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Operation Manual

VectorStar MS4640A Series Microwave Vector Network Analyzers (VNAs)

MS4642A, 10 MHz to 20 GHz, K Connectors
MS4644A, 10 MHz to 40 GHz, K Connectors
MS4645A, 10 MHz to 50 GHz, V Connectors
MS4647A, 10 MHz to 70 GHz, V Connectors



Anritsu

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Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: VectorStar (Microwave Vector Network Analyzer)

Model Number: MS464XA

conforms to the requirement of:

EMC Directive: 2004/108/EC
Low Voltage Directive: 2006/95/EC

Electromagnetic Compatibility: EN61326:2006

Emissions:	EN55011: 2007 Group 1 Class A	
Immunity:	EN 61000-4-2:1995 +A1:1998 +A2:2001	4kV CD, 8kV AD
	EN 61000-4-3:2002 +A1:2008	3V/m
	EN 61000-4-4:2004	0 5kV SL, 1kV PL
	EN 61000-4-5:2006	0 5kV L-L, 1kV L-E
	EN 61000-4-6: 2007	3V
	EN 61000-4-11: 2004	100% @ 20msec

Electrical Safety Requirement:

Product Safety: EN 61010-1:2001

Eric McLean, Corporate Quality Director

Morgan Hill, CA

14 JAN 2009
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close, Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

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印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
LCD	×	×	×	×	○	○
其他（电缆、风扇、连接器等） (Appended goods)	×	○	×	×	○	○

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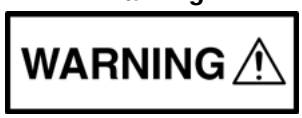
Symbols Used in Manuals

Danger



This indicates a very dangerous procedure that could result in serious injury or death, and possible loss related to equipment malfunction, if not performed properly.

Warning



This indicates a hazardous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

Caution



This indicates a hazardous procedure that could result in loss related to equipment malfunction if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manuals

The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.



This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.



This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

For Safety

Warning



Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.

Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

Warning

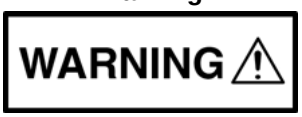


or



When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Warning



This equipment can not be repaired by the operator. Do not attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Warning



Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury if this equipment is lifted by one person.

Caution



Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

Chapter Descriptions

Chapter 1 — Overview
This chapter provides an overview of the VectorStar MS4640A Series Vector Network Analyzer (VNA) and a description of its major functions and available documentation. A summary of available precision component kits including AutoCal calibration kits, mechanical calibration kits, and verification kits is included.

Chapter 2 — Installation
This chapter provides information for the initial inspection and preparation for use of the MS4640A Series VNA and includes information on instrument installation, required operating environment, power requirements, initial inspection, and optional rack mounting procedures. After power up, the various power modes are described with general warm-up and calibration time intervals. The preventive maintenance section includes information on cleaning and fuse replacement along with preparation for storage or shipment. General set up procedures are provided for remote programming control over GPIB and Ethernet or USB only networks.

Chapter 3 — Front and Rear Panels
The chapter provides an overview of the MS4640A Series VNA hardware user interface including front panel buttons, front panel connectors, and back panel connectors. Included are photographs of the front and rear panels. Each front panel key is described with its function and a cross reference to the menu it activates on the user interface display. Each port and connector is described with its connector type, its function, input/output limits, and a cross-reference to a detailed connector pin-out diagram.

Chapter 4 — User Interface Display
The chapter describes the general display options of the MS4640A Series VNA and provides a general description of the MENU BAR, the ICON TOOLBAR, and the right-side function menus. General descriptions and procedures are provided for channel setup, trace graph setup, marker setup, and limit line setup. The MS4640A Series VNA displays measurement data using a “Channel Concept” where each channel can display both a different S-Parameter (or another specialty parameter) and a different graph type. As each channel is selected, the previously selected trace graph types, scaling, reference delay, S-Parameter, and other parameters associated with that channel appear on the screen. In addition, the same S-Parameter can be displayed simultaneously on two or more channels using the same or different trace graph types.

Chapter 5 — Main Menu
This user interface (UI) reference chapter summary operational information about the UI and detailed overview of the primary controls on the top-of-screen Menu Bar and Icon Bar, and the right-side application Main Menu. The Main Menu is available for VectorStar VNAs. The Menu Bar provides drop-down menu interface to major instrument functions. The Icon Bar provides single-click access many instrument functions and is user-configurable to meet individual needs. The description of the Main Menu (MAIN) provides top level descriptions of each major function with links to detailed descriptions of menus and dialog boxes in subsequent chapters.

Appendix A — Vector Network Analyzer Primer
This chapter describes the basic functions of a Vector Network Analyzer (VNA) and how it measures magnitude and phase characteristics of networks, amplifiers, attenuators, and antennas. Scattering parameters (S-parameters) are defined.

Appendix B — Initial Checkout Procedures
The initial checkout procedure chapter describes the detailed procedures for initial operational checkout (such as those performed by incoming quality inspectors) to ensure that the MS4640A Series VNA is fully operational. A quick check procedure is described along with how to determine the instrument's installed options, current operating system, application software, and firmware versions. Other procedures provided are self-test, non-ratio power, high-level signal, and system noise floor test.

Appendix C — Abbreviation Glossary

This glossary defines the abbreviations and terms that appear on the connectors, hard keys, menus, and buttons of the MS4640A Series VNA. In some cases, due to space limitations, multiple abbreviations are used for the same term or the same abbreviation is used with different punctuation.

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Subject Index

Chapter 1 — Overview

1-1 Introduction

This chapter provides an overview of the VectorStar MS4640A Series Vector Network Analyzer (VNA) and a description of its major functions and available documentation. A summary of available precision component kits including AutoCal calibration kits, mechanical calibration kits, and verification kits is included.

1-2 VectorStar MS4640A Series VNA Description

The MS4640A Series VNA is an instrument system that contains a built-in source, test set, and analyzer. Test results are displayed real time on a front panel touch screen or also to a separate video monitor. Screen captures can easily be printed or saved in common graphic file formats.

Depending on the model and installed options, the MS4640A Series VNAs provide a maximum frequency range from 70 kHz to 70 GHz for standalone VNAs. Through its front panel user interface, the instrument can be quickly configured to provide either:

- **25,000 Points**

  MS4640A Series VNAs have up to 25,000 total test points available, with up to 16 channels, and each channel with up to 16 trace display graphs where each channel is configured as a virtual separate VNA. Each trace can have up to 12 standard markers and one reference marker.

- **100,000 Points**

  The VNA can be configured with up to 100,000 total test points, limited to one channel with up to 16 trace display graphs. Each trace can have up to 12 standard markers and one reference marker.

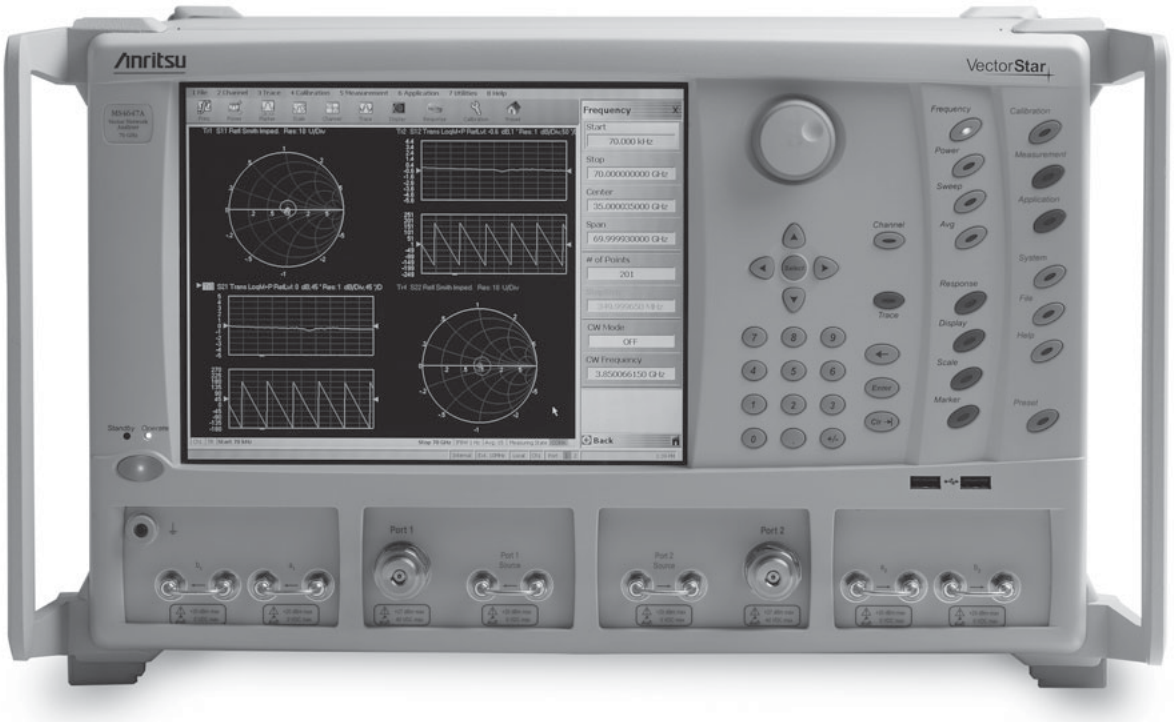


Figure 1-1. VectorStar MS4647A VNA Front Panel - Equipped with Option 051

1-3 VectorStar MS4640A Series VNA Models

The VectorStar VNA is available in four basic models as shown in Table 1-1.

Table 1-1. VectorStar MS4640A Series VNA Models

VNA Model Number	Name	Specifications	Test Port Connectors
MS4642A	Microwave Vector Network Analyzer	10 MHz to 20 GHz	K (m) Connector Test Ports
MS4644A	Microwave Vector Network Analyzer	10 MHz to 40 GHz	K (m) Connector Test Ports
MS4645A	Microwave Vector Network Analyzer	10 MHz to 50 GHz	V (m) Connector Test Ports
MS4647A	Microwave Vector Network Analyzer	10 MHz to 70 GHz	V (m) Connector Test Ports

For additional technical specifications and configuration data, see:

- **VectorStar MS4640A Series VNA Technical Data Sheet and Configuration Guide – 11410-00432**

1-4 VectorStar VNA Options

The available options depend on the VNA instrument model number as shown in Table 1-2 below.

Table 1-2. VectorStar MS4640A Series VNA Options (1 of 2)

Option Number	Option Name and Features	VNA Model and Option Compatibility	Order Number
Option 001	Rack Mount Option • Adds 19” Rack Mounting Handles	All MS4640A VNAs	MS4640A-001
Option 002	Time Domain Option • Displays all S-parameters and overlays with Frequency Domain, Low-pass Mode with added harmonics frequency list flexibility, Band-pass Mode, Phasor Impulse Mode, Windowing, Gating (pass-band or reject-band), and Frequency with Time Gate.	All MS4640A VNAs	MS4640A-002
Option 004	Additional Solid State Drive (SSD) • Plug and play Serial ATA SSD equipped with O/S and VectorStar Application. • Recommended for security operations.	All MS4640A VNAs	MS4640A-004
Option 007	Receiver Offset • Provides Multiple Source, which includes mixer, IMD, and other measurements where the source and receiver operate at different frequencies. • Independent Source/Receive Functions: Allows independent source and receive functions for Mixer, Harmonics, IMD, and other measurements, where the source and receive frequencies are offset. • Multiple Source Control Mode: Provides independent control the frequencies of up to four external sources, in addition to the internal source, and the receiver, in a synchronized manner. • NxN Frequency-Translated Devices: Provides calibration and measurements capability for NxN Frequency-translated devices. • For accurate and absolute magnitude and phase measurements of match, gain/loss, and group delay of devices such as mixers and converters.	All MS4640A VNAs Option 007 is required for: • Option 080/081 – Broadband/ Millimeter-Wave Measurement Capability (MS4647A VNAs only) • Option 082/083 – Millimeter-Wave Measurement Capability (All MS4640A VNAs)	MS4640A-007
Option 041	Noise Figure	Can be equipped on all MS4640A VNAs. • Requires front/rear panel access loops provided by Option 051, 061, or 062.	MS4640A-041

Table 1-2. VectorStar MS4640A Series VNA Options (2 of 2)

Option Number	Option Name and Features	VNA Model and Option Compatibility	Order Number
Option 051	Direct Access Loops	Can be equipped on all MS4640A VNAs. • Not compatible with Option 061 or Option 062 Active Measurement Suite (below) which also include loops.	MS464xA-051
Option 061	Active Measurements Suite with 2 Attenuators	Can be equipped on all MS4640A VNAs. • Not compatible with Option 051 Loops (above) or Option 062 Active Measurement Suite Four Attenuators (below).	MS464xA-061
Option 062	Active Measurements Suite with 4 Attenuators	Can be equipped on all MS4640A VNAs. • Not compatible with Option 051 Loops (above) or Option 061 Active Measurement Suite Two Attenuators (above).	MS464xA-062
Option 070	70 kHz Low-End Frequency Extension • Defines the VNA instrument low-side frequency limit. • Provides a lower limit specified to 70 kHz but which is allowed to go to 40 kHz.	Can be equipped on all MS4640A VNAs.	MS464xA-070
Option 080	Modular Broadband/Millimeter-Wave Connection Capability • Does not include Test Set, external cables, or Millimeter-Wave Modules.	For MS4647A VNAs only. • Use Option 080 if the VNA is not equipped with Option 051, 061, or 062 (above). • Not compatible with Option 081 (below).	MS4647A-080
Option 081	Modular Broadband/Millimeter-Wave Connection Capability • Does not include Test Set, external cables, or Millimeter-Wave Modules.	For MS4647A VNAs only. • Use Option 081 if the VNA is not equipped with Option 051, 061, or 062 (above). • Not compatible with Option 080 (above).	MS4647A-081
Option 082	Millimeter-Wave Capability • Does not include Test Set, external cables, or Millimeter-Wave modules.	Can be equipped on all MS4640A VNAs. • Use Option 082 if the VNA is not equipped with Option 051, 061, or 062 (above). • Not compatible with Option 083 (below).	MS464xA-082
Option 083	Millimeter-Wave Capability • Does not include Test Set, external cables, or Millimeter-Wave modules.	Can be equipped on all MS4640A VNAs. • Use Option 081 if the VNA is equipped with Option 051, 061, or 062 (above). • Not compatible with Option 082 (above).	MS464xA-083
–	VNA Hard Shell Transit Case	All MS4640A VNAs	760-246
–	Extended Warranty and Service Options	All MS4640A VNAs	MS464xA-ESxxx
Option 098	Standard Calibration	All MS4640A VNAs	MS464xA-098
Option 099	Premium Calibration with Certification	All MS4640A VNAs	MS464xA-099

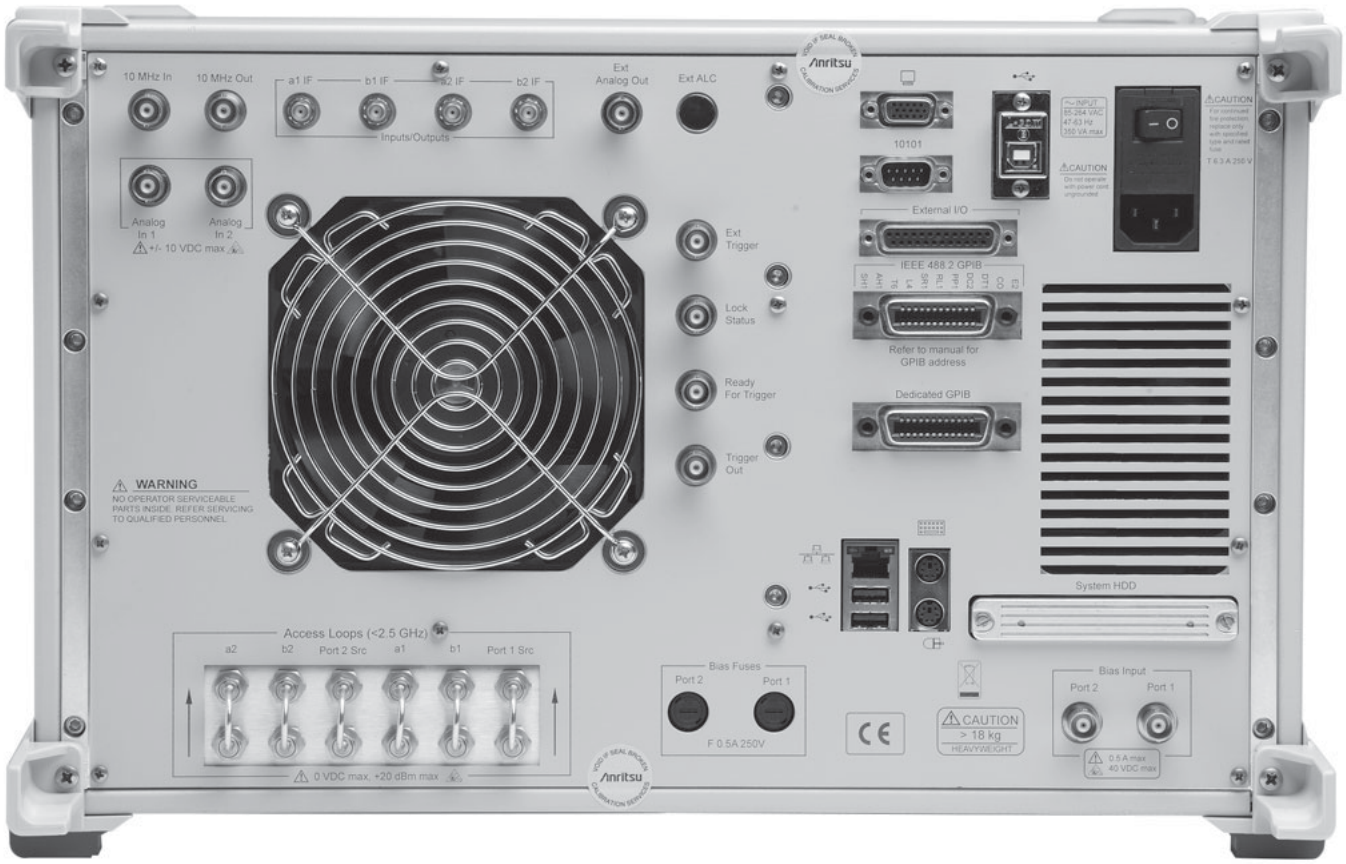


Figure 1-2. VectorStar MS4647 VNA Rear Panel - Equipped with Option 051

Shipping Contents

Each instrument includes the following:

- CD with technical publications and manuals in PDF format and miscellaneous software utilities
- DVD with a back-up image of the instrument's solid state drive
- USB optical mouse
- Power cord

1-5 VectorStar ME7838 Modular BB/mm-Wave VNA System

The modular broadband/millimeter-wave (BB/mm-Wave) system is available in two basic configurations. Additional configuration and configuration information is available in the relevant technical data sheet.

Table 1-3. VectorStar ME7838 Series Modular Broadband/Millimeter-Wave VNA System *(1 of 2)*

Part Number	Name	Specifications
Standard ME7838 Configuration Components		
MS4647A	VectorStar MS4647A Vector Network Analyzer (VNA)	10 MHz to 70 GHz V (m) Connector Test Ports
MS4640A-007	Receiver Offset Option	
MS4640A-002	Time Domain Option	
MS4640A-070	70 kHz Low End Frequency Extension	
MS4640A-08X	Broadband System	Select one: • Use MS4647A-080 if VNA Option 051, 061, or 062 is NOT selected below. • Use MS4647A-081 if VNA Option 051, 061, or 062 IS selected below.
3739A	Broadband/Millimeter-Wave Test Set	With front and rear panel interface cables
3739C	Broadband/Millimeter-Wave Test Set (Required for use with MA25300A 145 GHz Broadband modules)	With front and rear panel interface cables
3743A	Millimeter-Wave Module	70 GHz to 110+ GHz • 2 each with mounting bracket
MA25300A	Millimeter-Wave Module	54 GHz to 145 GHz • 2 each with mounting bracket
ME7838A-SS020	On Site System Assembly and Verification	
Phase Stable Cable Option – Select One (1)		
806-206	1.85 mm Phase Stable Interconnect Cable	70 cm (24 inches) • V (m) to V (f) • 2 cables
806-209	1.85 mm Phase Stable Interconnect Cable	91 cm (36 inches) • V (m) to V (f) • 2 cables
MS4647A VNA Front Panel Options – Select None or One (1)		
MS4647A-051	Front Panel Loops	Six (6) Front Panel Loops • Provides front panel loops for b1, a1, Port 1 Source, Port 2 Source, a2, and b2 • If Option 051 is selected, use Option MS4647A-081 above.
MS4647A-061	Active Measurement Suite, 2 Attenuators	Two (2) Attenuators • Include the six (6) front panel loops above. • Two (2) Attenuators • Bias tees in test set • Gain compression • Efficiency measurement software • If Option 061 is selected, use Option MS4647A-081 above.

Table 1-3. VectorStar ME7838 Series Modular Broadband/Millimeter-Wave VNA System *(2 of 2)*

Part Number	Name	Specifications
MS4647A-062	Active Measurement Suite, 4 Attenuators	Four (4) Attenuators • Include the six (6) front panel loops above. • Four (4) Attenuators • Bias tees in test set • Gain compression • Efficiency measurement software • If Option 062 is selected, use Option MS4647A-081 above.

For more information, consult the following documentation:

- **ME7838A Modular BB/mm-Wave Technical Data Sheet – 11410-00593**
- **ME7838D Modular BB/mm-Wave Technical Data Sheet – 11410-00778**
- **VectorStar ME7838 Series Broadband/Millimeter Wave Installation Guide – 10410-00293**
- **VectorStar Broadband/Banded Millimeter-Wave Modules Reference Manual – 10410-00311**

1-6 VectorStar ME7828A Standard BB/mm-Wave VNA System

In its standard broadband/millimeter-wave configuration, the VectorStar MS4640A Series VNAs are available in two basic configurations as described below. Additional configurations are described in the relevant technical data sheet.

Table 1-4. VectorStar ME7828A Series BB/mm-Wave VNA Models and Options

Part Number	Name	Specifications	Connectors
VectorStar ME7828A Series Broadband/Millimeter-Wave VNA Systems, consisting of:			
MS4647A	Microwave Vector Network Analyzer	10 MHz to 70 GHz	V (m) Test Ports
MS4640A-001	VNA Rack Mount Option. Adds handles and removes feet for shelf-mounting into a 19”.		
MS4640A-007	VNA Receiver Offset Option		
MS464xA-05x	VNA Direct Access Loop Option		
3738A	Broadband VNA Test Set		With Option 002
MG37022A	Fast Switching Signal Generator	2 each; 2 to 20 GHz	With Option 001
3742A-EW	Millimeter Module with Attenuator	2 each	
66670-3	MUX Coupler, Left	70 kHz internal bias tee	
66671-3	MUX Coupler, Right	70 kHz internal bias tee	
806-206	Phase Stable Interconnect Cable	70 cm (24 inches)	V (m) to V (f)
806-207	Phase Stable Interconnect Cable	70 cm (24 inches)	V (m) to V (m)
3700C3	Floor Console		
VectorStar ME7828A Millimeter-Wave VNA System, consisting of:			
MS464xA	Any MS4640A Series VNA	MS4642A, 10 MHz to 20 GHz MS4644A, 10 MHz to 40 GHz MS4645A, 10 MHz to 50 GHz MS4647A, 10 MHz to 70 GHz	K connectors K connectors V Connectors V Connectors
3738A	Broadband VNA Test Set		With Option 002
MG37022A	Fast Switching Signal Generator	2 each; 2 to 20 GHz	With Option 001
3740A-X or 3741A-X	Any pair of Millimeter Wave Modules See table below.	2 required	
3700C3	Floor Console		

Millimeter-Wave Module Options

The following millimeter-wave modules are available for the ME7828A Millimeter-Wave VNA Measurement System. If a millimeter-wave system is required, at least one pair of modules, matched for a band, are required. Multiple module pairs can be equipped with any VNA system. The general installation and connection requirements for each module pair are identical.

Table 1-5. Millimeter-Wave Module General Specifications and Part Numbers

Band / Module Name	Frequency	Anritsu Part Number	Measurement Type
V Band WR-15 mmW Module	50 to 75 GHz	3740A-V, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-V	Forward measurements only. Transmission.
		3741A-V	
E Band WR-12 mmW Module	60 to 90 GHz	3740A-E, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-E	Forward measurements only. Transmission.
		3740A-E	
Extended-E Band WR-12 mmW Module	56 to 94 GHz	3740A-EE, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-EE	Forward measurements only. Transmission.
		3741A-EE	
W Band WR-10 mmW Module	75 to 110 GHz	3740A-W, 2 each	Full 2-port measurements. Transmission/Reflection.
		3741A-W	Forward measurements only. Transmission.
		3740A-W	
Extended W Band WR-10 mmW Module	65 to 110 GHz	3740A-EW, 2 each	Full 2-port measurements. Transmission/Reflection.
		3740A-EW	Forward measurements only. Transmission/Reflection.
		3741A-EW	Forward measurements only. Transmission.
		3742A-EW	Full 2-port measurements. Transmission/Reflection, with Attenuator.

For additional information, consult the following documents:

- **VectorStar ME7828A Broadband/Millimeter-Wave Technical Data Sheet – 11410-00452**
- **VectorStar ME7828A Broadband/Millimeter-Wave Installation Guide – 10410-00287**

1-7 VectorStar MN4690B Series Multiport VNA System

In its multiport (or 4-Port) configuration, the VectorStar VNA is available in K connector and V connector configurations that support all VectorStar MS4640A Series VNAs. Additional configurations and options are described in the relevant technical data sheet.

The upper frequency limit depends on the test set and the VNA. The MN4694B Test Set upper limit 40 GHz and the MN4697B upper limit is 70 GHz. The system usable upper frequency limit is determined by the attached VNA.

The lower frequency limit for the MN4690B Test Sets is 10 kHz, but as above, the usable lower frequency limit is determined by the attached VNA and its installed options. For MS4640A Series VNAs equipped with Option 070 – 70 kHz Low End Frequency Extension, the lower frequency limit is specified as 70 kHz but allowed to go to 40 kHz.

For VNAs not equipped with Option 070, the lower limit is 10 MHz.

Table 1-6. VectorStar MN4690B Series Multiport/4-Port VNA System *(1 of 2)*

Part Number	Name	Specifications	Connectors
VectorStar MN4694B and MS4642A 20 GHz 4-Port Configuration, consisting of:			
MS4642A	VectorStar 2-Port VNA	Without Option 070: • 10 MHz to 20 GHz With Option 070: • 70 kHz to 20 GHz	K (m) Connector Test Ports
MS4642A-051	VNA Front Panel Direct Access Loops • Active Measurement Suit Option 061 or Option 062 can be substituted for Option 051.	Required	
MN4694B	Multiport Test Set	10 kHz to 40 GHz • Limited to range of VNA.	K (m) Connector Test Ports
VectorStar MN4694B and MS4644A 40 GHz 4-Port Configuration, consisting of:			
MS4644A	VectorStar 2-Port VNA	Without Option 070: • 10 MHz to 40 GHz With Option 070: • 70 kHz to 40 GHz	K (m) Connector Test Ports
MS4644A-051	VNA Front Panel Direct Access Loops • Active Measurement Suit Option 061 or Option 062 can be substituted for Option 051.		
MN4694B	Multiport Test Set	10 kHz to 40 GHz • Limited to VNA range.	K (m) Connector Test Ports

Table 1-6. VectorStar MN4690B Series Multiport/4-Port VNA System *(2 of 2)*

Part Number	Name	Specifications	Connectors
VectorStar MN4697B and MS4645A 50 GHz 4-Port Configuration, consisting of:			
MS4645A	VectorStar 2-Port VNA	Without Option 070: • 10 MHz to 50 GHz With Option 070: • 70 kHz to 50 GHz	V (m) Connector Test Ports
MS4645A-051	VNA Front Panel Direct Access Loops • Active Measurement Suit Option 061 or Option 062 can be substituted for Option 051.		
MN4697B	Multiport Test Set	10 kHz to 70 GHz • Limited to range of VNA	V (m) Connector Test Ports
VectorStar MN4697B and MS4647A 70 GHz 4-Port Configuration, consisting of:			
MS4647A	VectorStar 2-Port VNA	Without Option 070: • 10 MHz to 70 GHz With Option 070: • 70 kHz to 70 GHz	V (m) Connector Test Ports
MS4647A-051	VNA Front Panel Direct Access Loops • Active Measurement Suit Option 061 or Option 062 can be substituted for Option 051.		
MN4697B	Multiport Test Set	10 kHz to 70 GHz • Limited to range of VNA	V (m) Connector Test Ports

For more information, consult the following documentation:

- **VectorStar MN4690B Series Multiport VNA Measurement System Technical Data Sheet – 10410-00528**
- **VectorStar MN4690B Series Multiport Test Set Installation Guide – 10410-00288**
- **VectorStar MN4690B Series Multiport Test Set Quick Start Guide – 10410-00290**

1-8 VNA Instrument Control

Most menu functions can be directly accessed by pressing the front panel hard keys. Other than test connectors, I/O connectors, and the main power switch, there are no user controls on the back panel.

The MS4640A Series VNA is equipped with an internal hard disk drive for storing and recalling front panel and calibration setups, along with measurement information and data. The instrument can be controlled via:

- the front panel buttons and touch screen
- an attached USB keyboard and mouse
- an Ethernet LAN
- a USB LAN
- an IEEE 488.2 General Purpose Interface Bus (GPIB)

Note	The VectorStar MS4640A Series VNA **does not** support Remote Desktop interface.

Graphical User Interface

The graphical user interface (GUI) provides a combination of a menu command bar, icon task bar, and right-side navigation menu for most system functions. All of the on-screen navigation elements can be accessed by the instrument touch screen or an attached USB mouse and keyboard.

Note	When using the touch screen, a recommended best practice is to use a positive hard press to make sure the required setting in input into the system. A light touch may not change the instrument setting as required. To recalibrate the touch screen, navigate to the CALIBRATE TOUCH SCREEN dialog box located at **MAIN | System | SYSTEM | Utility | UTILITY | Calibrate Touch Screen | TOUCH SCREEN CONTROL PANEL dialog box**. The procedure is described in the **User Interface Manual – 10410-00307**. A more detailed touch screen calibration and adjustment procedure is described in the **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268**.

Front Panel Hard Keys

Most menu functions can be directly accessed by pressing the front panel hard keys. Other than test connectors, I/O connectors, and the main power switch, there are no user controls on the back panel.

