assembly into the chassis, then align and attach the switch J1 input semi-rigid coupling nut, but do not tighten.

8 – Install the four (4) A104 bracket-to-chassis mounting screws finger tight; do not yet tighten them.

9 – Slide both the A105 and A106 amplifier modules back into position and align and finger tighten the semi-rigid cables coupling nuts at the two A104 output ports.

10 – Carefully bend the two amplifier output cables back into position, then align and finger tighten the coupling nuts to both A105 and A106 amplifier J2 outputs.

11 – Install and finger tighten the A105 and A106 amplifier module mounting screws; do not yet tighten them.

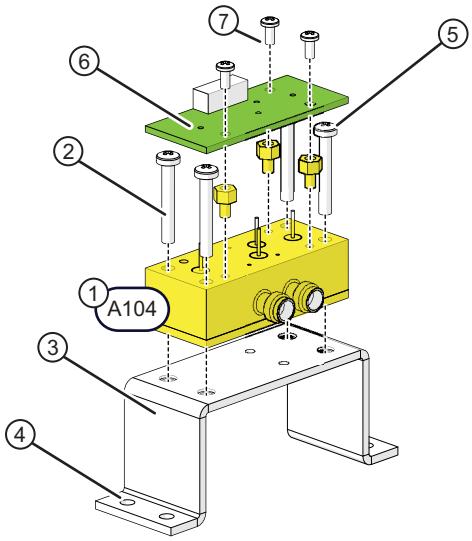
12 – Torque all semi-rigid coupling nuts to 0.9 N·m (8 lbf·in) using an 8 mm (5/16”) torque wrench.

13 – Tighten the all module mounting screws.

14 – Connect the module ribbon cable to the A104 module PCB connector P1.

Figure 7-10. A104 Module and Bracket Replacement Detail (2 of 2)

