

VectorStar™ ME7848A/E Series Opto-electronic Network Analyzer

VNA, O/E Calibration Module, and E/O Converter:

ME7848A/E-0210, 110 GHz, 1550 nm system

ME7848A/E-0211, 110 GHz, 1310 nm system

ME7848A-0240 40 GHz, 850 nm system

ME7848A-0270 70 GHz, 1550 nm system

ME7848A-0271 70 GHz, 1310 nm system

ME7848A-0272 70 GHz, 1310/1550 nm system

VNA and O/E module only:

ME7848A/E-0110 110 GHz, 1550 nm system

ME7848A/E-0111 110 GHz, 1310 nm system

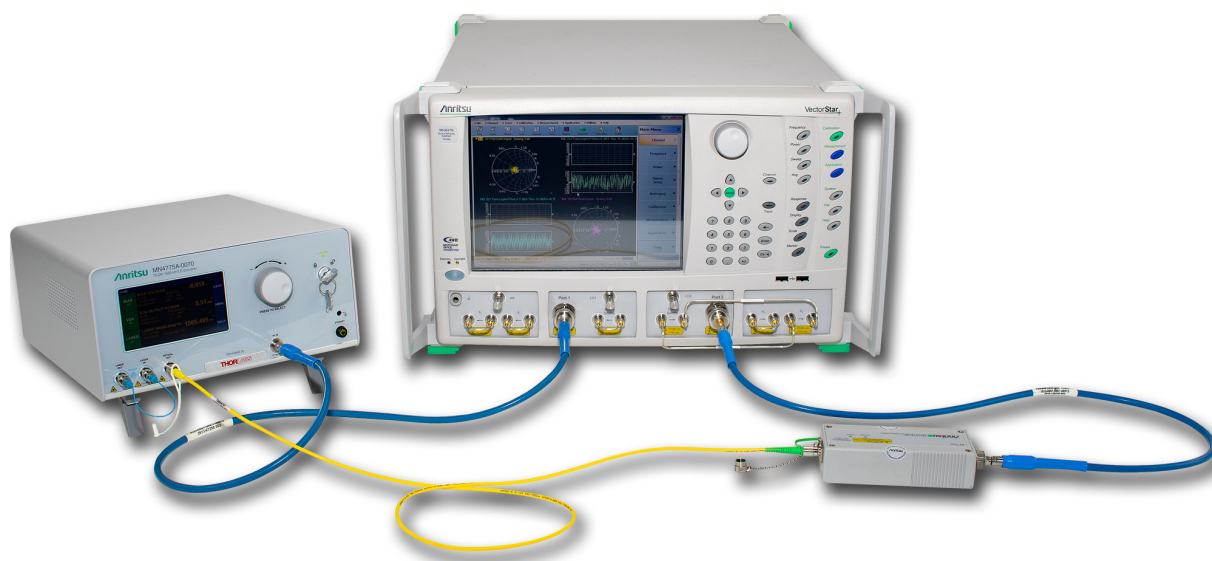
ME7848A/E-0112 110 GHz, 1310/1550 nm system

ME7848A-0140 40 GHz, 850 nm system

ME7848A-0170 70 GHz, 1550 nm system

ME7848A-0171 70 GHz, 1310 nm system

ME7848A-0172 70 GHz, 1310/1550 nm system



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UPDATES

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Table of Contents

Chapter 1 — General Information

1-1	Introduction	1-1
1-2	Identification Number	1-1
1-3	Contacting Anritsu	1-2
1-4	Related Documentation	1-2
	Product Information, Compliance, and Safety	1-2
	VectorStar™ MS464xB Series Vector Network Analyzers	1-2
	VectorStar ME7838 Series 2-Port BB/mmWave VNA Measurement System	1-2
	VectorStar ME7848A/E Series Opto-electronic Network Analyzer	1-2
	VectorStar MN4775A E/O Converter	1-3
	VectorStar MN4765B O/E Calibration Module	1-3
	Updates to Manuals	1-3
1-5	Electrostatic Discharge (ESD) Prevention	1-3
1-6	ME7848A/E Series ONA System Overview	1-3
	ME7848A/E-02xx Standard VNA System Components	1-3
	ME7848A/E-01xx Standard Broadband VNA System Components (VNA and O/E module only)	1-8
1-7	Recommended Test Equipment	1-11
	Test Equipment – ME7848A/E	1-11

Chapter 2 — Replaceable Parts

2-1	Introduction	2-1
2-2	ME7848A/E Series System Replaceable Parts	2-1

Chapter 3 — Performance Verification

3-1	Introduction	3-1
3-2	Calibration and Measurement Conditions	3-1
3-3	Laser Safety	3-2
3-4	ME7848A/E-0210 System Verification – 1550 nm Configuration	3-3
	ME7848A/E-0210 1550 nm System Setup	3-3
	Optical Power Meter (OPM) Measurement Setup – 1550 nm Configuration	3-5
	Optical Power Meter Measurement – 1550 nm Configuration	3-6
	Frequency Response Repeatability S21 Setup – 1550 nm Configuration	3-7
	Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration	3-8
	Optical Noise Floor S21 Setup – 1550 nm Configuration	3-11
	Optical Noise Floor S21 Measurement – 1550 nm Configuration	3-13

Table of Contents (Continued)

3-5	ME7848A/E-0211 System Verification – 1310 nm Configuration	3-19
	ME7848A/E-0271 1310 nm System Setup	3-19
	Optical Power Meter (OPM) Measurement Setup – 1310 nm Configuration	3-21
	Optical Power Meter Measurement – 1310 nm Configuration	3-22
	Frequency Response Repeatability S21 Setup – 1310 nm Configuration	3-23
	Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration . .	3-24
	Optical Noise Floor S21 Setup – 1310 nm Configuration	3-27
	Optical Noise Floor S21 Measurement – 1310 nm Configuration	3-30
3-6	ME7848A-0240 System Verification – 850 nm Configuration	3-35
	ME7848A-0240 850 nm System Setup	3-35
	Optical Power Meter (OPM) Measurement Setup – 850 nm Configuration	3-37
	Optical Power Meter Measurement – 850 nm Configuration	3-38
	Frequency Response Repeatability S21 Setup – 850 nm Configuration	3-39
	Frequency Response Repeatability S21-Mag Measurement – 850 nm Configuration . .	3-40
	Optical Noise Floor S21 Setup – 850 nm Configuration	3-42
	Optical Noise Floor S21 Measurement – 850 nm Configuration	3-44
3-7	ME7848A-0270 System Verification – 1550 nm Configuration	3-48
	ME7848A-0270 1550 nm System Setup	3-48
	Optical Power Meter (OPM) Measurement Setup – 1550 nm Configuration	3-50
	Optical Power Meter Measurement – 1550 nm Configuration	3-51
	Frequency Response Repeatability S21 Setup – 1550 nm Configuration	3-52
	Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration . .	3-53
	Optical Noise Floor S21 Setup – 1550 nm Configuration	3-55
	Optical Noise Floor S21 Measurement – 1550 nm Configuration	3-57
3-8	ME7848A-0271 System Verification – 1310 nm Configuration	3-63
	ME7848A-0271 1310 nm System Setup	3-63
	Optical Power Meter (OPM) Measurement Setup – 1310 nm Configuration	3-65
	Optical Power Meter Measurement – 1310 nm Configuration	3-66
	Frequency Response Repeatability S21 Setup – 1310 nm Configuration	3-67
	Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration . .	3-68
	Optical Noise Floor S21 Setup – 1310 nm Configuration	3-70
	Optical Noise Floor S21 Measurement – 1310 nm Configuration	3-72
3-9	ME7848A-0272 System Verification – 1310/1550 nm Configuration	3-76

Chapter 4 — Theory of Operation

4-1	Introduction	4-1
4-2	System Description	4-1
4-3	System Components	4-1
4-4	Functional Description of System Components	4-3
	VectorStar MS464xB Vector Network Analyzer	4-3
	MN4775A E/O Converter	4-4
	MN4765B O/E Calibration Module	4-4
4-5	ME7848A/E ONA System Operation	4-5
	Stimulus Signal Generation	4-5
	Test Signal Processing	4-5

Table of Contents (Continued)

Chapter 5 — Troubleshooting

5-1	Introduction	5-1
5-2	General Safety Warnings	5-1
5-3	Troubleshooting Strategy	5-4
	Suggested Troubleshooting Steps	5-4
5-4	General Troubleshooting of the System	5-4
	Procedure	5-4

Appendix A — ME7848A/E ONA Test Records

A-1	Introduction	A-1
A-2	ME7848A/E-0210 1550 nm Test Records	A-2
A-3	ME7848A/E-0211 1310 nm Test Records	A-6
A-4	ME7848A-0240 850 nm Test Records	A-10
A-5	ME7848A-0270 1550 nm Test Records	A-12
A-6	ME7848A-0271 1310 nm Test Records	A-14
A-7	ME7848A-0272 1310/1550 nm Test Records	A-16

Chapter 1 — General Information

1-1 Introduction

This manual provides general service and maintenance instructions for Anritsu ME7848A Opto-electronic Network Analyzer (ONA). The ME7848A/E series consists of:

- ME7848A/E-0110 110 GHz, 1550 nm system (VNA and O/E module only)
- ME7848A/E-0111 110 GHz, 1310 nm system (VNA and O/E module only)
- ME7848A/E-0112 110 GHz, 1310/1550 nm system (VNA and O/E module only)
- ME7848A-0140 40 GHz, 850 nm system (VNA and O/E module only)
- ME7848A-0170 70 GHz, 1550 nm system (VNA and O/E module only)
- ME7848A-0171 70 GHz, 1310 nm system (VNA and O/E module only)
- ME7848A-0172 70 GHz, 1310/1550 nm system (VNA and O/E module only)
- ME7848A/E-0210 110 GHz, 1550 nm system
- ME7848A/E-0211 110 GHz, 1310 nm system
- ME7848A-0240 40 GHz, 850 nm system
- ME7848A-0270 70 GHz, 1550 nm system
- ME7848A-0271 70 GHz, 1310 nm system
- ME7848A-0272 70 GHz, 1310/1550 nm system

Each ME7848A/E Series System consists of a combination of the following components, specified by its respective TDS (Technical Data Sheet):

- VectorStar™ MS464xB Vector Network Analyzer or ME7838AX/EX broadband VNA system
- MN4765B-XXXX O/E Calibration Module
- MN4775A-0040/0070/0071/0072/0110/0111 E/O Converter (-02XX systems only)

This manual contains procedures for:

- Testing the system for proper operation
- Verifying System Performance, independent of any external equipment
- Troubleshooting the failed system to the failed instrument/module level

Throughout this manual, the term “ONA System” will be used interchangeably to refer to ME7848A Series Opto-electronic Network Analyzer.

1-2 Identification Number

All Anritsu instruments are assigned a unique identification number (up to seven-digit), such as “090201” or “1010222”. This number appears on a decal affixed to the rear panel of each instrument. Use the VectorStar VNA’s identification number during any correspondence with Anritsu Customer Service about Anritsu instruments.

1-3 Contacting Anritsu

To contact Anritsu, visit:

<http://www.anritsu.com/en-US/contact-us>

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

Updated product information can be found on your product page:

<http://www.anritsu.com/en-us/test-measurement/products/me7848a>

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

All documents listed below are available as free downloads at www.anritsu.com.

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

- ME7838AX/A4X Modular BB/mmWave Technical Data Sheet – 11410-02825
- ME7838D Modular BB/mmWave Technical Data Sheet – 11410-00778
- ME7838EX/E4X Modular BB/mmWave Technical Data Sheet – 11410-002827
- ME7838G Modular BB/mmWave Technical Data Sheet – 11410-01060
- ME7838D/G Modular BB/mmWave Quick Start Guide – 10410-00732
- ME7838 Series Modular BB/mmWave Installation Guide – 10410-00293
- VectorStar Broadband/Banded mmWave Modules Reference Manual – 10410-00311
- ME7838 Series Modular BB/mmWave Maintenance Manual – 10410-00306

VectorStar ME7848A/E Series Opto-electronic Network Analyzer

- ME7848A/E ONA Technical Data Sheet – 11410-01145
- ME7848A/E ONA Quick Start Guide – 10410-00777
- ME7848A/E Maintenance Manual – 10410-00778

VectorStar MN4775A E/O Converter

- MN4775A E/O Converter Technical Data Sheet – 11410-01144
- MN4775A E/O Converter Operations Manual – 10410-00774
- MN4775A E/O Converter Quick Start Guide – 10410-00779

VectorStar MN4765B O/E Calibration Module

- MN4765B O/E Calibration Module Operating Manual – 10410-00742

Updates to Manuals

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

<http://www.anritsu.com/en-us/test-measurement/products/ms4640b-series>

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 ME7848A/E Series Opto-electronic Network Analyzer.

1-6 ME7848A/E Series ONA System Overview

The ME7848A/E opto-electronic network analyzer (ONA) system comprises a VNA, a calibration O/E module, and a laser/modulator E/O converter assembly. Together, they allow calibrated RF response measurements of E/O, O/E, and certain O/O devices.

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

- [Table 1-1, "ME7848A/E-02xx Standard ONA System Components"](#)
- [Table 1-2, "ME7848A/E-01xx Standard ONA System Components"](#)

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

ME7848A/E-02xx Standard VNA System Components

Table 1-1. ME7848A/E-02xx Standard ONA System Components (1 of 5)

Part Number	Name	Specifications
Standard ME7848A-0210 Configuration		
ME7838AX	VectorStar ME7838AX Broadband Vector Network Analyzer (VNA)	10 MHz to 125 GHz W(m) Test Ports
MN4765B with option 0110	O/E Calibration Module	
MN4775A with option 0110	E/O Converter	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system

Table 1-1. ME7848A/E-02xx Standard ONA System Components (2 of 5)

Part Number	Name	Specifications
Standard ME7848E-0210 Configuration		
ME7838EX	VectorStar ME7838EX Broadband Vector Network Analyzer (VNA)	10 MHz to 110 GHz W(m) Test Ports
MN4765B with option 0110	O/E Calibration Module	
MN4775A with option 0110	E/O Converter	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848A-0211 Configuration		
ME7838AX	VectorStar ME7838AX Broadband Vector Network Analyzer (VNA)	10 MHz to 125 GHz W(m) Test Ports
MN4765B with option 0111	O/E Calibration Module	
MN4775A with option 0111	E/O Converter	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848E-0211 Configuration		
ME7838EX	VectorStar ME7838EX Broadband Vector Network Analyzer (VNA)	10 MHz to 110GHz W(m) Test Ports
MN4765B with option 0111	O/E Calibration Module	
MN4775A with option 0111	E/O Converter	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848A-0240 Configuration		
MS4644B	VectorStar MS4644B Vector Network Analyzer (VNA)	10 MHz to 40 GHz K (m) Test Ports
MN4765B with option 0040	O/E Calibration Module	
MN4775A with option 0040	E/O Converter	

Table 1-1. ME7848A/E-02xx Standard ONA System Components (3 of 5)

Part Number	Name	Specifications
MS4644B VNA Front Panel Options – Select One (1)		
MS4644B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4644B-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.
MS4644B-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.
2000-1957-R	Accessory Kit	850 nm Accessory Kit for 40 GHz ME7848A ONA system
Standard ME7848A-0270 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0070	O/E Calibration Module	
MN4775A with option 0070	E/O Converter	
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system

Table 1-1. ME7848A/E-02xx Standard ONA System Components (4 of 5)

Part Number	Name	Specifications
Standard ME7848A-0271 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0071	O/E Calibration Module	
MN4775A with option 0071	E/O Converter	
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system
Standard ME7848A-0272 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0072	O/E Calibration Module	
MN4775A with option 0072	E/O Converter	

Table 1-1. ME7848A/E-02xx Standard ONA System Components (5 of 5)

Part Number	Name	Specifications
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2.
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system.

ME7848A/E-01xx Standard Broadband VNA System Components (VNA and O/E module only)

Table 1-2. ME7848A/E-01xx Standard ONA System Components (1 of 4)

Part Number	Name	Specifications
Standard ME7848A-0110 Configuration		
ME7838AX	VectorStar ME7838AX Broadband Vector Network Analyzer (VNA)	10 MHz to 125 GHz; W(m) Test Ports
MN4765B with option 0110	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848E-0110 Configuration		
ME7838EX	VectorStar ME7838EX Broadband Vector Network Analyzer (VNA)	10 MHz to 110 GHz; W(m) Test Ports
MN4765B with option 0110	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848A-0111 Configuration		
ME7838AX	VectorStar ME7838AX Broadband Vector Network Analyzer (VNA)	10 MHz to 125 GHz; W(m) Test Ports
MN4765B with option 0111	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A /E ONA system
Standard ME7848E-0111 Configuration		
ME7838EX	VectorStar ME7838EX Broadband Vector Network Analyzer (VNA)	10 MHz to 110 GHz; W(m) Test Ports
MN4765B with option 0111	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A /E ONA system
Standard ME7848A-0112 Configuration		
ME7838AX	VectorStar ME7838AX Broadband Vector Network Analyzer (VNA)	10 MHz to 125 GHz; W(m) Test Ports
MN4765B with option 0112	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system

Table 1-2. ME7848A/E-01xx Standard ONA System Components (2 of 4)

Part Number	Name	Specifications
Standard ME7848E-0112 Configuration		
ME7838EX	VectorStar ME7838EX Broadband Vector Network Analyzer (VNA)	10 MHz to 110 GHz; W(m) Test Ports
MN4765B with option 0112	O/E Calibration Module	
2000-2119-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 110 GHz ME7848A/E ONA system
Standard ME7848A-0140 Configuration		
	VectorStar MS4644B Vector Network Analyzer (VNA)	10 MHz to 40 GHz K (m) Test Ports
MN4765B with option 0040	O/E Calibration Module	
MS4644B VNA Front Panel Options – Select One (1)		
MS4644B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4644B-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.
MS4644B-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.
2000-1957-R	Accessory Kit	850 nm Accessory Kit for 40 GHz ME7848A ONA system
Standard ME7848A-0170 Configuration		
MS4647B	VectorStar MS4647B Vector Network Analyzer (VNA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0070	O/E Calibration Module	

Table 1-2. ME7848A/E-01xx Standard ONA System Components (3 of 4)

Part Number	Name	Specifications
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system
Standard ME7848A-0171 Configuration		
ME7838AX or ME7838EX	VectorStar MS4647B Vector Network Analyzer (ONA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0071	O/E Calibration Module	
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system
Standard ME7848A-0172 Configuration		
ME7838AX or ME7838EX	VectorStar MS4647B Vector Network Analyzer (ONA)	10 MHz to 70 GHz V(m) Test Ports
MN4765B with option 0072	O/E Calibration Module	

Table 1-2. ME7848A/E-01xx Standard ONA System Components (4 of 4)

Part Number	Name	Specifications
MS4647B VNA Front Panel Options – Select One (1)		
MS4647B-051	Front Panel Loops	6 Front Panel Loops Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2
MS4647B-061	Active Measurement Suite	2 Attenuators Includes front panel loops above with two (2) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
MS4647B-062	Active Measurement Suite	4 Attenuators Includes front panel loops above with four (4) attenuators, bias tees in test set, gain compression, and efficiency measurement software.
2000-1958-R	Accessory Kit	1310 and 1550 nm Accessory Kit for 70 GHz ME7848A ONA system

1-7 Recommended Test Equipment

The tables below list the recommended test equipment to be used for all maintenance activities for the ME7848A/E Opto-electronic Network Analyzer (ONA) systems.

- [Table 1-3, “Recommended Test Equipment for ME7848A/E ONA System](#)

Test Equipment – ME7848A/E

Table 1-3. Recommended Test Equipment for ME7848A/E ONA System

Instrument	Critical Specification	Recommended Manufacturer and Model	Use Codes ^a
Optical Power Meter		ThorLabs PM100D	P, T
Photodiode Power Sensor		Thorlabs S155C	P, 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 ME7848A/E Series ONA System

Note	This chapter does not include the replaceable parts information for the MS4640B/ME7838xX Vector Network Analyzer. For replaceable parts information, refer to the VectorStar MS4640B Series VNA Maintenance Manual – 10410-00320 or ME7838 Maintenance Manual – 10410-00306.
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2-2 ME7848A/E Series System Replaceable Parts

Part numbers and description of ME7848A/E Series system level replaceable parts are shown in [Table 2-1](#).

Note	There are no serviceable components or subassemblies inside the MN4775A converters or the MN4765B O/E modules. The modules must be returned to Anritsu Company for repair.
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Table 2-1. ME7848A/E Series System Level Replaceable Parts List

Part Number	Description
2000-1959-R	Fiber Connector Cleaner, 2.5mm
2000-1961-R	Ferrule Cleaner, 2.5mm
2000-1964-R	70 GHz Semi-rigid Cable Set (contains 2 cables part number 3-62109-249)
2000-1963-R	40 GHz Semi-rigid Cable Set (contains 2 cables part number 3-57989-67)
33VFVF50C	V F-F Adapter
33KFKF50C	K F-F Adapter
806-209-R	One meter F-M V RF cables
806-304-R	One meter F-M K RF cables
808-20-R	One meter 780-970 nm FC/PC-FC/APC fiber patch cord
808-21-R	One meter 1310-1550 nm FC/PC-FC/APC fiber patch cord
3671W1-50-2 W1 (male) to W1 (female), 13.0 cm (5.1 in)	W (13 cm) RF cables
33WFWF50	W F-F Adapter

Chapter 3 — Performance Verification

3-1 Introduction

This chapter provides the following procedures to be used to verify the performance of the ME7848A/E Opto-electronic Network Analyzer systems.:

- [Section 3-4 “ME7848A/E-0210 System Verification – 1550 nm Configuration” on page 3-3](#)
- [Section 3-5 “ME7848A/E-0211 System Verification – 1310 nm Configuration” on page 3-19](#)
- [Section 3-6 “ME7848A-0240 System Verification – 850 nm Configuration” on page 3-35](#)
- [Section 3-7 “ME7848A-0270 System Verification – 1550 nm Configuration” on page 3-48](#)
- [Section 3-8 “ME7848A-0271 System Verification – 1310 nm Configuration” on page 3-63](#)
- [Section 3-9 “ME7848A-0272 System Verification – 1310/1550 nm Configuration” on page 3-76](#)

Note There are no performance verifications for the ME7848A/E-01xx systems.
--

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 optical fiber patch cord and the cleanliness of the connectors on the MN4775A and MN4765B
- The condition and stability of the interconnect coaxial cables linking host VNA, MN4775A, and MN4765B
- Orientation of the fiber patch cord, where the green connector must be installed on the MN4765B.

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
 - $23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$, with $< 1\text{ }^{\circ}\text{C}$ variation from calibration temperature
 - Relative Humidity
 - 20-50% recommended

3-3 Laser Safety

All statements regarding safety of operation and technical data in this manual will only apply when the unit is operated correctly. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Only with written consent from Anritsu may changes to single components be carried out or components not supplied by Anritsu be used.

Laser Radiation

The -007x/-011x options of the MN4775A are class 1M devices, while the MN4775A-0040 is a class 3B device (due to the shorter wavelength).

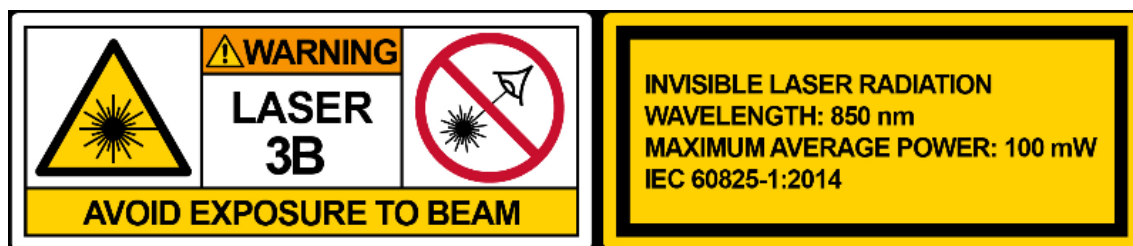
- **MN4775A-007x/-011x: Class 1M Laser**



Warning



- **MN4775A-0040: Class 3B Laser**



Avoid Exposure – Radiation emitted from apertures. Do not look into the laser aperture while the laser is on. Injury to the eye may result. Laser should not be turned on unless there is an optical fiber connected to the laser output port.

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

3-4 ME7848A/E-0210 System Verification – 1550 nm Configuration

This section contains the following setup and measurement procedures:

- [ME7848A/E-0210 1550 nm System Setup](#)
- [Optical Power Meter \(OPM\) Measurement Setup – 1550 nm Configuration](#)
- [Optical Power Meter Measurement – 1550 nm Configuration](#)
- [Frequency Response Repeatability S21 Setup – 1550 nm Configuration](#)
- [Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration](#)
- [Optical Noise Floor S21 Setup – 1550 nm Configuration](#)
- [Optical Noise Floor S21 Measurement – 1550 nm Configuration](#)

ME7848A/E-0210 1550 nm System Setup

1. Configure components (VNA, O/E, E/O, RF and Optical cables) as shown in [Figure 3-1](#).

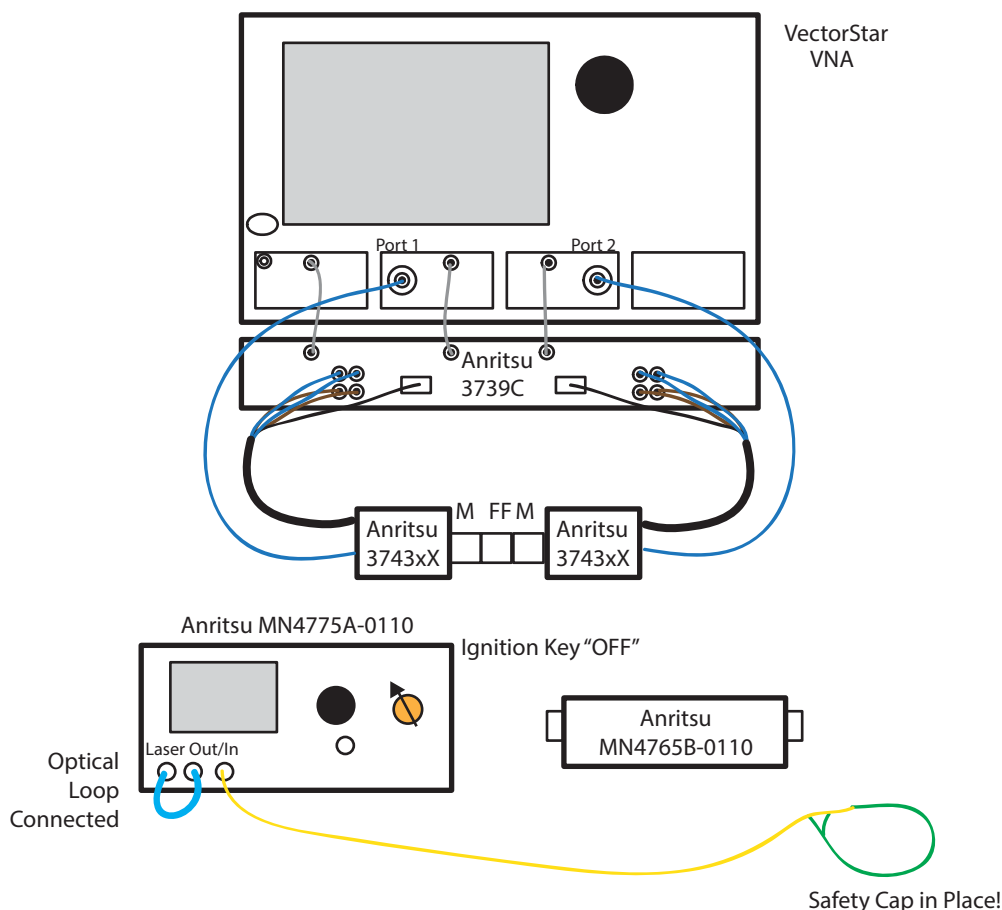


Figure 3-1. Initial ME7848A/E-0210 1550 nm Initial System Setup

Note

Refer to the **MN4775A Operation Manual** – 10410-00774 regarding proper operation of the Anritsu E/O Converter.

2. Apply power to MN4775A-0110 E/O Converter by pushing the **Standby** button until it turns **green**.
3. Apply power to the VNA.

4. Apply power to MN4765B-0110 O/E Calibration Module via +12 V power cube.
5. MN4775A-0110 E/O Converter:
 - a. Verify **Optical Loop** is in place on MN4775A-0110 E/O Converter.

Note There is a key on the optical fiber cable that needs to be oriented correctly before the screw will tighten correctly.

- b. Keep **Ignition-Key** in **OFF** Position as shown in [Figure 3-1](#).
6. Make initial VNA RF Connections shown in [Figure 3-1](#).
 - a. Place WF-WF Adapter on the port 2 module.
 - b. VNA Port 1 to VNA Port 2 via a 13 cm RF Cable.
 - c. Verify the connection between the **Male end** on cable at Port 1 and **Female End** on cable at Port 2.
7. Make Optical connection to MN4775A-0110 as shown in [Figure 3-1](#).
 - a. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0110 E/O Converter.
 - b. Place the **Green-colored** cap onto the **Green-colored** end of the Optical cable.
8. Turn MN4775A-0110 E/O Converter Ignition Key to **ON**.

Typical Bias, VOA, Laser Control

Typical Bias Secondary Screen Showing Mode, etc.

Please Note here showing Typical Setup Please Set values as described in Instructions

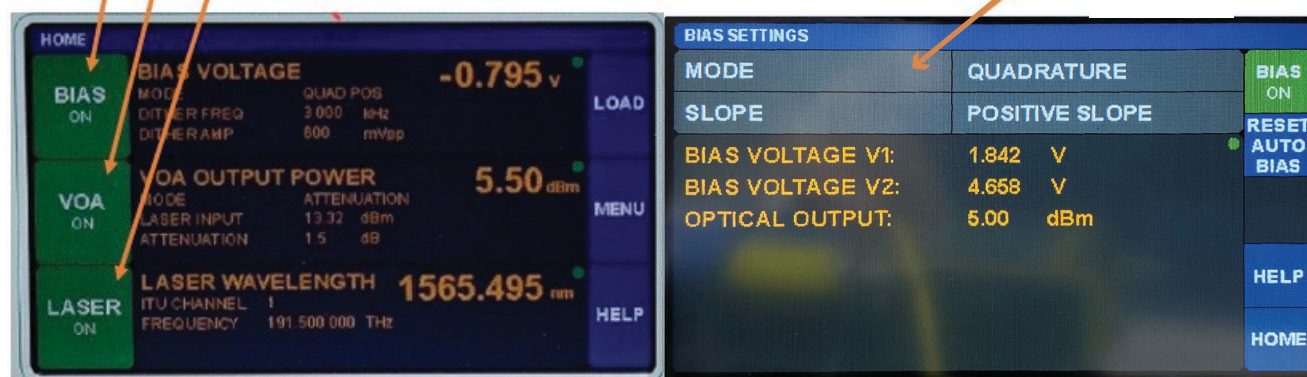


Figure 3-2. E/O Converter Setup Screen

Note The depiction of the touch screen settings above is for reference only; actual settings are as given below.