Hard Disk Configuration

The internal hard disk has the following organization:

- **One Primary Partition**

  This is the default booting partition.

- **One Recovery Partition**

  This contains a backup of the main partition that can be used to restore the main partition if the main partition becomes corrupted. This is set up to be as small as possible (about 5% extra space is allocated in addition to the space consumed by the Recovery utility).

System Identification and Computer Name

All Anritsu instruments are assigned a unique six-digit identification (ID) number such as “080101.” This number is affixed to a decal on the back panel of each unit. Please use this number in any correspondence with Anritsu Customer Service. The computer name is set to SNXXXXXX where XXXXXX is the Anritsu serial number for the instrument.

Precision Component and Calibration Kits

Two types of precision-component kits are available: calibration and verification. Calibration kits contain components used to identify and separate error sources inherent in microwave test setups. Verification kits consist of components with characteristics traceable to the National Institute of Standards and Technology (NIST) and are used as the most dependable means of checking system accuracy. Each of these kits contains a floppy disk and/or a USB memory device that provides coefficient, characterization, or measurement data for each component. Refer to the relevant data sheet below for detailed specifications on automatic calibrators, mechanical calibration kits, and verification kits:

- **VectorStar MS4640A Series VNA Technical Data Sheet and Configuration Guide – 11410-00432**

Automatic Calibrators

The AutoCal modules provide fast and repeatable calibrations with a single connection to the test ports, eliminating susceptibility to user errors and connector wear. The MS4640A Series VNA controls the AutoCal module directly for 1- or 2-Port calibrations and Thru Updates. Each AutoCal module is shipped with a characterization file and the necessary serial connection cable.

Mechanical Calibration Kits

The mechanical calibration kits provide 50 Ohm calibrations for SMA, 3.5 mm, K, and V devices.

Verification Kits

Verification kits can be used with the provided software and data to verify the calibration and resulting performance of the MS4640A Series VNA. The applicable calibrations are Short-Open-Load-Thru (SOLT) with Sliding Load using the mechanical and AutoCal kits.

1-9 Related Documentation

Refer to the other documentation supplied with or available for the VectorStar MS4640A Series VNA for more detailed explanations and procedures. Available documents for the MS4640A Series VNA, ME7838A and ME7838D Modular Broadband/Millimeter-Wave VNA Systems, the ME7828A Standard Broadband/ Millimeter-Wave VNA System, and the MN4690B Series Multiport VNA System are listed below.

VectorStar MS4640A Series Vector Network Analyzers

The following VectorStar documentation is available on the Anritsu internet, and provided on the user documentation CD and in the instrument in the instrument context-sensitive help system.

- MS4640A Series VNA Technical Data Sheet (TDS) – 11410-00432
- MS4640A Series VNA Operation Manual (OM) – 10410-00266
- MS4640A Series VNA User Interface Reference Manual (UI-RM) – 10410-00307
- MS4640A Series VNA Measurement Guide (MG) – 10410-00269
- MS4640A Series VNA Programming Manual (PM) – 10410-00267
  - For IEEE, System, and SCPI commands.
- MS4640A Series VNA Programming Manual Supplement (PM-S) – 10410-00308
  - For Lightning 37xxxX and HP8510 commands.
- MS4640A Series VNA Maintenance Manual (MM) – 10410-00268
- MS4640A Series VNA User Help System (HELP) – 10450-00008
  - The help is complied from the OM, UI-RM, MG, and PM documents above and is available on the instrument as context-sensitive help, as a help instance on the user documentation CD below, and from the Anritsu web site.
- MS4640A Series VNA User Documentation Compact Disc (CD) – 10920-00049
  - Provided with the instrument, the CD contains the TDS, OM, UI-RM, PM, PM-S, MG, and MM (described above) in Adobe PDF format, as well as a instance of the User Help System.

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

- ME7838A Modular BB/mm-Wave Technical Data Sheet (TDS) – 11410-00593
- ME7838D Modular BB/mm-Wave Technical Data Sheet (TDS) –11410-00778
- ME7838A Modular BB/mm-Wave Quick Start Guide (QSG) –10410-00292
- ME7838D Modular BB/mm-Wave Quick Start Guide (QSG) –10410-00732
- ME7838 Series Modular BB/mm-Wave Installation Guide (IG) –10410-00293
- VectorStar Broadband/Banded Millimeter-Wave Modules (RM) –10410-00311
- ME7838 Series Modular BB/mm-Wave Maintenance Manual (MM) –10410-00306

VectorStar ME7828A Standard BB/mm Wave VNA Measurement System

- ME7828A Series Broadband/Millimeter-Wave Technical Data Sheet – 11410-00452
- ME7828A Series Broadband/Millimeter-Wave Quick Start Guide – 10410-00289
- ME7828A Series Broadband/Millimeter-Wave Installation Guide – 10410-00287
- ME7828A Series Broadband/Millimeter-Wave Maintenance Manual – 10410-00304

VectorStar MN4690B Series Multiport VNA Measurement System

- MN4690B Series Multiport VNA Measurement System Technical Data Sheet – 11410-00513
- MN4690B Series Multiport Test Set Installation Guide – 10410-00288
- MN4690B Series Multiport Test Set Quick Start Guide – 10410-00290
- MN4690B Series Multiport Test Set Maintenance Manual – 10410-00305

- MN4690B Series Multiport Test Set User Documentation CD – 10920-00051

Calibration, Verification, and System Performance Verification

- 36585K and 36585V Precision Auto Calibrator (AutoCal) Module Reference Manual – 10410-00279
- 3650A, 3652A, and 3654D Mechanical Calibration Kit Reference Manual – 10410-00278
- 366X-1 Verification Kits (3666-1 3.5mm Connectors, 3668-1 K Connectors, 3669B-1 V Connectors) and 3-2300-527 Performance Verification Software (PVS) User Guide – 10410-00270
- 366X-1 Verification Kit and 3-2300-527 PVS Quick Start Guide – 10410-00285
- 3656B W1 (1 mm) Calibration/Verification Kit and 2300-496 System Performance Verification Software User Guide for the VectorStar ME/7838A/ME7828A and Lightning ME7808A/B/C BB/mm-Wave VNA Systems – 10410-00286
- 3659 - Cal-Verif- Kit-UG and 2300-558 System Performance Verification Software for BB-mmW ME7838D with 0.8 mm Connectors – 10410-00327

Updates to Manuals

For updates to any of the MS4640A Series VNA documentation, visit Anritsu's Web site at:
http://www.anritsu.com/VectorStar

Documentation Conventions

The following conventions are used throughout the entire MS4640A Series documentation set:

Instrument Identification

Throughout this manual, the following term definitions are used:

- VectorStar VNA refers to any VectorStar VNA instrument or system.
- VNA refers to any VectorStar standalone VNA instrument.
- M4640A Series VNA or MS464xA Series VNA refers to the MS4642A K, MS4644A K, MS4645A V, or the MS4647A V VNAs.
- MN4690B refers to the test set and software changes to convert the 2-Port VNA into a 4-Port VNA.
- ME7828A, ME7838A, and ME7838D refer to VectorStar VNA systems for millimeter-wave and/or brandband testing. ME7828A/ME7838A/ME7838D ready refers to standalone VNAs that have the necessary internal options to later connect to the required test set and modules.
- When required to identify a specific VNA model, the specific model number is used, such as MS4647A.

Note	Many of the images in this document are used as typical representations of the product or of the product features. Your instrument and instrument displays may vary slightly from these images.

Hard Keys or Front Panel Keys

Front panel hard keys are denoted with a bold Sans Serif font such as "Press the front panel **Frequency** key."

User Interface, Menus, and Soft Buttons

The MS4640A Series VNA user interface consists of menus, button lists, sub-menus, toolbars, and dialog boxes. All of these elements are denoted with a special font, such as the CALIBRATION menu or the AutoCal button.

User Interface Navigation

- **Previous**

  The prior object such as a menu or dialog box that was used to navigate to the current object is always identified with a "Previous" cross reference line. In some cases, multiple menus can link to the same sub-menu/dialog.

- **Navigation**

Elements in navigation shortcuts or paths (identified as “Navigation”) are separated with the pipe symbol (“|”). Menu and dialog box names are distinctive Sans Serif font in CAPITALS. Button names are in Title Case. For example, the path to the AUTOCAL menu is:

- MAIN | Calibration | CALIBRATION | Calibrate | CALIBRATE | AutoCal | AUTOCAL

User Input

User input such as entering values or other information is denoted in a mono-spaced font such as:

```
This font denotes a string of user input.
```

1-10 Security Concerns for CPU Memory and the Hard Disk Drive

Memory Overview

Considering secure environments, the internal memories of the MS4640A series VNA uses DRAM (Dynamic Random Access Memory) in its CPU board and Flash Memory in its DSP (Digital Signal Processing) board. The disk drive in new units is an easily removable SATA Solid State Drive (SSD). Older units have an easily removable Hard Disk Drive (HDD).

DRAM and Flash Memory

The DRAM is used by the CPU for temporary memory purposes and all the information is lost upon powering off the unit, which is characteristic of dynamic memory.

Flash Memory is used to save instrument factory calibrations and settings. No user application information is stored in Flash Memory and the memory space is not user-accessible. Since this memory space is not used by the user, nor by the instrument to store user application settings, it does not require cleansing after it has entered a Secured Location.

Solid State Drive/Hard Disk Drive

The current Solid State Drive (SSD) (and the older Hard Disk Drive or HDD) are fully accessible by the user to store configuration data and measurements including instrument saved setups, custom presets, last used setups, and similar information. For secure applications and locations, the SSD can be easily and quickly removed from the instrument chassis and left in the Secure Location. The chassis can then be moved to another location and another optional SSD installed. The SSD/HDD is accessible from the rear panel, and can be removed by loosening two screws, sliding the drive out, and then unplugging the connector cable, allowsing the VNA case chassis can then be transferred to another location.

When operation in secure environments is planned, the recommended option is to purchase one or more of the **MS4640A-004 Additional Solid State Drive** assemblies. The Option 004 SSD supplies a separate assembly that is loaded with the proper factory configuration data and information. By using the Option 004 SSD, the VNA can then continue to be used in both outside non-secure and inside secure environments. Multiple Option 004 SSDs can be used to facilitate support of multiple secure locations.

1-11 Operating System

The VectorStar software runs on both Microsoft® Windows XP and Windows 7 (32-bit). However, Windows 7 only supports VectorStar software version 1.7.7 and higher.

Maintaining Operating System Integrity

The Microsoft Windows operating system on the MS4640A Series VNA is configured for optimum performance when the instrument leaves the factory. To maintain the system's operating integrity, follow proper Windows shutdown procedures and DO NOT modify the operating system configuration, the firewall settings, the system registry, the hard disk drive partitions, or the Anritsu user accounts.

Antivirus Protection

The MS4640A Series VNA is tested with most common antivirus software, but stability is not guaranteed with all antivirus software. Anritsu recommends connecting the instrument only to a secure network. The user assumes the responsibility to provide virus protection because this is not supplied with the instrument. Contact your network administrator for information about your network security and antivirus protection policies.

Windows Updates

Not all Microsoft updates are compatible with the MS4640A Series VNAs and, if installed, may affect the performance of the instrument.

Caution	Changing some of the default Windows settings may cause a loss of instrument control or undesired instrument behavior. Changing the Windows Regional and Language Options settings may cause unstable front panel operation. These settings must be maintained as English (United States) as is set at the factory by default.

As such, the ability of the VNA to automatically receive and install updates has been turned off. Operating system updates should only be installed from an Anritsu-certified source, typically in the form of an update contained in a USB Memory Device. Anritsu recommends not installing updates from Microsoft. Ensure that the Windows update feature of the operating system remains off. Consult Anritsu Customer service for procedures on how to safeguard the instrument from undesired conditions that could result from Windows updates.

Chapter 2 — Installation

2-1 Introduction

This chapter provides information for the initial inspection and preparation for use of the MS4640A Series VNA and includes information on instrument installation, required operating environment, power requirements, initial inspection, and optional rack mounting procedures. After power up, the various power modes are described with general warm-up and calibration time intervals. The preventive maintenance section includes information on cleaning and fuse replacement along with preparation for storage or shipment. General set up procedures are provided for remote programming control over GPIB and Ethernet or USB only networks.

2-2 Unpacking the Product

Initial Inspection

Inspect the shipping container for damage. If the container or cushioning material is damaged, retain until the contents of the shipment have been checked against the packing list and the instrument has been checked for mechanical and electrical operation. If the MS4640A Series VNA is damaged mechanically, notify your local sales representative or Anritsu Customer Service. If either the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as Anritsu. Keep the shipping materials for the carrier's inspection.

Warning



Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury if this equipment is lifted by one person.

Preparation for Use

The MS4640A Series VNA requires no special setup. After unpacking, the VNA is ready for use.

2-3 Optional Rack Mount Installation

Instruments that are ordered from the factory with a rack mount option arrive with the rack mount hardware pre-installed. Alternatively, the rack mount option may be ordered at a later time and installed whenever required by the user. The general procedure to install the rack mount kit is described below:

1. Disconnect the line cord and any other attachments from the instrument.
2. Carefully place the instrument on a secure and stable work surface.
3. Using a Phillips screwdriver, remove the two front panel handles and the four feet at the rear of the instrument (see Figure 2-1). Save the screws for later use.

Note	The screws with green heads have metric threads. If it becomes necessary to replace any of these screws, always use the exact replacement green-headed screws to avoid damage to the instrument. The Anritsu part numbers for these metric-threaded screws are 905-8 (long) and Z-951102 (short).

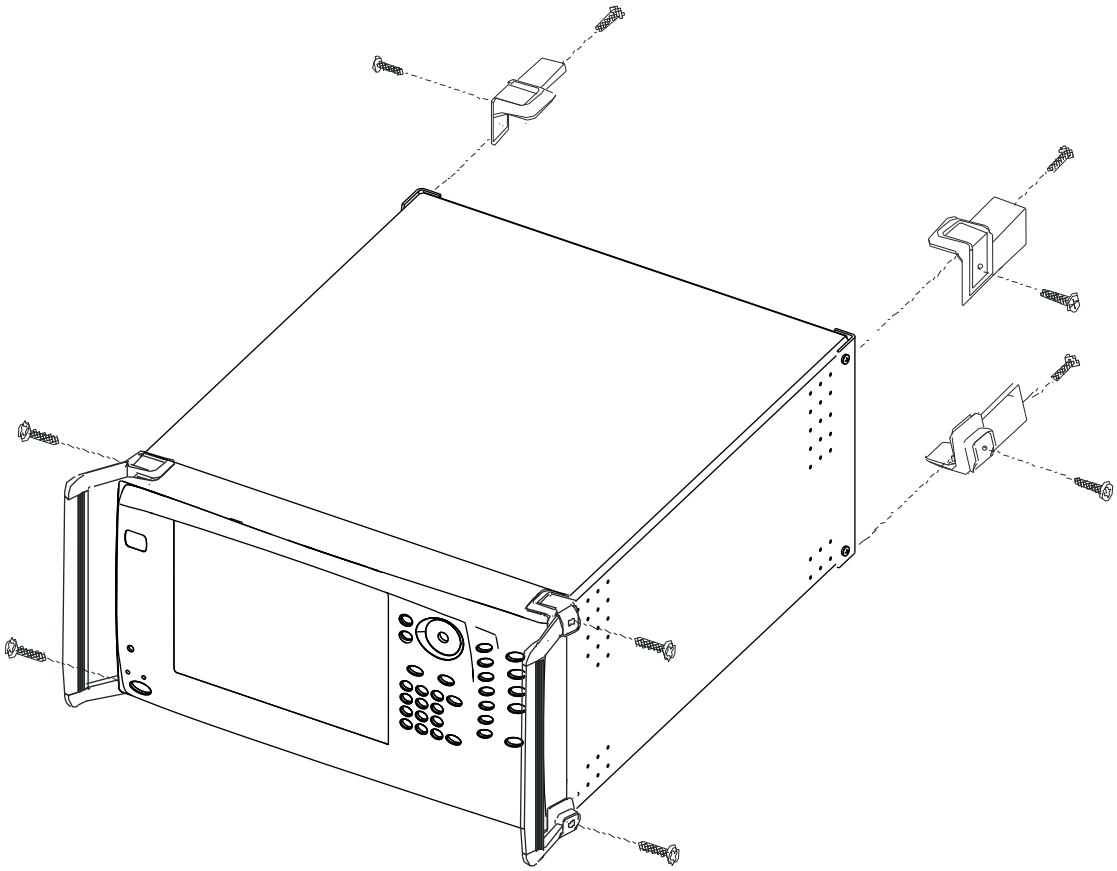


Figure 2-1. Removing Instrument Handles and Feet for Rack Mount

Note	The rack installation figures are for generic instruments and may differ in general appearance.

4. Install the rack mount bracket onto the instrument sides using the green-headed screws removed earlier (see Figure 2-2).

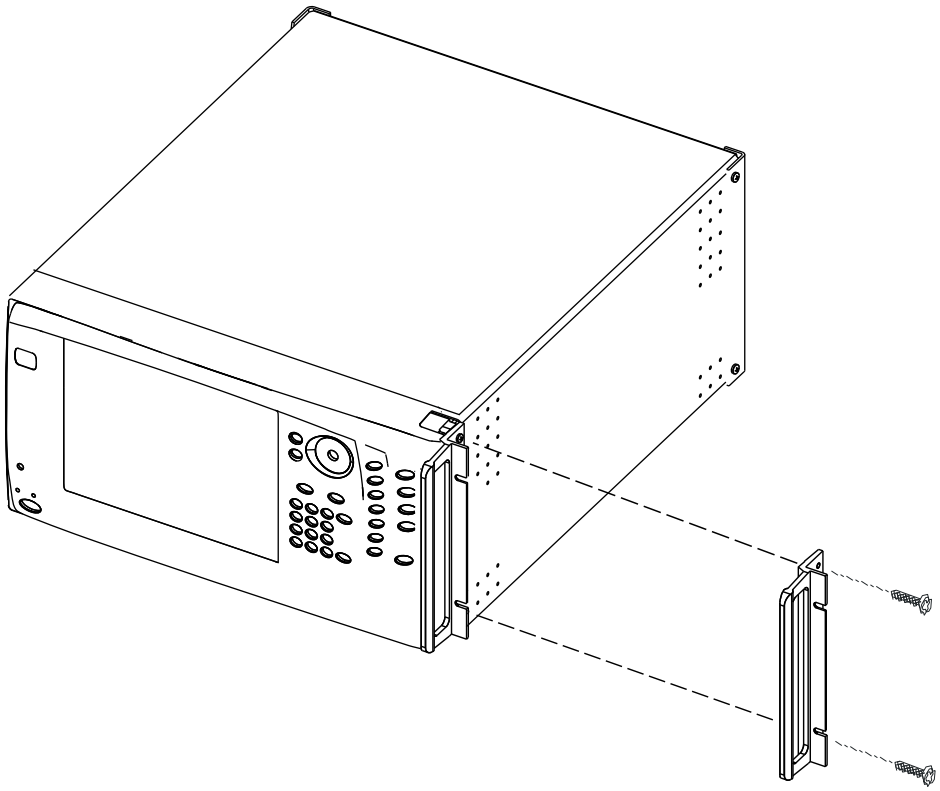


Figure 2-2. Attaching Rack Mount Ears to Instrument

5. This completes the installation of the rack mount handles.

2-4 Installing and Configuring the Additional Solid State Drive

The **MS4640A-004 Additional Solid State Drive (SSD)** provides the capability of using a different SSD for different measurement tasks, and then to be able to quickly remove the measurement data and store it a secure location. A separate SSD drive can be quickly installed in instrument, freeing it for other tasks or to accompany the instrument back to the factory for recalibration.

Note	Using multiple removable SSDs makes the VectorStar VNAs ideal for secure environments. The hard drive can be left in the secure environment, and the instrument chassis moved to a different location where another SSD can be installed, maintaining instrument usage. The internal memories of the instrument retain no user data after the SSD has been removed.

The **MS4640A-004 SSD** is factory-configured to the same specification as the instrument's original hard drive. Both drives provide the factory as-shipped instrument configuration, setup, and calibration information.

To use the Additional SSD, the general process is to copy any user setup, data, and calibration files from the original SSD to the optional SSD while outside the secure environment. Then, when configured, move the SSD into the secure environment.

Procedure

1. Prior to the hard drive replacement, copy and save any user setup, data, or calibration files to a USB Memory Device.
2. Make sure also that the following hardware calibrations are copied from the `C:\AnritsuVNA\Data` folder:
   - `AlcCal.alc`
   - `AllHWCal.ahc`
   - `AnalogInCal.alc`
   - `LOCal.slc`
   - `SqmPowerCal.sqm`
   - `tenMHzCal.tmc`
3. When all files are copied, power down the instrument and turn it off.
   - If the instrument is in the Operate mode (the green **Operate LED** is on), from the front panel, press and hold the left side **Standby/Operate key** for at lease one (1) second.
   - The green **Operate LED** turns off and the orange **Standby LED** turns on, indicating the instrument is in Standby mode.
   - From the rear panel, use the **AC Power Rocker Switch** to turn the instrument off by pressing the "**O**" side of the rocker switch.
4. On the **Rear Panel**, loosen the two captive screws anchoring the **SSD** in place.
5. Remove the orignial **SSD**, insert into an anti-static bag or container, and store in a safe place.
6. Slide in the replacement **SSD**. You will feel a slight resistance the last few millimeters as the connector seats. Do not force.
7. Tighten the captive screws evenly on both sides of the drive.
8. Power up the system and it should boot as before the change.
   - From the rear panel, use the **AC Power Rocker Switch** to turn the instrument on by pressing the "**|**" side of the rocker switch.
   - The orange **Standby LED** turns on, indicating the instrument is in Standby mode. When the orange Standby LED is on steady and not blinking, from the front panel, press and hold the left side **Standby/Operate key** for at lease one (1) second.
   - The orange **Standby LED** turns off and the green **Operate LED** turns on, indicating the instrument is in Operate mode.

The **Option-004 Additional Solid State Drive** drive is shipped in the same configuration as the instrument's as-shipped drive.

2-5 Connecting External Devices

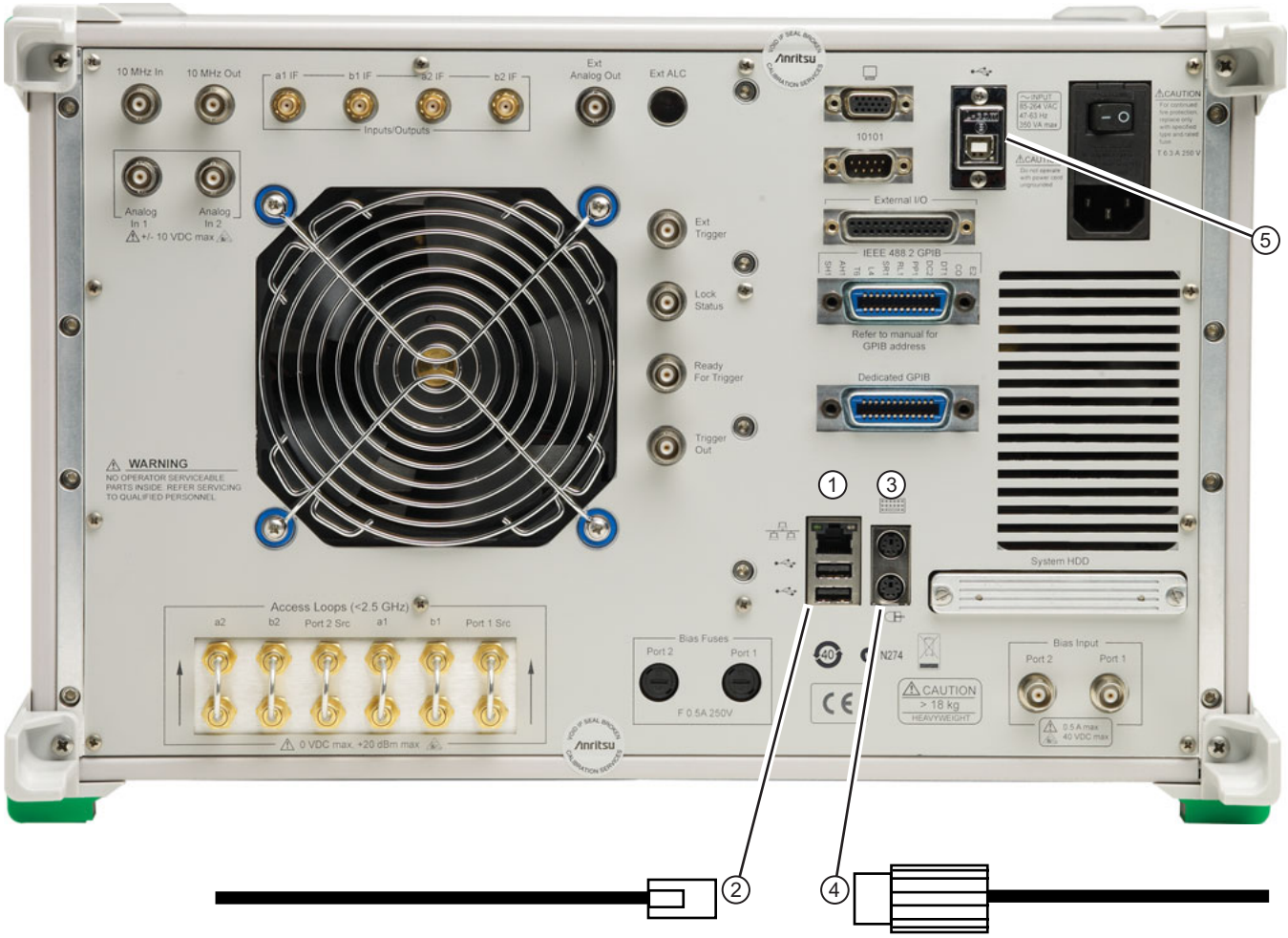
After unpacking, the MS4640A Series VNA ready for use although it is strongly recommended that you connect an external keyboard and mouse to facilitate ease of use of the VectorStar VNA application and operating system. The VNA also supports the connection of an XGA/VGA monitor, printer, and many other Windows-based peripherals. In general, most peripherals are rated as plug-and-play with no driver installation or further configuration required.

Connecting an External Mouse or Keyboard

The VNA provides USB Type A and PS/2 DIN connector ports for external keyboard and mouse interfaces. USB Type A connectors are available on both the front and rear panels; PS/2 connectors are only available on the rear panel. If the USB Type A connectors are needed for other devices, a USB keyboard/mouse can be connected through the PS/2 connector by using a user-provided USB to PS/2 adapter connector.

When connecting either a keyboard and/or mouse, ensure that the instrument is set to standby mode before connecting them. When the MS4640A Series VNA is set to **Operate**, the keyboard and mouse should be automatically detected by the operating system and be ready for use. To use any advanced features of your external keyboard and mouse, follow the manufacturers installation instructions.

Note	A USB mouse may require a hot connection while the instrument is in the **Operate** mode with the VectorStar VNA Application software running. If a USB mouse fails to operate when the instrument is started with the mouse plugged into the USB port, reboot the instrument with the mouse disconnected and make the hot connection after the VectorStar VNA Application software is running.



1. Rear Panel USB Type A Ports – Also two Type A Ports on Front Panel.
2. USB Cable.
3. Rear Panel PS/2 Port.
4. PS/2 Cable.
5. USB Type B Control Port – For VNA control over a USB network.

Figure 2-3. Rear Panel Keyboard and Mouse Connections

Note	Advanced keyboard and mouse features may not be supported in the analyzer application, but should function as expected in the Windows environment.

There are two rear panel USB 2.0 Type A Ports (also two on front panel) that can be used for USB connections for a USB mouse or keyboard. In addition, there are two rear panel PS/2 Ports with Mini-DIN (f) connectors for keyboard (top) and mouse (bottom) connections using a PS/2 Mini-DIN (m) connector and cable.

Connecting an External XGA/VGA Monitor

The rear panel **XGA/VGA Video Port** external monitor interface is a standard XGA/VGA DB-15 Mini-DIN (f) connector. When connecting an external monitor, ensure that the instrument is in standby mode and that the monitor is disconnected from its power source. Once the monitor is connected, turn on its power and then set the VNA to Operate. The monitor should be automatically detected by the operating system and be ready for use.

Connecting an External Printer

The external printer interface is typically connected through an available front or rear panel **USB Type-A Port**. Many printers will be recognized by the Windows operating system and require no further installation.

If installation and configuration is required, install your printer driver according to the manufacturer's directions. The hardware connection should be made when the VNA is in Standby or Off mode to allow for proper initialization of the hardware during boot-up of the operating system.

If you attempt to print from the VNA application before a printer is installed, a dialog box appears prompting you to install a printer.

Connecting Other USB Peripherals

Use any available USB 2.0 Type A Port for connecting other USB devices such as a scanner, hard drive, camera, or USB memory device (a "memory stick"). The USB interface offers the same behavior that is typically experienced in the Windows operating system environment.

If connection of multiple USB devices is considered, the use of a user-supplied powered USB hub is recommended. If the USB Type A Ports are required for other devices, an attached USB keyboard and/or USB mouse can be attached to the rear panel **Keyboard/Mouse PS/2** ports by using a user-supplied **USB to PS/2 Adapter**.