A104 Assembly Detail



1 – A104 SPDT Switch Module, 0.04 GHz to 40 GHz – 70242

2 – Module-to-Bracket Mounting Screws, 4 each

3 – Mounting Bracket

4 – Bracket-to-Chassis Mounting Screws, 4 each

5 – Hex Threaded PCB Standoffs, 3 each

6 – SPDT Switch Control PCB Assembly – ND70926/3-ND70926

7 – PCB Mounting Screws – 3 each

Figure 7-11. A104 Module, PCB, and Bracket Mounting Detail

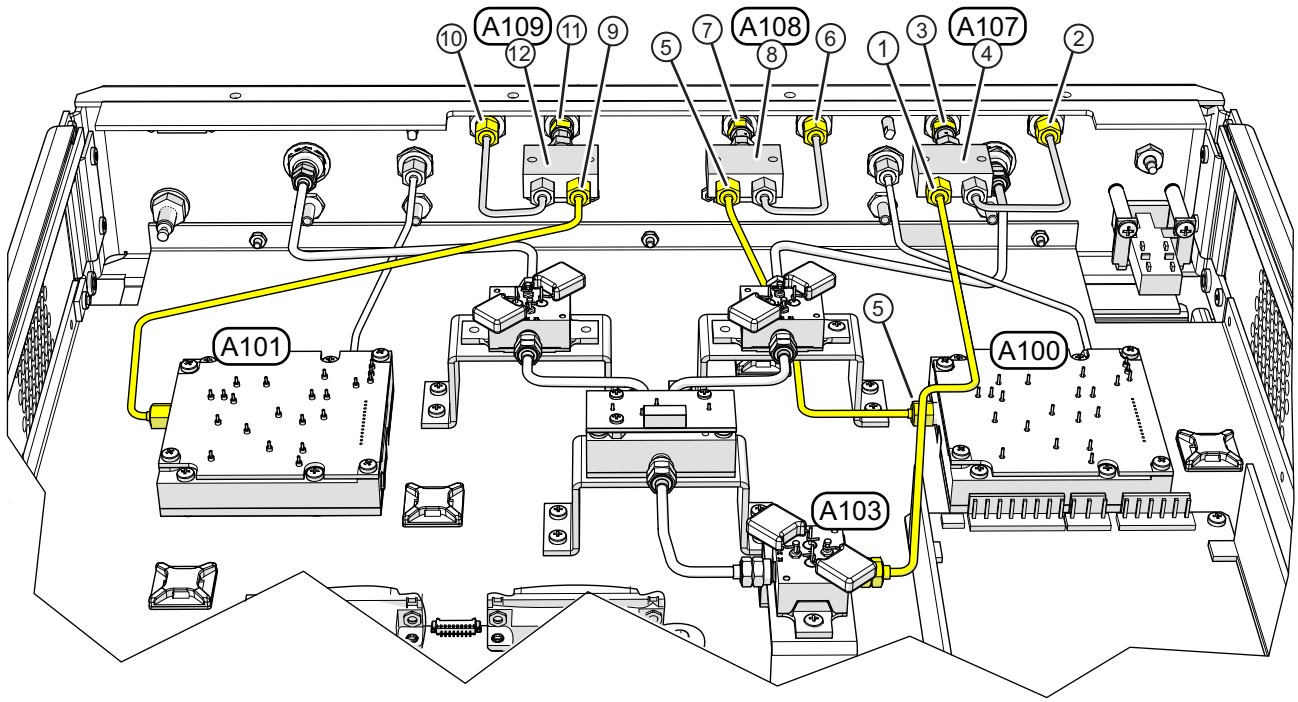
A107, A108, A109 Power Divider Modules

The A107 module connects between the Front Panel and the A103 Amplifier Module. The A108 module connects between the Front Panel and the A100 Doubler Module. The A109 module connects between the Front Panel and the A101 Doubler Module.

Replacement Part: Power Divider Module

- **A107 – 3-1091-404**
- **A108, A109 – 3-1091-405**

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the designated module as illustrated in Figure 7-12.



A107 Replacement

1. Remove the A103 to A107 semi-rigid cable
2. Disconnect the semirigid cable from the front panel
3. Disconnect the A107 front panel coupling nut from the front panel.
4. Remove the A107 module, transfer the module to panel semirigid cable to the new module and reinstall in reverse sequence.

A108 Replacement

1. Remove the A100 to A108 semi-rigid cable.
2. Disconnect the semirigid cable from the front panel
3. Disconnect the A108 front panel coupling nut from the front panel.
4. Remove the A108 module, transfer the semirigid cable to the new module and reinstall in reverse sequence.

A109 Replacement

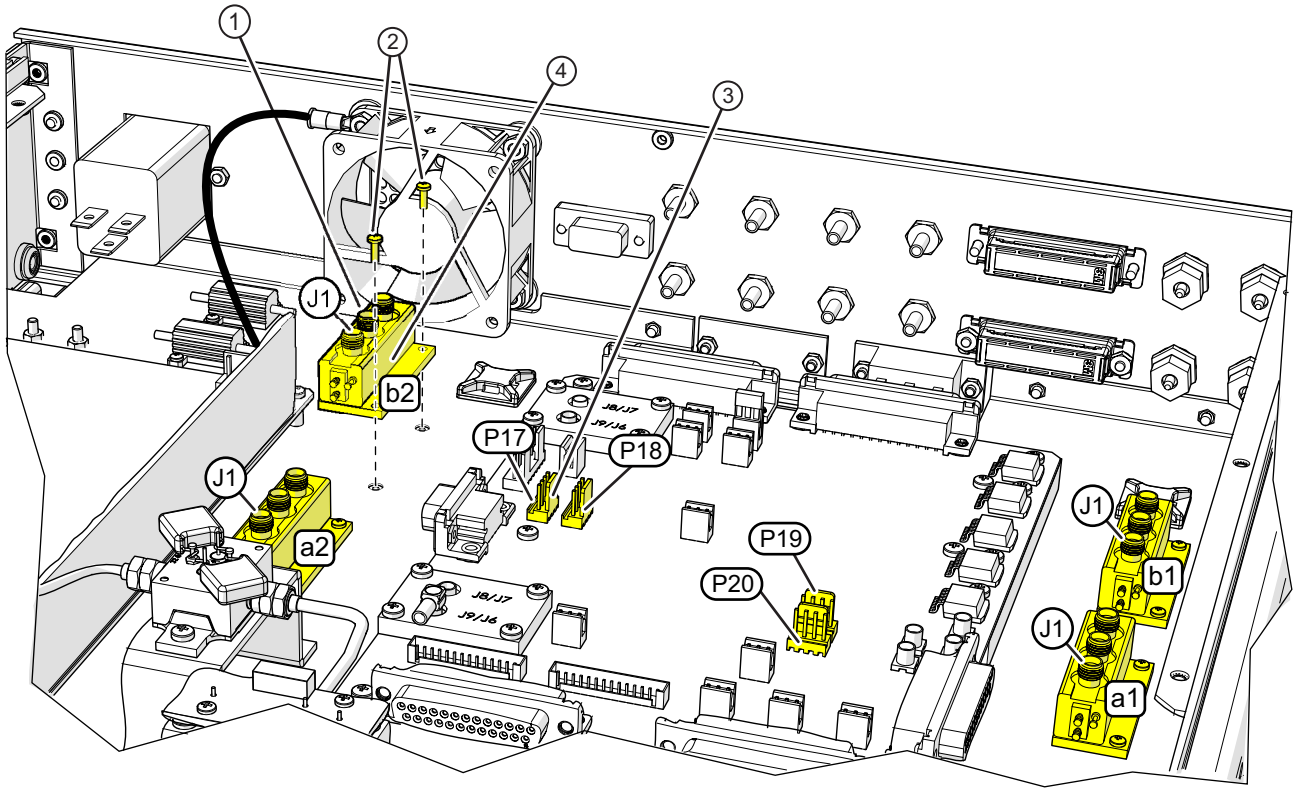
1. Remove the A101 to A109 semi-rigid cable
2. Disconnect the semirigid cable from the front panel.
3. Disconnect the A109 front panel coupling nut from the front panel.
4. Remove the A109 module, transfer the semirigid cable to the new module and reinstall in reverse sequence.