9. Make settings on MN4775A-0110 via the display touch screen as described below; refer to [Figure 3-2](#) (left side).
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.

10. Select ITU Channel:

- a. Touch center section of LASER WAVELENGTH region to bring up secondary screen (not shown in figure 3-2).
- b. At secondary screen select ITU Channel 39 = 1550.12 nm WAVE LENGTH. Touch green checkmark.
- c. Touch Home to return to the main screen.

11. Select VOA Mode:

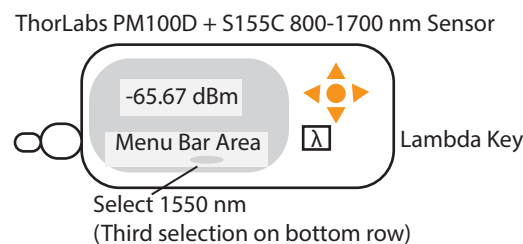
- a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen as shown in Figure 3-2 (left side).
- b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
- c. Select and adjust output power to +3 dBm.

12. Select Bias Mode:

- a. Touch center section of BIAS VOLTAGE region to bring up secondary screen as shown in Figure 3-2 (right side).
- b. At secondary screen select MODE = QUADRATURE.

13. Turn E/O Converter LASER Inter-Lock Ignition Key to OFF.**Optical Power Meter (OPM) Measurement Setup – 1550 nm Configuration**

1. Apply Power via **black button** adjacent to sensor (side panel).
2. Allow 1 minute warm up

**Figure 3-3. Power Meter QP – 1550 nm Configuration**

3. Verify following default settings.
 - a. Range = Auto.
 - b. Units = dBm.
4. Navigate to MEAS CONFIG menu via front panel buttons.
 - a. Select Zero to zero the sensor (About 2 seconds).
 - b. Exit MEAS CONFIG menu.
5. Set Measurement Wavelength.
 - a. On Front Panel select **Lambda** button as shown in Figure 3-3.
 - b. Navigate to 1550nm Wavelength icon in menu bar area.
 - c. On PM100D Meter select OK to choose 1550 nm selection, as shown in Figure 3-3.

Optical Power Meter Measurement – 1550 nm Configuration

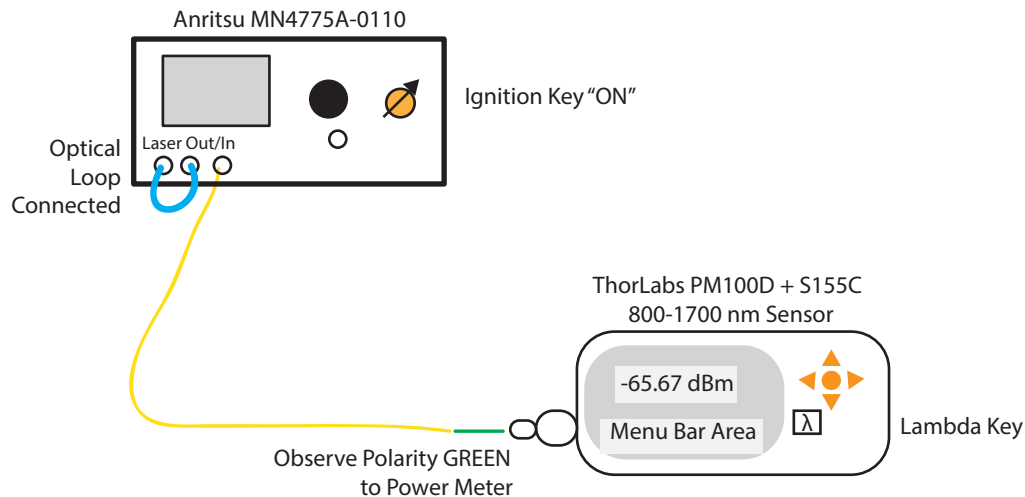


Figure 3-4. Optical Power Measurement – 1550 nm Configuration

1. Optical Power Measurement Using PM100D:

- a. Connect PM100D OPM to E/O Converter Output via Optical Cable, as shown in [Figure 3-4](#).
- b. Verify that the PM100D's power is **ON**.
- c. Turn E/O Converter Ignition Key = **ON**.
- d. Using E/O Touch Panel:
 - i. Laser = ON.
 - ii. VOA = ON, VOA Mode = Constant Output at +3 dBm.
 - iii. BIAS = ON.
- e. Modify Bias Mode
 - i. Push touch screen at Bias center navigate to Secondary Bias settings screen.
 - ii. Select Bias Mode = PEAK.
 - iii. Select Reset Auto-Bias Cal.
- f. Wait for readings to stabilize; nominally less than ± 0.5 dB bounce.
- g. Enter nominal reading from PM100D Optical Power Meter into the test records in [Table A-1](#), "Optical Power Measurement – 1550 nm Band" on page A-2.
- h. Expected range for this measurement is +3 dBm ± 2 dB.

Note Meter reading may fluctuate nominally ± 0.5 dB.

2. Set E/O Converter Inter-Lock to **OFF**:

- a. Set E/O Converter Gen Laser Interlock to **OFF** via Ignition Key.
- b. Power down Optical Power Meter.

3. Disconnect the Optical Power Meter.

Frequency Response Repeatability S21 Setup – 1550 nm Configuration

1. Power on MN4775A-0110, ME7838AX/EX, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0110 E/O Converter Ignition key to **OFF**.

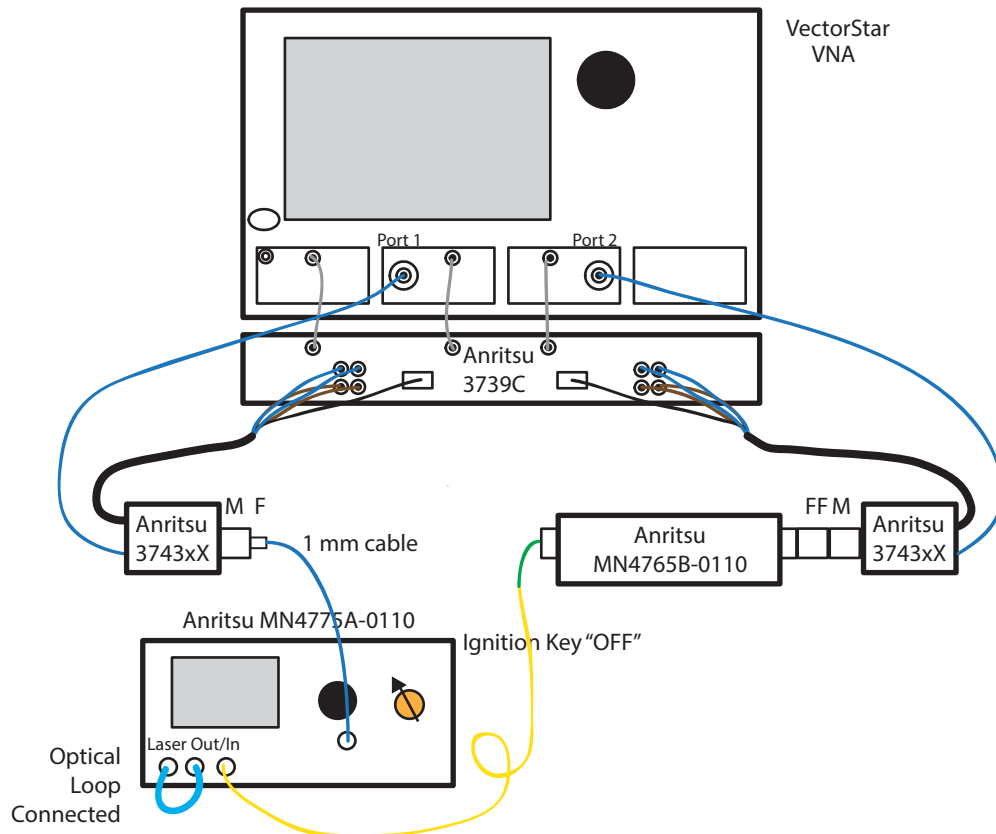


Figure 3-5. Optical Connection to MN4765B-0110

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0110 E/O Converter as shown in [Figure 3-5](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0110 as shown in [Figure 3-5](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0110 E/O Converter RF Input as shown in [Figure 3-5](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0110 O/E Module Output to VNA Port 2 as shown in [Figure 3-5](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0110 E/O Converter as shown in [Figure 3-5](#).
9. Make settings on MN4775A-0110 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.

10. Select ITU-Channel:
 - a. Touch center section of LASER WAVELENGTH region to bring up secondary screen.
 - b. At Secondary Screen select ITU Channel 39 = 1550.041 nm WAVE LENGTH.
 - c. Touch Home to return to the main screen.
11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring Up Secondary Screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +3 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.

Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration

1. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch on Display and change Trace Format to Log Mag.
 - d. Touch Response and change S21.

2. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-6](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-6](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 10 dB)	P1 Src Power(>54G)
1	☒	Start & Stop	70 kHz	300 kHz	3	115 kHz	10 Hz	-10	-10
2	☒	Start & Stop	311 kHz	2.01 MHz	3	849.5 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	9.99 MHz	4	2.546666666666...	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.49999 GHz	5	622.495 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	10 GHz	16	500 MHz	10 Hz	-10	-10
6	☒	Start & Stop	10.00001 GHz	24 GHz	29	499.9996428571...	10 Hz	-10	-10
7	☒	Start & Stop	24.00001 GHz	40 GHz	33	499.9996875 MHz	10 Hz	-10	-10
8	☒	Start & Stop	40.00001 GHz	54 GHz	29	499.9996428571...	10 Hz	-10	-10
9	☒	Start & Stop	54.00001 GHz	60 GHz	13	499.9991666666...	10 Hz	-10	-10
10	☒	Start & Stop	60.00001 GHz	65 GHz	11	499.999 MHz	10 Hz	-10	-10
11	☒	Start & Stop	65.00001 GHz	70 GHz	11	499.999 MHz	10 Hz	-10	-10
12	☒	Start & Stop	70.00001 GHz	80 GHz	21	499.9995 MHz	10 Hz	-10	-10
13	☒	Start & Stop	80.00001 GHz	90 GHz	21	499.9995 MHz	10 Hz	-10	-10
14	☒	Start & Stop	90.00001 GHz	100 GHz	21	499.9995 MHz	10 Hz	-10	-10
▶ 15	☒	Start & Stop	100.00001 GHz	110 GHz	21	499.9995 MHz	10 Hz	-10	-10

Figure 3-6. ME7838AX/EX Frequency-Based Segmented Sweep Settings

3. Normalize the trace (data divided by memory).
 - a. Select Display.
 - b. Select View Trace.
 - c. Select Store Data to Memory.
 - d. Select Data, Memory Math.
4. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
5. Select File and then Save Data, file name HLN#1, file type .csv.
6. Repeat [Step 4](#) through [Step 5](#) twenty four (24) more times. When saving the data, increment the number at the end of the file name by one (e.g. HLN#2, HLN#3, and so on.).
7. Copy the twenty five (25) saved data files off the ME7838AX/EX onto a USB flash drive for transferring to a Personal Computer.
8. On a separate Windows Personal Computer, import the saved data from the HLN#n files into Microsoft Excel so the RMS values can be calculated.

9. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:
- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data25, RMS Linear Mag, RMS Log Mag
 - ii. Column A: Freq (Imported from the HLN#n files)
 - iii. Column B through Column AO: Data1 through Data25 (Imported from the HLN#n files)
 - b. Set up cell AA2 to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Z2)$$
 - c. Copy the formula to the next cell on Column AA until it reaches the last frequency point.
 - d. For magnitude measurements only:
 - i. Set up cell AB2 to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(V2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column AB until it reaches the last frequency point.
 - e. Rename Sheet 1 to Frequency Response S21 by right-clicking on the Sheet 1 tab, selecting Rename and typing in the new name.
 - f. Record the largest calculated RMS value of each frequency band listed in Frequency Response S21 worksheet into [Table A-2, “Frequency Response Repeatability – 1550 nm Band” on page A-2](#).

Optical Noise Floor S21 Setup – 1550 nm Configuration

1. Power on MN4775A-0110, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0110 E/O Converter Ignition key is set to **OFF**.

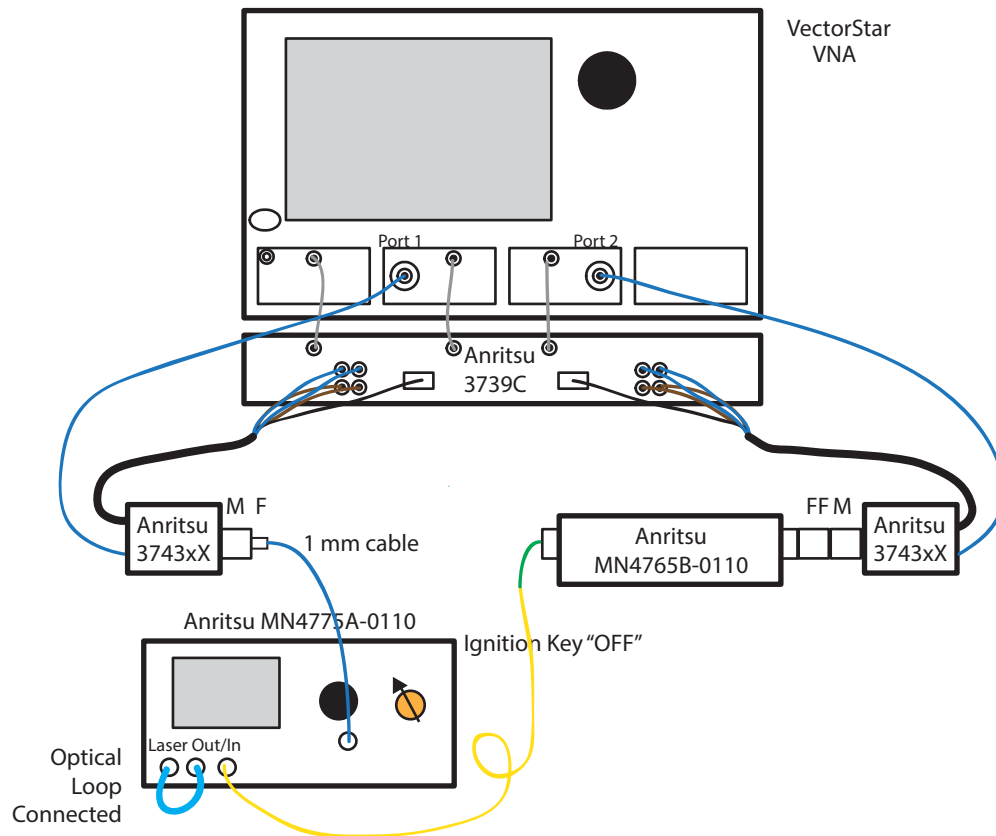


Figure 3-7. Optical Connection to MN4765B-0110

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0110 E/O Converter as shown in [Figure 3-7](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0110 as shown in [Figure 3-7](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0110 E/O Converter RF Input as shown in [Figure 3-7](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0110 O/E Module Output to VNA Port 2 as shown in [Figure 3-7](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0110 E/O Converter as shown in [Figure 3-7](#).
9. Make settings on MN4775A-0110 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.

10. Select ITU-Channel
 - a. Touch center section of LASER WAVELENGTH region to bring up secondary screen.
 - b. At secondary screen select ITU Channel 39 = 1550.041 nm WAVE LENGTH.
 - c. Touch Home to return to the main screen.
11. Select VOA Mode
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +3 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button
14. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch Display and change Trace Format to Log Mag.
 - d. Touch Response and change to S21.

15. Configure the VectorStar VNA: using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-8](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-8](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 10 dB)	P1 Src Power(>54G)
1	☒	Start & Stop	70 kHz	300 kHz	7	38.3333333333...	10 Hz	-10	-10
2	☒	Start & Stop	311 kHz	2 MHz	9	211.125 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	10 MHz	11	765 kHz	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.49999 GHz	9	311.2475 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	10 GHz	26	300 MHz	10 Hz	-10	-10
6	☒	Start & Stop	10.00001 GHz	24 GHz	47	304.3476086956...	10 Hz	-10	-10
7	☒	Start & Stop	24.00001 GHz	40 GHz	54	301.8866037735...	10 Hz	-10	-10
8	☒	Start & Stop	40.00001 GHz	54 GHz	47	304.3476086956...	10 Hz	-10	-10
9	☒	Start & Stop	54.00001 GHz	60 GHz	54	113.2073584905...	10 Hz	-10	-10
10	☒	Start & Stop	60.00001 GHz	65 GHz	17	312.499375 MHz	10 Hz	-10	-10
11	☒	Start & Stop	65.00001 GHz	70 GHz	17	312.499375 MHz	10 Hz	-10	-10
12	☒	Start & Stop	70.00001 GHz	80 GHz	34	303.03 MHz	10 Hz	-10	-10
13	☒	Start & Stop	80.00001 GHz	90 GHz	34	303.03 MHz	10 Hz	-10	-10
14	☒	Start & Stop	90.00001 GHz	100 GHz	34	303.03 MHz	10 Hz	-10	-10
15	☒	Start & Stop	100.00001 GHz	110 GHz	34	303.03 MHz	10 Hz	-10	-10

Figure 3-8. ME7838AX/EX Frequency-Based Segmented Sweep Settings

Optical Nose Floor S21 Measurement – 1550 nm Configuration

1. VectorStar VNA, select Calibration.
2. Select Calibrate.
3. Select Manual Cal.
4. Select Transmission Freq. Response.
5. Select Modify Cal Setup.

6. Select Edit Cal Params (see [Figure 3-9](#)).

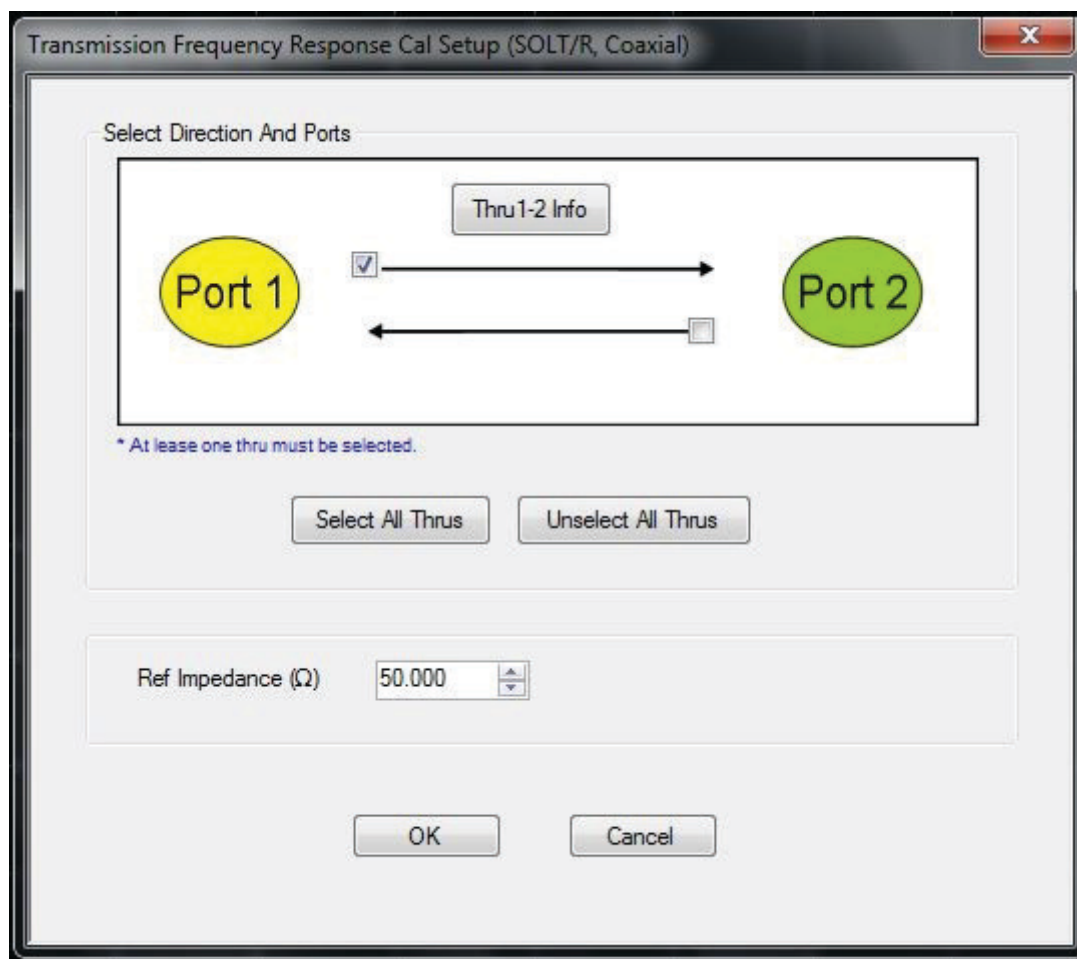


Figure 3-9. TRANSMISSION FREQUENCY RESPONSE CAL SETUP (SOLT/R, Coaxial) Dialog

7. Click on Thru1-2 Info and the screen appears (see [Figure 3-10](#)) and verify Length (mm), Line loss (dB/mm), and @Frequency (GHz) are set to 0.000.

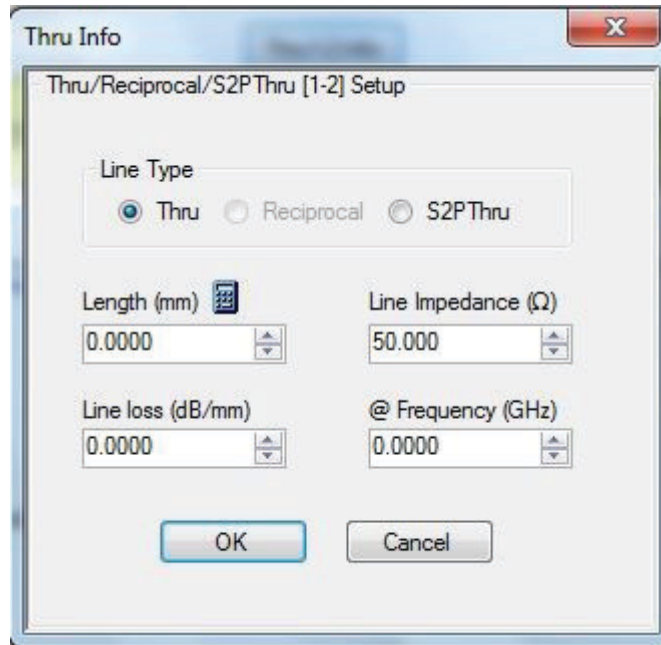


Figure 3-10. THRU INFO Dialog

8. Click OK and OK again to close EDIT CALIBRATION PARAMETERS dialog.
9. Select Back.
10. Perform a Transmission Frequency Response-only calibration. Select Done and observe that the **Green Calibration lamp** in VNA is on.
 - a. Select Thru/Recip.
 - b. Select Thru and wait for green checkmark to appear.
 - c. Select Back.
 - d. Select Done.
 - e. Verify **Green Calibration lamp** is **ON**.

11. Set E/O Converter Ignition key to **OFF**, see figure [Figure 3-11](#).

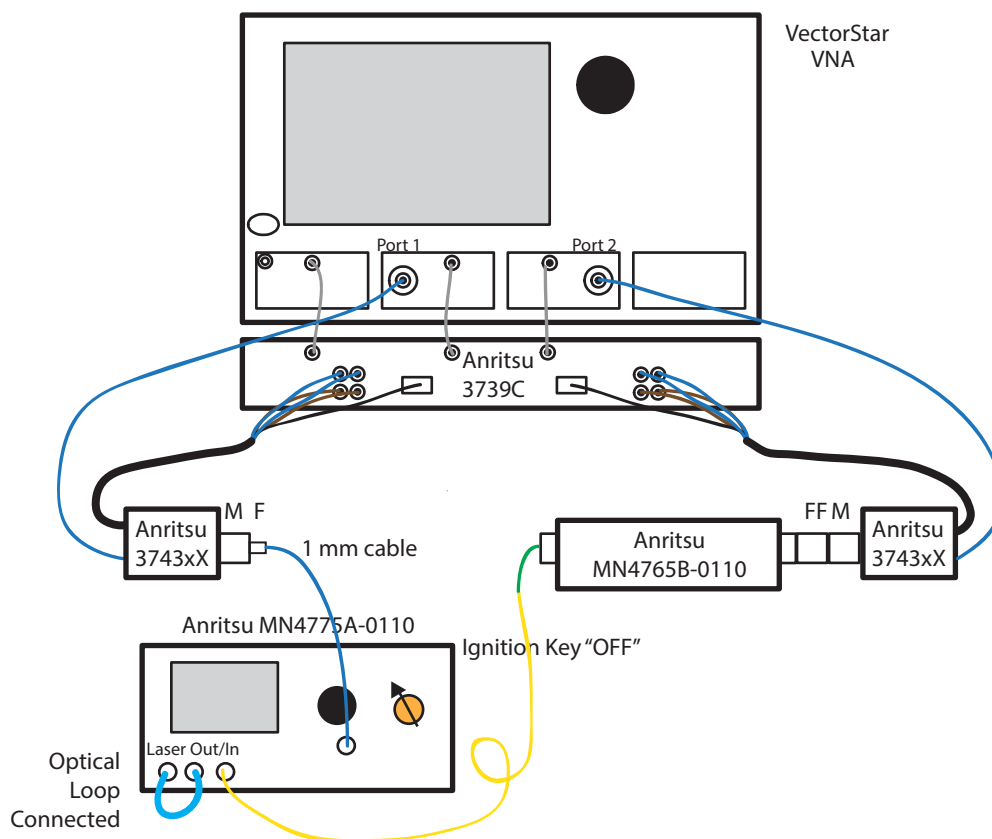


Figure 3-11. Turning Off Laser

12. Select Scale

- a. Click on Reference Position and set it to 10. The screen should look like [Figure 3-12](#) (the frequency list used in the plot is different from that set up in this procedure, but the overall shape of the curve should be similar).

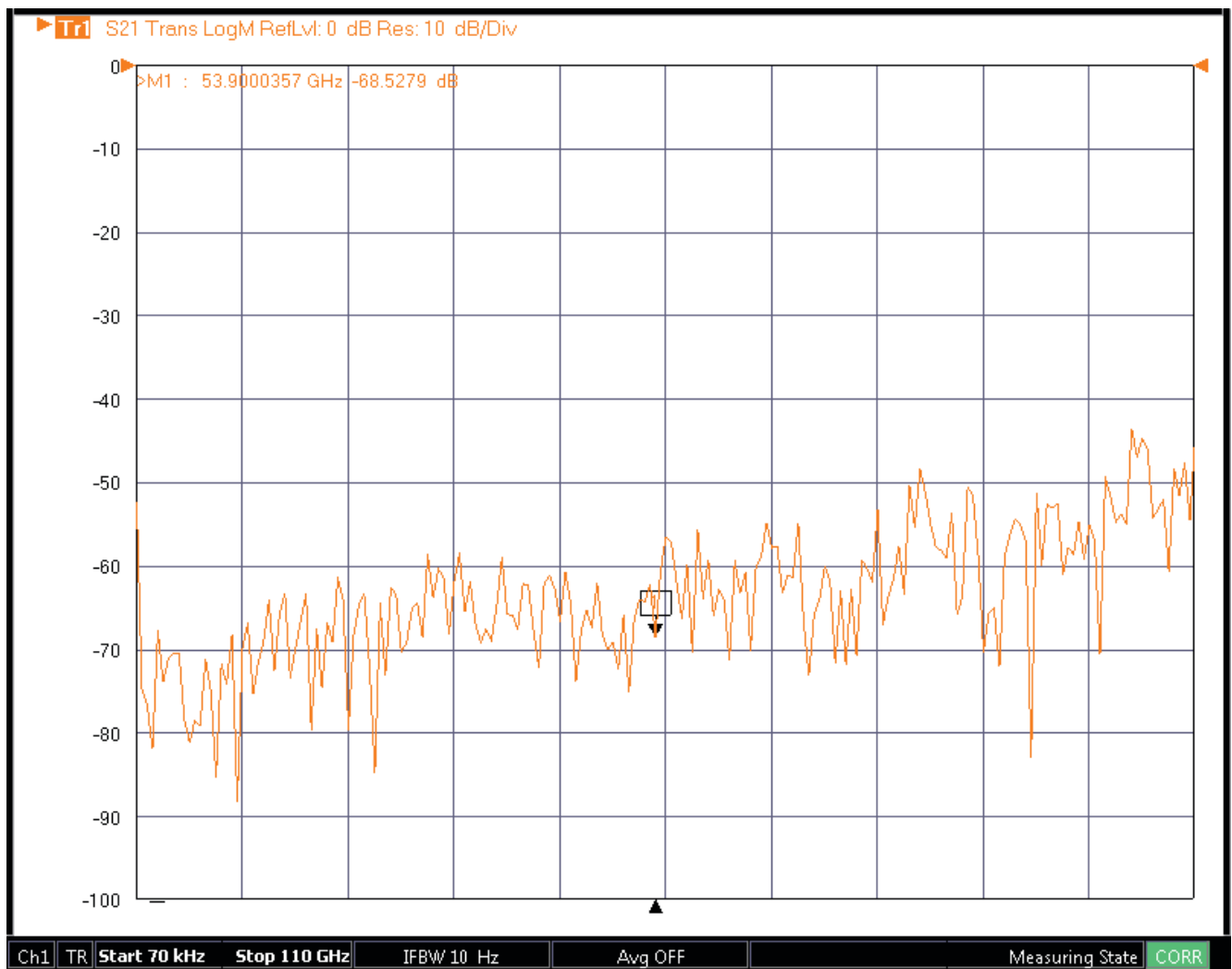


Figure 3-12. Typical Noise Floor Display—Reference Only

13. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
14. Select File and then Save Data, file name NF#1, file type .csv.
15. Repeat [Step 12](#) and [Step 14](#) fifteen (15) more times. When saving the data, increment the number at the end of the file name by one (e.g. NF#2, NF#3, and so on.).
16. Copy the sixteen (16) saved data files off the ME7838AX/EX onto a USB flash drive for transferring to a Personal Computer.
17. On a separate Windows Personal Computer, import the saved data from the NF#n files into Microsoft Excel so the RMS values can be calculated.

18. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data16, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the NF#n files).
 - iii. Column B through Column Q: Data1 through Data16 (Imported from the HLN#n files).
- b. Set up cell R to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Q2)$$
- c. Copy the formula to the next cell on Column R until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell S to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(R2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column S until it reaches the last frequency point.
- e. Rename Sheet 1 to S16 Magnitude by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the highest calculated RMS value of each frequency band listed in:
 - [Table A-3, “Optical Noise Floor S21 \(Option 000\) – 1550 nm Band” on page A-3](#)
 - [Table A-4, “Optical Noise Floor S21 \(Option 51\) – 1550 nm Band” on page A-4](#)
 - [Table A-5, “Optical Noise Floor S21 \(Option 61 or 62\) – 1550 nm Band” on page A-5](#)

3-5 ME7848A/E-0211 System Verification – 1310 nm Configuration

This section contains the following setup and measurement procedures:

- [ME7848A/E-0271 1310 nm System Setup](#)
- [Optical Power Meter \(OPM\) Measurement Setup – 1310 nm Configuration](#)
- [Optical Power Meter Measurement – 1310 nm Configuration](#)
- [Frequency Response Repeatability S21 Setup – 1310 nm Configuration](#)
- [Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration](#)
- [Optical Noise Floor S21 Setup – 1310 nm Configuration](#)
- [Optical Noise Floor S21 Measurement – 1310 nm Configuration](#)

ME7848A/E-0271 1310 nm System Setup

1. Configure components (VNA, O/E, E/O, RF and Optical cables) as shown in [Figure 3-13](#).

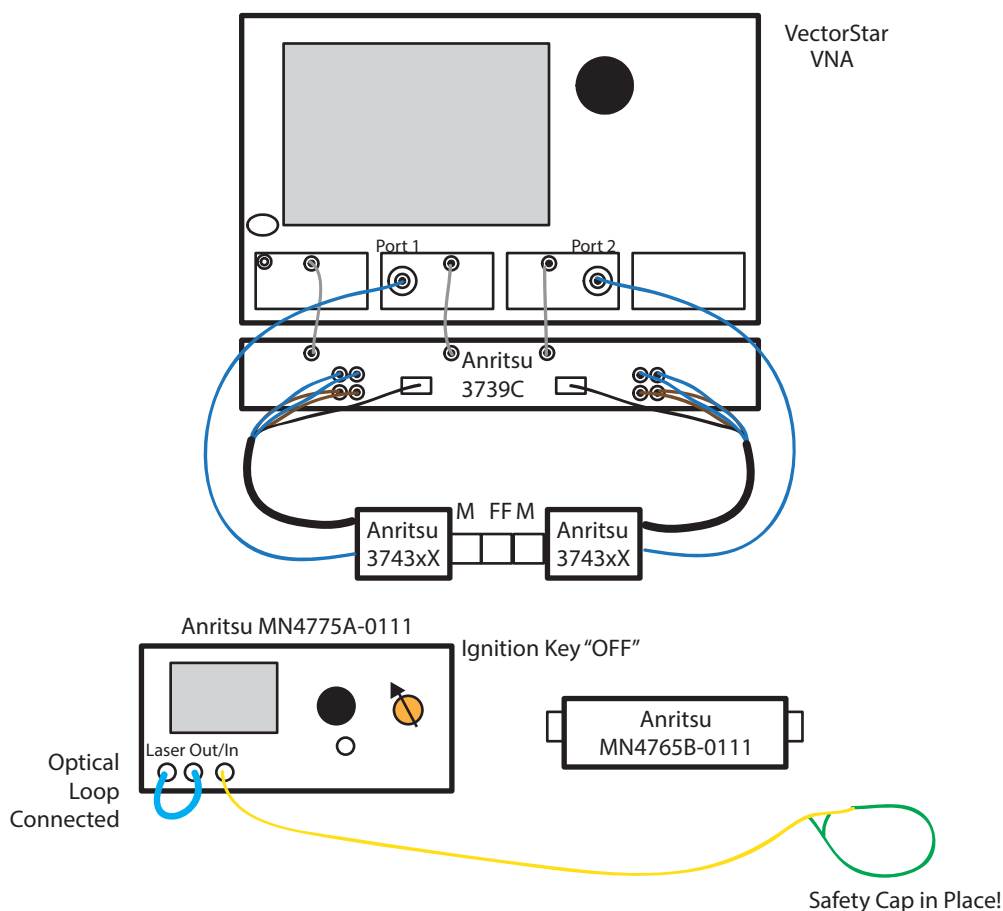


Figure 3-13. Initial ME7848A/E-0271 1310 nm Initial System Setup

Note

Refer to the **MN4775A Operation Manual – 10410-00774** regarding proper operation of the Anritsu E/O Converter.

2. Apply power to MN4775A-0111 E/O Converter by pushing the **Standby** button until it turns **green**.
3. Apply power to the VNA.
4. Apply power to MN4765B-0111 O/E Calibration Module via +12 V power cube.
5. MN4775A-0111 E/O Converter:
 - a. Verify **Optical Loop** is in place on MN4775A-0111 E/O Converter.

Note

There is a key on the optical fiber cable that needs to be oriented correctly before the screw will tighten correctly.

- b. Keep **Ignition-Key** in OFF Position as shown in [Figure 3-13](#).
6. Make initial VNA RF Connections shown in [Figure 3-13](#).
 - a. Place WF-WF Adapter on the port 2 module.
 - b. VNA Port 1 to VNA Port 2 via a 13 cm RF Cable.
 - c. Verify connection between **Male end** on cable at Port 1 and **Female End** on Cable at Port 2.
7. Make Optical connection shown to MN4775A-0111 as shown in [Figure 3-13](#).
 - a. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0071 E/O Converter.
 - b. Place the **Green-colored** cap onto the **Green-colored** end of the Optical cable.
8. Turn MN4775A-0111 E/O Converter Ignition Key to **ON**.

Typical Bias, VOA, Laser Control

Typical Bias Secondary Screen Showing Mode, etc.

Please Note here showing Typical Setup Please Set values as described in Instructions

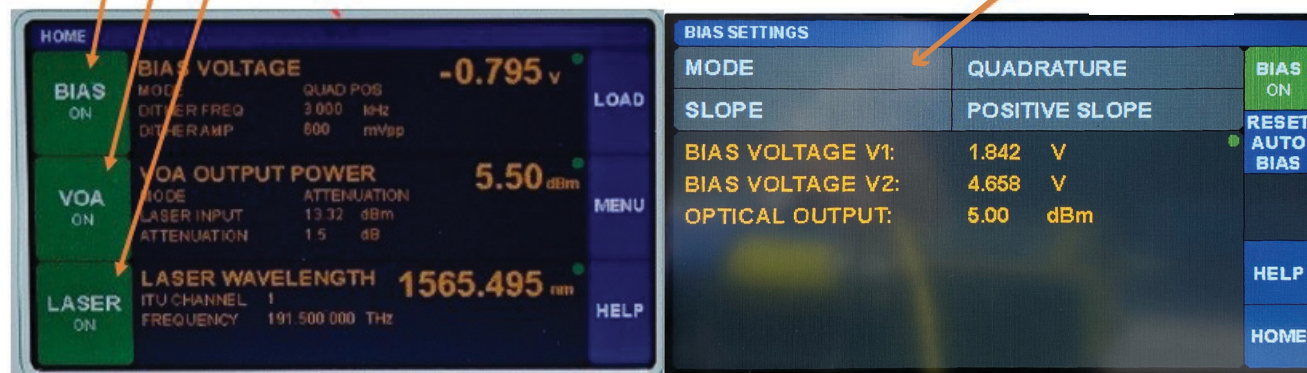


Figure 3-14. E/O Converter Setup Screen

Note

The depiction of the touch screen settings above is for reference only; actual settings are as given below.

9. Make settings on MN4775A-0111 via the display touch screen as described below; refer to [Figure 3-14](#).
 - a. Touch **LASER ON** square-pad to turn the **LASER** to **ON** state.
 - b. Touch **VOA ON** square-pad to enable VOA Attenuator.
 - c. Touch **BIAS ON** square-pad to enable BIAS Regulator.

10. Select ITU-Channel.
 - Not required for 1310 System as wavelength is fixed.
11. Select VOA Mode.
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen as shown in [Figure 3-14](#) (left side).
 - b. At secondary screen, touch **Mode** and then touch **Out** to change mode to **CONSTANT OUTPUT**.
 - c. Select and adjust output power to **+3 dBm**.
12. Select Bias Mode.
 - a. Touch center section of **BIAS VOLTAGE** region to bring up secondary screen as shown in [Figure 3-14](#) (right side).
 - b. At secondary screen select **MODE = QUADRATURE**.
13. Turn E/O Converter LASER Inter-Lock Ignition Key to **OFF**.

Optical Power Meter (OPM) Measurement Setup – 1310 nm Configuration

1. Verify Optical Sensor Model: S155C 800 – 1700nm, fitted to PM100D Meter
2. Apply Power via **black button** adjacent to sensor (on side panel).
3. Allow 1 minute warm up.

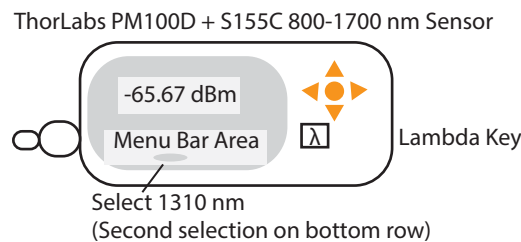


Figure 3-15. Power Meter QP 1310 nm Configuration

4. Verify following default settings.
 - a. Range = Auto.
 - b. Units = dBm.
5. Navigate to MEAS CONFIG menu via front panel buttons.
 - a. Select **Zero** to zero the sensor (About 2 seconds).
 - b. Exit MEAS CONFIG menu.
6. Set Measurement Wavelength.
 - a. On Front Panel select **Lambda** button as shown in [Figure 3-15](#).
 - b. Navigate to 1310 nm Wavelength icon in menu bar area.
 - c. On PM100D Meter select **OK** to choose 1310 nm selection, as shown in [Figure 3-15](#).

Optical Power Meter Measurement – 1310 nm Configuration

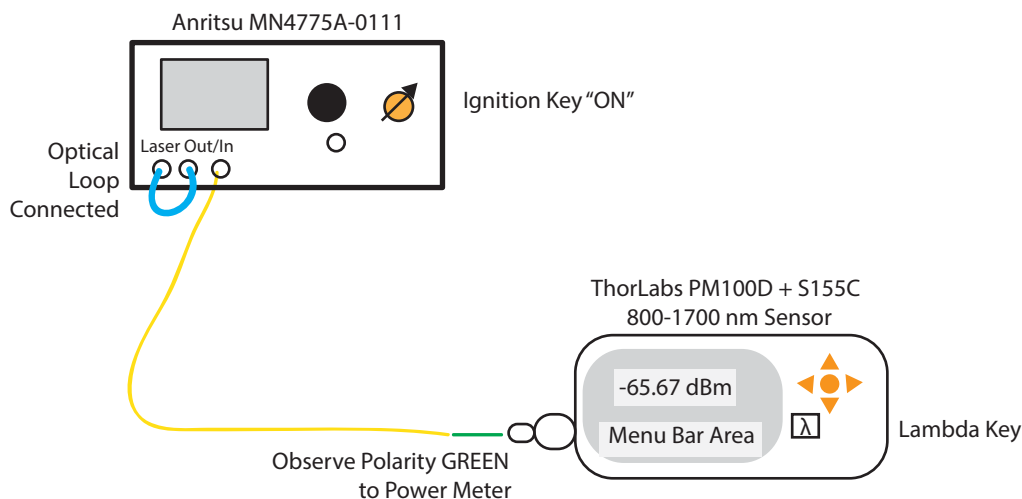


Figure 3-16. Optical Power Measurement – 1310 nm Configuration

1. Optical Power Measurement Using PM100D:

- a. Connect PM100D OPM to E/O Converter Output via Optical Cable as shown in [Figure 3-16](#).
- b. Verify the PM100D's power is **ON**.
- c. Turn E/O Converter Ignition Key = **ON**.
- d. Using E/O Touch Panel:
 - i. Laser = ON.
 - ii. VOA = ON, VOA Mode = Constant Output at +3 dBm.
 - iii. BIAS = ON.
- e. Modify Bias Mode:
 - i. Push touch screen at Bias center navigate to Secondary Bias settings screen
 - ii. Select Bias Mode = PEAK.
 - iii. Select Trigger Auto-Bias Cal.
- f. Wait for readings to stabilize; nominally less than ± 0.5 dB bounce.
- g. Enter nominal reading from PM100D Optical Power Meter into the test records in [Table A-6](#), "Optical Power Measurement – 1310 nm Band" on page A-6.
- h. Expected range for this measurement is +3 dBm ± 2 dB

Note Meter reading may fluctuate nominally ± 0.5 dB.

2. E/O Converter Inter-Lock to **OFF**:

- a. Set E/O Converter Gen Laser Inter-Lock to **OFF** via Ignition Key
- b. Power down Optical Power Meter

3. Disconnect the Optical Power Meter.

Frequency Response Repeatability S21 Setup – 1310 nm Configuration

1. Power on MN4775A-0111, ME7838AX/EX, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0111 E/O Converter Ignition key is set to **OFF**.

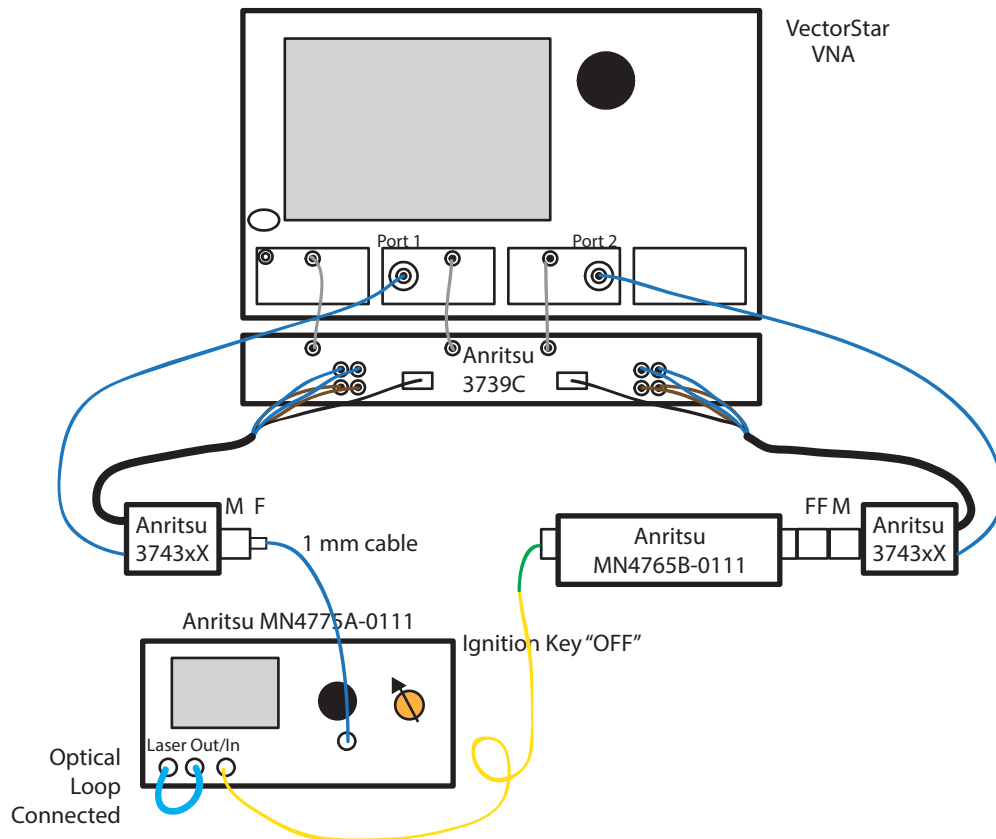


Figure 3-17. Optical Connection to MN4765B-0111

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0111 E/O Converter as shown in [Figure 3-17](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0111 as shown in [Figure 3-17](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0111 E/O Converter RF Input as shown in [Figure 3-17](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0111 O/E Module Output to VNA Port 2 as shown in [Figure 3-17](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify that **Optical Loop** is in place on MN4775A-0111 E/O Converter as shown in [Figure 3-17](#).

9. Make settings on MN4775A-0111 via the display touch screen as described below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel
 - Channel setting not required on 1310 nm systems.
11. Select VOA Mode
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to **CONSTANT OUTPUT**.
 - c. Set Power to +3 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK Mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring Up Secondary Screen.
 - b. At Secondary Screen select MODE = QUADRATURE.
13. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.

Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration

1. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch on Display and change Trace Format to Log Mag.
 - d. Touch Response and change S21.

2. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-18](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-18](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 10 dB)	P1 Src Power(>54G)
1	☒	Start & Stop	70 kHz	300 kHz	3	115 kHz	10 Hz	-10	-10
2	☒	Start & Stop	311 kHz	2.01 MHz	3	849.5 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	9.99 MHz	4	2.546666666666...	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.49999 GHz	5	622.495 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	10 GHz	16	500 MHz	10 Hz	-10	-10
6	☒	Start & Stop	10.00001 GHz	24 GHz	29	499.9996428571...	10 Hz	-10	-10
7	☒	Start & Stop	24.00001 GHz	40 GHz	33	499.9996875 MHz	10 Hz	-10	-10
8	☒	Start & Stop	40.00001 GHz	54 GHz	29	499.9996428571...	10 Hz	-10	-10
9	☒	Start & Stop	54.00001 GHz	60 GHz	13	499.9991666666...	10 Hz	-10	-10
10	☒	Start & Stop	60.00001 GHz	65 GHz	11	499.999 MHz	10 Hz	-10	-10
11	☒	Start & Stop	65.00001 GHz	70 GHz	11	499.999 MHz	10 Hz	-10	-10
12	☒	Start & Stop	70.00001 GHz	80 GHz	21	499.9995 MHz	10 Hz	-10	-10
13	☒	Start & Stop	80.00001 GHz	90 GHz	21	499.9995 MHz	10 Hz	-10	-10
14	☒	Start & Stop	90.00001 GHz	100 GHz	21	499.9995 MHz	10 Hz	-10	-10
▶ 15	☒	Start & Stop	100.00001 GHz	110 GHz	21	499.9995 MHz	10 Hz	-10	-10

Figure 3-18. ME7838AX/EX Frequency-Based Segmented Sweep Settings

3. Normalize the trace (data divided by memory):
 - a. Select Display.
 - b. Select View Trace.
 - c. Select Store Data to Memory.
 - d. Select Data, Memory Math.
4. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
5. Select File and then Save Data, file name HLN#1, file type .csv.
6. Repeat [Step 4](#) through [Step 5](#) twenty four (24) more times. When saving the data, increment the number at the end of the file name by one (e.g. HLN#2, HLN#3, and so on.).
7. Copy the twenty five (25) saved data files off the ME7838AX/EX onto a USB flash drive for transferring to a Personal Computer.
8. On a separate Windows Personal Computer, import the saved data from the HLN#n files into Microsoft Excel so the RMS values can be calculated.

9. There are many ways one can set up Microsoft Excel for calculating the RMS values. Below is an example:
- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data25, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the HLN#n files).
 - iii. Column B through Column AO: Data1 through Data25 (Imported from the HLN#n files).
 - b. Set up cell AA2 to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Z2)$$
 - c. Copy the formula to the next cell on Column AA until it reaches the last frequency point.
 - d. For magnitude measurements only:
 - i. Set up cell AB2 to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(V2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column AB until it reaches the last frequency point.
 - e. Rename Sheet 1 to Frequency Response S21 by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
 - f. Record the largest calculated RMS value of each frequency band listed in the Frequency Response S21 worksheet into [Table A-7, “Frequency Response Repeatability – 1310 nm Band” on page A-6](#).

Optical Noise Floor S21 Setup – 1310 nm Configuration

1. Power on MN4775A-0111, ME7838AX/EX, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0111 E/O Converter Ignition key is set to **OFF**.

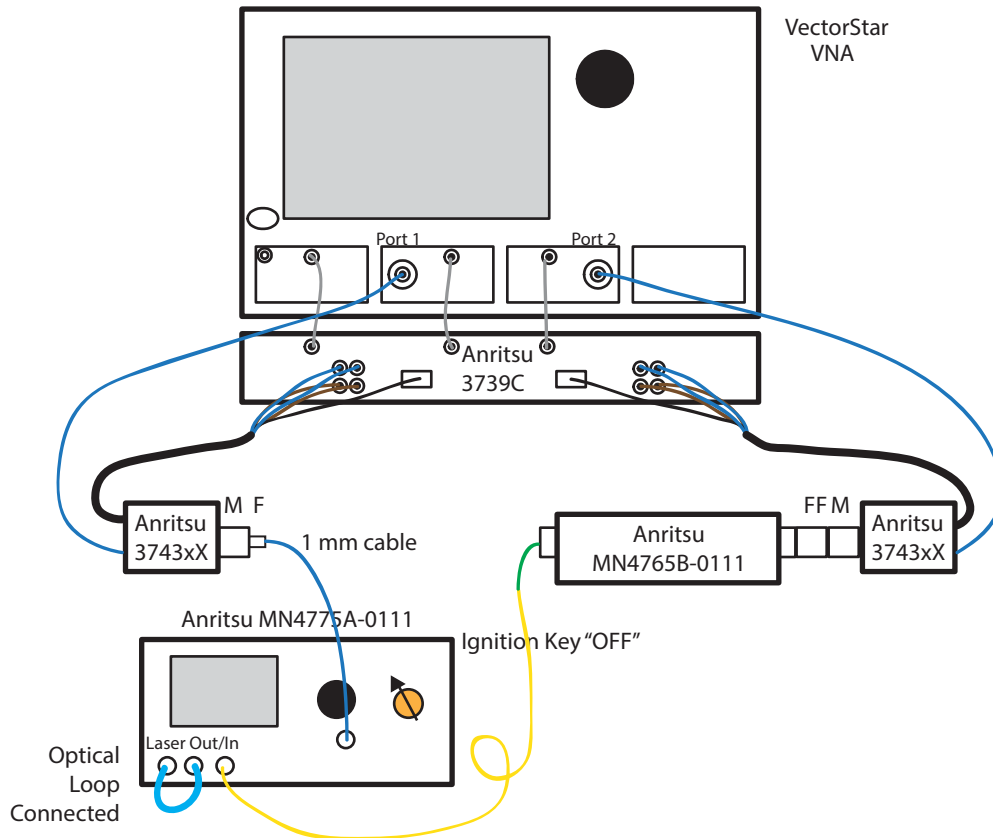


Figure 3-19. Optical Connection to MN4765B-0111

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0111 E/O Converter as shown in [Figure 3-19](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0111 as shown in [Figure 3-19](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0111 E/O Converter RF Input as shown in [Figure 3-19](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0111 O/E Module Output to VNA Port 2 as shown in [Figure 3-19](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0111 E/O Converter.
9. Make settings on MN4775A-0111 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.

10. Select ITU-Channel
 - a. Channel setting not required on 1310 nm systems
11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +3 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.
14. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch Display and change Trace Format to Log Mag.
 - d. Touch Response and change to S21.

15. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-20](#).
- Select Channel, then select Sweep.
 - Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - In this new screen, enter the information from the first entry in [Figure 3-20](#).
 - Select Add and repeat until all the segments are entered.
 - Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 10 dB)	P1 Src Power(>54G)
1	☒	Start & Stop	70 kHz	300 kHz	7	38.3333333333...	10 Hz	-10	-10
2	☒	Start & Stop	311 kHz	2 MHz	9	211.125 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	10 MHz	11	765 kHz	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.49999 GHz	9	311.2475 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	10 GHz	26	300 MHz	10 Hz	-10	-10
6	☒	Start & Stop	10.00001 GHz	24 GHz	47	304.3476086956...	10 Hz	-10	-10
7	☒	Start & Stop	24.00001 GHz	40 GHz	54	301.8866037735...	10 Hz	-10	-10
8	☒	Start & Stop	40.00001 GHz	54 GHz	47	304.3476086956...	10 Hz	-10	-10
9	☒	Start & Stop	54.00001 GHz	60 GHz	54	113.2073584905...	10 Hz	-10	-10
10	☒	Start & Stop	60.00001 GHz	65 GHz	17	312.499375 MHz	10 Hz	-10	-10
11	☒	Start & Stop	65.00001 GHz	70 GHz	17	312.499375 MHz	10 Hz	-10	-10
12	☒	Start & Stop	70.00001 GHz	80 GHz	34	303.03 MHz	10 Hz	-10	-10
13	☒	Start & Stop	80.00001 GHz	90 GHz	34	303.03 MHz	10 Hz	-10	-10
14	☒	Start & Stop	90.00001 GHz	100 GHz	34	303.03 MHz	10 Hz	-10	-10
▶ 15	☒	Start & Stop	100.00001 GHz	110 GHz	34	303.03 MHz	10 Hz	-10	-10

Figure 3-20. ME7838AX/EX Frequency-Based Segmented Sweep Settings

Optical Nose Floor S21 Measurement – 1310 nm Configuration

1. On VectorStar VNA, select Calibration.
2. Select Calibrate.
3. Select Manual Cal.
4. Select Transmission Freq. Response.
5. Select Modify Cal Setup.
6. Select Edit Cal Params (see [Figure 3-21](#)).

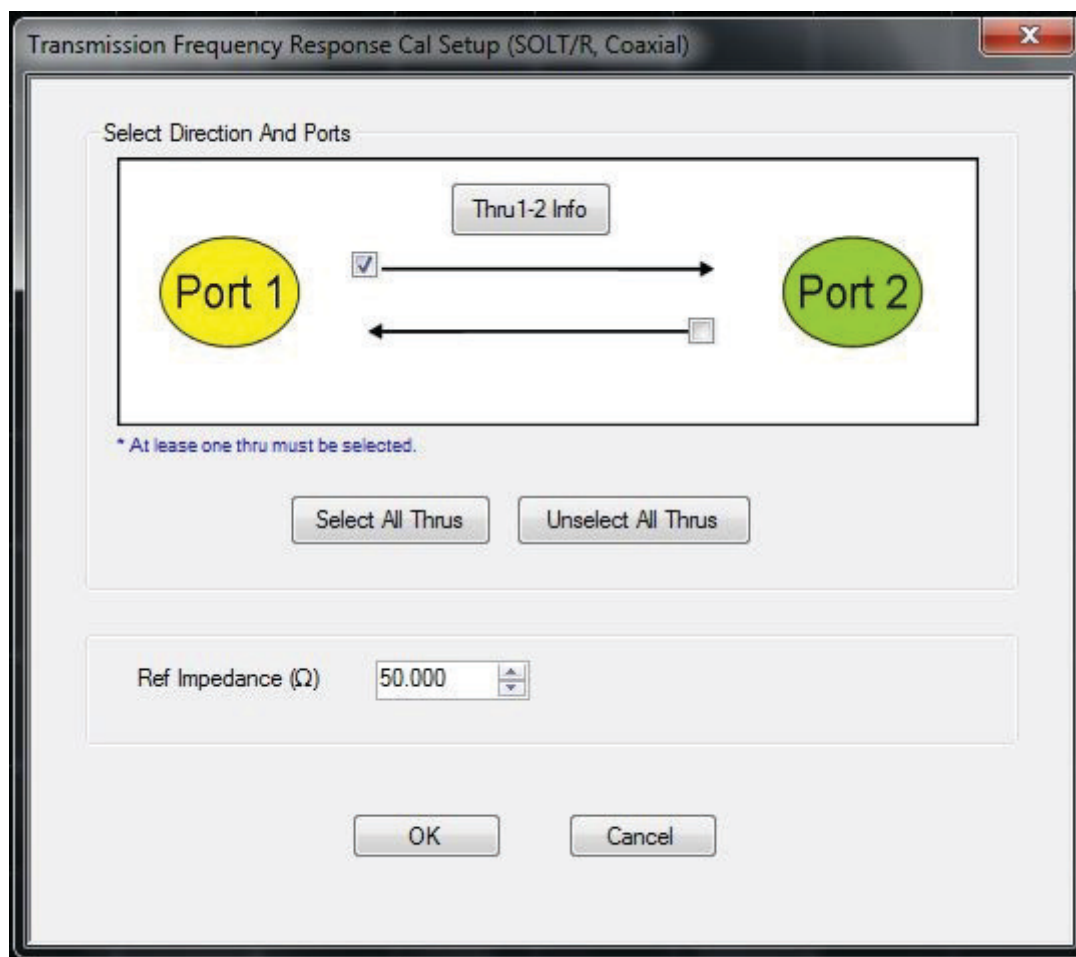


Figure 3-21. TRANSMISSION FREQUENCY RESPONSE CAL SETUP (SOLT/R, Coaxial) Dialog

7. Click on Thru1-2 Info and the THRU INFO dialog appears (see [Figure 3-22](#)) and verify that Length (mm), Line loss (dB/mm), and @Frequency (GHz) are set to 0.000.

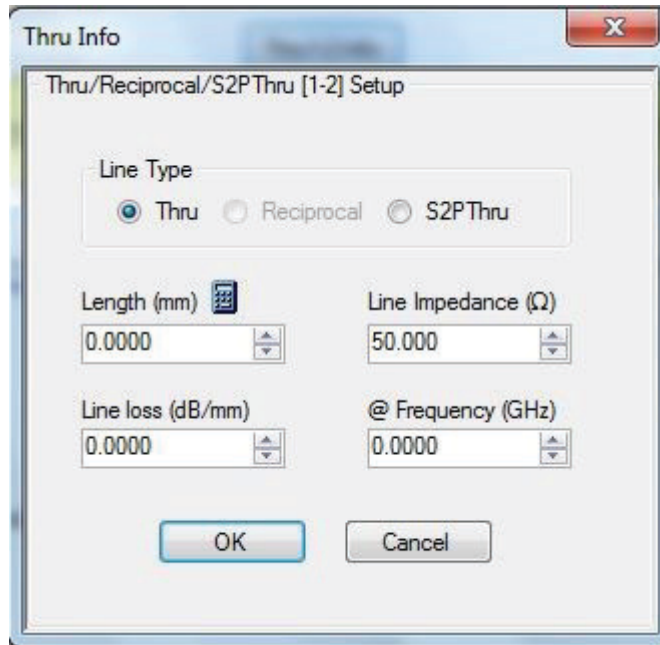


Figure 3-22. THRU INFO Dialog

8. Click OK and OK again to close EDIT CALIBRATION PARAMETERS dialog.
9. Select Back.
10. Perform a Transmission Frequency Response-only calibration. Select Done and observe that the **Green Calibration lamp** in VNA is **ON**.
 - a. Select Thru/Recip.
 - b. Select Thru and wait for green checkmark to appear.
 - c. Select Back.
 - d. Select Done.
 - e. Verify **Green Calibration lamp** is **ON**.