2-6 Operating Environment and Power Requirements

Before installing the VectorStar MS4640A Series VNA in its operating environment, ensure that all airflow passages at the sides and rear of the instrument are clear. Proper ventilation is of particular importance whenever the unit is being rack mounted. Keep the cooling fan filters clean so that the ventilation holes are not obstructed. A blocked fan filter can cause the instrument to overheat and shut down. The MS4640A Series VNA can be operated within the following environmental limits:

Table 2-1. Operational Environmental Specifications and Power Requirements

Parameter	Specification
Environmental Specifications	
Operating Temperature Range:	0 to +50 degrees Celsius (per MIL-PRF-28800F)
Relative Humidity:	5% to 95% (per MIL-PRF-28800F)
Altitude:	4,600 meters, 43.9 cm Hg
Vibration:	Sinusoidal 5 Hz to 55 Hz on 3 axes
Power Requirements	
Voltages:	90 to 264 VAC maximum (single phase)
Frequency:	47 to 63 Hz (power factor controlled)
Power:	350 VA maximum
Installation Category:	The MS4640A Series VNA is intended for Installation Category (Overvoltage Category) II

Warning



or



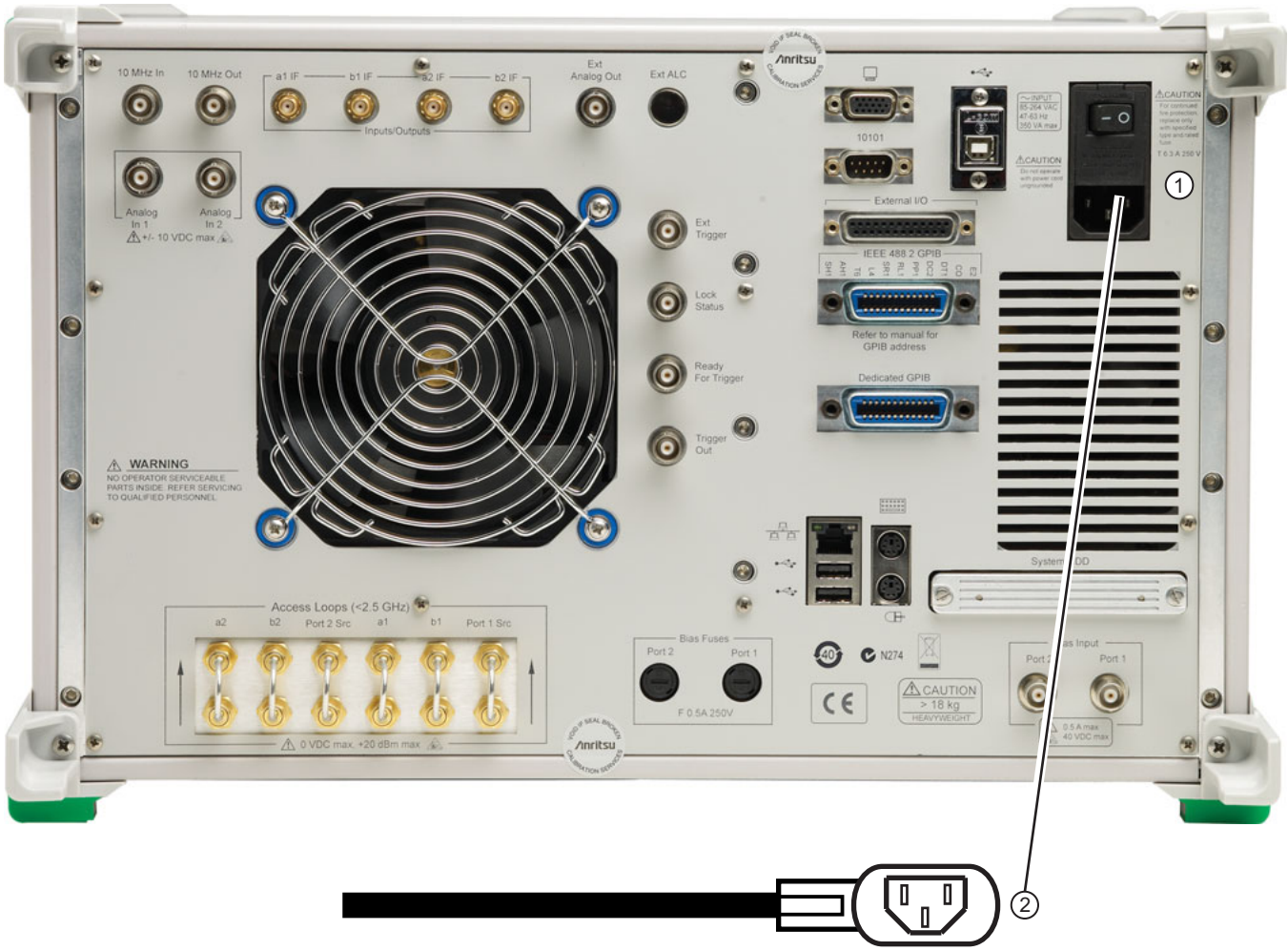
When supplying power to this equipment, connect the accessory 3-pin power cord only to a 3-pin grounded power outlet connected in turn to local AC Mains. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the equipment frame to a suitable ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

2-7 Power-On/Power-Off Procedures

The power-on procedure involves connecting the instrument to AC Mains, using the back panel **AC Power Rocker Switch** to turn the instrument on, and then using the front panel **Standby/Operate key** to toggle the instrument into operate mode. The power-off procedure involves using the front panel **Standby/Operate key** to toggle the instrument into standby mode, and then using the back panel **AC Power Rocker Switch** to turn the instrument off.

During the transition from operate to standby, first the **green Operate LED** blinks and then the **orange Standby LED** blinks. Finally, the **Standby LED** stops blinking and goes into a steady state of illumination.

Note	Do not turn the instrument off or unplug it while it is changes from standby to operate, or from operate to standby. Do not turn the instrument off or unplug it when it is in operate mode. Doing so may cause the Windows application to improperly close.



1. The AC Power Entry Module contains the rear panel AC Power Rocker Switch (at top) and the IEC C14 AC Power Socket (m) (at bottom).	2. The AC Mains Connection is made with an AC Input Cable connected to local AC mains power at one end and to the instrument using the IEC C13 AC Line Socket at the other end.

Figure 2-4. Rear Panel Power Connection to AC Mains Power

Procedure – Power-On to Standby Mode

To turn the instrument on:

1. Connect the supplied AC power cord to local AC mains power.
2. Connect the other end of the power cord to the rear panel **IEC C14 Chassis AC Power Socket** located in the upper right corner of the rear panel.
3. Switch the instrument on by changing the **AC Power Rocker Switch** to "**|**" (or **ON**). The orange **Standby LED** illuminates. The instrument is now in standby mode.

Note	Whenever the VNA is not being used, it should be left connected to the power source and placed in standby mode. This keeps the internal time-base frequency reference at the correct operating temperature. When the instrument is in standby mode, it is safe to turn it off from the rear panel **AC Power Rocker Switch.** After turning off the instrument, you must wait at least 15 seconds before turning the instrument back on again. This delay is required to allow the internal power supplies to discharge and to assure a reliable cold start.

Procedure – Standby Mode to Operate Mode

To set the instrument to operate mode:

1. Press and hold the front panel **Standby/Operate key** for at least one second. The orange **Standby LED** turns off and the green **Operate LED** illuminates. The VectorStar VNA information splash screen is displayed during the change to operate mode process and is shown below in Figure 2-5, "MS4640A Series VNA Startup Splash Screen".

Note	The MS4640A Series VNA requires at least two minutes to load the system software and perform a series of internal calibrations. The system uses a self-test to check all sub-systems for proper operation and download firmware into the various peripheral devices.

2. When fully in operate mode, the MS4640A Series VNA displays the main channel and trace display with the application menus on the right side. See Figure 4-1, "User Interface - Single Channel - Four Traces" for a typical full screen display.

Note	When the instrument is in operate mode, do not use the rear panel **AC Power Rocker Switch** to turn off the instrument nor disconnect the instrument from the AC power. Doing so will cause the Windows application to close improperly. When placing the MS4640A Series VNA in operation, allow at least 90 minutes of warm-up time in the operate mode before using the VNA to assure stable operation and the highest possible accuracy.

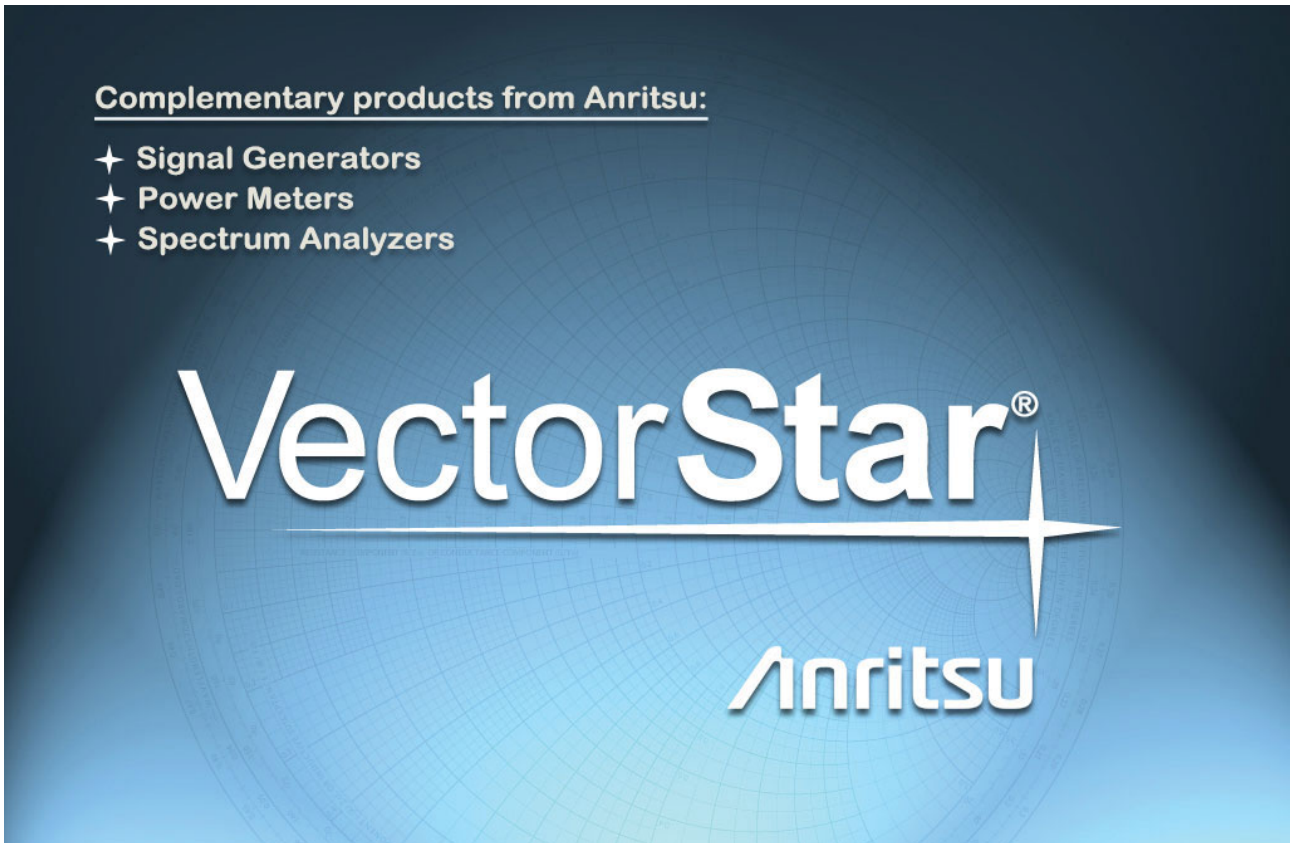


Figure 2-5. MS4640A Series VNA Startup Splash Screen

Procedure – Operate Mode to Standby Mode

To set the instrument to standby mode from operate mode:

1. Press and hold the front panel **Standby/Operate key** for at least one second. The green **Operate LED** blinks and then the orange **Standby LED** blinks. The instrument switches from operate mode to standby mode.
2. When fully in standby mode, the orange **Standby LED** is illuminated and is not blinking.

Note	Do not disconnect the instrument from power nor turn off with the **AC Power Rocker Switch** while the instrument is changing from operate mode to standby mode.

Procedure – Standby Mode to Power-Off

To turn the instrument off:

1. Make sure that the instrument is in standby mode. The orange **Standby LED** should be illuminated and not blinking.
2. Turn off the instrument by pressing the "**O**" (or **OFF**) on the rear panel **AC Power Rocker Switch**.
3. If necessary, the instrument can now be disconnected from the AC power mains.

Note	After turning off the instrument, you must wait at least 15 seconds before turning the instrument back on again. This delay is required to allow the internal power supplies to discharge and to assure a reliable cold start.

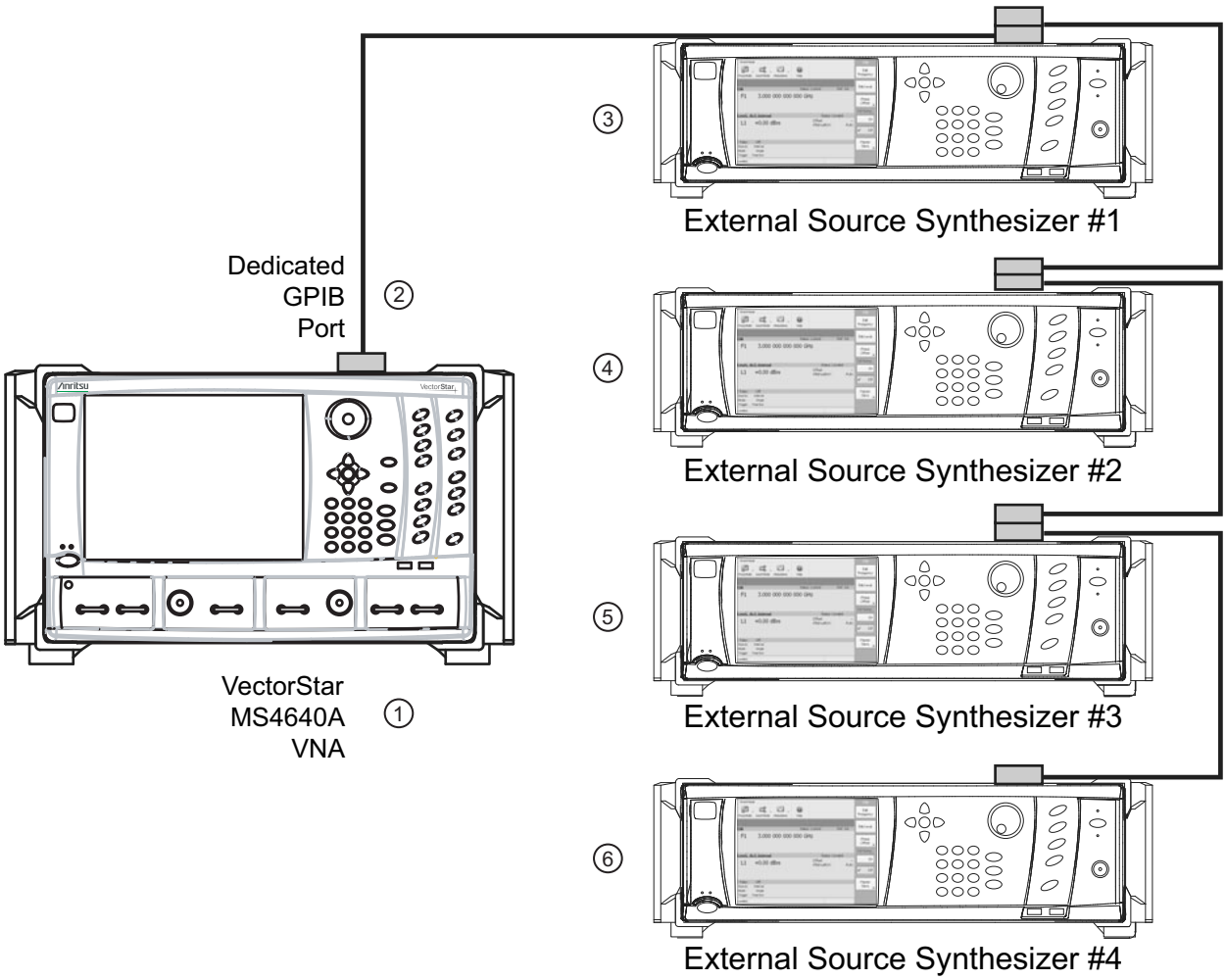
2-8 GPIB Setup

The interface between the MS4640A Series VNA and other devices on the GPIB is via a standard 24-wire GPIB interface cable. This cable uses a double-sided connector where one connector face is a plug and the other a receptacle. These double-function connectors allow parallel connection of two or more cables to a single instrument connector.

Caution	When two or more cables are connected in parallel, do not bend the attached connectors as this could damage the rear panel GPIB Port connector.

Configuring the Dedicated GPIB Port

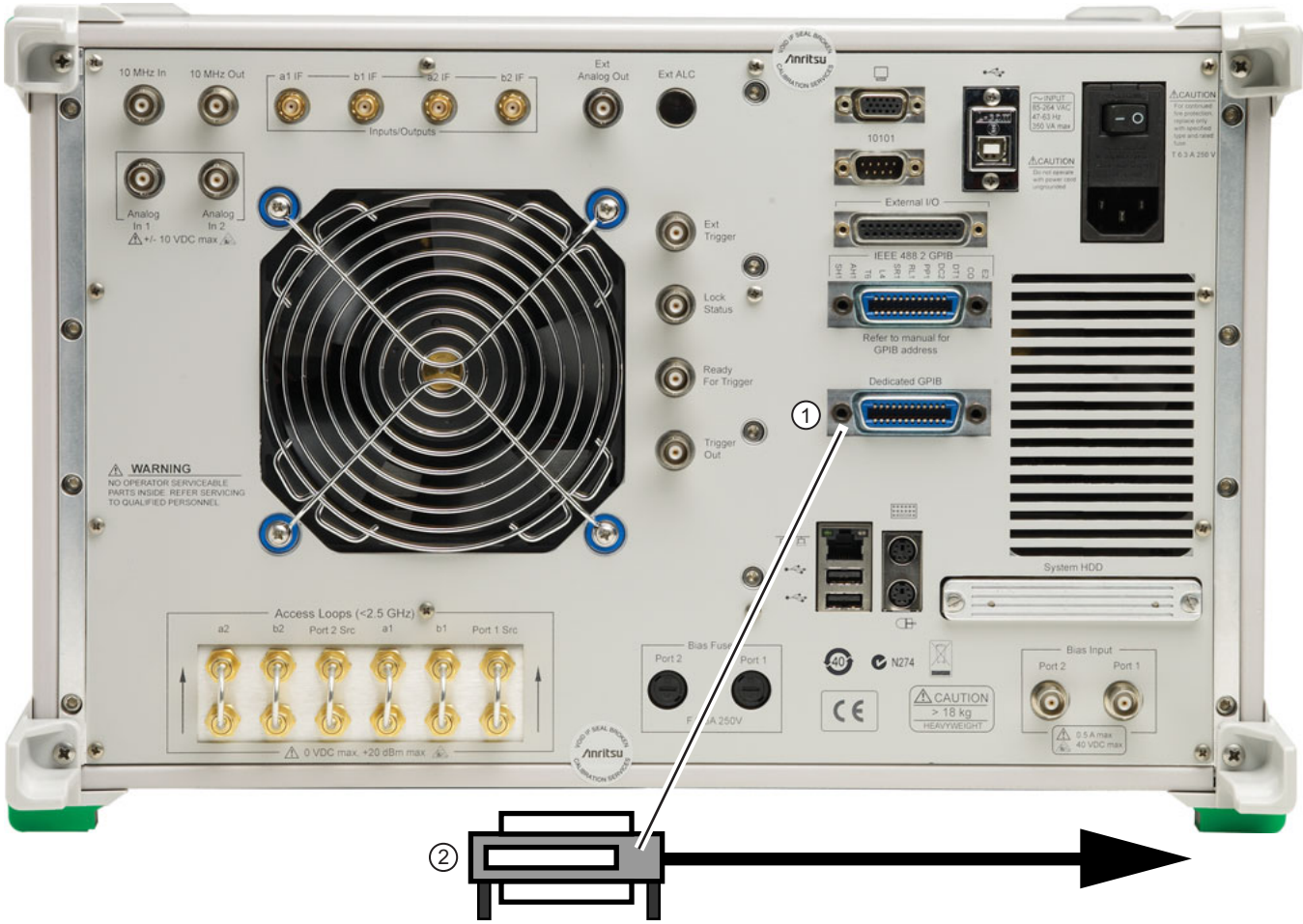
Use this procedure to set up the dedicated GPIB port to control other GPIB devices such as Power Meters or Signal Generators by using the VNA rear panel **Dedicated GPIB Port**. An example of a complex GPIB configuration with the VNA as the GPIB controller is shown in Figure 2-6.



1. VectorStar MS4640A Series VNA.
2. Rear Panel Dedicated GPIB Port and GPIB Cable.
3. Synthesizer GPIB address 4 as External Source #1.
4. Synthesizer GPIB address 5 as External Source #2.
5. Synthesizer GPIB address 2 as External Source #3.
6. Synthesizer GPIB address 3 as External Source #4.

Figure 2-6. VNA as a Remote GPIB Controller for Synthesizers

1. Connect GPIB devices to the VNA rear panel **Dedicated GPIB Port** using the appropriate length GPIB cable.

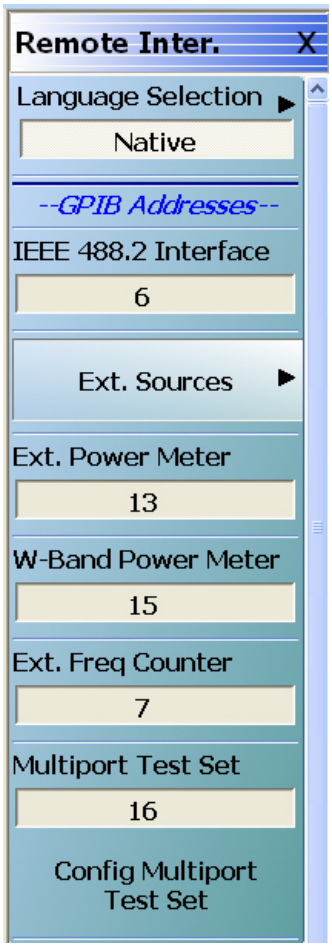


1. Rear Panel Dedicated GPIB Port for control of connected external sources, power meters, and frequency counters.	2. GPIB Cable Connection to peripheral devices.

Figure 2-7. MS4640A Series VNA Dedicated GPIB Port

2. Power-up the MS4640A Series VNA and any attached GPIB devices, and allow the system to warm up for at least 90 minutes.
3. Navigate to the REMOTE INTER menu:
   - MAIN | System | SYSTEM | Remote Interface | REMOTE INTER.
   - Figure 2-8, “REMOTE INTER (REMOTE INTERFACE) Menu” on page 2-14

- A detailed menu description is located in the **User Interface Manual – 10410-00307**.



On the REMOTE INTER. (REMOTE INTERFACE) menu: The IEEE 488.2 Interface, Ext. Sources, Ext. Power Meter, Ext. Freq Counter, and the Multiport Test Set buttons control GPIB addresses for the subject devices.	The Ext. Sources button displays the EXT. SRC. ADDR. menu where GPIB addresses are assigned for external source 1 through external source 4.

Figure 2-8. REMOTE INTER (REMOTE INTERFACE) Menu

4. The GPIB address for any controlled device can be kept at the factory default values or changed as required. The default GPIB addresses are:

- External Source 1 = 4
- External Source 2 = 5
- External Source 3 = 2
- External Source 4 = 3
- Power Meter = 13
- Wide Band Power Meter = 15
- Frequency Counter = 7
- Multiport Test Set = 16
  - Only available when a MN4694B or MN4797B Multiport/4-Port Test Set is installed.
  - The test set must be on and the VNA must be rebooted for any GPIB address change to take effect.

- See the **VectorStar MN4690B Multiport Test Set Installation Guide – 10410-00528** for complete installation and configuration instructions.

- The VectorStar instrument itself = 6

5. The GPIB addresses for the External Sources are changed on the EXT. SRC ADDR. (EXTERNAL SOURCE ADDRESS) sub-menu shown below in Figure 2-9.

- MAIN | System | SYSTEM | Remote Interface | REMOTE INTER. | Ext. Sources | EXT. SRC. ADDR
- A detailed description of the menu is available in the **User Interface Manual – 10410-00307.**

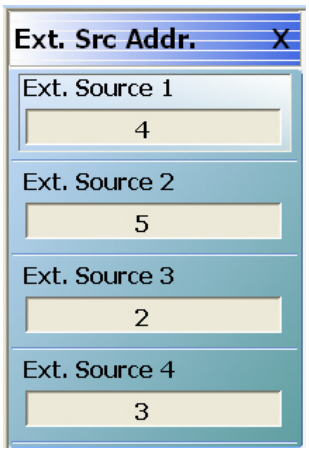


Figure 2-9. EXT. SRC. ADDR. (EXTERNAL SOURCE ADDRESS) Menu

6. If a change of GPIB address is required, click the device button, and the device field toolbar appears as shown below:



7. Use the front panel keys, a keyboard, or mouse to set the required GPIB address.

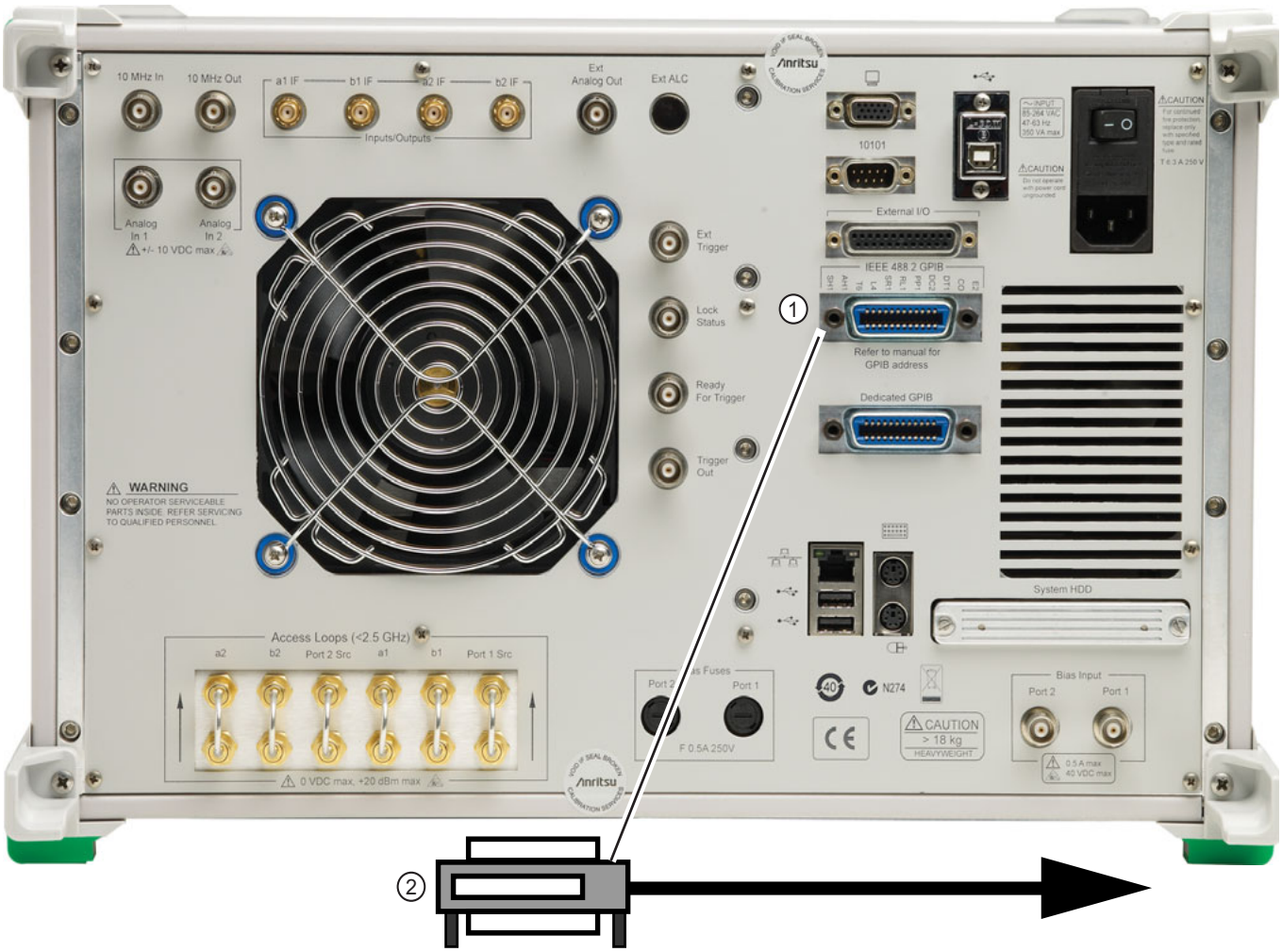
8. Click the Enter button to set the new GPIB address.

For information on the programming command sets, refer to the **VectorStar MS4640A Series VNA Programming Manual – 10410-00267**.

Configuring the IEEE 488.2 GPIB Port

Use this procedure to set up the talker/listener port to control the VNA remotely over an IEEE 488.2 GPIB bus network. In this configuration, an external computer/controller is physically connected to the VNA rear panel **IEEE 488.2 GPIB Port** with a standard GPIB cable. Most of the MS4640A Series VNA functions (except power on/off and initialization of the hard disk) can be controlled remotely by an external computer/controller via the IEEE-488.2 GPIB bus network.

1. Connect the VNA to the GPIB Controller using the rear panel **IEEE 488.2 GPIB Port** DB-24 (f) connector and a standard GPIB cable.



1. 1. IEEE 488.2 (Upper) Port	2. GPIB Cable Connection. Note that the Dedicated GPIB Port is not used in this configuration.

Figure 2-10. IEEE 488.2 GPIB Talker/Listener Ports

2. Apply power to the MS4640A Series VNA and allow the system to warm up for at least 90 minutes.
3. Once the software has finished loading and start-up testing is complete, the instrument is ready to be remotely controlled via the GPIB. The instrument will not respond to GPIB commands until the instrument's software has been loaded.

Note	The factory default GPIB address for the instrument is six (6).

Configuring the VectorStar VNA GPIB Address

To change the VectorStar VNA GPIB address:

1. Navigate to the REMOTE INTER. menu:
   - MAIN | System | SYSTEM | Remote Interface | REMOTE INTER.
2. On the REMOTE INTER menu, the IEEE 488.2 GPIB button.

   The IEEE 488.2 GPIB toolbar appears below the icon toolbar near the top of the display.



3. Use the front panel keys, a keyboard, or a mouse to set the required GPIB address.
4. Click the Enter button to set the new GPIB address.

For information on the programming command sets, refer to the:

- **VectorStar MS4640A Series VNA Programming Manual – 10410-00267**
- **VectorStar MS4640A Series VNA Programming Manual Supplement – 10410-00308**

2-9 Ethernet LAN TCP/IP and USB Setup

The MS4640A Series VNA supports Ethernet 10/100 BASE-T. The instrument is connected directly to the LAN via the rear panel RJ-45 Ethernet Port using a standard CAT-5 Ethernet cable. The MS4640A Series VNAs can also be controlled remotely across a Universal Serial Bus (USB) Type 2 network by a PC equipped with a USB control application using the rear panel **USB Control Port**.