Figure 7-12. A107, A108 or A109 Power Divider Module Replacement

a1, a2, b1, b2 – Coaxial Switch – ND81416/3-ND81416

Replacement Part: a1, a2, b1, b2 – Coaxial Switch – DC-3000 MHz, SPDT, SMA – ND81416 – 3-1021-35

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.
2. Remove the top cover as described in Section 7-3.
3. Replace the desired module(s) as illustrated in Figure 7-13. Refer to Table 7-2 on page 7-19 for coaxial connection points.



The following steps apply to all four coaxial switches, with the procedure example shown for the b2 Module.

1. Disconnect the SMA coaxial cables from the module. Make note of the connection point for each cable.
2. Remove the two (2) M2 x 6 mm mounting screws
3. Disconnect the b2 module control cable from P17 of the A1 PCB.
4. Installation is reverse of disassembly. The new module comes with the control cable installed for attachment to its appropriate connector on the A1 PCB.

   a1 switch control cable connects to A1-P20

   a2 switch control cable connects to A1-P18

   b1 switch control cable connects to A1-P19

   b2 switch control cable connects to A1-P17

Figure 7-13. a1, b1, a2, b2 Coaxial Switch Module Replacement

Table 7-2. Coaxial Switch Module Cable Connections

From Coax Switch/Port	To	Cable Label
a1 J1	Rear Panel a2 IN	a2 IN/a1J1
a1 J2	Rear Panel a1 OUT	a1 OUT/a1J2
a1 J3	Rear Panel a1 IN	a1 IN/a1J3
a2 J1	A1 PCB J8	J8/a2J1
a2 J2	Rear Panel a2 OUT	a2 OUT/a2J2
a2 J3	A1 PCB Assy J6	J6/a2J3
b1 J1	Rear Panel b2 IN	b2 IN/b1J1
b1 J2	Rear Panel b1 OUT	b1 OUT/b1J2
b1 J3	Rear Panel b1 IN	b1 IN/b1J3
b2 J1	PORT 2 (4) TEST	P2 TEST/b2J1
b2 J2	Rear Panel b2 OUT	b2 OUT/b2J2
b2 J3	PORT 1 (3) TEST	P1 TEST/b2J3

