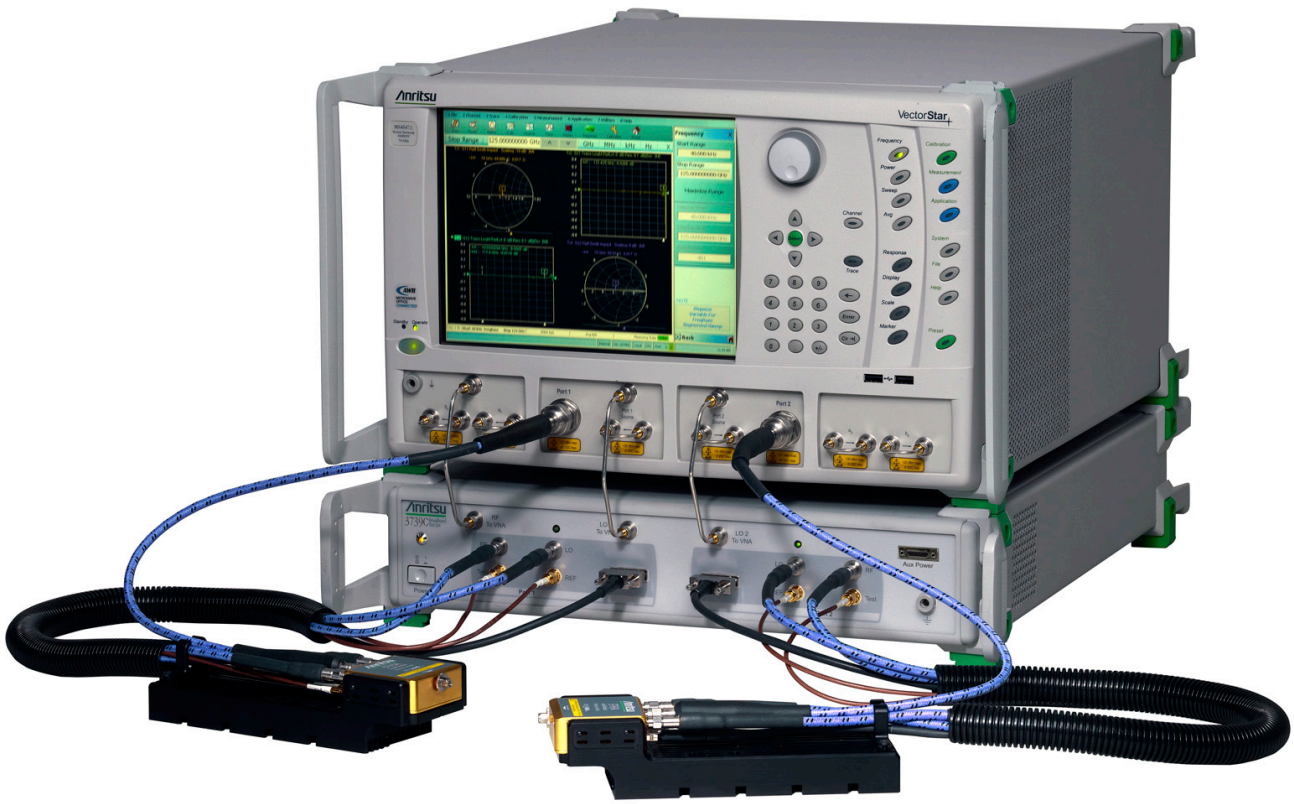
Maintenance Manual

VectorStar™ ME7838 Series 2-Port Broadband/Banded mmWave VNA System

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

ME7838A/AX mmWave VNA System, 70 kHz to 110/125 GHz
ME7838D mmWave VNA System, 70 kHz to 145 (150) GHz
ME7838E/EX mmWave VNA System, 70 kHz to 110 GHz
ME7838G mmWave VNA System, 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 VectorStar™ ME7838 Series Broadband/mmWave (BB/mmWave) Vector Network Analyzer System. The ME7838 series consists of:

- ME7838A/AX mmWave VNA System, 70 kHz to 110/125 GHz
- ME7838D mmWave VNA System, 70 kHz to 145 (150) GHz
- ME7838E/EX mmWave VNA System, 70 kHz to 110 GHz
- ME7838G mmWave VNA System, 70 kHz to 220 (226) GHz

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

- VectorStar MS464xA/MS464xB Vector Network Analyzer
- 3739A/3739B/3739C Broadband 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

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

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”. For an ME7838x system this number is on the decal affixed to the rear panel of the MS464xA/B VNA in the system. 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/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/me7838

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 Documentation

VectorStar Series VNA documentation is available on Anritsu's Web site at:
http://www.anritsu.com/test-measurement/products/me7838

Product Information, Compliance, and Safety

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

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/AX Modular BB/mmWave Quick Start Guide (QSG) –10410-00292
- ME7838D/G Modular BB/mmWave Quick Start Guide (QSG) –10410-00732
- ME7838E/EX Modular BB/mmWave Quick Start Guide (QSG) –10410-00729
- ME7838 Series Modular BB/mmWave Installation Guide (IG) – 10410-00293
- 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 4-Port Broadband VNA Technical Data Sheet (TDS) – 11410-00704
- ME7838AX/AX4 Modular BB/mmWave VNA Technical Data Sheet (TDS) – 11410-02825
- ME7838A4/A4X Modular BB/mmWave VNA Quick Start Guide (QSG) – 10410-00735
- ME7838D4 4-Port Broadband VNA Technical Data Sheet (TDS) – 11410-01099
- ME7838E4 4-Port Broadband VNA Technical Data Sheet (TDS) – 11410-01100
- ME7838EX/E4X Modular BB/mmWave Technical Data Sheet (TDS) – 11410-02827
- ME7838E4/E4X Modular BB/mmWave VNA Quick Start Guide (QSG) – 10410-00771
- ME7838G4 4-Port Broadband VNA Technical Data Sheet (TDS) – 11410-01196
- ME7838D4/G4 VectorStar Multiport Quick Start Guide (QSG) – 10410-00770
- ME7838x Series 4-Port Broadband VNA Installation Guide (IG) – 10410-00734
- ME7838x Series Multiport Broadband VNA Maintenance Manual (MM) – 10410-00736
- 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
- 365xx-x 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 ME7838A/AX and Lightning ME7808A/B/C BB/mmWave VNA Systems – 10410-00286
- 3656C W1 (1 mm) Calibration/Verification Kit and System Performance Verification Software User Guide for the VectorStar ME7838A/AX and Lightning ME7808A/B/C BB/mmWave VNA Systems – 10410-00784
- 3659 0.8 mm Calibration/Verification Kit and System Performance Verification Software User Guide for the VectorStar ME7838 BB/mmWave VNA Systems – 10410-00327

Updates to Manuals

For updates to any of the VectorStar Series VNA documentation, visit Anritsu's Web site at:
https://www.anritsu.com

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 ME7838 Series VNA System Overview

The ME7838 Series 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, “ME7838A Standard Broadband VNA System Components – MS4647A Based
- Table 1-2, “ME7838A Waveguide Band Configuration System Components – MS4640A Based
- Table 1-3, “ME7838A/AX Standard Broadband VNA System Components – MS4647B Based
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- Table 1-5, “ME7838E/EX Standard Broadband VNA System Components
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Additional configuration information is available in the relevant system technical data sheet.

ME7838A Standard Broadband VNA System Components – MS4647A Based

Table 1-1. ME7838A Standard Broadband VNA System Components – MS4647A Based

Part Number	Name	Specifications
Standard ME7838A/AX 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-08X	mmWave Interface Option	Select one: • Use Option MS4647A-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647A-081 if VNA Option 051, 061, or 062 ***is*** selected below.
3739A or 3739B	Broadband Test Set	With front and rear panel interface cables
3743A	mmWave Modules	70 GHz to 110+ GHz 2 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 2 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
806-396-R	1.85 mm Phase Stable Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
MS4647A VNA Front Panel Options – Select None or 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.

ME7838A Waveguide Band Configuration System Components – MS4640A Based

Table 1-2. ME7838A Waveguide Band Configuration System Components – MS4640A Based

Part Number	Name	Specifications
Waveguide Band ME7838A/AX 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-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4645A-082 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4644A-082 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647A-081 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4645A-083 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4644A-083 if VNA Option 051, 061, or 062 ***is*** selected below.
3739A or 3739B	Broadband Test Set	With front and rear panel interface cables
3744A-EE or SM6499	mmWave Modules	56 GHz to 95 GHz, WR-12 2 each
3744A-EW or SM6527	mmWave Modules	65 GHz to 110 GHz, WR-10 2 each
MS4640A VNA Front Panel Options – Select None or 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.

ME7838A/AX Standard Broadband VNA System Components – MS4647B Based

Table 1-3. ME7838A/AX Standard Broadband VNA System Components – MS4647B Based

Part Number	Name	Specifications
Standard ME7838A/AX 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-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-081 if VNA Option 051, 061, or 062 ***is*** selected below.
3739B or 3739C	Broadband Test Set	With front and rear panel interface cables
3743A/AX	mmWave Modules	70 kHz to 125 GHz 2 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 2 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
806-396-R	1.85 mm Phase Stable Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
MS4647B VNA Front Panel Options – Select None or 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 • If Option 051 is selected, use Option MS4647B-081 above.
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. • If Option 061 is selected, use Option MS4647B-081 above.
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. • If Option 062 is selected, use Option MS4647B-081 above.

ME7838A/AX Waveguide Band Configuration System Components – MS4640B Based

Table 1-4. ME7838A/AX Waveguide Band Configuration System Components – MS4640B Based

Part Number	Name	Specifications
Waveguide Band ME7838A/AX 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 MS4647B-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4645B-082 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4644B-082 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-081 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4645B-083 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4644B-083 if VNA Option 051, 061, or 062 ***is*** selected below.
3739B or 3739C	Broadband Test Set	With front and rear panel interface cables
3744A-EE	mmWave Modules	56 GHz to 95 GHz, WR-12 2 each
3744A-EW	mmWave Modules	65 GHz to 110 GHz, WR-10 2 each
MS4640B VNA Front Panel Options – Select None or 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 • If Option 051 ***is*** selected, use Option MS4647B-081 or MS464xB-083 above.
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. • If Option 061 ***is*** selected, use Option MS4647B-081 or MS464xB-083 above.
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. • If Option 062 ***is*** selected, use Option MS4647B-081 or MS464xB-083 above.

ME7838E/EX Standard Broadband VNA System Components

Table 1-5. ME7838E/EX Standard Broadband VNA System Components

Part Number	Name	Specifications
Standard ME7838E/EX 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-086 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-087 if VNA Option 051, 061, or 062 ***is*** selected below.
3739B or 3739C	Broadband Test Set	With front and rear panel interface cables
3743E/EX	mmWave Modules	70 kHz to 110 GHz 2 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 2 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
806-396-R	1.85 mm Phase Stable Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
MS4647B VNA Front Panel Options – Select None or 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 • If Option 051 is selected, use Option MS4647B-087 above.
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. • If Option 061 is selected, use Option MS4647B-087 above.
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. • If Option 062 is selected, use Option MS4647B-087 above.

ME7838E/EX Waveguide Band Configuration System Components

Table 1-6. ME7838E/EX Waveguide Band Configuration System Components

Part Number	Name	Specifications
Waveguide Band ME7838E/EX 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 MS4647B-086 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4645B-086 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4644B-086 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-087 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4645B-087 if VNA Option 051, 061, or 062 ***is*** selected below. • Use Option MS4644B-087 if VNA Option 051, 061, or 062 ***is*** selected below.
3739B or 3739C	Broadband Test Set	With front and rear panel interface cables
3744E-EE	mmWave Modules	56 GHz to 95 GHz, WR-12 2 each
3744E-EW	mmWave Modules	65 GHz to 110 GHz, WR-10 2 each
MS4640B VNA Front Panel Options – Select None or 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 • If Option 051 ***is*** selected, use Option MS464xB-087.
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. • If Option 061 ***is*** selected, use Option MS464xB-087.
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. • If Option 062 ***is*** selected, use Option MS464xB-087.

ME7838D Standard Broadband VNA System Components

Table 1-7. ME7838D Standard Broadband VNA System Components

Part Number	Name	Specifications
Standard ME7838D 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-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-081 if VNA Option 051, 061, or 062 ***is*** selected below.
3739C	Broadband Test Set	With front and rear panel interface cables
MA25300A	mmWave Modules	70 kHz to 145 GHz 2 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 2 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
806-396-R	1.85 mm Phase Stable Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
MS4647B VNA Front Panel Options – Select None or 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 • If Option 051 is selected, use Option MS4647B-081 above.
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. • If Option 061 is selected, use Option MS4647B-081 above.
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. • If Option 062 is selected, use Option MS4647B-081 above.

ME7838G Standard Broadband VNA System Components

Table 1-8. ME7838G Standard Broadband VNA System Components

Part Number	Name	Specifications
Standard ME7838G 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-080 if VNA Option 051, 061, or 062 is ***not*** selected below. • Use Option MS4647B-081 if VNA Option 051, 061, or 062 ***is*** selected below.
3739C	Broadband Test Set	With front and rear panel interface cables
MA25400A	mmWave Modules	70 kHz to 220 GHz 2 each
Coaxial Cable Option – Select One (1)		
806-206-R	1.85 mm Interconnect Cable	70 cm (24 inches) V (m) to V (f), 2 cables
806-209-R	1.85 mm Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
806-396-R	1.85 mm Phase Stable Interconnect Cable	91.5 cm (36 inches) V (m) to V (f), 2 cables
MS4647B VNA Front Panel Options – Select None or 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 • If Option 051 is selected, use Option MS4647B-081 above.
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. • If Option 061 is selected, use Option MS4647B-081 above.
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. • If Option 062 is selected, use Option MS4647B-081 above.

1-7 Recommended Test Equipment

The tables below list the recommended test equipment to be used for all maintenance activities for the ME7838 Series VNA System Broadband configurations and Waveguide Band configurations.

- Table 1-9, "Recommended Test Equipment for ME7838A/AX/E/EX VNA System – Broadband Configuration
- Table 1-10, "Recommended Test Equipment for ME7838A/AX/E/EX VNA System – Waveguide Band Configuration
- Table 1-11, "Recommended Test Equipment for ME7838D VNA System
- Table 1-12, "Recommended Test Equipment for ME7838G VNA System

Test Equipment – ME7838A/AX/E/EX – Broadband Configuration

Table 1-9. Recommended Test Equipment for ME7838A/AX/E/EX VNA System – Broadband Configuration (1 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Calibration/Verification Kit	Connector Type: W1	Anritsu 3656C Anritsu 3656B for ME7838A/E (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, 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

Table 1-9. Recommended Test Equipment for ME7838A/AX/E/EX VNA System – Broadband Configuration (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
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: 4 to 11 GHz	Anritsu MS2720T with Opt 732	T
RF Cable	Frequency Range: 4 to 11 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T
Attenuator	Frequency Range: DC to 40 GHz Attenuation: 20 dB	Anritsu 41KC-20	T

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

Test Equipment – ME7838A/AX/E/EX – Waveguide Band Configuration

Table 1-10. Recommended Test Equipment for ME7838A/AX/E/EX 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, 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: 4 to 11 GHz	Anritsu MS2720T with Opt 732	T
RF Cable	Frequency Range: 4 to 11 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T
Attenuator	Frequency Range: DC to 40 GHz Attenuation: 20 dB	Anritsu 41KC-20	T

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

Test Equipment – ME7838D

Table 1-11. Recommended Test Equipment for ME7838D 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
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	Freq. Range: 70 kHz to 70 GHz Power Range:–30 to +20 dBm	Anritsu SC7770	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	W1 male to 0.8 mm female	Anritsu 33W.8F50 (part of Anritsu 3659)	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, E4418B, or N1913A with Option 200	A
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: –30 to +20 dBm	Keysight W8486A	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 to145 GHz 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: 4 to 11 GHz	Anritsu MS2720T with Opt 732	T
RF Cable	Frequency Range: 4 to 11 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T

Table 1-11. Recommended Test Equipment for ME7838D VNA System (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[a]
Attenuator	Frequency Range: DC to 40 GHz Attenuation: 20 dB	Anritsu 41KC-20	T

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

Test Equipment – ME7838G

Table 1-12. Recommended Test Equipment for ME7838G 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: WR05 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	WR5 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 Processor • 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	Freq. Range: 70 kHz to 70 GHz Power Range:−30 to +20 dBm	Anritsu SC7770	A
Adapter	W1 female to V female	Anritsu 34WFVF50	A
Adapter	W1 male to 0.08 mm female	Anritsu 33W.8F50 (part of Anritsu 3659)	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 or N1913A with Option 200	A
Waveguide Power Sensor	Frequency Range: 75 to 110 GHz Power Range: −30 to +20 dBm	Keysight W8486A	A
Adapter	WR-10 Waveguide to W1 female	Anritsu 35WR10WF	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
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 145 GHz WR-6 Waveguide to 0.8 mm female	Flann Microwave K1612	A
Adapter	K male to K male	Anritsu 33KK50B/C or K220B	A

Table 1-12. Recommended Test Equipment for ME7838G VNA System (2 of 2)

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes[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: 4 to 21 GHz	Anritsu MS2720T with Opt 732	T
RF Cable	Frequency Range: 4 to 21 GHz Connector Type: K	Anritsu 15KK50-1.0A	T
Digital Multimeter	DC Voltage: ± 20 V	Any	T
Attenuator	Frequency Range: DC to 40 GHz Attenuation: 20 dB	Anritsu 41KC-20	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 ME7838 Series VNA System
- Replaceable parts in Model 3739A Broadband Test Set
- Replaceable parts in Model 3739B Broadband Test Set
- Replaceable parts in Model 3739C Broadband Test Set
- Replaceable parts in Model 3743A/AX/E/EX and 3744A/E mmWave Modules
- Replaceable parts in MA25300A mmWave Module
- Replaceable parts in MA25400A mmWave Module

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**.

2-2 ME7838 Series System Replaceable Parts

Part numbers and description of ME7838 Series system level replaceable parts are shown in below in Table 2-1.

Note	There are no serviceable components or subassemblies inside the 3743A/AX/E/EX, 3744A/E, MA25300A, MA25400A, SM6499, or SM6527 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. ME7838 Series System Level Replaceable Parts List

Part Number	Description
3-806-225	BNC male to BNC male Coaxial Cable, 2 ft (~61 cm) • 2 per instrument, 1 per replacement kit, RoHS Compliant
3-806-226	mmWave Module Power/Control Cable • 2 per instrument, 1 per replacement kit, RoHS Compliant
806-223	V male to V male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739A
806-224	K male to K male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739A
806-254	K male to K male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739B and 3739C
3-806-254	K male to K male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739C, RoHS Compliant
806-256	V male to V male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739B and 3739C
3-806-256	V male to V male RF Cable, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, for 3739C, RoHS Compliant
3-ND75298	Test IF Cable, SMA male to SSMC male, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, RoHS Compliant
3-ND75299	Reference IF Cable, SMA male to SSMC male, 3 ft (~91 cm) • 2 per instrument, 1 per replacement kit, RoHS Compliant
3-ND75300	a1 IF Cable, SMA male to SMA male, 1.5 ft (~46 cm) • Rear panel cable, RoHS Compliant
3-ND75301	b1 IF Cable, SMA male to SMA male, 1.5 ft (~46 cm) • Rear panel cable, RoHS Compliant
3-ND75302	a2 IF Cable, SMA male to SMA male, 1.5 ft (~46 cm) • Rear panel cable, RoHS Compliant
3-ND75303	b2 IF Cable, SMA male to SMA male, 1.5 ft (~46 cm) • Rear panel cable, RoHS Compliant
3-ND75304	I/O Cable Assembly • Rear panel cable, RoHS Compliant

Table 2-1. ME7838 Series System Level Replaceable Parts List

Part Number	Description
3-ND73915	VNA/Test Set Inter-connect Cable Set • Includes IF and I/O cables 3-ND75300, 3-ND75301, 3-ND75302, • 3-ND75303 and 3-ND75304 described above; RoHS Compliant
ND73916	mmWave Module Interface Cable Set for 3739A • Includes test port/test set to module cables ND75298, ND75299, 3-806-226, 806-223 and 806-224 described above.
3-ND75338	mmWave Module Interface Cable Set for 3739B 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

2-3 3739A Test Set Replaceable Subassemblies and Parts

Replaceable parts of 3739A Test Set are listed in Table 2-2 below.

Table 2-2. 3739A Broadband Test Set Replaceable Parts List

Replacement Part Number	Description
3-40-183	Power Supply • Does not include cable harnesses, see ND73168 below.
ND73168	Power Supply Cable Harness • 71918 • Does not include Power Supply, see 3-40-183 above.
ND73158-RFB	A103 RF Amplifier Module, consists of: • 3-71907 – soldered-on cable harness, to A1 PCB Connector P3. • 72234 – A103 – 20 GHz to 40 GHz Amplifier
ND73159-RFB	A100 LO Amplifier Module, Port 1, consists of: • 3-71916-1 – Soldered-on cable harness, to A1 PCB Connector P13. • 3-1070-13 – MW Amplifier Module, 0.01 GHz to 20 GHz
ND73160-RFB	A105 LO Amplifier Module, Port 2, consists of: • 3-71916-2 – Soldered-on cable harness, to A1 PCB Connector P12. • 3-1070-13 – MW Amplifier Module, 0.01 GHz to 20 GHz
ND73161-RFB	A101 Modulator Module, Port 1, consists of: • 3-73601-1 – Soldered-on cable harness, to A1 PCB Connector P10. • 72231 – Modulator Module
ND73162-RFB	A106 Modulator Module, Port 2, consists of: • 3-73601-2 – Soldered-on cable harness, to A1 PCB Connector P11. • 72231 – Modulator Module
3-1000-58	A102 Isolator Module, Port 1, 5 GHz to 10 GHz • No cable harness • 1 per instrument, 1 per replacement kit A107 Isolator Module, Port 2, 5 GHz to 10 GHz • No cable harness • 1 per instrument, 1 per replacement kit
70242-RFB	A104, SPDT Switch, 0.04 to 40 GHz • Does not include SPDT Switch Control PCB Assembly – ND70926 – 64951- 3 (below).
ND70926-RFB	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 (above).
ND73163-RFB	A1 Bias Control PCB Assembly – 3-72143-3
ND73164	Rear Panel Fan Assembly • 3-71919 – Soldered-on 165 mm cable, to A1 PCB Connector P9.
ND73169	Front Panel Frame Assembly – Including mmWave module power and control interface connectors, Power LED, Port 1 LED and Port 2 LED • 71894
K232B	K female to K female Panel Adapter • Five (5) per system, 1 per replacement kit
V232	V female to V female Panel Adapter • two (2) per system, 1 per replacement kit

2-4 3739B Test Set Replaceable Subassemblies and Parts

Replaceable parts of 3739B Test Set are listed in Table 2-3 below.

Table 2-3. 3739B Broadband Test Set Replaceable Parts List

Replacement Part Number	Description
3-40-183	Power Supply • Does not include cable harnesses, see ND73168 below.
ND73168	Power Supply Cable Harness • 71918 • Does not include Power Supply, see 3-40-183 above.
ND75882-RFB	A1 Bias Control PCB Assembly – 3-74276-3
ND75883-RFB	A100, A101 Doubler Module • 74094 • 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
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
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
70242-RFB	A104, SPDT Switch, 0.04 to 40 GHz • Does not include SPDT Switch Control PCB Assembly – ND70926 – 64951- 3 (below).
ND70926-RFB	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 (above).
ND73164	Rear Panel Fan Assembly • 3-71919 – Soldered-on 165 mm cable, to A1 PCB Connector P9.
ND75877	Front Panel Frame Assembly – Including mmWave module power and control interface connectors, Power LED, Port 1 LED and Port 2 LED • 74811
K232B	K female to K female Panel Adapter • Five (5) per system, 1 per replacement kit
V232	V female to V female Panel Adapter • two (2) per system, 1 per replacement kit

2-5 3739C Test Set Replaceable Subassemblies and Parts

Replaceable parts of 3739C Test Set are listed in Table 2-4 below.

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

Table 2-4. 3739C Broadband Test Set Replaceable Parts List (1 of 2)

Replacement Part Number	Description
3-40-183	Power Supply; RoHS Compliant • Does not include cable harnesses, see ND73168 below
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
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
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
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)

Table 2-4. 3739C Broadband Test Set Replaceable Parts List (2 of 2)

Replacement Part Number	Description
ND70926-RFB	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 (above)
3-ND70926-RFB	SPDT Switch Control PCB Assembly – 3-80736; RoHS Compliant • Does not include M-M ribbon cable for connection to A1 PCB Connector P5. • Mounts on top of A104 SPDT Switch – 3-70242 (above)
3-ND80353	Rear Panel Module Bias Switch with cable harness – 3-80186-1; RoHS Compliant • Cable harness to A1 PCB Connector P21.
3-ND73164	Rear Panel Fan Assembly; RoHS Compliant • 3-71919 – Soldered-on 165 mm cable, to A1 PCB Connector P9
3-ND80354	Front Panel Frame Assembly; RoHS Compliant • Including mmWave module power and control interface connectors, Power LED, Port 1 LED, and Port 2 LED
1010-47	6 dB Fixed Attenuator • Located on the back side of the LO1 and LO2 connectors at the inside of the front panel
3-1010-47	6 dB Fixed Attenuator; RoHS Compliant • Located on the back side of the LO1 and LO2 connectors at the inside of the front panel
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

2-6 3743A/AX/E/EX and 3744A/E mmWave Module Replaceable Parts

Replaceable parts of 3743A/AX/E/EX and 3744A/E mmWave Modules are listed in the table below:

Table 2-5. 3743A/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; RoHS Compliant • 12 per system, 6 per module, 1 per replacement kit
3-ND75332	Heatsink; RoHS Compliant • Two (2) per system, 1 per replacement kit

2-7 MA25300A mmWave Module Replaceable Parts

Replaceable parts of MA25300A mmWave Modules are listed in the table below:

Table 2-6. MA25300A mmWave Module Replaceable Parts List

Replacement Part Number	Description
3-76147	• Knurled M3 Screw for mounting mmWave Modules in brackets; RoHS Compliant • 8 per system, 4 per module, 1 per replacement kit
3-ND80600	Heatsink; RoHS Compliant • Two (2) per system, 1 per replacement kit

2-8 MA25400A mmWave Module Replaceable Parts

Replaceable parts of MA25400A mmWave Modules are listed in the table below:

Table 2-7. MA25400A mmWave Module Replaceable Parts List

Replacement Part Number	Description
3-83968	• Knurled M3 Screw for mounting mmWave Modules in brackets; RoHS Compliant • 8 per system, 4 per module, 1 per replacement kit
3-ND84646	Heatsink; RoHS Compliant • Two (2) 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 ME7838 Series VNA System in both Broadband system configuration and Waveguide mmWave system configuration.

- "ME7838A/AX/E/EX System Verification – Baseband"
- "ME7838A/AX/E/EX System Verification – Waveguide mmWave"
- "ME7838D System Verification"
- "ME7838G System Verification"

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 ME7838A/AX/E/EX System Verification – Baseband

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 International System of Units (SI) via national metrology institutes.

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 W1 Connector Broadband VNA System Performance Verification Software in conjunction with the Anritsu 3656B/C Calibration / Verification Kit.

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.

Note	The 3656C Calibration / Verification Kit must be used on the ME7838AX/EX systems. The 3656C Calibration / Verification Kit can be used on the ME7838A/E systems. The 3656B Calibration / Verification Kit can only be used on the ME7838A/E systems.

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.
- 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 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 **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 ME7838A/AX/E/EX System Verification Procedure – Baseband

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

Note	The 3656C Calibration / Verification Kit must be used on the ME7838AX/EX systems. The 3656C Calibration / Verification Kit can be used on the ME7838A/E systems. The 3656B Calibration / Verification Kit can only be used on the ME7838A/E systems.

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

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 both 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 both modules on a leveled surface so that both test ports are facing each other.

4. Install the W1 female to female adapter from the 3656C 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 breakpoint set to 67 GHz for the 3656B/C.

3-5 ME7838A/AX/E/EX System Verification – Waveguide mmWave

The performance of ME7838A/AX/E/EX Waveguide 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 ME7838A/AX/E/EX System Verification Procedure – Waveguide mmWave

The mmWave system verification procedure is described below. It verifies the corrected source match and corrected directivity of the ME7838A/AX/E/EX 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 both mmWave modules (3744A-EE, 3744A-EW, SM6499, SM6527, 3744E-EE, or 3744E-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 both 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 MS464xx 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:

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 MS464xx 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

21. In the Full One Port Cal Setup window (Figure 3-1), select:

a. Waveguide Kit: Select WR12 for 3744E-EE, 3744A-EE, or SM6499; WR10 for 3744E-EW, 3744A-EW, or SM6527

b. Load Type: Sliding Load (For both Test Port 1 and Test Port 2).

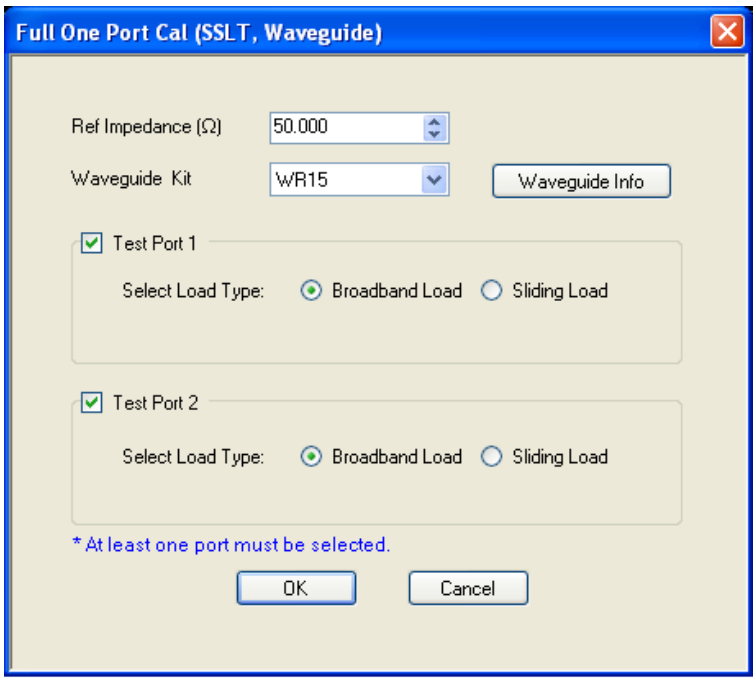


Figure 3-1. Full One Port Cal Setup Window

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. Select Done to complete the calibration.