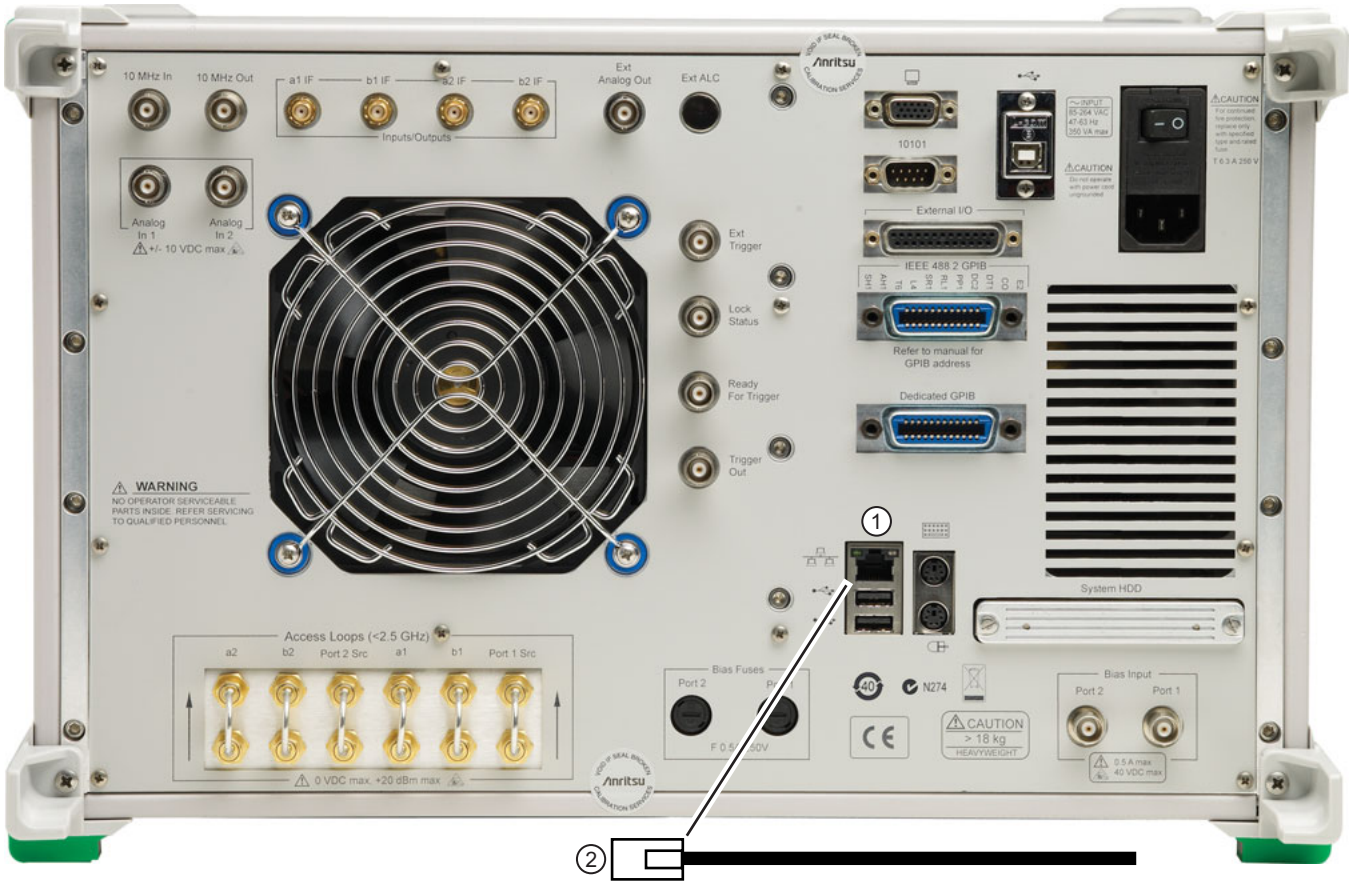
Default Plug-and-Play Configuration

The MS4640A Series VNA and its Windows operating system comes pre-configured and ready to plug into and connect with an existing Ethernet or USB network. The Ethernet network must provide DNS/DHCP and be configured with a gateway. USB networks are typically auto-detecting without the need for configuration; however, a special USB network cable (described in the note below) is required.

Note	The required PC-to-Instrument USB 2.0 networking cable (also called a USB-USB cable, USB networking cable, or USB bridge cable) has a small electronic circuit module in the middle of the cable that allows the PC and the VectorStar VNA to talk to each other at 480 Mbps. The PC-to-Instrument USB cable is user-provided and does not come with the VectorStar MS4640A Series VNA.

Warning	Using the wrong type of USB-USB cable can result in damage to the PC and/or VectorStar USB ports and/or power supplies. Do NOT use a so-called “USB A / A” cable that is similar to a serial port cross-over null-modem cable.

Connect the VNA to the network with an Ethernet cable between the VNA rear panel **RJ-45 Ethernet Port** and your local network port or a USB network cable between the VNA rear panel **USB Type 2 Port** and your local network hub.



1. Rear Panel Ethernet Port (at top) and USB Ports (at bottom).	2. Matching USB or Ethernet Connection Cable.

Figure 2-11. MS4640A Series VNA Ethernet and USB Ports

The MS4640A Series VNA has one **Ethernet RJ45 (f) connector** and two (2) with **USB 2.0 Type A port connectors**. There are two additional **USB 2.0 Type A ports** on the instrument front panel. Use the Ethernet port to connect to a LAN (Local Area Network). Windows will automatically detect the network settings and configure the network connection.

Manually Configuring TCP/IP Ethernet LAN Settings

Note	This section is provided for general information about manually configuring an Ethernet connection and does not apply to USB networking. Consult your local network administrator for the exact requirements and settings that are required for your network installation.

To see the current network settings for your MS4640A Series VNA, with the VectorStar Application Software running, navigate to the NETWORK INTERF. (Network Interface) menu as follows (see Figure 2-12):

- MAIN | System | SYSTEM | Ntwk Interface | NETWORK INTERF.

The detailed description of the menu, its operation, and connected dialog boxes are described in the **User Interface Manual – 10410-00307**.

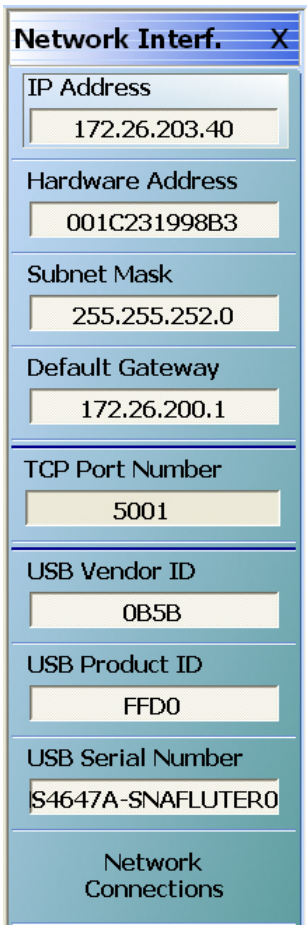


Figure 2-12. NETWORK INTERF. (NETWORK INTERFACE) Menu

The top eight (8) display buttons provide information for the current network settings. Changes to these settings must be made through the Microsoft Windows configuration utilities by clicking the Network Connections button.

The NETWORK CONNECTIONS dialog box shows the current available local networks,

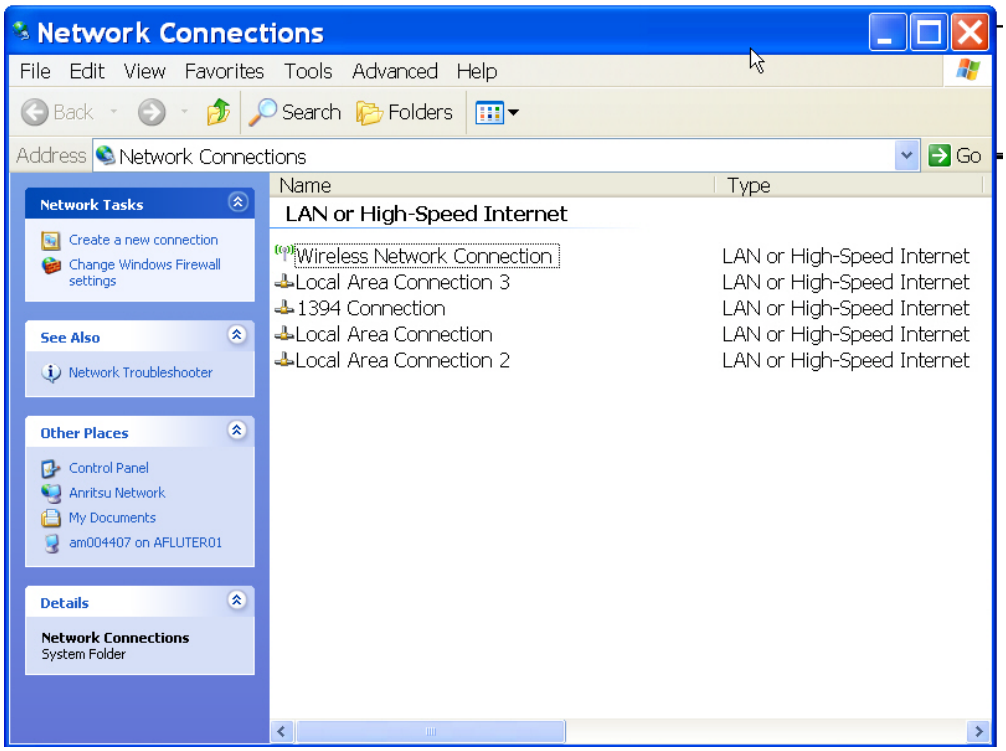


Figure 2-13. NETWORK CONNECTIONS Dialog Box

It provides access to various network configuration utilities and setup wizards as follows:

- A link to the Create a new connection wizard
- A link to the Network Troubleshooter wizard
- If connected to one or more networks, a link to each network name is provided with links to the settings of each connection

Note	You may need to consult your network documentation or network administrator for assistance in manually configuring your network setup. The **Network Connections Help** system provides information related to computer networking. If an Internet connection is present, links to Microsoft and other URLs are also provided.

For information on the programming command sets, refer to the:

- **VectorStar MS4640A Series VNA Programming Manual – 10410-00267**
- **VectorStar MS4640A Series VNA Programming Manual Supplement – 10410-00308**

2-10 Configuring the Remote Language

The MS4640A Series VNA command parser responds to either Native SCPI commands or to the legacy Anritsu Lightning-model command set. The MS4640A VNAs also support many HP/Agilent 8510 programming commands.

Regardless of the setting, the MS4640A VNA parser will respond to commands from either source.

Scripts written in older versions of the Lightning command set or in the HP/Agilent 8510 command set may need editing to be fully compatible with the VNA. Not all Lightning and HP/Agilent commands are supported.

Processing and response times will be improved if the Remote Language setting matches the majority of the sent commands.

If necessary, you can change the VNA default GPIB language from Native to Lightning or HP/Agilent 8510x as follows:

1. Navigate to the Remote Lang. menu:

- This menu is described in greater detail in the **User Interface Manual – 10410-00307**.
- MAIN | System | SYSTEM | Remote Interface | REMOTE INTER. | Language Selection | REMOTE LANG.



Figure 2-14. REMOTE LANG. (REMOTE LANGUAGE) Menu

2. Select the interface language being used.

3. The menu auto-returns to the REMOTE INTER menu.

2-11 Calibration/Verification Interval

If the MS4640A Series VNA requires service or calibration, the system may be returned to factory specifications and re-imaged with a standard software configuration. User installed applications and data may be lost and unable to be retrieved. It is advised that user data be backed up, copied, and retained by the user. Applications will need to be reinstalled from their original installation disks. A complete system restore from a previous user backup is not advised after service or calibration as this will result in the new calibrations being overwritten, thus voiding the calibration accuracy.

2-12 Fuse Maintenance

The MS4640A Series VNA requires periodic cleaning of the cooling fan screen to prevent an obstruction that could facilitate overheating. Additional maintenance that may be required includes replacing a blown fuse, replacing the CPU backup battery, and cleaning the LCD panel. The final part of this sections defines how to restore the VectorStar `C:\drive` application in the event the operating system becomes corrupted or inoperable.

Fuse Summary

The MS4640A contains six (6) fuses, four (4) external and two (2) internal.

External Fuses

There are two sets of rear panel fuses available for field replacement.

- **AC Power Input Fuses**

  Two fuses located inside the IEC C14 AC Power Entry Module connector rated at T 6.3 A, 250 V.

- **Bias Input Fuses**

  Two fuses, one per port, located inside the twist-off fuse holders rated at F 0.5 A, 250 V, quick acting.

Internal Fuses

Internal fuses are **not** replaceable at the field level. They are mounted within the field-replaceable power supply module. Internal fuse information is provided for reference only.

- **Internal Fuse #1**

  Rated at 6.3 A, 250 V, F (quick acting)

- **Internal Fuse #2**

  Rated at 15 A, 32 Vdc (automotive type).

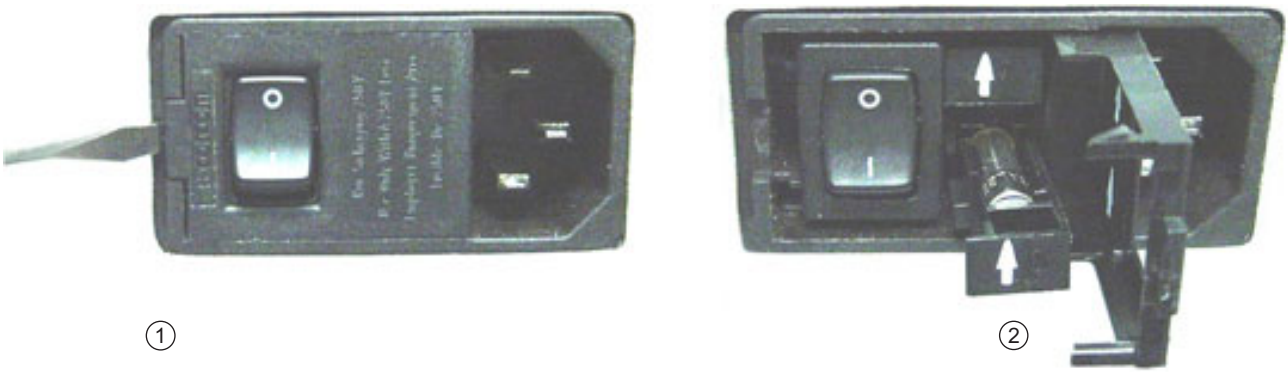
External Rear Panel AC Input Fuses

The AC line fuses used in the MS4640A Series VNA are 6.3A, type T fuses. The line fuse values are printed on the rear panel next to the power connector. Always use a new fuse of the type and rating specified by the fuse markings on the rear panel of the instrument. To replace the line fuses, refer to Figure 2-15 and follow the procedure steps below.

Danger	Before changing the fuse, always remove the power cord from the power outlet. There is the risk of receiving a fatal electric shock if the fuse is replaced with the power cord connected.

1. Set the MS4640A Series VNA to standby mode using the front panel **Power** button, and, at the back panel, turn the instrument off by using the AC Power Entry Module **On/Off** switch.
2. Disconnect the power cord from the rear panel power receptacle.
3. Using a small flat-blade screwdriver, carefully pry under the tab next to the rear panel power receptacle to open the fuse block cover and gain access to the fuse holder.
4. Slide out the fuse holder.

5. Replace the fuse in the fuse holder.
6. Install the fuse holder back into the rear panel fuse block.
7. Close the cover to secure the fuse holder in place. The cover will close with an audible snap.



1. Opening the Rear Panel Fuse Holder with a flat blade screwdriver.	2. Sliding out and replacing a fuse.

Figure 2-15. Replacing the Rear Panel Fuse

8. Reconnect the analyzer to the power source and turn the back panel **On/Off** switch to on.
9. At the front panel, set the MS4640A Series VNA to operate using the front panel **Power** button.

Bias Fuse Replacement

The required replacement Bias Port fuses used in the VectorStar MS4640A Series VNAs are printed on the rear panel below the **Bias Port Fuse Holders**. Always use a new fuse of the type and rating specified by the fuse markings on the rear panel of the instrument. To replace the bias fuses, follow the procedure steps below.

Danger	Before changing the fuse, always remove the power cord from the power outlet. There is the risk of receiving a fatal electric shock if the fuse is replaced with the power cord connected.

1. Set the MS4640A Series VNA to standby mode using the front panel **Power** button, and, at the back panel, turn the instrument off by using the **AC Power Entry Module On/Off** switch.
2. Disconnect the power cord from the rear panel power receptacle.
3. Remove any DC biasing from the **DC Bias Inputs**.
4. Using a small flat-blade screwdriver, unscrew the each **Bias Fuse Holder.**
5. Slide out fuse holder.
6. Remove the fuse.
7. Replace the fuse in the fuse holder.
8. Install the fuse holder back into the rear panel fuse block.
9. Lightly tighten the fuse holder with the flat-blade screwdriver.
10. Reconnect the analyzer to the power source and turn the back panel **On/Off** switch to on.
11. At the front panel, set the VNA to operate using the front panel **Power** button.

2-13 Operating System Restore

The VectorStar VNA is configured with Windows Operating System Restore. This system can be accessed from the Windows desktop Start menu and used to restore the VectorStar operating system to a recent known good state.

The instrument is shipped with a "Point of Shipment" restore point. Additional restore points are created when the VectorStar application is updated, other user applications are installed, when new or updated hardware drivers are installed, or when restore points are created manually. Restore points are saved for a limited time, so the system should be restored as soon as problems are discovered.

Note	For detailed information about system restore and additional restore tasks, refer to the Windows Operating System Help and Support as detailed in the procedure below.

In the event that the VectorStar operating system or application becomes corrupt or inoperable, the instrument must be returned to a qualified service center for repair.

Caution	Restoring the system software may adversely affect some user data or programs that are loaded onto the instrument hard drive. The instrument operating system will be configured as it was on the selected restore date, including the original option configuration. Before starting the system restore procedure, back up all user data, applications, and ensure that the installation files of any additional software or instrument options are available for reinstallation.

Procedure

The following procedure should be performed with a mouse attached to the instrument.

1. Close the VectorStar application and reveal the operating system desktop by clicking:

   File | Exit

2. To access the Operating System Help and Support for additional information on System Restore, move the mouse pointer to the bottom of the desktop to reveal the Windows Task Bar and click:

   Start | Help and Support

   Search for topics on "System Restore."

3. Open System Restore by moving the mouse pointer to the bottom of the desktop to reveal the Windows Task Bar and clicking:

   Start | Programs | Accessories | System Tools | System Restore

4. If you are prompted for an administrator password or confirmation, enter the password or provide confirmation.

5. Follow the on-screen instructions to restore your computer to an earlier restore point shown on the calendar. The most recent known good restore point should be used to restore the instrument operating system.

6. Do not interrupt the restoration process once it has started.

2-14 Preparation for Storage or Shipment

Use the following information for preparing the MS4640A Series VNAs for storage or shipment.

Preparation for Storage

Preparing the VNA for storage consists of cleaning the unit, packing it inside of the storage container with moisture-absorbing desiccant crystals, and storing the unit in a temperature-controlled environment that is maintained between –40 °C and +75 °C.

Preparation for Shipment

To provide maximum protection against damage in transit, the VNA should be repackaged in either the optional **VNA Transit Case – 760-246** or the original shipping container. If these containers are not available and the unit is being returned to Anritsu for repair, advise Anritsu Customer Service and they will send a new shipping container free of charge. In the event these options are not possible, instructions for packaging and shipment are given below:

Remove Attached Equipment and Connectors

1. Remove any user-supplied connectors or adapters. If installed, remove the rack mounting ears and related hardware.

Use a Suitable Container

2. Obtain a corrugated cardboard carton with at least 125 kg test strength. This carton should have inside dimensions of no less than 15 cm (6.0”) larger than the instrument unit dimensions to allow for cushioning.

Dimensions

3. The instrument dimensions are:
   - **Height**

     267 mm body height (10.5”) - 286 mm between feet outer edges (11.3”)
   - **Width**

     426 mm body height (16.7”) - 457 mm between feet outer edges (17.9”), 487 mm between front panel handle outer edges (19.2”)
   - **Depth**

     502 mm body depth (16.7”) - 591 mm between handle and foot outer edges (23.3”)

Protect the Instrument

4. Surround the unit with polyethylene sheeting to protect the finish. A sealed bag is recommended as a best practice.

Cushion the Instrument

5. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the unit. Provide at least 8 cm (3.0”) of dunnage on all sides; best practices recommend completely filling the space between the carton and instrument with dunnage.

Seal the Container

6. Seal the carton by using either shipping tape or an industrial stapler.

Address the Container

7. If the instrument is being returned to Anritsu for service, mark the address of the appropriate Anritsu service center and your return address on the carton in one or more prominent locations.
8. Contact information for all worldwide Anritsu Service Centers is available on the Web site at: http://www.anritsu.com/Contact.asp

Chapter 3 — Front and Rear Panels

3-1 Chapter Overview

The chapter provides an overview of the MS4640A Series VNA hardware user interface including front panel buttons, front panel connectors, and back panel connectors. Included are photographs of the front and rear panels. Each front panel key is described with its function and a cross reference to the menu it activates on the user interface display. Each port and connector is described with its connector type, its function, input/output limits, and a cross-reference to a detailed connector pin-out diagram.

3-2 Front Panel Touch Screen

The touch screen display shows the instrument measurement graphs and the system navigation menus. The menus are available by using either the touch screen or a connected mouse and keyboard. A complete description of the various display and menus appears in the chapters below.

Note	When using the touch screen, a recommended best practice is to use a positive hard press to make sure the required setting in input into the system. A light touch may not change the instrument setting as required. To recalibrate the touch screen, navigate to the CALIBRATE TOUCH SCREEN dialog box located at **MAIN | System | SYSTEM | Utility | UTILITY | Calibrate Touch Screen | TOUCH SCREEN CONTROL PANEL dialog box**. The procedure is described in the **User Interface Manual – 10410-00307**. A more detailed touch screen calibration and adjustment procedure is described in the **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268**.

3-3 Front Panel Hard Keys and Connectors

The MS4640A Series VNA front panel areas, keys, and port connectors are identified below in Figure 3-1.

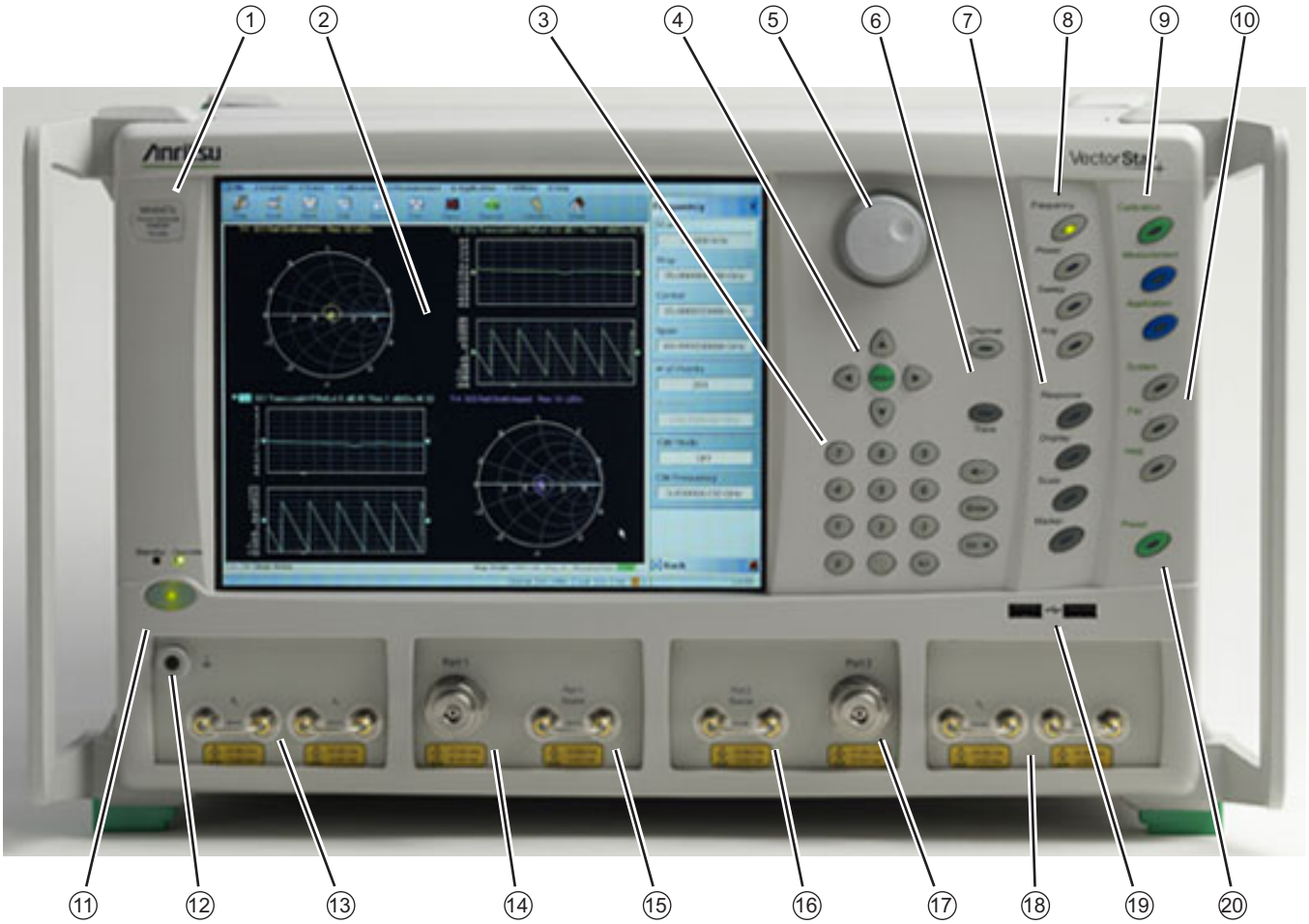


Figure 3-1. MS4640A Series VNA Front Panel Hard Keys and Connectors (2 of 2)

1. Model Number – Instrument model number identification
2. Display Area – Touch screen with instrument test results and graphics with the MENU BAR at top and the ICON BAR immediately below. The MAIN menu with access to specific-functions menus and dialog boxes is on the right side. This area is also terms the right-side application menus.
3. Data Entry – Data entry keypad with numbers from 0 (zero) to 9 (nine), Decimal Point, and +/– (Plus/Minus).
4. Navigation Keys – Up, Down, Left, Right arrow navigation keys and the center Select key.
5. Rotary Knob – Scrolls through values or changes settings. Pressing it is the same function as the Select key.
6. Channel Key – Select displays the Channel menu.
7. Analysis Key Group – Response, Display, Scale, and Marker Keys. Select of each displays the named menu.
8. Setup Key Group – Power, Sweep, and Avg Keys. Select of each displays the named menu.
9. Measurement Key Group – Calibration, Measurement, and Application Keys
10. System Key Group – System, File, and Help keys
11. Standby/Operate Key – Pressing and holding the key for more than one (1) second toggles the VNA between standby and operate modes. When in standby mode, the orange Standby LED above the key is illuminated. When in operate mode, the green Operate LED above the key is illuminated.
12. Ground – Chassis Ground Port Banana connector
13. Direct Access Loops – b1 Front Panel Direct Access Loop (left) and a1 Front Panel Direct Access Loop (right).
14. Test Post Port 1 – K (f) on MS4642A and MS4644A VNAs – V (f) on MS4647A VNAs.
15. Port 1 Direct Access Loop – Port 1 Source Front Panel Direct Access Loop
16. Direct Access Loop – Port 2 Source Front Panel Direct Access Loop
17. Test Port 2 – Same connector types as for Test Port 1 above.
18. Direct Access Loop – a2 Front Panel Direct Access Loop (left) – b2 Front Panel Direct Access Loop (right)
19. USB Ports – Two USB 2.0 Type A Ports
20. Preset Key – The Preset key restores the instrument to one of three prior states. User Defined: A previously saved user-defined state. Default: The factory as-shipped state. Default 0: The factory original setting. The user selects which preset mode is used.

Figure 3-1. MS4640A Series VNA Front Panel Hard Keys and Connectors (2 of 2)

Front Panel Hard Key and Connector Description

The front panel hard keys are described in Table 3-1 below. The cross reference links are to related information in this chapter and detailed menu descriptions in separate chapters

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

Key Name	Primary Functions
Power Key and Chassis Ground Connector 	
Standby/Operate Key	Pressing and holding the Standby/Operate key for at least one (1) second toggles the VNA between operate mode and standby mode. **Power Up** To power up the VNA into Standby mode, connect the instrument to AC power and then set the rear panel AC Power Rocker Switch (which is part of the upper right corner AC Power Input Module) to "|" or ON. The orange Standby LED on the front panel is illuminated and the Standby/Operate key is illuminated with an orange LED. • "AC Power Connectors and Controls" on page 3-14 below. **Standby to Operate Mode** With the VNA in standby mode, to change to operate mode, press and hold the Standby/Operate key for at least one (1) second. The green Operate LED is illuminated and the Standby/Operate key is illuminated with a green LED. **Operate to Standby Mode** With the VNA in operate mode, to change to standby mode, press and hold the Standby/Operate key for at least one (1) second. The orange Standby LED is illuminated and the Standby/Operate key is illuminated with an orange LED. **Power Off** With the VNA in standby mode, to remove AC power from the VNA and turn the VNA off, set the rear panel AC Power Rocker Switch to "O" or OFF. Do not remove AC Power from the VNA while it is in operate mode. Do not turn off the VNA while it is in operate mode.
Chassis Grounding Port	Provides an instrument chassis and signal grounding (earth) point. Banana (f).