7-9 Rear Panel Fan Assembly – 3-ND73164

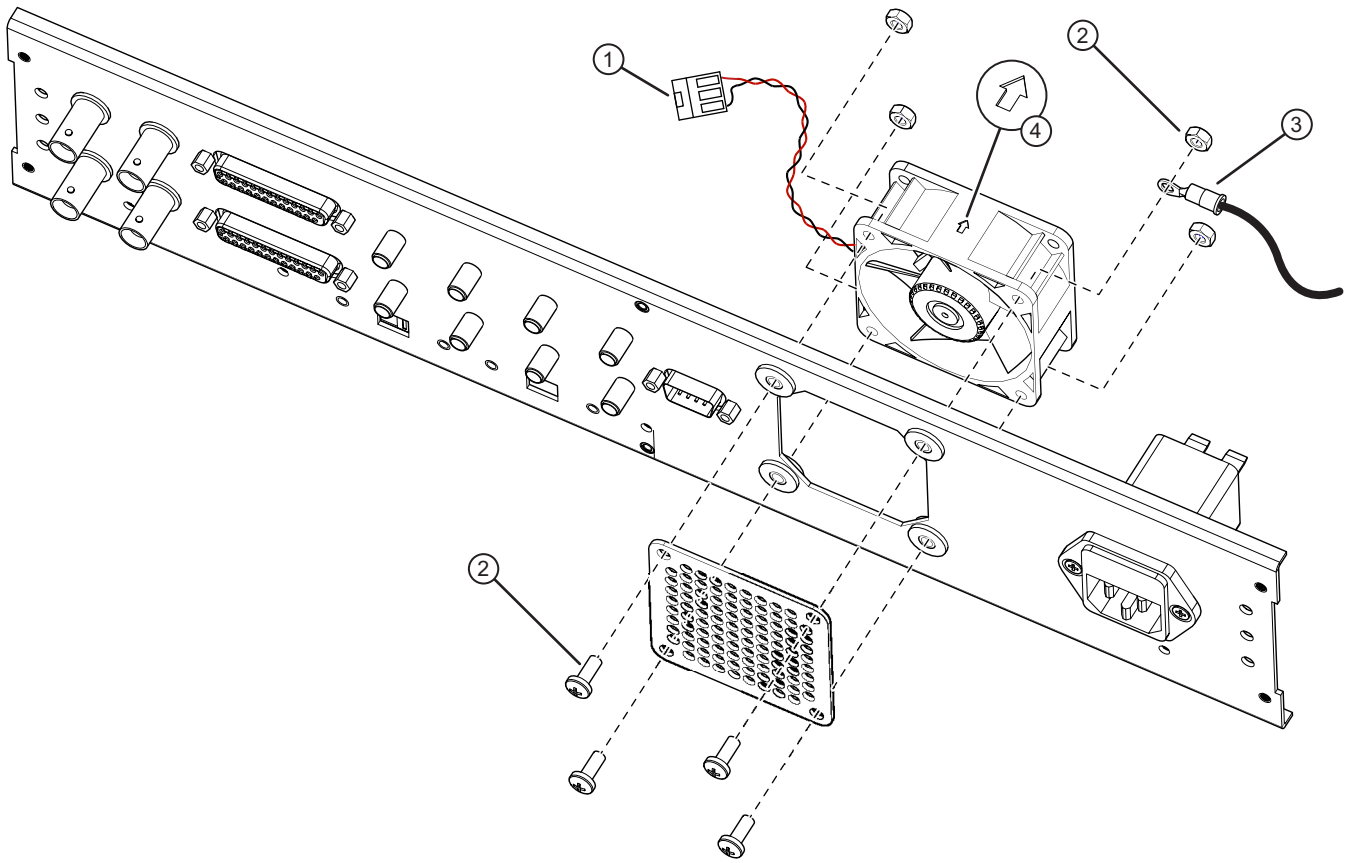
Required Tools

- Phillips head screwdriver for Phillips head M4 machine screws.
- Open end wrench for M4 Kep Nuts

1. Power down the VNA and Test Sets, disconnect the cables between the VNA, Test Sets, and Modules. Refer to Section 7-3 “Disassembly – Power, Disconnect, and Covers” on page 7-1.

2. Remove the top cover as described in Section 7-3.

- Replace the fan assembly as illustrated in Figure 7-14.



1. Disconnect the fan power cable from the P9 connector of the A1 Test Set Control PCB Assembly
2. Remove the 4 fan guard mounting screws from the rear panel. Hold the fan mounting nuts with an open end wrench.
3. Remove the grounding wire.
4. Fan installation is the reverse of removal. Make sure the arrow mark on the new fan is pointing away from the rear panel to ensure proper airflow direction. Ensure the grounding wire is reattached.