Port 1 Directivity Verification:

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

77. Select Display | Trace Format | Log Mag.

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

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

79. Select Scale | Auto Scale Active Trace.

80. Select Marker.

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

82. 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".

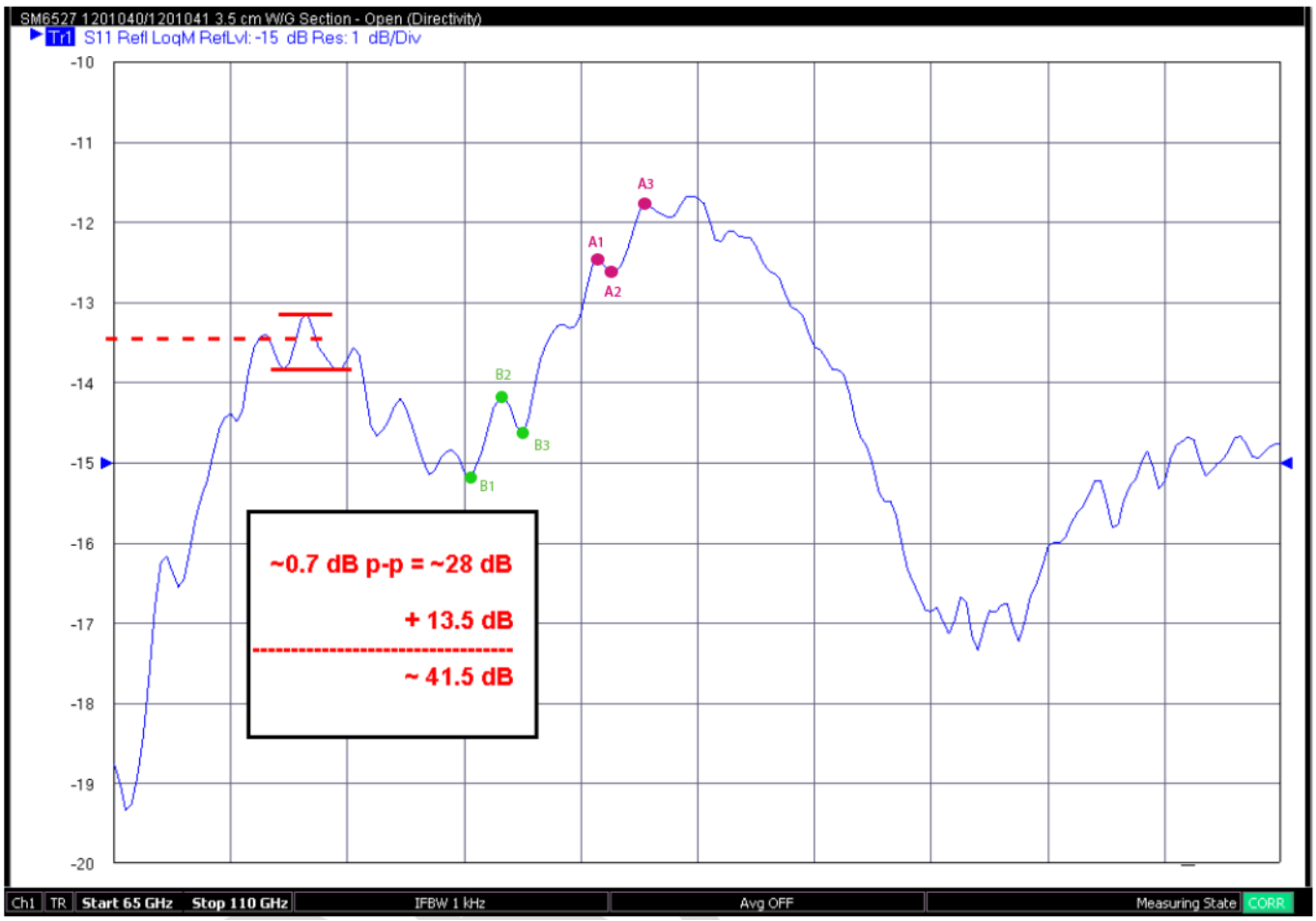


Figure 3-2. Markers Positioning for Directivity Verification

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

84. 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

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

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

86. On the RF measurement chart in Figure 3-4 on page 3-14, find the "REF ± X Pk to Pk Ripple dB" value closest to the calculated value in step 85.

87. 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.

88. 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

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

Port 1 Source Match Verification:

90. 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).

91. 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.

92. Select Marker.

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

94. 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".

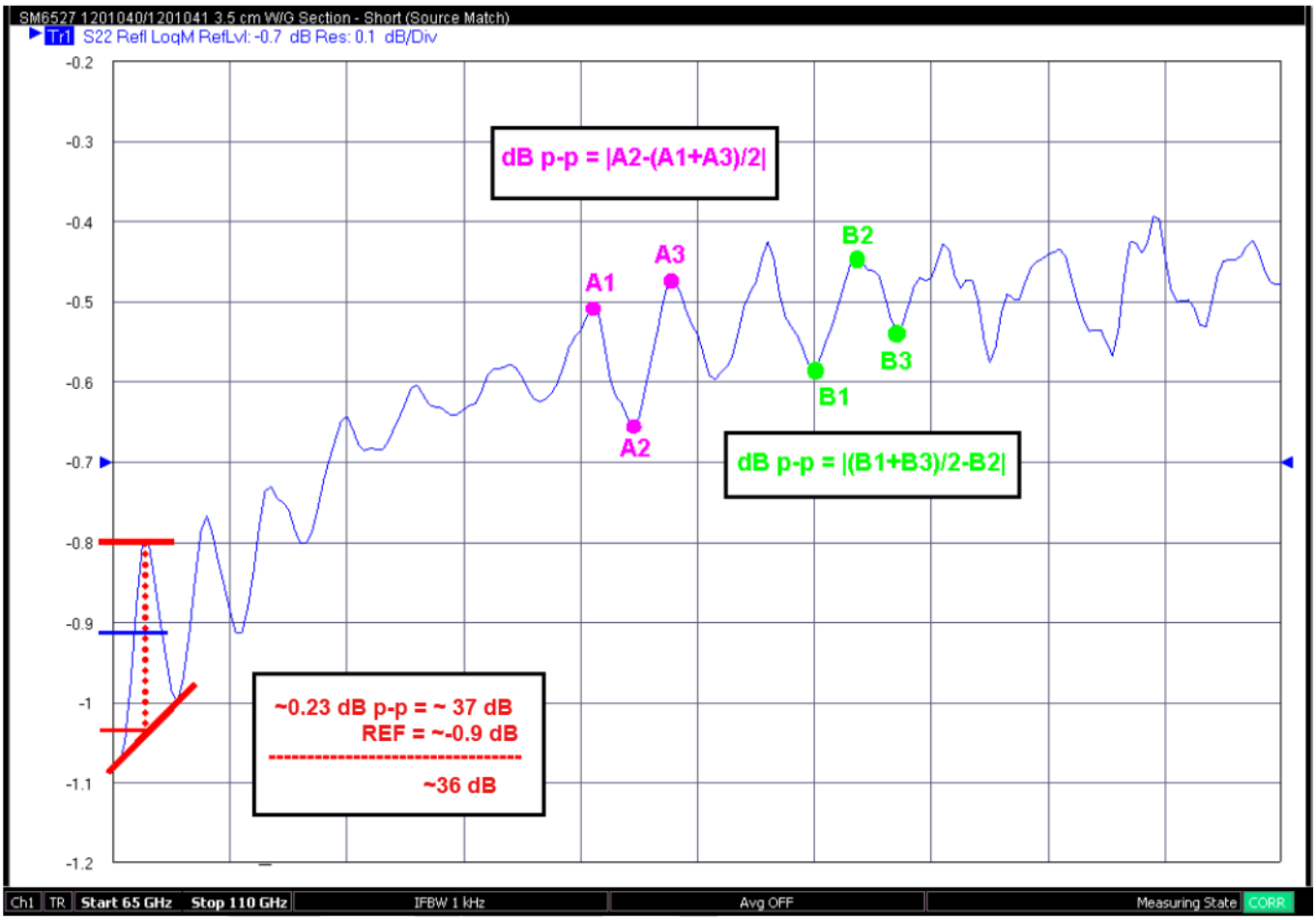


Figure 3-3. Marker Positioning for Source Match Verification

95. 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

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

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

97. 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.

98. 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.

99. 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|

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

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

Port 2 Source Match Verification:

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

103. Select Trace | Next Trace until the VNA displays the S_{22}.

104. Select Display | Trace Format | Log Mag.

105. Repeat Step 91 to Step 99.

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

Port 2 Directivity Verification:

107. Remove the flush short from the Flann precision waveguide section.

108. Repeat Step 79 to Step 88.

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

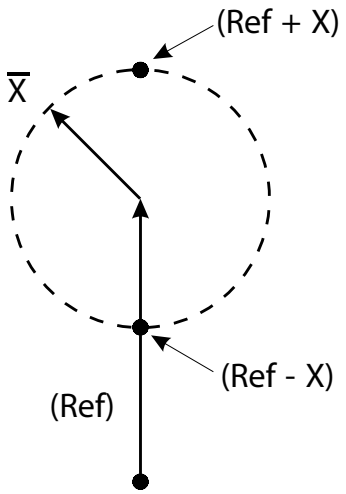
The first three columns are conversion tables for return loss, reflection coefficient, and SWR.

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 ME7838D System Verification

The ME7838D system 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 International System of Units (SI) via national metrology institutes.

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 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 ME7838D 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 3656C 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.

3-8 ME7838D 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.

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.

Equipment Required

- Personal Computer:
  - Microsoft Windows Operating System
  - National Instruments GPIB interface
  - GPIB interface cable
- Anritsu 3659 0.8 mm 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**.

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

2. Dismount both MA25300A 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 both modules on a leveled surface so that both test ports 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 ME7838D/G 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 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	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.

3-9 ME7838G System Verification

The ME7838G system is verified using two procedures:

- ME7838G 0.8 mm Coaxial System Verification
- ME7838G 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.

ME7838G 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.

ME7838G 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 (226) GHz by analyzing the S-parameter measurements of a specified waveguide device.

Performance Verification Software Overview

The Anritsu 0.8 mm Connector ME7838D/G 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.

3-10 ME7838G 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 both 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 both modules on a leveled surface so that both test ports 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 ME7838D/G 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. 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.

3-11 ME7838G 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 both 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 both module.
3. Place both mmWave modules on a leveled surface.
4. On the VNA, set the start and stop frequency to 140 GHz and 220 (226) 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. Reference Plane Location: Ends of Line 1
    c. Line Length Representation: Phy. Length
    d. Cal Device X: Line
    e. Device X Phy. Length (mm): 0
    f. Cal Device Y: Line
    g. Device Y Phy. Length (mm): 0.569 for OML V05CAL or 0.533 for VDI WR5.1CK Cal Kit
    h. Reflection Type: Short-like
    i. Short-like Offset Length (mm): 0

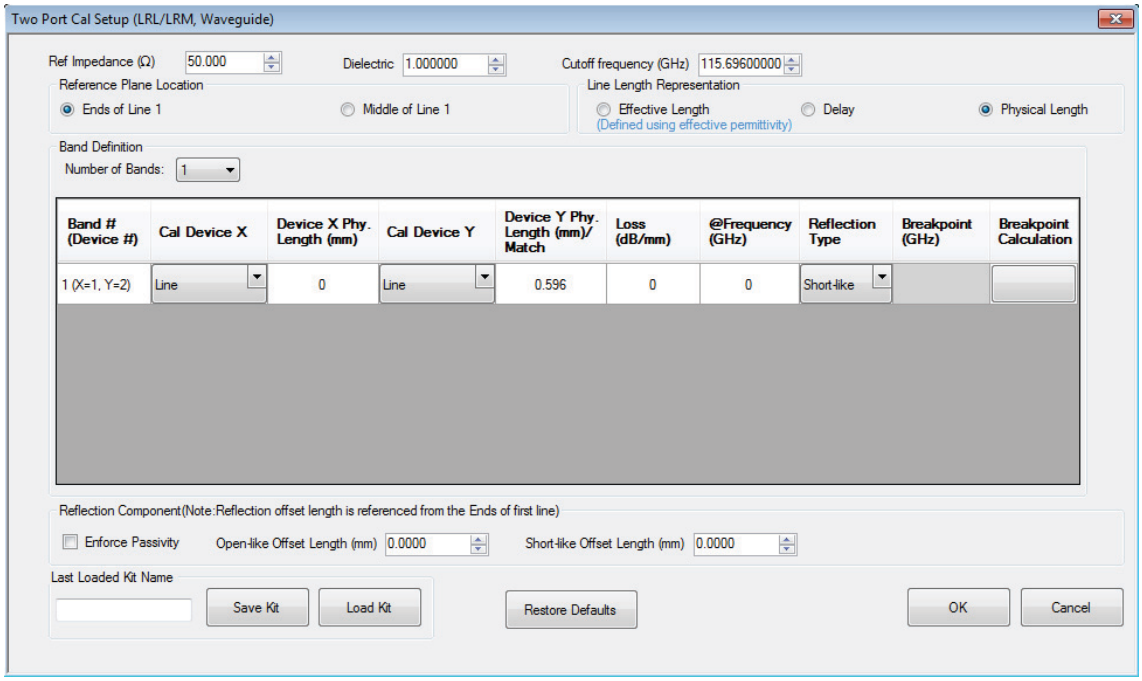


Figure 3-5. Two Port Cal Setup (LRL/LRM, Waveguide) Window Setup

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 1-2 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 2 module and select Port 2 Short-like to measure the short.

17. Remove the Flush Short from Port 2 module.

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

19. Select Port 1-2 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 2 modules.

21. Select Device 2 Line to measure.

22. Remove the cal kit shim.

23. Connect Port 1 module to Port 2 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 2 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 2.

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

33. Verify that S11 and S22 are better than -10 dB and verify that S21 and S12 are better than -2 dB.

34. Record the measured values to Table A-3, “S-Parameter Measurements Results” on page A-3.

Chapter 4 — Theory Of Operation

4-1 Introduction

This chapter provides a brief functional description of the ME7838 Series Broadband/mmWave VNA system. It also briefly describes the operation of each major instrument or assembly.

4-2 System Description

ME7838 Series Broadband/mmWave Vector Network Analyzer System is a ratio measurement system used to measure complex vector signal characteristics of devices and systems up to 220 (226) 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 between the test port of the two mmWave Modules (or connected between wafer probes that are linked to the test port connectors of the modules). It simultaneously 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 MS464xx 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 ME7838 Series Broadband/mmWave VNA System consists of the following major components:

- VectorStar MS464xx Series VNA (e.g. MS4647B)
- 3739A, 3739B or 3739C Broadband Test Set (3739B or 3739C test set required for ME7838D or ME7838G systems)
- mmWave Modules (2 each) – Refer to Section 1-6 “ME7838 Series VNA System Overview” on page 1-4 for model numbers of available mmWave modules.

Figure 4-1 on page 4-2 shows the ME7838 Series VNA Broadband system configuration and illustrates the interconnections among the VNA, Test Set, and mmWave Modules.

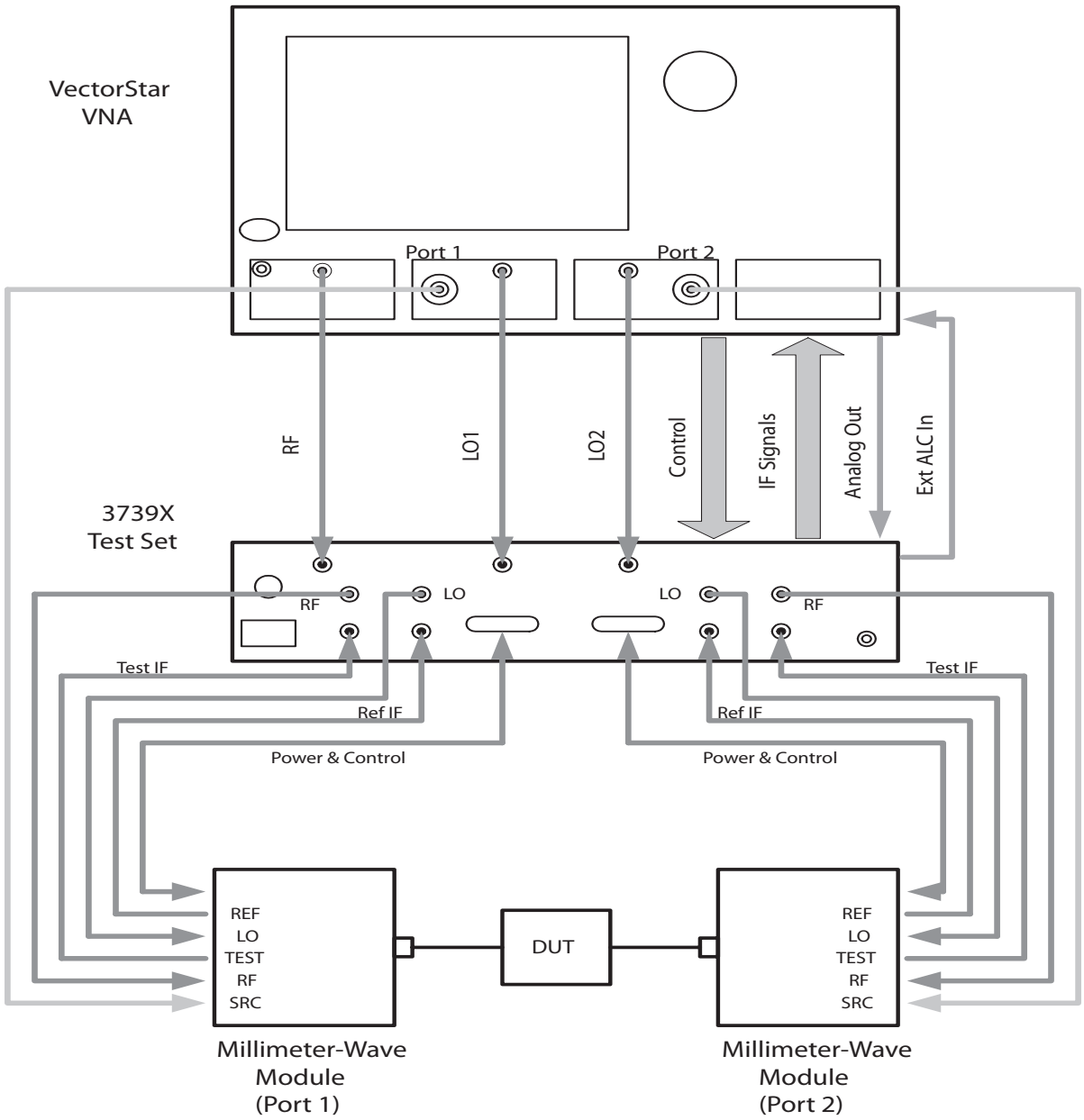


Figure 4-1. ME7838 Series VNA System Interconnections

4-4 Functional Description of System Components

This section contains brief descriptions of each system components.

VectorStar MS464xx Vector Network Analyzer

The VectorStar MS464xx VNA performs the following tasks:

- Controlling the operation of the entire ME7838 Series 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 ME7838 Series Broadband/mmWave VNA System.

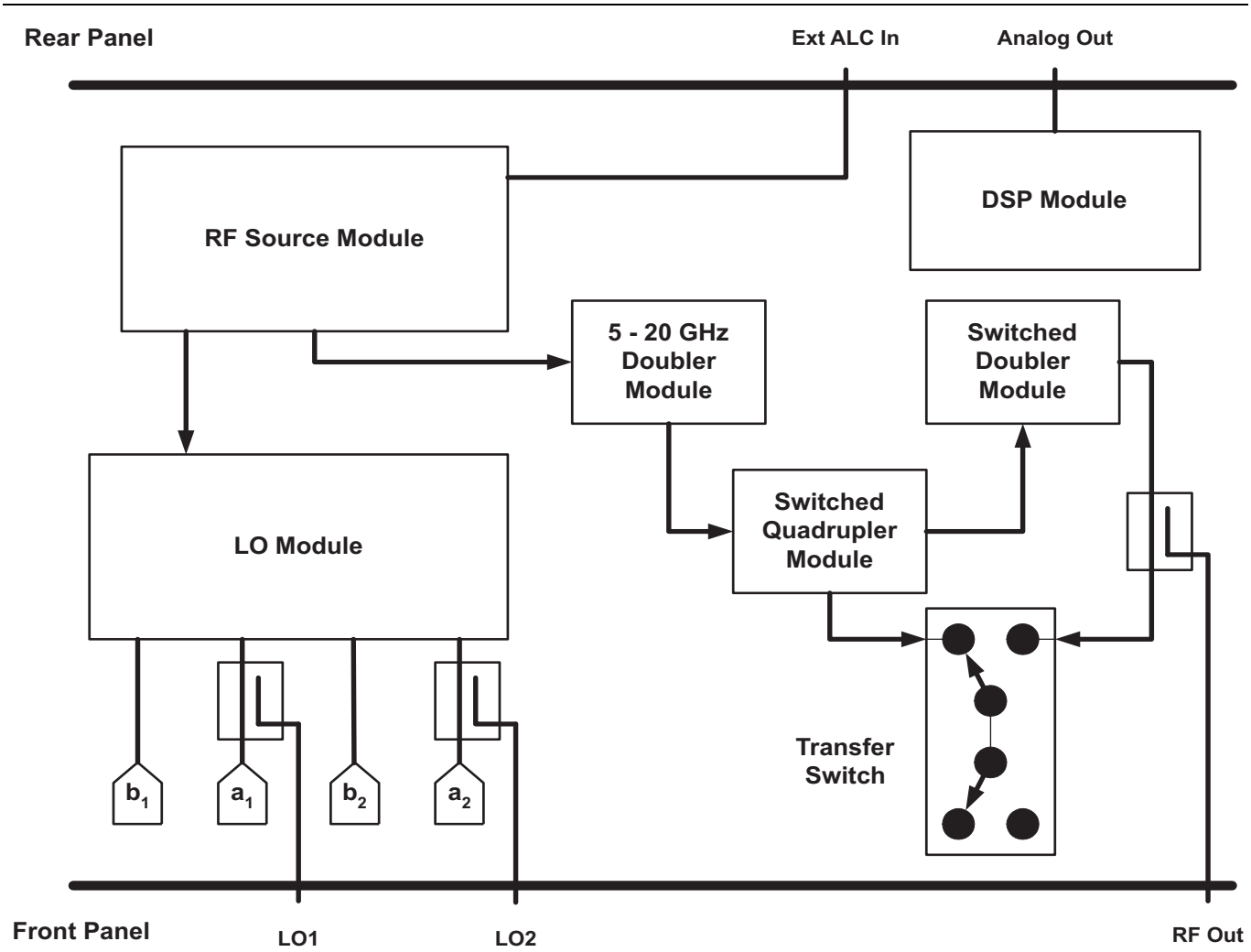


Figure 4-2. MS4647A/B Option 080/081 Block Diagram

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.
- When the instrument is set in Modular/BB mode and sweeping from 54 GHz to 220 (226) 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

3739A Broadband Test Set

The 3739A Broadband Test Set performs the following tasks:

- Decoding the control logic sent from the MS464xA 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 VNA
- Providing DC power for both mmWave Modules
- Passing IF signals from mmWave Modules to MS464xA VNA

Figure 4-3 shows the block diagram of the 3739A Test Set.

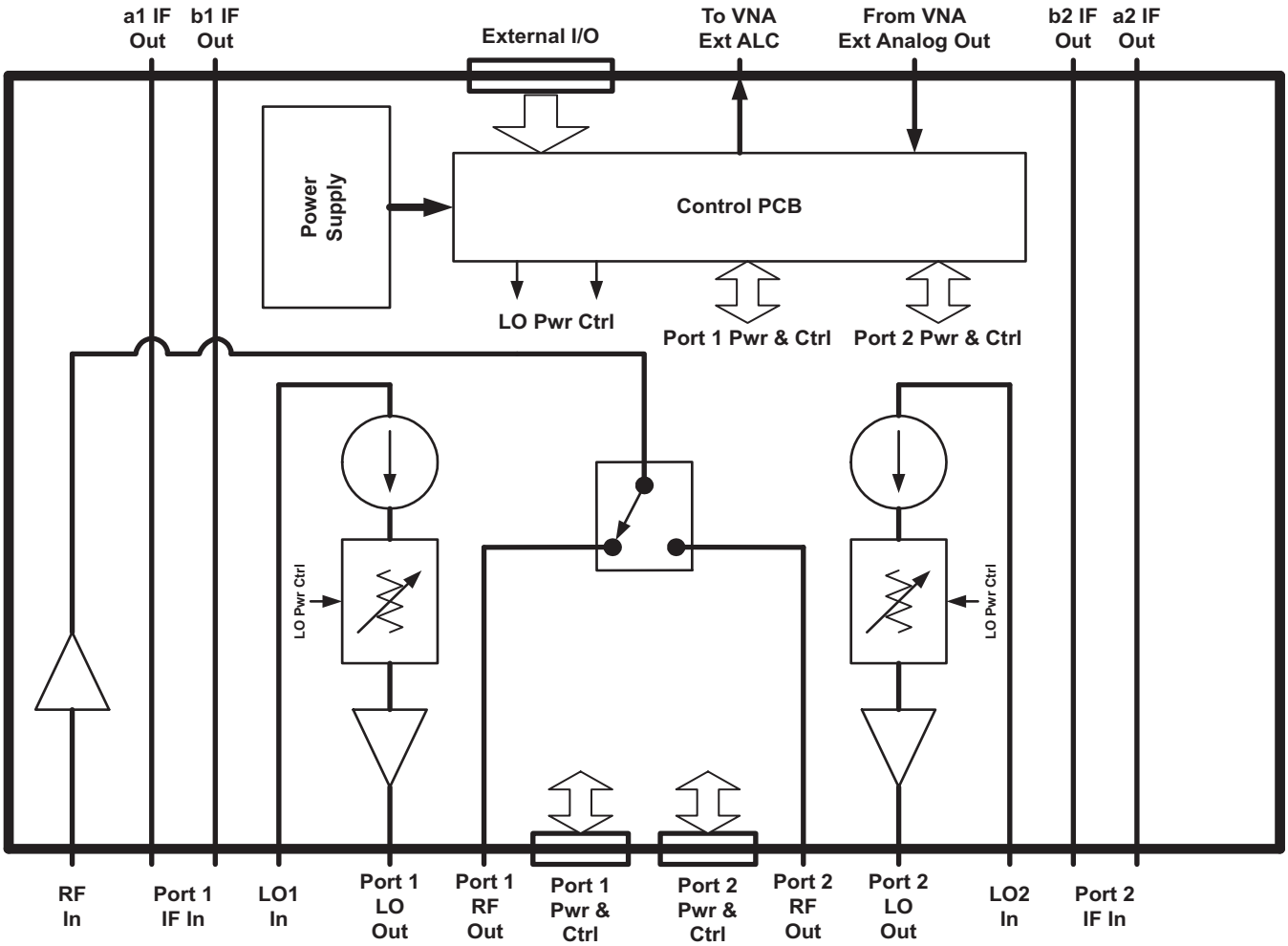


Figure 4-3. 3739A Test Set Block Diagram

The Port 1 and Port 2 LO Out ports have a typical power output at 5 to 10 GHz of +6 dBm.

The Port 1 and Port 2 RF Out ports have minimum power output at 26 to 40 GHz of +10 dBm.

3739B Broadband Test Set

The 3739B Broadband Test Set performs the following tasks:

- Decoding the control logic sent from the MS464xA or MS464xB 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 or MS464xB VNA
- Providing DC power for both mmWave Modules
- Passing IF signals from mmWave Modules to MS464xA or MS464xB VNA

Figure 4-4 shows the block diagram of the 3739B Test Set.