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

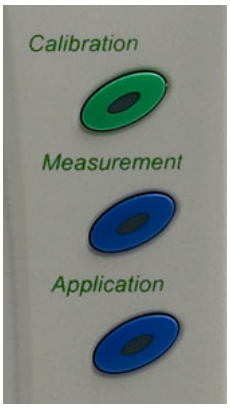
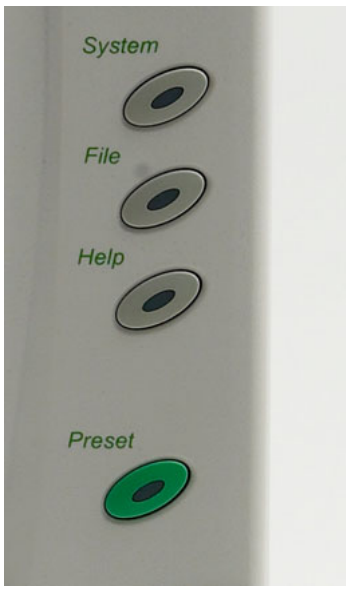
Key Name	Primary Functions
Calibration, Measurement, and Application Keys	
	
Calibration Key	Pressing **Calibration** displays the user interface CALIBRATION menu. • MAIN | Calibration | CALIBRATION
Measurement Key	Pressing **Measurement** displays the MEASUREMENT menu in the user interface display. • MAIN | Measurement | MEASUREMENT
Application Key	Pressing **Application** displays the APPLICATION menu in the user interface display. • MAIN | Application | APPLICATION
System, File, Help, and Preset Keys	
	
System Key	Pressing **System** displays the System menu in the user interface display. • MAIN | System | SYSTEM
File Key	Pressing **File** displays the File menu in the user interface display. • MAIN | File | FILE
Help Key	Pressing **Help** displays the Help menu in the user interface display. • MENU BAR | Help | Context Sensitive Help

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

Key Name	Primary Functions
Preset Key	Returns the instrument (or presets it) to the last active configuration preset loaded as defined and set in the PRESET SETUP menu. Depending on the user-set preset configuration, this can be either: • User Defined: A previously saved user-defined state. • Default: The factory as-shipped state. • Default 0: The factory original setting. The user selects which preset mode is used. • MENU BAR | Utilities | Preset • MAIN | System | SYSTEM | Setup | SETUP | Preset Setup | PRESET SETUP

Frequency, Power, and Sweep Setup Key Group



Frequency Key	Pressing **Frequency** displays the FREQUENCY menu in the user interface display. • MAIN | Frequency | FREQUENCY
Power Key	Pressing **Power** displays the POWER menu in the user interface display. • MAIN | Power | POWER
Sweep Key	Pressing **Sweep** displays the SWEEP menu in the user interface display. • MAIN | Sweep Setup | SWEEP SETUP
Average Key	Pressing **Avg** displays the AVERAGING menu in the user interface display. • MAIN | Averaging | AVERAGING

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

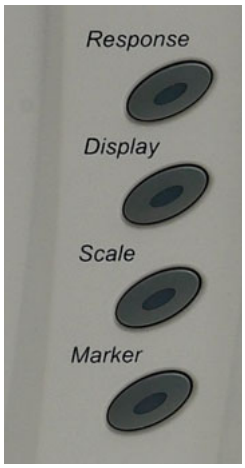
Key Name	Primary Functions
Response, Display, Scale, and Marker Key Group	
	
Response Key	Pressing **Response** displays the Response menu in the user interface display. The RESPONSE menu displayed depends on whether the instrument is in 2-Port or 4-Port mode. • MAIN | Response | RESPONSE
Display Key	Pressing **Display** displays the Display menu in the user interface display. • MAIN | Display | DISPLAY
Scale Key	Pressing **Scale** displays the Scale menu in the user interface display. • MAIN | Scale | SCALE menu
Marker Key	Pressing **Marker** displays the Marker menu in the user interface display. • MAIN | Marker | MARKERS [1]
Channel and Trace Key Group	
	
Channel Key	Pressing **Channel** displays the Channel menu in the user interface display. • MAIN | Channel | CHANNEL
Trace Key	Pressing **Trace** displays the Trace menu in the user interface display. • MAIN | Trace | TRACE

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

Key Name	Primary Functions
	Navigation and Data Entry Keys 
Rotary Knob	The operation of the Rotary Knob varies depending on the cursor focus. On selections, rotating the **Rotary Knob** clockwise moves the selection down. Rotating counterclockwise moves the selection up. On menus, moves the button focus up or down. On field toolbars, increases or decreases the field value. Pressing the **Rotary Knob** starts the action of the selected menu button or applies the input value of the selected field toolbar.
Up Arrow Key	Pressing **Up** moves the cursor or selection up.
Down Arrow Key	Pressing **Down** moves the cursor or selection down.
Left Arrow Key	Pressing **Left** moves the cursor or selection to the left.
Right Arrow Key	Pressing **Right** moves the cursor or selection to the right.
Select Key	Pressing **Select** starts the action of the selected menu button. Same as pressing the **Rotary Knob**.

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

Key Name	Primary Functions
Keypad and Data Entry Key Group	
	
Keypad Digit Keys	Used to enter digits from **0 (zero)** to **9 (nine)**.
. (Decimal) Key	Used to enter a decimal point.
+/- (Plus/Minus) Key	Toggles an entered value between **+ (plus)** and **– (minus)**.
Backspace / Delete Key	Deletes characters and moves the cursor to the left.
Enter Key	Causes the user-defined value or the field toolbar value to be entered into the instrument.
Clear/Tab Key	Clears the value of a field or tabs forward to the next field.

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

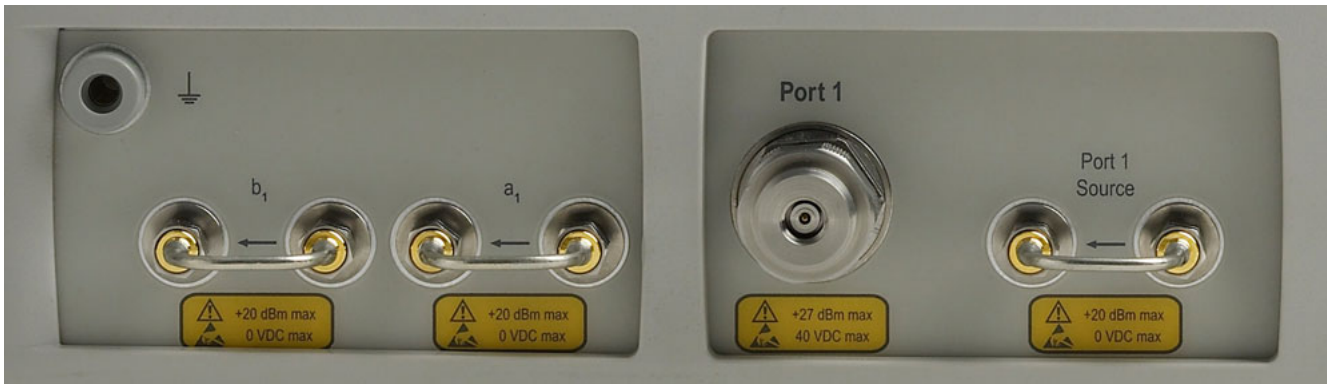
Key Name	Primary Functions
Test Port 1 and Loop Connectors	
	
Test Port 1	Universal Test Port Connector • K (m) for MS4642A and MS4644A • V (m) for MS4645A and MS4647A • Damage Input Levels: +27 dBm max., 40 VDC max. • Exchangeable in case of damage.
Port 1 Source	Source paths, ≥ 2.5 GHz coverage. • K (f) for MS4622A and MS4644A. • V (f) for MS4645A and MS4647A. • Damage Input Levels: +20 dBm max., 0 VDC max. • Optional. Included with Option 051, 061, and 062. This port is also used to interface with MN469xB Series 4-Port Test Sets and ME78x8x Series Broadband/Millimeter Wave Systems.
b_1 Test Receiver - Port 1	Test receiver paths. • As above. • Optional. Included with Option 051, 061, and 062.
a_1 Reference Receiver - Port 1	Reference receiver paths. • As above. • Optional. Included with Option 051, 061, and 062.

Table 3-1. Front Panel Hard Keys and Functions (7 of 8)

Key Name	Primary Functions
	Test Port 2 and Loop Connectors 
Test Port 2	Universal Test Port Connector. • K (m) for MS4622A and MS4644A • V (m) for MS4645A and MS4647A • Damage Input Levels: +27 dBm max., 40 VDC max. • Exchangeable in case of damage.
Port 2 Source	Source paths, ≥ 2.5 GHz coverage. • K (f) connectors for the MS4642A and MS4644A VNAs. • V (f) connectors for the MS4645A and MS4647A VNAs. • Damage Input Levels: +20 dBm max., 0 VDC max. • Optional. Included with Option 051, 061, and 062. This port is also used to interface with MN469xB Series 4-Port Test Sets and ME7828x Series Broadband/Millimeter Wave Systems.
b_2 Test Receiver - Port 2	Test receiver paths. • As above. • Optional. Included with Option 051, 061, and 062.
a_2 Reference Receiver - Port 2	Reference receiver paths. • As above. • Optional. Included with Option 051, 061, and 062.
	Front Panel USB Ports 
USB Ports	USB 2.0 Type A Ports, two (2) each. • For peripherals such as keyboard, mouse, memory stick, or hardware key. • There are two additional USB 2.0 Type A Ports located on the rear panel.

3-4 Rear Panel Ports and Connectors

The MS4640A Series VNA rear panel connectors are shown below in Figure 3-2, “MS4640A Series VNA Rear Panel Ports and Connectors (1 of 2)” on page 3-12 which provides identification of each connector and port.

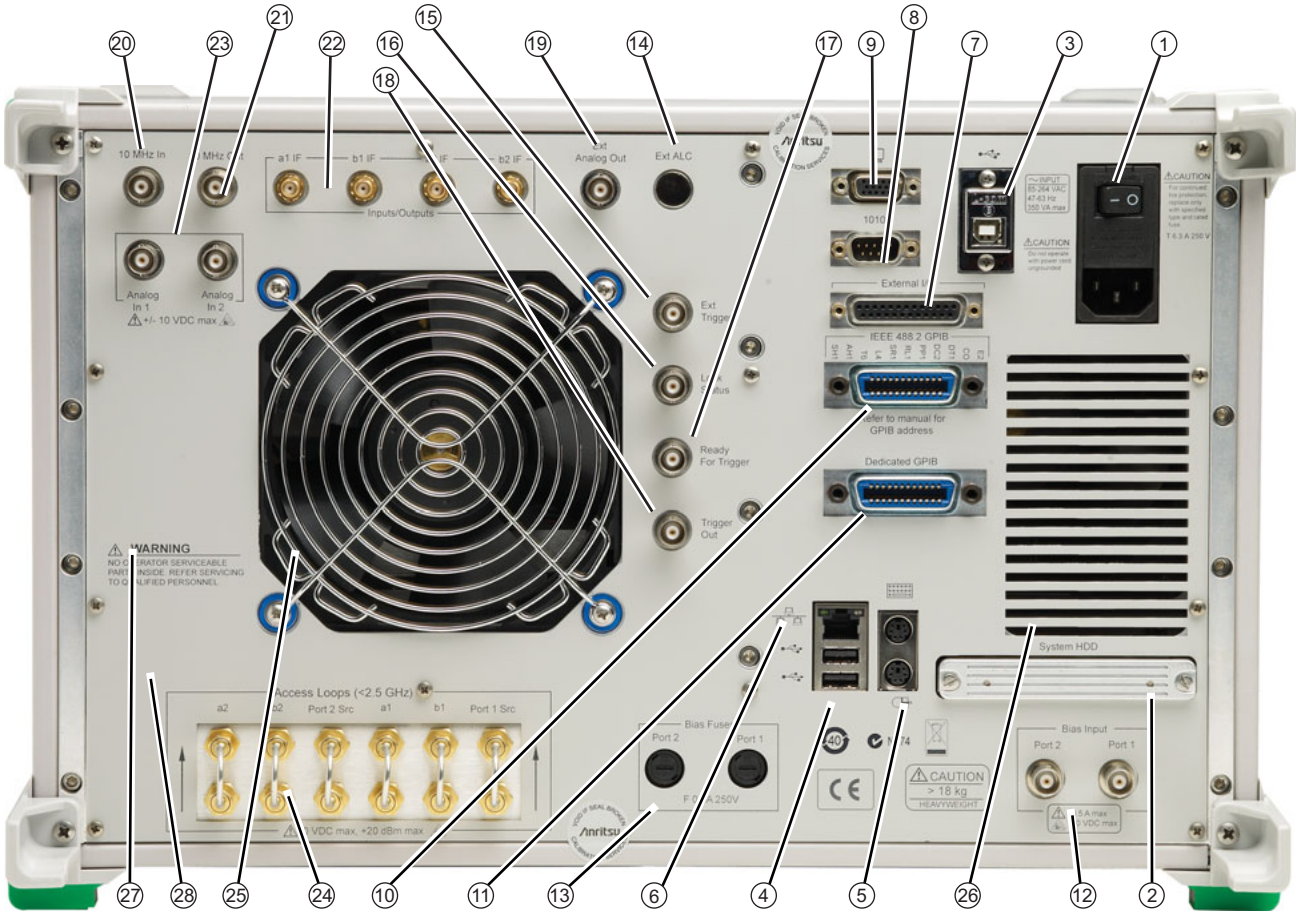


Figure 3-2. MS4640A Series VNA Rear Panel Ports and Connectors (1 of 2)

All ports and controls are standard and equipped on all models unless otherwise noted.

1. AC Input Module Connector: Contains the AC Power Rocker Switch, the AC Power Internal Fuses (located under the switch), and the IEC C14 Chassis AC Power Socket.
2. System SDD: The internal Solid State Drive.
3. USB 2.0 Type B Port: USB connection when instrument is controlled by a USB controller.
4. USB 2.0 Type A Ports: USB connection ports for computer peripheral devices such as a printer, keyboard, or mouse. Note that there two (2) additional USB 2.0 Type A Ports on the front panel.
5. Keyboard PS/2 Mini-DIN Port and Mouse PS/2 Mini-DIN Port
6. 10/100BaseT Ethernet Port: RJ-45 LAN port.
7. External I/O 25-pin D-Sub Connector (f)
8. Serial (10101) 9-pin D-Sub Connector (f): A standard RS-232C serial port for computer peripherals. Also for instrument control of special purpose peripherals such as AutoCal calibrator modules.
9. XGA/VGA 15-pin D-Sub Connector (f)
10. IEEE 488.2 GPIB (f) Port: GPIB port for GPIB talker/listener.
11. Dedicated GPIB (f) Port: GPIB port for control of peripheral devices such as a Power Meter or External Source.
12. Bias Input Ports: Bias Input Port 2 (on left) and Bias Input Port 1 (on right)
13. Bias Fuses: Bias Fuse Port 2 (on left) and Bias Fuse Port 1 (on right)
14. Ext. ALC BNC (f) – External Automatic Leveling Control.
15. Ext. Trigger BNC (f) – External Trigger.
16. Lock Status BNC (f)
17. Ready for Trigger BNC (f)
18. Trigger Out BNC (f)
19. Ext. Analog Out BNC (f) – External Analog Out.
20. 10 MHz In BNC (f)
21. 10 MHz Out BNC (f)
22. IF Input/Outputs: a1 IF Input/Output (on left), b1 IF Input/Output (on left center), a2 IF Input/Output (on right center), and b21 IF Input/Output (on right)
23. Analog Inputs: Analog In 1 (on left) and Analog In 2 (on right)
24. Access Loops: Optional.
    - Only equipped with MS4640A VNAs with Option 051, 061, or 062.
    - If equipped, the < 2.5 GHz Access Loops are (from left to right): a2 Access Loop, b2 Access Loop, Port 2 Src Access Loop, a1 Access Loop, b1 Access Loop, and Port 1 Src Access Loop.
25. Fan Grill
26. Internal Air Cooling Opening
27. Service warning
28. Anritsu Company Instrument Serial Number and Installed Options Sticker.

Figure 3-2. MS4640A Series VNA Rear Panel Ports and Connectors (1 of 2)

Rear Panel Port and Connector Descriptions

A summary of the VectorStar VNA rear panel connectors is available in Table 3-2 below. The table defines each connector's name, its connector type and general specifications. The External I/O Connector also provides a connector pin-out diagram.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

Connector Name	Primary Function / Cross References
AC Power Connectors and Controls 	
AC Power Input Module	Contains the **AC Power Rocker Switch**, the **AC Power Internal Fuses** (under the switch) and the **IEC C14 Chassis AC Power Socket**, described in rows below.
AC Power Rocker Switch	**Power On** Used to the turn the VNA on and off where "**|**" is ON and "**O**" is OFF. **Standby to Operate Mode** Once turned on, the VNA is in standby mode. On the front panel, press and hold the left side **Standby/Operate** key for at least one (1) second to place the VNA in operate mode. **Operate to Standby Mode** With the VNA in operate mode, press and hold the **Standby/Operate** key for at least one second to return the VNA to standby mode. **Power Off** Only turn off the VNA when it is in standby mode. Do not disconnect the AC power while the VNA is in operate mode. Do not turn off the VNA while it is in operate mode.
AC Power Internal Fuses	Use the tab in the **AC Power Rocker Switch** (described above) to remove the fuse cover and access the fuses. Two (2) T-Type 6.3 A 250 Volt internal fuses Rated for 700 VA max. 90-264 VAC, 47-63 Hz (power factor controlled)

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

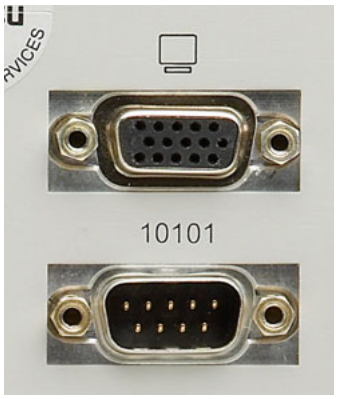
Connector Name	Primary Function / Cross References
IEC C14 Chassis AC Power Socket	Allows for a cable connection to AC mains power using the IEC C13 AC Line Socket on the provided power cord. The other end of the provided power cord provides a plug suitable for the instrument location.
USB Control Port 	
USB Control Port	USB 2.0 Type B Port controlling the instrument externally and for remote operation.
XGA/VGA and Serial (10101) Ports 	
XGA/VGA Video Port	15-pin Mini D-Sub (f) Connector For simultaneously projecting the instrument's screen display onto an external VGA monitor, with minimum resolution of 1024 x 768.
Serial (10101) Port	9-pin Mini D-Sub (f) Connector Compatible with RS-232C. Provides control for AutoCal modules and other accessories.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

Connector Name	Primary Function / Cross References
External Analog Out Ports 	
External (Ext) Analog Out	BNC (f) Connector External Analog Output. For external attenuator control, external switch control, analog triggering assistance, measurement system integration and other purposes. Normal operating modes: Sawtooth sync sweep, TTL indication of driving port, open loop level controller. Range: -10 V to +10 V; low impedance drive. Accuracy: 20 mV + 2%.
External (Ext) Automatic Level Control (ALC)	BNC (f) Connector External Automatic Level Control.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

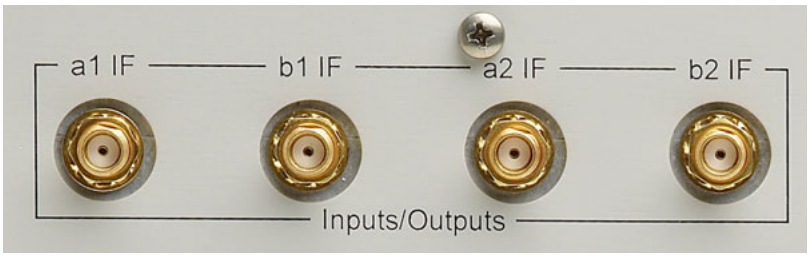
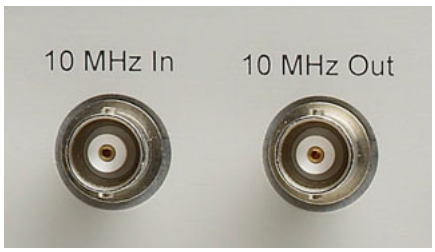
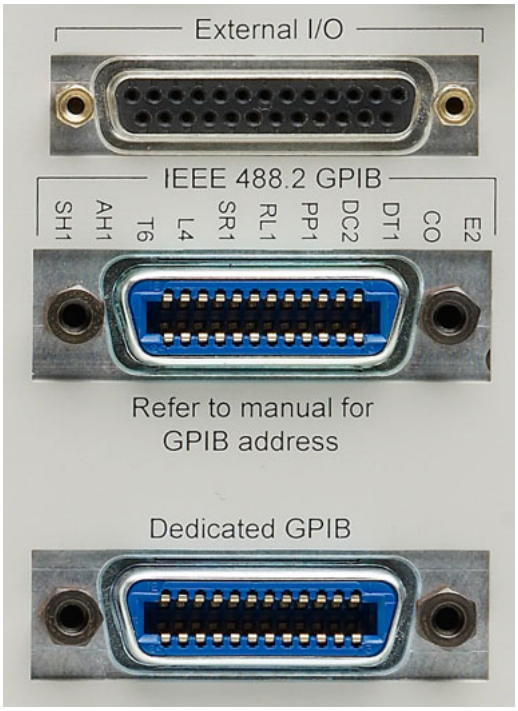
Connector Name	Primary Function / Cross References
IF Input/Output Loop Connectors 	
Input/Outputs a1 IF	SMA (f) Connectors Inputs used with external converters such as Millimeter Wave (mmW) modules, or for antenna testing. Outputs used with external IF digitizers and processors. Nominal Inputs: 5 to 20 MHz (mode dependant), 0 dBm for full scale Nominal. Outputs: 0.2 to 100 MHz (mode dependant), +10 dBm max. These ports also used to interface with the VectorStar ME7828x Broadband/Millimeter Wave Systems.
Input/Outputs b1 IF	SMA (f) Connectors As above.
Input/Outputs a2 IF	SMA (f) Connectors As above.
Input/Outputs b2 IF	SMA (f) Connectors As above.
10 MHZ Input/Output Ports 	
10 MHz Input	BNC (f) Connector Auto-sensing, better than 0.001 Hz/Hz accuracy recommended. Signal: –10 dBm to +3 dBm, Nominal 50 Ohms.
10 MHz Output	BNC (f) Connector Derived from the internal reference time base, unless an external 10 MHz reference input is applied. 0 ± 5 dBm sinusoidal, 50 Ohms

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

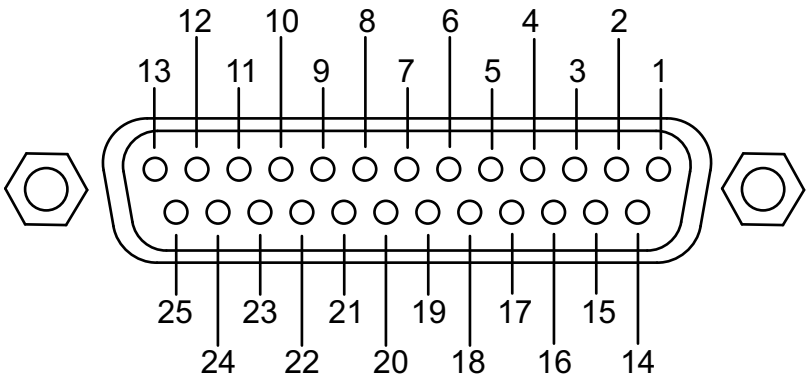
Connector Name	Primary Function / Cross References

External I/O and GPIB Ports



External I/O Port	25-pin D-Sub (f) connector. User-defined I/O for custom external test set interface, to synchronize with different sweep states, such as Start, Stop, or Driven Port. The next section provides a pin out diagram of the connector.

External I/O Port Connector Pin Out



Pin Number	Pin Name – Description
1	Limit Pass/Fail – Indicates the results of limit testing for all channels. User selectable from the Limit Line setup menu. (0 V to 3.3 V) TTL-high = Fail or TTL-low = Fail.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

Connector Name	Primary Function / Cross References
2, 3, 15, 16	TTL In – Configurable as a digital input for use in sending information to the instrument from external sensors or input devices. The inputs are TTL compatible and 5 V tolerant.
4, 13, 14, 21	GND – Digital signaling ground.
5 - 12, 17-20, 22	TTL Out – Configurable as a digital output for use in sending information to external devices, handlers, and output processors. The outputs are 0 V low and +3.3 V high and are TTL compatible.
23 - 25	Reserved – Reserved for controlling Anritsu external test sets.
IEEE 488.2 GPIB Port	24-Pin (f) GPIB Connector GPIB talker/listener port IEEE 488.2 compatible, for controlling the instrument externally, for remote operation.
Dedicated GPIB Port	24-Pin (f) GPIB Connector. Dedicated GPIB controller port For the control of external instruments such as power meters, external test sets, or other GPIB compatible accessories.

External Trigger and Lock Ports



Ext Trigger	BNC (f) Connector External Trigger

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

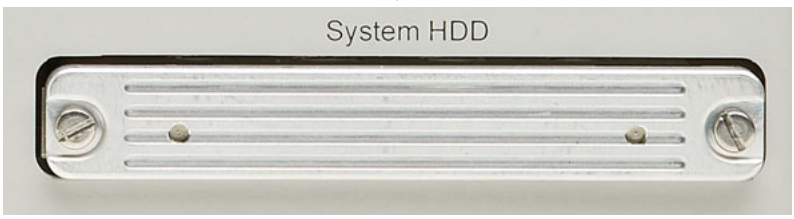
Connector Name	Primary Function / Cross References
Lock Status	BNC (f) Connector Trigger Lock Status
Ready for Trigger	BNC (f) Connector
Trigger Out	BNC (f) Connector

Analog In Ports



Analog Input 1	BNC (f) Connector Independent input for measurements simultaneous with the RF measurements, for current sensing, efficiency computation, and power detection. Range: –10 V to +10 V with automatic offset and gain calibrations. Accuracy: 2 mV + 2% for |V| < 5 V; 2% for |V| > 5 V Nominal input impedance: 60 K Ohms.
Analog Input 2	BNC (f) Connector As above.

System Hard Disk Drive (HDD)



System SSD/HDD	The system removable Soid State Drive (or Hard Disk Drive on older VNAs). If spare drives are available, the SSD/HDD can be quickly exchanged for security or other reasons.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

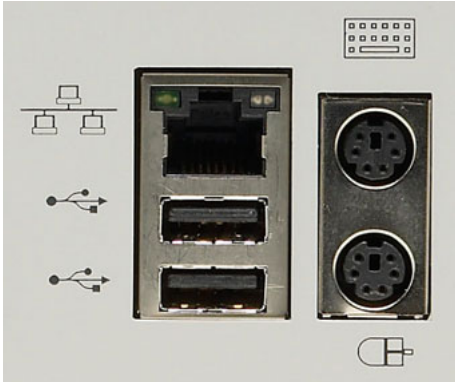
Connector Name	Primary Function / Cross References
Network, USB, and PS2 Connectors	
	
LAN Ethernet Port	10/100BaseT Ethernet RJ-45 Connector. Standard.
Universal Series Bus (USB) 2.0 Type A Ports	USB 2.0 Type A Ports, two (2) on Rear Panel. For peripherals such as keyboard, mouse, memory stick, and hardware key. There are two additional USB 2.0 Type A Ports located on the front panel.
Keyboard/Mouse PS/2 Ports	Dedicated Mini-DIN PS/2 ports, two (2) on Rear Panel. Used to connect a PS/2 keyboard and/or a PS/2 mouse. With a user-supplied **PS/2 to USB** adapter, can be used to connect a USB keyboard and USB mouse, sparing the USB 2.0 ports for additional peripherals.
Bias Input Ports	
	
Bias Input Port 1 Connector	BNC (f) Connector. One input per Bias Input Port Optional. Equipped with Option 051, 061, or 062.
Bias Input Port 2 Connector	BNC (f) Connector. As above.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

Connector Name	Primary Function / Cross References
Bias Fuses 	
Bias Fuse Port 1	Fuse Connector Included with optional Bias Input Ports above. One fuse per Bias Input Port Fuses are F-Type rated at 0.5 A, 250 V.
Bias Fuse Port 2	Fuse Connector As above.

Table 3-2. VectorStar MS4640A Series VNA Rear Panel Connectors (1 of 10)

Connector Name	Primary Function / Cross References
Access Loops (< 2.5 GHz) 	
a2 Access Loop	SMA (f) port with SMA (m) loop. Receiver path for Port 2 For <2.5 GHz frequency coverage. Damage Input Level: +20 dBm max., 0 VDC max.
b2 Access Loop	SMA (f) port with SMA (m) loop. Test receiver path for Port 2. Specifications as above. Also used to connect with the VectorStar MN469xB 4-Port (Multi-Port) Test Sets.
Port 2 Src Loop	SMA (f) port with SMA (m) loop. Port 2 Source path. Specifications as above. Also used to connect with the VectorStar MN469xB 4-Port (Multi-Port) Test Sets.
a1 Access Loop	SMA (f) port with SMA (m) loop. Receiver path for Port 1. Specifications as above.
b1 Access Loop	SMA (f) port with SMA (m) loop. Test receiver path for Port 1. Specifications as above. Also used to connect with the VectorStar MN469xB 4-Port (Multi-Port) Test Sets.
Port 1 Src Loop	SMA (f) port with SMA (m) loop. Port 1 Source path. Specifications as above. Also used to connect with the VectorStar MN469xB 4-Port (Multi-Port) Test Sets.

Chapter 4 — User Interface Display

4-1 Chapter Overview

The chapter describes the general display options of the MS4640A Series VNA and provides a general description of the MENU BAR, the ICON TOOLBAR, and the right-side function menus. General descriptions and procedures are provided for channel setup, trace graph setup, marker setup, and limit line setup. The MS4640A Series VNA displays measurement data using a “Channel Concept” where each channel can display both a different S-Parameter (or another specialty parameter) and a different graph type. As each channel is selected, the previously selected trace graph types, scaling, reference delay, S-Parameter, and other parameters associated with that channel appear on the screen. In addition, the same S-Parameter can be displayed simultaneously on two or more channels using the same or different trace graph types.