Figure 7-14. Rear Panel Fan Assembly – 3-ND73164 – 3-71919

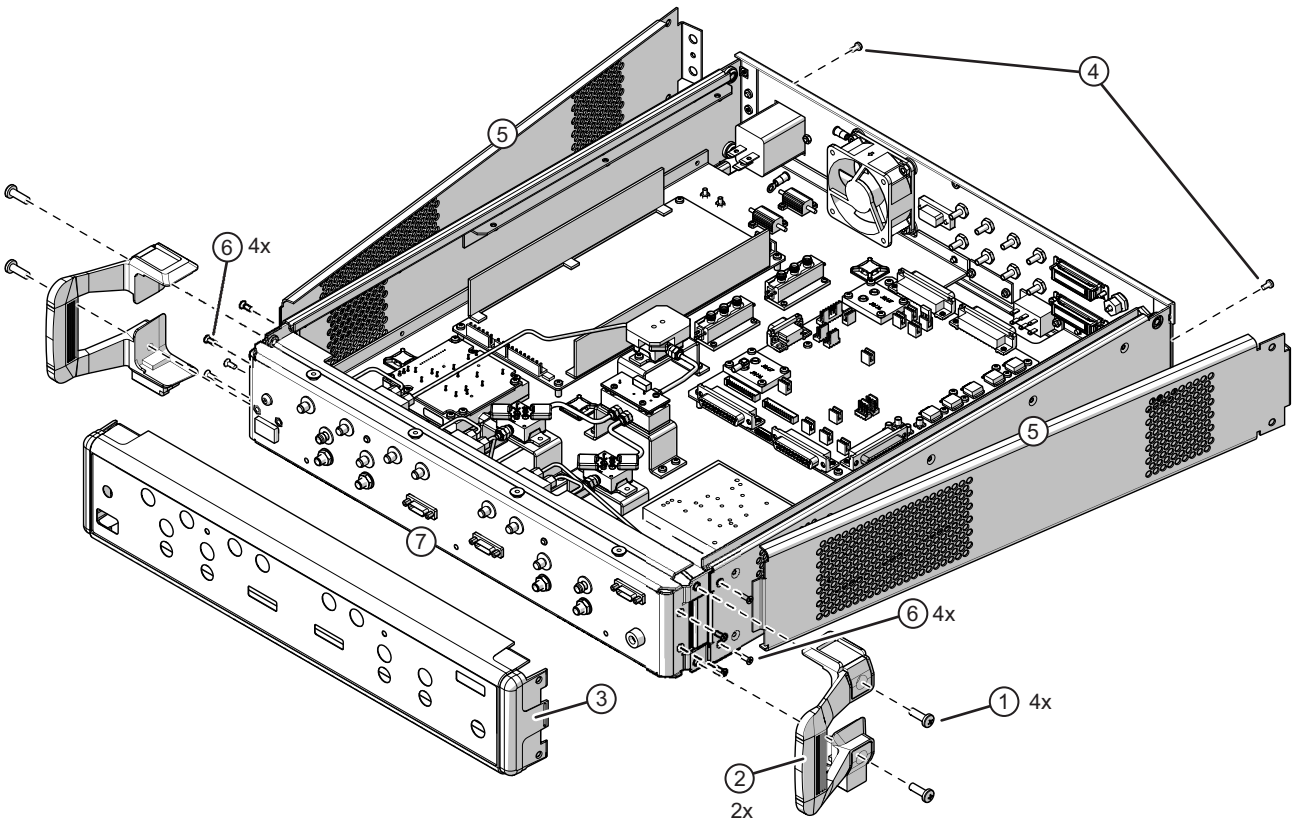
7-10 Front Panel Assembly

Replacement Part: 3736B Front Panel Assembly – 3-ND80389

Within the assembly, there are no replaceable parts. The procedure involves:

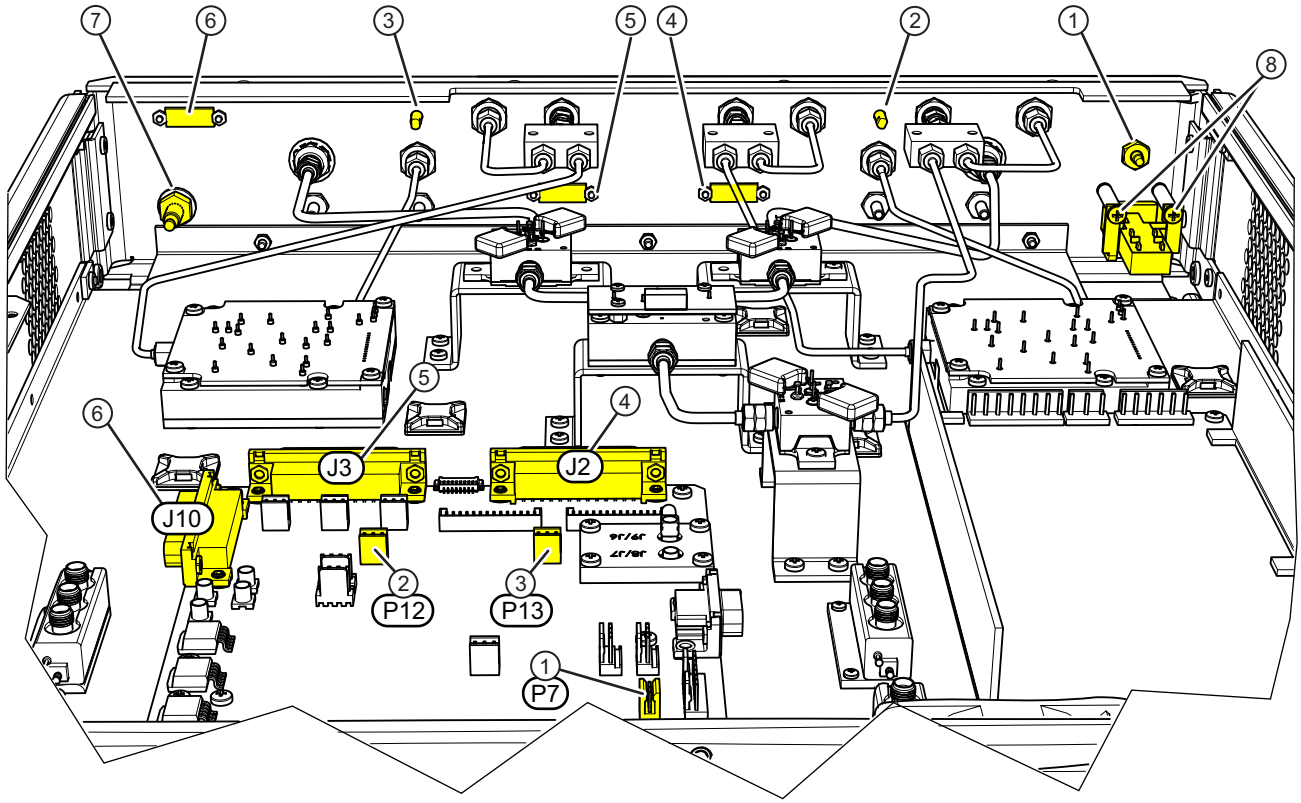
- Preliminary Disassembly
- Disconnecting RF and signal cables
- Removing the assembly from the Test Set Chassis
- Removing components from the to-be-replaced Front Panel
- Installing those components on the replacement Front Panel
- Reassembly