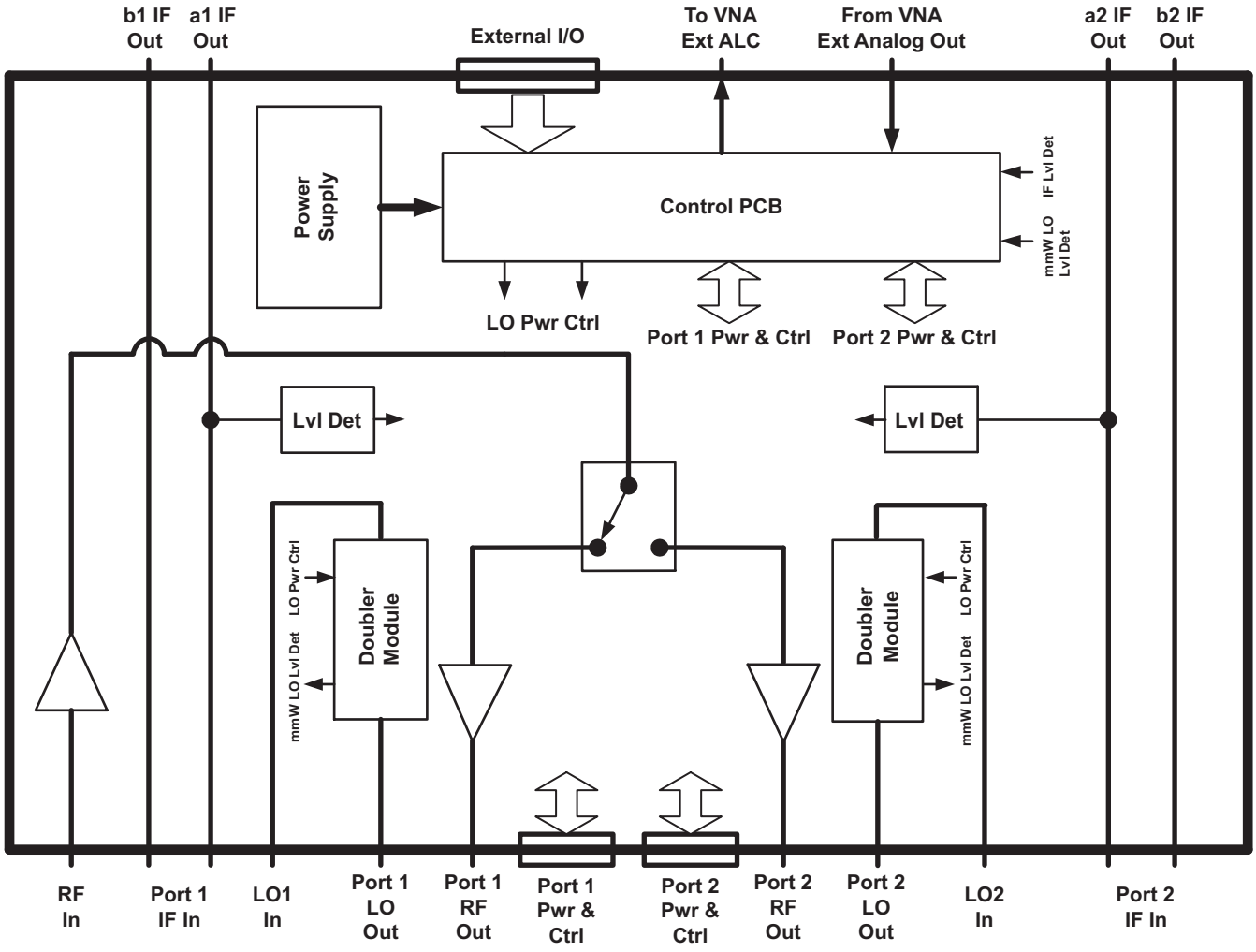


Figure 4-4. 3739B Test Set Block Diagram

Both Port 1 and Port 2 LO Out ports have typical power output at 5 to 10 GHz of +6 dBm in Modular/BB mode (used when Anritsu 3743/3744 series or MA25300A series modules are installed) and at 8 to 22 GHz of +17 dBm in mmW mode (used when OML/VDI mmWave modules are installed). When used with the MA25400A modules, the LO range is 5 to 19 GHz with a minimum output power of +10 dBm.

Both Port 1 and Port 2 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 mmW mode.

3739C Broadband Test Set

The 3739C Broadband Test Set performs the following tasks:

- Decoding the control logic sent from the MS464xB 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 MS464xB VNA
- Providing DC power for both mmWave Modules
- Passing IF signals from mmWave Modules to MS464xB VNA
- 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.

Figure 4-5 shows the block diagram of the 3739C Test Set.

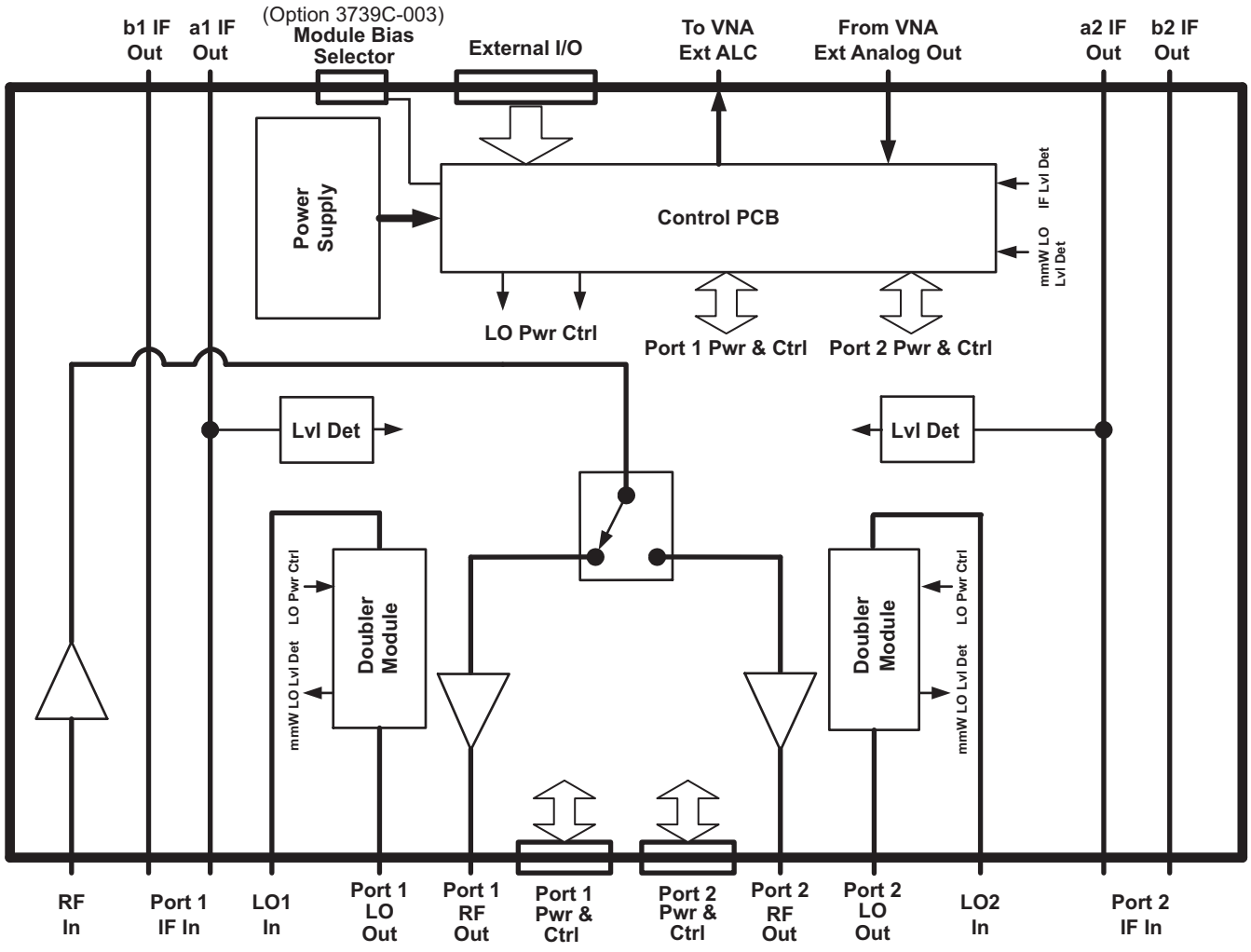


Figure 4-5. 3739C Test Set Block Diagram

Both Port 1 and Port 2 LO Out ports have minimum power output at 5 to 10 GHz of +6 dBm in Modular/BB mode (used when Anritsu 3743/3744 Series or MA25300A modules are installed) and at 8 to 22 GHz of +17 dBm in mmW mode (used when OML/VDI mmWave modules are installed). When used with the MA25400A modules, the LO range is 5 to 19 GHz with a minimum output power of +10 dBm.

Both Port 1 and Port 2 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 mmW mode.

3743A/AX 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 mmWave Module

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

- Passing stimulus signals below 54 GHz from the MS4647B VNA to the W1 Connector Test Port
- Passing 70 kHz to 30 GHz test signals from the W1 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

3744A-EE mmWave Module

The 3744A-EE (or SM6499) mmWave Module performs the following task:

- 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

3744E-EE mmWave Module

The 3744E-EE mmWave Module performs the following task:

- 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 mmWave Module

The 3744A-EW (or SM6527) mmWave Module performs the following task:

- 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 task:

- 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 task:

- Passing stimulus signals below 54 GHz from the MS4647B VNA to the 0.8 mm Connector Test Port
- Passing 70 kHz to 30 GHz test signals from the 0.8 mm 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 task:

- Passing stimulus signals below 54 GHz from the MS4647B VNA to the 0.6 mm Flange-based Coaxial Output Interface
- Passing 70 kHz to 30 GHz test signals from the 0.6 mm Flange-based Coaxial Output Interface 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 ME7838A/AX System Operation – Broadband Configuration

This section describes the system operation of the ME7838A/AX 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 directly to 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 3739A, 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 3743A/AX mmWave Modules.

In the 3743A/AX mmWave Module, the frequency of the RF signal is either doubled, tripled, or quadrupled 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 120 GHz, the frequency of the RF signal is tripled. For operation between 120 and 125 GHz, the frequency of the RF signal is quadrupled.

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 for further signal processing.

Note	In the **MS4640A Series Microwave Vector Network Analyzer Maintenance Manual – 10410-00268**, refer to **Chapter 6 – Theory of Operation** for signal processing details. In the **MS4640B Series Microwave Vector Network Analyzer Maintenance Manual – 10410-00320**, refer to **Chapter 2 – Theory of Operation** for signal processing details.

For operation above 30 GHz, the MS4647A or MS4647B VNA outputs two LO signals to the 3739A, 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 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 3739A, 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 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 3739A, 3739B or 3739C Test Set. The output is the Test IF signal.

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

4-6 ME7838A/AX System Operation – Waveguide Band Configuration

This section describes the system operation of the Waveguide Band ME7838A/AX VNA System.

Stimulus Signal Generation

The MS464xA or MS464xB VNA outputs an RF signal to the 3739A, 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 amplified and fed to the 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 3739A, 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 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 3739A, 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 3739A, 3739B or 3739C Test Set. The output is the Test IF signal.

Both the Reference and Test IF signals are then fed to the 3739A, 3739B or 3739C Test Set. The IF signals pass through the 3739A, 3739B or 3739C Test Set and are fed to the IF Inputs of the MS464xA or MS464xB VNA for further signal processing.

4-7 ME7838E/EX System Operation – Broadband Configuration

This section describes the system operation of the ME7838E/EX 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.

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

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.

4-8 ME7838E/EX System Operation – Waveguide Band Configuration

This section describes the system operation of the Waveguide Band ME7838E/EX 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 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 ME7838D System Operation

This section describes the system operation of the ME7838D 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 0.8 mm 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 0.8 mm connector test port of the MA25300A Module is then fed back to the test port 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.

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 0.8 mm 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.

4-10 ME7838G System Operation

This section describes the system operation of the ME7838G 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 its 0.6 mm Flange-based Coaxial Interface test port. The stimulus signal is then delivered to the Device Under Test (DUT) via the 0.8 mm or 1 mm connector adapter, waveguide adapter, or wafer probe attached to 0.6 mm Flange-based Coaxial Interface test port of the MA25400A mmWave Module.

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, 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 150 GHz, the frequency of the RF signal is doubled and then tripled. For operation between 150 and 220 (226) GHz, the frequency of the RF signal is double-doubled and then tripled.

Test Signal Processing

For operation in frequencies up to 30 GHz, the reflected/transmitted test signal received at the 0.6 mm flange-based coaxial interface test port of the MA25400A Module is then fed back to the test port 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.

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 0.6 mm flange-based coaxial interface 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 two adjustment procedures that are used to restore the calibration of the ME7838A/AX/D/E/EX/G System related to the RF leveling at the Test Port and the stability of sampling system of the mmWave modules. The two procedures are:

- LO Level Calibration
- ALC Level Calibration

Use these procedures after either the 3739A/3739B/3739C Broadband Test Set has been repaired or the mmWave Modules have been repaired or replaced.

	The LO Level Calibration (below in Section 5-2 “LO Level Calibration”) must be performed prior to performing the ALC Level Calibration.
Note	ME7838G System requires a different LO Level than ME7838A/AX/D/E/EX systems. A new LO Level Cal is required when upgrading from an ME7838A/AX/D/E/EX system to ME7838G.
	The ALC calibration is described in Section 5-3 “ALC Level Calibration” on page 5-6 below.

5-2 LO Level Calibration

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 3739A Test Set:
  - A100 Port 1 LO Amplifier – ND73159-RFB
  - A101 Port 1 Modulator – ND73161-RFB
  - A1 Bias Control PCB Assembly – ND73163-RFB
- Any of the following RF components are replaced in the 3739B or 3739C Test Set:
  - A100 Port 1 Doubler Module – ND75883-RFB or 3-ND75883-RFB
  - A1 Bias Control PCB Assembly – ND75882-RFB or 3-ND75882-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. Ensure that all system components have been assembled per **VectorStar ME7838 Series VNA System Installation Guide – 10410-00293**.
2. Install a GPIB interface cable between the power meter GPIB port and the Dedicated GPIB port of the MS464xx 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 MS464xx VNA and 3739A, 3739B, or 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 on page 5-2.

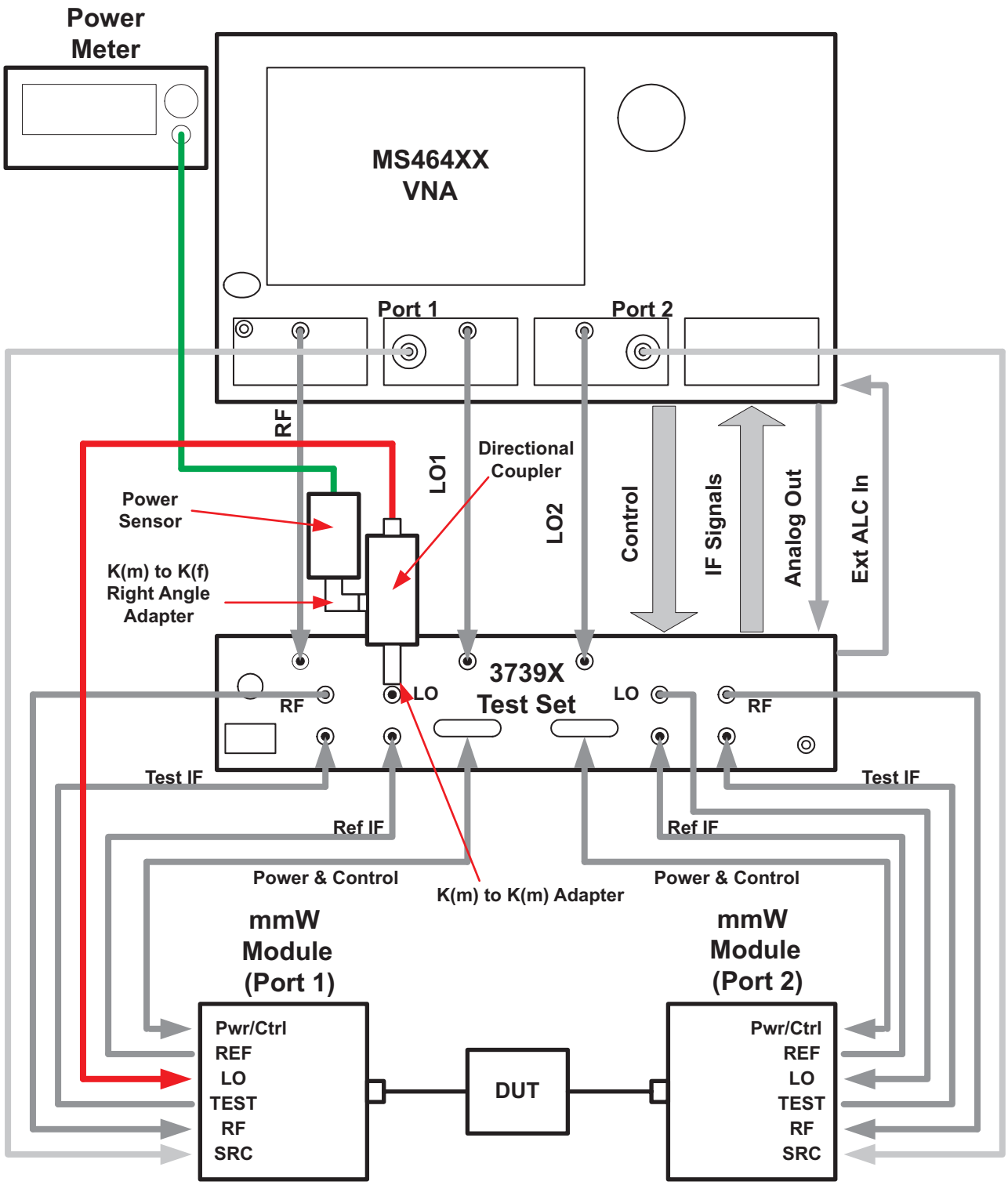


Figure 5-1. LO Level Cal Setup (Broadband Configuration shown)

7. Disconnect the LO cable from the Port 1 LO connector of the 3739A, 3739B or 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 MS464xx 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.

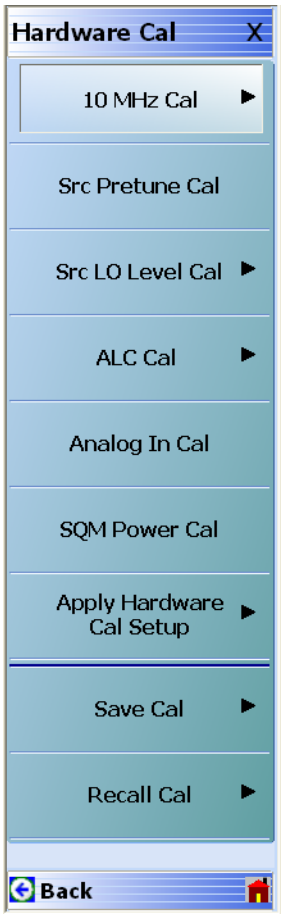


Figure 5-4. HARDWARE CAL Menu

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

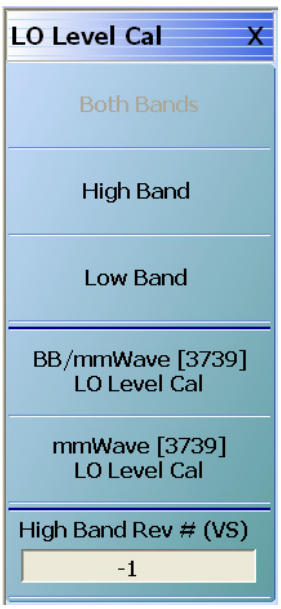


Figure 5-5. LO LEVEL CAL Menu

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

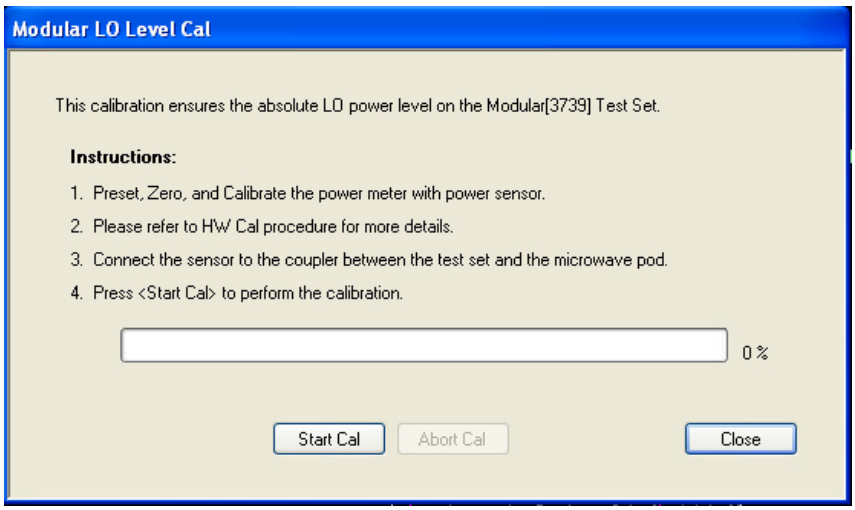


Figure 5-6. Modular LO LEVEL CAL Dialog Box

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 3739A, 3739B or 3739C Test Set and re-connect the LO cable.

5-3 ALC Level Calibration

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. Ensure that all system components have been assembled per **VectorStar ME7838 Series Broadband/mmWave VNA System Installation Guide – 10410-00293**.
2. 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**.
3. 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 4.
4. Install a GPIB interface cable between the Anritsu ML243XA power meter GPIB port and the **Dedicated GPIB** port of the MS464xx VNA.
5. 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.
6. 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
7. 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
8. Install the Anritsu SC7770 power sensor to the Anritsu ML2437A or ML2438A power meter.
9. Install the Keysight W8486A power sensor to the Keysight 437B, E4418B, or N1913A power meter.
10. 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.

11. 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.

12. 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.

13. 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.

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

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

16. 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.

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

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

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

20. The Diagnostics Access dialog box appears providing an entry field to enter the diagnostics access password as shown below in Figure 5-7.

Figure 5-7. DIAGNOSTICS ACCESS Dialog Box

21. Select Hardware Cal to access the Hardware Cal menu as shown in Figure 5-8.

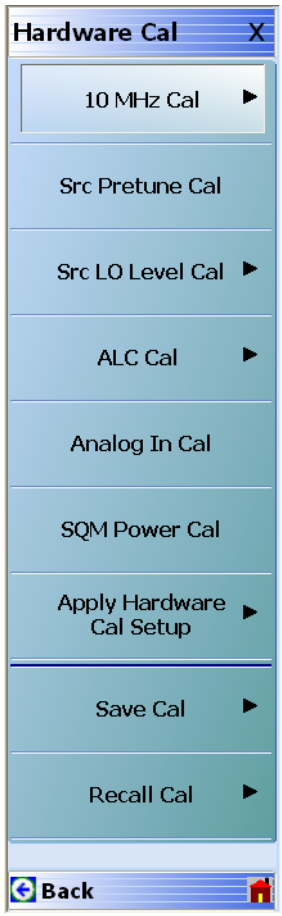


Figure 5-8. HARDWARE CAL Menu

22. Select ALC Cal; the ALC Level Cal menu appears as shown in Figure 5-9.

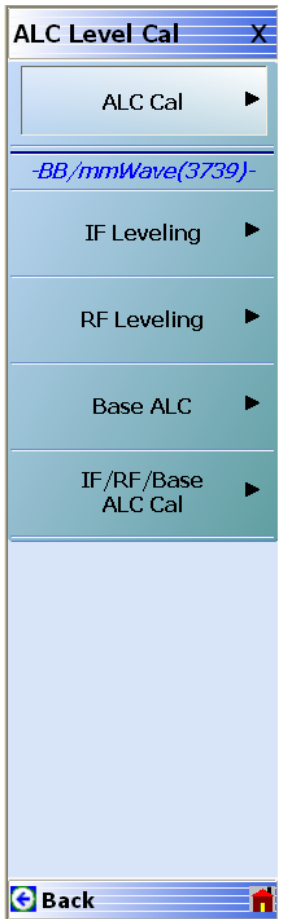


Figure 5-9. ALC LEVEL CAL Menu

ALC Calibration Procedure – Broadband Configuration

1. Select IF/RF/Base ALC Cal; the ALC[3739-All] menu appears as shown in Figure 5-9.

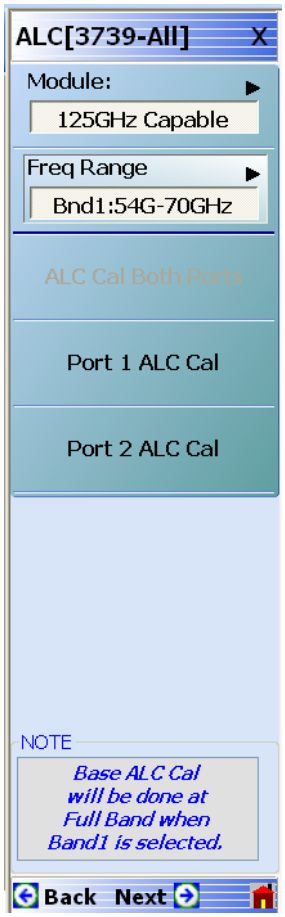


Figure 5-10. ALC[3739-All] Menu

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

Port 1 ALC Calibration

3. Confirm that Freq Range displays Bnd1:54G-70GHz. If not, select Freq Range and select Band 1.
4. Connect the Anritsu SC7770 power sensor to the Test Port of the mmWave Module at Port 1.
5. Select Port 1 ALC Cal.
6. Click the Start Cal button to start the calibration.
7. 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. If the mmWave Modules are MA25300A or MA25400A, remove the 33W.8F50 Adapter from the Anritsu SC7770 power sensor and install the adapter to the 35WR10WF adapter mounted on the Keysight W8486A power sensor before connecting it to the Test Port of the Millimeter Module at Port 1.
8. Change the Freq Range to Bnd2:70G-125GHz.
9. Select Port 1 ALC Cal.
10. Click the Start Cal button to start the calibration.
11. When calibration is complete, disconnect the Keysight W8486A power sensor from the Test Port of the Millimeter Module at Port 1. Skip to Step 32 if the mmWave Modules are not MA25300A or MA25400A.

12. Connect the ELVA-1 WR06 170 GHz Power Sensor to the Test Port of the mmWave Module at Port 1. For the MA25400A module, remove the 33.8G50 Adapter from the mmWave Module at Port 1 and install the 35WR5G Adapter prior to connecting the ELVA-1 WR06 170 GHz Power Sensor to the Test Port of the mmWave Module at Port 1.
13. Change the Freq Range to Bnd3:125G-145GHz (Bnd3:125G-170GHz for MA25400A).
14. Select Port 1 ALC Cal.
15. Click the Start Cal button to start the calibration.
16. When calibration is complete, disconnect the ELVA-1 WR06 170 GHz Power Sensor from the Test Port of the mmWave Module at Port 1. Skip to Step 26 if the mmWave Modules are not MA25400A.
17. Connect the ELVA-1 WR05 220 GHz Power Sensor to the Test Port of the mmWave Module at Port 1.
18. Change the Freq Range to Bnd4:170G-220GHz.
19. Select Port 1 ALC Cal.
20. Click the Start Cal button to start the calibration.
21. When the calibration is complete, disconnect the ELVA-1 WR05 220 GHz Power Sensor from the Test Port of the mmWave Module at Port 1.

Port 2 ALC Calibration

22. Connect the ELVA-1 WR05 220 GHz Power Sensor to the Test Port of the mmWave Module at Port 2.
23. Select Port 2 ALC Cal.
24. Click the Start Cal button to start the calibration.
25. When the calibration is complete, disconnect the ELVA-1 WR05 220 GHz Power Sensor from the Test Port of the mmWave Module at Port 2.
26. Change the Freq Range to Bnd3:125G-145GHz (Bnd3:125G-170GHz for MA25400A).
27. Connect the ELVA-1 WR06 170 GHz 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 calibration is complete, disconnect the ELVA-1 WR06 170 GHz Power Sensor from the Test Port of the mmWave Module at Port 2. If the mmWave Modules are MA25400A, remove the 35WR5G Adapter from the mmWave Module at Port 2 and install the 33.8G50 Adapter.
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. If the mmWave Modules are MA25300A or MA25400A, remove the 33W.8F50 Adapter from the Keysight W8486A power sensor and install the adapter to the Anritsu SC7770 power sensor.
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.

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**, part number 10410-00311.

Port 1 IF Leveling Calibration

1. Select IF Leveling. The ALC [3739-IF] menu as shown in Figure 5-11 on page 5-14 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.

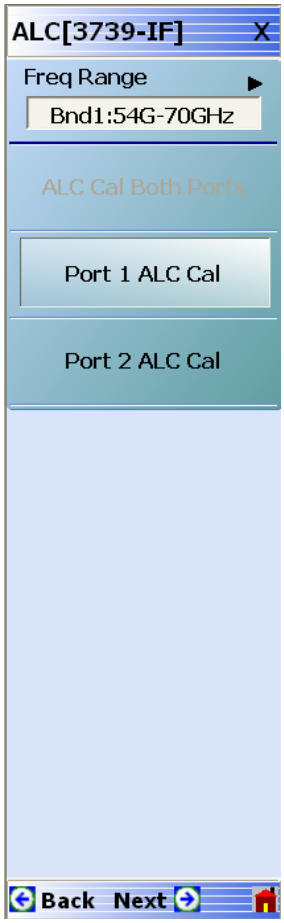


Figure 5-11. ALC [3739-IF] Menu

Port 1 RF Leveling Calibration

11. Select Back and then RF Leveling. The ALC [3739-RF] menu as shown in Figure 5-12 on page 5-15 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.

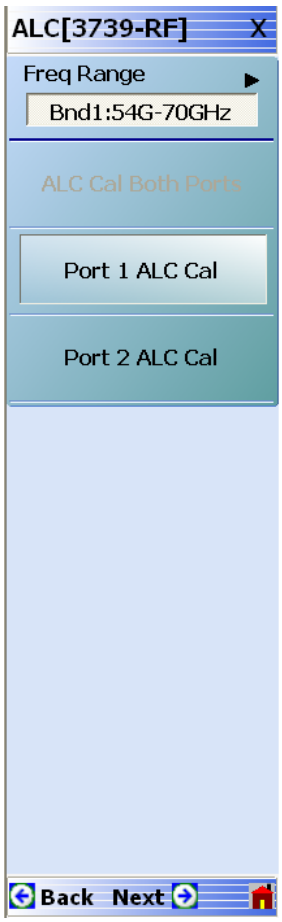


Figure 5-12. ALC [3739-RF] Menu

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.