11. Set E/O Converter Ignition key to **OFF** (see figure [Figure 3-23](#)).

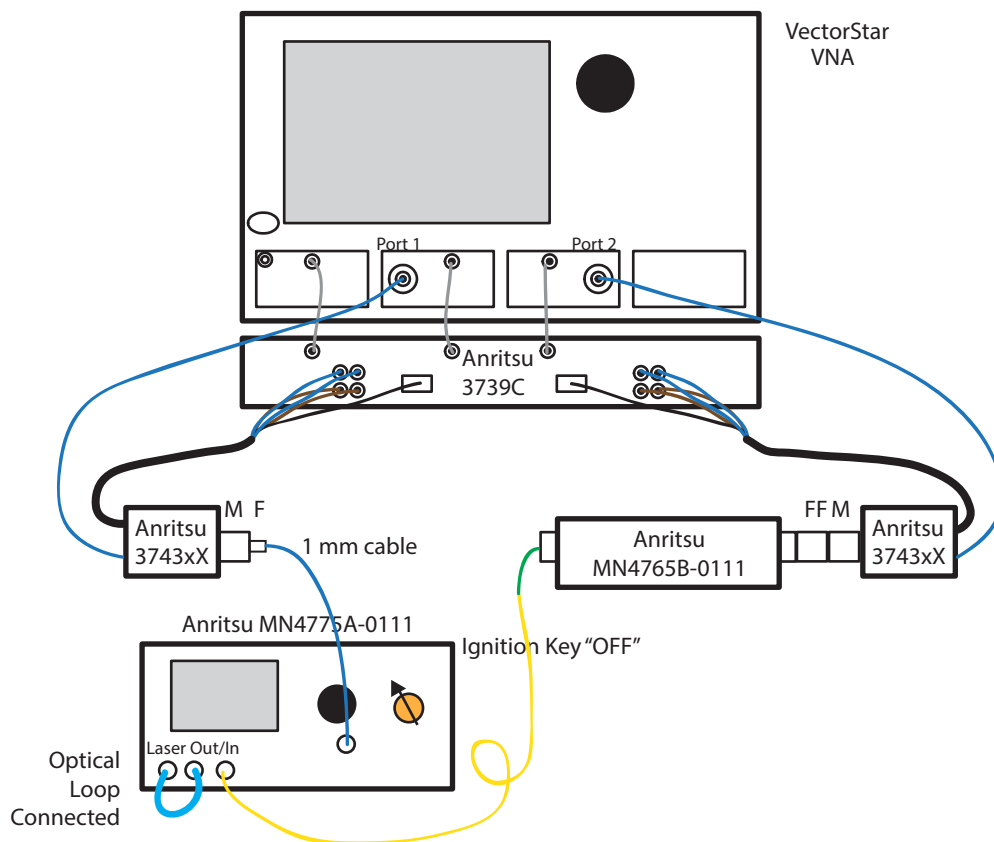


Figure 3-23. Turning Off Laser

12. Select Scale

- a. Click on **Reference Position** and set it to 10. The screen should look like [Figure 3-24](#). The frequency list used in this plot is different from that set up in this procedure but the overall shape of the curve should be similar.

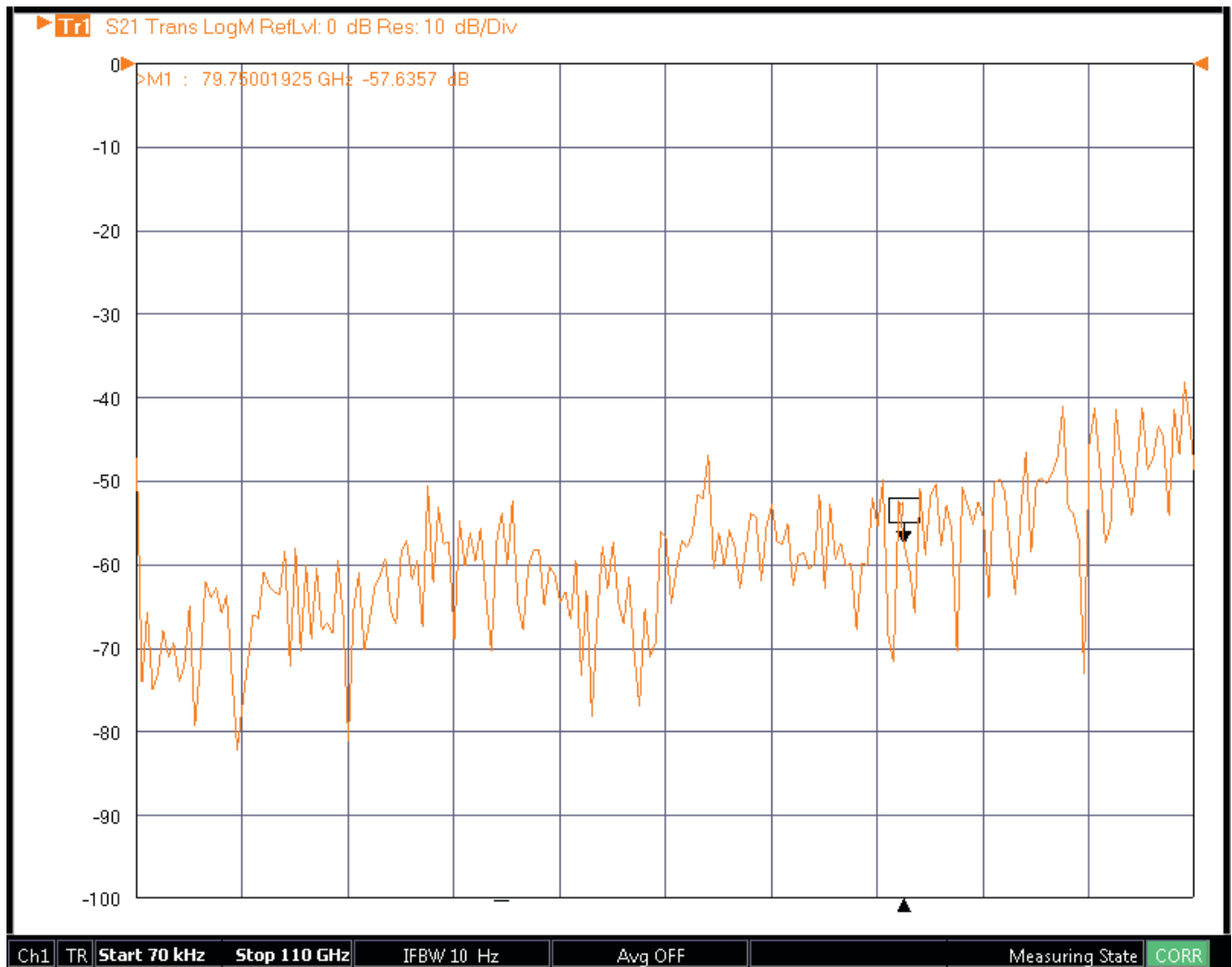


Figure 3-24. Typical Noise Floor Display—Reference Only

13. Select **Sweep** and then **Hold Functions**. Select **Single Sweep & Hold**.
14. Select **File** and then **Save Data**, file name NF#1, file type .csv.
15. Repeat [Step 13](#) and [Step 14](#) fifteen (15) more times. When saving the data, increment the number at the end of the file name by one (e.g. NF#2, NF#3, and so on.).
16. Copy the sixteen (16) saved data files off the ME7838AX/EX onto a USB flash drive for transferring to a Personal Computer.
17. On a separate Windows Personal Computer, import the saved data from the NF#n files into Microsoft Excel so the RMS values can be calculated.

18. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data16, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the NF#n files).
 - iii. Column B through Column Q: Data1 through Data16 (Imported from the NF#n files).
- b. Set up cell R to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Q2)$$
- c. Copy the formula to the next cell on Column R until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell S to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(R2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column S until it reaches the last frequency point.
- e. Rename Sheet 1 to S16 Magnitude by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the highest calculated RMS value of each frequency band listed in:
 - [Table A-8, “Optical Noise Floor S21 \(Option 000\) – 1310 nm Band” on page A-7](#)
 - [Table A-9, “Optical Noise Floor S21 \(Option 51\) – 1310 nm Band” on page A-8](#)
 - [Table A-10, “Optical Noise Floor S21 \(Option 61 or 62\) – 1310 nm Band” on page A-9](#)

3-6 ME7848A-0240 System Verification – 850 nm Configuration

This section contains the following setup and measurement procedures:

- [ME7848A-0240 850 nm System Setup](#)
- [Optical Power Meter \(OPM\) Measurement Setup – 850 nm Configuration](#)
- [Optical Power Meter Measurement – 850 nm Configuration](#)
- [Frequency Response Repeatability S21 Setup – 850 nm Configuration](#)
- [Frequency Response Repeatability S21-Mag Measurement – 850 nm Configuration](#)
- [Optical Noise Floor S21 Setup – 850 nm Configuration](#)
- [Optical Noise Floor S21 Measurement – 850 nm Configuration](#)

ME7848A-0240 850 nm System Setup

1. Configure components (VNA, O/E, E/O, RF, and Optical cables) as shown in [Figure 3-25](#).

Note

The Anritsu MN4775A-0040 does not have Laser Out and Laser In connectors like the MN4775A-0070, MN4775A-0071, and MN4775A-0072.

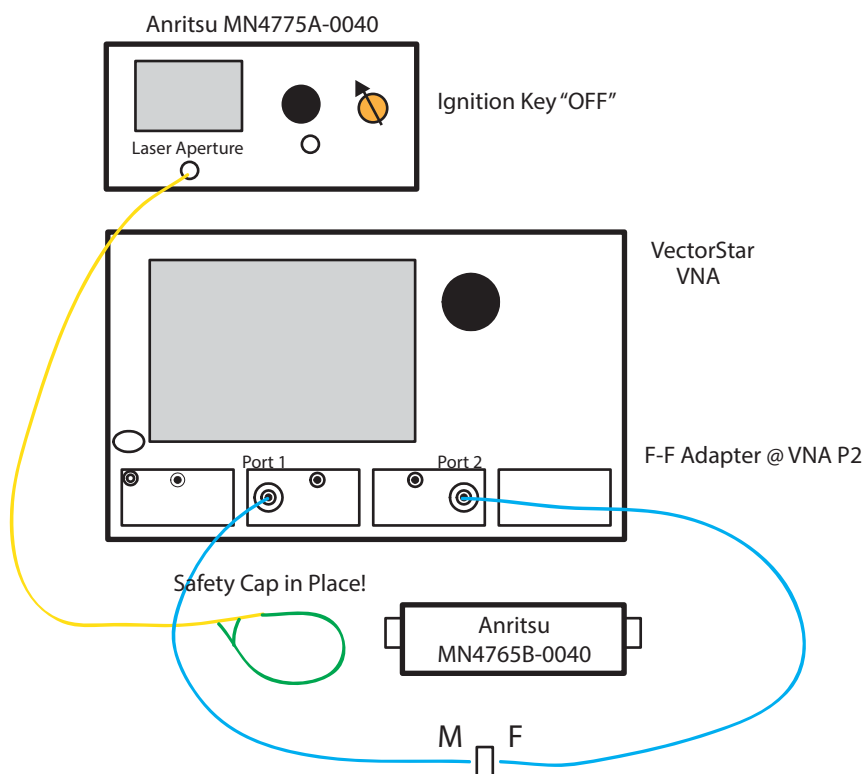


Figure 3-25. Initial ME7848A-0240 850 nm Initial System Setup

Note

Refer to the **MN4775A Operation Manual** – 10410-00774 regarding proper operation of the Anritsu E/O Converter.

2. Apply power to MN4775A-0040 E/O Converter by pushing the **Standby** button until it turns **green**.
3. Apply power to the VNA.
4. Apply power to MN4765B-0040 O/E Calibration Module via +12 V power cube.

5. MN4775A-0040 E/O Converter:
- g. Keep **Ignition-Key** in **OFF** Position, as shown in [Figure 3-25](#).
6. Make initial VNA RF Connections shown in [Figure 3-25](#).

a. Place KF-KF Adapter on VNA Port 2.

b. Connect VNA Port 1 to VNA Port 2 via 3 ft. of combined two RF Cables.

c. Verify the connection between the **Male end** on cable at Port 1 and **Female End** on cable at Port 2.
7. Make Optical connection to MN4775A-0040 as shown in [Figure 3-25](#).

Note

There is a key on the optical fiber cable that needs to be oriented correctly before the screw will tighten correctly.

- a. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0040 E/O Converter.

b. Place the **Green-colored** cap onto the **Green-colored** end of the Optical cable.
8. Turn MN4775A-0040 E/O Converter Ignition Key to **ON**.

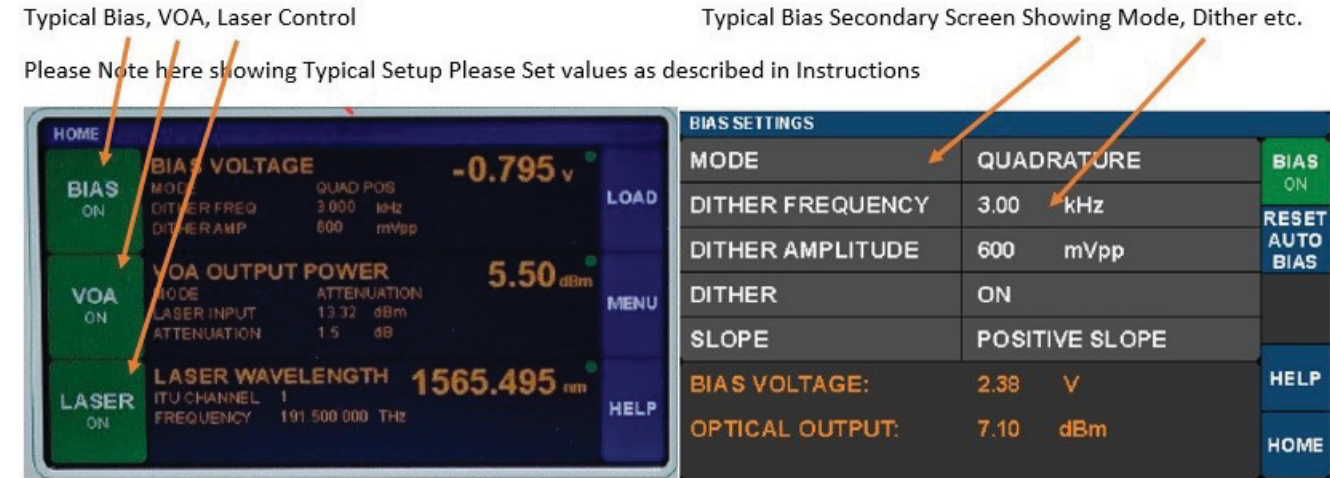


Figure 3-26. E/O Converter Setup Screens

Note

The depiction of the touch screen settings above is for reference only; actual settings are as given below.

9. Make settings on MN4775A-0040 via the Display Touch Screen as described below, refer to [Figure 3-26](#) (left side).

a. Touch LASER ON square-pad to turn the LASER to **ON** state.

b. Touch VOA ON square-pad to enable VOA Attenuator.

c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel.

• Not required for 850 System as wavelength is fixed at 852 nm.

11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen as shown in [Figure 3-26](#) (left side).
 - b. At secondary screen, touch **Mode** and then touch **Out** to change mode to **CONSTANT OUTPUT**.
 - c. Select and adjust output power to **-3 dBm**.
12. Select Bias Mode.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen as shown in [Figure 3-26](#) (right side).
 - b. At Secondary Screen select **MODE = QUADRATURE**.
13. Typical default BIAS SETTINGS MN4775A-0040:
 - a. Dither-Frequency 3 kHz
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE.
14. Turn E/O Converter LASER Inter-Lock Ignition Key to **OFF**.

Optical Power Meter (OPM) Measurement Setup – 850 nm Configuration

1. Verify Optical Sensor Model: S155C 800 – 1700nm, fitted to PM100D Meter.
2. Apply Power via **black button** adjacent to sensor (side panel).
3. Allow 1 minute warm up.

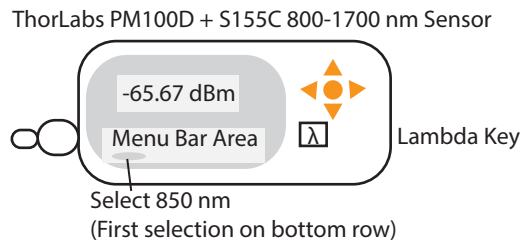


Figure 3-27. Power Meter – 850 nm Configuration

4. Verify following default settings:
 - a. Range = Auto.
 - b. Units = dBm.
5. Navigate to MEAS CONFIG menu via front panel buttons.
 - a. Select **Zero** to zero the sensor (About 2 seconds).
 - b. Exit MEAS CONFIG menu.
6. Set Measurement Wavelength.
 - a. On Front Panel select **Lambda** button as shown in [Figure 3-27](#).
 - b. Navigate to 850 nm Wavelength icon in menu bar area.
 - c. On PM100D Meter select **OK** to choose 850 nm selection, as shown in [Figure 3-27](#).

Optical Power Meter Measurement – 850 nm Configuration

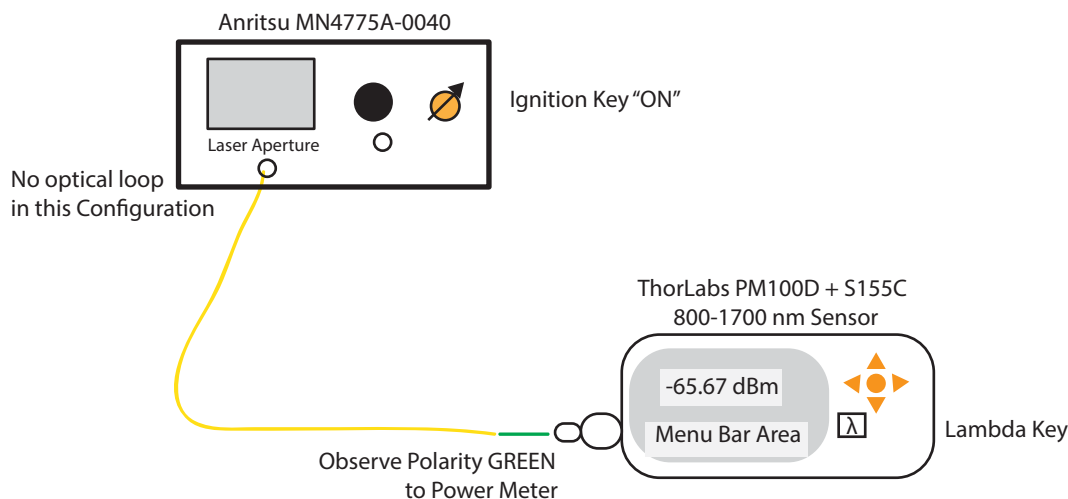


Figure 3-28. Optical Power Measurement – 850 nm Configuration

1. Optical Power Measurement Using PM100D:

- a. Connect PM100D OPM to E/O Converter Output via Optical Cable, as shown in [Figure 3-28](#).
- b. Verify the PM100D's power is **ON**.
- c. Turn E/O Converter Ignition Key = **ON**.
- d. Using E/O Touch Panel:
 - i. Laser = ON.
 - ii. VOA = ON, VOA Mode = Constant Output at -3 dBm.
 - iii. BIAS = ON.
- e. Modify Bias Mode
 - i. Press touch screen at Bias center to navigate to Secondary Bias settings screen.
 - ii. Select Bias Mode = PEAK.
 - iii. Select Reset Auto-Bias Cal.
- f. Wait for readings to stabilize; nominally less than ± 0.5 dB bounce.
- g. Enter nominal reading from PM100D Optical Power Meter into the test records in [Table A-11](#), "Optical Power Measurement – 850 nm Band" on page A-10.
- h. Expected range for this measurement is $-3 \text{ dBm} \pm 2 \text{ dB}$.

Note Meter reading may fluctuate nominally ± 0.5 dB.

2. E/O Converter Inter-Lock to **OFF**:

- a. Set E/O Converter Gen Laser Interlock to **OFF** via Ignition Key.
- b. Power down Optical Power Meter.

3. Disconnect the Optical Power Meter.

Frequency Response Repeatability S21 Setup – 850 nm Configuration

1. Power on MN4775A-0040, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0040 E/O Converter Ignition key is set to **OFF**.

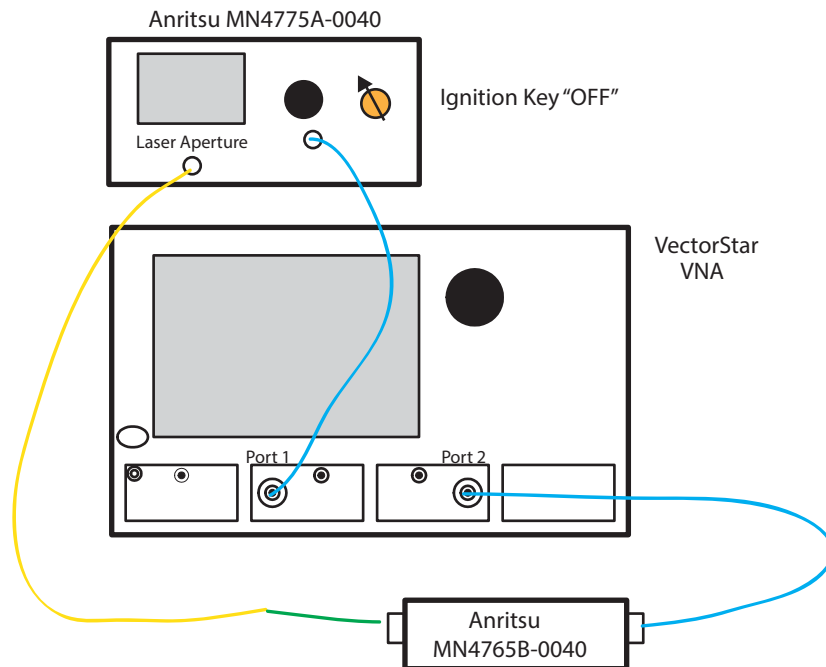


Figure 3-29. Optical Connection to MN4765B-0040

3. Connect **Yellow-colored** end of Optical patch cable to MN4775A-0040 E/O Converter as shown in [Figure 3-29](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0040 as shown in [Figure 3-29](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0040 E/O Converter RF Input as shown in [Figure 3-29](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0040 O/E Module Output to VNA Port 2 as shown in [Figure 3-29](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Make the following settings on MN4775A-0040 via the touch screen:
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
9. Select ITU-Channel
 - a. Channel setting not required on 850 nm systems.

10. Select VOA Mode
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to -3 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
11. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At Secondary Screen select MODE = QUADRATURE.
12. Verify the default Bias settings for the MN4775A-0040.
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE SLOPE.
 - e. Touch Home to return to the main screen.
13. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.

Frequency Response Repeatability S21-Mag Measurement – 850 nm Configuration

1. On the VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch on Display and change Trace Format to Log Mag.
 - d. Touch Response and change to S21.
2. Configure the VectorStar VNA: using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-30](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-30](#).
 - d. Select Add and repeat until all the segments are entered
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)	Pe Av
1	☒	Start & Stop	70 kHz	200 kHz	3	65 kHz	10 Hz	5	5	1
2	☒	Start & Stop	311.002 kHz	2.01 MHz	3	849.499 kHz	10 Hz	5	5	1
3	☒	Start & Stop	2.35 MHz	9.99 MHz	4	2.546666666666...	10 Hz	5	5	1
4	☒	Start & Stop	10.01 MHz	2.499 GHz	5	622.2475 MHz	10 Hz	5	5	1
5	☒	Start & Stop	2.5 GHz	5 GHz	5	625 MHz	10 Hz	5	5	1
6	☒	Start & Stop	5.001 GHz	20 GHz	31	499.9666666666...	10 Hz	5	5	1
7	☒	Start & Stop	20.001 GHz	40 GHz	43	476.1666666666...	10 Hz	5	5	1

Figure 3-30. MS4644B Frequency-Based Segmented Sweep Settings

3. Normalize the trace (data divided by memory).
 - a. Select Display.
 - b. Select View Trace.
 - c. Select Store Data to Memory.
 - d. Select Data, Memory Math.
4. Select Sweep and then Hold functions. Select Single Sweep & Hold.
5. Select File and then Save Data, file name HLN#1, file type .csv.
6. Repeat [Step 4](#) and [Step 5](#) twenty four (24) more times. When saving the data, increment the number at the end of the file name by one (e.g. HLN#2, HLN#3, and so on.).
7. Copy the twenty five (25) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
8. On a separate Windows Personal Computer, import the saved data from the HLN#n files into Microsoft Excel so the RMS values can be calculated.
9. There are many ways one can set up Microsoft Excel for calculating the RMS values. Below is an example:
 - a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data25, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the HLN#n files).
 - iii. Column B through Column AO: Data1 through Data25 (Imported from the HLN#n files).
 - b. Set up cell AA2 to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$=STDEV.P(B2:Z2)$$
 - c. Copy the formula to the next cell on Column AA until it reaches the last frequency point.
 - d. For magnitude measurements only:
 - i. Set up cell AB2 to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$=20 \times \log(V2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column AB until it reaches the last frequency point.
 - e. Rename Sheet 1 to Frequency Response S21 by right-clicking on the Sheet 1 tab, selecting Rename and typing in the new name.
 - f. Record the largest calculated RMS value of each frequency band listed in the Frequency Response S21 worksheet into [Table A-12, “Frequency Response Repeatability – 850 nm Band” on page A-10](#).

Optical Noise Floor S21 Setup – 850 nm Configuration

1. Power on MN4775A-0040, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0040 E/O Converter Ignition key is set to **OFF**.

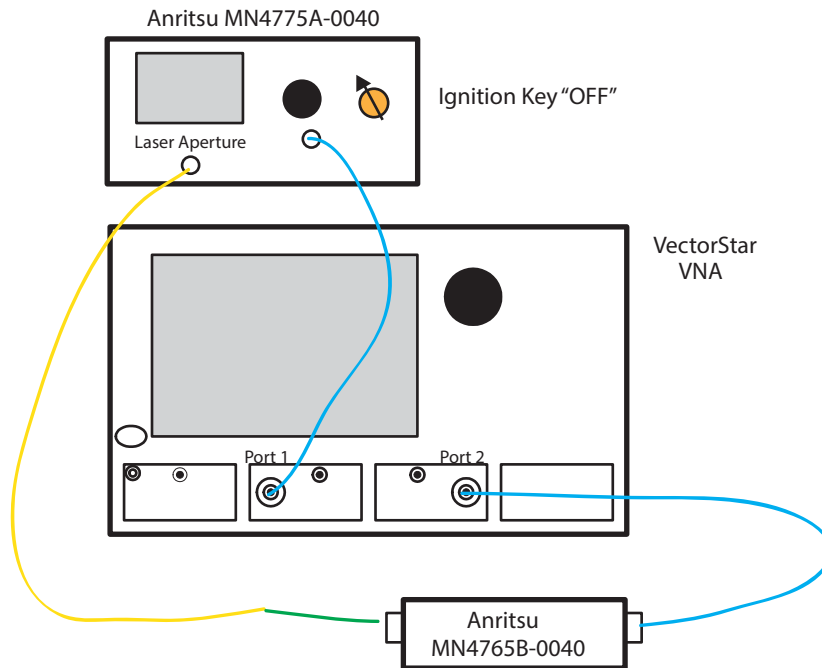


Figure 3-31. Optical Connection to MN4765B-0040

3. Connect **Yellow-colored** end of optical patch cable to MN4775A-0040 E/O Converter as shown in [Figure 3-31](#).
4. Connect **Green-colored** end of optical cable to MN4765B-0040 as shown in [Figure 3-31](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0040 E/O Converter RF Input as shown in [Figure 3-31](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0040 O/E Module Output to VNA Port 2 as shown in [Figure 3-31](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Make settings on MN4775A-0040 via the display touch screen:
 - a. Touch LASER ON Square-Pad to turn the LASER to **ON** state.
 - b. Touch VOA ON Square-Pad to enable VOA Attenuator.
 - c. Touch BIAS ON Square-Pad to enable BIAS Regulator.
9. Select ITU-Channel
 - a. Channel setting not required on 850 nm systems.

10. Select VOA Mode:

- Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
- At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
- Set Power to -3 dBm. Touch green checkmark.
- Touch Home to return to the main screen.

11. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power:

- Touch center section of BIAS VOLTAGE region to bring up secondary screen.
- At secondary screen select MODE = QUADRATURE.

12. Verify the default BIAS SETTINGS MN4775A-0040:

- Dither-Frequency 3 kHz.
- Dither-Amplitude 600 mVpp.
- Dither ON.
- Dither Slope POSITIVE SLOPE.
- Touch Home to return to the main screen.

13. Preset the VectorStar VNA as follows:

- Select Preset button on the icon bar and then the OK button.

14. On VectorStar VNA:

- Touch Trace and set the # of Traces to 1.
- Double click on TR1 to make the trace full screen.
- Touch Display and change Trace Format to Log Mag.
- Touch Response and change to S21.

15. Configure the VectorStar VNA: using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-32](#).

- Select Channel, then select Sweep.
- Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
- In this new screen, enter the information from the first entry in [Figure 3-32](#).
- Select Add and repeat until all the segments are entered.
- Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)	Pe Av
▶ 1	☒	Start & Stop	70 kHz	200 kHz	11	13 kHz	10 Hz	-10	-10	1
2	☒	Start & Stop	311.002 kHz	2.01 MHz	22	80.904666666666...	10 Hz	-10	-10	1
3	☒	Start & Stop	2.35 MHz	9.99 MHz	20	402.1052631578...	10 Hz	-10	-10	1
4	☒	Start & Stop	10.01 MHz	2.499 GHz	17	155.561875 MHz	10 Hz	-10	-10	1
5	☒	Start & Stop	2.5 GHz	5 GHz	17	156.25 MHz	10 Hz	-10	-10	1
6	☒	Start & Stop	5.001 GHz	20 GHz	51	299.98 MHz	10 Hz	-10	-10	1
7	☒	Start & Stop	20.001 GHz	40 GHz	67	303.0151515151...	10 Hz	-10	-10	1

Figure 3-32. MS4644B Frequency -Based Segmented Sweep Setting

Optical Nose Floor S21 Measurement – 850 nm Configuration

1. On VectorStar VNA, select Calibration.
2. Select Calibrate.
3. Select Manual Cal.
4. Select Transmission Freq. Response.
5. Select Modify Cal Setup.
6. Select Edit Cal Params (see [Figure 3-33](#)).