Remove the components as shown on Figure 7-16 to prepare for front panel removal.



1. Remove the four (4) screws holding the handles to the assembly.
2. Remove the handle from each side.
3. Remove the front panel cover
4. Remove the screw holding each the side panel cover in place.
5. Remove the side covers to expose the front panel mounting screws.
6. Remove the four (4) front panel mounting screws on each side.
7. The front panel assembly is now ready for the second phase of removal.

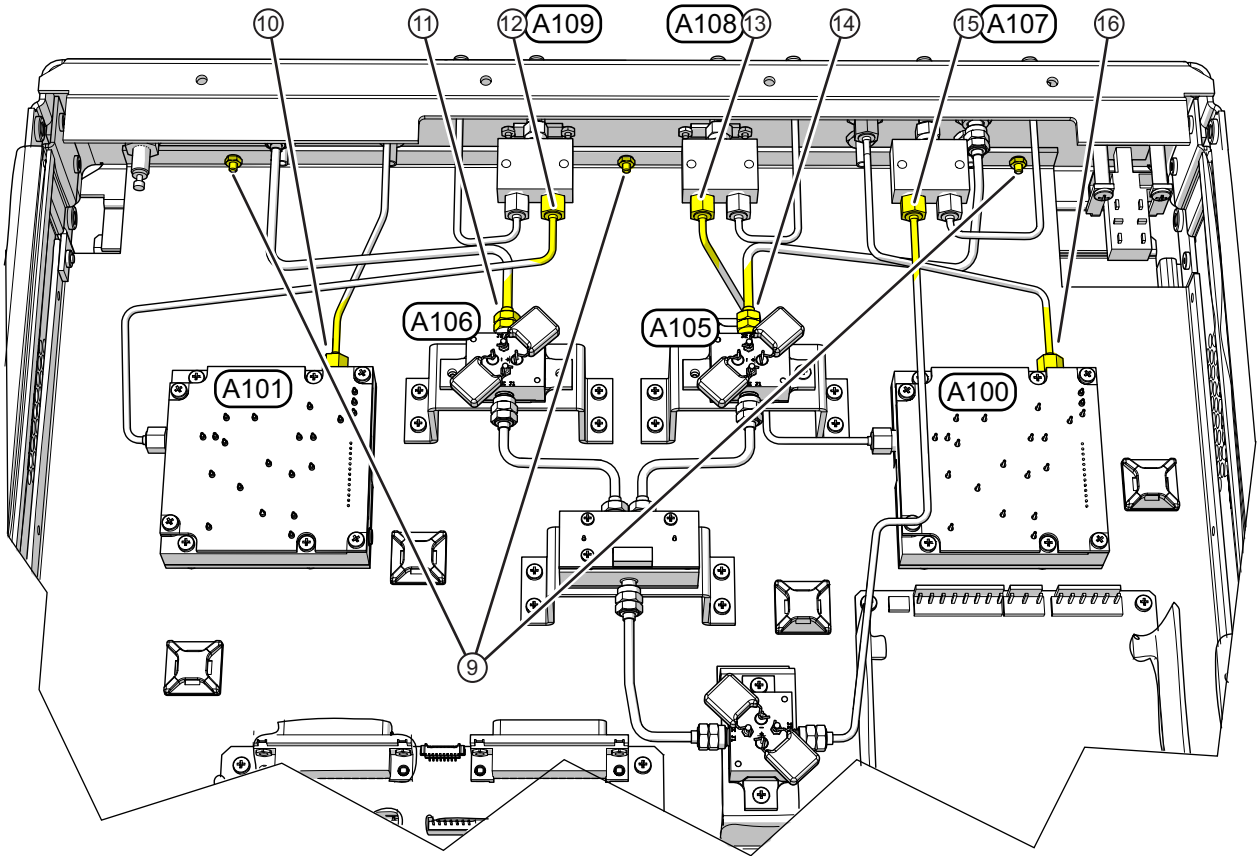
Figure 7-15. Front Panel Replacement – Part 1



Note: Except for the Ground Plug and the Power Switch, the following cables are included with the replacement Front Panel.