Chapter 6 — Troubleshooting

6-1 Introduction

This chapter provides information about troubleshooting tests that can be used to check the ME7838 Series VNA System for proper operation. These tests are intended to be used as a troubleshooting tool for identifying the faulty system components and checking the functionality of internal components and sub-assemblies in the 3739A, 3739B and 3739C Broadband Test Sets.

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 3739X 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 ME7838 Series VNA System consists of the following major components:

- MS464X Series VectorStar VNA
- 3739A, 3739B or 3739C Broadband Test Set
- mmWave Modules (2 each)

A good understanding of the respective ME7838 Series 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 and Section 4-5 “ME7838A/AX System Operation – Broadband Configuration” on page 4-10 through Section 4-10 “ME7838G System Operation” on page 4-15.

It is also imperative to isolate whether the system fault is in the MS4640 Series VectorStar VNA, the 3739x Broadband Test Set, or mmWave Modules.

Suggested Troubleshooting Strategy

The suggested troubleshooting strategy for ME7838 Series Broadband/mmWave VNA System is as follows:

- Ensure that both VNA and Test Set can be powered up.
- Ensure that no setup and installation errors exist (e.g. cabling error and cable connection). Refer to the VectorStar ME7838 Series VNA System Installation Guide – part number 10410-00293.
- Isolate the fault to a system components (e.g. VNA, Test Set, or mmWave Module) using a process of elimination. Refer to the “General Troubleshooting of the System” on page 6-2.

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

6-4 General Troubleshooting of the System

This section provides general troubleshooting procedures of the ME7838 Series VNA System. It assumes that setup and installation errors have been eliminated.

Procedure

1. Ensure that the system is sweeping in the system specified frequency range (e.g.70 kHz to 110 GHz for ME7838A/AX Broadband configuration, 56 to 94 GHz for Banded mmWave configuration using the 3744A-EE modules), with Trace 1 set to S11, Trace 2 set to S12, Trace 3 set to S21, and Trace 4 set to S22.
2. Determine whether the fault occurs only in forward sweep (S11, S21), only in reverse sweep (S12, S22) or in both sweeps (S11, S21, S12, S22).
3. If the fault occurs at all frequencies and both sweeps, you can assume that the fault lies in the MS464xx VNA. Refer to Chapter 4 of the **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268** or Chapter 5 of the **VectorStar MS4640B Series VNA Maintenance Manual – 10410-00320** for troubleshooting information.
4. If the fault occurs at any frequency below 30 GHz, you can assume that the fault lies in the MS4647A or MS4647B VNA in the ME7838 Series Broadband VNA system.
5. If the fault occurs at any frequency starting at 30 GHz or above, do the following:
   a. Perform the “Troubleshooting Test – VNA Source and LO Power Level Check” on page 6-4.
      - If the RF, LO1 or LO2 power level is low, then the fault lies in the MS464xx VNA.
   b. Perform the “Troubleshooting Test – Non-Ratio Power Level Check” on page 6-6.
      - 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 3739X Test Set. If the fault is below 54 GHz, the fault lies in the MS4647A or MS4647B 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 3739X Test Set; assuming that the MS464xx 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 3739X Test Set. If the fault is below 54 GHz, the fault lies in the MS4647A or MS4647B 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 3739X Test Set; assuming that the MS464xx VNA has passed the VNA Source and LO Power Level Check.

c. Refer to "General Troubleshooting of the 3739A Test Set" on page 6-7 for procedures to further isolate if the fault is in the 3739A Test Set.

d. Refer to "General Troubleshooting of the 3739B/C Test Set" on page 6-13 for procedures to further isolate if the fault is in the 3739B/C Test Set.

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

The VNA Source and LO Power Level Check verifies that sufficient levels of source power and LO power are supplied to the 3739A, 3739B or 3739C Test Set.

Note	This test assumes that the ME7838A/AX system is assembled per the **VectorStar ME7838 Series 2-Port Broadband/Banded mmWave VNA System Installation Guide – 10410-00293.**

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

Procedure

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 MS464xx VNA.

RF Port Output Level Check

4. Set the VNA Start Frequency to 54 GHz and Stop Frequency of the ME7838 Series VNA system.

5. Turn on CW Mode.

6. Connect the power sensor to the **RF** port of the MS464xx 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 MS464xx VNA.

Table 6-1. Expected VNA RF Output Level (1 of 2)

VNA Set Freq	RF Port Output Freq	Expected Power Level
54.0000001 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

Table 6-1. Expected VNA RF Output Level (2 of 2)

VNA Set Freq	RF Port Output Freq	Expected Power Level
180 GHz	15 GHz	0 dBm
220 GHz	16.67 GHz	0 dBm

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 MS464xx 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 MS464xx 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 MS464xx 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 ME7838A/AX and ME7838E/EX)
- Anritsu 3659 Calibration / Verification Kit (For ME7838D)
- Anritsu 3655E-1 WR-12 Calibration Kit (For ME7838A/AX/E/EX Banded mmWave configuration)
- Anritsu 3655W-1 WR-10 Calibration Kit (For ME7838A/AX/E/EX Banded mmWave configuration)
- Anritsu 33GG50 Through-line Adapter (For ME7838G)

Procedure

1. Ensure that the system is sweeping the system's specified frequency range (e.g. 70 kHz to 110 GHz for ME7838A/AX Broadband configuration), with Trace 1 set to S11, Trace 2 set to S12, Trace 3 set to S21, and Trace 4 set to S22.
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 A1, Denominator to 1, and Driver Port to Port 1.
5. Use a mouse to move the Reference Line to one graticule below top scale.
6. Repeat Step 2 through Step 5 for Trace 2, setting Numerator to B2, Denominator to 1 and Driver Port to Port 2 (Port 1 for MA25400A).
7. Repeat Step 2 through Step 5 for Trace 3, setting Numerator to B1, Denominator to 1 and Driver Port to Port 1 (Port 2 for MA25400A).
8. Repeat Step 2 through Step 5 for Trace 4, setting Numerator to A2, Denominator to 1 and Driver Port to Port 2.
9. Connect shorts to both test ports on the mmWave Modules. If mmWave Modules are MA25400A, install 33GG50 Through-line Adapter between the mmWave Modules.
10. Observe whether any portions of these traces show any abnormality (e.g. very low power level).

6-7 General Troubleshooting of the 3739A Test Set

This section provides general troubleshooting procedures of the 3739A Test Set.

Suggested Troubleshooting Steps

The suggested troubleshooting steps for 3739A Test Set are as follows:

- Verify that the DC voltages from the power supply are at the expected level. Refer to "Troubleshooting Test – 3739A Power Supply DC Check" on page 6-8.
- Verify that the DC bias voltages of RF components and fan assembly are present on the Test Set A1 Bias Control PCB Assembly. Refer to "Troubleshooting Test – 3739A A1 Bias Control PCB DC Bias Check" on page 6-10.
- Verify that the power level of the Port 1 RF port and Port 2 RF port are at the expected level. Refer to "Troubleshooting – 3739A Test Set Port Power Level Check" on page 6-11.
- Verify that the power level of the Port 1 LO port and Port 2 LO port are at the expected level. Refer to "Troubleshooting – 3739A Test Set Port Power Level Check" on page 6-11.

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

6-8 Troubleshooting Test – 3739A Power Supply DC Check

This procedure verifies that the expected DC voltages from the power supply is present in the 3739A Test Set.

Equipment Required

- Digital Multimeter

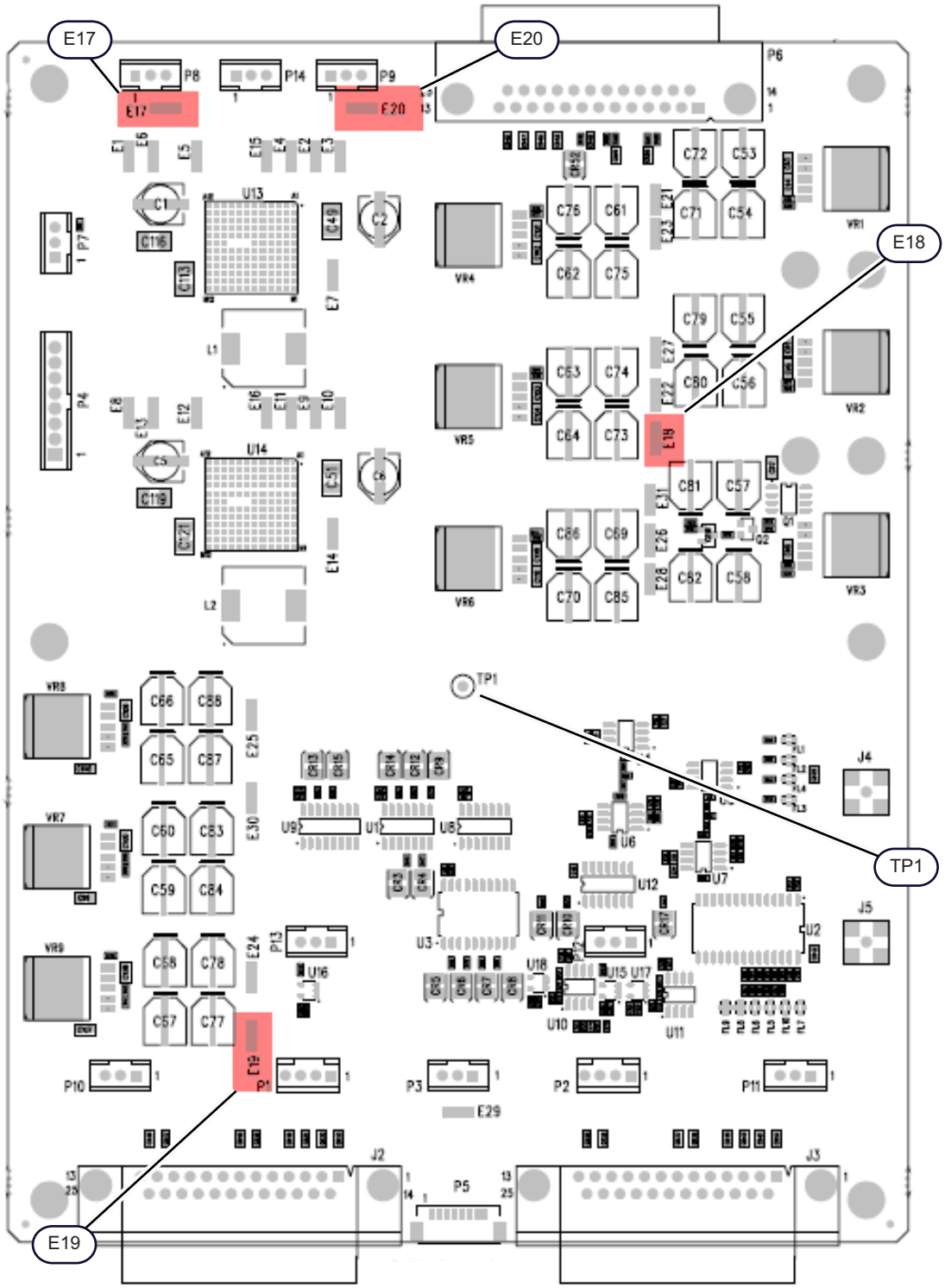
Procedure

1. Turn off the 3739A Test Set and unplug the AC power cord.
2. Remove the top cover of the 3739A Test Set.
3. Connect the Test Set to AC power and turn the unit back on.
4. Use a digital multimeter to measure the DC voltages at the test points stated in Table 6-2 on the Test Set Bias Control PCB Assembly and verify if they are at the expected level. Refer to Figure 6-1 on page 6-9 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

5. If any of the voltages is not present, replace the power supply.



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

Figure 6-1. Locations of Power Supply Voltage Test Points on 3739A A1 Board

6-9 Troubleshooting Test – 3739A 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 3739A Test Set chassis.

Equipment Required

- Digital Multimeter

Procedure

1. Turn off the 3739A Test Set and unplug the AC power cord.
2. Remove the top cover of the 3739A Test Set.
3. Unplug the cable harnesses connected to the connectors listed in Table 6-3
4. Connect the Test Set to AC power and turn the unit back on.
5. Use a digital multimeter to measure the DC voltages presented at the connectors per Table 6-3. Refer to Figure 6-1 on page 6-9 for connector locations.

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

Connector	Function	Common (Pin)	Measure (Pin)	Expected DC Voltage
P1	LO1 Amp Bias	2	3	–12 V
		2	4	+12 V
P2	LO2 Amp Bias	2	3	–12 V
		2	4	+12 V
P3	Source Amp Bias	3	1	+4.5 V
		3	2	–0.05 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

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

6-10 Troubleshooting – 3739A Test Set 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

Procedure

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 3739A Test Set.

RF Port Output Level Check

4. Set the VNA Start Frequency to 54 GHz and Stop Frequency to 110 GHz.
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 3739A 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

9. Set the VNA Trace 1 to S22.
10. Connect the power sensor to the Port 2 RF port of the 3739A 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 3739A 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, do the following:

- **a.** Power off the 3739A Test Set.
- **b.** Remove the Port 1 Isolator bracket mounting screws.
- **c.** Disconnect the Right-angle adapter from the Port 1 LO Amplifier.
- **d.** Connect the cable from Spectrum Analyzer RF input to the output of the Port 1 LO Amplifier.
- **e.** Power on the 3739A Test Set.
- **f.** Check if the Port 1 LO Amplifier output level is low.
- **g.** If the level is <–9 dBm, then replace the Port 1 LO Amplifier.
- **h.** If the level is >–9 dBm, then replace the Port 1 LO Modulator.

Port 2 LO Port Output Level Check

19. Disconnect the Spectrum Analyzer Input RF Cable from the Port 1 LO port of the 3739A 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, do the following:

- **a.** Power off the 3739A Test Set.
- **b.** Remove the Port 2 Isolator bracket mounting screws.
- **c.** Disconnect the Right-angle adapter from the Port 2 LO Amplifier.
- **d.** Connect the cable from Spectrum Analyzer RF input to the output of the Port 2 LO Amplifier.
- **e.** Power on the 3739A Test Set.
- **f.** Check if the Port 2 LO Amplifier output level is low.
- **g.** If the level is <–9 dBm, then replace the Port 2 LO Amplifier.
- **h.** If the level is >–9 dBm, then replace the Port 2 LO Modulator.

6-11 General Troubleshooting of the 3739B/C Test Set

This section provides general troubleshooting procedures of the 3739B/C Test Set.

Suggested Troubleshooting Steps

The suggested troubleshooting steps for 3739B/C Test Set are as follows:

- Verify that the DC voltages from the power supply are at the expected level. Refer to "Troubleshooting Test – 3739B/C Power Supply DC Check" on page 6-14
- Verify that the DC bias voltages of RF components and fan assembly are present on the Test Set Bias Control PCB Assembly. Refer to "Troubleshooting Test – 3739B/C A1 Bias Control PCB DC Bias Check" on page 6-17.
- Verify that the power level of the Port 1 RF port and Port 2 RF port are at the expected level. Refer to "Troubleshooting – 3739B/C Test Set Port Power Level Check" on page 6-18.
- Verify that the power level of the Port 1 LO port and Port 2 LO port are at the expected level. Refer to "Troubleshooting – 3739B/C Test Set Port Power Level Check" on page 6-18.

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.

6-12 Troubleshooting Test – 3739B/C Power Supply DC Check

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

Equipment Required

- Digital Multimeter

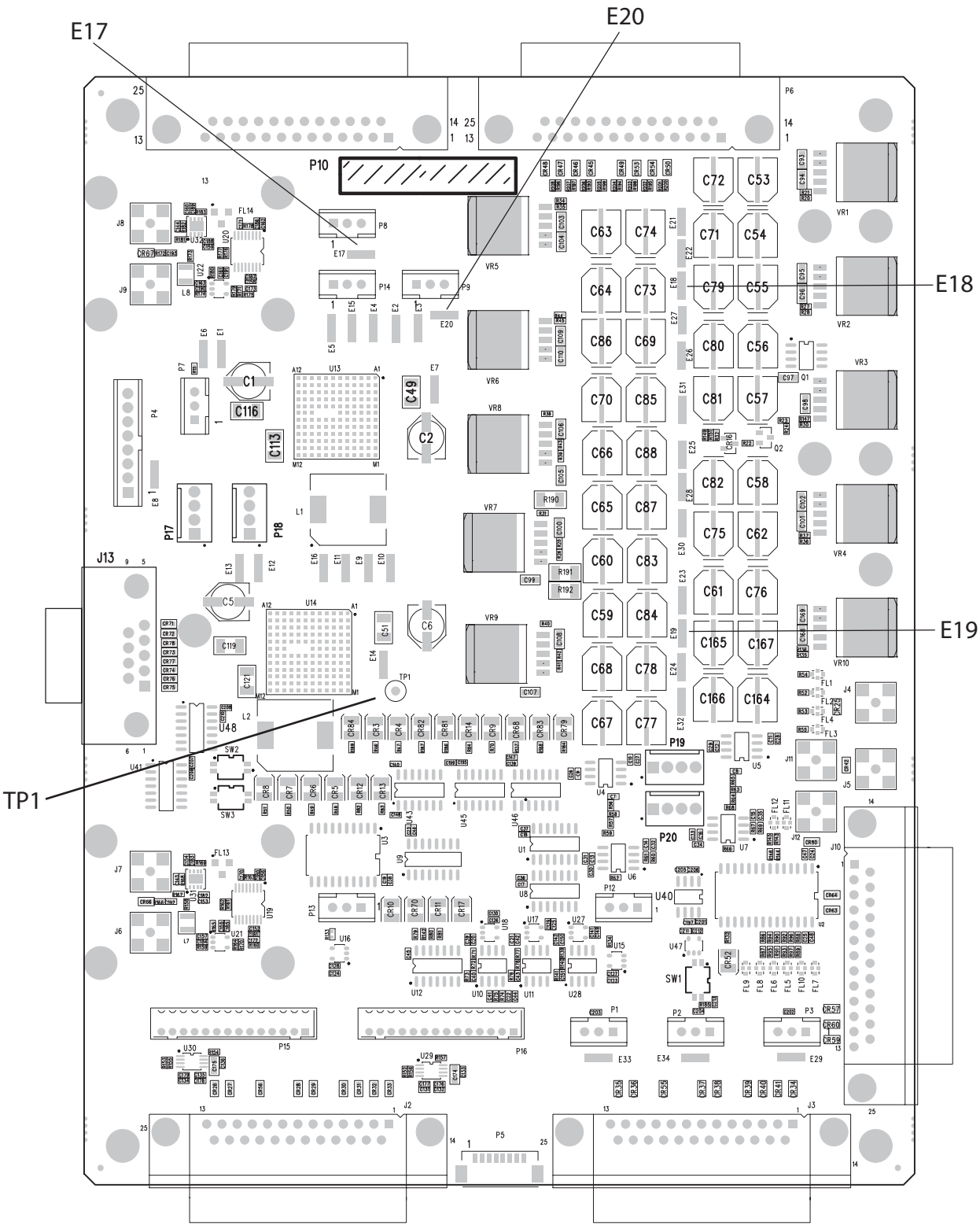
Procedure

1. Turn off the 3739B/C Test Set and unplug the AC power cord.
2. Remove the top cover of the 3739B/C Test Set.
3. Remove the stiffener plate.
4. Connect the Test Set to AC power and turn the unit back on.
5. Use a digital multimeter to measure the DC voltages at the test points stated in Table 6-5 on the Test Set Bias Control PCB Assembly and verify if they are at the expected level. Refer to Figure x for locations of test points.

Table 6-5. Power Supply Expected DC Voltages

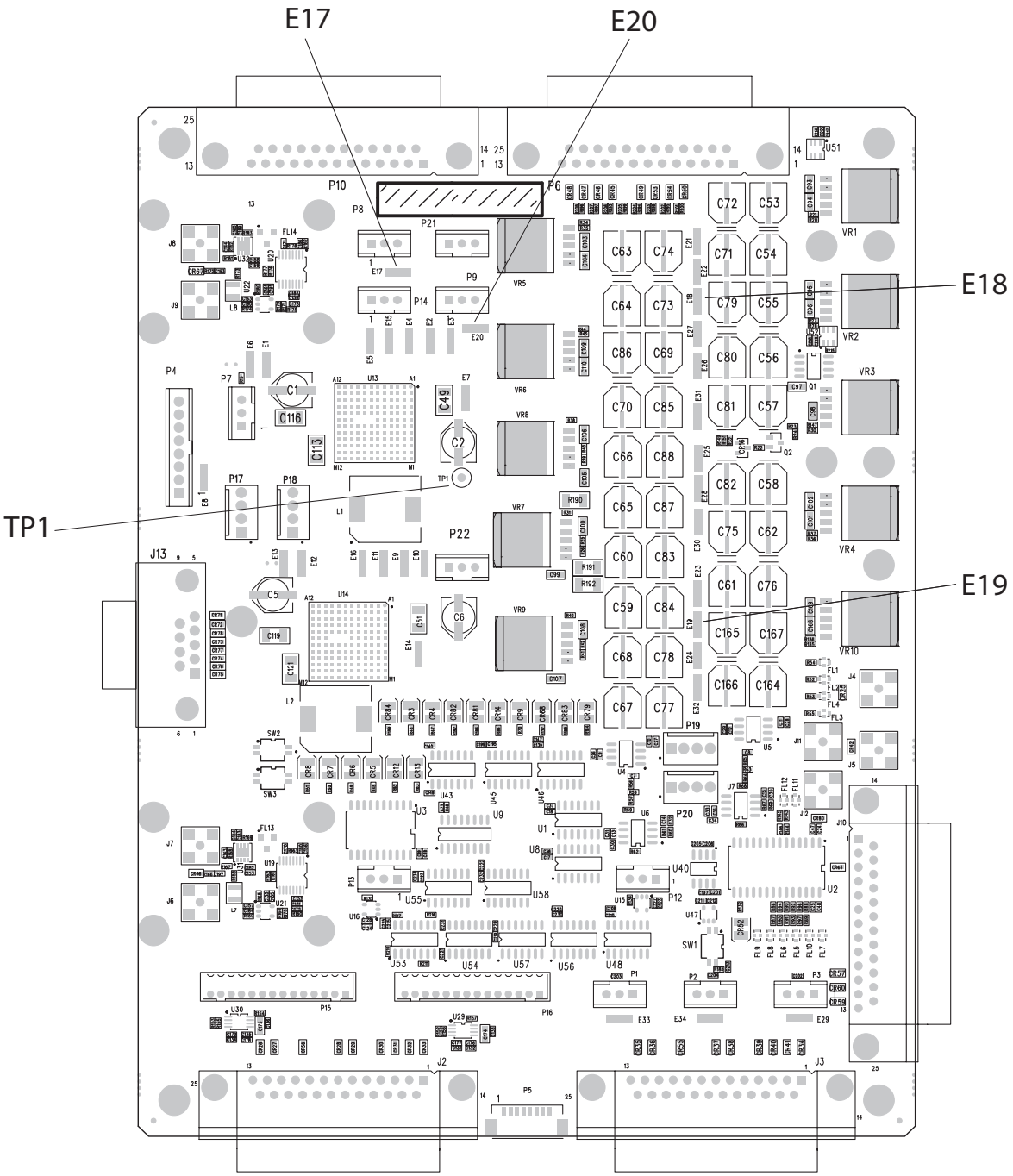
Test Point	Common	Expected Voltage
E17	**TP1**	+5 V
E18	**TP1**	+12 V
E19	**TP1**	–12 V
E20	**TP1**	+12 V

6. If any of the voltages is 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 3739B A1 Board



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

Figure 6-3. Locations of Power Supply Voltage Test Points on 3739C A1 Board

6-13 Troubleshooting Test – 3739B/C 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 3739B/C Test Set chassis.

Equipment Required

- Digital Multimeter

Procedure

1. Turn off the 3739B/C Test Set and unplug the AC power cord.
2. Remove the top cover of the 3739B/C 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 the connectors per. Refer to Figure 6-1 on page 6-9 for connector locations.

Table 6-6. 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.

6-14 Troubleshooting – 3739B/C Test Set 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
- Anritsu 41KC-20 20 dB Fixed Attenuator

Procedure

1. Turn on the Power Meter and allow it to warm up at least 30 minutes.
2. Calibrate the power sensor and install the 20 dB Fixed Attenuator to the power sensor input. Make sure to add the 20 dB offset to the power meter setting.
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 3739B/C 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 ME7838 Series 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 3739B/C 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 6-7. Expected Test Set RF Output Level (1 of 2)

VNA Set Freq	RF Port Output Freq	Expected Power Level
54 GHz	27 GHz	+17 dBm
68 GHz	34 GHz	+17 dBm
80 GHz	40 GHz	+17 dBm
80.1 GHz	26.7 GHz	+17 dBm
95 GHz	31.7 GHz	+17 dBm
110 GHz	36.7 GHz	+17 dBm
120 GHz	20 GHz	+17 dBm
140 GHz	23.4 GHz	+17 dBm
160 GHz	13.33 GHz	+17 dBm

Table 6-7. Expected Test Set RF Output Level (2 of 2)

VNA Set Freq	RF Port Output Freq	Expected Power Level
180 GHz	15 GHz	+17 dBm
220 GHz	16.67 GHz	+17 dBm

9. Set the VNA Trace 1 to S22.

10. Connect the power sensor to the Port 2 RF port of the 3739B/C 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 3739B/C 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 (21 GHz for ME7838G system).

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 for ME7838A/AX/D/E/EX systems and between 5 and 20 GHz for ME7838G systems.

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 3739B/C 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.

Chapter 7 — Removal and Replacement Procedures for 3739A

7-1 Introduction

This chapter provides procedures for removing and re-installing the replaceable components and sub-assemblies in the 3739A Test Set.

7-2 Disassembly – Power, Disconnect, and Covers

Use this procedure to prepare the 3739A 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.

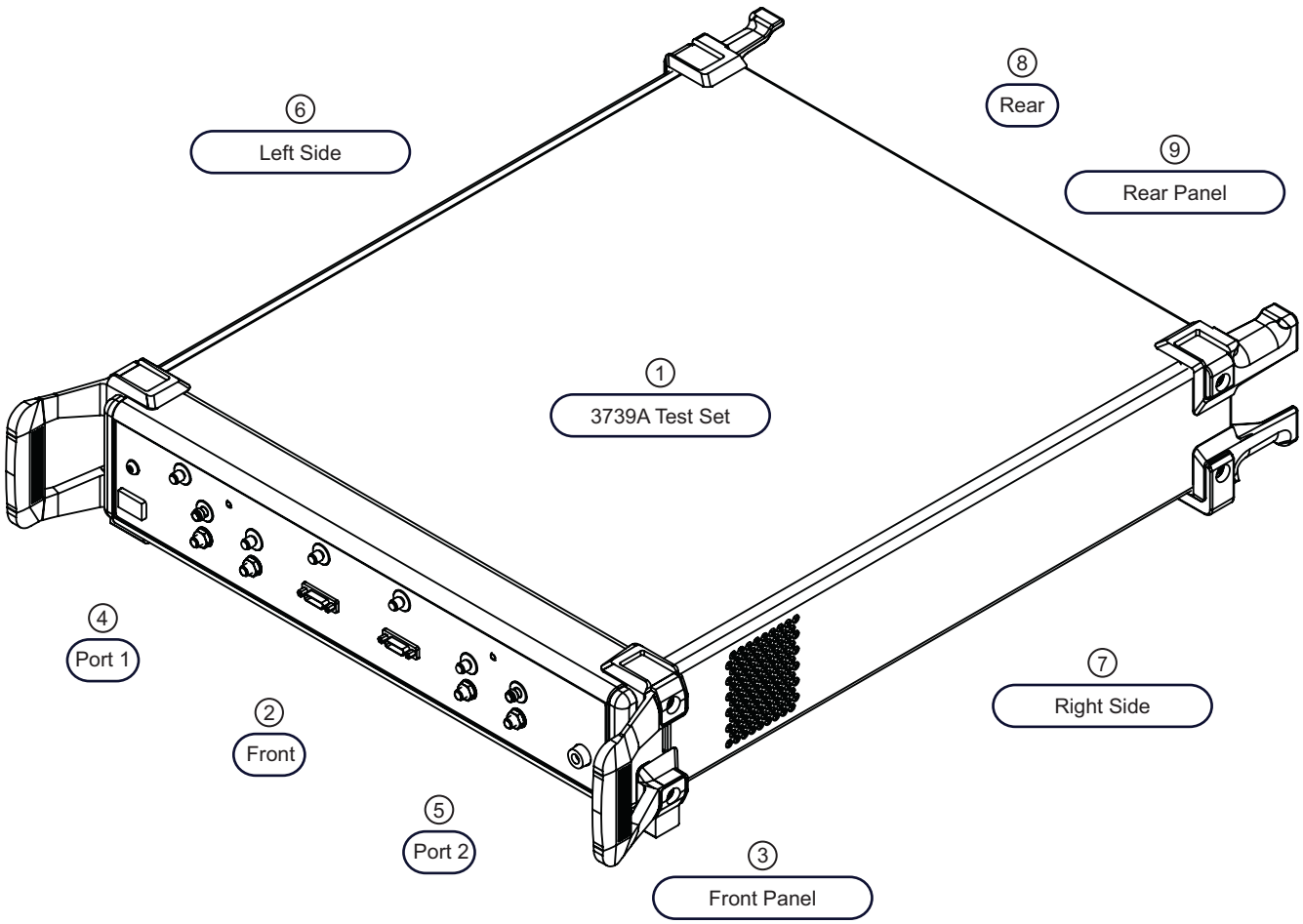
1. Prepare a clean and static free work area. Make sure the work area is well grounded. Cover the work surface with a soft, clean anti-static mat.
2. Provide all personnel with appropriate anti-static grounding wrist straps and similar equipment.
3. Power down the VNA.
4. Power down the Test Set.
5. Disconnect the rear panel cables between VNA and the Test Set. Disconnect the Power Cable from the AC Mains.
6. When the 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.
7. Disconnect the front panel cables between the VNA/Test Set and the mmWave Modules.
8. Set the mmWave Modules and the Port-to-Module Note aside in a secure, clean, and anti-static environment.
9. Make sure all VNA front rear panel cables have been disconnected. Remove VNA from the top of the Test Set.