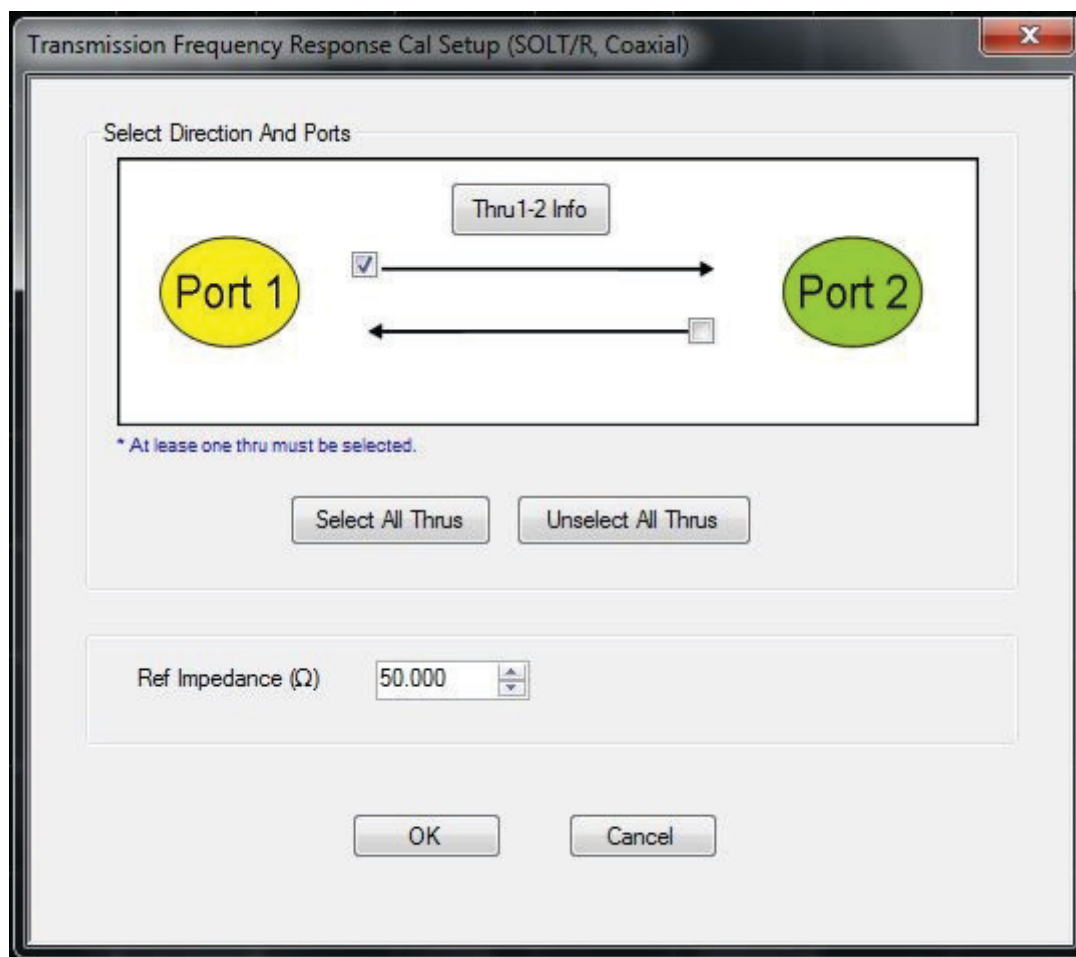


Figure 3-33. TRANSMISSION FREQUENCY RESPONSE CAL SETUP (SOLT/R, Coaxial) Dialog

7. Click on Thru1-2 Info and the THRU INFO dialog appears (see [Figure 3-34](#)) and verify that Length (mm), Line loss (dB/mm), and @Frequency (GHz) are set to 0.000.

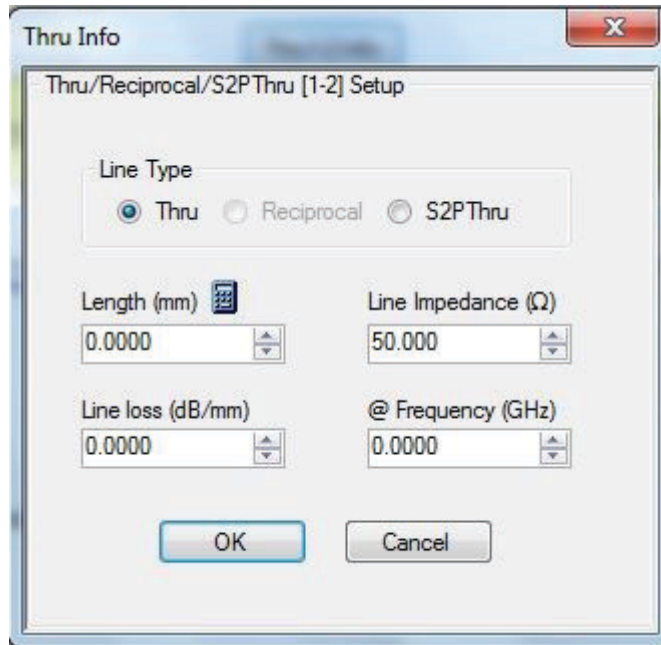


Figure 3-34. THRU INFO Dialog

8. Click OK and OK again to close EDIT CALIBRATION PARAMETERS dialog.
9. Select Back.
10. Perform a Transmission Frequency Response-only calibration. Select Done and observe that the **Green Calibration lamp** in VNA is **ON**:
 - a. Select Thru/Recip.
 - b. Select Thru and wait for green checkmark to appear.
 - c. Select Back.
 - d. Select Done.
 - e. Verify **Green Calibration lamp** is **ON**.

11. Set E/O Converter Ignition key to **OFF** (see figure [Figure 3-35](#)).

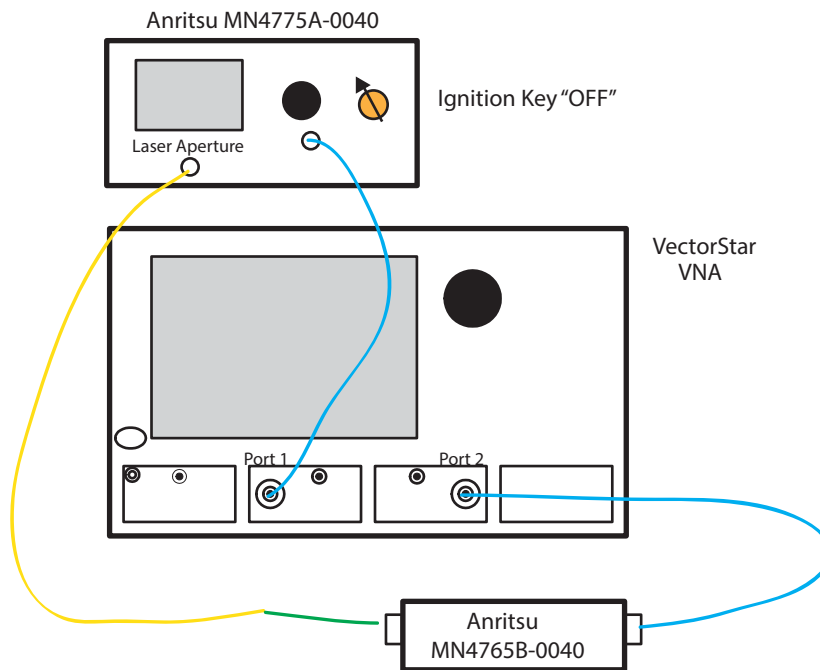


Figure 3-35. Turning Off Laser

12. Select Scale.
 - a. Click on Reference Value and set it to -50 dB.
13. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
14. Select File and then Save Data, file name NF#1, file type .csv.
15. Repeat [Step 13](#) and [Step 14](#) fifteen (15) more times. When saving the data, increment the number at the end of the file name by one (e.g. NF#2, NF#3 and so on.).
16. Copy the sixteen (16) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
17. On a separate Windows Personal Computer, import the saved data from the NF#n files into Microsoft Excel so the RMS values can be calculated.

18. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the headers: Freq, Data1 through Data16, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the NF#n files).
 - iii. Column B through Column Q: Data1 through Data16 (Imported from the HLN#n files).
- b. Set up cell R to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Q2)$$
- c. Copy the formula to the next cell on Column R until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell S to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(R2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column S until it reaches the last frequency point.
- e. Rename Sheet 1 to **S16 Magnitude** by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the highest calculated RMS value of each frequency band listed in:
 - [Table A-13, “Optical Noise Floor S21 \(Option 51\) – 850 nm Band” on page A-11](#)
 - [Table A-14, “Optical Noise Floor S21 \(Option 61 or 62\) – 850 nm Band” on page A-11](#)

3-7 ME7848A-0270 System Verification – 1550 nm Configuration

This section contains the following setup and measurement procedures:

- [ME7848A-0270 1550 nm System Setup](#)
- [Optical Power Meter \(OPM\) Measurement Setup – 1550 nm Configuration](#)
- [Optical Power Meter Measurement – 1550 nm Configuration](#)
- [Frequency Response Repeatability S21 Setup – 1550 nm Configuration](#)
- [Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration](#)
- [Optical Noise Floor S21 Setup – 1550 nm Configuration](#)
- [Optical Noise Floor S21 Measurement – 1550 nm Configuration](#)

ME7848A-0270 1550 nm System Setup

1. Configure components (VNA, O/E, E/O, RF and Optical cables) as shown in [Figure 3-36](#).

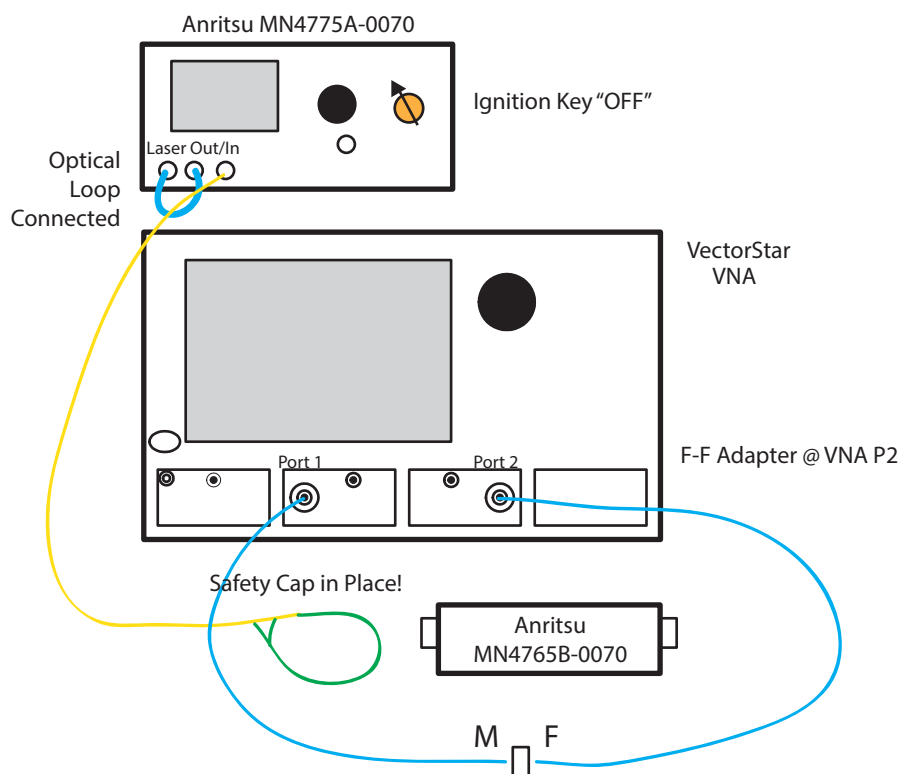


Figure 3-36. Initial ME7848A-0270 1550 nm Initial System Setup

Note	Refer to the MN4775A Operation Manual – 10410-00774 regarding proper operation of the Anritsu E/O Converter.
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2. Apply power to MN4775A-0070 E/O Converter by pushing the **Standby** button until it turns **green**.
3. Apply power to the VNA.
4. Apply power to MN4765B-0070 O/E Calibration Module via +12 V power cube.

5. MN4775A-0070 E/O Converter:
- a. Verify **Optical Loop** is in place on MN4775A-0070 E/O Converter.

Note

There is a key on the optical fiber cable that needs to be oriented correctly before the screw will tighten correctly.

- b. Keep **Ignition-Key** in **OFF** Position as shown in [Figure 3-36](#).
6. Make initial VNA RF Connections shown in [Figure 3-36](#).

a. Place VF-VF Adapter on VNA Port 2.

b. VNA Port 1 to VNA Port 2 via 3 ft. RF Cables.

c. Verify the connection between the **Male end** on cable at Port 1 and **Female End** on cable at Port 2.
7. Make Optical connection to MN4775A-0070 as shown in [Figure 3-36](#).

a. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0070 E/O Converter.

b. Place the **Green-colored** cap onto the **Green-colored** end of the Optical cable.
8. Turn MN4775A-0070 E/O Converter Ignition Key to **ON**.

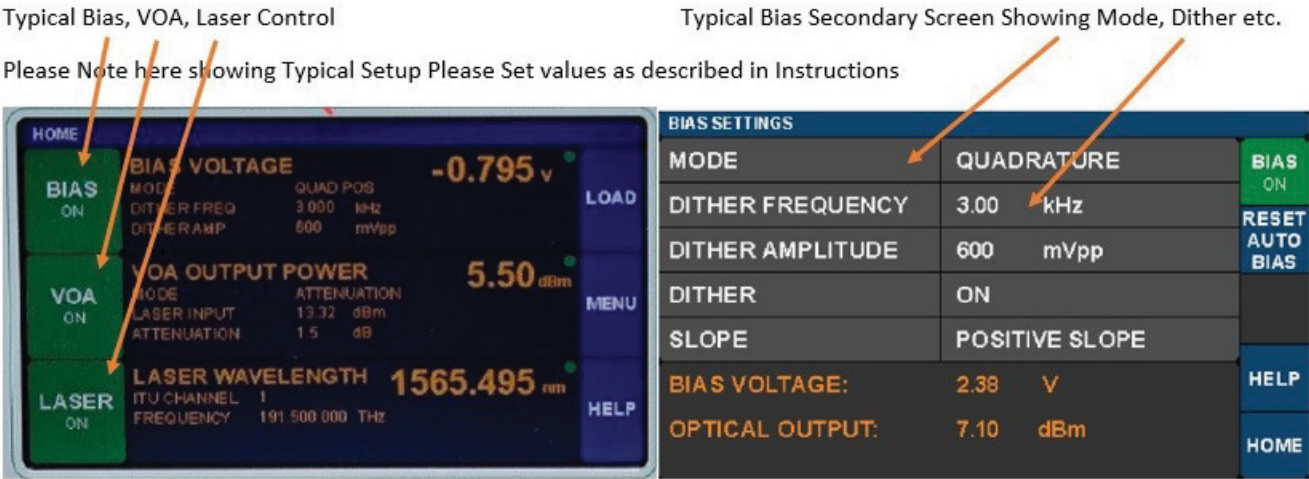


Figure 3-37. E/O Converter Setup Screen

Note

The depiction of the touch screen settings above is for reference only; actual settings are as given below.

9. Make settings on MN4775A-0070 via the display touch screen as described below; refer to [Figure 3-37](#) (left side).
- a. Touch **LASER ON** square-pad to turn the LASER to **ON** state.

b. Touch **VOA ON** square-pad to enable VOA Attenuator.

c. Touch **BIAS ON** square-pad to enable BIAS Regulator.

10. Select ITU Channel:
 - a. Touch center section of LASER WAVELENGTH region to bring up secondary screen (not shown in figure 3-2).
 - b. At secondary screen select ITU Channel 34 = 1550.12 nm WAVE LENGTH. Touch green checkmark.
 - c. Touch Home to return to the main screen.
11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen as shown in Figure 3-37 (left side).
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Select and adjust output power to +5 dBm.
12. Select Bias Mode:
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen as shown in Figure 3-37 (right side).
 - b. At secondary screen select MODE = QUADRATURE.
13. Typical default BIAS SETTINGS MN4775A-0070:
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE.
14. Turn E/O Converter LASER Inter-Lock Ignition Key to **OFF**.

Optical Power Meter (OPM) Measurement Setup – 1550 nm Configuration

1. Apply Power via **black button** adjacent to sensor (side panel).
2. Allow 1 minute warm up

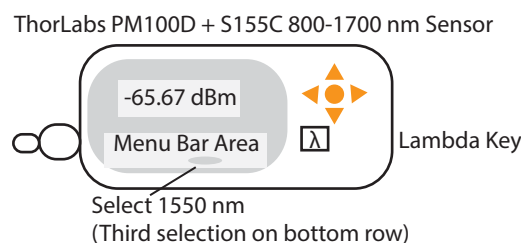


Figure 3-38. Power Meter QP – 1550 nm Configuration

3. Verify following default settings.
 - a. Range = Auto.
 - b. Units = dBm.
4. Navigate to MEAS CONFIG menu via front panel buttons.
 - a. Select Zero to zero the sensor (About 2 seconds).
 - b. Exit MEAS CONFIG menu.

5. Set Measurement Wavelength.

- a. On Front Panel select **Lambda** button as shown in [Step 3-38](#).
- b. Navigate to 1550nm Wavelength icon in menu bar area.
- c. On PM100D Meter select OK to choose 1550 nm selection, as shown in [Figure 3-38](#).

Optical Power Meter Measurement – 1550 nm Configuration

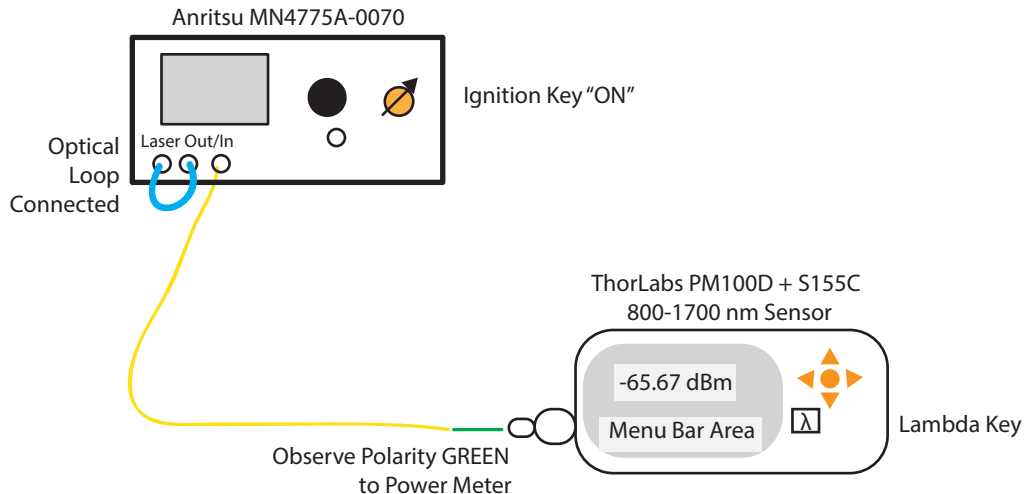


Figure 3-39. Optical Power Measurement – 1550 nm Configuration

1. Optical Power Measurement Using PM100D:

- a. Connect PM100D OPM to E/O Converter Output via Optical Cable, as shown in [Figure 3-39](#).
- b. Verify that the PM100D's power is **ON**.
- c. Turn E/O Converter Ignition Key = **ON**.
- d. Using E/O Touch Panel:
 - i. Laser = ON.
 - ii. VOA = ON, VOA Mode = Constant Output at + 5 dBm.
 - iii. BIAS = ON.
- e. Modify Bias Mode
 - i. Push touch screen at Bias center navigate to Secondary Bias settings screen.
 - ii. Select Bias Mode = PEAK.
 - iii. Select Reset Auto-Bias Cal.
- f. Wait for readings to stabilize; nominally less than ± 0.5 dB bounce.
- g. Enter nominal reading from PM100D Optical Power Meter into the test records in [Table A-15](#), "Optical Power Measurement – 1550 nm Band" on page A-12.
- h. Expected range for this measurement is +5 dBm ± 2 dB.

Note Meter reading may fluctuate nominally ± 0.5 dB.

2. Set E/O Converter Inter-Lock to **OFF**:
 - a. Set E/O Converter Gen Laser Interlock to **OFF** via Ignition Key.
 - b. Power down Optical Power Meter.
3. Disconnect the Optical Power Meter.

Frequency Response Repeatability S21 Setup – 1550 nm Configuration

1. Power on MN4775A-0070, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0070 E/O Converter Ignition key to **OFF**.

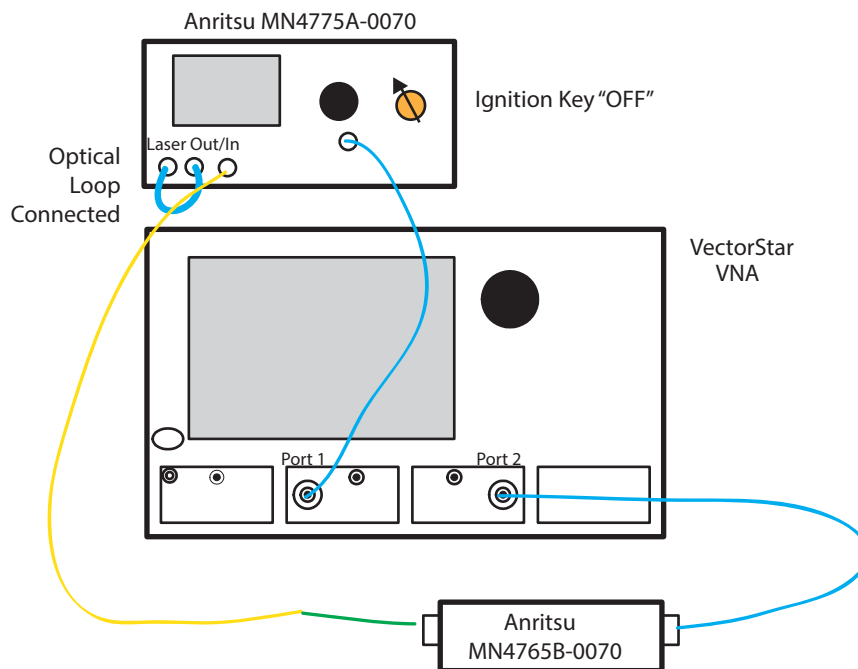


Figure 3-40. Optical Connection to MN4765B-0070

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0070 E/O Converter as shown in [Figure 3-40](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0070 as shown in [Figure 3-40](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0070 E/O Converter RF Input as shown in [Figure 3-40](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0070 O/E Module Output to VNA Port 2 as shown in [Figure 3-40](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0070 E/O Converter as shown in [Figure 3-40](#).

9. Make settings on MN4775A-0070 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel:
 - a. Touch center section of LASER WAVELENGTH region to bring up secondary screen.
 - b. At Secondary Screen select ITU Channel 31 = 1550.041 nm WAVE LENGTH.
 - c. Touch Home to return to the main screen.
11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring Up Secondary Screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +5 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Verify the default BIAS SETTINGS MN4775A-0070.
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE SLOPE.
 - e. Touch Home to return to the main screen.
14. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.

Frequency Response Repeatability S21-Mag Measurement – 1550 nm Configuration

1. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch on Display and change Trace Format to Log Mag.
 - d. Touch Response and change S21.

2. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-41](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-41](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)
2	☒	Start & Stop	311 kHz	2.01 MHz	3	849.5 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	9.99 MHz	4	2.546666666666...	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.499 GHz	5	622.2475 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	5 GHz	5	625 MHz	10 Hz	-10	-10
6	☒	Start & Stop	5.001 GHz	20 GHz	31	499.9666666666...	10 Hz	-10	-10
7	☒	Start & Stop	20.001 GHz	38 GHz	36	514.2571428571...	10 Hz	-10	-10
8	☒	Start & Stop	38.001 GHz	50 GHz	24	521.6956521739...	10 Hz	-10	-10
9	☒	Start & Stop	50.001 GHz	65 GHz	31	499.9666666666...	10 Hz	-10	-10
10	☒	Start & Stop	65.001 GHz	67 GHz	4	666.3333333333...	10 Hz	-10	-10
▶ 11	☒	Start & Stop	67.001 GHz	70 GHz	6	599.8 MHz	10 Hz	-10	-10

Figure 3-41. MS4647B Frequency-Based Segmented Sweep Settings

3. Normalize the trace (data divided by memory).
 - a. Select Display.
 - b. Select View Trace.
 - c. Select Store Data to Memory.
 - d. Select Data, Memory Math.
4. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
5. Select File and then Save Data, file name HLN#1, file type .csv.
6. Repeat [Step 4](#) through [Step 5](#) twenty four (24) more times. When saving the data, increment the number at the end of the file name by one (e.g. HLN#2, HLN#3, and so on.).
7. Copy the twenty five (25) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
8. On a separate Windows Personal Computer, import the saved data from the HLN#n files into Microsoft Excel so the RMS values can be calculated.

9. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data25, RMS Linear Mag, RMS Log Mag
 - ii. Column A: Freq (Imported from the HLN#n files)
 - iii. Column B through Column AO: Data1 through Data25 (Imported from the HLN#n files)
- b. Set up cell AA2 to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Z2)$$
- c. Copy the formula to the next cell on Column AA until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell AB2 to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(V2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column AB until it reaches the last frequency point.
- e. Rename Sheet 1 to *Frequency Response S21* by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the largest calculated RMS value of each frequency band listed in *Frequency Response S21* worksheet into [Table A-16, “Frequency Response Repeatability – 1550 nm Band”](#) on [page A-12](#).

Optical Noise Floor S21 Setup – 1550 nm Configuration

1. Power on MN4775A-0070, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0070 E/O Converter Ignition key is set to **OFF**.

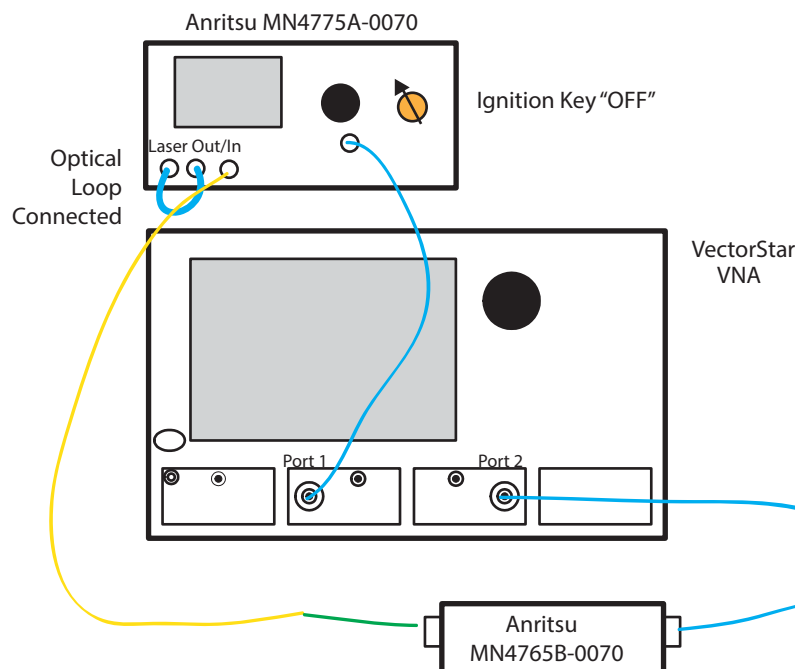


Figure 3-42. Optical Connection to MN4765B-0070

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0070 E/O Converter as shown in [Figure 3-42](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0070 as shown in [Figure 3-42](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0070 E/O Converter RF Input as shown in [Figure 3-42](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0070 O/E Module Output to VNA Port 2 as shown in [Figure 3-42](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0070 E/O Converter as shown in [Figure 3-42](#).
9. Make settings on MN4775A-0070 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel
 - a. Touch center section of LASER WAVELENGTH region to bring up secondary screen.
 - b. At secondary screen select ITU Channel 31 = 1550.041 nm WAVE LENGTH.
 - c. Touch Home to return to the main screen.
11. Select VOA Mode
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +5 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Verify the default BIAS SETTINGS MN4775A-0070:
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE SLOPE.
 - e. Touch Home to return to the main screen.
14. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button
15. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch Display and change Trace Format to Log Mag.
 - d. Touch Response and change to S21.

16. Configure the VectorStar VNA: using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-43](#).
- Select Channel, then select Sweep.
 - Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - In this new screen, enter the information from the first entry in [Figure 3-43](#).
 - Select Add and repeat until all the segments are entered.
 - Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)	Pe Av
1	☒	Start & Stop	70 kHz	200 kHz	11	13 kHz	10 Hz	-10	-10	1
2	☒	Start & Stop	311 kHz	2.01 MHz	22	80.90476190476...	10 Hz	-10	-10	1
3	☒	Start & Stop	2.35 MHz	9.99 MHz	20	402.1052631578...	10 Hz	-10	-10	1
4	☒	Start & Stop	10.01 MHz	2.499 GHz	17	155.561875 MHz	10 Hz	-10	-10	1
5	☒	Start & Stop	2.5 GHz	5 GHz	17	156.25 MHz	10 Hz	-10	-10	1
6	☒	Start & Stop	5.001 GHz	20 GHz	51	299.98 MHz	10 Hz	-10	-10	1
7	☒	Start & Stop	20.001 GHz	38 GHz	61	299.9833333333...	10 Hz	-10	-10	1
8	☒	Start & Stop	38.001 GHz	50 GHz	41	299.975 MHz	10 Hz	-10	-10	1
9	☒	Start & Stop	50.001 GHz	65 GHz	51	299.98 MHz	10 Hz	-10	-10	1
10	☒	Start & Stop	65.001 GHz	67 GHz	11	199.9 MHz	10 Hz	-10	-10	1
11	☒	Start & Stop	67.001 GHz	70 GHz	15	214.2142857142...	10 Hz	-10	-10	1

Figure 3-43. MS4647B Frequency-Based Segmented Sweep Settings

Optical Noise Floor S21 Measurement – 1550 nm Configuration

- VectorStar VNA, select Calibration.
- Select Calibrate.
- Select Manual Cal.
- Select Transmission Freq. Response.
- Select Modify Cal Setup.

6. Select Edit Cal Params (see [Figure 3-44](#)).

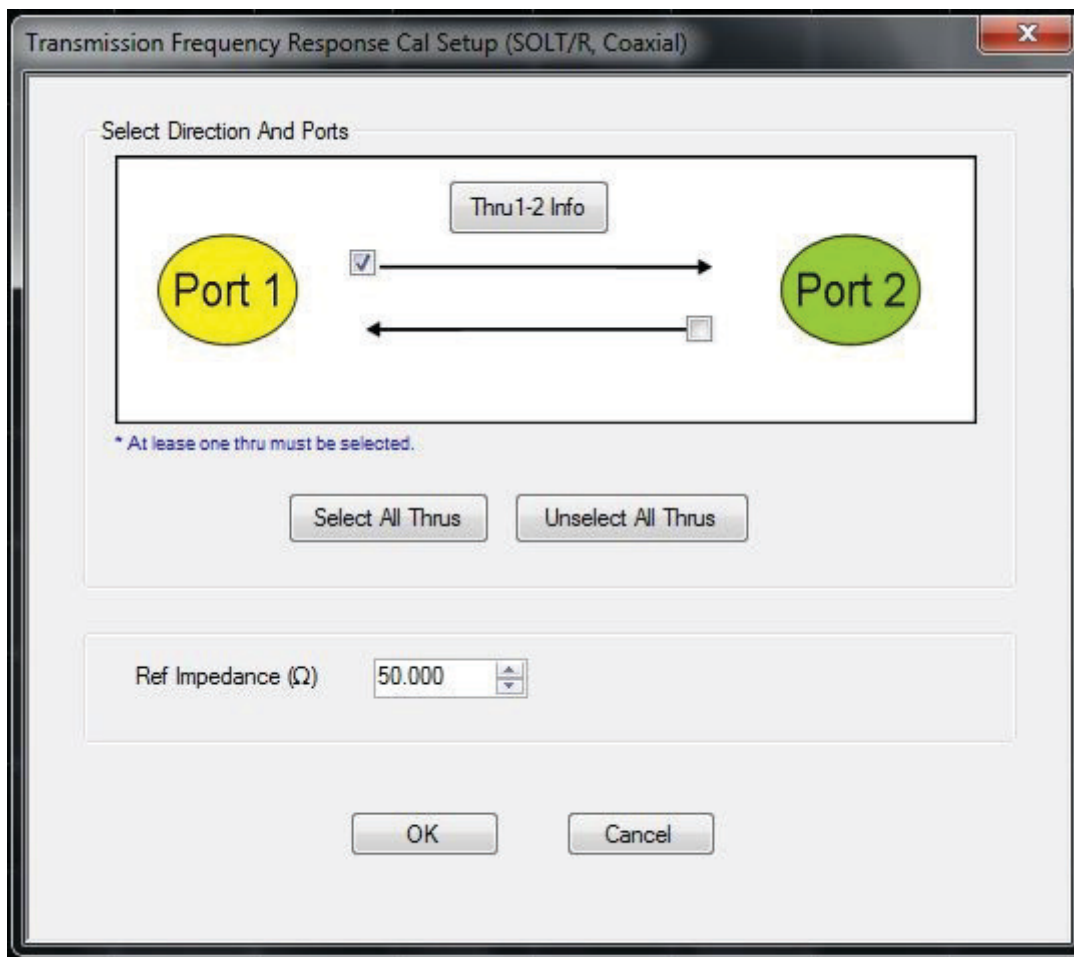


Figure 3-44. TRANSMISSION FREQUENCY RESPONSE CAL SETUP (SOLT/R, Coaxial) Dialog

7. Click on Thru1-2 Info and the screen appears (see [Figure 3-45](#)) and verify Length (mm), Line loss (dB/mm), and @Frequency (GHz) are set to 0.000.