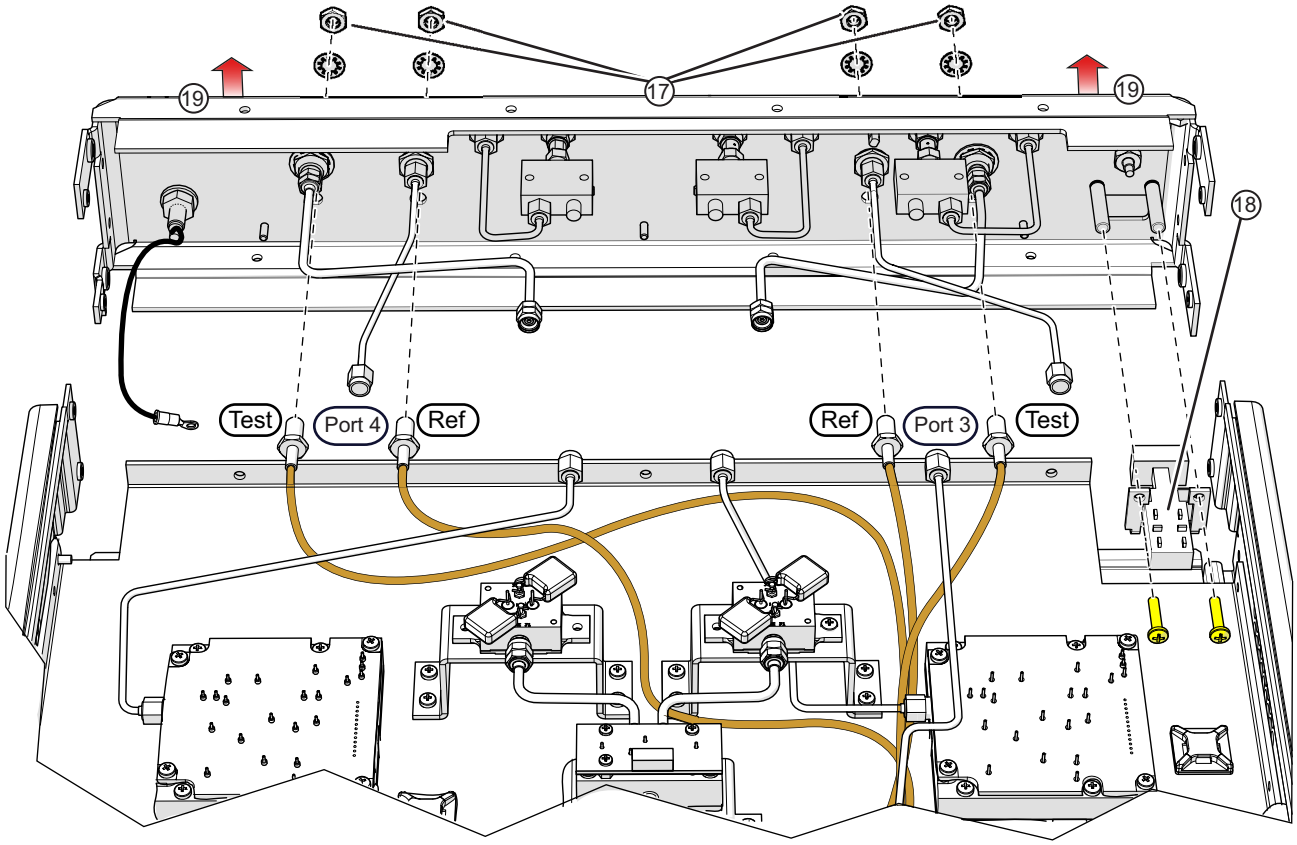
1. LED Power – Disconnect at A1 PCB Connector P7.
2. Port 3 LED – Disconnect at A1 PCB Connector P13.
3. Port 4 LED – Disconnect at A1 PCB Connector P12.
4. Port 3 Power/Control – Disconnect at A1 PCB J2.
5. Port 4 Power/Control – Disconnect at A1 PCB J3.
6. Aux Power – Disconnect at A1 PCB J10.
7. Front Panel Ground Plug – Disconnect the cable ring lug from the chassis.
8. Power Switch – Remove two (2) mounting screws.