Caution

The weight of a fully equipped MS464xA 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.

10. Set the VNA aside in a secure, clean, and anti-static environment.

11. Move the Test Set to the repair area.



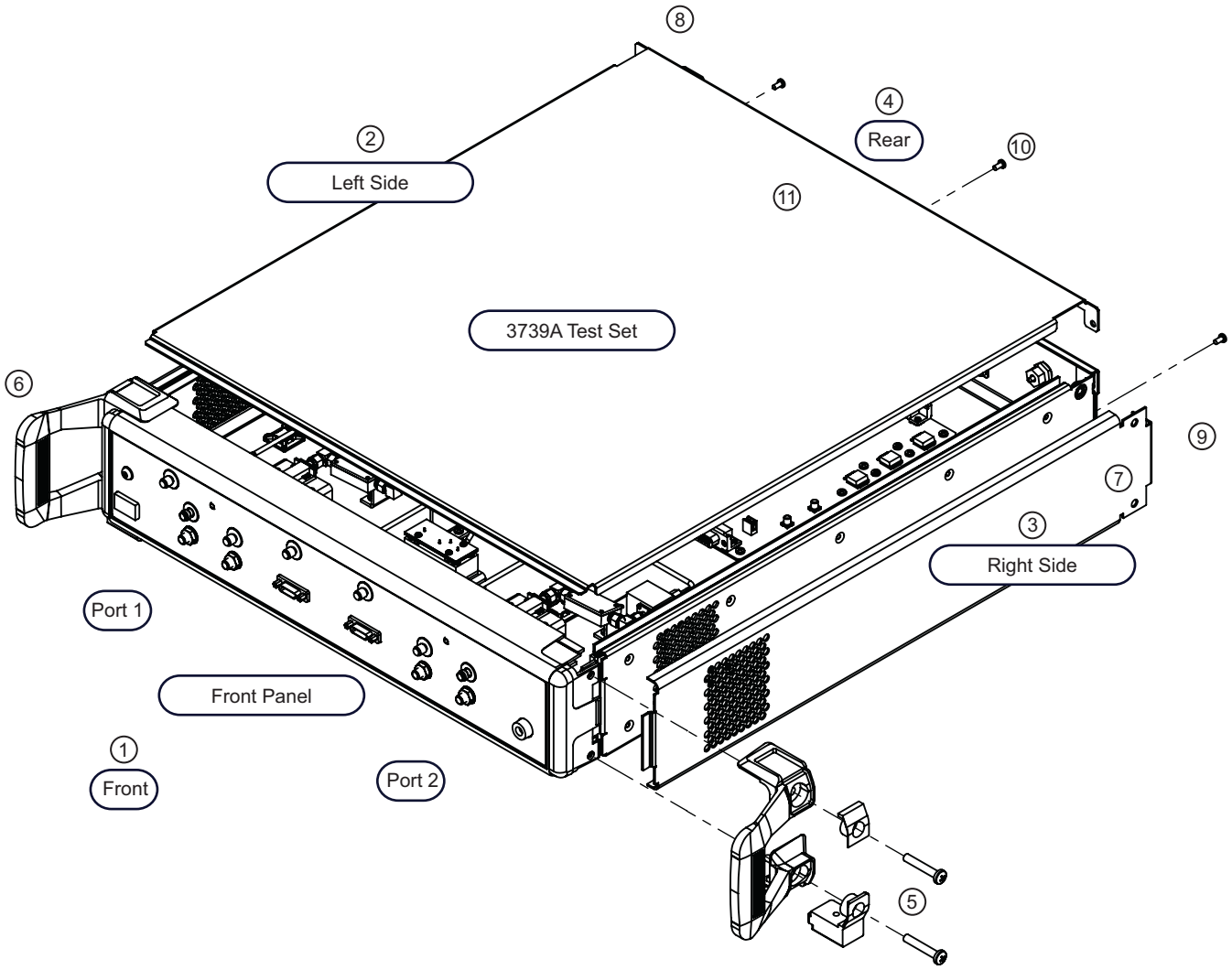
All orientation is when viewed from the front. 1 – 3739A Test Set – With Top Cover, Front Handles, and Rear Feet attached to unit. 2 – Test Set Front 3 – Front Panel Assembly – RF, LO1, and LO2 connectors at top connect to MS464xA VNA RF Deck. 4 – Port 1 Connectors – RF, LO, Power, Test, and Ref – Power Switch and LED to left.	5 – Port 2 Connectors – Power, LO, RF, Ref, and Test – Ground plug to right. 6 – Left Side 7 – Right Side 8 – Test Set Rear 9 – Rear Panel Assembly

Figure 7-1. 3739A Broadband/mmWave Test Set

12. As shown below in Figure 7-2 on page 7-3, remove top cover.

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.

13. Reattach the rear feet to the chassis.



1 – Test Set Front – Port 1 to left – Port 2 to right	7 – Right Side Dress Plate
2 – Test Set Left Side	8 – Rear Left Feet and Hardware – Removed here.
3 – Test Set Right Side	9 – Rear Right Feet and Hardware – Removed here.
4 – Test Set Rear Panel	10 – Top Cover Screws
5 – Front Right Side Handle, Feet, and Hardware	11 – Top Cover – Lift from rear
6 – Front Left Side Handle, Feet, and Hardware	

Figure 7-2. 3739A Test Set – Initial Disassembly and Removing Top Cover

7-3 Reassembly – Power, Disconnect, and Covers

Use this procedure to reassemble the Test Set and reconnect it to the VNA.

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

Caution

The weight of a fully equipped MS464xA 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.

Connect Rear Panel Cables

8. Connect the rear panel IF cables:
   - **a.** VNA a1 IF to Test Set IF Output a1
   - **b.** VNA b1 IF to Test Set IF Output b1
   - **c.** VNA a2 IF to Test Set IF Output a2
   - **d.** VNA b2 IF to Test Set IF Output b2
9. Connect the rear panel BNC cables:
   - **a.** VNA Ext Analog Out (left) to Test Set Ext Analog In (lower)
   - **b.** VNA Ext ALC (right) to Test Set Ext ALC Out (upper)
10. Connect the rear panel I/O cable: VNA External I/O to Test Set External I/O.
11. If used, connect a GPIB cable to either the IEEE 488.2 GPIB Connector and/or the Dedicated GPIB Connector.
12. Connect the VNA Power Cable to the VNA. Do not yet connect to AC Mains.
13. Connect the Test Set Power Cable to Test Set. Do not yet connect to AC Mains.

Front Panel VNA to Test Set Connections

14. Connect the three VNA to Test Set connections:
    - **a.** Connect VNA RF to Test Set RF. When correctly threaded, and tightened, torque to 0.9 N·m (8 lbf·in).
    - **b.** Connect the VNA LO1 to Test Set LO1. Tighten and torque as above.
    - **c.** Connect the VNA LO2 to Test Set LO2. Tighten and torque as above.

Port 1 Cable Connections to VNA and Test Set

15. Connect the Port 1 to Module Port 1 Cable Assembly to the Test Set. Note that each cable is clearly labeled:
    - **a.** Port 1 Test. Tighten and torque as above.
    - **b.** Port 1 Ref. Tighten and torque as above.
    - **c.** Port 1 RF. Tighten and torque as above.

d. Port 1 LO. Tighten and torque as above.

e. Power 1 Power and Signal. Fasten in place with two screws.

f. Route the other end of the cable assembly to the Port 1 Module location.

16. Connect the phase-stable cable to the VNA Test Port 1. Thread, tighten, and torque as above. Route the other end of the cable assembly to the Port 1 Module location.

Port 2 Cable Connections to VNA and Test Set

17. Connect the Port 2 to Module Port 2 Cable Assembly to the Test Set. Note that each cable is clearly labeled:

a. Port 2 Test. Tighten and torque as above.

b. Port 2 Ref. Tighten and torque as above.

c. Port 2 RF. Tighten and torque as above.

d. Port 2 LO. Tighten and torque as above.

e. Power 2 Power and Signal. Fasten in place with two screws.

f. Route the other end of the cable assembly to the Port 2 Module location.

18. Connect the phase-stable cable to the VNA Test Port 2. Thread, tighten, and torque as above. Route the other end of the cable assembly to the Port 2 Module location.

19. Place the modules into position, observing the correct module-to-port configuration.

20. If the modules were removed from their brackets (either the factory original or a user-defined), install them in the bracket, observing which side of the module is up.

- The factory as-shipped orientation is with the **RF**, **SRC**, and **LO** connectors and the **W1** connector closest to the bracket. The procedure steps below assume the factory as-shipped orientation.
- If the module orientation has been changed, the general recommendation is to install the cables and connectors closest to the bracket first.

Port 1 Module Connections

21. Connect the **SRC** cable to the Port 1 Module. Align, thread, tighten, and then use an 8 mm (5/16") torque end wrench and torque to 0.9 N·m (8 lbf·in), for 3743A mmWave Module only.

22. Connect the **RF** cable to the Port 1 Module. Thread and tighten as above.

23. Connect the **LO** cable to the Port 1 Module. Thread, tighten, and torque as above.

24. Connect the **REF** cable to the Port 1 Module. Insert, thread carefully, and gently tighten the SSMC connector. Tighten using a 4 mm (5/32") end wrench.

25. Connect the **TEST** cable to the Port 1 Module. Thread and tighten the SSMC connector as above.

26. Carefully, observing the connector polarity, match up the markings on the **Power/Signal** plug with the power/signal connector. The connector snaps into place.

Port 2 Module Connections

27. Following the same sequence as the sub-section above, connect the cables to the Port 2 Module.

a. SRC

b. RF

c. LO

d. REF

e. TEST

f. Power/Signal

VNA and Test Set Power Connections

28. Connect the VNA and Test Set to AC Mains power.

29. Power up the Test Set by pressing the front panel Power Switch. The Power LED should illuminate.

30. Power up the VNA as follows:

a. On the VNA Rear Panel, set the AC Power Rocker Switch to **ON** or "|". The VNA is in standby mode and the Front Panel orange Standby LED is illuminated.

b. On the VNA Front Panel, press the Standby/Operate key for at least one second. The green Operate LED illuminates. The splash screen appears, and the instrument starts.

7-4 Replaceable Part Chassis Locations

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

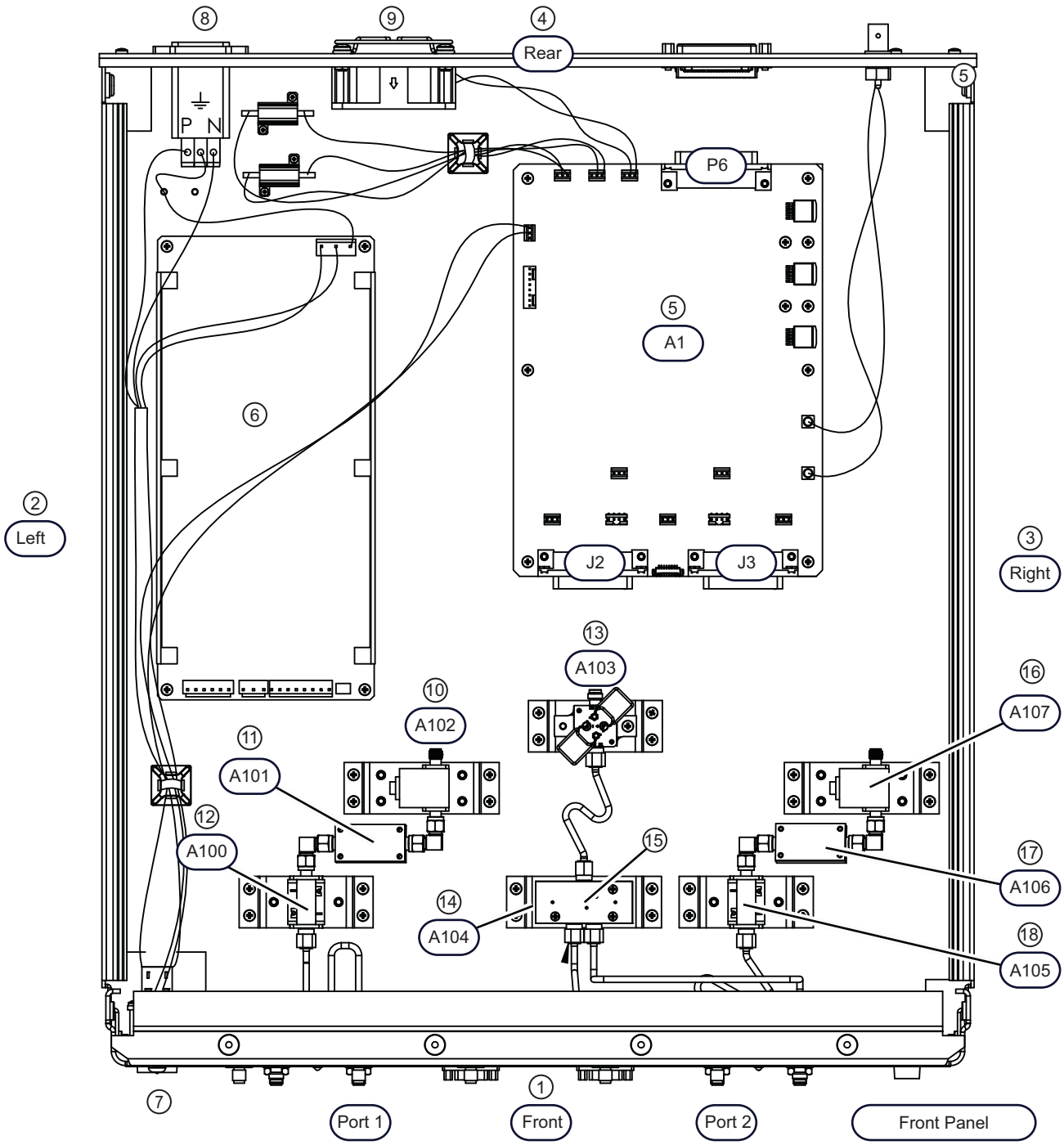


Figure 7-3. 3739A Test Set – Chassis Top Side – Major Component Locations (1 of 2)

1 – Test Set Front and Front Panel Assembly – ND73169 – Port 1 on left – Port 2 on right. 2 – Test Set Left Side 3 – Test Set Right Side 4 – Test Set Rear Panel 5 – A1 Bias Control PCB Assembly – ND73163 – 3-72143-3 – J2 connects to Port 1 Power, J3 connects to Port 2 Power, and P6 connects to Rear Panel External I/O. 6 – Power Supply Module – 3-40-183 – Not shown here is Power Supply Cable Harness – ND73168 – 71918. 7 – Front Panel Power Switch and Attached Cable Harness 8 – Rear Panel AC Input Module 9 – Rear Panel Fan Assembly	10 – A102 Isolator Module, Port 1, 5 GHz to 10 GHz – 3-1000-58 11 – A101 Modulator Module, Port 1 – ND73161 – 72231 – With soldered-on cable harness. 12 – A100 LO Amplifier Module, 0.01 GHz to 20 GHz, Port 1 – ND73159 – 3-1070-13 – With soldered-on cable harness. 13 – A103 RF Amplifier Module, 20 GHz to 40 GHz – ND73158 – 72234 – With soldered-on cable harness. 14 – A104, SPDT Switch Module, 0.04 to 40 GHz – 70242 15 – SPDT Switch Control PCB Assembly – ND70926 – 64951-3 – Mounts on top of the A104. A detachable cable connects to A1 PCB Connector P5. 16 – A107 Isolator Module, Port 1, 5 GHz to 10 GHz – 3-1000-58 17 – A106 Modulator Module, Port 2 – ND73162 – 72231 – With soldered-on cable harness. 18 – A105 LO Amplifier Module, 0.01 GHz to 20 GHz, Port 2 – ND73160 – 3-1070-13 – With soldered-on cable harness.

Figure 7-3. 3739A Test Set – Chassis Top Side – Major Component Locations (2 of 2)

7-5 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 on page 7-7.

Replacement Parts

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

Reference Figure

A representative Power Supply module is shown below in Figure 7-4. The installed version may differ slightly in appearance and color. The mounting hold and connector locations will be the same.

Figure 7-4. Power Supply Module – 3-40-183

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 7-1 above.
2. Remove the top cover as described in the procedure above.

Disconnect the Power Supply Cable Harness

3. On the front of the power supply, disconnect the Power Supply Cable Harness – ND73168 – 71918 from the power supply. On the power supply, when the power supply is viewed from the front of the chassis, the connectors are:

- Left Front Connector, 8 Pin Connector, Pin 1 on right.
- Center Front Connector, 3 Pin Connector, Pin 1 on right
- Right Front Connector, 6 Connector, Pin 1 on right
- The other end of the harness connects to the A1 PCB connector P4.

4. On the rear of the power supply, disconnect the 3 Pin Connector which connects to the rear panel AC Distribution Module and the front panel Power Switch.

Remove Power Supply

5. Remove the four Phillips pan head screws holding the Power Supply in place and remove the unit.

Remove Power Supply Cable Harness

6. Only perform this step is the harness is to be replaced. Otherwise, skip ahead to the next step. If the harness is to be replaced:

a. Disconnect the other end of the cable harness from the A1 PCB connector P4.

b. Remove the harness.

c. Connect the replacement harness to the A1 PCB connector P4.

Install Replacement Power Supply

7. Place the replacement power supply into the chassis, and loosely insert the four screws.

8. Make sure the power supply is correctly positioned, and then tighten all four screws.

Connect Power Supply Cable Harness

9. Reconnect the power supply cable harness. The connections are:

- Left Front Connector: 8 Pin Connector – Pin 1 on right.
- Center Front Connector: 3 Pin Connector – Pin 1 on right
- Right Front Connector: 6 Connector – Pin 1 on right
- The other end of the harness should be connected to the A1 PCB connector P4.

Common Reassembly Procedures

10. If no other interior replacement procedures are required, follow the common reassembly procedures described above in "Reassembly – Power, Disconnect, and Covers" on page 7-4.

7-6 A1 Bias Control PCB Assembly – ND73163-RFB

Use this procedure to replace A1 Bias Control PCB Assembly. The A1 PCB location is shown above in Figure 7-3 on page 7-7.

Replacement Parts

- A1 Bias Control PCB Assembly – ND73163-RFB

Reference Figures

The A1 Bias Control PCB is located near the rear center of the chassis as shown in Figure 7-3 on page 7-7 above. The A1 PCB Connector and Test Point locations are shown in below.

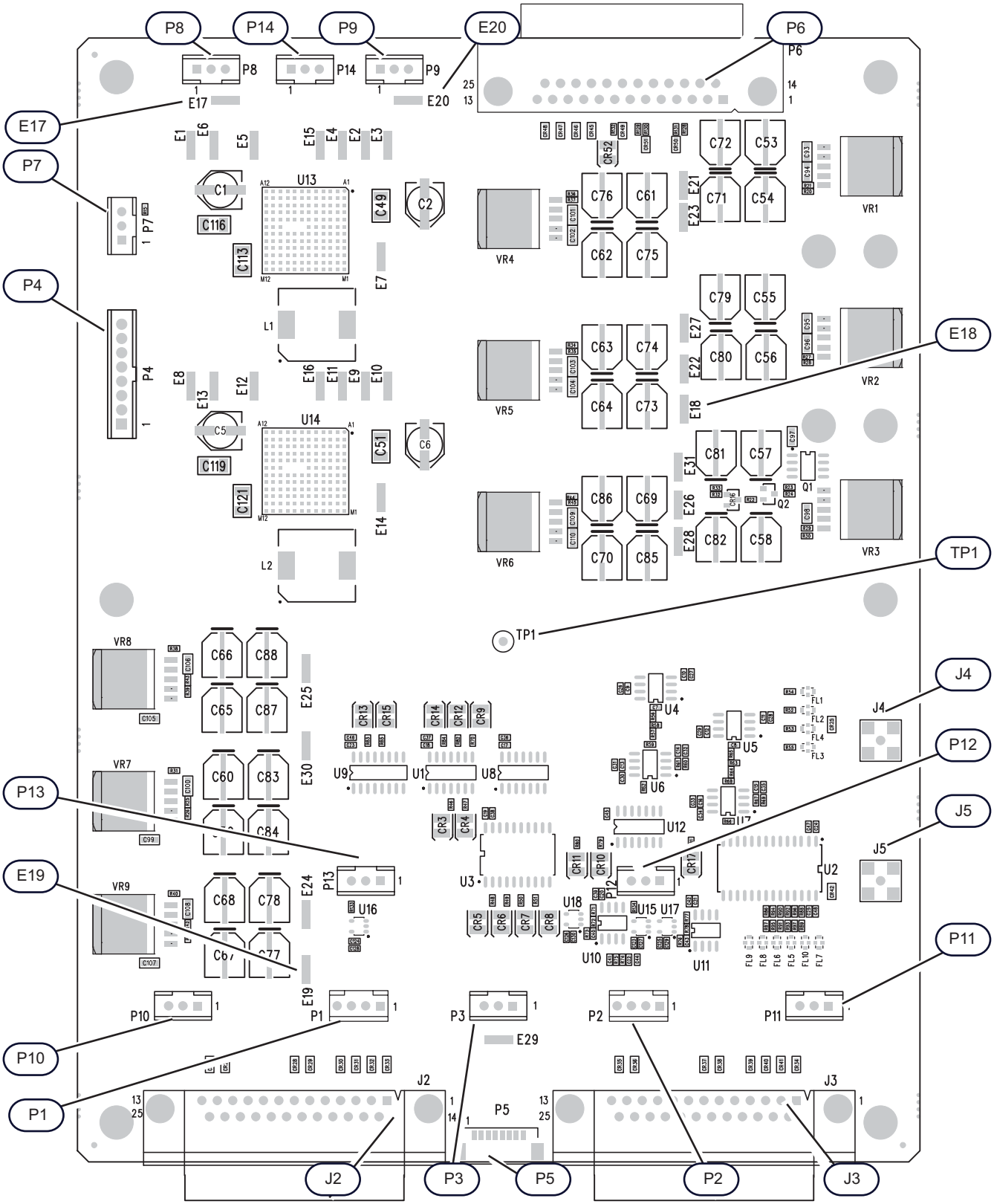


Figure 7-5. A1 Bias Control PCB Assembly – ND73163 – 3-72143-3 (1 of 2)

E17 – Test Point	P4 – To Power Supply Cable Harness
E18 – Test Point	P5 – To A104 SPDT Switch Module
E19 – Test Point	P6 – To Rear Panel, External I/O Connector
E20 – Test Point	P7 – To Front Panel, Power LED Cable Harness
J2 – To Front Panel, Port 1 Power/Signal.	P8 – To Power Supply Load Resistors
J3 – To Front Panel, Port 2 Power/Signal.	P9 – To Rear Panel Fan Assembly
J4 – To Rear Panel, External Analog Out BNC Connector.	P10 – To A101 Modulator Module, Port 1.
J5 – To Rear Panel, External ALC Out BNC Connector.	P11 – To A106 Modulator Module, Port 2.
P1 – To A100 LO Amplifier Module, Port 1 LO.	P12 – To Front Panel Port 2 LED
P2 – To A105 LO Amplifier Module, Port 2, LO.	P13 – To Front Panel Port 1 LED
P3 – To A103 RF Amplifier Module, Port 1, RF.	P14 – To Power Supply Load Resistors
	TP1 – Test Point

Figure 7-5. A1 Bias Control PCB Assembly – ND73163 – 3-72143-3 (2 of 2)

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 7-1 above.
2. Remove the top cover as described in the procedure above.

Disconnect Attached Cable Harnesses

3. Disconnect all cables attached to the A1 PCB.
4. Leave the other ends of the cables attached to their destination connectors.
5. See Table 7-1 on page 7-14 below for a list of all A1 PCB Cable Connections.

Remove and Replace the A1 PCB

6. Undo and remove the ten (10) pan head Phillips M3 × 8 mm screws holding the PCB to the chassis standoffs.
7. Lift the A1 PCB out of the chassis and set aside.
8. Place the replacement A1 PCB into the chassis, two large J2 and J3 connectors towards the Front Panel.
9. Loosely insert the ten pan head screws and make sure the PCB is correctly positioned, and then tighten the screws.
10. Reconnect the cable harnesses to the A1 PCB as listed in Table 7-1 on page 7-14.

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

A1 PCB Connector	Cable To Location
J2	To Front Panel – Port 1 Power/Signal.
J3	To Front Panel – Port 2 Power/Signal.
J4	To Rear Panel – External Analog Out BNC Connector
J5	To Rear Panel – External ALC Out BNC Connector
P1	To A100 LO Amplifier Module, Port 1
P2	To A105 LO Amplifier Module, Port 2
P3	To A103 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
P10	To A101 Modulator Module, Port 1
P11	To A106 Modulator Module, Port 2
P16	To A101 Modulator Module, Port 1
P11	To A106 Modulator Module, Port 2
P12	To Front Panel – Port 2 LED
P13	To Front Panel – Port 1 LED
P14	To Power Supply Load Resistors

Common Reassembly Procedures

11. If no other interior replacement procedures are required, follow the common reassembly procedures described above in "Reassembly – Power, Disconnect, and Covers" on page 7-4.

7-7 Module Replacement Basics

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 on page 7-7.

Basic 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 equipped, remove the bracket-to-chassis hardware.
3. Undo 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 and bracket assembly from the chassis.

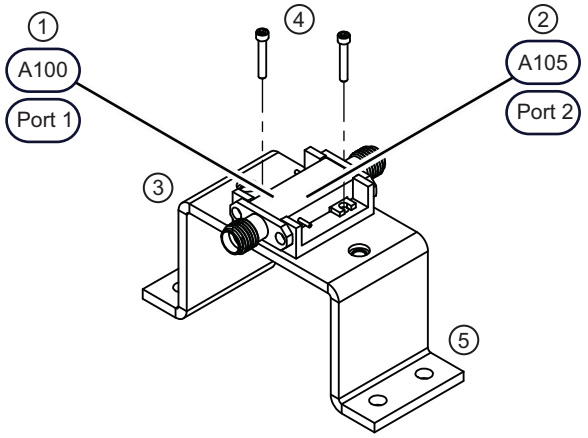
Basic Module Re-Installation Procedure

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

1. If equipped, place the module/bracket assembly into the chassis, observing the correct input/output orientation of the module connectors.
2. 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.
8. Repeat the general steps above until the module group is complete.

A100 – ND73159-RFB and A105 – ND73160-RFB LO Amplifier Modules and Bracket Assembly

The A100 Module and the similar A105 Modules are mounted on a pedestal bracket as shown in Figure 7-6 below. The removal and replacement of the A105 module is described in the next section below.



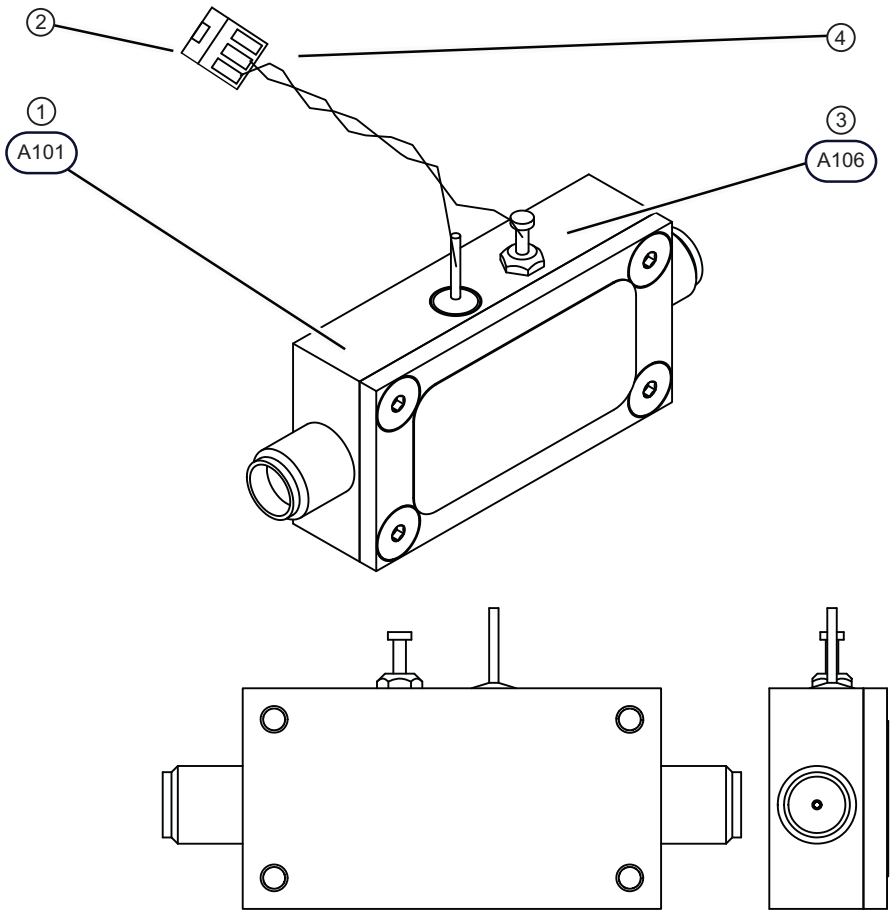
1 – A100 LO Amplifier Module – ND73159 – 3-1070-13 with 3-71916-1 soldered-on cable harness – Connects to Port 1. 2 – A105 LO Amplifier Module – ND73160 – 3-1070-13 with 3-71916-2 soldered-on cable harness – Connects to Port 2.	3 – Pedestal Mounting Bracket 4 – Hex Socket Head Screws, 0 × 80 × 0.375”, 2 each. 5 – Pan Head Phillips Screws for bracket-to-chassis mounting, 4 each.