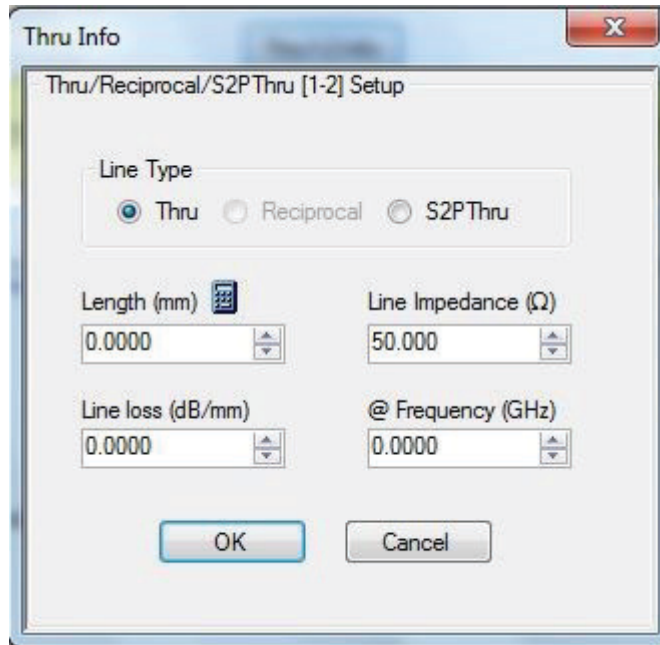


Figure 3-45. THRU INFO Dialog

8. Click OK and OK again to close EDIT CALIBRATION PARAMETERS dialog.
9. Select Back.
10. Perform a Transmission Frequency Response-only calibration. Select Done and observe that the **Green Calibration lamp** in VNA is on.
 - a. Select Thru/Recip.
 - b. Select Thru and wait for green checkmark to appear.
 - c. Select Back.
 - d. Select Done.
 - e. Verify **Green Calibration lamp** is **ON**.

11. Set E/O Converter Ignition key to **OFF**, see figure [Figure 3-46](#).

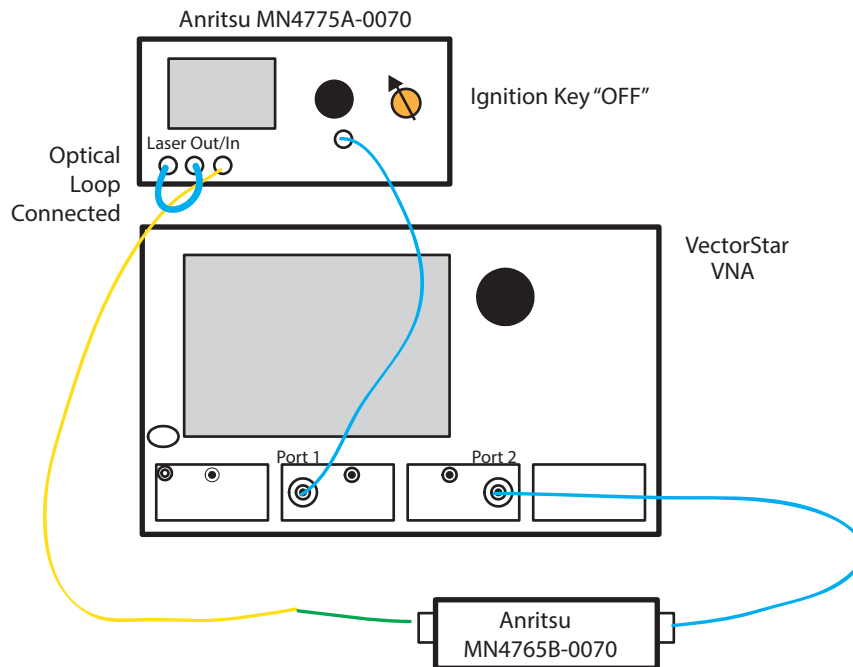


Figure 3-46. Turning Off Laser

12. Select Scale

- a. Click on Reference Value and set it to -50 dB. The screen should look like [Figure 3-47](#).

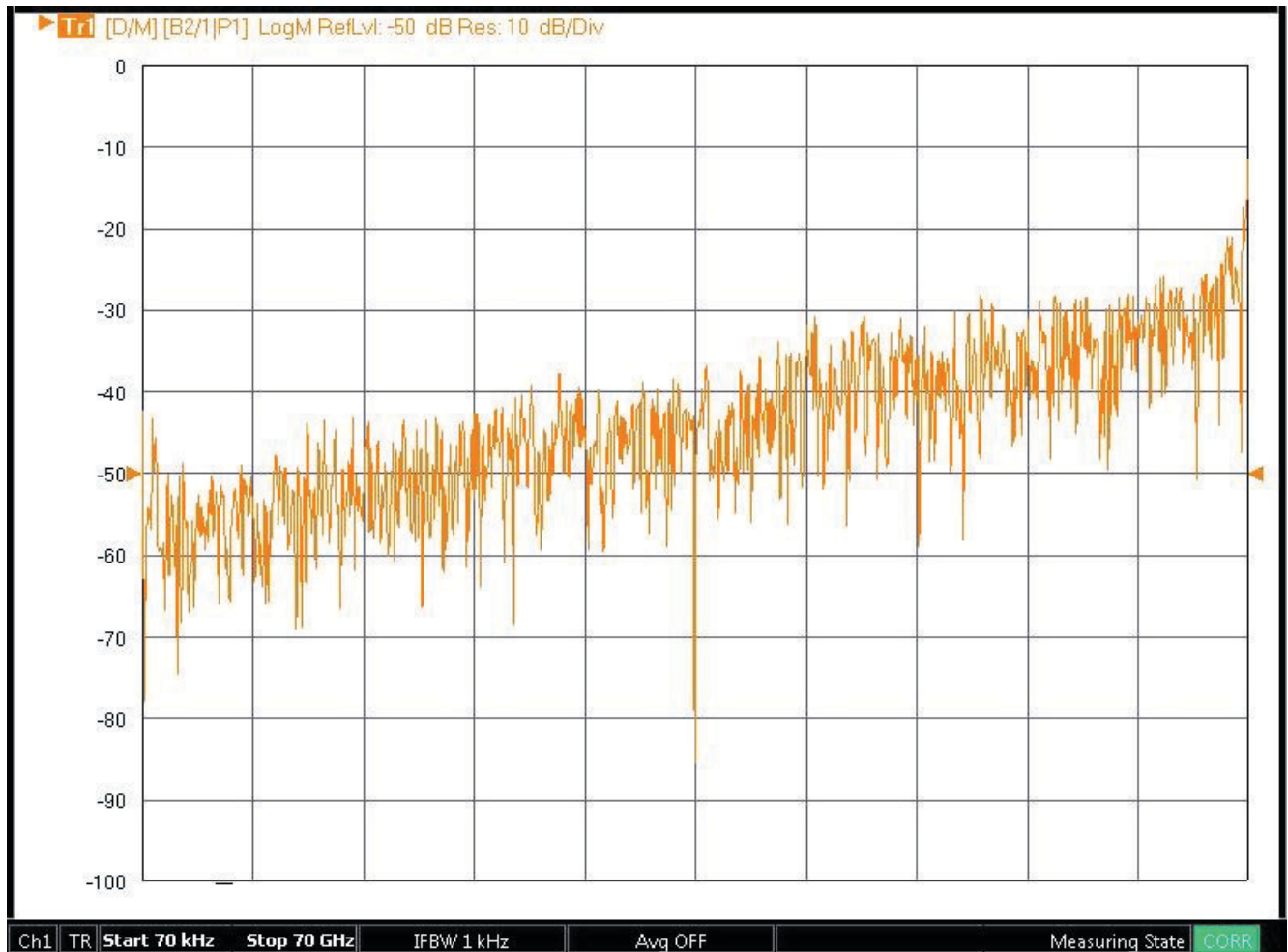


Figure 3-47. Typical Noise Floor Display—Reference Only

13. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
14. Select File and then Save Data, file name NF#1, file type .csv.
15. Repeat [Step 13](#) and [Step 14](#) fifteen (15) more times. When saving the data, increment the number at the end of the file name by one (e.g. NF#2, NF#3, and so on.).
16. Copy the sixteen (16) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
17. On a separate Windows Personal Computer, import the saved data from the NF#n files into Microsoft Excel so the RMS values can be calculated.

18. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data16, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the NF#n files).
 - iii. Column B through Column Q: Data1 through Data16 (Imported from the HLN#n files).
- b. Set up cell R to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$= \text{STDEV.P}(B2:Q2)$$
- c. Copy the formula to the next cell on Column R until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell S to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$= 20 \times \log(R2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column S until it reaches the last frequency point.
- e. Rename Sheet 1 to S16 Magnitude by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the highest calculated RMS value of each frequency band listed in:
 - [Table A-17, “Optical Noise Floor S21 \(Option 51\) – 1550 nm Band” on page A-13](#)
 - [Table A-18, “Optical Noise Floor S21 \(Option 61 or 62\) – 1550 nm Band” on page A-13](#)

3-8 ME7848A-0271 System Verification – 1310 nm Configuration

This section contains the following setup and measurement procedures:

- [ME7848A-0271 1310 nm System Setup](#)
- [Optical Power Meter \(OPM\) Measurement Setup – 1310 nm Configuration](#)
- [Optical Power Meter Measurement – 1310 nm Configuration](#)
- [Frequency Response Repeatability S21 Setup – 1310 nm Configuration](#)
- [Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration](#)
- [Optical Noise Floor S21 Setup – 1310 nm Configuration](#)
- [Optical Noise Floor S21 Measurement – 1310 nm Configuration](#)

ME7848A-0271 1310 nm System Setup

1. Configure components (VNA, O/E, E/O, RF and Optical cables) as shown in [Figure 3-48](#).

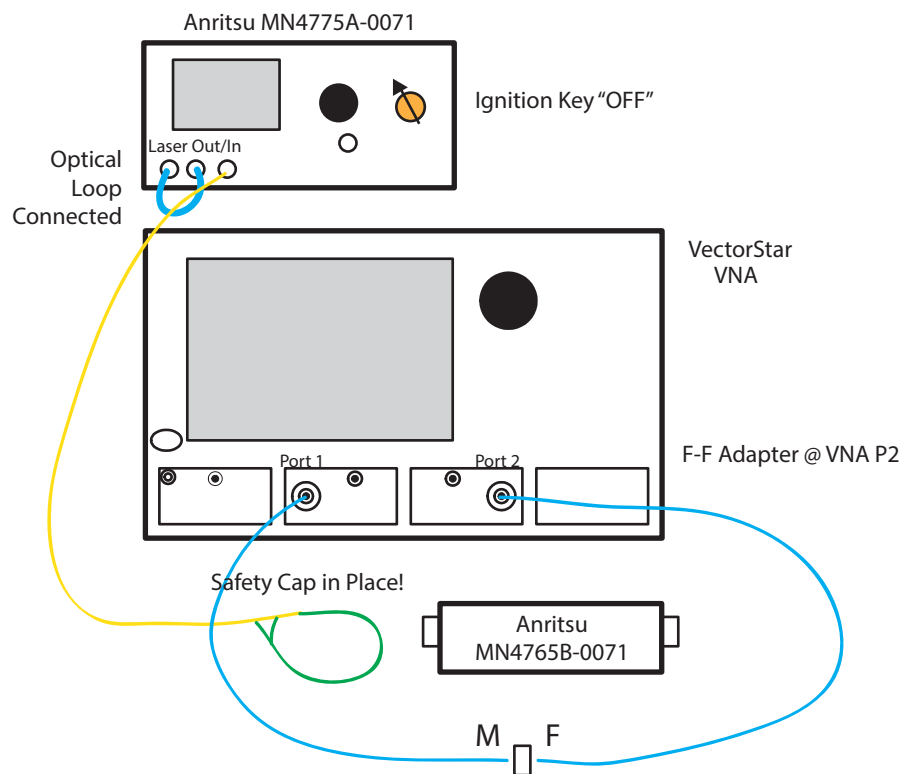


Figure 3-48. Initial ME7848A-0271 1310 nm Initial System Setup

Note	Refer to the MN4775A Operation Manual – 10410-00774 regarding proper operation of the Anritsu E/O Converter.
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2. Apply power to MN4775A-0071 E/O Converter by pushing the **Standby** button until it turns **green**.
3. Apply power to the VNA.
4. Apply power to MN4765B-0071 O/E Calibration Module via +12 V power cube.

5. MN4775A-0071 E/O Converter:

- a. Verify **Optical Loop** is in place on MN4775A-0071 E/O Converter.

Note There is a key on the optical fiber cable that needs to be oriented correctly before the screw will tighten correctly.

- b. Keep **Ignition-Key** in OFF Position as shown in [Figure 3-48](#).

6. Make initial VNA RF Connections shown in [Figure 3-48](#).

- a. Place VF-VF Adapter on VNA Port 2.
- b. VNA Port 1 to VNA Port 2 via 3 ft. RF Cables.
- c. Verify connection between **Male end** on cable at Port 1 and **Female End** on Cable at Port 2.

7. Make Optical connection shown to MN4775A-0071 as shown in [Figure 3-48](#).

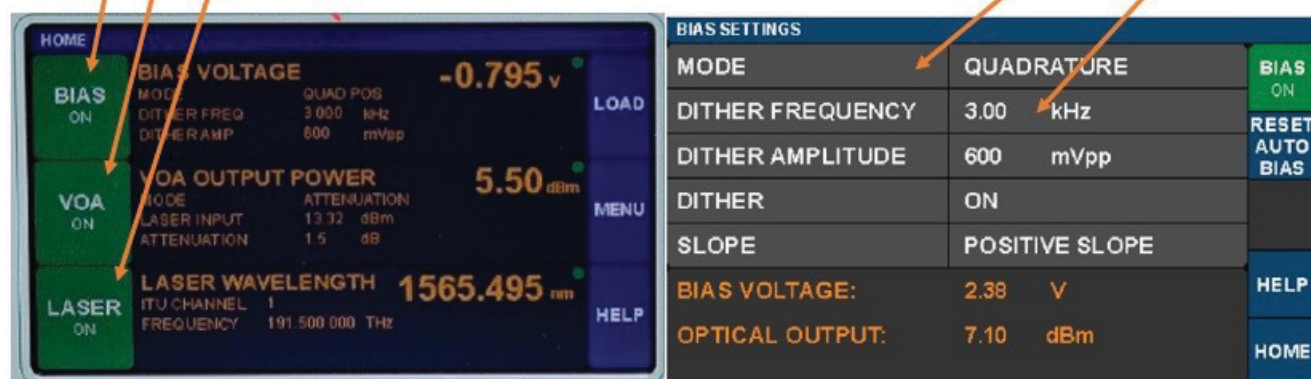
- a. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0071 E/O Converter.
- b. Place the **Green-colored** cap onto the **Green-colored** end of the Optical cable.

8. Turn MN4775A-0071 E/O Converter Ignition Key to **ON**.

Typical Bias, VOA, Laser Control

Typical Bias Secondary Screen Showing Mode, Dither etc.

Please Note here showing Typical Setup Please Set values as described in Instructions

**Figure 3-49.** E/O Converter Setup Screen

Note The depiction of the touch screen settings above is for reference only; actual settings are as given below.

9. Make settings on MN4775A-0071 via the display touch screen as described below; refer to [Figure 3-49](#).

- a. Touch **LASER ON** square-pad to turn the LASER to **ON** state.
- b. Touch **VOA ON** square-pad to enable VOA Attenuator.
- c. Touch **BIAS ON** square-pad to enable BIAS Regulator.

10. Select ITU-Channel.

- Not required for 1310 System as wavelength is fixed.

11. Select VOA Mode.
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen as shown in [Figure 3-49](#) (left side).
 - b. At secondary screen, touch **Mode** and then touch **Out** to change mode to **CONSTANT OUTPUT**.
 - c. Select and adjust output power to **+2 dBm**.
12. Select Bias Mode.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen as shown in [Figure 3-49](#) (right side).
 - b. At secondary screen select **MODE = QUADRATURE**.
13. Typical default BIAS SETTINGS MN4775A-0071:
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE.
14. Turn E/O Converter LASER Inter-Lock Ignition Key to **OFF**.

Optical Power Meter (OPM) Measurement Setup – 1310 nm Configuration

1. Verify Optical Sensor Model: S155C 800 – 1700nm, fitted to PM100D Meter
2. Apply Power via **black button** adjacent to sensor (on side panel).
3. Allow 1 minute warm up.

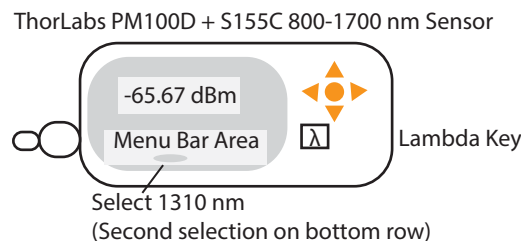


Figure 3-50. Power Meter QP 1310 nm Configuration

4. Verify following default settings.
 - a. Range = Auto.
 - b. Units = dBm.
5. Navigate to MEAS CONFIG menu via front panel buttons.
 - a. Select **Zero** to zero the sensor (About 2 seconds).
 - b. Exit MEAS CONFIG menu.
6. Set Measurement Wavelength.
 - a. On Front Panel select **Lambda** button as shown in [Figure 3-50](#).
 - b. Navigate to 1310 nm Wavelength icon in menu bar area.
 - c. On PM100D Meter select **OK** to choose 1310 nm selection, as shown in [Figure 3-50](#).

Optical Power Meter Measurement – 1310 nm Configuration

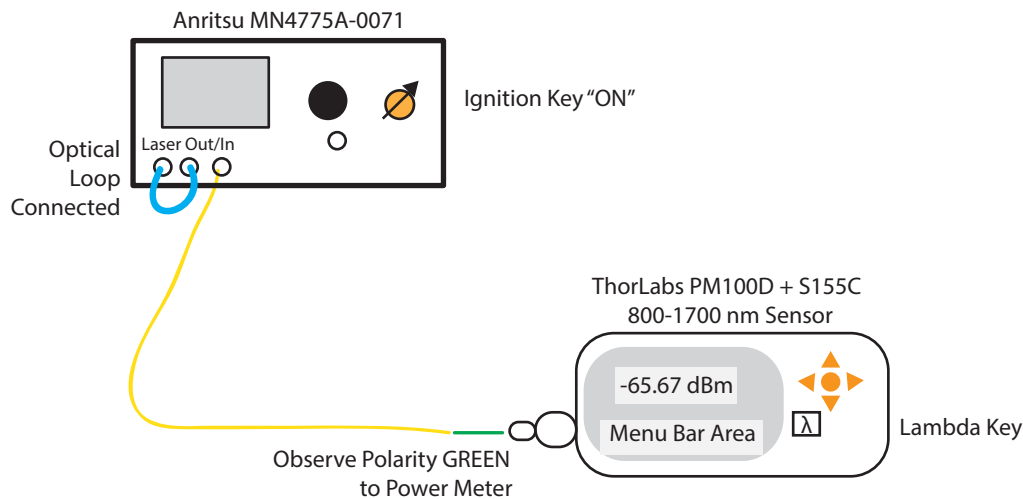


Figure 3-51. Optical Power Measurement – 1310 nm Configuration

1. Optical Power Measurement Using PM100D:

- a. Connect PM100D OPM to E/O Converter Output via Optical Cable as shown in [Figure 3-51](#).
- b. Verify the PM100D's power is **ON**.
- c. Turn E/O Converter Ignition Key = **ON**.
- d. Using E/O Touch Panel:
 - i. Laser = ON.
 - ii. VOA = ON, VOA Mode = Constant Output at + 2 dBm.
 - iii. BIAS = ON.
- e. Modify Bias Mode:
 - i. Push touch screen at Bias center navigate to Secondary Bias settings screen
 - ii. Select Bias Mode = PEAK.
 - iii. Select Trigger Auto-Bias Cal.
- f. Wait for readings to stabilize; nominally less than ± 0.5 dB bounce.
- g. Enter nominal reading from PM100D Optical Power Meter into the test records in [Table A-19](#), "Optical Power Measurement – 1310 nm Band" on page A-14.
- h. Expected range for this measurement is +2 dBm ± 2 dB

Note Meter reading may fluctuate nominally ± 0.5 dB.

2. E/O Converter Inter-Lock to **OFF**:

- a. Set E/O Converter Gen Laser Inter-Lock to **OFF** via Ignition Key
- b. Power down Optical Power Meter

3. Disconnect the Optical Power Meter.

Frequency Response Repeatability S21 Setup – 1310 nm Configuration

1. Power on MN4775A-0071, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0071 E/O Converter Ignition key is set to **OFF**.

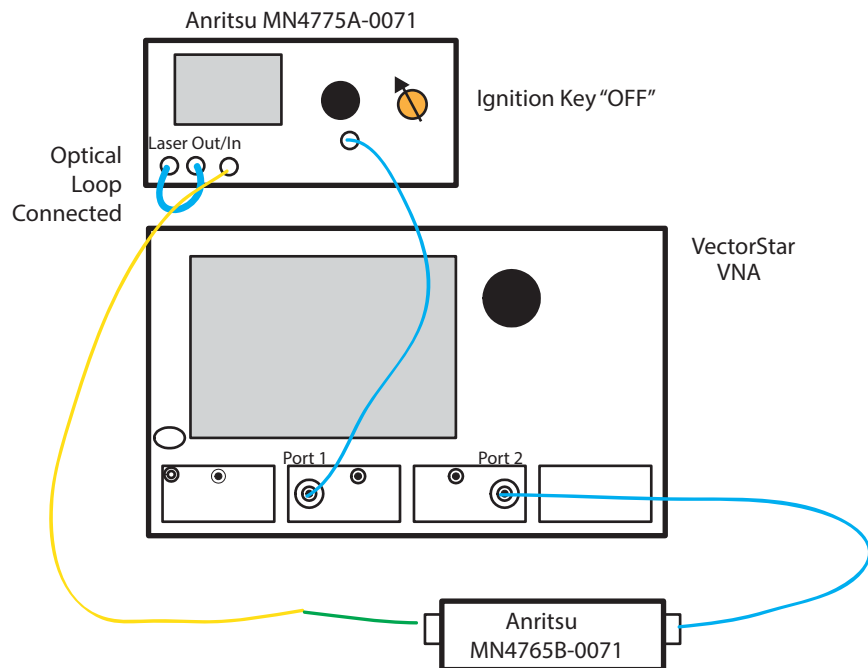


Figure 3-52. Optical Connection to MN4765B-0071

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0071 E/O Converter as shown in [Figure 3-52](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0071 as shown in [Figure 3-52](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0071 E/O Converter RF Input as shown in [Figure 3-52](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0071 O/E Module Output to VNA Port 2 as shown in [Figure 3-52](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify that **Optical Loop** is in place on MN4775A-0071 E/O Converter as shown in [Figure 3-52](#).
9. Make settings on MN4775A-0071 via the display touch screen as described below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel
 - Channel setting not required on 1310 nm systems.

11. Select VOA Mode
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +2 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK Mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring Up Secondary Screen.
 - b. At Secondary Screen select MODE = QUADRATURE.
13. Verify the default BIAS SETTINGS MN4775A-0071.
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE SLOPE.
 - e. Touch Home to return to the main screen.
14. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.

Frequency Response Repeatability S21-Mag Measurement – 1310 nm Configuration

1. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch on Display and change Trace Format to Log Mag.
 - d. Touch Response and change S21.
2. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-53](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-53](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)
2	☒	Start & Stop	311 kHz	2.01 MHz	3	849.5 kHz	10 Hz	-10	-10
3	☒	Start & Stop	2.35 MHz	9.99 MHz	4	2.546666666666...	10 Hz	-10	-10
4	☒	Start & Stop	10.01 MHz	2.499 GHz	5	622.2475 MHz	10 Hz	-10	-10
5	☒	Start & Stop	2.5 GHz	5 GHz	5	625 MHz	10 Hz	-10	-10
6	☒	Start & Stop	5.001 GHz	20 GHz	31	499.9666666666...	10 Hz	-10	-10
7	☒	Start & Stop	20.001 GHz	38 GHz	36	514.2571428571...	10 Hz	-10	-10
8	☒	Start & Stop	38.001 GHz	50 GHz	24	521.6956521739...	10 Hz	-10	-10
9	☒	Start & Stop	50.001 GHz	65 GHz	31	499.9666666666...	10 Hz	-10	-10
10	☒	Start & Stop	65.001 GHz	67 GHz	4	666.3333333333...	10 Hz	-10	-10
11	☒	Start & Stop	67.001 GHz	70 GHz	6	599.8 MHz	10 Hz	-10	-10

Figure 3-53. MS4647B Frequency-Based Segmented Sweep Settings

3. Normalize the trace (data divided by memory):
 - a. Select Display.
 - b. Select View Trace.
 - c. Select Store Data to Memory.
 - d. Select Data, Memory Math.
4. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
5. Select File and then Save Data, file name HLN#1, file type .csv.
6. Repeat [Step 4](#) through [Step 5](#) twenty four (24) more times. When saving the data, increment the number at the end of the file name by one (e.g. HLN#2, HLN#3, and so on.).
7. Copy the twenty five (25) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
8. On a separate Windows Personal Computer, import the saved data from the HLN#n files into Microsoft Excel so the RMS values can be calculated.
9. There are many ways one can set up Microsoft Excel for calculating the RMS values. Below is an example:
 - a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data25, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the HLN#n files).
 - iii. Column B through Column AO: Data1 through Data25 (Imported from the HLN#n files).
 - b. Set up cell AA2 to calculate the RMS value in Linear Mag by entering the following formula into the cell:
$$=STDEV.P(B2:Z2)$$
 - c. Copy the formula to the next cell on Column AA until it reaches the last frequency point.
 - d. For magnitude measurements only:
 - i. Set up cell AB2 to calculate the RMS value in Log Mag by entering the following formula into the cell:
$$=20 \times \log(V2 + 1, 10)$$
 - ii. Copy the formula to the next cell on Column AB until it reaches the last frequency point.
 - e. Rename Sheet 1 to Frequency Response S21 by right-clicking on the Sheet 1 tab, selecting Rename and typing in the new name.
 - f. Record the largest calculated RMS value of each frequency band listed in the Frequency Response S21 worksheet into [Table A-20, “Frequency Response Repeatability – 1310 nm Band” on page A-14](#).

Optical Noise Floor S21 Setup – 1310 nm Configuration

1. Power on MN4775A-0071, MS464xB, and MN4765B and allow the instruments to warm up for 90 minutes.
2. Verify MN4775A-0071 E/O Converter Ignition key to **OFF**.

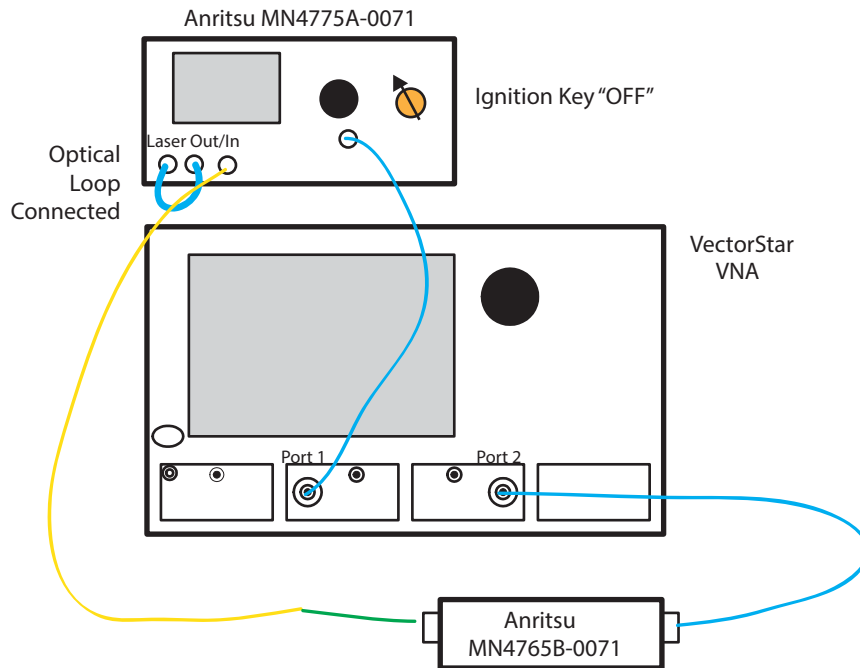


Figure 3-54. Optical Connection to MN4765B-0071

3. Connect **Yellow-colored** end of Optical Patch cable to MN4775A-0071 E/O Converter as shown in [Figure 3-54](#).
4. Connect **Green-colored** end of Optical cable to MN4765B-0071 as shown in [Figure 3-54](#).
5. Connect the VNA Port 1 to Anritsu MN4775A-0071 E/O Converter RF Input as shown in [Figure 3-54](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
6. Connect Anritsu MN4765B-0071 O/E Module Output to VNA Port 2 as shown in [Figure 3-54](#).
 - Use torque wrench to tighten the connectors to ensure that the connections do not work themselves loose during the test.
7. Set E/O Converter Ignition key to **ON**.
8. Verify **Optical Loop** is in place on MN4775A-0071 E/O Converter.
9. Make settings on MN4775A-0071 via the display touch screen as below.
 - a. Touch LASER ON square-pad to turn the LASER to **ON** state.
 - b. Touch VOA ON square-pad to enable VOA Attenuator.
 - c. Touch BIAS ON square-pad to enable BIAS Regulator.
10. Select ITU-Channel
 - a. Channel setting not required on 1310 nm systems

11. Select VOA Mode:
 - a. Touch center section of VOA OUTPUT POWER region to bring up secondary screen.
 - b. At secondary screen, touch Mode and then touch Out to change mode to CONSTANT OUTPUT.
 - c. Set Power to +2 dBm. Touch green checkmark.
 - d. Touch Home to return to the main screen.
12. Restore Bias Mode as QUADRATURE from PEAK mode utilized to measure power.
 - a. Touch center section of BIAS VOLTAGE region to bring up secondary screen.
 - b. At secondary screen select MODE = QUADRATURE.
13. Verify the default BIAS SETTINGS MN4775A-0071:
 - a. Dither-Frequency 3 kHz.
 - b. Dither-Amplitude 600 mVpp.
 - c. Dither ON.
 - d. Dither Slope POSITIVE SLOPE.
 - e. Touch Home to return to the main screen.
14. Preset the VectorStar VNA as follows:
 - a. Select Preset button on the icon bar and then the OK button.
15. On VectorStar VNA:
 - a. Touch Trace and set the # of Traces to 1.
 - b. Double click on TR1 to make the trace full screen.
 - c. Touch Display and change Trace Format to Log Mag.
 - d. Touch Response and change to S21.
16. Configure the VectorStar VNA; using Frequency Based Segmented Sweep, create a segmented sweep table as shown in [Figure 3-55](#).
 - a. Select Channel, then select Sweep.
 - b. Select Freq-based Seg. Sweep Setup and a new window appears at the bottom of the screen.
 - c. In this new screen, enter the information from the first entry in [Figure 3-55](#).
 - d. Select Add and repeat until all the segments are entered.
 - e. Set Sweep type to Segmented Sweep (Freq Based).