4-2 User Interface Main Screen

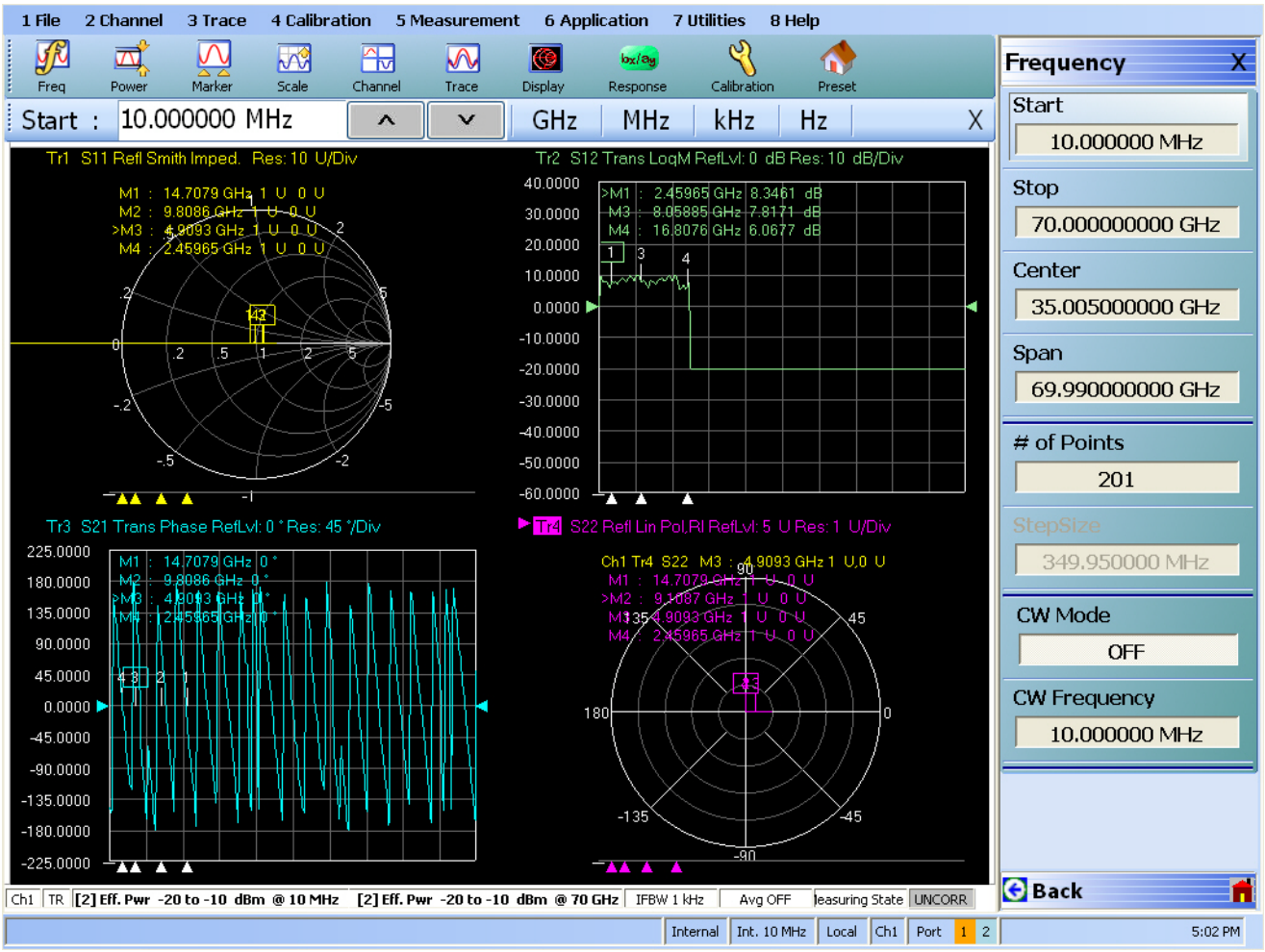


Figure 4-1. User Interface - Single Channel - Four Traces

Single Channel User Interface Control and Display Areas

The entire instrument main display is a touch screen that can be manipulated by touching, or by clicking on with an attached USB mouse. The figure below shows the general display areas for a single channel displaying four graphical traces.

	When using the touch screen, a recommended best practice is to use a positive hard press to make sure the required setting in input into the system. A light touch may not change the instrument setting as required.
Note	To recalibrate the touch screen, navigate to the CALIBRATE TOUCH SCREEN dialog box located at **MAIN | System | SYSTEM | Utility | UTILITY | Calibrate Touch Screen | TOUCH SCREEN CONTROL PANEL dialog box**. The procedure is described in in the **User Interface Manual – 10410-00307**.
	A detailed touch screen calibration and adjustment procedure is described in the **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268**.

Multiple Channel User Interface Control and Display Areas

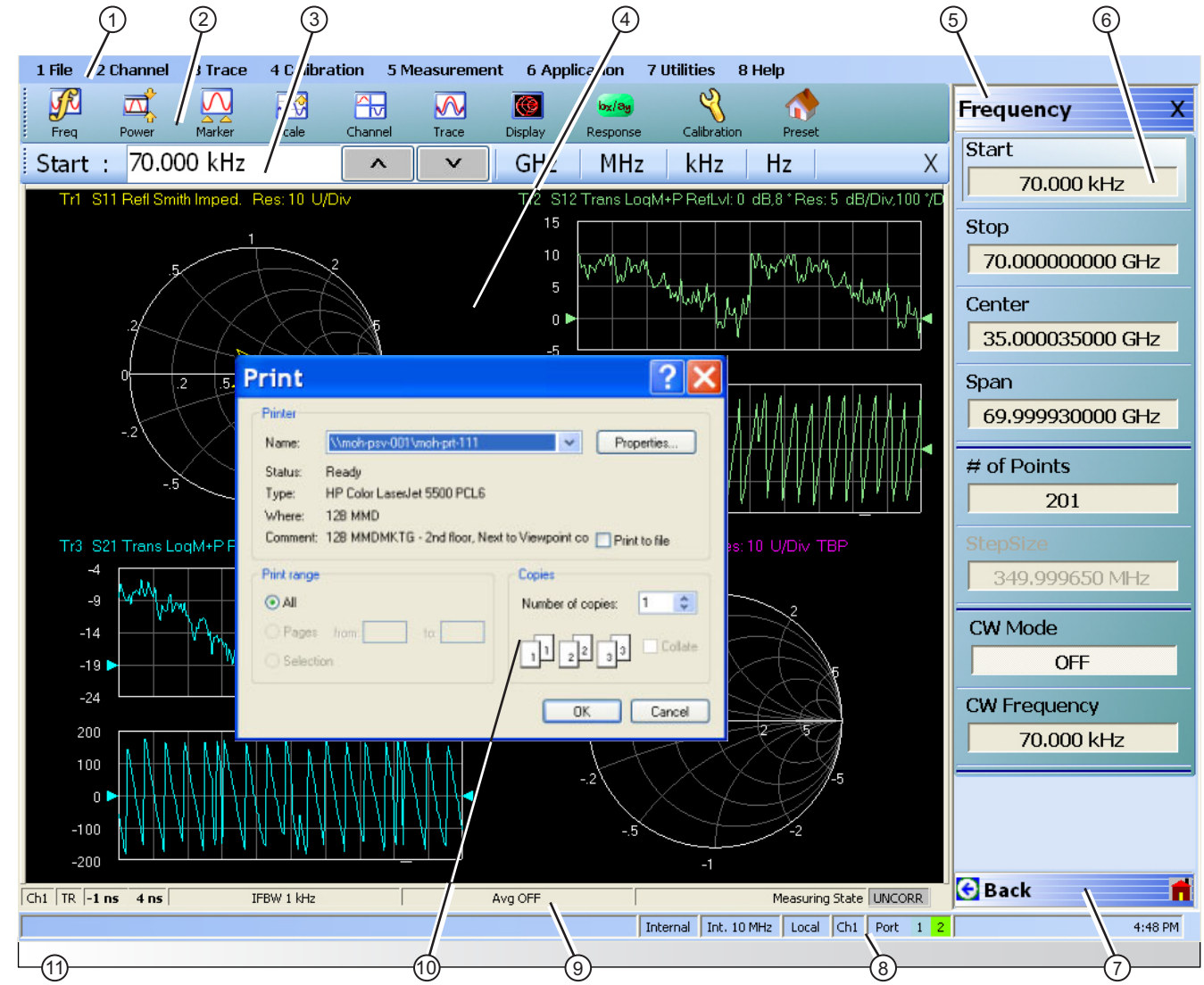


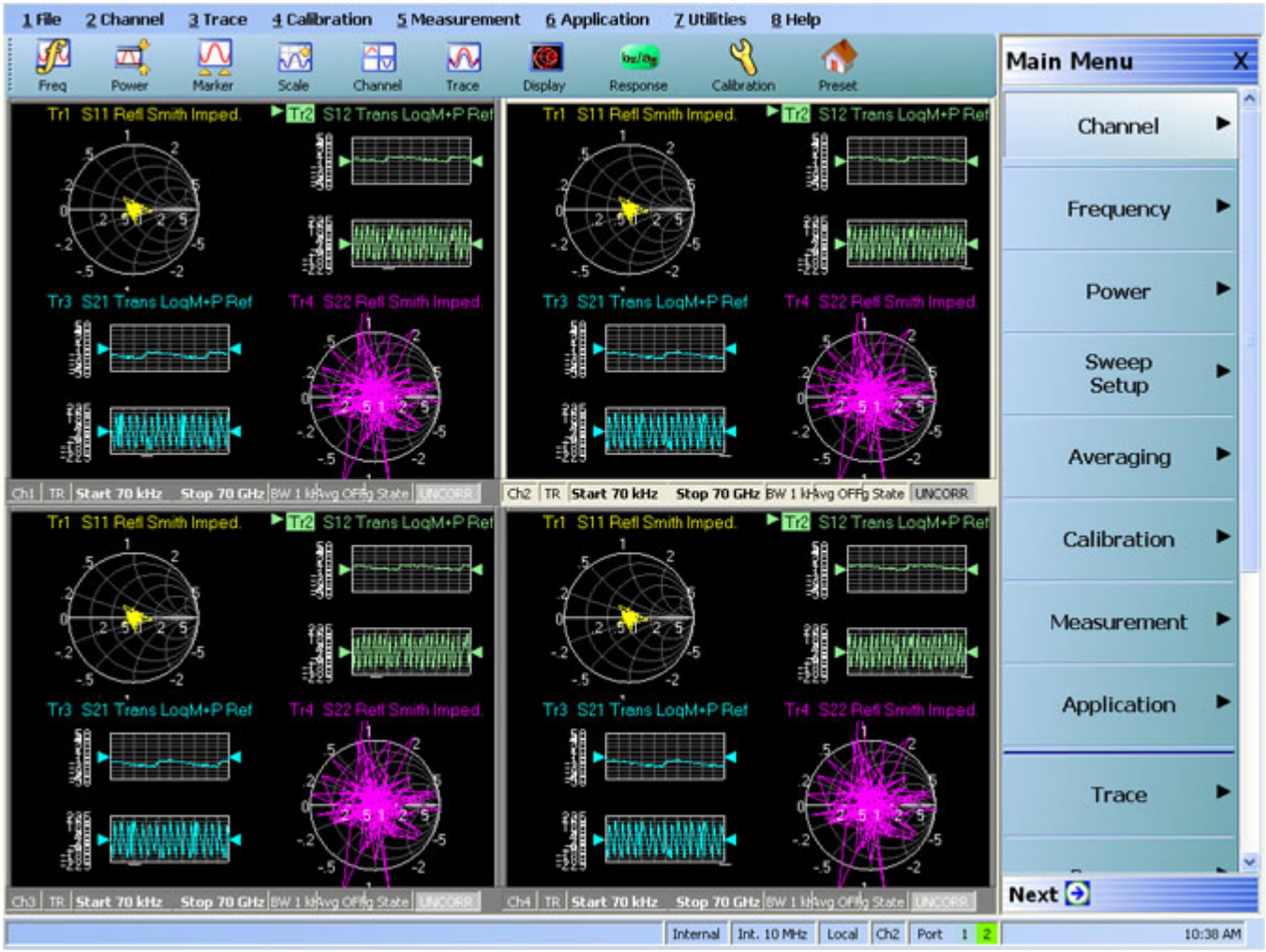
Figure 4-2. User Interface Display Areas (1 of 2)

1. Menu Bar – Displays eight (8) drop-down menus: File, Channel, Trace, Calibration, Measurement, Application, Utilities, and Help.
2. Icon Toolbar – User-configured with up to 10 user-selected quick access icons.
3. Field Toolbar – Appears only when field button is clicked for input. Display field for value, with one or more units (such as dB, dBm, or Hz), an Enter button, and an X close button.
4. Display Area – Displays from one to 16 channels. Each channel can have from one to 16 trace display graphs. Each trace display can optionally have from one to 12 markers, a reference marker, and an upper and lower limit line.
5. Menu Title – Displays the name of the displayed right-side menu. Menu titles are unique to each menu.
6. Menu Buttons – The menu buttons allow the user to set parameters, make configuration selections, read result values, start processes, toggle between two or more values, display sub-menus, and display dialog boxes.
7. Menu Navigation Buttons – The navigation buttons always appear at the bottom of the right-side menu and allow browser-like forward and backward navigation through the user's history. Back returns to previous selected higher-level menu, Next returns to a previously selected lower-level menu), and Home returns to the Main Menu.
8. System Status Bar – Displays status messages, and configuration status that affects the entire instrument.
9. Channel Status Bar – Provides status for each channel display near the bottom of the screen. If multiple channels are displayed, there is a separate status bar for each channel display.
10. Dialog Box Display Area – Most dialog boxes, whether from the VNA or from the underlying operating system, appear in the center of the display area.
11. Tableau Data Display/Input Area – The tableau area only appears when the appropriate menu button is selected. When selected, the display shrinks upwards and the tabular data area expands.

Figure 4-2. User Interface Display Areas (2 of 2)

For all VectorStar VNA models, if the instrument is in 25,000 point mode, multiple channels can be selected by the user.

For VectorStar MS4640A Series VNAs, in 100,000 point mode, the instrument is limited to one channel. Each available channel can have up to 16 graphical traces. The figure below shows an instrument setup with four channels, each with four traces. The channel and trace display layout shown below is user-defined as a 2 × 2 configuration for channels and traces.



Four Channels — Each channel with Four Traces — 16 Total Traces

Figure 4-3. User Interface - 16 Traces

Function Access

The MS4640A Series VNA provides multiple methods to access the menus and functions that include:

- Front panel keys
- Attached USB mouse
- Attached USB keyboard
- Display touch screen

Each of the methods above can manipulate the instrument through the five major user interface areas on the main display:

- The top MENU BAR with its drop-down menus and menu commands.
- The ICON TOOLBAR with up to 10 single-click functions, available as a default configuration or as a user-definable configuration of icon functions.
- The right side APPLICATION MENU system that provides access to over 100 function menus, sub-menus, dialog boxes, and configuration options.
- For some parameters, selecting a button displays a FIELD TOOLBAR that appears just below the icon toolbar allowing input of parameter values and units.
- For some parameters, selecting a button displays a CONFIGURATION or SETUP TABLEAU below the main display area for input of complex parameter sets such as segmented frequency or power sweeps.

To Select a Channel

1. To select a channel in a multi-channel display, do one of the following:
   - Click anywhere inside the desired channel box.
   - From the keyboard, **ALT + 2 then 7** to view the previous channel or **ALT + 2 then 8** to view the next channel.
   - On the top menu bar, select MENU BAR | Channel | Channel Prev or MENU BAR | Channel | Channel Next.
   - On the right side menu, select MAIN | Channel | CHANNEL | Chan Next or Chan Previous.
2. The selected channel border changes from gray to white. Above, Figure 4-3, “User Interface - 16 Traces” on page 4-5 shows Channel 2 (Ch2) selected.

Note	The **Ch->Max**, **Ch->Next**, and **Ch-Prev** icons are available for the icon toolbar. These icons provide one click access to channel maximum, channel next, and channel previous functions. They can be added to the icon toolbar for a custom configuration and saved as part of a preset configuration.

To Maximize a Channel Display

1. Use one of the methods above to select the desired channel.
2. Do one of the following to maximize the selected channel:
   - From the keyboard, enter **CTRL + 1** or **ALT + 2, then 6**.
   - On the main display, double-click on the channel border box.
   - On the top menu bar, select MENU BAR | Channel | Channel Max.
   - On the right side menu, select MAIN | Channel | CHANNEL | Chan. Max.
3. The selected channel now fills the display area.
   - Maximize a channel display to review the channel status information at the bottom of its screen.

To Make the Display Area Larger

1. The top icon toolbar and the right side menus can be removed to make the display area larger.
2. Remove the icon toolbar by doing one of the following:
   - From the keyboard, select **ALT + 7 then 2**
   - On the top menu bar, select MENU BAR | Utilities | Toolbar Off.

3. The icon toolbar disappears. Repeat **Step #2** to make the icon toolbar re-appear.
4. Remove the right side menus by doing one of the following:
   - From the keyboard, enter **ALT + 7 then 7**
   - On the top menu bar, select MENU BAR | Utilities | Clear.
5. The right side menu disappears. Repeat **Step #4** to make the menu re-appear.

To Select Traces within a Channel

1. Use one of the methods above to maximize the channel display.
2. To select a trace in a multi-trace display, do one of the following:
   - With a mouse, single click the trace title.
     - If you double-click either the trace title or anywhere within the trace, the trace is both selected and maximized.
   - From the keyboard, enter **ALT + 3 then 7** to view the previous trace or **ALT + 3 then 8** to view the next trace.
   - On the top menu bar, select MENU BAR | Trace | Trace Prev or MENU BAR | Trace | Trace Next.
   - On the right side menu, select MAIN | Trace | TRACE | Trace Previous or Trace Next.
   - The selected trace number is highlighted and a left arrow appears.



Trace 1 Selected	Trace 1 Not Selected

Figure 4-4. Trace Selection Indicator

Note	The **Tr->Max**, **Tr->Next**, and **Tr->Previous** icons are available for the icon toolbar. These icons provide one click access to trace maximum, trace next, and trace previous functions. They can be added to the icon toolbar for a custom configuration and saved as part of a preset configuration.

To Maximize a Trace Display

1. Use one of the methods above to select the desired trace.
2. For a maximum display, make sure the trace's channel is maximized.
3. Do one of the following to maximize the selected trace:
   - From the keyboard, select **ALT + 3, then 6**.
   - On the main display, double-click anywhere in the trace display.
   - On the top menu bar, select MENU BAR | Trace | Trace Max.
   - On the right side menu, select MAIN | Trace | TRACE | Trace Max.
4. The selected trace now fills the display area.
   - Maximize a trace display to review the trace status information at the bottom of trace screen.
5. Repeat the actions above to return the trace to its normal size.

4-3 Using the Front Panel Keys

Most front panel keys go directly to a specific first-level menu or sub-menu function. See Chapter 3, "Front and Rear Panels" for a detailed description of all front panel keys and ports.

Table 4-1. Front Panel Hard Key Summary

Key Name	Primary Functions
Power Key	Pressing the **Power** key toggles the VNA between Operate mode and Standby mode. Before using this key, make sure the rear panel **AC Power Input Connector Switch** is set to **ON**.
Calibration Key	Pressing **Calibration** displays the user interface Calibration menu.
Measurement Key	Pressing **Measurement** displays the Measurement menu in the user interface display.
Application Key	Pressing **Application** displays the Application menu in the user interface display.
System Key	Pressing **System** displays the System menu in the user interface display.
File Key	Pressing **File** displays the File menu in the user interface display.
Help Key	Pressing **Help** displays the Help menu in the user interface display.
Preset Key	Returns the instrument to the last active configuration preset loaded.
Frequency Key	Pressing **Frequency** displays the Frequency menu in the user interface display.
Power Key	Pressing **Power** displays the Power menu in the user interface display.
Sweep Key	Pressing **Sweep** displays the Sweep menu in the user interface display.
Average Key	Pressing **Avg** displays the Averaging menu in the user interface display.
Response Key	Pressing **Response** displays the Response menu in the user interface display.
Display Key	Pressing **Display** displays the Display menu in the user interface display.
Scale Key	Pressing **Scale** displays the Scale menu in the user interface display.
Marker Key	Pressing **Marker** displays the Marker menu in the user interface display.
Channel Key	Pressing **Channel** displays the Channel menu in the user interface display.
Trace Key	Pressing **Trace** displays the Trace menu in the user interface display.

4-4 Using the Menu Bar Interface

Menu Bar Overview

The menu bar at the top of the screen provides eight drop-down menus for quick access to major VectorStar VNA menu functions and dialogs. The configuration is fixed and not user-configurable. The figure below shows all of the available MENU BAR functions and command menus.

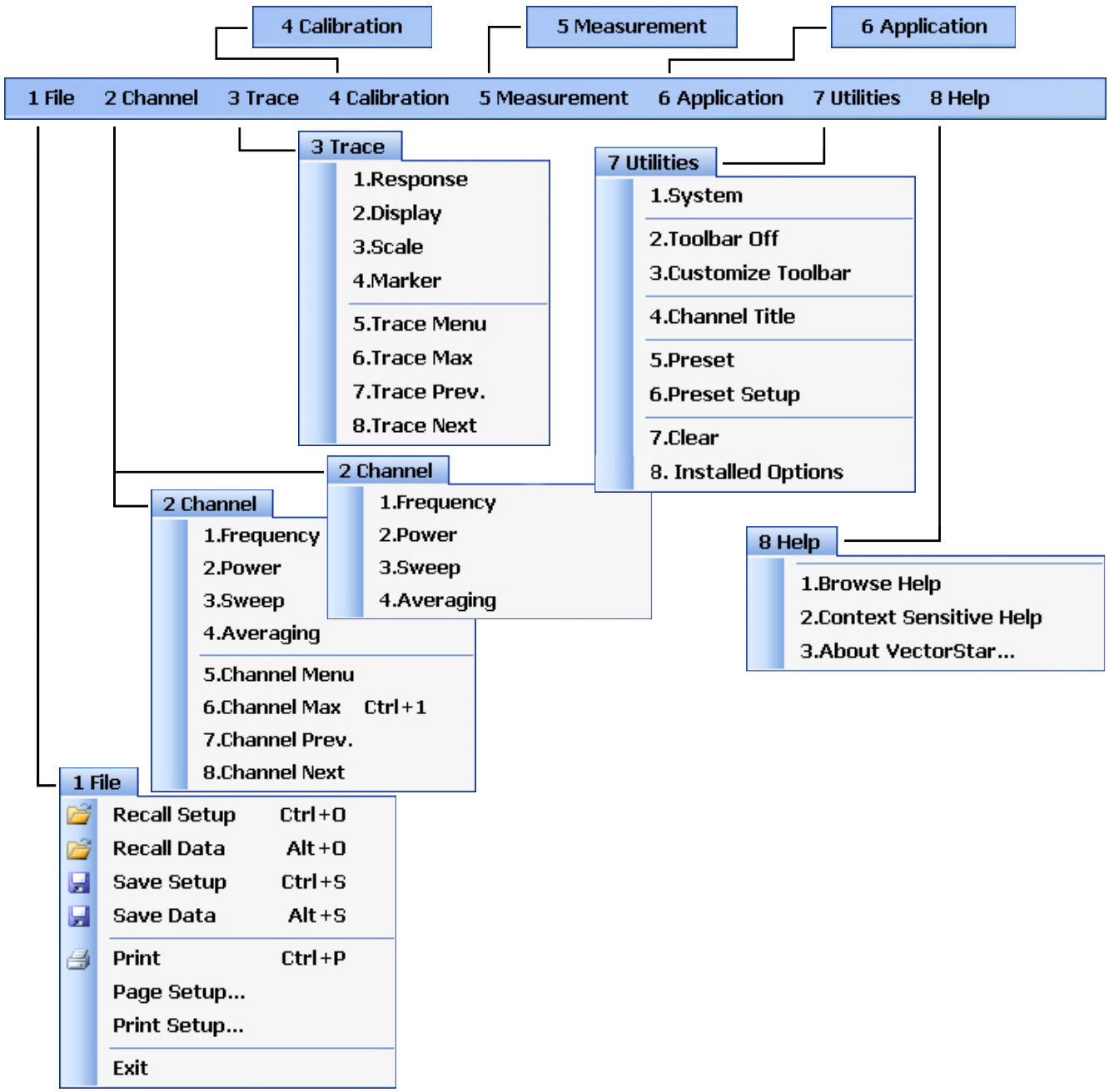


Figure 4-5. MENU BAR Major Functions, Drop-Down Menus, and Commands (1 of 2)

The appearance of the **CHANNEL** menu depends on the instrument point mode. For all VectorStar VNA models, if the instrument is in 25,000 point mode, the **CHANNEL** menu has eight selections, as shown in the left CHANNEL menu.	For VectorStar VNA models, if the instrument is in 100,000 point mode, the **CHANNEL** menu has only four selections, as shown in the right CHANNEL menu.

Figure 4-5. MENU BAR Major Functions, Drop-Down Menus, and Commands (2 of 2)

Menu Bar General Operation

The MENU BAR drop-down menus and commands can be accessed by clicking on the menu bar and required command.

The keyboard can be used to enter the menu and/or command short cut, most of which use the **ALT (ALTERNATE)** key. To access a menu from the keyboard, press and hold the **ALT (ALTERNATE)** key and the number in front of the menu name.

- For example, **ALT+1** opens the FILE menu.
- For example, **ALT+7** opens the UTILITY menu.

To access most commands listed on the drop-down menus, follow the **ALT +** sequence with the menu command number.

- For example, to access the Preset command on the UTILITIES menu, enter **ALT+7, and then 5.**
- For example, to access the right side SYSTEM menu, enter **ALT+7m and then 1**.

Some MENU BAR menu commands can also be accessed by using the keyboard **Control (CTRL)** key. Press and hold the **CTRL** key and then the letter key.

- For example, to recall a previously saved setup, enter **CTRL + O (letter O).**
- For example, to print the current display screen, enter **CTRL + P.**

Menu Bar Drop-Down Menus and Commands

The menu bar appears at the top of the instrument display and provides direct access to system menus and some button functions.

The table below summarizes all menu bar drop down commands and provides cross references to sections that describe the resultant menu or command in greater detail.

Table 4-2. Menu Bar Drop-Down Menu Descriptions (1 of 12)

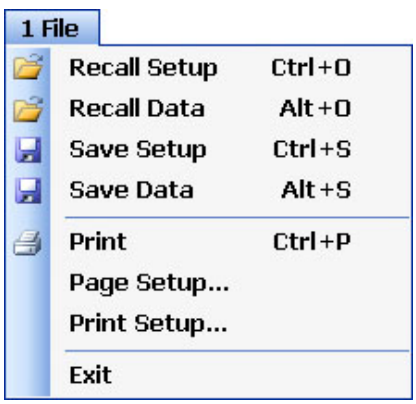
Menu and Command Name	Menu and Command Descriptions
FILE Drop-Down Menu	 • Keyboard: ALT + 1 • MENU BAR | File • MAIN | File | FILE

Table 4-2. Menu Bar Drop-Down Menu Descriptions (2 of 12)

Menu and Command Name	Menu and Command Descriptions
Recall Setup Command	Select displays the RECALL SETUP dialog box and allows the recall of previously saved setup and/or calibration files: – Active Channel Setup and Calibration (.chx) File – Active Channel Setup (.stx) File – All Channel Setup (.sta) File • Keyboard: CTRL + O (letter O) • MENU BAR | File | Recall Setup • MAIN | File | FILE | Recall Setup | RECALL SETUP Dialog Box
Recall Data Command	Select displays the RECALL DATA dialog box and allows the recall of a previously saved active channel and/or active trace data file of these types: – Active Channel S2P (.s2p) File – Formatted Data into Active Trace (.tdf) File – Unformatted Data into Active Trace (.tdu) File – Formatted Data into Active Trace Memory (.tdf) File – Unformatted Data into Active Trace Memory (.tdu) File • Keyboard: Keyboard: ALT + O (letter O) • MENU BAR | File | Recall Data • MAIN | File | FILE | Recall Data | RECALL DATA Dialog Box
Save Setup Command	Select displays the Save Setup dialog box and allows the user to save the currently applied system presets configuration file. • Keyboard: CTRL + S • MENU BAR | File | Save Setup • MAIN | File | FILE | Save Setup | SAVE SETUP Dialog Box
Save Data Command	Select displays the SAVE DATA (Active Channel .txt) dialog box. Use this dialog to save the current channel data file. • Keyboard: ALT + S • MENU BAR | File | Save Data • MAIN | File | FILE | Save Data | SAVE DATA Dialog Box
Print Command	Select displays the Windows PRINT dialog box to print the current main display. • Keyboard: CTRL + P • MENU BAR | File | Print • MAIN | File | Print | PRINT Dialog Box
Page Setup Command	Select dispays the Windows PAGE SETUP dialog box with controls for: • Paper size • Paper source tray at printer • Orientation as Portrait or Landscape • Margins for Left, Right, Tol, and Bottom

Table 4-2. Menu Bar Drop-Down Menu Descriptions (3 of 12)

Menu and Command Name	Menu and Command Descriptions

Print Setup Command	Select displays the PRINT SETUP dialog box. The controls allow the print output to be customized as required. The following paramaters can be set:
	• Output Format – Can be set as Bitmap with Page Setup, 4 Trace Graphical, or 4 Trace Tabular.
	• Header Output – Include Header – The header configuration set in the fields below can be included or left off print reports. Each field can be separately configured to be included or not.
	  • Header Output – Model – Provides an input field for model number information such as the DUT or VNA model.
	  • Header Output – Operator Name – Provides an input field for operator name or other identification.
	  • Header Output – Device ID – Provides an input field for the DUT identification.
	  • Header Output – Operator Comment – Provides a large free form input field for comments about the DUT or test.
	• Logo Setup – Include Logo – The logo set in the fields below can be included or left off print reports.
	  • Select Logo Type – Anritsu – The default selection set an Anritsu logo or user defined logo in BMP graphics format.
	  • Select Logo Type – User – If a user logo is selected, the graphic file it must be copied onto the VectorStar VNA in a known location. Then use the Browse button to navigate to the logo file.