Figure 7-6. A100 and A105 Modules – Bracket Mounting Detail

A101 – ND73161-RFB and A106 – ND73162-RFB Modulator and Bracket Assembly

On Port 1, the A101 Modulator Module connects between the A102 Isolator Module and the A100 LO Amplifier Module. Each side of the A101 Modulator Module uses an RF Elbow connector which is transferred to the replacement A101 Module. The replacement module comes with a soldered-on cable harness that connects to A1 PCB Connector P10.

On Port 2, the A106 Modulator Module connects between the A107 Isolator Module and the A105 LO Amplifier Module. Each side of the A106 Module uses an RF Elbow connector which is transferred to the replacement A106 Module. The replacement module comes with a soldered-on cable harness that connects to A1 PCB Connector P11.

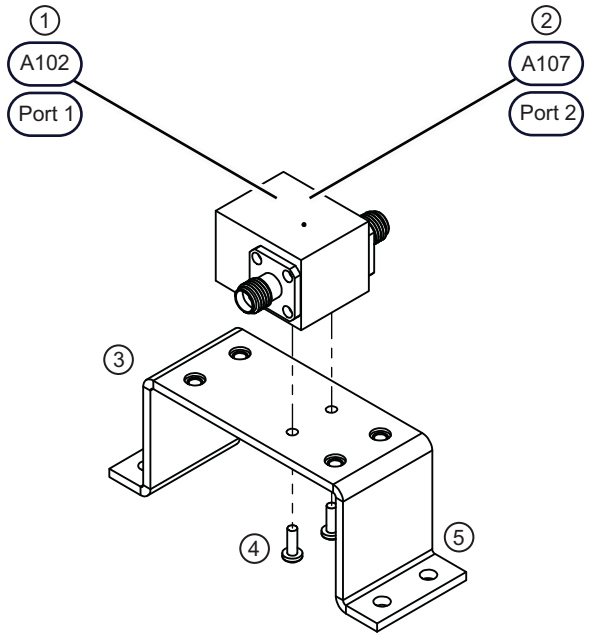


1 – A101 Modulator Module, Port 1 – With 3-73601-1 soldered-on cable harness – A Right-Angle Elbow M-M Adapter is attached to each module I/O port.	3 – A106 Modulator Module, Port 2 – With 3-73601-2 soldered-on cable harness – A Right-Angle Elbow M-M Adapter is attached to each module I/O port.
2 – A101 Cable Harness – Connects to A1 PCB Connector P10.	4 – A106 Cable Harness – Connects to A1 PCB Connector P11.

Figure 7-7. A101 and A106 Modulator Modules

A102 and A107 Isolator Modules – 3-1000-58 and Bracket Assembly

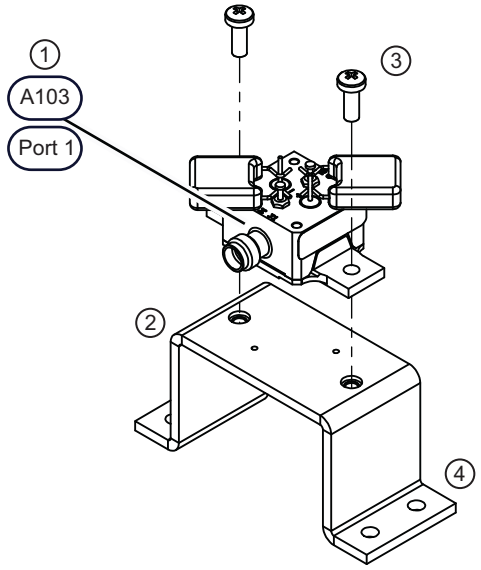
The A102 Module and the similar A107 Module are mounted on a pedestal bracket as shown in Figure 7-8 below. The removal and replacement of the A107 Module is described in the next section below.



1 – A102 Isolator Module, Port 1, 5 GHz to 10 GHz – 3-1000-58 – Note that the A102/A107 modules does not have an attached cable harness. 2 – A107 Isolator Module, Port 2, 5 GHz to 10 GHz – 3-1000-58 3 – Pedestal Mounting Bracket	4 – Bracket-to-Module Mounting Screws, 2 each – Note that these screws thread into the bottom of the module. The module and bracket assembly must be removed from the chassis to separate the module from the bracket. 5 – Bracket-to-Chassis Mounting Screws, 4 each

Figure 7-8. A102 and A107 Modules – Bracket Mounting Detail

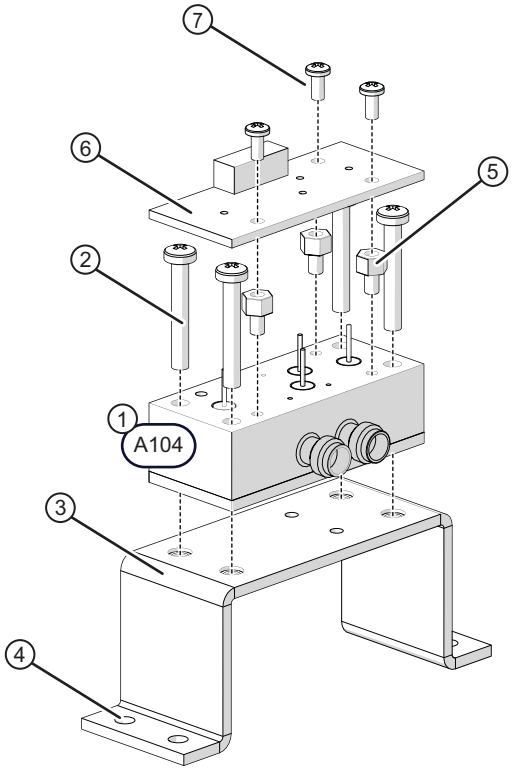
A103 RF Amplifier Module – ND73158-RFB and Bracket Assembly



1 – A103 RF Amplifier Module, 20 GHz to 40 GHz – With 3-71907 soldered-on cable harness – Connects to A1 PCB Connector P3. 2 – Pedestal Mounting Bracket	3 – Module-to-Bracket Mounting Screws, 2 each 4 – Bracket-to-Chassis Mounting Screws, 4 each

Figure 7-9. A103 Module and Bracket Mounting Detail

A104 SPDT Switch Module – 70242-RFB and Bracket Assembly



1 – A104 SPDT Switch Module, 0.04 GHz to 40 GHz – 70242	5 – Hex Threaded PCB Standoffs, 3 each
2 – Module-to-Bracket Mounting Screws, 4 each	6 – SPDT Switch Control PCB Assembly – 64951-3
3 – Mounting Bracket	7 – PCB Mounting Screws – 3 each
4 – Bracket-to-Chassis Mounting Screws, 4 each	

Figure 7-10. A104 Module and Bracket Mounting Detail

7-8 Module Replacement Sequence

The table below lists the replacement sequence for the eight (8) modules in the 3739A Test Set. Use the general procedures described above to remove each required module:

- "Basic Module Removal Procedure" on page 7-15
- "Basic Module Re-Installation Procedure" on page 7-15

First Procedure

In all cases, perform this procedure first:

- "Disassembly – Power, Disconnect, and Covers" on page 7-1.

Last Procedure

In all cases, once the replacement procedure has been completed, and no other replacement procedures are required, perform this procedure last:

- "Reassembly – Power, Disconnect, and Covers" on page 7-4.

Table 7-2. 3739A Module Replacement Sequence (1 of 3)

Module To Be Replaced	Figure Reference Removal and Replacement Sequence
A100 LO Amplifier Module, Port 1 – ND73159-RFB	Figure 7-6, "A100 and A105 Modules – Bracket Mounting Detail" on page 7-16 Remove A102 from chassis. Remove A101 from chassis. • Two screws hold module to bracket. Separate A100 Module from bracket. • Four screws hold bracket to chassis. Assembly replacement A100 Module and bracket. Replace A100 in chassis. Replace A101 in chassis. Replace A102 in chassis. Cable harness connects to A1 PCB Connector P13.
A101 Modulator Module, Port 1 – ND73161-RFB	Figure 7-7, "A101 and A106 Modulator Modules" on page 7-17 Remove A102 from chassis. Remove A101 from chassis. • No bracket, Separate A101 Module from two RF right-angle elbow connectors. • Note elbow orientation. Attach elbow connectors to replacement A101 Module. Replace A101 in chassis. Replace A102 in chassis. Cable harness connects to A1 PCB Connector P10.

Table 7-2. 3739A Module Replacement Sequence (2 of 3)

Module To Be Replaced	Figure Reference Removal and Replacement Sequence
A102 Isolator Module, 5 GHz to 10 GHz, Port 1 – 3-1000-58	Figure 7-8, "A102 and A107 Modules – Bracket Mounting Detail" on page 7-18 Remove A102 from chassis. • Four screws hold bracket to chassis. Turn assembly upside down to access two screws holding bracket to module. Separate A102 Module from bracket. Assemble replacement A102 Module and bracket. Replace A102 in chassis. No cable harness.
A103 RF Amplifier Module, 20 GHz to 40 GHz – ND73158-RFB	Figure 7-9, "A103 Module and Bracket Mounting Detail" on page 7-19 Remove A103 from chassis. • Four screws hold bracket to chassis. Separate A103 Module from bracket. • Two screws hold module to bracket. Assemble replacement A103 Module and bracket. Replace A103 in chassis. Cable harness connects to A1 PCB Connector P3.
A104, SPDT Switch, 0.04 to 40 GHz – 70242-RFB	Figure 7-10, "A104 Module and Bracket Mounting Detail" on page 7-20 Remove A103 from chassis. Remove A104 from chassis. • Four screws hold A104 Module Assembly to chassis. Remove SPDT Switch Control PCB Assembly – 64951-3 which mounts on top of the A104 Module. • Three screws hold SPDT PCB to A104 Module. Remove three PCB threaded standoffs. Separate A104 Module and bracket. Assemble replacement A104 Module and bracket. Replace three PCB threaded standoffs. Replace SPDT PCB on top of A104 Module. • Three screws hold SPDT PCB to A104 Module. Replace A104 Module Assembly into chassis. SPDT cable harness connects to A1 PCB Connector P5.

Table 7-2. 3739A Module Replacement Sequence (3 of 3)

Module To Be Replaced	Figure Reference Removal and Replacement Sequence
A105 LO Amplifier Module, Port 2 – ND73160-RFB	Figure 7-6, “A100 and A105 Modules – Bracket Mounting Detail” on page 7-16 Remove A107 from chassis. • Four screws hold bracket to chassis. Remove A106 from chassis. Remove A105 from chassis. Separate A105 Module and bracket. • Two screws hold module to bracket. Assemble replacement A105 Module and bracket. Replace A105 in chassis. Replace A106 in chassis. Replace A107 in chassis. Cable harness connects to A1 PCB Connector P12.
A106 Modulator Module, Port 2 – ND73162-RFB	Figure 7-7, “A101 and A106 Modulator Modules” on page 7-17 Remove A107 from chassis. Remove A106 from chassis. • No bracket. Separate A106 Module from two RF right-angle elbow connectors. Attach elbow connectors to replacement A106 Module. • Note elbow orientation. Replace A106 in chassis. Replace A106 in chassis. Cable harness connects to A1 PCB Connector P11.
A107 Isolator Module, Port 2, 5 GHz to 10 GHz – 3-1000-58	Figure 7-8, “A102 and A107 Modules – Bracket Mounting Detail” on page 7-18 Remove A107 from chassis. • Four screws hold bracket to chassis. Turn assembly upside down to access two screws holding bracket to module. Separate A107 Module from bracket. Assemble replacement A107 Module and bracket. Replace A107 in chassis. No cable harness.

7-9 Rear Panel Fan Assembly – ND73164

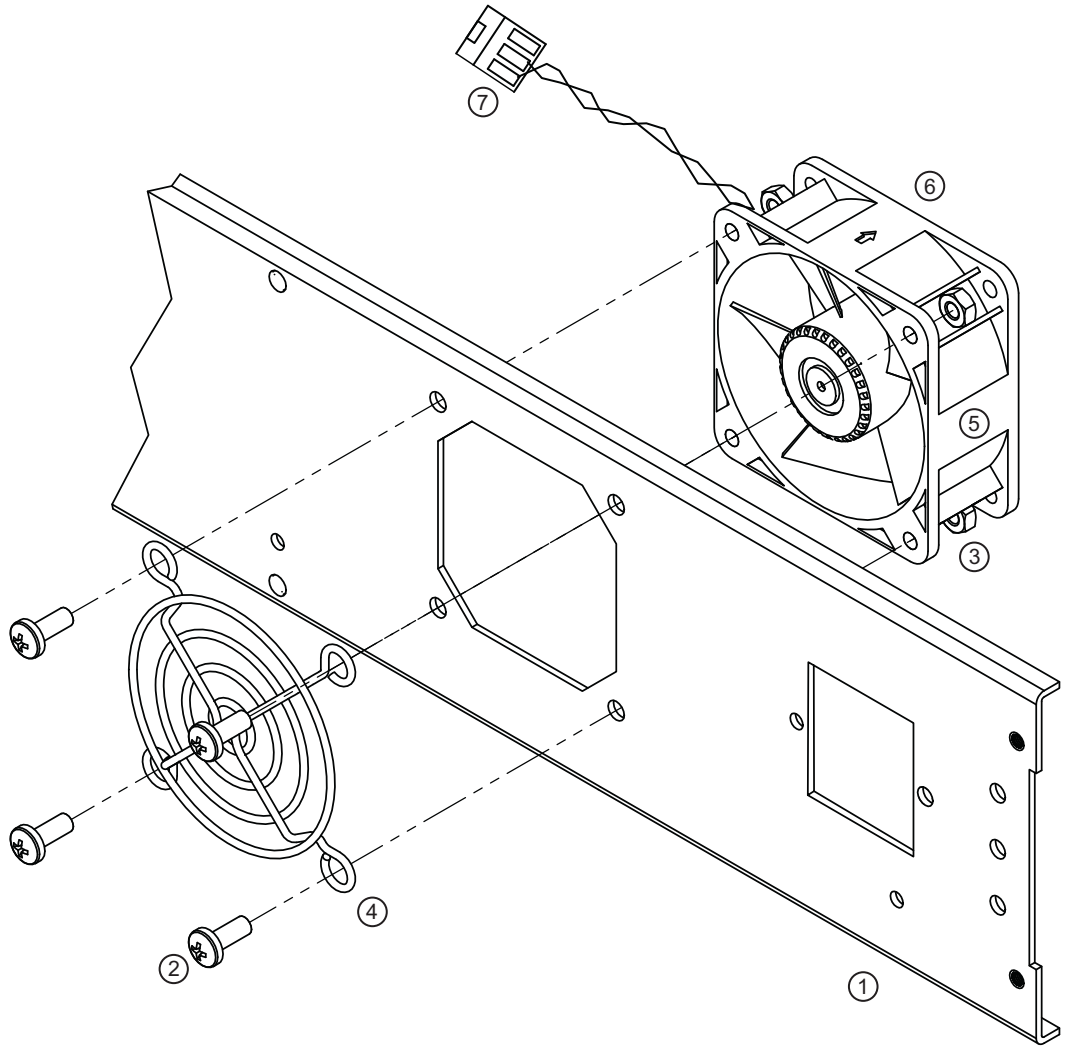
Use this procedure to replace the rear panel fan assembly. The top cover must be removed to replace the fan.

Required Tools

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

Reference Figures

See Figure 7-3 on page 7-7 above for the location of the Rear Panel Fan Assembly. See Figure 7-11 below for assembly details.



1 – Rear Panel	5 – Rear Panel Fan
2 – Finger Guard and Fan Mounting Screws, 4 each	6 – Air Flow into Chassis – Note fan flow direction arrow.
3 – Finger Guard and Fan Mounting Nuts, 4 each	7 – Rear Panel Fan Assembly Cable Connector – Connects to A1 PCB Connector P9
4 – External Finger Guard	

Figure 7-11. Rear Panel Fan Assembly – ND73164 – 3-71919

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 7-1 above.
2. Remove the top cover as described in the procedure above.

Fan Replacement

3. Identify the location of the Rear Panel Fan Assembly as shown above in Figure 7-3 on page 7-7 above.
4. Disconnect the fan assembly power plug from the A1 Bias Control PCB at connector P9.
5. Review the Rear Panel Fan mounting hardware as shown below in
6. Using a Phillips head screwdriver and an M4 open end wrench, loosen and remove the four (4) screws and Kep nuts that hold the fan assembly and the outside finger guard to the Rear Panel.
7. Remove the to-be-replaced fan assembly and insert the replacement assembly. Note the airflow arrow orientation on the fan to move air into the chassis.
8. Insert each mounting screw through the finger guard, rear panel, fan, and secure in place with a Kep nut and loosely tighten.
9. When all four screws are in place, make sure the fan assembly is centered in the rear panel opening, and tighten the four (4) screws and nuts.
10. Connect the fan power cable to the A1 PCB Connector P9.

Common Reassembly Procedures

11. If no other interior replacement procedures are required, follow the common reassembly procedures described above.
    - "Reassembly – Power, Disconnect, and Covers" on page 7-4

7-10 Front Panel Assembly – ND73169 – 71894

Use this procedure to replace the front panel assembly. Within the assembly, there are no replaceable parts. The procedure involves:

- 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
- Installing the replacement Front Panel in the chassis
- Reconnecting the RF and signal cables

The Front Panel general orientation is shown above in Figure 7-3 on page 7-7. See Figure 7-12 below for an illustration of the Front Panel viewed from inside the chassis where Port 1 is on the right with the supplied cable harnesses and the cables that must be disconnected.

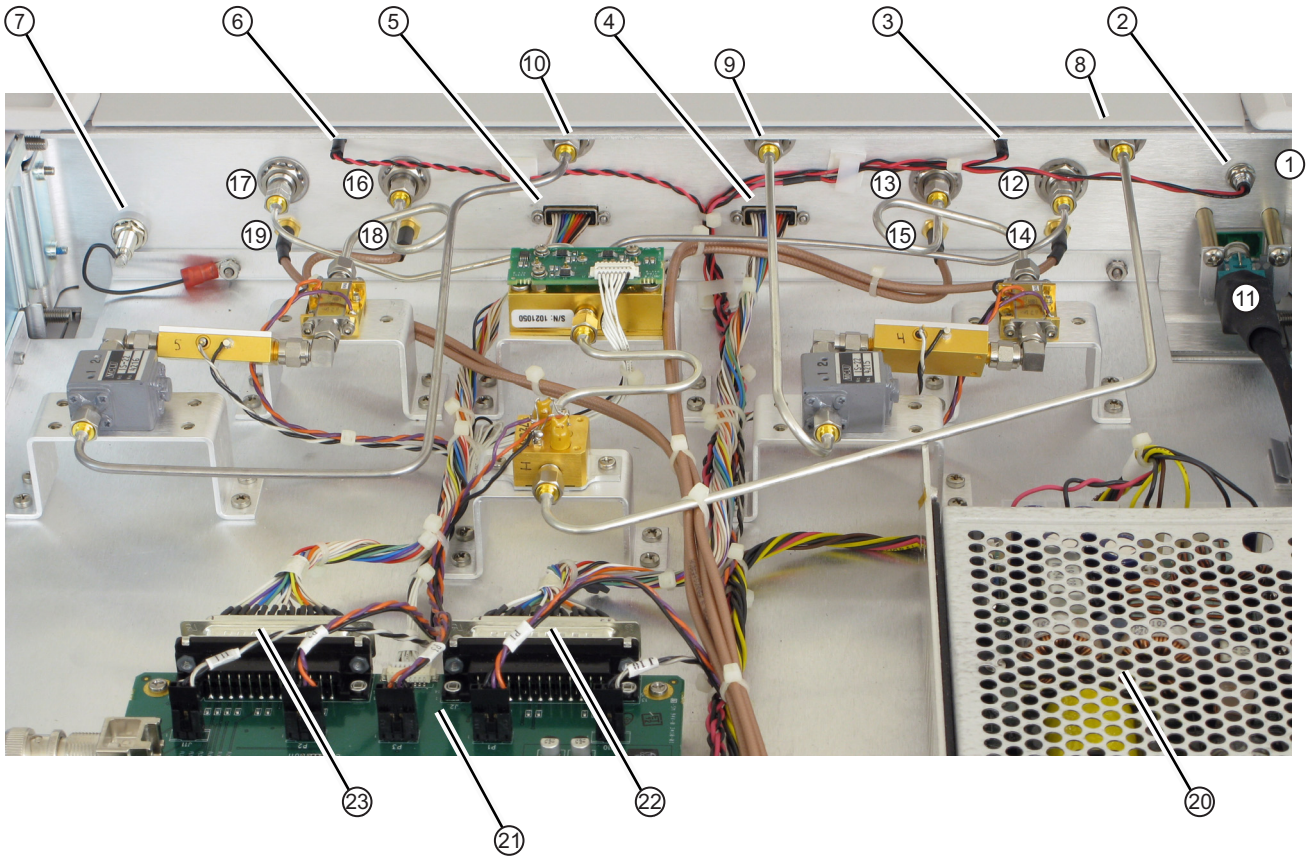


Figure 7-12. Front Panel Assembly – ND73168 – View from inside chassis (1 of 2)

1 – Front Panel Assembly – ND73169 – Viewed from Inside Chassis – Power Switch and Port 1 on right – Port 2 and Ground on left.	**Disconnect These Cables – Port 1**
Cable Harnesses Provided with ND73169	12 – Port 1 RF Connector, Semi-Rigid Coaxial Cable
2 – Power LED Cable Harness	13 – Port 1 LO Connector, Semi-Rigid Coaxial Cable
3 – Port 1 LED Cable Harness	14 – Port 1 Test Connector, Flexible Coaxial Cable
4 – Port 1 Power Cable Harness	15 – Port 1 Ref Connector, Flexible Coaxial Cable
5 – Port 2 Power Cable Harness	**Disconnect These Cables – Port 2**
6 – Port 1 LED Cable Harness	16 – Port 2 LO Connector, Semi-Rigid Coaxial Cable
7 – Ground Plug Cable Harness	17 – Port 2 RF Connector, Semi-Rigid Coaxial Cable
Disconnect These Cables – Top Row	18 – Port 2 Ref Connector, Flexible Coaxial Cable
8 – RF Connector, Semi-Rigid Coaxial Cable	19 – Port 2 Test Connector, Flexible Coaxial Cable
9 – LO1 Connector, Semi-Rigid Coaxial Cable	**Power Supply and A1 PCB**
10 – LO2 Connector, Semi-Rigid Coaxial Cable	20 – Power Supply Module – 3-40-183
Disconnect Switch	21 – A1 Bias Control PCB Assembly – ND73163 – 3-72143-3
11 – Power Switch and Cable Harness Assembly – Remove two screws to detach power switch.	22 – A1 PCB Connector J2 – Connects to Port 1
	23 – A1 PCB Connector J3 – Connects to Port 2

Figure 7-12. Front Panel Assembly – ND73168 – View from inside chassis (2 of 2)

Replacement Part

- Front Panel Assembly – ND73169

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area. Refer to Section 7-2 above for specific instructions.
2. Remove the top cover as described in the procedure above.

Front Panel Removal

3. Disconnect the following cables from their destination connectors. Note that these cables are included with the replacement Front Panel.
   a. LED Power – Disconnect at A1 PCB Connector P7.
   b. Port 1 LED – Disconnect at A1 PCB Connector P13.
   c. Port 2 LED – Disconnect at A1 PCB Connector P12.
   d. Port 1 Power / Control – Disconnect at A1 PCB Connector J2.
   e. Port 2 Power / Control – Disconnect at A1 PCB Connector J3.

Disconnect Semi-Rigid Coaxial Cables

4. Disconnect the three semi-rigid coaxial connectors from the Front Panel top connector row. Once loose, bend the cables slightly out of the way.
   a. RF connector.
   b. LO1 connector.
   c. LO2 connector.

5. Disconnect the flexible and semi-rigid coaxial cables from these locations. Note that each cable is labeled with a part number, the starting assembly and connector number, and the ending assembly and connector number.

a. Port 1 RF

b. Port 1 Test

c. Port 1 LO

d. Port 1 Ref

e. Port 2 LO

f. Port 2 Ref

g. Port 2 RF

h. Port 2 Test

Disconnect the Ground and Power Switch

6. Disconnect the Front Panel Ground plug cable harness by removing the Kep nut holding the ring lug to the chassis.

7. Undo the two screws holding the switch bracket to the Front Panel Switch Standoffs. Leave the switch harness cables connected at their destinations.

Remove Front Panel

8. Remove the hardware holding the Front Panel to the side panels.

9. Carefully gather up the cable harnesses attached to the Front Panel, and remove the Front Panel assembly from the chassis. Carefully feed the Power Switch through the opening so it and its cable harness remain with the chassis.

Remove the F-F Adapters from the To-Be-Replaced Front Panel

10. Using a 4 mm (5/16") torque end wrench, loosen and remove the hex nut and washer holding each female-female bulkhead adapters in place.

a. Remove the two (2) **V232 F-F** adapters.

b. Remove the five (5) **K232B F-F** adapters.

Install the F-F Adapters on the Replacement Front Panel

11. At the replacement Front Panel, install the two (2) **V232 F-F** adapters to:

- Port 1 RF
- Port 2 RF

12. At the replacement Front Panel, install the five (5) **K232B F-F** adapters to:

- RF
- LO1
- LO2
- Port 1 LO
- Port 2 LO

13. Place the replacement Front Panel assembly in place, making sure the Power Switch assembly is correctly in the panel opening. Insert the two screws but do not tighten.

14. Insert the two screws on each side holding the Front Panel assembly to the side panels, but do not tighten.

Connect Cable Bottom Row

15. Install the bottom row of flexible coaxial cables to these locations:

- Port 1 Test
- Port 1 Ref
- Port 2 Ref
- Port 2 Test

16. Torque each connector 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.

Connect Cable Middle Row

17. Connect the middle row of semi rigid coaxial cables to these locations:

- Port 1 RF
- Port 1 LO
- Port 2 LO
- Port 2 RF

18. As above, torque each connector to 0.9 N·m (8 lbf·in) using a plain 8 mm (5/16") end wrench to hold the connector body, and the 4 mm torque wrench to torque the cable nut.

Connect Cable Top Row

19. Connect the top row of semi rigid coaxial cables to these locations:

- RF
- LO1
- LO2

20. As above, torque each connector to 0.9 N·m (8 lbf·in) using two end wrenches.

Tighten All Screws

21. Torque each connector to 0.9 N·m (8 lbf·in).

22. Tighten the side panel screws

23. Tighten the screws holding the power switch in place.

Connect Replacement Front Panel Cables

24. Connect the front panel cable harnesses to these locations:

a. LED Power – Connect to A1 PCB Connector P7.

b. Port 1 LED – Connect to A1 PCB Connector P13.

c. Port 2 LED – Connect to A1 PCB Connector P12.

d. Port 1 Power / Control – Connect to A1 PCB Connector J2.

e. Port 2 Power / Control – Connect to A1 PCB Connector J3.

Common Reassembly Procedures

25. If no other interior replacement procedures are required, follow the common reassembly procedures described above.

- "Reassembly – Power, Disconnect, and Covers" on page 7-4

Chapter 8 — Removal and Replacement Procedures for 3739B/C

8-1 Introduction

This chapter provides procedures for removing and re-installing the replaceable components and sub-assemblies in the 3739B and 3739C Test Sets.

8-2 Disassembly – Power, Disconnect, and Covers

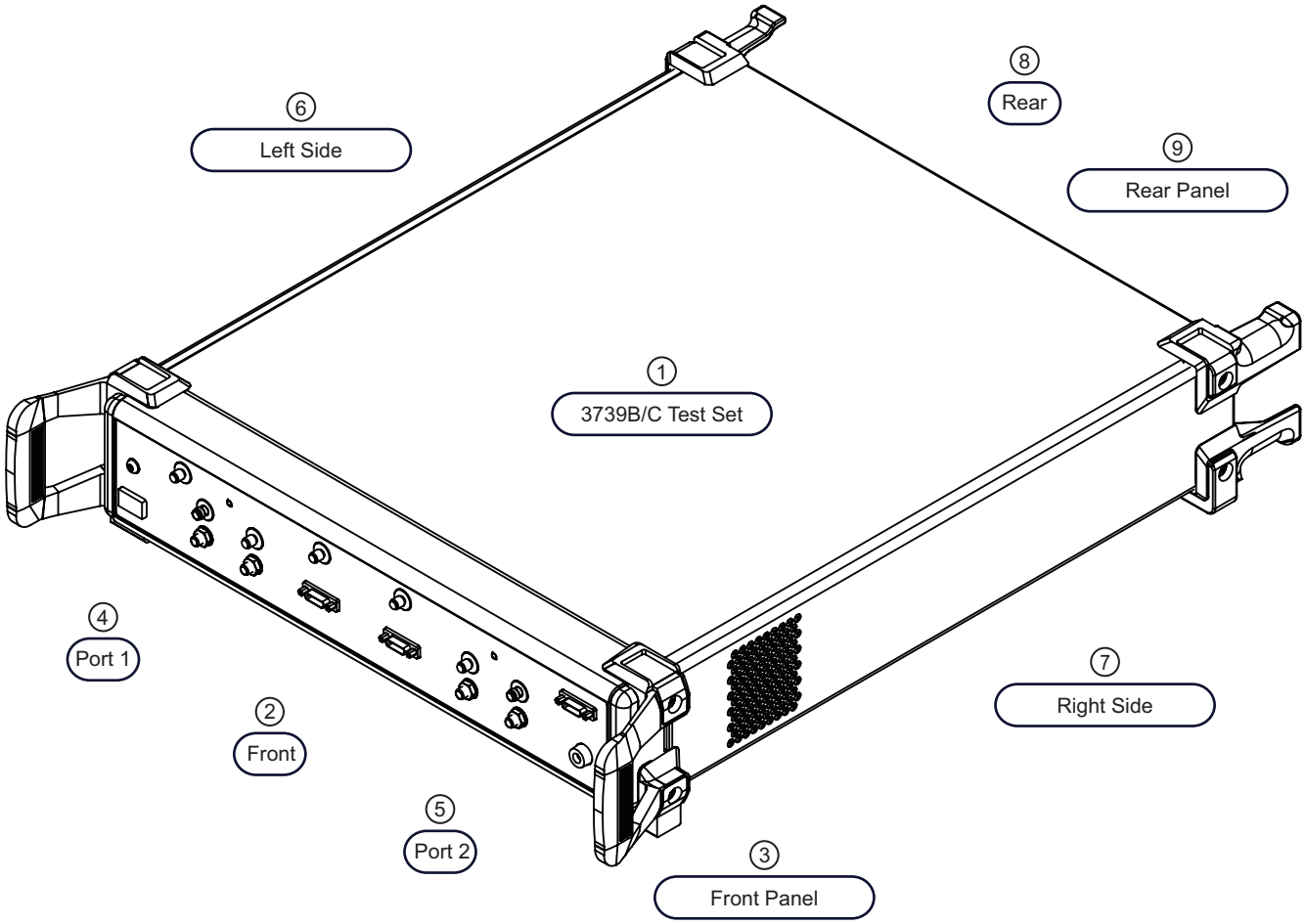
Use this procedure to prepare the 3739B or 3739C Test Set for removal and replacement procedures for all of its replaceable components. Other than the front and rear panel cables, all replacement components require this common disassembly procedure.