	Seg. On	Freq Def. for F1 & F2	F1	F2	# of Pts	Step/Stop Freq	IFBW	P1 Src Pwr (Src Atten = 0 dB)	P2 Src Pwr (Src Atten = 0 dB)	Pe Av
1	☒	Start & Stop	70 kHz	200 kHz	11	13 kHz	10 Hz	-10	-10	1
2	☒	Start & Stop	311 kHz	2.01 MHz	22	80.90476190476...	10 Hz	-10	-10	1
3	☒	Start & Stop	2.35 MHz	9.99 MHz	20	402.1052631578...	10 Hz	-10	-10	1
4	☒	Start & Stop	10.01 MHz	2.499 GHz	17	155.561875 MHz	10 Hz	-10	-10	1
5	☒	Start & Stop	2.5 GHz	5 GHz	17	156.25 MHz	10 Hz	-10	-10	1
6	☒	Start & Stop	5.001 GHz	20 GHz	51	299.98 MHz	10 Hz	-10	-10	1
7	☒	Start & Stop	20.001 GHz	38 GHz	61	299.9833333333...	10 Hz	-10	-10	1
8	☒	Start & Stop	38.001 GHz	50 GHz	41	299.975 MHz	10 Hz	-10	-10	1
9	☒	Start & Stop	50.001 GHz	65 GHz	51	299.98 MHz	10 Hz	-10	-10	1
10	☒	Start & Stop	65.001 GHz	67 GHz	11	199.9 MHz	10 Hz	-10	-10	1
11	☒	Start & Stop	67.001 GHz	70 GHz	15	214.2142857142...	10 Hz	-10	-10	1

Figure 3-55. MS4647B Frequency-Based Segmented Sweep Settings

Optical Nose Floor S21 Measurement – 1310 nm Configuration

1. On VectorStar VNA, select Calibration.
2. Select Calibrate.
3. Select Manual Cal.
4. Select Transmission Freq. Response.
5. Select Modify Cal Setup.
6. Select Edit Cal Params (see [Figure 3-56](#)).

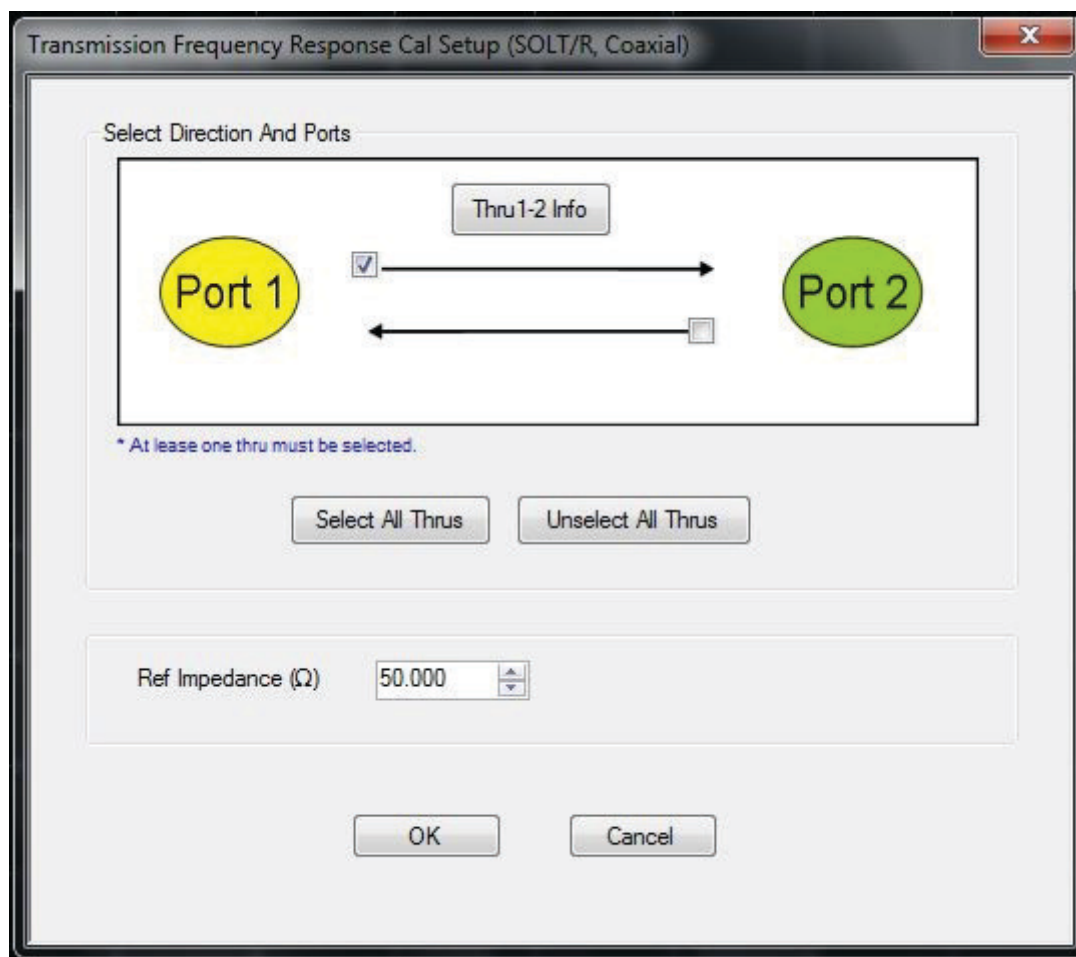


Figure 3-56. TRANSMISSION FREQUENCY RESPONSE CAL SETUP (SOLT/R, Coaxial) Dialog

7. Click on Thru1-2 Info and the THRU INFO dialog appears (see [Figure 3-57](#)) and verify that Length (mm), Line loss (dB/mm), and @Frequency (GHz) are set to 0.000.

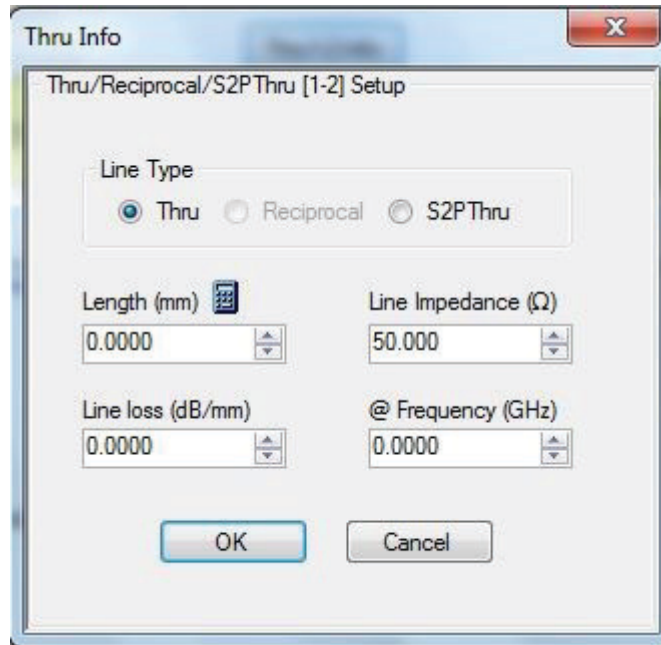


Figure 3-57. THRU INFO Dialog

8. Click OK and OK again to close EDIT CALIBRATION PARAMETERS dialog.
9. Select Back.
10. Perform a Transmission Frequency Response-only calibration. Select Done and observe that the **Green Calibration lamp** in VNA is **ON**.
 - a. Select Thru/Recip.
 - b. Select Thru and wait for green checkmark to appear.
 - c. Select Back.
 - d. Select Done.
 - e. Verify **Green Calibration lamp** is **ON**.

11. Set E/O Converter Ignition key to **OFF** (see figure [Figure 3-58](#)).

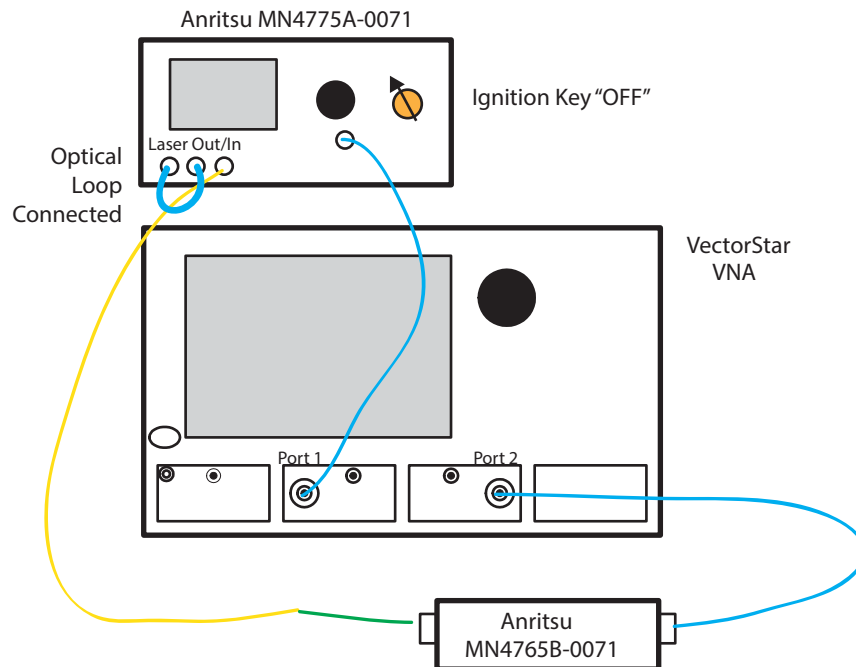


Figure 3-58. Turning Off Laser

12. Select Scale

- a. Click on Reference Value and set it to -50 dB. The screen should look like [Figure 3-59](#).

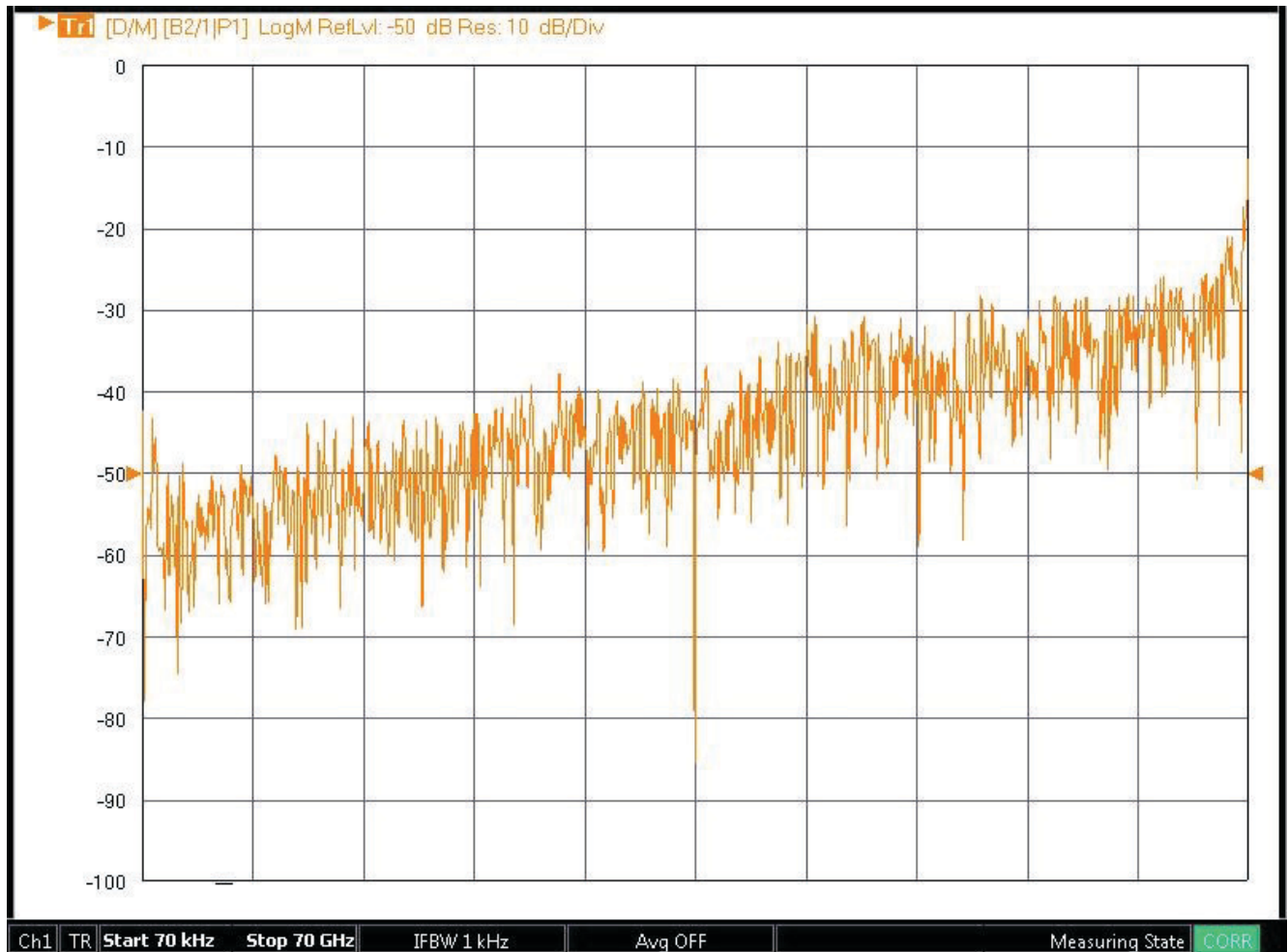


Figure 3-59. Typical Noise Floor Display—Reference Only

13. Select Sweep and then Hold Functions. Select Single Sweep & Hold.
14. Select File and then Save Data, file name NF#1, file type .csv.
15. Repeat [Step 13](#) and [Step 14](#) fifteen (15) more times. When saving the data, increment the number at the end of the file name by one (e.g. NF#2, NF#3, and so on.).
16. Copy the sixteen (16) saved data files off the MS464xB onto a USB flash drive for transferring to a Personal Computer.
17. On a separate Windows Personal Computer, import the saved data from the NF#n files into Microsoft Excel so the RMS values can be calculated.

18. There are many ways one can set up Microsoft Excel for calculating the RMS values. Here is an example:

- a. Assume the data are in an Excel worksheet as follows:
 - i. Row 1 is the header: Freq, Data1 through Data16, RMS Linear Mag, RMS Log Mag.
 - ii. Column A: Freq (Imported from the NF#n files).
 - iii. Column B through Column Q: Data1 through Data16 (Imported from the NF#n files).
- b. Set up cell R to calculate the RMS value in Linear Mag by entering the following formula into the cell:
= STDEV.P(B2:Q2)
- c. Copy the formula to the next cell on Column R until it reaches the last frequency point.
- d. For magnitude measurements only:
 - i. Set up cell S to calculate the RMS value in Log Mag by entering the following formula into the cell:
= 20 x log(R2 + 1, 10)
 - ii. Copy the formula to the next cell on Column S until it reaches the last frequency point.
- e. Rename Sheet 1 to S16 Magnitude by right-clicking on the Sheet 1 tab, selecting **Rename** and typing in the new name.
- f. Record the highest calculated RMS value of each frequency band listed in:
 - [Table A-21, “Optical Noise Floor S21 \(Option 51\) – 1310 nm Band” on page A-15](#)
 - [Table A-22, “Optical Noise Floor S21 \(Option 61 or 62\) – 1310 nm Band” on page A-15](#)

3-9 ME7848A-0272 System Verification – 1310/1550 nm Configuration

This system incorporates both 1550 nm (C-band tunable) and 1310 nm (fixed) lasers connected by an optical switch. Thus the verification is performed by running both [Section 3-7](#) and [Section 3-8](#) with the laser selected appropriately. The only difference is that for the 1550 nm setting ([Section 3-7](#)) the optical power should be set to +4 dBm and the optical power reading should be $+4 \pm 2$ dBm.

Chapter 4 — Theory of Operation

4-1 Introduction

This chapter provides a brief functional description of the ME7848A/E Series ONA system. It also briefly describes the operation of each major instrument or assembly.

4-2 System Description

The ME7848A/E opto-electronic network analyzer (ONA) system comprises a VNA, a calibration O/E module, and a laser/modulator converter assembly. Together, they allow calibrated RF response measurements of E/O, O/E, and certain O/O devices.

The VectorStar ME7848A/E opto-electronic network analyzer (ONA) is a VNA-based system for characterizing opto-electronic components used in photonic high-speed data transmission networks. The VectorStar ME7848A/E 200 series ONA consists of an MN4775A E/O converter, an MN4765B O/E calibration module/detector, and the appropriate frequency range VectorStar VNA. The ME7848A/E 100 series ONA includes the VectorStar VNA and MN4765B O/E calibration module without the converter.

For measurements of E/O DUTs (when not using the ME7848A/E 200 system), the VectorStar VNA is combined with the MN4765B O/E calibration module. When the DUT is an O/E device, then the user's E/O modulator is characterized with the MN4765B calibration module and the measurement reference is transferred to the E/O modulator. The lack of a dedicated, stable E/O modulator results in a system where guaranteed performance specifications cannot be provided. With availability of a full performance E/O converter that includes a bias-stable laser and modulator, the new ME7848A/E 200 series ONA can quickly and easily switch between E/O, O/O, and O/E measurements with specified accuracy.

4-3 System Components

The ME7848A/E-100 Series ONA System consists of the following major components:

- VectorStar MS464xB Series VNA (e.g. MS4647B) or ME7838AX/EX broadband VNA system
- MN4765B O/E calibration module

The ME7848A/E-200 Series ONA System consists of the following major components:

- VectorStar MS464xB Series VNA (e.g. MS4647B) or ME7838AX/EX broadband VNA system
- MN4775A E/O converter
- MN4765B O/E calibration module

[Figure 4-1 on page 4-2](#) shows the ME7848A/E Series ONA system configuration and illustrates the interconnections among the VNA, E/O converter, and O/E calibration module for the cases of 40 and 70 GHz systems. For 110 GHz systems, the VNA is replaced by a broadband system and the EO and OE components are connected, in an electrical sense, to remote mmWave modules.

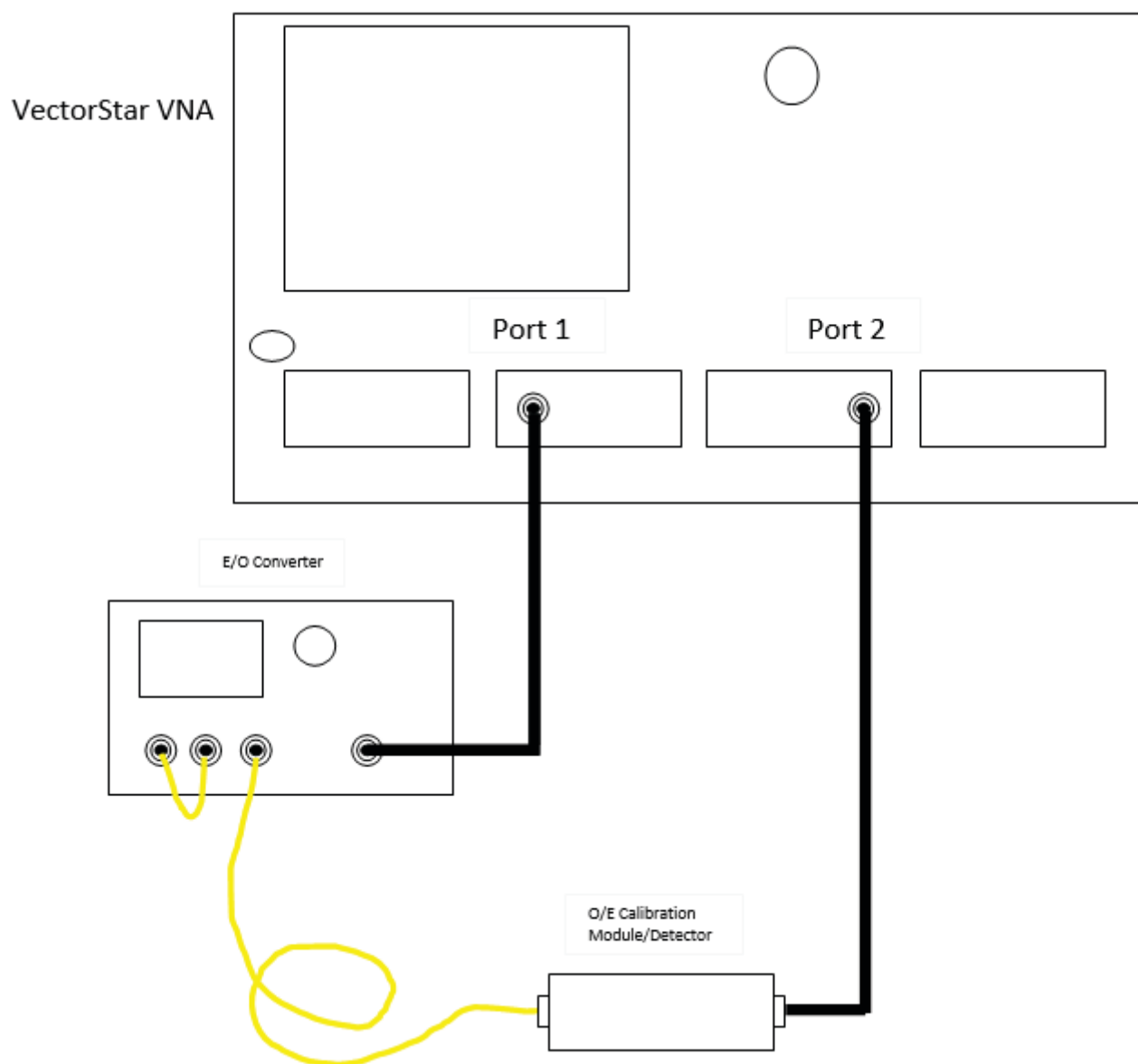


Figure 4-1. ME7848A/E Series ONA System Interconnections

4-4 Functional Description of System Components

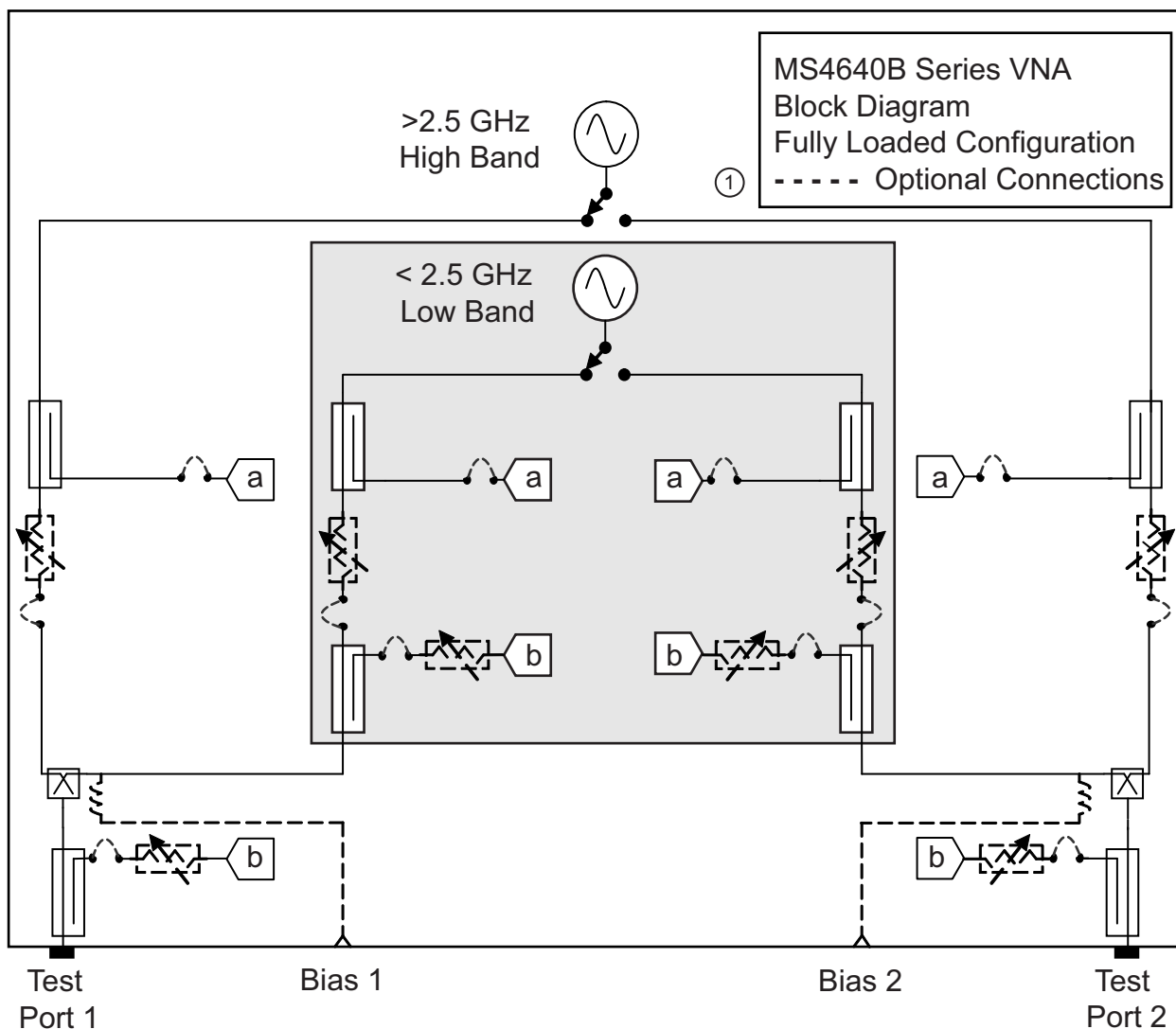
This section contains brief descriptions of each system components.

VectorStar MS464xB Vector Network Analyzer

The VectorStar MS464xB VNA performs the following tasks:

- Controlling the operation of the entire ME7848A/E Series ONA system
- Providing stimulus signal
- Handling complex vector signal measurements

Figure 4-2 shows the components in the MS4647B that are essential for the operation of the ME7848A/E Series ONA System.



1. Items with broken (dashed) lines are optional connections.

Figure 4-2. VectorStar MS4640B Series VNA Simplified Block Diagram

The ME7838AX/EX broadband VNAs (used in the -0x1x systems) have the same basic functionality, but cover the frequency range to 110 GHz. External mmWave modules are part of this configuration, and the EO and OE components are connected to the RF test ports on these modules.

MN4775A E/O Converter

Each E/O converter is fully integrated and contains the laser source, lithium niobate (LiNbO₃) Mach-Zehnder intensity modulator (MZM), and automatic bias controller; the only required external input is the signal source to the Modulator RF In port.

The MN4775A-0040, MN4775A-0070/0110, and MN4775A-0071/0111 include an 850 nm fixed-wavelength laser, a C-band tunable laser, and a 1310 nm fixed-wavelength laser, respectively. The MN4775A-0072 includes both a C-band tunable laser and a 1310 nm fixed wavelength laser connected to the Laser Out port via an optical switch. The C-band laser source is tunable on the ITU 50 GHz grid and includes a dither feature for wavelength stabilization. An external laser source, operating from 1250 nm to 1610 nm, can also be used to provide the optical input for the MN4775A-0070/0110 and the MN4775A-0071/0111. The MN4775A-0040 does not have an external loop between the laser and modulator.

Either the internal laser or an external laser source may be coupled to the Laser In port (MN4775A-007x/011x), which uses PM fiber with light linearly polarized along the slow axis, as shown on the front panel. The maximum input power to the Laser In port is 20 dBm (100 mW). Optical power is monitored in three places (Mon-1,-2,-3) for the purpose of enabling bias and power control. These power values are also available at the I/O port. Mon-1 is at the Laser Input, Mon-2 is at the MZM Output, and Mon-3 is at the final Optical Output.

Figure 4-3 shows the block diagram of the E/O Converter.

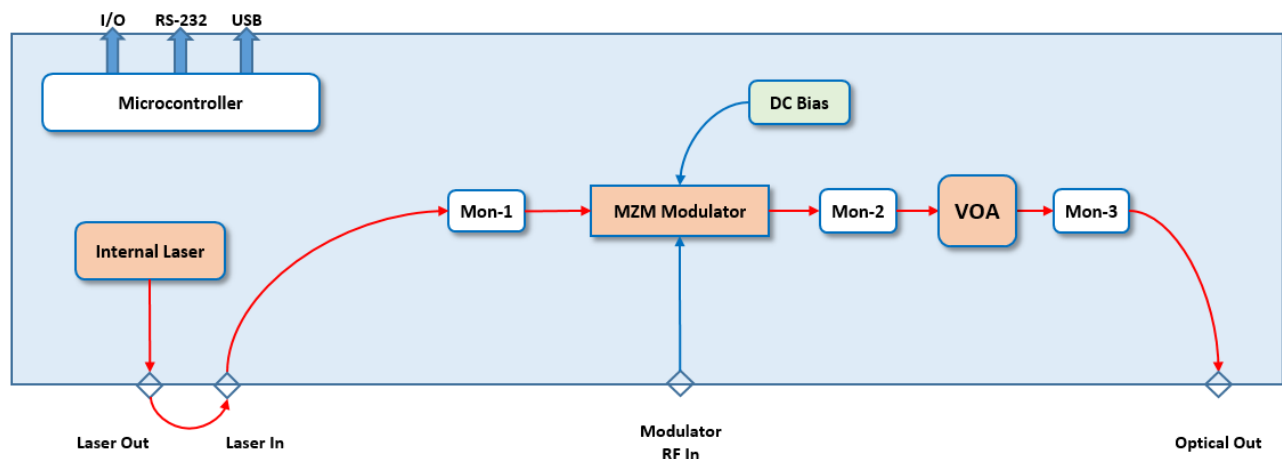


Figure 4-3. MN4775A E/O Converter Block Diagram

MN4765B O/E Calibration Module

The MN4765B converts the modulated optical signal back to an electrical signal that is measured by the VNA.