Figure 7-16. Front Panel Replacement – Part 2



9. Remove Panel to Chassis nuts - 3 Places. Front panel should be free to move.
10. Disconnect semirigid cable from J2 of A101.
11. Disconnect semirigid cable from J2 of A106.
12. Disconnect semirigid cable from J2 of A109.
13. Disconnect semirigid cable from J1 of A108.
14. Disconnect semirigid cable from J2 of A105.
15. Disconnect semirigid cable from J1 of A107.
16. Disconnect semirigid cable J2 of A100.

Figure 7-17. Front Panel Replacement – Part 3



17. Remove Port 3 and Port 4 Test and Ref connector nuts and washers – 4 Places.
18. Make sure power switch is free from the front panel.
19. Remove the front panel with semirigid cables, connectors and power divider modules still attached.
20. Transfer connectors, semirigid cables and power dividers to the new panel. Ensure all components are transferred to the same positions as the old panel to prevent disturbing factory calibration of the test set.
21. Carefully slide the front panel assembly into position, routing the attached cables as it is moved into place.
22. Insert the Port 3 and Port 4 Test and Ref port connectors back into their respective positions on the panel, and attach their washers and nuts from the panel front and finger tighten.
23. Reconnect the semirigid cable ends to their respective modules and finger tighten as shown in Figure 7-17 on page 7-23.
24. Connect the three (3) front panel to chassis plate nuts and finger tighten.
25. Reconnect the Panel Ground, LED, and Signal Cable ends to their respective positions on A1 PCB as shown in Figure 7-16 on page 7-22.
26. Torque each connector to 0.9 N·m (8 lbf·in).
27. Install the front panel side mounting screws and reassemble the test set side covers, feet and handles in reverse order as shown in Figure 7-15 on page 7-21.

Figure 7-18. Front Panel Replacement – Part 4

Appendix A — Test Records

A-1 Introduction

This appendix provides test records that can be used to record the performance of the ME7838x4 mmWave configuration VNA system.

Make a copy of the following Test Record pages and document the measured values each time performance verification is performed. Continuing to document this process each performance verification session provides a detailed history of the instrument's performance.

A-2 ME7838x4 Banded mmWave Configuration VNA System Test Record

Instrument Information

ME7838_4	Operator:	Date:
VectorStar VNA Model: MS4644A [ ] MS4644B [ ] MS4645A [ ] MS4645B [ ] MS4647A [ ] MS4647B [ ]	VectorStar VNA Serial Number:	VectorStar VNA Options:
Port 1 mmWave Module Model:	Module Serial Number:	
Port 2 mmWave Module Model:	Module Serial Number:	
Port 3 mmWave Module Model:	Module Serial Number:	
Port 4 mmWave Module Model:	Module Serial Number:	

Directivity Verification

Table A-1. Directivity

Frequency	Port 1 Module	Port 2 Module	Port 1 Measured (dB)	Port 2 Measured (dB)	Specification
56 to 94 GHz	3744A-EE	3744A-EE			>44 dB
65 to 110 GHz	3744A-EW	3744A-EW			>40 dB
Frequency	**Port 3 Module**	**Port 4 Module**	**Port 3 Measured (dB)**	**Port 4 Measured (dB)**	**Specification**
56 to 94 GHz	3744A-EE	3744A-EE			>44 dB
65 to 110 GHz	3744A-EW	3744A-EW			>40 dB

Source Match Verification

Table A-2. Source Match

Freq (GHz	Port 1 Module	Port 2 Module	Port 1 Measured (dB)	Port 2 Measured (dB)	Specification
56 to 94 GHz	3744A-EE	3744A-EE			>33 dB
65 to 110 GHz	3744A-EW	3744A-EW			>30 dB
Freq (GHz	**Port 3 Module**	**Port 4 Module**	**Port 3 Measured (dB)**	**Port 4 Measured (dB)**	**Specification**
56 to 94 GHz	3744A-EE	3744A-EE			>33 dB
65 to 110 GHz	3744A-EW	3744A-EW			>30 dB

A-3 ME7838G4 WR05 S-Parameter Measurements Test Record

Instrument Information

ME7838G4	Operator:	Date:
VectorStar VNA Model: MS4647B	VectorStar VNA Serial Number:	VectorStar VNA Options: 51 [ ] 61 [ ] 62 [ ] 70 [ ] 80 [ ] 81 [ ] 84 [ ] 85 [ ]
Port 1 mmWave Module Model: MA25400A	Module Serial Number:	
Port 2 mmWave Module Model: MA25400A	Module Serial Number:	

S-Parameter Measurements

Table A-3. S-Parameter Measurements Results

S-Parameters	Measured	Test Limits
S11	dB	-10 dB max
S41	dB	-2 dB min
S14	dB	-2 dB min
S44	dB	-10 dB max
S22	dB	-10 dB max
S23	dB	-2 dB min
S32	dB	-2 dB min
S33	dB	-10 dB max

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