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.
4. Power down the Test Set.
5. Disconnect the rear panel cables between VNA and the Test Set. Disconnect the Power Cable from the AC Mains.
6. 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.
7. Disconnect the front panel cables between the VNA/Test Set and the mmWave Modules.
8. Set the mmWave Modules and the Port-to-Module Note aside in a secure, clean, and anti-static environment.
9. Make sure all VNA front rear panel cables have been disconnected. Remove VNA from the top of the Test Set.

Caution

The weight of a fully equipped MS464xx 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.

10. Set the VNA aside in a secure, clean, and anti-static environment.
11. Move the Test Set to the repair area.



All orientation is when viewed from the front. 1 – 3739B/C Test Set – With Top Cover, Front Handles, and Rear Feet attached to unit. 2 – Test Set Front 3 – Front Panel Assembly – RF, LO1, and LO2 connectors at top connect to MS464xx VNA RF Deck. 4 – Port 1 Connectors – RF, LO, Power, Test, and Ref – Power Switch and LED to left.	5 – Port 2 Connectors – Power, LO, RF, Ref, and Test – Ground plug to right. 6 – Left Side 7 – Right Side 8 – Test Set Rear 9 – Rear Panel Assembly

Figure 8-1. 3739B/C Broadband/mmWave Test Set

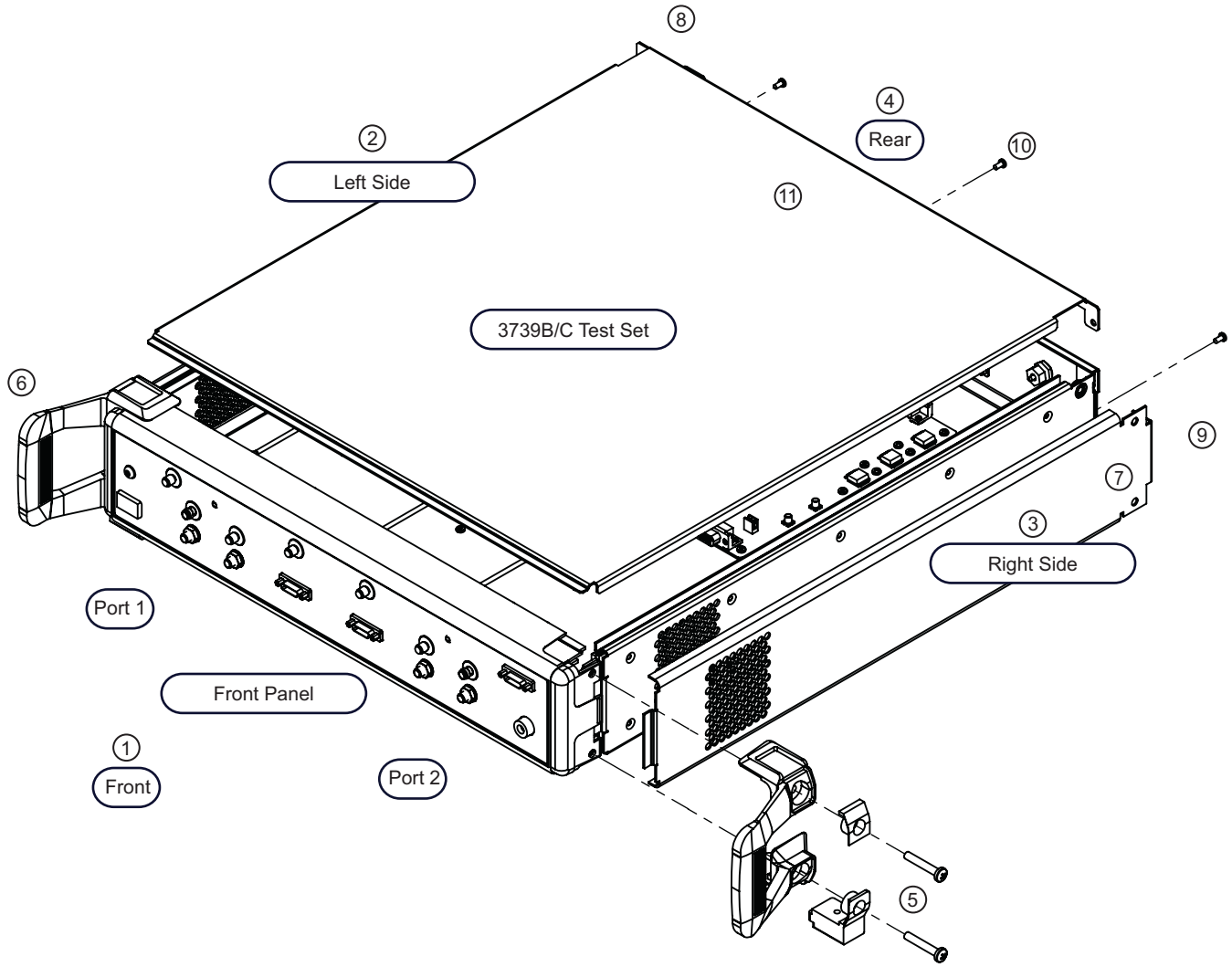
12. As shown below in Figure 8-2 on page 8-3, remove top cover.

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.

13. Remove the six Philip screws that secure the stiffener plate to the chassis.

14. Remove the stiffener plate.

15. Reattach the rear feet to the chassis.



1 – Test Set Front – Port 1 to left – Port 2 to right	7 – Right Side Dress Plate
2 – Test Set Left Side	8 – Rear Left Feet and Hardware – Removed here.
3 – Test Set Right Side	9 – Rear Right Feet and Hardware – Removed here.
4 – Test Set Rear Panel	10 – Top Cover Screws
5 – Front Right Side Handle, Feet, and Hardware	11 – Top Cover – Lift from rear
6 – Front Left Side Handle, Feet, and Hardware	

Figure 8-2. 3739B/C Test Set – Initial Disassembly and Removing Top Cover

8-3 Reassembly – Power, Disconnect, and Covers

Use this procedure to reassemble the Test Set and reconnect it to the VNA.

1. If the rear feet were reattached, remove them once again.
2. If the front handles were reattached, remove them once again.
3. Replace the stiffener plate.
4. Replace 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.

Connect Rear Panel Cables

9. Connect the rear panel IF cables:
   - **a.** VNA a1 IF to Test Set IF Output a1
   - **b.** VNA b1 IF to Test Set IF Output b1
   - **c.** VNA a2 IF to Test Set IF Output a2
   - **d.** VNA b2 IF to Test Set IF Output b2
10. Connect the rear panel BNC cables:
   - **a.** VNA Ext Analog Out (left) to Test Set Ext Analog In (lower)
   - **b.** VNA Ext ALC (right) to Test Set Ext ALC Out (upper)
11. Connect the rear panel I/O cable: VNA External I/O to Test Set External I/O.
12. If used, connect a GPIB cable to either the IEEE 488.2 GPIB Connector and/or the Dedicated GPIB Connector.
13. Connect the VNA Power Cable to the VNA. Do not yet connect to AC Mains.
14. Connect the Test Set Power Cable to Test Set. Do not yet connect to AC Mains.

Front Panel VNA to Test Set Connections

15. Connect the three VNA to Test Set connections:
   - **a.** Connect VNA RF to Test Set RF. When correctly threaded, and tightened, torque to 0.9 N·m (8 lbf·in).
   - **b.** Connect the VNA LO1 to Test Set LO1. Tighten and torque as above.
   - **c.** Connect the VNA LO2 to Test Set LO2. Tighten and torque as above.

Port 1 Cable Connections to VNA and Test Set

16. Connect the Port 1 to Module Port 1 Cable Assembly to the Test Set. Note that each cable is clearly labeled:

- **a.** Port 1 Test. Tighten and torque as above.
- **b.** Port 1 Ref. Tighten and torque as above.
- **c.** Port 1 RF. Tighten and torque as above.
- **d.** Port 1 LO. Tighten and torque as above.
- **e.** Power 1 Power and Signal. Fasten in place with two screws.
- **f.** Route the other end of the cable assembly to the Port 1 Module location.

17. Connect the phase-stable cable to the VNA Test Port 1. Thread, tighten, and torque as above. Route the other end of the cable assembly to the Port 1 Module location.

Port 2 Cable Connections to VNA and Test Set

18. Connect the Port 2 to Module Port 2 Cable Assembly to the Test Set. Note that each cable is clearly labeled:

- **a.** Port 2 Test. Tighten and torque as above.
- **b.** Port 2 Ref. Tighten and torque as above.
- **c.** Port 2 RF. Tighten and torque as above.
- **d.** Port 2 LO. Tighten and torque as above.
- **e.** Power 2 Power and Signal. Fasten in place with two screws.
- **f.** Route the other end of the cable assembly to the Port 2 Module location.

19. Connect the phase-stable cable to the VNA Test Port 2. Thread, tighten, and torque as above. Route the other end of the cable assembly to the Port 2 Module location.

20. Place the modules into position, observing the correct module-to-port configuration.

21. If the modules were removed from their brackets (either the factory original or a user-defined), install them in the bracket, observing which side of the module is up.

- The factory as-shipped orientation is with the **RF**, **SRC**, and **LO** connectors and the **W1** connector closest to the bracket. The procedure steps below assume the factory as-shipped orientation.
- If the module orientation has been changed, the general recommendation is to install the cables and connectors closest to the bracket first.

Port 1 Module Connections

22. Connect the **SRC** cable to the Port 1 Module. Align, thread, tighten, and then use an 8 mm (5/16") torque end wrench and torque to 0.9 N·m (8 lbf·in), for 3743A, 3743E and MA25300A mmWave Modules only.

23. Connect the **RF** cable to the Port 1 Module. Thread and tighten as above.

24. Connect the **LO** cable to the Port 1 Module. Thread, tighten, and torque as above.

25. Connect the **REF** cable to the Port 1 Module. Insert, thread carefully, and gently tighten the SSMC connector. Tighten using a 4 mm (5/32") end wrench.

26. Connect the **TEST** cable to the Port 1 Module. Thread and tighten the SSMC connector as above.

27. Carefully, observing the connector polarity, match up the markings on the **Power/Signal** plug with the power/signal connector. The connector snaps into place.

Port 2 Module Connections

28. Following the same sequence as the sub-section above, connect the cables to the Port 2 Module.

a. SRC

b. RF

c. LO

d. REF

e. TEST

f. Power/Signal

VNA and Test Set Power Connections

29. Connect the VNA and Test Set to AC Mains power.

30. Power up the Test Set by pressing the front panel Power Switch. The Power LED should illuminate.

31. Power up the VNA as follows:

a. On the VNA Rear Panel, set the AC Power Rocker Switch to **ON** or "|". The VNA is in standby mode and the Front Panel orange Standby LED is illuminated.

b. On the VNA Front Panel, press the Standby/Operate key for at least one second. The green Operate LED illuminates. The splash screen appears, and the instrument starts.

8-4 Replaceable Part Chassis Locations

The general location of chassis internal components is shown in Figure 8-3 below.

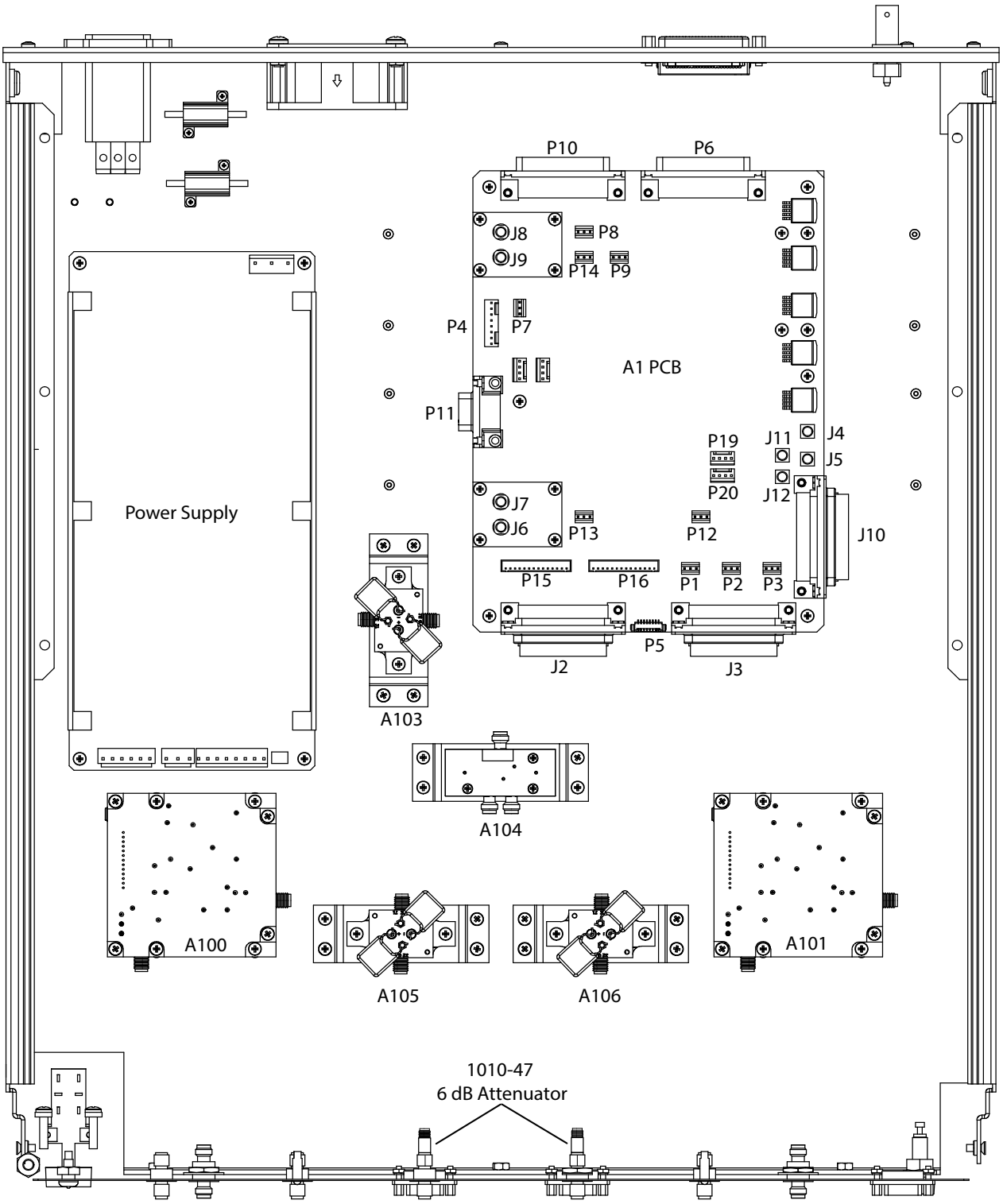


Figure 8-3. 3739B/C Test Set – Chassis Top Side – Major Component Locations (1 of 2)

A1 Bias Control PCB Assembly: – For 3739B: ND73163-RFB – 3-72143-3 – For 3739C: ND80352-RFB or 3-ND80352-RFB – 3-80120-3 Power Supply Module – 3-40-183 – Not shown here is Power Supply Cable Harness – 3-ND73168.	A100 Doubler Module, Port 1 – ND75883-RFB or 3-ND75883-RFB A101 Doubler Module, Port 2 – ND75883-RFB or 3-ND75883-RFB A103 RF Amplifier Module, 8 GHz to 40 GHz – ND75884-RFB or 3-ND75884-RFB – With soldered-on cable harness. A104, SPDT Switch Module, 0.04 to 40 GHz – 70242-RFB or 3-70242-RFB – SPDT Switch Control PCB Assembly – ND70926-RFB or 3-ND70926-RFB – Mounts on top of the A104. A detachable cable connects to A1 PCB Connector P15. A105 RF Amplifier Module, 8 GHz to 40 GHz – ND75885-RFB or 3-ND75885-RFB – With soldered-on cable harness. A106 RF Amplifier Module, 8 GHz to 40 GHz – ND75886-RFB or 3-ND75886-RFB – With soldered-on cable harness. 1010-47 or 3-1010-47 – 6 dB Fixed Attenuator

Figure 8-3. 3739B/C Test Set – Chassis Top Side – Major Component Locations (2 of 2)

8-5 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 8-3 on page 8-7.

Replacement Parts

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

Reference Figure

A representative Power Supply module is shown below in Figure 8-4. The installed version may differ slightly in appearance and color. The mounting hold and connector locations will be the same.

Figure 8-4. Power Supply Module – 3-40-183

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 8-1 above.
2. Remove the top cover as described in the procedure above.

Disconnect the Power Supply Cable Harness

3. On the front of the power supply, disconnect the Power Supply Cable Harness – ND73168 – 71918 from the power supply. On the power supply, when the power supply is viewed from the front of the chassis, the connectors are:
   - Left Front Connector, 8 Pin Connector, Pin 1 on right.
   - Center Front Connector, 3 Pin Connector, Pin 1 on right
   - Right Front Connector, 6 Connector, Pin 1 on right
   - The other end of the harness connects to the A1 PCB connector P4.
4. On the rear of the power supply, disconnect the 3 Pin Connector which connects to the rear panel AC Distribution Module and the front panel Power Switch.

Remove Power Supply

5. Remove the four Phillips pan head screws holding the Power Supply in place and remove the unit.

Remove Power Supply Cable Harness

6. Only perform this step is the harness is to be replaced. Otherwise, skip ahead to the next step. If the harness is to be replaced:
   a. Disconnect the other end of the cable harness from the A1 PCB connector P4.
   b. Remove the harness.
   c. Connect the replacement harness to the A1 PCB connector P4.

Install Replacement Power Supply

7. Place the replacement power supply into the chassis, and loosely insert the four screws.
8. Make sure the power supply is correctly positioned, and then tighten all four screws.

Connect Power Supply Cable Harness

9. Reconnect the power supply cable harness. The connections are:
   - Left Front Connector: 8 Pin Connector – Pin 1 on right.
   - Center Front Connector: 3 Pin Connector – Pin 1 on right
   - Right Front Connector: 6 Connector – Pin 1 on right
   - The other end of the harness should be connected to the A1 PCB connector P4.

Common Reassembly Procedures

10. If no other interior replacement procedures are required, follow the common reassembly procedures described above in "Reassembly – Power, Disconnect, and Covers" on page 8-4.

8-6 A1 Bias Control PCB Assembly

Use this procedure to replace A1 Bias Control PCB Assembly. The A1 PCB location is shown above in Figure 8-3 on page 8-7.

Replacement Parts

- 3739B A1 Bias Control PCB Assembly – ND75882-RFB – 3-74276-3
- 3739C A1 Bias Control PCB Assembly – ND80352-RFB or 3-ND80352-RFB – 3-80120-3

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 8-1 above.
2. Remove the top cover as described in the procedure above.

Disconnect Attached Cable Harnesses

3. Disconnect all cables attached to the A1 PCB.
4. Leave the other ends of the cables attached to their destination connectors.
5. See Table 8-1 on page 8-12 below for a list of all A1 PCB Cable Connections.

Remove and Replace the A1 PCB

6. Undo and remove the ten (10) pan head Phillips M3 × 8 mm screws holding the PCB to the chassis standoffs.
7. Lift the A1 PCB out of the chassis and set aside.
8. Place the replacement A1 PCB into the chassis, two large J2 and J3 connectors towards the Front Panel.
9. Loosely insert the ten pan head screws and make sure the PCB is correctly positioned, and then tighten the screws.
10. Reconnect the cable harnesses to the A1 PCB as listed in Table 8-1 for 3739B or in Table 8-2 for 3739C.

Table 8-1. 3739B 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

Table 8-2. 3739C 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
P20	Jumper together Pin 1 and Pin 2
P21	To Rear Panel – Normal/Boost Switch

Common Reassembly Procedures

11. If no other interior replacement procedures are required, follow the common reassembly procedures described above in "Reassembly – Power, Disconnect, and Covers" on page 8-4.

8-7 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 8-3 on page 8-7.

General Module Removal

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.

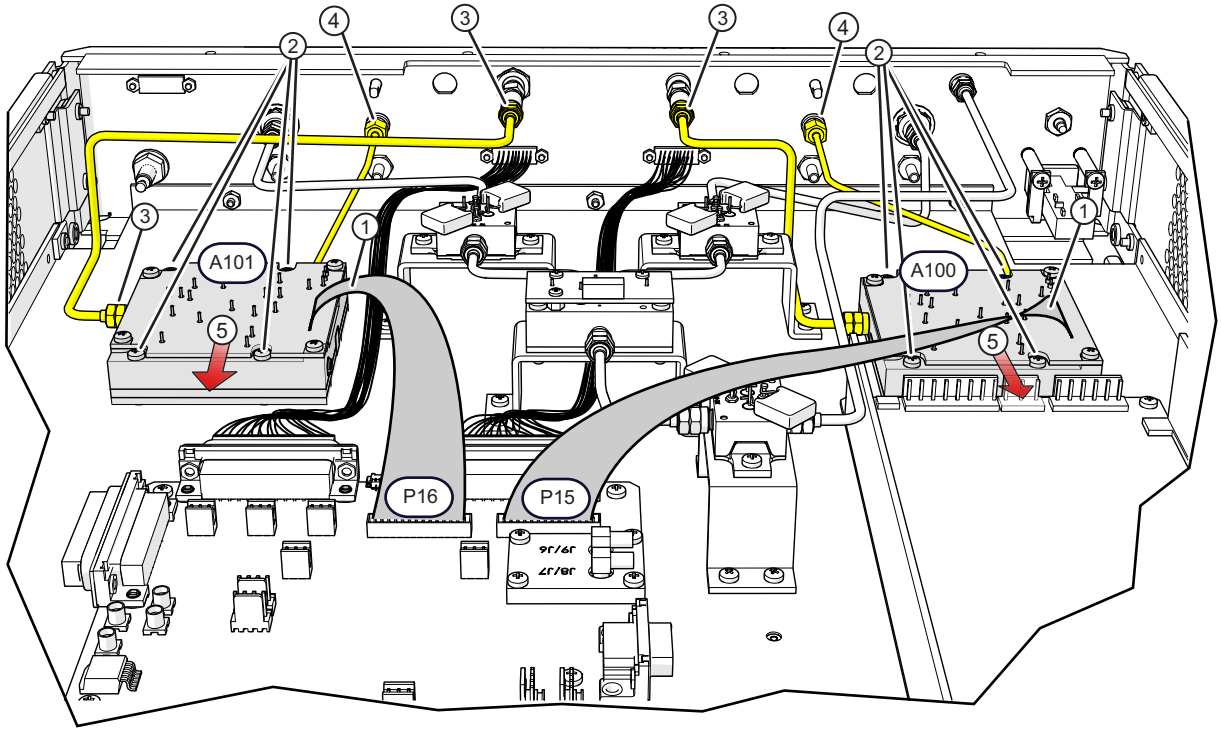
General Module Installation

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 or 3-ND75883-RFB Doubler Modules

The A100 and A101 Modules are replaced as shown in Figure 8-5.The A100 Module connects between the Front Panel LO1 Connector and the Port 1 LO Connector. The A101 Module connects between the Front Panel LO2 Connector and the Port 2 LO Connector.

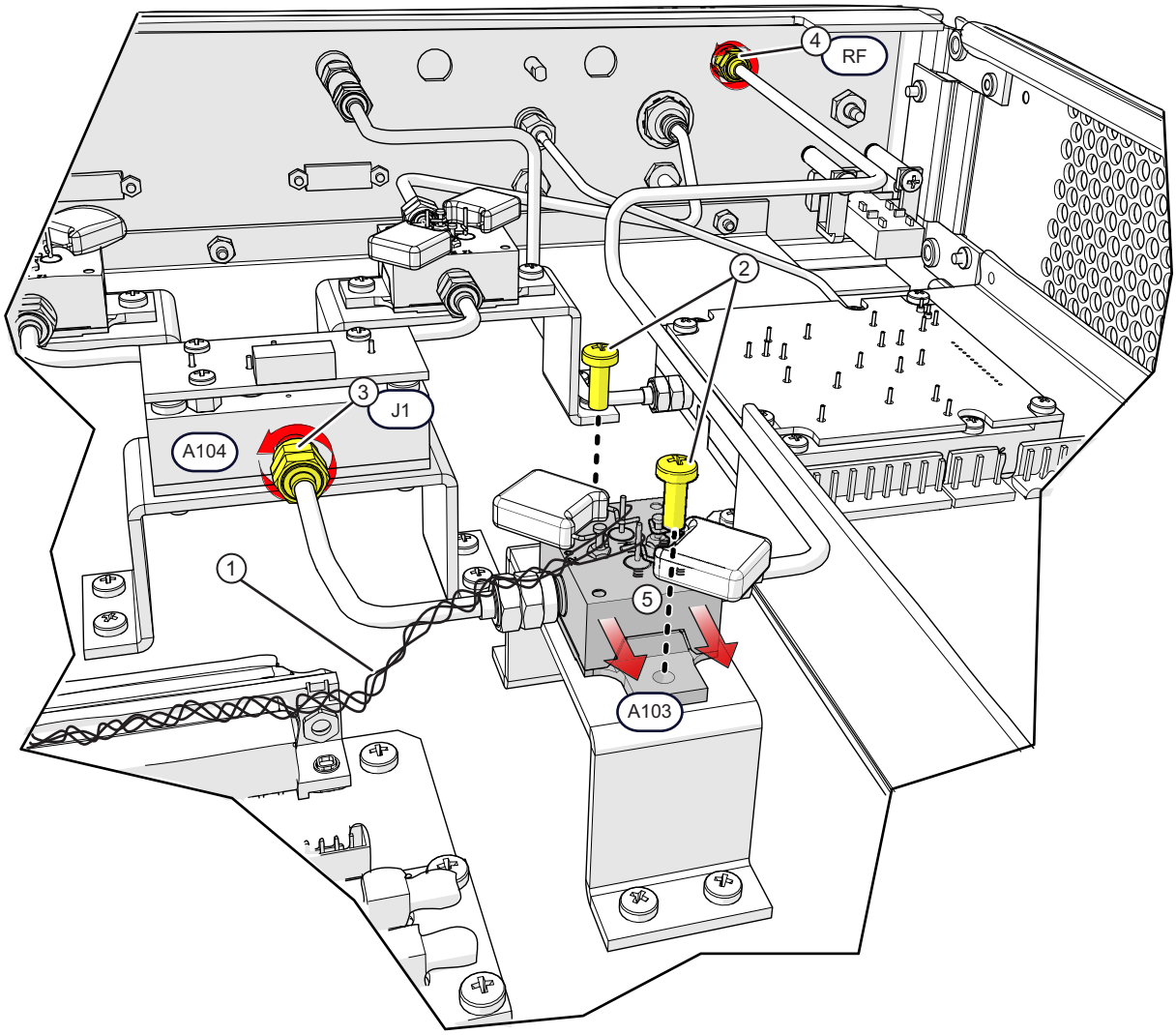


A101: **Doubler Module – Connects to Port LO 2**	**A100:** **Doubler Module – Connects to Port LO 1**
1 – Disconnect the ribbon cable from the module.	1 – Disconnect the ribbon cable from the module.
2 – Remove the four (4) M3 x 0.5 x 20 mm pan head phillips module mounting screws.	2 – Remove the four (4) M3 x 0.5 x 20 mm pan head Phillips module mounting screws.
3 – Disconnect the semi-rigid cable coupling nut from the LO2 front panel 6 dB attenuator connector.	3 – Disconnect the semi-rigid cable coupling nut from the LO1 front panel 6 dB attenuator connector.
4 – Disconnect the semi-rigid cable coupling nut at Port 2 LO connector.	4 – Disconnect the semi-rigid cable coupling nut at Port 1 LO connector.
5 – Remove the module with semi-rigid cables attached.	5 – Remove the module with semi-rigid cables attached.
6 – Transfer the semi-rigid cables to J1 and J2 of the new A101 module but do not tighten the coupling nuts.	6 – Transfer the semi-rigid cables to J1 and J2 of the new module but do not tighten the coupling nuts.
7 – Install the assembly and connect the coupling nuts but do not tighten.	7 – Install the assembly and connect the coupling nuts but do not tighten.
8 – Install and tighten the four (4) mounting screws.	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.	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.