The MN4765B is a characterized, unamplified photodiode module. It is used as an optical receiver with the Anritsu MS464xB and ME7838AX/EX Series VNAs to perform highly accurate and stable optoelectronic measurements of both modulators (E/O) and photoreceivers (O/E). Bandwidth and wavelength coverage depends on the option selected when the module is ordered. The MN4765B allows error-corrected Transfer Function, Group Delay, and Return Loss measurements of optoelectronic components.

4-5 ME7848A/E ONA System Operation

This section describes the system operation of the ME7848A/E ONA System.

Stimulus Signal Generation

The ME7838AX/EX VNA outputs a stimulus signal from its test port and feeds directly to the MN4775A via coaxial cable. These stimulus signal modulates the MN4775A E/O converter's internal laser. The modulated optical signal is then sent to the MN4765B. The MN4765B O/E Calibration Module removes frequency from the optical signal so test signal processing can occur.

Test Signal Processing

The test signal from the MN4765B RF connector is then fed back to the test port of the MS464xB or ME7838AX/EX 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.
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Note	In the VectorStar ME7838 Series 2-Port Broadband/Banded mmWave VNA System Maintenance Manual –10410-00306 , refer to Chapter 4 – Theory Of Operation .
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Chapter 5 — Troubleshooting

5-1 Introduction

This chapter provides information about troubleshooting tests that can be used to check the ME7848A/E Series VNA System for proper operation. These tests are intended to be used as a troubleshooting tool for identifying the faulty system components.

5-2 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, 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 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.

All statements regarding safety of operation and technical data in this manual will only apply when the unit is operated correctly. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Only with written consent from Anritsu may changes to single components be carried out or components not supplied by Anritsu be used.

Warning



Risk of Electrical Shock

Before applying power to the instrument, make sure that the protective conductor of the 3-conductor mains power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock with damage to your health or even death. Only use mains cable with sufficient current and voltage ratings for this instrument. The local supply voltage must be in the range specified on the rear panel, and the correct fuse must be installed in the fuse holder. If not, replace the main fuse. Do not position equipment in a way that makes it difficult for the user to operate the disconnecting device. Do not remove covers. Refer servicing to qualified personnel.

Warning



Risk of Explosion

The instrument must not be operated in explosion endangered environments.

Laser Radiation

The -007x/-011x options of the MN4775A are class 1M devices, while the MN4775A-0040 is a class 3B device (due to the shorter wavelength).

- **MN4775A-007x/-011x: Class 1M Laser**

**Warning**

- **MN4775A-0040: Class 3B Laser**



Avoid Exposure – Radiation emitted from apertures. Do not look into the laser aperture while the laser is on. Injury to the eye may result. Laser should not be turned on unless there is an optical fiber connected to the laser output port.

Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Caution**ESD Sensitive Component**

The components inside this instrument are ESD sensitive. Take all appropriate precautions to discharge personnel and equipment before making any connections to the unit. A front panel grounding jack is provided for connection to a wrist strap

Caution**Components Not Water Resistant**

This instrument should be kept clear of environments where liquid spills or condensing moisture are likely. It is not water resistant. To avoid damage to the instrument, do not expose it to spray, liquids, or solvents.

Follow Intended Usage Guidelines**Caution**

This product is not suitable for household room illumination.

Inputs and outputs must only be connected with shielded connection cables.

Do not obstruct the air ventilation slots in housing.

Mobile telephones, cellular phones, or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and meets all requirements of the Canadian Interference Causing Equipment Standard ICES-003 for digital apparatus. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

5-3 Troubleshooting Strategy

The ME7848A/E Series ONA System consists of the following major components:

- MS464X Series VectorStar VNA or ME7838AX/EX broadband VNA system
- MN4775A-0xxx E/O Converter
- MN4765B-0xxx O/E Calibration Module

A good understanding of the respective ME7848A/E Series ONA 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 “ME7848A/E ONA System Operation” on page 4-5](#).

It is also imperative to isolate whether the system fault is in the VectorStar VNA, the MN4775A-0xxx E/O Converter, or MN4765B-0xxx O/E Calibration Module.

Suggested Troubleshooting Steps

The suggested troubleshooting steps for ME7848A/E ONA System are as follows:

- Ensure that the VNA, E/O Converter, and O/E Calibration Module all can be powered up.
- Ensure that no setup and installation errors exist (e.g. cabling error and cable connection). Refer to the **VectorStar ME7848A/E ONA Quick Start Guide – 10410-00777**.
- Isolate the fault to a system components (e.g. VNA, E/O Converter, or O/E Calibration Module) using a process of elimination. Refer to the [“General Troubleshooting of the System” on page 5-4](#).

Note	The critical information to know is the frequency at which the fault occurs.
-------------	--

5-4 General Troubleshooting of the System

This section provides general troubleshooting procedures of the ME7848A/E ONA System. It assumes that setup and installation errors have been eliminated.

Procedure

1. Verify the MN4775A-0xxx laser is off and the key is set to Lock.
2. Remove both ends of the optical cable between the MN4775A-0xxx and MN4765B-0xxx modules and verify they are seated correctly. These cables have a notch on them which aligns to the connector. Reinstall the cables.
3. Remove the blue optical patch cable on the MN4775A-007x/011x (this optical cable is not present on the MN4775A-0040 module) and verify it is seated correctly. This cable has notches on it which align to the connector. Reinstall the cable.
4. Use the performance verification setup “Frequency Response Repeatability S21 Setup and Frequency Response Repeatability S21 Setup measurement” in Chapter 3 to set the unit up and verify it is sweeping correctly. Turn the laser on and off to verify that the level changes.
5. If you have low power, clean all of optical cables and optical connectors. Also, verify the RF coaxial cables are clean and correctly torqued.

Appendix A — ME7848A/E ONA Test Records

A-1 Introduction

This appendix provides test records that can be used to record the performance of the ME7848A/E Millimeter-Wave configuration VNA system.

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

- [“ME7848A/E-0210 1550 nm Test Records”](#)
- [“ME7848A/E-0211 1310 nm Test Records”](#)
- [“ME7848A-0240 850 nm Test Records”](#)
- [“ME7848A-0270 1550 nm Test Records”](#)
- [“ME7848A-0271 1310 nm Test Records”](#)
- [“ME7848A-0272 1310/1550 nm Test Records”](#)

A-2 ME7848A/E-0210 1550 nm Test Records**Instrument Information**

ME7848A/E	Operator:	Date:
VectorStar VNA Model:	S/N:	VectorStar VNA Options:

RF Test Band and Wave Length**Table A-1.** Optical Power Measurement – 1550 nm Band

ME7848A/E-0210 Optical Power Measurement					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A/E-0210	MN4775A-0110		5	1	0.31

Table A-2. Frequency Response Repeatability – 1550 nm Band

ME7848A/E-0210 Frequency Response Repeatability S21-Mag			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0110		0.03
Band (0.300-00002)	MN4775A-0110		0.02
Band (00002-00010)	MN4775A-0110		0.01
Band (00010-02500)	MN4775A-0110		0.01
Band (02500-10000)	MN4775A-0110		0.01
Band (10000-24000)	MN4775A-0110		0.01
Band (24000-40000)	MN4775A-0110		0.02
Band (40000-54000)	MN4775A-0110		0.02
Band (54000-60000)	MN4775A-0110		0.02
Band (60000-65000)	MN4775A-0110		0.02
Band (65000-70000)	MN4775A-0110		0.02
Band (70000-80000)	MN4775A-0110		0.02
Band (80000-90000)	MN4775A-0110		0.02
Band (90000-100000)	MN4775A-0110		0.02
Band (100000-110000)	MN4775A-0110		0.02

Table A-3. Optical Noise Floor S21 (Option 000) – 1550 nm Band

ME7848A/E-0210 Optical Noise Floor S21 (Option 000)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0110		-45	NA	0.55
Band (0.300-00002)	MN4775A-0110		-57	NA	0.51
Band (00002-00010)	MN4775A-0110		-71	NA	0.45
Band (00010-02500)	MN4775A-0110		-69	NA	0.55
Band (02500-10000)	MN4775A-0110		-72	NA	0.50
Band (10000-24000)	MN4775A-0110		-67	NA	0.53
Band (24000-40000)	MN4775A-0110		-63	NA	0.65
Band (40000-54000)	MN4775A-0110		-66	NA	0.76
Band (54000-60000)	MN4775A-0110		-63	NA	0.71
Band (60000-65000)	MN4775A-0110		-62	NA	0.73
Band (65000-70000)	MN4775A-0110		-61	NA	0.74
Band (70000-80000)	MN4775A-0110		-58	NA	0.82
Band (80000-90000)	MN4775A-0110		-57	NA	0.86
Band (90000-100000)	MN4775A-0110		-51	NA	0.90
Band (100000-110000)	MN4775A-0110		-53	NA	0.95

Table A-4. Optical Noise Floor S21 (Option 51) – 1550 nm Band

ME7848A/E-0210 Optical Noise Floor S21 (Option 51)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0110		-45	NA	0.55
Band (0.300-00002)	MN4775A-0110		-57	NA	0.51
Band (00002-00010)	MN4775A-0110		-71	NA	0.45
Band (00010-02500)	MN4775A-0110		-69	NA	0.55
Band (02500-10000)	MN4775A-0110		-71	NA	0.50
Band (10000-24000)	MN4775A-0110		-65	NA	0.53
Band (24000-40000)	MN4775A-0110		-62	NA	0.65
Band (40000-54000)	MN4775A-0110		-65	NA	0.76
Band (54000-60000)	MN4775A-0110		-63	NA	0.71
Band (60000-65000)	MN4775A-0110		-62	NA	0.73
Band (65000-70000)	MN4775A-0110		-61	NA	0.74
Band (70000-80000)	MN4775A-0110		-58	NA	0.82
Band (80000-90000)	MN4775A-0110		-57	NA	0.86
Band (90000-100000)	MN4775A-0110		-51	NA	0.90
Band (100000-110000)	MN4775A-0110		-53	NA	0.95

Table A-5. Optical Noise Floor S21 (Option 61 or 62) – 1550 nm Band

ME7848A/E-0210 Optical Noise Floor S21 (Option 61 or 62)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0110		-45	NA	0.55
Band (0.300-00002)	MN4775A-0110		-57	NA	0.51
Band (00002-00010)	MN4775A-0110		-71	NA	0.45
Band (00010-02500)	MN4775A-0110		-69	NA	0.55
Band (02500-10000)	MN4775A-0110		-71	NA	0.50
Band (10000-24000)	MN4775A-0110		-65	NA	0.53
Band (24000-40000)	MN4775A-0110		-61	NA	0.65
Band (40000-54000)	MN4775A-0110		-63	NA	0.76
Band (54000-60000)	MN4775A-0110		-63	NA	0.71
Band (60000-65000)	MN4775A-0110		-62	NA	0.73
Band (65000-70000)	MN4775A-0110		-61	NA	0.74
Band (70000-80000)	MN4775A-0110		-58	NA	0.82
Band (80000-90000)	MN4775A-0110		-57	NA	0.86
Band (90000-100000)	MN4775A-0110		-51	NA	0.90
Band (100000-110000)	MN4775A-0110		-53	NA	0.95

A-3 ME7848A/E-0211 1310 nm Test Records

Instrument Information

ME7848A/E	Operator:	Date:
VectorStar VNA Model:	S/N	VectorStar VNA Options:

RF Test Band and Wave Length

Table A-6. Optical Power Measurement – 1310 nm Band

ME7848A/E-0211 Optical Power Measurement					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A/E-0211	MN4775A-0111		5	1	0.31

Table A-7. Frequency Response Repeatability – 1310 nm Band

ME7848A/E-0211 Frequency Response Repeatability S21-Mag			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0111		0.03
Band (0.300-00002)	MN4775A-0111		0.02
Band (00002-00010)	MN4775A-0111		0.01
Band (00010-02500)	MN4775A-0111		0.01
Band (02500-10000)	MN4775A-0111		0.01
Band (10000-24000)	MN4775A-0111		0.01
Band (24000-40000)	MN4775A-0111		0.02
Band (40000-54000)	MN4775A-0111		0.02
Band (54000-60000)	MN4775A-0111		0.02
Band (60000-65000)	MN4775A-0111		0.02
Band (65000-70000)	MN4775A-0111		0.02
Band (70000-80000)	MN4775A-0111		0.02
Band (80000-90000)	MN4775A-0111		0.02
Band (90000-100000)	MN4775A-0111		0.02
Band (100000-110000)	MN4775A-0111		0.02

Table A-8. Optical Noise Floor S21 (Option 000) – 1310 nm Band

ME7848A/E-0211 Optical Noise Floor S21 (Option 000)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0111		-39	NA	0.55
Band (0.300-00002)	MN4775A-0111		-51	NA	0.51
Band (00002-00010)	MN4775A-0111		-72	NA	0.45
Band (00010-02500)	MN4775A-0111		-63	NA	0.55
Band (02500-10000)	MN4775A-0111		-66	NA	0.50
Band (10000-24000)	MN4775A-0111		-61	NA	0.53
Band (24000-40000)	MN4775A-0111		-58	NA	0.65
Band (40000-54000)	MN4775A-0111		-60	NA	0.76
Band (54000-60000)	MN4775A-0111		-57	NA	0.71
Band (60000-65000)	MN4775A-0111		-57	NA	0.73
Band (65000-70000)	MN4775A-0111		-56	NA	0.74
Band (70000-80000)	MN4775A-0111		-53	NA	0.82
Band (80000-90000)	MN4775A-0111		-51	NA	0.86
Band (90000-100000)	MN4775A-0111		-45	NA	0.90
Band (100000-110000)	MN4775A-0111		-47	NA	0.95

Table A-9. Optical Noise Floor S21 (Option 51) – 1310 nm Band

ME7848A/E-0211 Optical Noise Floor S21 (Option 51)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0111		-39	NA	0.55
Band (0.300-00002)	MN4775A-0111		-51	NA	0.51
Band (00002-00010)	MN4775A-0111		-72	NA	0.45
Band (00010-02500)	MN4775A-0111		-63	NA	0.55
Band (02500-10000)	MN4775A-0111		-65	NA	0.50
Band (10000-24000)	MN4775A-0111		-59	NA	0.53
Band (24000-40000)	MN4775A-0111		-57	NA	0.65
Band (40000-54000)	MN4775A-0111		-59	NA	0.76
Band (54000-60000)	MN4775A-0111		-57	NA	0.71
Band (60000-65000)	MN4775A-0111		-57	NA	0.73
Band (65000-70000)	MN4775A-0111		-56	NA	0.74
Band (70000-80000)	MN4775A-0111		-53	NA	0.82
Band (80000-90000)	MN4775A-0111		-51	NA	0.86
Band (90000-100000)	MN4775A-0111		-45	NA	0.90
Band (100000-110000)	MN4775A-0111		-47	NA	0.95

Table A-10. Optical Noise Floor S21 (Option 61 or 62) – 1310 nm Band

ME7848A/E-0211 Optical Noise Floor S21 (Option 61 or 62)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0111		-39	NA	0.55
Band (0.300-00002)	MN4775A-0111		-51	NA	0.51
Band (00002-00010)	MN4775A-0111		-72	NA	0.45
Band (00010-02500)	MN4775A-0111		-63	NA	0.55
Band (02500-10000)	MN4775A-0111		-64	NA	0.50
Band (10000-24000)	MN4775A-0111		-59	NA	0.53
Band (24000-40000)	MN4775A-0111		-56	NA	0.65
Band (40000-54000)	MN4775A-0111		-57	NA	0.76
Band (54000-60000)	MN4775A-0111		-57	NA	0.71
Band (60000-65000)	MN4775A-0111		-57	NA	0.73
Band (65000-70000)	MN4775A-0111		-56	NA	0.74
Band (70000-80000)	MN4775A-0111		-53	NA	0.82
Band (80000-90000)	MN4775A-0111		-51	NA	0.86
Band (90000-100000)	MN4775A-0111		-45	NA	0.90
Band (100000-110000)	MN4775A-0111		-47	NA	0.95

A-4 ME7848A-0240 850 nm Test Records

Instrument Information

ME7848A	Operator:	Date:
VectorStar VNA Model:	S/N	VectorStar VNA Options:

RF Test Band and Wave Length

Table A-11. Optical Power Measurement – 850 nm Band

ME7848A-0240 Optical Power Measurement S21-Mag					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A-0240	MN4775A-0040		-5	-1	0.31

Table A-12. Frequency Response Repeatability – 850 nm Band

ME7848A-0240 Frequency Response Repeatability S21-Mag			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0040		0.014
Band (0.300-00002)	MN4775A-0040		0.014
Band (00002-00010)	MN4775A-0040		0.01
Band (00010-02500)	MN4775A-0040		0.01
Band (02500-05000)	MN4775A-0040		0.01
Band (05000-20000)	MN4775A-0040		0.012
Band (20000-40000)	MN4775A-0040		0.02

Table A-13. Optical Noise Floor S21 (Option 51) – 850 nm Band

ME7848A-0240 Optical Noise Floor S21 (Option 51)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0040		-32	N/A	0.42
Band (0.300-00002)	MN4775A-0040		-37	N/A	0.49
Band (00002-00010)	MN4775A-0040		-42	N/A	0.42
Band (00010-02500)	MN4775A-0040		-50	N/A	0.58
Band (02500-05000)	MN4775A-0040		-52	N/A	0.46
Band (05000-20000)	MN4775A-0040		-47	N/A	0.46
Band (20000-40000)	MN4775A-0040		-32	N/A	0.58

Table A-14. Optical Noise Floor S21 (Option 61 or 62) – 850 nm Band

ME7848A-0240 Optical Noise Floor S21 (Option 61 or 62)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0040		-32	N/A	0.42
Band (0.300-00002)	MN4775A-0040		-37	N/A	0.49
Band (00002-00010)	MN4775A-0040		-42	N/A	0.42
Band (00010-02500)	MN4775A-0040		-50	N/A	0.58
Band (02500-05000)	MN4775A-0040		-52	N/A	0.46
Band (05000-20000)	MN4775A-0040		-47	N/A	0.46
Band (20000-40000)	MN4775A-0040		-32	N/A	0.58

A-5 ME7848A-0270 1550 nm Test Records**Instrument Information**

ME7848A	Operator:	Date:
VectorStar VNA Model:	S/N:	VectorStar VNA Options:

RF Test Band and Wave Length**Table A-15.** Optical Power Measurement – 1550 nm Band

ME7848A-0270 Optical Power Measurement					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A-0270	MN4775A-0070		7	3	0.31

Table A-16. Frequency Response Repeatability – 1550 nm Band

ME7848A-0270 Frequency Response Repeatability S21-Mag			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0070		0.014
Band (0.300-00002)	MN4775A-0070		0.014
Band (00002-00010)	MN4775A-0070		0.01
Band (00010-02500)	MN4775A-0070		0.01
Band (02500-05000)	MN4775A-0070		0.01
Band (05000-20000)	MN4775A-0070		0.01
Band (20000-38000)	MN4775A-0070		0.01
Band (38000-50000)	MN4775A-0070		0.01
Band (50000-65000)	MN4775A-0070		0.01
Band (65000-67000)	MN4775A-0070		0.01
Band (67000-70000)	MN4775A-0070		0.02

Table A-17. Optical Noise Floor S21 (Option 51) – 1550 nm Band

ME7848A-0270 Optical Noise Floor S21 (Option 51)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0070		-56	N/A	0.42
Band (0.300-00002)	MN4775A-0070		-61	N/A	0.49
Band (00002-00010)	MN4775A-0070		-66	N/A	0.42
Band (00010-02500)	MN4775A-0070		-76	N/A	0.58
Band (02500-05000)	MN4775A-0070		-76	N/A	0.46
Band (05000-20000)	MN4775A-0070		-72	N/A	0.46
Band (20000-38000)	MN4775A-0070		-69	N/A	0.58
Band (38000-50000)	MN4775A-0070		-61	N/A	0.81
Band (50000-65000)	MN4775A-0070		-56	N/A	0.94
Band (65000-67000)	MN4775A-0070		-53	N/A	0.90
Band (67000-70000)	MN4775A-0070		-48	N/A	1.32

Table A-18. Optical Noise Floor S21 (Option 61 or 62) – 1550 nm Band

ME7848A-0270 Optical Noise Floor S21 (Option 61 or 62)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0070		-56	N/A	0.42
Band (0.300-00002)	MN4775A-0070		-61	N/A	0.49
Band (00002-00010)	MN4775A-0070		-66	N/A	0.42
Band (00010-02500)	MN4775A-0070		-76	N/A	0.58
Band (02500-05000)	MN4775A-0070		-76	N/A	0.46
Band (05000-20000)	MN4775A-0070		-72	N/A	0.46
Band (20000-38000)	MN4775A-0070		-69	N/A	0.58
Band (38000-50000)	MN4775A-0070		-60	N/A	0.81
Band (50000-65000)	MN4775A-0070		-53	N/A	0.94
Band (65000-67000)	MN4775A-0070		-50	N/A	0.90
Band (67000-70000)	MN4775A-0070		-44	N/A	1.32

A-6 ME7848A-0271 1310 nm Test Records**Instrument Information**

ME7848A	Operator:	Date:
VectorStar VNA Model:	S/N	VectorStar VNA Options:

RF Test Band and Wave Length**Table A-19.** Optical Power Measurement – 1310 nm Band

ME7848A-0271 Optical Power Measurement					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A-0271	MN4775A-0071		4	0	0.31

Table A-20. Frequency Response Repeatability – 1310 nm Band

ME7848A-0271 Frequency Response Repeatability S21-Mag			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0071		0.014
Band (0.300-00002)	MN4775A-0071		0.014
Band (00002-00010)	MN4775A-0071		0.01
Band (00010-02500)	MN4775A-0071		0.01
Band (02500-05000)	MN4775A-0071		0.01
Band (05000-20000)	MN4775A-0071		0.01
Band (20000-38000)	MN4775A-0071		0.01
Band (38000-50000)	MN4775A-0071		0.01
Band (50000-65000)	MN4775A-0071		0.01
Band (65000-67000)	MN4775A-0071		0.01
Band (67000-70000)	MN4775A-0071		0.02

Table A-21. Optical Noise Floor S21 (Option 51) – 1310 nm Band

ME7848A-0271 Optical Noise Floor S21 (Option 51)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0071		-49	N/A	0.42
Band (0.300-00002)	MN4775A-0071		-54	N/A	0.49
Band (00002-00010)	MN4775A-0071		-59	N/A	0.42
Band (00010-02500)	MN4775A-0071		-69	N/A	0.58
Band (02500-05000)	MN4775A-0071		-69	N/A	0.46
Band (05000-20000)	MN4775A-0071		-65	N/A	0.46
Band (20000-38000)	MN4775A-0071		-62	N/A	0.58
Band (38000-50000)	MN4775A-0071		-54	N/A	0.81
Band (50000-65000)	MN4775A-0071		-49	N/A	0.94
Band (65000-67000)	MN4775A-0071		-46	N/A	0.90
Band (67000-70000)	MN4775A-0071		-41	N/A	1.32

Table A-22. Optical Noise Floor S21 (Option 61 or 62) – 1310 nm Band

ME7848A-0271 Optical Noise Floor S21 (Option 61 or 62)					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0071		-49	N/A	0.42
Band (0.300-00002)	MN4775A-0071		-54	N/A	0.49
Band (00002-00010)	MN4775A-0071		-59	N/A	0.42
Band (00010-02500)	MN4775A-0071		-69	N/A	0.58
Band (02500-05000)	MN4775A-0071		-69	N/A	0.46
Band (05000-20000)	MN4775A-0071		-65	N/A	0.46
Band (20000-38000)	MN4775A-0071		-62	N/A	0.58
Band (38000-50000)	MN4775A-0071		-53	N/A	0.81
Band (50000-65000)	MN4775A-0071		-47	N/A	0.94
Band (65000-67000)	MN4775A-0071		-43	N/A	0.90
Band (67000-70000)	MN4775A-0071		-38	N/A	1.32

A-7 ME7848A-0272 1310/1550 nm Test Records**Instrument Information**

ME7848A-0272	Operator:	Date:
VectorStar VNA Model:	S/N:	VectorStar VNA Options:

RF Test Band and Wave Length**Table A-23.** Optical Power Measurement – 1310 nm Band

ME7848A-0272 Optical Power Measurement – 1330 nm					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A-0272	MN4775A-0072		4	0	0.31

Table A-24. Optical Power Measurement – 1550 nm Band

ME7848A-0272 Optical Power Measurement – 1550 nm					
Model	E/O Module	Measured Value (dBm)	Upper Specification (dBm)	Lower Specification (dBm)	Measurement Uncertainty (dB)
ME7848A-0272	MN4775A-0072		6	2	0.31

Table A-25. Frequency Response Repeatability – 1310 nm Band

ME7848A-0272 Frequency Response Repeatability S21-Mag – 1330 nm			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		0.014
Band (0.300-00002)	MN4775A-0072		0.014
Band (00002-00010)	MN4775A-0072		0.01
Band (00010-02500)	MN4775A-0072		0.01
Band (02500-05000)	MN4775A-0072		0.01
Band (05000-20000)	MN4775A-0072		0.01
Band (20000-38000)	MN4775A-0072		0.01
Band (38000-50000)	MN4775A-0072		0.01
Band (50000-65000)	MN4775A-0072		0.01
Band (65000-67000)	MN4775A-0072		0.01
Band (67000-70000)	MN4775A-0072		0.02

Table A-26. Frequency Response Repeatability – 1550 nm Band

ME7848A-0270 Frequency Response Repeatability S21-Mag – 1550 nm			
RF Test Band (MHz)	E/O Module	Measured Value (dB rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		0.014
Band (0.300-00002)	MN4775A-0072		0.014
Band (00002-00010)	MN4775A-0072		0.01
Band (00010-02500)	MN4775A-0072		0.01
Band (02500-05000)	MN4775A-0072		0.01
Band (05000-20000)	MN4775A-0072		0.01
Band (20000-38000)	MN4775A-0072		0.01
Band (38000-50000)	MN4775A-0072		0.01
Band (50000-65000)	MN4775A-0072		0.01
Band (65000-67000)	MN4775A-0072		0.01
Band (67000-70000)	MN4775A-0072		0.02

Table A-27. Optical Noise Floor S21 (Option 51) – 1310 nm Band

ME7848A-0271 Optical Noise Floor S21 (Option 51) – 1310 nm					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		-49	N/A	0.42
Band (0.300-00002)	MN4775A-0072		-54	N/A	0.49
Band (00002-00010)	MN4775A-0072		-59	N/A	0.42
Band (00010-02500)	MN4775A-0072		-69	N/A	0.58
Band (02500-05000)	MN4775A-0072		-69	N/A	0.46
Band (05000-20000)	MN4775A-0072		-65	N/A	0.46
Band (20000-38000)	MN4775A-0072		-62	N/A	0.58
Band (38000-50000)	MN4775A-0072		-54	N/A	0.81
Band (50000-65000)	MN4775A-0072		-49	N/A	0.94
Band (65000-67000)	MN4775A-0072		-46	N/A	0.90
Band (67000-70000)	MN4775A-0072		-41	N/A	1.32

Table A-28. Optical Noise Floor S21 (Option 51) – 1550 nm Band

ME7848A-0270 Optical Noise Floor S21 (Option 51) – 1550 nm					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		-56	N/A	0.42
Band (0.300-00002)	MN4775A-0072		-61	N/A	0.49
Band (00002-00010)	MN4775A-0072		-66	N/A	0.42
Band (00010-02500)	MN4775A-0072		-76	N/A	0.58
Band (02500-05000)	MN4775A-0072		-76	N/A	0.46
Band (05000-20000)	MN4775A-0072		-72	N/A	0.46
Band (20000-38000)	MN4775A-0072		-69	N/A	0.58
Band (38000-50000)	MN4775A-0072		-61	N/A	0.81
Band (50000-65000)	MN4775A-0072		-56	N/A	0.94
Band (65000-67000)	MN4775A-0072		-53	N/A	0.90
Band (67000-70000)	MN4775A-0072		-48	N/A	1.32

Table A-29. Optical Noise Floor S21 (Option 61 or 62) – 1310 nm Band

ME7848A-0272 Optical Noise Floor S21 (Option 61 or 62) – 1310 nm					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		-49	N/A	0.42
Band (0.300-00002)	MN4775A-0072		-54	N/A	0.49
Band (00002-00010)	MN4775A-0072		-59	N/A	0.42
Band (00010-02500)	MN4775A-0072		-69	N/A	0.58
Band (02500-05000)	MN4775A-0072		-69	N/A	0.46
Band (05000-20000)	MN4775A-0072		-65	N/A	0.46
Band (20000-38000)	MN4775A-0072		-62	N/A	0.58
Band (38000-50000)	MN4775A-0072		-53	N/A	0.81
Band (50000-65000)	MN4775A-0072		-47	N/A	0.94
Band (65000-67000)	MN4775A-0072		-43	N/A	0.90
Band (67000-70000)	MN4775A-0072		-38	N/A	1.32

Table A-30. Optical Noise Floor S21 (Option 61 or 62) – 1550 nm Band

ME7848A-0272 Optical Noise Floor S21 (Option 61 or 62) – 1550 nm					
RF Test Band (MHz)	E/O Module	Measured Value (dBm rms)	Upper Specification (dBm rms)	Lower Specification (dBm rms)	Measurement Uncertainty (dB)
Band (0.070-0.300)	MN4775A-0072		-56	N/A	0.42
Band (0.300-00002)	MN4775A-0072		-61	N/A	0.49
Band (00002-00010)	MN4775A-0072		-66	N/A	0.42
Band (00010-02500)	MN4775A-0072		-76	N/A	0.58
Band (02500-05000)	MN4775A-0072		-76	N/A	0.46
Band (05000-20000)	MN4775A-0072		-72	N/A	0.46
Band (20000-38000)	MN4775A-0072		-69	N/A	0.58
Band (38000-50000)	MN4775A-0072		-60	N/A	0.81
Band (50000-65000)	MN4775A-0072		-53	N/A	0.94
Band (65000-67000)	MN4775A-0072		-50	N/A	0.90
Band (67000-70000)	MN4775A-0072		-44	N/A	1.32



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Anritsu Company
490 Jarvis Drive
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USA
<http://www.anritsu.com>