Exit Command	Select displays a confirmation dialog box. Click OK to exit the VectorStar application and return to the Windows OS desktop. Click Cancel to remain in the VectorStar application. • MENU BAR | File | Exit

Table 4-2. Menu Bar Drop-Down Menu Descriptions (4 of 12)

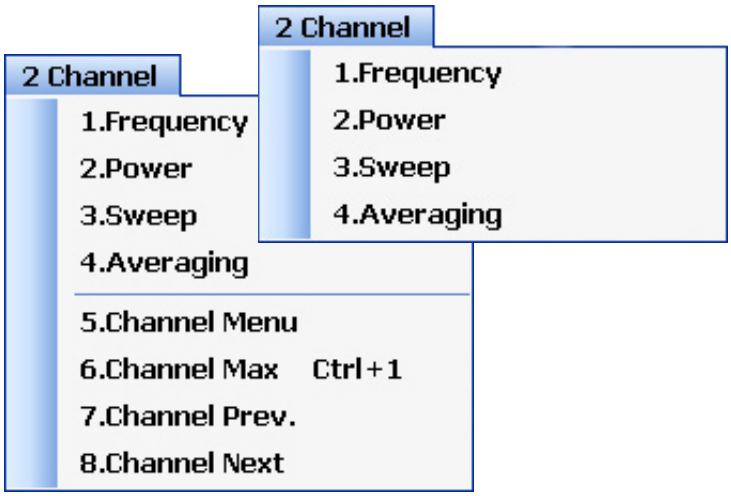
Menu and Command Name	Menu and Command Descriptions
CHANNEL Drop-Down Menu	 • CHANNEL menu for 25,000 point mode shown at left. • CHANNEL menu for 100,000 point mode short at right. • Keyboard: ALT + 2 • MENU BAR | Channel • MAIN | Channel | CHANNEL
Frequency	Select displays the right-side FREQUENCY menu. • Front Panel Key: Frequency • Keyboard: ALT + 2 then 1 • MENU BAR | Channel | Frequency • MAIN | Frequency | FREQUENCY
Power	Select displays the right-side POWER menu. • Front Panel Key: Power • Keyboard: ALT + 2 then 2 • MENU BAR | Channel | Power • MAIN | Power | POWER
Sweep	Select displays the right-side SWEEP SETUP menu. • Front Panel Key: Sweep • Keyboard: ALT + 2, then 3 • MENU BAR | Channel | Sweep • MAIN | Sweep Setup | SWEEP SETUP
Averaging	Select displays the right-side AVERAGING menu. • Front Panel Key: Avg (Average) • Keyboard: ALT + 2 then 4 • MENU BAR | Channel | Averaging • MAIN | Averaging | ADVERAGING

Table 4-2. Menu Bar Drop-Down Menu Descriptions (5 of 12)

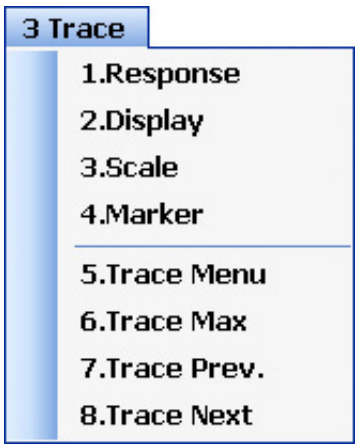
Menu and Command Name	Menu and Command Descriptions
Channel Menu Command	Select displays the right-side CHANNEL menu. • Prerequisites: Instrument must be in 25,000 point mode. • Front Panel: **Channel Key** • Keyboard: **ALT + 2, then 5** • MENU BAR | Channel | Channel Menu • MAIN | Channel | CHANNEL
Channel Max Command	Select maximizes the display of the active channel. Select again returns to the previous multi-channel display. • Prerequisites: Instrument must be in 25,000 point mode. • Keyboard: ALT + 2, then 6 • Keyboard: CTRL + 1 • MENU BAR | Channel | Channel Max • MAIN | Channel | CHANNEL | Chan. Max
Channel Previous Command	Selects the next lower channel number. If channel 1 was previously selected, selects the highest numbered channel. • Prerequisites: Instrument must be in 25,000 point mode. • Keyboard: **ALT + 2, then 7** • MENU BAR | Channel | Channel Prev. • MAIN | Channel | CHANNEL | Chan. Previous
Channel Next Command	Selects the next higher channel number. If the highest numbered channel was previously selected, selects channel 1. • Prerequisites: Instrument must be in 25,000 point mode. • Keyboard: **ALT + 2, then 8** • MENU BAR | Channel | Channel Next • MAIN | Channel | CHANNEL | Chan. Next
TRACE Drop-Down Menu	 • Keyboard: ALT + 3 • MENU BAR | Trace • MAIN | Trace | TRACE

Table 4-2. Menu Bar Drop-Down Menu Descriptions (6 of 12)

Menu and Command Name	Menu and Command Descriptions
Response Command	Select displays the right-side RESPONSE menu. • Front Panel Key: Response • Keyboard: ALT + 3 then 1 • MENU BAR | Trace | Response • MAIN | Response | RESPONSE
Display Command	Select displays the right-side DISPLAY menu. • Front Panel Key: Display • Keyboard: ALT + 3, then 2 • MENU BAR | Trace | Display • MAIN | Display | DISPLAY
Scale Command	Select displays the right-side SCALE menu. The name of the SCALE menu (and the buttons on it) depend on the display type selected such as: – Scale (Log Mag) – Scale (Lin Mag) – Scale (Phase) – Scale (Real) – Scale (Imag) – Scale (SWR) • Front Panel Key: Scale • Keyboard: ALT + 3, then 3 • MENU BAR | Trace | Scale • MAIN | Scale | SCALE
Marker Command	Select displays the right-side MARKERS [1] menu. • Front Panel Key: Marker • Keyboard: ALT + 3, then 4 • MENU BAR | Trace | Marker • MAIN | Marker | MARKER [1]
Trace Menu Command	Select displays the right-side TRACE menu. • Front Panel Key: Trace • Keyboard: ALT + 3, then 5 • MENU BAR | Trace | Trace Menu • MAIN | Trace | TRACE
Trace Max Command	Select maximizes the active trace to full screen display. Selecting again, returns the trace to the standard multi-trace display. • Keyboard: ALT + 3, then 6 • MENU BAR | Trace | Trace Max • MAIN | Trace | TRACE | Trace Max

Table 4-2. Menu Bar Drop-Down Menu Descriptions (7 of 12)

Menu and Command Name	Menu and Command Descriptions
Trace Previous Command	Selects the next lower trace number on the active channel. If Trace 1 is currently selected, the highest numbered trace is selected. If the current trace is not maximized, the previous trace will not be maximized. If the current trace is maximized, the previous trace will be maximized. • Keyboard: ALT + 3, then 7 • MENU BAR | Trace | Trace Prev. • MAIN | Trace | TRACE | Trace Previous
Trace Next Command	Selects the next higher trace number on the active channel. If the highest numbered trace is currently displayed, the Trace 1 is displayed. If the current trace is not maximized, the next trace will not be maximized. If the current trace is maximized, the next trace will be maximized. • Keyboard: ALT + 3, then 8 • MENU BAR | Trace | Trace Next • MAIN | Trace | TRACE | Trace Previous

Table 4-2. Menu Bar Drop-Down Menu Descriptions (8 of 12)

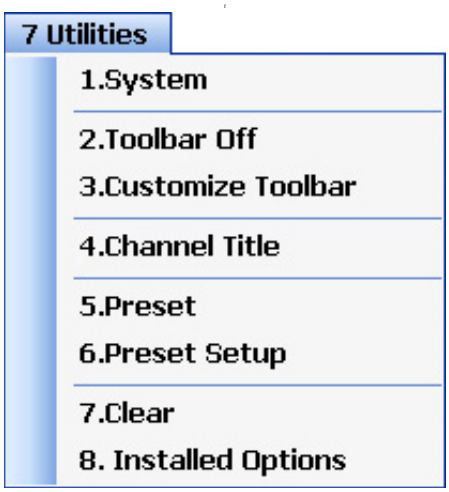
Menu and Command Name	Menu and Command Descriptions
CALIBRATION Drop-Down Menu	 The CALIBRATION drop-down menu has one command that selects the right-side CALIBRATION menu • Keyboard: ALT + 4 • MENU BAR | Calibration • MAIN | Calibration | CALIBRATION
MEASUREMENT Drop-Down Menu	 Select displays the right-side MEASUREMENT menu. • Front Panel Key: Measurement • Keyboard: ALT + 5 • MENU BAR | Measurement • MAIN | Measurement | MEASUREMENT
APPLICATION Drop-Down Menu	 The APPLICATION menu/command selects the right-side APPLICATION menu. • Front Panel Key: Application • Keyboard: ALT + 6 • MENU BAR | Application • MAIN | Application | APPLICATION
UTILITY Drop-Down Menu	 • Keyboard: ALT + 7 • MENU BAR | Utilities

Table 4-2. Menu Bar Drop-Down Menu Descriptions (9 of 12)

Menu and Command Name	Menu and Command Descriptions
System Command	Select displays the right-side SYSTEM menu. • Front Panel Key: System • Keyboard: ALT + 7, then 1 • MENU BAR | Utilities | System • MAIN | System | SYSTEM
Toolbar Off Command	Toggles the ICON TOOLBAR, immediately below the MENU BAR, on and off. • Keyboard: ALT + 7, then 2 • MENU BAR | Utilities | Toolbar Off
Customize Toolbar Command	Select displays the CUSTOMIZE TOOLBAR dialog box and allows the user to select which icons are to be displayed in the toolbar. Up to 10 icons can be displayed at one time and there are a total of 32 available icons. The Icon Toolbar configuration is saved when a Preset Save is completed. • Keyboard: ALT + 7, then 3 • MENU BAR | Utilities | Customize Toolbar
Channel Title Command	Select displays the DISPLAY SETUP menu and allows a user-defined title to be applied to and displayed above the active channel. Each channel can have a different or the same title. • Keyboard: ALT + 7, then 4 • MENU BAR | Utilities | Channel Title • MAIN | Display | DISPLAY | Display Area Setup | DISPLAY SETUP | Edit Chan. Title | EDIT CHANNEL TITLE Dialog Box
Preset Command	• Returns the instrument to its prior saved state which can be either the factory-default preset, or a user-defined setup. The PRESET SETUP menu selection defines which is used. • Front Panel Key: Preset • Keyboard: ALT + 7, then 5 • MENU BAR | Utilities | Preset • No right-side menu available to preset the instrument: – Use either the Front Panel **Preset Key** or the Menu Bar Function above. • Navigation to the PRESET SETUP: MAIN | System | SYSTEM | Setup | SETUP | Preset Setup | PRESET SETUP
Preset Setup Command	Select displays the PRESET SETUP menu which allows the user to customize whether the preset function restores the instrument to: – User Defined: A previously saved user-defined state. – Default: The factory as-shipped state. – Default 0: The factory original setting. • Keyboard: ALT + 7, then 6 • MENU BAR | Utilities | Preset Setup • MAIN | System | SYSTEM | Setup | SETUP | Preset Setup | PRESET SETUP

Table 4-2. Menu Bar Drop-Down Menu Descriptions (10 of 12)

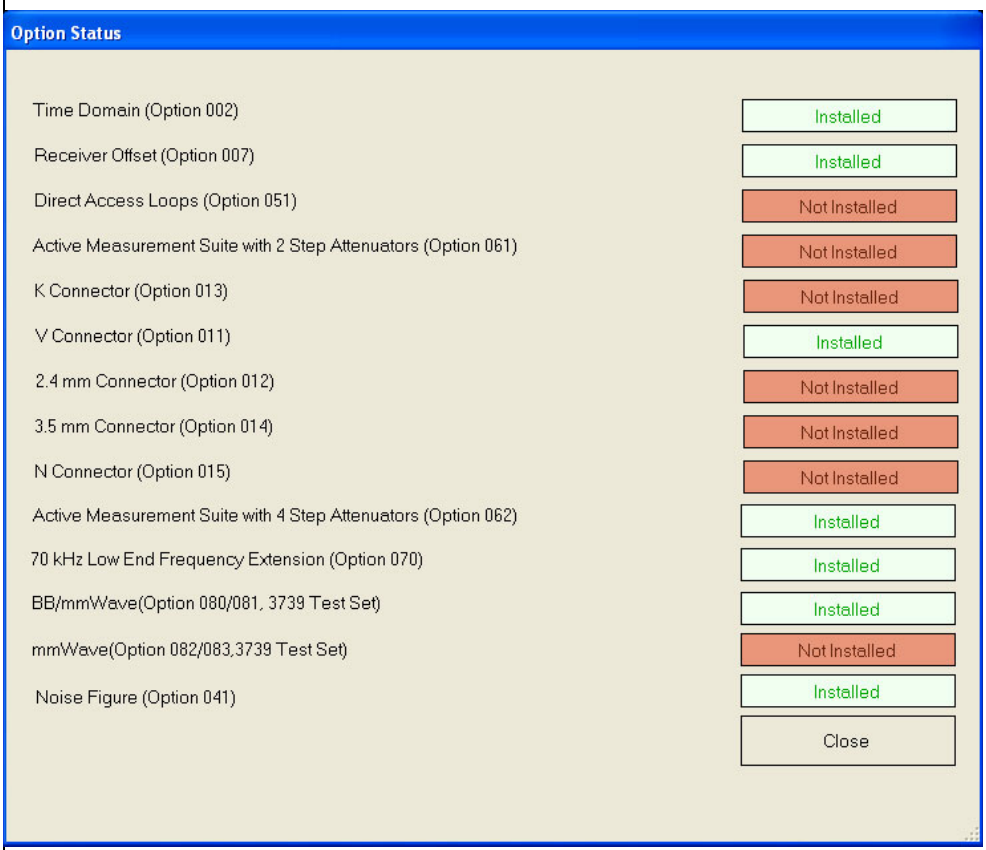
Menu and Command Name	Menu and Command Descriptions
Clear Command	Select toggles the displayed right-side menu off and on. When toggled back on, the previously selected menu is displayed. For example, if the CALIBRATE function menu was displayed when the display was cleared, the CALIBRATE function menu is again displayed when Clear is selected a second time. • Keyboard: ALT + 7, then 7 • MENU BAR | Utilities | Clear Command
Installed Option Command	Select displays the OPTION STATUS dialog box (with a typical display shown below) that lists all installed, included, and not installed instrument options. Click Close to clear.  • Keyboard: **ALT + 7, then 8** • MENU BAR | Utilities | Installed Options • MAIN | System | SYSTEM | Setup | SETUP | Misc. Setup | MISC. SETUP | Installed Options | OPTION STATUS Dialog Box

Table 4-2. Menu Bar Drop-Down Menu Descriptions (11 of 12)

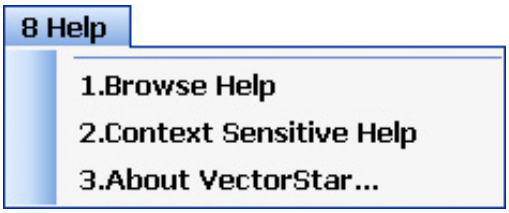
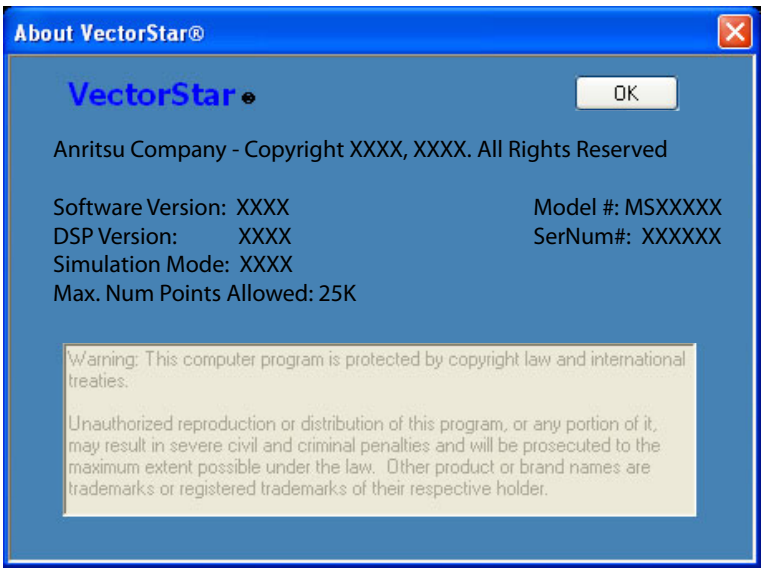
Menu and Command Name	Menu and Command Descriptions
HELP Drop-Down Menu	 • Keyboard: ALT + 8 • MENU BAR | Help
Browse Help Command	Select displays the Help System, typically showing the help system table of contents and topics as an HTML page. The Help System navigation comprises the following main controls: **Contents Tab** – The initial display is with Closed Book icons. Click the Closed Book icon to open it. An Open Book icon appears, listing its Content Topics below the icon. If a single-column topic appears without the left-side navigation functions, click the Show Navigation button to show the left-side navigation and search functions. Any topic can be saved to the Favorites Listing (described below) for rapid access. Click the top-right Printer icon to print the topic to an attached local or network printer. **Search Tab** – The Search tab provides a search field for user entry of a keyword, phrase, or topic. Enter the term in the search field and click Go!. The search results appear in left-side Rank Title listing as Topic Links. Click a Topic Link of interest and the Topic appears in the in the right-side window with the search term highlighted. • Keyboard: ALT + 8, then 1 • MENU BAR | Help | Browse Help
Context Sensitive Help Command	Select displays the context-sensitive help page based on the current right-side menu or topic. This is typically accessed by pressing the front panel Help key. Once enabled, a context-sensitive help page is displayed for each menu selected. • Front Panel Key: Help • Keyboard: ALT + 8, then 2 • MENU BAR | Help | Context Sensitive Help

Table 4-2. Menu Bar Drop-Down Menu Descriptions (12 of 12)

Menu and Command Name	Menu and Command Descriptions
About VectorStar Command	Select displays the ABOUT VECTORSTAR dialog box with typical information as shown below.  The dialog box provides instrument configuration information. Click OK to close the dialog box. The following information is provided: – Copyright Statement – Software Version – DSP Version – Model # (Model Number) – SerNum# (Serial Number) – Max. Num Points Allowed (Maximum number of points allowed in current mode) • Keyboard: ALT + 8, then 3 • MENU BAR | Help | About VectorStar Command

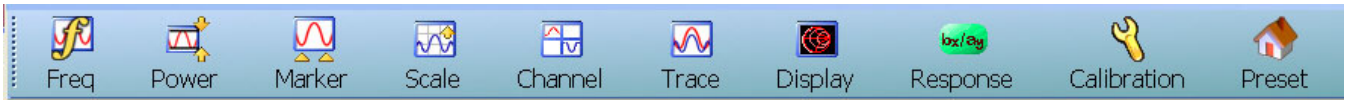
4-5 Icon Toolbar

Overview

The Icon Toolbar is located immediately below the Menu Bar and allows single-click access to over 31 menus and functions. The icon toolbar is user-configurable and up to 10 icons be displayed at in any configuration.

Using the Icon Toolbar Interface

The as-shipped factory default Icon Toolbar is shown below in Figure 4-6.



The definitions and functions of the default icons are (from left to right):

- **Freq Icon** – Select displays the right-side FREQUENCY menu.
- **Power Icon** – Select displays the right-side POWER menu.
- **Marker Icon** – Select displays the right-side MARKERS [1] menu.
- **Scale Icon** – Select displays the right-side SCALE menu.
- **Channel Icon** – Select displays the right-side CHANNEL menu.
- **Trace Icon** – Select displays the right-side TRACE menu.
- **Display Icon** – Select displays the right-side DISPLAY menu.
- **Response Icon** – Select displays the right-side RESPONSE menu.
- **Calibration Icon** – Select displays the right-side CALIBRATION menu.
- **Preset Icon** – Select returns the system to its prior preset status at the time of the last preset save.

All available icons are described in the in Table 4-3.

Figure 4-6. Icon Toolbar with Factory Default Function Icons

Available Icon Functions

The available icon functions that can be added to a user-defined icon toolbar are listed in table below. Once configured, a preset save allows the toolbar configuration to be recalled at any time.

The procedures for changing the icon toolbar are described following the icon table and uses the "CUSTOMIZE (ICON) TOOLBAR Dialog Box" on page 4-27 below. When a user-defined toolbar is configured, the first selected icon goes to the left-most position on the toolbar. The tenth selected icon goes to the right-most position on the toolbar.

Table 4-3. Icon Descriptions - Listed Alphabetically (1 of 6)

Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Application Icon		Select displays the right-side APPLICATION menu. • Front Panel Key: **Application** • Keyboard: ALT + 6 • Menu Bar: MENU BAR | 6 Application | 6 APPLICATION • MAIN | Application | APPLICATION

Table 4-3. Icon Descriptions - Listed Alphabetically (2 of 6)

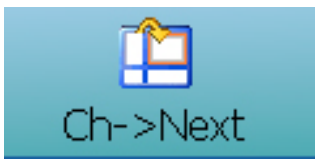
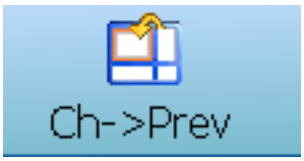
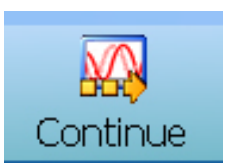
Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Average Icon		Select displays the right-side AVERAGING menu. • Front Panel Key: **Avg (Average)** • Keyboard: ALT + 2, then 4 • MENU BAR | Channel | Averaging • MAIN | Averaging | AVERAGING
Calibration Icon		Default Icon. Select displays the right-side CALIBRATION menu. • Front Panel Key: **Calibration** • Keyboard: ALT + 4 • MENU BAR | Calibration • MAIN | Calibration | CALIBRATION
Ch->Max Icon		When multiple channels are used, select activates and displays the channel with the maximum trace value. • MAIN | Channel | CHANNEL | Chan. Max
Ch->Next Icon		When multiple channels are used, select activates and displays the next higher channel number. If the highest channel number is currently active, channel 1 (one) is activated and displayed. • MAIN | Channel | CHANNEL | Chan. Next
Ch->Prev Icon		When multiple channels are used, select activates and displays the next lower channel number. If channel 1 (one) is currently active, the highest numbered channel is activated and displayed. • MAIN | Channel | CHANNEL | Chan. Previous
Channel Icon		Default Icon. Select displays the right-side CHANNEL menu. • Front Panel Key: **Channel** • Keyboard: ALT + 2 • MENU BAR | Channel | Channel Menu • MAIN | Channel | CHANNEL
Continue Icon		After a system pause or hold with the Hold icon, the Continue icon resumes operation with all prior settings in effect. • MAIN | Sweep Setup | SWEEP SETUP | Hold Functions | HOLD FUNCTIONS | Continue

Table 4-3. Icon Descriptions - Listed Alphabetically (3 of 6)

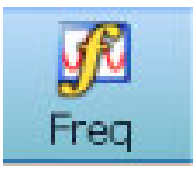
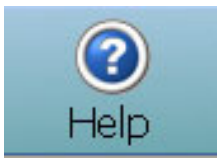
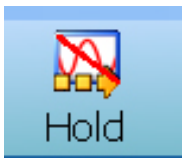
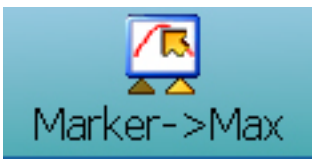
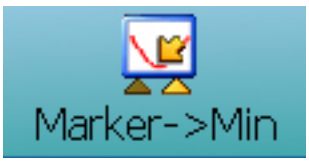
Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Display Icon		Default Icon. Select displays the right-side DISPLAY menu. • Front Panel Key: **Display** • Keyboard: ALT + 3, then 2 • MENU BAR | Trace | Display • MAIN | Trace | TRACE
File Icon		Select displays the right-side FILE menu. • Front Panel Key: **File** • Keyboard: ALT + 1 • MAIN | File | FILE
Freq Icon		Default Icon. Select displays the right-side FREQUENCY menu. • Front Panel Key: **Frequency** • Keyboard: ALT + 2 then 1 • MENU BAR | Channel | Frequency • MAIN | Frequency | FREQUENCY
Help Icon		Select displays the context-sensitive HELP system for the current instrument menu display. Click OK to clear. • Front Panel Key: **Help** • Keyboard: – ALT + 8, then 1 – ALT + 8, then 2 • MENU BAR | Help | Context Sensitive Help
Hold Icon		Select pauses the system operation, retaining all system presets and current configuration settings. • MAIN | Sweep Setup | SWEEP SETUP | Hold Functions | HOLD FUNCTIONS | Hold
Marker->Max Icon		Displays marker with maximum value. • MAIN | Marker | MARKER [1] | Marker Search | MARKER SEARCH | Max
Marker->Min Icon		Select displays the marker with minimum value. • MAIN | Marker | MARKER [1] | Marker Search | MARKER SEARCH | Min

Table 4-3. Icon Descriptions - Listed Alphabetically (4 of 6)

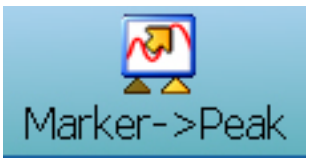
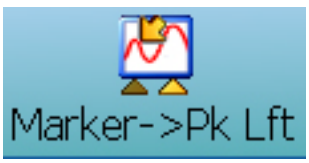
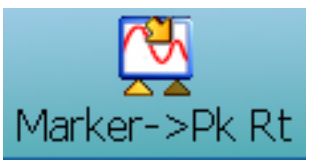
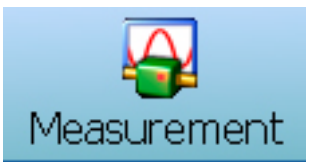
Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Marker->Off Icon		Select turns all marker displays off. • MAIN | Marker | MARKER [1] | Marker Setup | MARKER SETUP | All Markers Off
Marker->Peak Icon		Select displays marker with the highest peak value. • MAIN | Marker | MARKER [1] | Marker Search | MARKER SEARCH | Peak | PEAK | Search Peak
Marker->Pk Lft Icon		Select displays the next peak value marker to the left of current selected marker. • MAIN | Marker | MARKER [1] | Marker Search | MARKER SEARCH | Peak | PEAK | Search Left
Marker->Pk Rt Icon		Select moves the current active marker to the next trace peak value to the right of its current position. • MAIN | Marker | MARKER [1] | Marker Search | MARKER SEARCH | Peak | PEAK | Search Right
Marker Icon		Default Icon. Select displays the right-side MARKERS [1] menu. • Front Panel Key: **Marker** • Keyboard: ALT + 3, then 4 • MENU BAR | Trace | Marker • MAIN | Marker | MARKER [1]
Measurement Icon		Select displays the right-side MEASUREMENT menu. • Front Panel Key: **Measurement** • Keyboard: ALT + 5 • MENU BAR | Measurement | 5 MESUREMENT • MAIN | Measurement
Power Icon		Default Icon. Select displays the right-side POWER menu. • Front Panel Key: **Power** • Keyboard Equivalent: ALT + 2, then 2 • MENU BAR | Channel | Power • MAIN | Power | POWER

Table 4-3. Icon Descriptions - Listed Alphabetically (5 of 6)

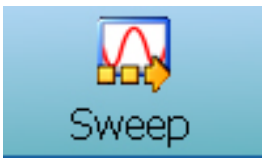
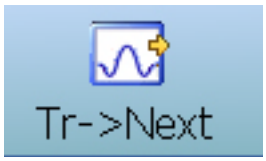
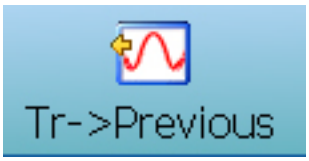
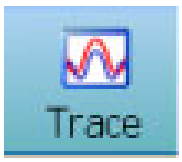
Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Preset Icon		Default Icon. Select returns the system to its prior preset status which is the status at the time of the last preset save. • Front Panel Key: **Preset** • Keyboard: ALT + 7, then 5 • MENU BAR | Utilities | Preset The instrument preset function is only available from the MENU BAR and the instrument front panel key. To setup the preset function, use the PRESET SETUP menu described at the locations below: • MAIN | System | SYSTEM | Preset Setup | PRESET SETUP
Print Icon		Select displays the PRINT dialog box, usually to print a copy of the main display. Once the dialog box appears, click OK to print; click Cancel to abort. • MENU BAR | File | Print • MAIN | File | FILE | Print | PRINT Dialog Box
Response Icon		Default Icon. Select displays the right-side RESPONSE menu. • Front Panel Key: **Response** • Keyboard: ALT + 3, then 1 • MENU BAR | Trace | Response • MAIN | Response | RESPONSE
Scale Icon		Default Icon. Select displays the right-side SCALE menu. • Front Panel Key: **Scale** • Keyboard: ALT + 3, then 3 • MENU BAR | Trace | Scale • Main | Scale | SCALE
Sweep Icon		Select displays the right-side SWEEP SETUP menu. • Front Panel Key: **Sweep** • Keyboard: ALT + 2, then 2 • MENU BAR | Channel | Sweep • MAIN | Sweep | SWEEP
Tr->Max Icon		Select maximizes the display with the currently active trace. • Keyboard: ALT + 3, then 6 • MENU BAR | Trace | Trace Max • MAIN | Trace | TRACE | Trace Max

Table 4-3. Icon Descriptions - Listed Alphabetically (6 of 6)

Icon Name	Icon	Description
Icon Description Definitions		**Default Icons** – These are one of the 10 default icons and are provided after a return to the factory standard configuration. **Front Panel Key** – If available, the front panel hard key that accesses this menu or function. **Keyboard** – If available, the keyboard shortcut to access this menu or function. **Menu Bar** – If available, navigation path to access this menu or function. **Navigation** – To navigate to this menu or function from the MAIN menu. **Description** – If available, where this menu, dialog box, or function is described in greater detail in this document.
Tr->Next Icon		Select displays the next higher trace number. When the highest trace number is reached, the next click displays trace number 1 (one). • Keyboard: ALT + 3, then 8 • MENU BAR | Trace | Trace Next • MAIN | Trace | TRACE | Trace Next
Tr->Previous Icon		Select displays the next lower trace number. When the lowest trace number 1 is reached, the next click displays the highest numbered trace. • Keyboard: ALT + 3 then 7 • MENU BAR | Trace | Trace Prev. • MAIN | Trace | TRACE | Trace Previous
Trace Icon		Default Icon. Select displays the right-side TRACE menu. • Front Panel Key: **Trace** • Keyboard: ALT + 3, then 5 • MENU BAR | Trace | Trace Menu • MAIN | Trace | TRACE

CUSTOMIZE (ICON) TOOLBAR Dialog Box

Use the CUSTOMIZE TOOLBAR dialog box to setup the Icon Toolbar with the icons you need for quick access to commands and functions. Once configured, and after a Preset Configuration save, the Icon Toolbar settings can be recalled with the other preset configuration parameters.

Previous

- "UTILITY Drop-Down Menu" on page 4-17

Keyboard

- **ALT + 7, then 3**

Navigation

- MENU BAR | Utilities | Customize Toolbar | CUSTOMIZE TOOLBAR Dialog Box

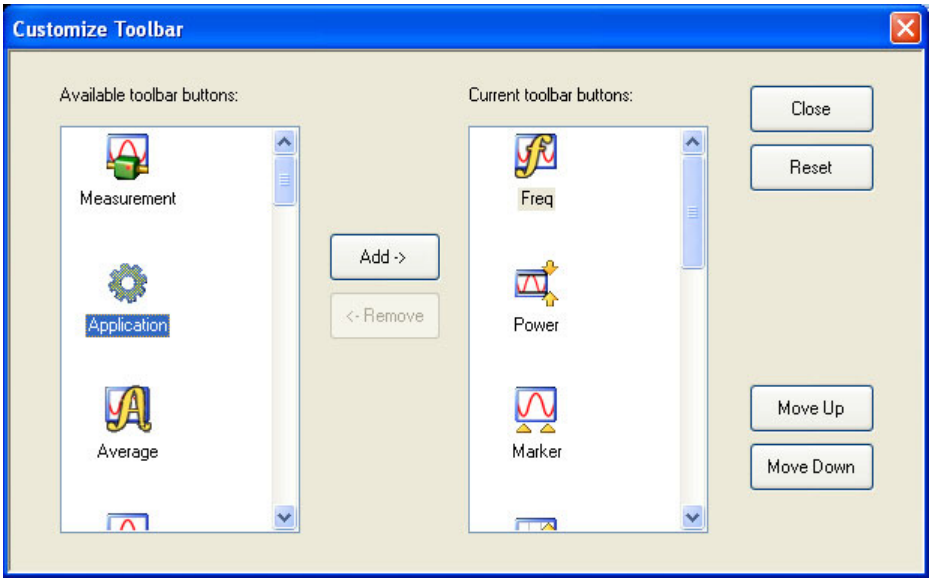


Figure 4-7. CUSTOMIZE TOOLBAR Dialog Box

Procedure

With the CUSTOMIZE TOOLBAR dialog box open, the left-side Available Toolbar Buttons area shows icons that are not in use on the current toolbar, while the right-side Current Toolbar Buttons area shows the current in-use icons.