Figure 8-5. A100 and A101 Doubler Module Replacement Detail

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

The A103 RF Amplifier Module connects between the Front Panel VNA RF Input Connector and the A104 SPDT Switch. The replacement module comes with a soldered-on cable harness that connects to A1 PCB Connector P1.



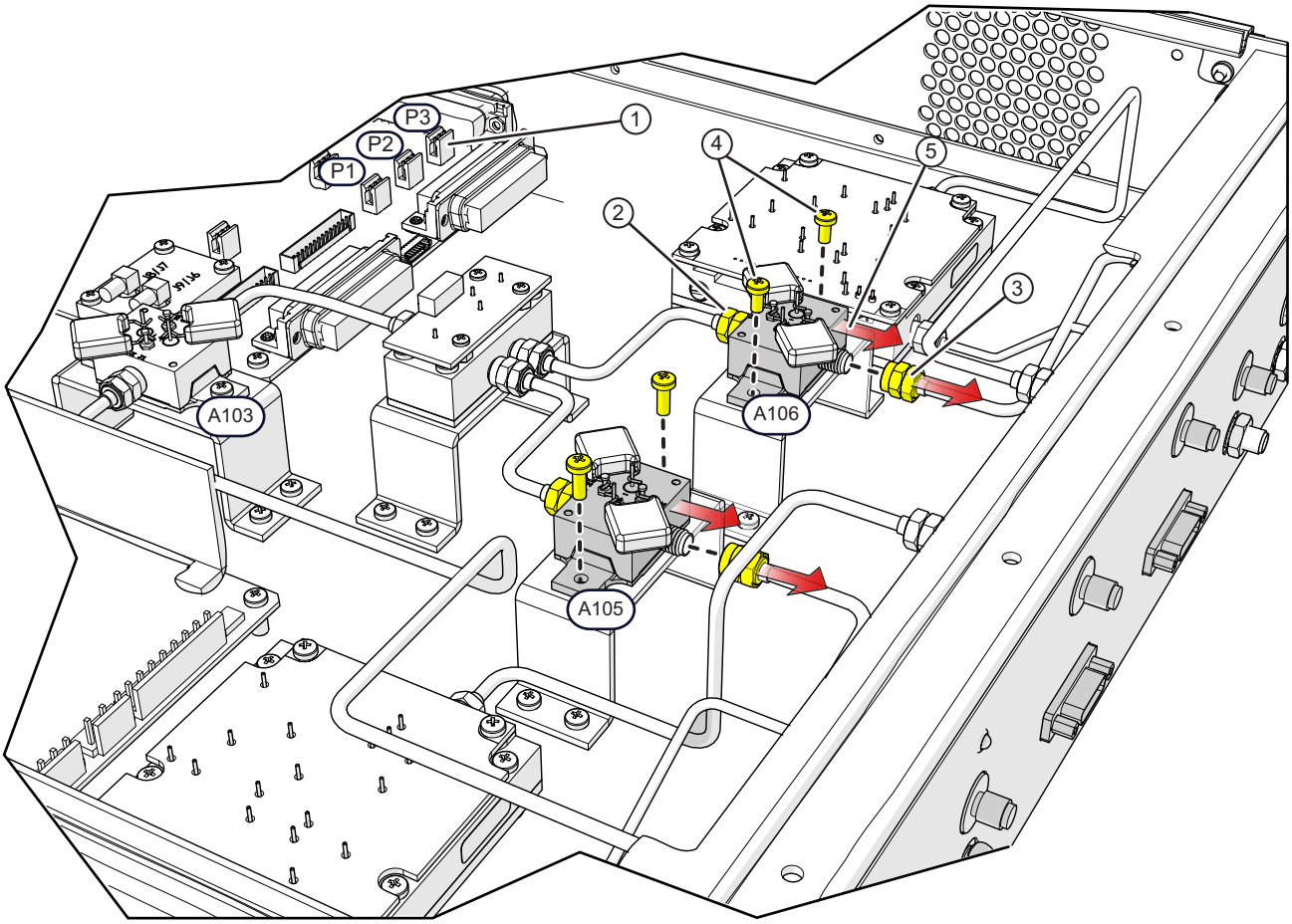
1 – Disconnect the module power cable from P1 at A1 PCB. 2 – Remove the two (2) M3 x 0.5 x 8 mm module mounting screws. 3 – Disconnect the semi-rigid cable coupling nut from A104 switch input J1. 4 – Disconnect the semi-rigid cable coupling nut from the front panel VNA RF input connector. 5 – Remove 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 tighten the coupling nuts.	7 – Install the assembly then align and connect the coupling nuts to A104 and front panel RF 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 two 8 mm (5/16”) wrenches using one to hold the connector body and the other to torque the cable nut. 10 – Tighten the two (2) module mounting screws. 11 – Connect the module power cable to connector P1 at A1 PCB.

Figure 8-6. A103 RF Amplifier Module Replacement Detail

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

On Port 1, the A105 RF Amplifier 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 Connector P2.

On Port 2, the A106 Amplifier Module connects between 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 Connector P3.



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 8-7. A105 and A106 RF Amplifier Module Replacement Detail

A104 SPDT Switch Module – 70242-RFB or 3-70742-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 8-8 and Figure 8-9.

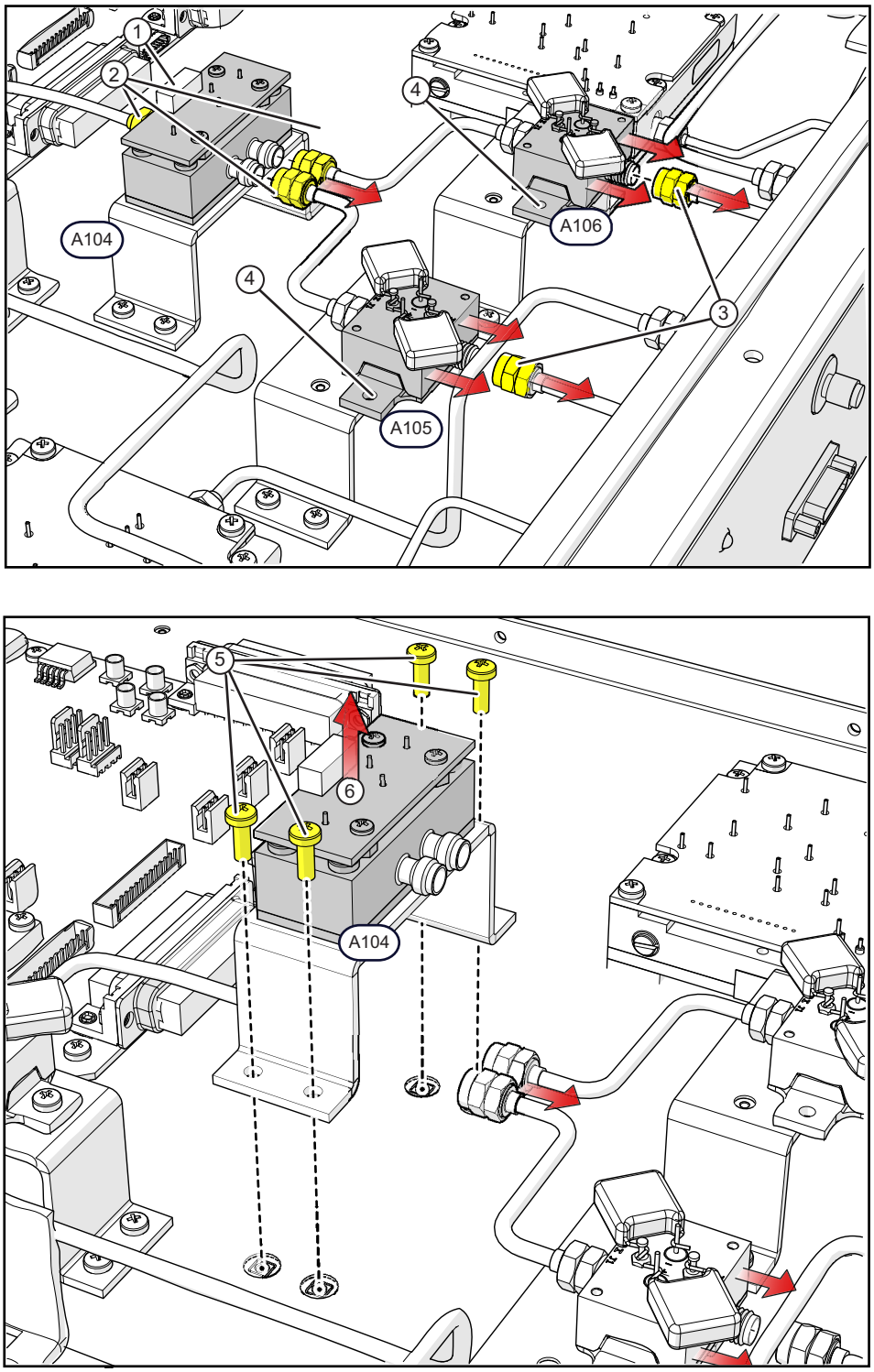


Figure 8-8. A104 Module and Bracket Replacement Detail (1 of 2)

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 8-9 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 8-8. A104 Module and Bracket Replacement Detail (2 of 2)

A104 Assembly Detail

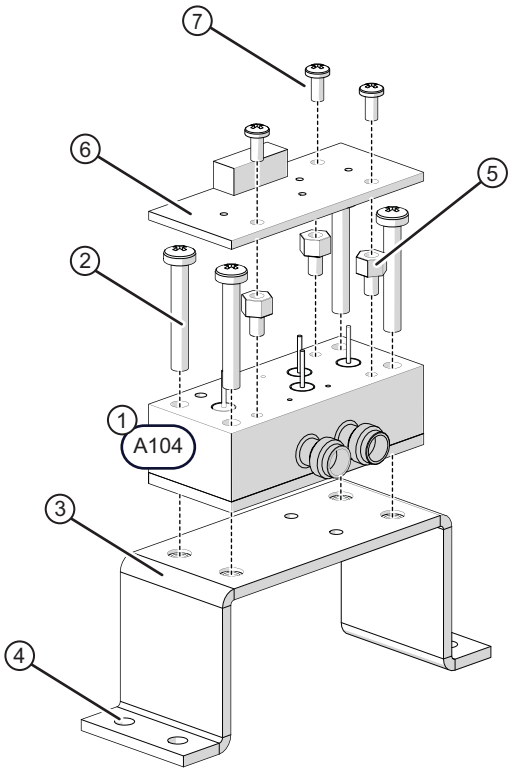


Figure 8-9. A104 Module, PCB, and Bracket Mounting Detail (1 of 2)

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 – 64951-3 7 – PCB Mounting Screws – 3 each

Figure 8-9. A104 Module, PCB, and Bracket Mounting Detail (2 of 2)

8-8 Rear Panel Fan Assembly – ND73164 or 3-ND73164

Use this procedure to replace the rear panel fan assembly. The top cover must be removed to replace the fan.

Required Tools

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

Reference Figures

See Figure 8-3 on page 8-7 above for the location of the Rear Panel Fan Assembly. See Figure 8-10 below for assembly details.

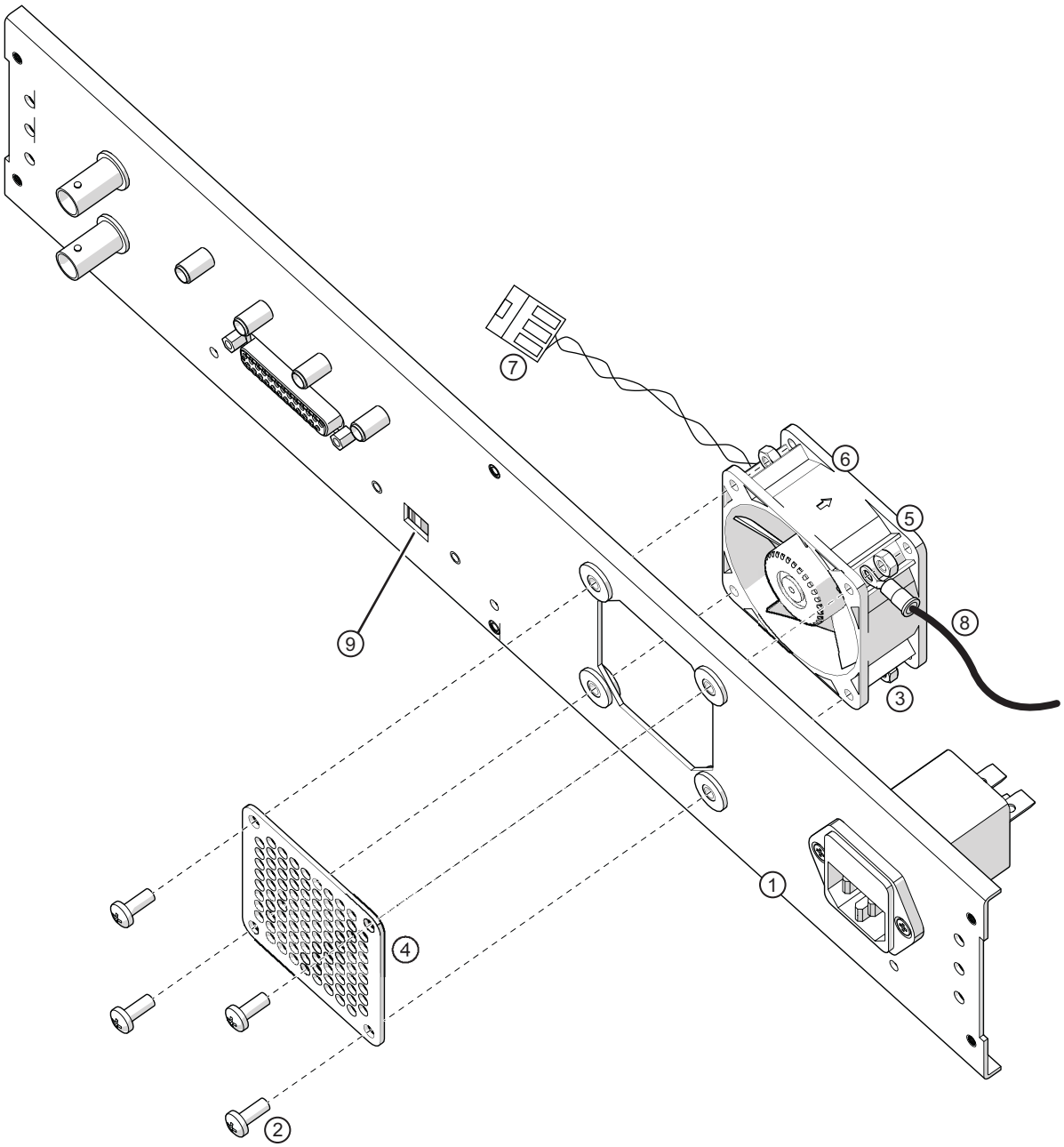


Figure 8-10. Rear Panel Fan Assembly (1 of 2)

1 – Rear Panel	6 – Air Flow into Chassis – Note fan flow direction arrow.
2 – Finger Guard and Fan Mounting Screws, 4 each	7 – Rear Panel Fan Assembly Cable Connector – Connects to A1 PCB Connector P9
3 – Finger Guard and Fan Mounting Nuts, 4 each	8 – Ground Lug
4 – External Finger Guard	9 – Option 3739C-003 – Module Interface Cable Length Switch
5 – Rear Panel Fan	

Figure 8-10. Rear Panel Fan Assembly (2 of 2)

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
   - See "Disassembly – Power, Disconnect, and Covers" on page 8-1 above.
2. Remove the top cover as described in the procedure above.

Fan Replacement

3. Identify the location of the Rear Panel Fan Assembly as shown above in Figure 8-3 on page 8-7 above.
4. Disconnect the fan assembly power plug from the A1 Bias Control PCB at connector P9.
5. Review the Rear Panel Fan mounting hardware as shown below in
6. Using a Phillips head screwdriver and an M4 open end wrench, loosen and remove the four (4) screws and Kep nuts that hold the fan assembly and the outside finger guard to the Rear Panel.
7. Remove the to-be-replaced fan assembly and insert the replacement assembly. Note the airflow arrow orientation on the fan to move air into the chassis.
8. Insert each mounting screw through the finger guard, rear panel, fan, and secure in place with a Kep nut and loosely tighten.
9. When all four screws are in place, make sure the fan assembly is centered in the rear panel opening, and tighten the four (4) screws and nuts.
10. Connect the fan power cable to the A1 PCB Connector P9.

Common Reassembly Procedures

11. If no other interior replacement procedures are required, follow the common reassembly procedures described above.
    - "Reassembly – Power, Disconnect, and Covers" on page 8-4

8-9 Front Panel Assembly

Use this procedure to replace the front panel assembly.

Replacement Parts

- 3739B Front Panel Assembly – ND75877
- 3739C Front Panel Assembly – 3-ND80354

Procedure

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

- 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
- Installing the replacement Front Panel in the chassis
- Reconnecting the RF and signal cables

The Front Panel general orientation is shown above in Figure 8-3 on page 8-7. See Figure 8-11 below for an illustration of the Front Panel viewed from inside the chassis where Port 1 is on the right with the supplied cable harnesses and the cables that must be disconnected.

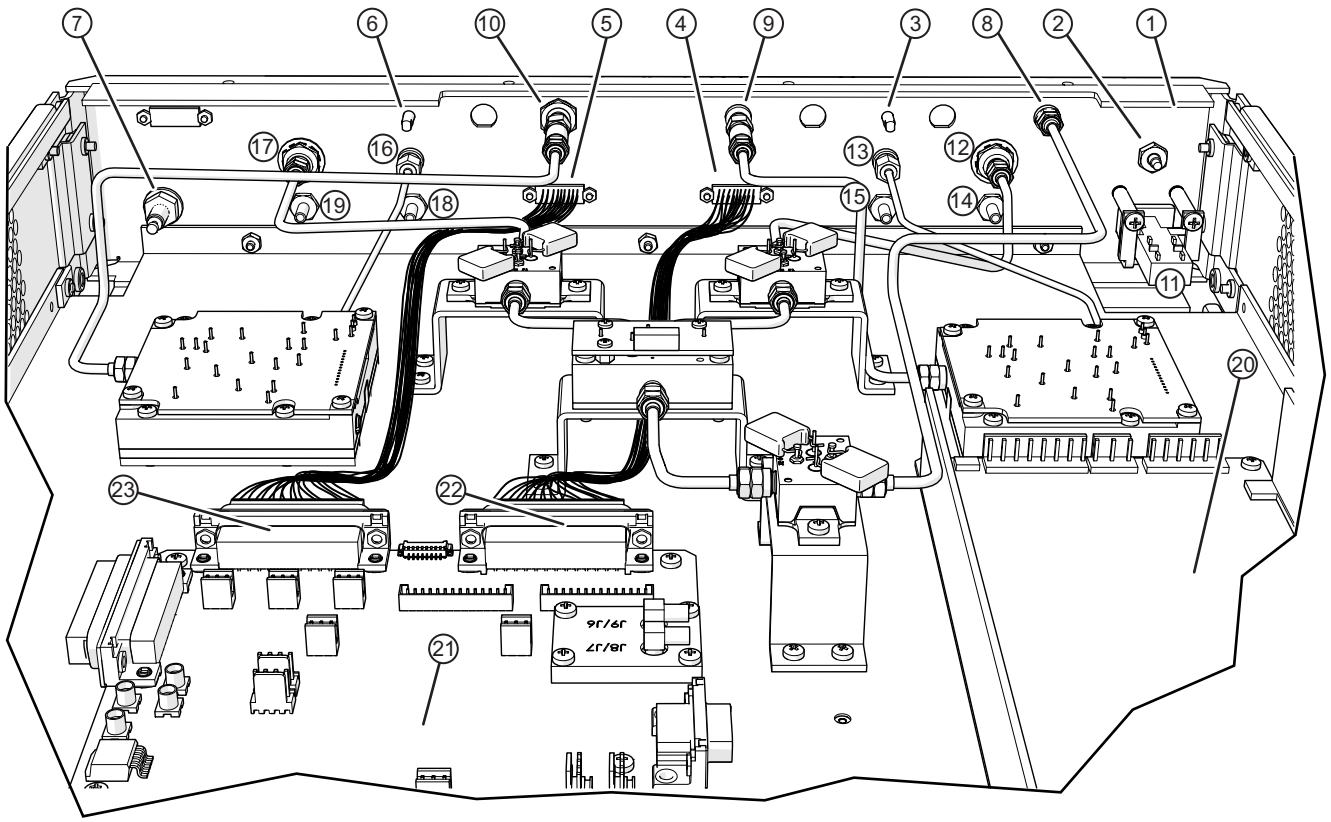


Figure 8-11. Front Panel Assembly – View from inside chassis (1 of 2)

1 – Front Panel Assembly – Viewed from Inside Chassis – Power Switch and Port 1 on right – Port 2 and Ground on left.	**Disconnect These Cables – Port 1**
Cable Harnesses Provided	12 – Port 1 RF Connector, Semi-Rigid Coaxial Cable
2 – Power LED Cable Harness	13 – Port 1 LO Connector, Semi-Rigid Coaxial Cable
3 – Port 1 LED Cable Harness	14 – Port 1 Test Connector, Flexible Coaxial Cable
4 – Port 1 Power Cable Harness	15 – Port 1 Ref Connector, Flexible Coaxial Cable
5 – Port 2 Power Cable Harness	**Disconnect These Cables – Port 2**
6 – Port 1 LED Cable Harness	16 – Port 2 LO Connector, Semi-Rigid Coaxial Cable
7 – Ground Plug Cable Harness	17 – Port 2 RF Connector, Semi-Rigid Coaxial Cable
Disconnect These Cables – Top Row	18 – Port 2 Ref Connector, Flexible Coaxial Cable
8 – RF Connector, Semi-Rigid Coaxial Cable	19 – Port 2 Test Connector, Flexible Coaxial Cable
9 – LO1 Connector, Semi-Rigid Coaxial Cable and 6 dB attenuator	**Power Supply and A1 PCB**
10 – LO2 Connector, Semi-Rigid Coaxial Cable and 6 dB attenuator	20 – Power Supply Module – 3-40-183
Disconnect Switch	21 – A1 Bias Control PCB Assembly – ND73163 – 3-72143-3
11 – Power Switch and Cable Harness Assembly – Remove two screws to detach power switch from Panel.	22 – A1 PCB Connector J2 – Connects to Port 1
	23 – A1 PCB Connector J3 – Connects to Port 2

Figure 8-11. Front Panel Assembly – View from inside chassis (2 of 2)

Replacement Procedure

Common Disassembly Procedures

1. Power down the VNA and Test Set and disconnect the cables between the VNA, Test Set, and Modules. Move the Test Set to the repair area.
2. Remove the top cover as described in Section 8-2 above.

Front Panel Removal

3. Disconnect the following cables from their destination connectors. Note that these cables are included with the replacement Front Panel.
   a. LED Power – Disconnect at A1 PCB Connector P7.
   b. Port 1 LED – Disconnect at A1 PCB Connector P13.
   c. Port 2 LED – Disconnect at A1 PCB Connector P12.
   d. Port 1 Power / Control – Disconnect at A1 PCB Connector J2.
   e. Port 2 Power / Control – Disconnect at A1 PCB Connector J3.

Disconnect Semi-Rigid Coaxial Cables

4. Disconnect the three semi-rigid coaxial connections from the Front Panel top connector row. Once loose, bend the cables slightly out of the way.
   - **a.** RF connector.
   - **b.** LO1 6 dB attenuator and semi-rigid cable
   - **c.** LO2 6 dB attenuator and semi-rigid cable
5. Disconnect the flexible and semi-rigid coaxial cables from these locations. Note that each cable is labeled with a part number, the starting assembly and connector number, and the ending assembly and connector number.
   - **a.** Port 1 RF
   - **b.** Port 1 Test
   - **c.** Port 1 LO
   - **d.** Port 1 Ref
   - **e.** Port 2 LO
   - **f.** Port 2 Ref
   - **g.** Port 2 RF
   - **h.** Port 2 Test

Disconnect the Ground and Power Switch

6. Disconnect the Front Panel Ground plug cable harness by removing the Kep nut holding the ring lug to the chassis.
7. Undo the two screws holding the switch bracket to the Front Panel Switch Standoffs. Leave the switch harness cables connected at their destinations.

Remove Front Panel

8. Remove the hardware holding the Front Panel to the side panels.
9. Carefully gather up the cable harnesses attached to the Front Panel, and remove the Front Panel assembly from the chassis. Carefully feed the Power Switch through the opening so it and its cable harness remain with the chassis.

Remove the F-F Adapters from the To-Be-Replaced Front Panel

10. Using a 4 mm (5/16") torque end wrench, loosen and remove the hex nut and washer holding each female-female bulkhead adapters in place.
    - **a.** Remove the two (2) **V232 F-F** adapters.
    - **b.** Remove the five (5) **K232B F-F** adapters.

Install the F-F Adapters on the Replacement Front Panel

11. At the replacement Front Panel, install the two (2) **V232 F-F** adapters to:
    - Port 1 RF
    - Port 2 RF

12. At the replacement Front Panel, install the five (5) **K232B F-F** adapters to:

- RF
- LO1
- LO2
- Port 1 LO
- Port 2 LO

13. Place the replacement Front Panel assembly in place, making sure the Power Switch assembly is correctly in the panel opening. Insert the two screws but do not tighten.

14. Insert the two screws on each side holding the Front Panel assembly to the side panels, but do not tighten.

Connect Cable Bottom Row

15. Install the bottom row of flexible coaxial cables to these locations:

- Port 1 Test
- Port 1 Ref
- Port 2 Ref
- Port 2 Test

16. Torque each connector 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.

Connect Cable Middle Row

17. Connect the middle row of semi rigid coaxial cables to these locations:

- Port 1 RF
- Port 1 LO
- Port 2 LO
- Port 2 RF

18. As above, torque each connector to 0.9 N·m (8 lbf·in) using a plain 8 mm (5/16") end wrench to hold the connector body, and the 4 mm torque wrench to torque the cable nut.

Connect Cable Top Row

19. Connect the top row of semi rigid coaxial cables to these locations:

- RF
- LO1 6 dB attenuator and semi-rigid cable
- LO2 6 dB attenuator and semi-rigid cable

20. As above, torque each connector to 0.9 N·m (8 lbf·in) using two end wrenches.

Tighten All Screws

21. Torque each connector to 0.9 N·m (8 lbf·in).

22. Tighten the side panel screws

23. Tighten the screws holding the power switch in place.

Connect Replacement Front Panel Cables

24. Connect the front panel cable harnesses to these locations:

a. LED Power – Connect to A1 PCB Connector P7.

b. Port 1 LED – Connect to A1 PCB Connector P13.

c. Port 2 LED – Connect to A1 PCB Connector P12.

d. Port 1 Power / Control – Connect to A1 PCB Connector J2.

e. Port 2 Power / Control – Connect to A1 PCB Connector J3.

Common Reassembly Procedures

25. If no other interior replacement procedures are required, follow the common reassembly procedures described above.

- "Reassembly – Power, Disconnect, and Covers" on page 8-4

Appendix A — Test Records

A-1 Introduction

This appendix provides test records that can be used to record the performance of the ME7838A/AX/D/E/EX/G mmWave configuration VNA system and the WR05 test results of the ME7838G 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 ME7838 mmWave Configuration VNA System Test Record

Instrument Information

ME7838A [ ] ME7838E [ ] ME7838AX [ ] ME7838EX [ ]	Operator:	Date:
VectorStar VNA Model: MS4642A [ ] MS4644A [ ] MS4645A [ ] MS4647A [ ] MS4642B [ ] MS4644B [ ] MS4645B [ ] MS4647B [ ]	VectorStar VNA Serial Number:	VectorStar VNA Options: 51 [ ] 61 [ ] 62 [ ] 70 [ ] 80 [ ] 81 [ ] 82 [ ] 83 [ ] 84 [ ] 85 [ ] 86 [ ] 87 [ ] 88 [ ] 89 [ ]
Port 1 mmWave Module Model:	Module Serial Number:	
Port 2 mmWave Module Model:	Module Serial Number:	

Directivity Verification

Table A-1. Directivity Results

Frequency	Port 1 Module	Port 2 Module	Port 1 Measured	Port 2 Measured	Specification
56 to 94 GHz	SM6499	SM6499	dB	dB	>44 dB
56 to 94 GHz	3744A-EE	3744A-EE	dB	dB	>44 dB
56 to 94 GHz	3744E-EE	3744E-EE	dB	dB	>44 dB
65 to 110 GHz	SM6527	SM6527	dB	dB	>40 dB
65 to 110 GHz	3744A-EW	3744A-EW	dB	dB	>40 dB
65 to 110 GHz	3744E-EW	3744E-EW	dB	dB	>40 dB

Source Match Verification

Table A-2. Source Match Results

Freq (GHz	Port 1 Module	Port 2 Module	Port 1 Measured	Port 2 Measured	Specification
56 to 94 GHz	SM6499	SM6499	dB	dB	>33 dB
56 to 94 GHz	3744A-EE	3744A-EE	dB	dB	>33 dB
56 to 94 GHz	3744E-EE	3744E-EE	dB	dB	>33 dB
65 to 110 GHz	SM6527	SM6527	dB	dB	>30 dB
65 to 110 GHz	3744A-EW	3744A-EW	dB	dB	>30 dB
65 to 110 GHz	3744E-EW	3744E-EW	dB	dB	>30 dB

A-3 ME7838G WR05 S-Parameter Measurements Test Record

Instrument Information

ME7838G	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
S21	dB	-2 dB min
S12	dB	-2 dB min
S22	dB	-10 dB max

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