Removing Icons

1. To change the icons in the current icon toolbar, in the right side Current button area, select an icon to remove. When selected, the Add-> and <-Remove buttons become available.
2. Remove unwanted icons as required by selecting the icon and then clicking the <-Remove button.
3. Removed icons appear at the bottom of the Available Toolbar Buttons list.

Adding Icons

1. Scroll through the Available Toolbar Buttons list and select an icon to add, then click the Add-> button. The selected icon appears in the right side Current Toolbar Buttons area.
2. Repeat the selection process until all required icons listed in the right side Current Toolbar Buttons area or you have reached the maximum of 10 icons.
3. In the Current Toolbar Button display, the icon displayed at the top of the list will appear on the extreme list of the toolbar. The tenth icon displayed at the bottom of the list will appear on the extreme right of the toolbar.

Moving Icons

To change the left to right sequence of the current icons, select an icon, and click the Move Up/Move Down buttons until the icons are correctly positioned left to right.

Saving the Configuration

When the icons are in the correct sequence. Click the Close button to apply the icons to the icon toolbar. It is recommended that a Preset Save be preformed to save the icon toolbar configuration. If the icon toolbar needs adjustment, re-open the Customize Toolbar dialog box and repeat the steps above.

Reset to Factory Default

To return the icon toolbar to its factory default state, click the Reset button.

4-6 MAIN Menu and Application Menus

This section summarizes the MAIN menu which is the home menu for all right-side menu interface menus, dialog boxes, and functions.

Below each menu button name is a link to the individual chapter/help topic that describes that menu and its related submenus in greater detail. For example, the **Frequency** button which calls the FREQUENCY related menus, toolbars, and dialog boxes links to the detailed descriptions in in the **User Interface Manual – 10410-00307** under the description of each menu set.

Note that the actual instrument MAIN menu is longer than the display height and is accessed through the use of side scroll-bars.

MAIN Menu

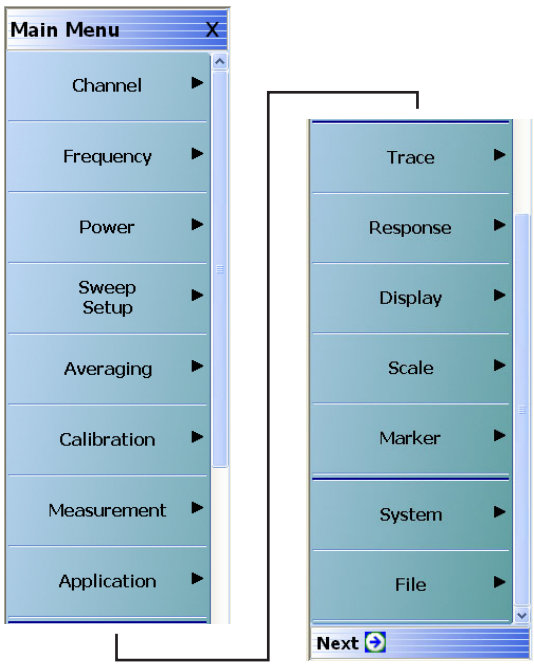


Figure 4-8. MAIN Menu

Channel

Select displays the CHANNEL menu.

- See in the **User Interface Manual – 10410-00307** and the description of the CHANNEL menu.

Frequency

Select displays the FREQUENCY menu. See in the **User Interface Manual – 10410-00307** and the description of the FREQUENCY menus for a general description of the menus. There, each FREQUENCY menu variant is described in greater detail.

Power

Select displays the POWER menu. The POWER menus change depending both the sweep type selected and whether the VNA in 2-Port mode or in 4-Port mode. See the **User Interface Manual – 10410-00307** and the description of the 2-Port and 4-Port Power menus.

Sweep Setup

Select displays the SWEEP SETUP menu.

Averaging

Select displays the AVERAGING menu.

Calibration

Select displays the CALIBRATION menu. The menu version displayed depends on whether the VNA is in 2-Port or 4-Port Mode.

Measurement

Displays the MEASUREMENT menu.

Application

Displays the APPLICATION menu.

Trace

Displays the TRACE menu.

Response

Displays the RESPONSE menu. The menu version displayed depends on whether the VNA is in 2-Port or 4-Port Mode.

Display

Displays the DISPLAY menu.

Scale

Displays the SCALE menu. The SCALE menu has variants depending on the trace type selected. See the SCALE menu chapter in the **User Interface Manual – 10410-00307**.

Marker

Select displays the MARKER [1] menu.

System

Select displays the SYSTEM menu.

File

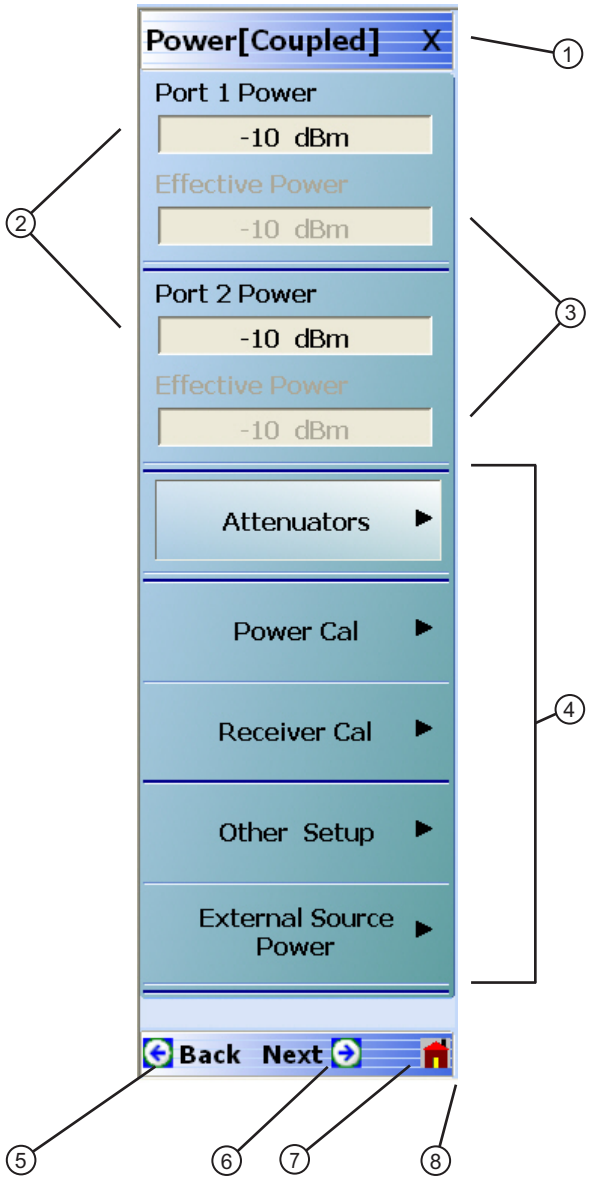
Select displays the FILE menu.

The rest of this chapter describes the operation of the interface.

4-7 Using the Main Menu Interface

Types of Menus, Menu Buttons, and Menu Toolbars

The Main Menu (or MAIN) is the right-side navigation function for the instrument. The Main Menu has multiple types of menus, menu buttons, and menu toolbars that allow the user to configure and control the operation of the VNA. Each menu consists of the elements shown in the figure below.



1. Menu Title – Each menu title is unique.
2. Field Buttons – The button shows the currently selected value. Selecting the button displays a field toolbar.
3. Display Buttons – Read-only calculated display based on parameters entered at other buttons and toolbars.
4. Menu Buttons – Displays a menu or dialog box.
5. Back Button – Returns to a higher-level menu.
6. Next Button – If available, displays a sub-menu that has been already selected.
7. Home Button – Returns to the MAIN menu.
8. Scroll Bar – Not shown in this example, long menus have a right-side scroll bar to display all options.

Figure 4-9. Menu and Button Components

Menu Title

At the top of the menu, a unique menu title, which is not repeated on any other menu. For space reasons, menu names are often abbreviated. For definitions, see Appendix C, "Abbreviation Glossary".

Menu Buttons

One or more menu buttons that either call a sub-menu, allow for a field value to be specified, toggle a function off or on, or allow a selection to be made from a group of choices. If the menu is longer than one screen, a scroll box and scroll arrows appear on the right side of the menu.

Menu Navigation Buttons

The menu navigation area buttons appear at the bottom of each menu.



Back Button

The Back button returns the menu display to last selected higher-level menu.

Next Button

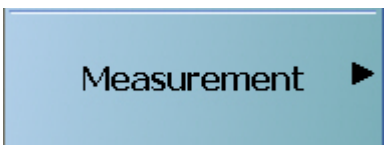
The Next button returns the menu display to the next deeper sub-menu that has already been selected. The availability of the Back and Next buttons (above) depends on the user's navigation path. The Home button (below) always appears.

Home Button

The Home button returns the menu display to the MAIN menu.

Menu Buttons

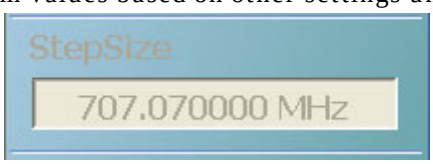
Menu buttons call lower-level menus.



For example, the Measurement button on the MAIN menu calls the MEASUREMENT menu. Most button names show the name of the called sub-menu.

Display Button

Read-only display buttons show system values based on other settings and parameters.



For example, the Step Size display button shows the step size for each point based on a frequency span of 70 GHz using 100 measuring points.

Plain Buttons

Plain buttons start a process or display an operating system dialog box. If they start a process, the button is usually dimmed while the process is running, and when complete, the button is returned to normal brightness.

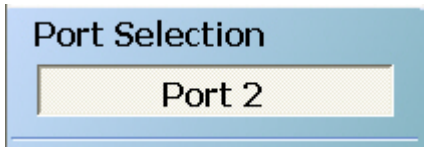


Toggle Buttons

Toggle buttons cycle through two or more values with each click of the button and display their current setting in the button field. For example, in the POWER CALS menu, the Port Selection button displays an initial setting of Port 1.



Clicking the Port Selection button selects Port 2.

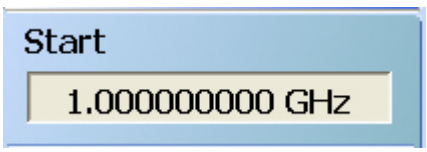


Clicking the Port Selection button a second time returns the setting to Port 1.



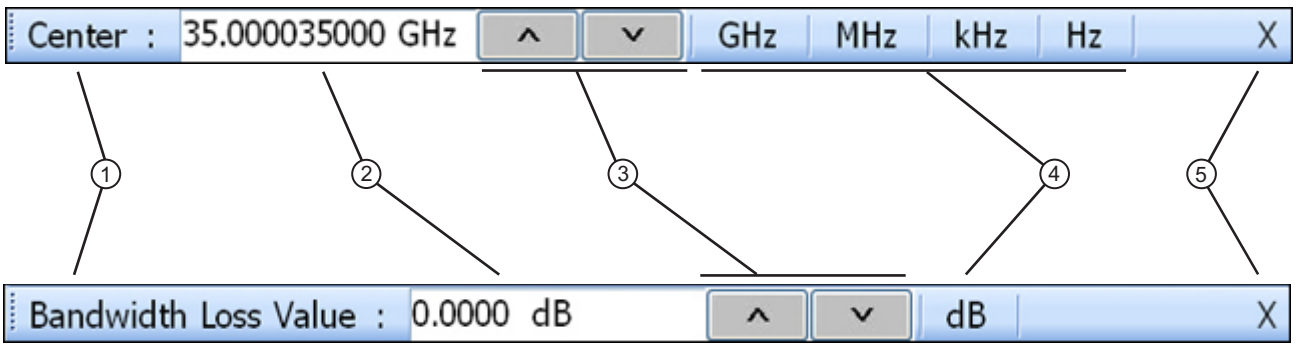
Field Selection Buttons

Field selection buttons display a user-defined parameter or value. Clicking a field selection button such as the Start button on the FREQUENCY menu displays a field toolbar (described below) that allows the user to specify parameter values and units.



Field Toolbars

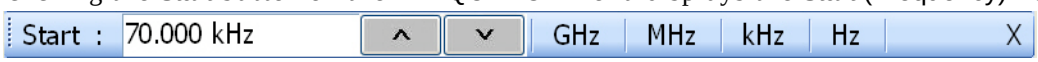
Field toolbars appear under the Icon Toolbar after their field button has been selected. The field toolbar displays its name, a value field, up/down arrows to increment the value, and one or more unit select buttons.



1. Toolbar Name – The toolbar name usually is based on the name of the button that called the toolbar.
2. Value Field – Entry area for parameter value. Entry can be from the front panel Number Keys, or from an attached USB keyboard, or by clicking the Up/Down arrows (below).
3. Up/Down Arrows – Increments the value field up or down to quickly enter values. The same effect from the front panel Up/Down Arrow Keys, or from the keyboard Up/Down arrow keys.
4. Available Units Selection – If available (shown in the upper toolbar), allows the selection of units from two or more values. If not available (shown in the lower toolbar), the units are fixed and not selectable.
5. Close X – Closes the toolbar and returns the selected value to the field button that called the toolbar.

Figure 4-10. Field Toolbar Selections

For example, clicking the Start button on the FREQUENCY menu displays the Start (Frequency) field toolbar.



Some field toolbars have units that cannot be changed. For example, clicking the Port 1 Power button on the POWER menu displays the Port 1 Power field toolbar with units fixed as dBm.



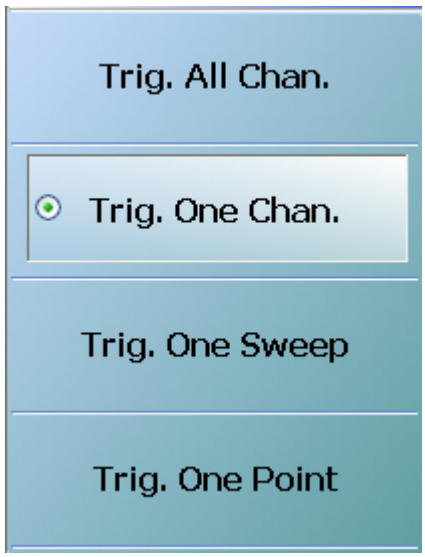
The system limits for each toolbar are defined in the System Limits Appendix in the Programming Manual Supplement – 10410-00308. The appendix lists the default, minimum allowable, and maximum allowable values and whether the toolbar changes apply on a per-trace, per-channel, or per-system basis.

Button Selection Icon

The button select icon identifies a selected option.



For example, on the MANUAL TRIGGER menu below, the Trig. One Chan. (Trigger One Channel) option has been selected.



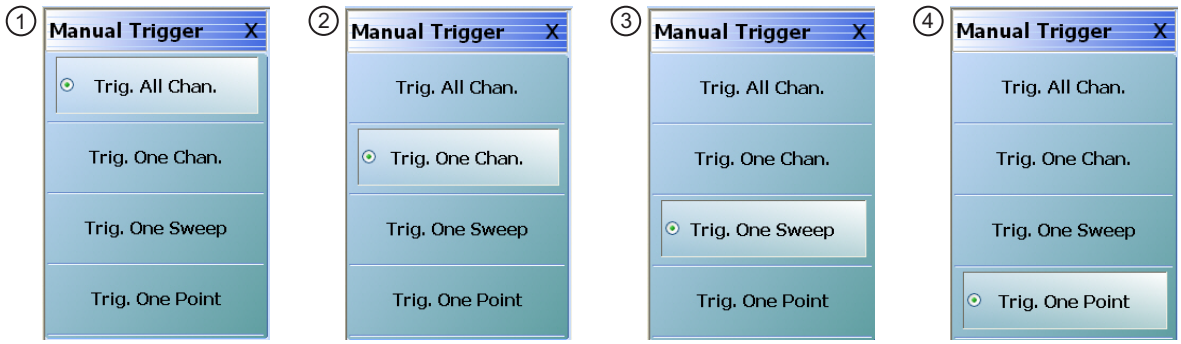
After selection, depending on the menu, the user either clicks the Back button navigation icon to return to the prior menu, or once selected, the system auto-returns to the prior menu.

Navigation

- MAIN | Sweep Setup | SWEEP SETUP | Trigger | TRIGGER | Manual Trigger Setup | MANUAL TRIGGER

Button Selection Groups

Button selection groups (also called a "radio button group") allow the user to make one selection from two or more possible options. The selection of any one button de-selects all other buttons in the group. For example, the MANUAL TRIGGER menu is a button selection group with four (4) buttons.



After making the selection, use the **Back** button to return to the previous menu. 1. Trigger All Channels button selected.	2. Trigger One Channel button selected. 3. Trigger One Sweep button selected. 4. Trigger One Point button selected.

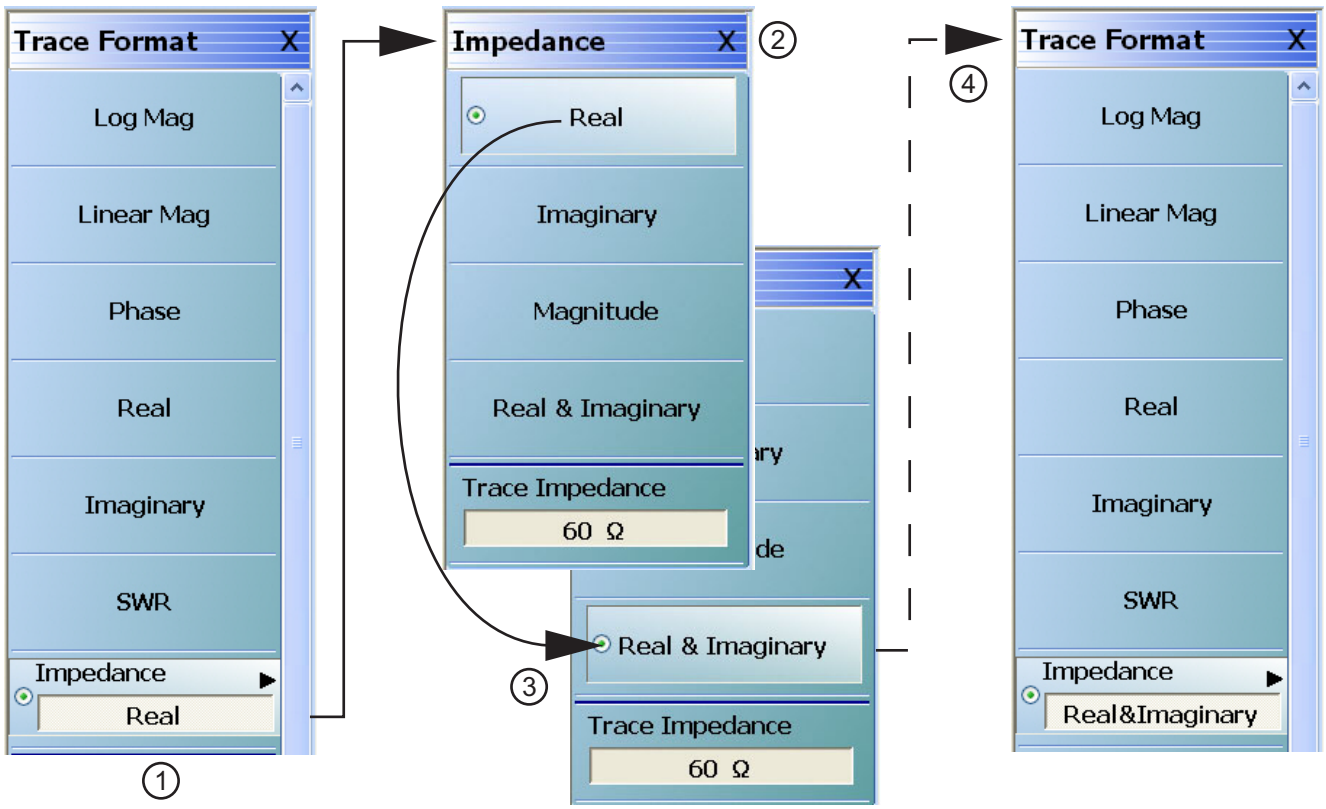
Figure 4-11. Button Selection Group Example on the MANUAL TRIGGER Menu

After a selection has been made, the button is identified with the selection icon. The user returns to the prior menu by clicking the **Back** navigation button. In some menus, after a selection is made, the system auto-returns to the previous menu (described below).

Auto-Return Button Groups

Auto-return groups are button selection groups (described above) that automatically return to the higher-level menu after a selection is made.

For example, on the TRACE FORMAT menu shown below (1), clicking on the Impedance button displays the IMPEDANCE menu with its current selection of Real (2). When another selection such as Real & Imaginary is made (3), the system auto-returns to the TRACE FORMAT menu with the Impedance button now set to Real & Imaginary (4).

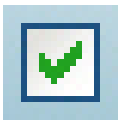


1. Original TRACE FORMAT Menu with Impedance setting as “Real”
   - The bottom Impedance field button is set to “Real
   - Clicking the Impedance button displays the IMPEDANCE menu.
2. Original IMPEDANCE Menu with “Real”
   - The IMPEDANCE menu appears with impedance set as “Real.”
3. IMPEDANCE Menu with “Real & Imaginary”
   - The user selects “Real & Imaginary” and the system auto-returns to the TRACE FORMAT menu.
4. Modified TRACE FORMAT Menu with Impedance setting as “Real & Imaginary”
   - The TRACE FORMAT menu automatically re-appears with impedance set as “Real & Imaginary.”

Figure 4-12. Auto-Return Button Group Example on the IMPEDANCE Menu

Completion Checkmark Button

In the **Calibration** menus, some buttons list the required tasks for each calibration type. The completion checkmark icon indicates that a calibration task has been completed.



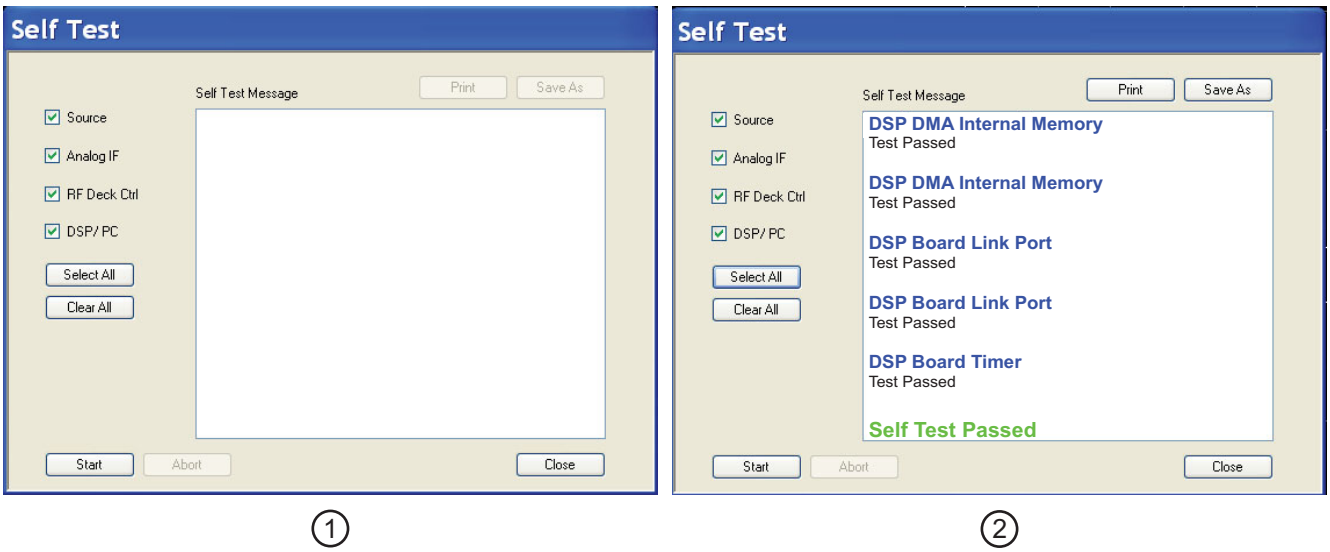
For example, in a Full 2 Port Reflection Calibration, one of the required steps is a Port 1 Short test.



The button above left shows the test has not been started. The user makes the necessary physical connections between the VNA and the required connector/adapter, and then clicks the button to begin the test. The button dims while the test is performed. After the test is successfully completed, the completion icon appears on the left side of the button as shown above right.

4-8 Using Dialog Boxes

Most dialog boxes are standard Microsoft dialog boxes and appear in the center of the display area.



1. SELF TEST dialog prior to starting tests (at left).	2. SELF TEST dialog box after tests with result of Self Test Passed (at right).

Figure 4-13. Dialog Box Example

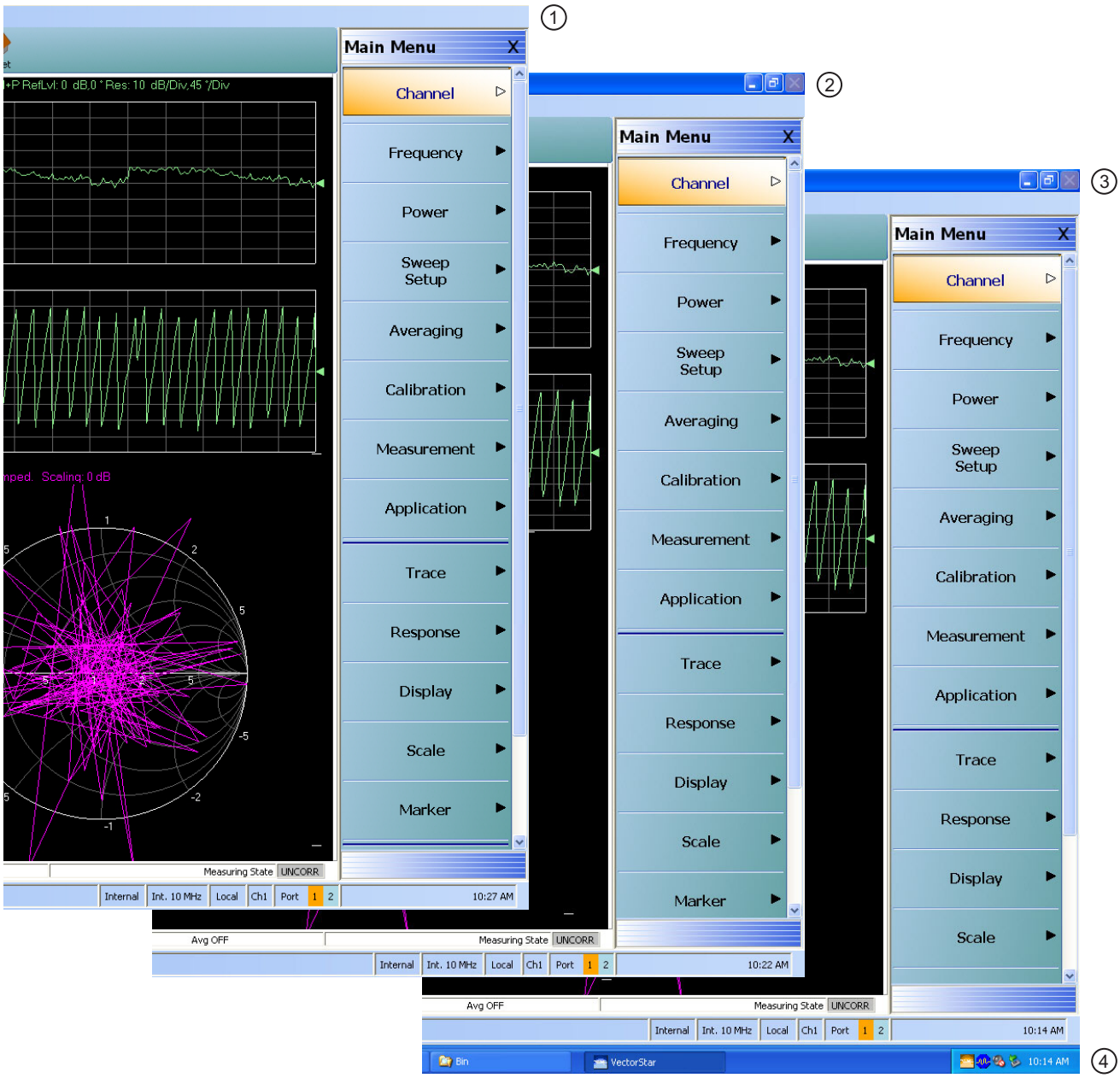
Standard Dialog Box Buttons

Most dialog boxes also have some combination of standard buttons for OK, Cancel, and Save. Other buttons and types of buttons may be present. Within dialog boxes are Dialog Box Areas that are usually named for the options that can be selected or the information that is displayed. For example, in the figure above, test status and completion messages are displayed in the Self Test Message area. Most Dialog Box Areas are delimited by a line, box, or shadowbox that contains the information or settings for a series of common attributes. If the area is named in the dialog box, that name is used in any related procedures. If the area is not named, the area is named for the first data or input field. Some dialog boxes have links that call sub-dialog boxes.

4-9 Setting the Main Display as Resizeable and/or Task Bar

The default VectorStar Application installation is for the display to be on running on top of all other applications as well as on top of the Windows desktop with the display set to completely fill the screen.

By changing the settings in the VNA setup script, a resizeable display and/or a visible task bar can be set as shown in the figure below.



1. At left, standard main display without Resize and Task Bar controls.	3. At right top, main display with Resize/Minimize controls.
2. At center, main display with Resize/Minimize controls.	4. At right bottom, main display with Task Bar displayed.

Figure 4-14. Main Display Resize and Task Bar Configuration Options

Procedure

1. Make sure a keyboard and a mouse are connected to the VNA.

2. Close the VectorStar application.

- MENU BAR | File | Exit | OK

Change the Settings for 25,000 Point 16 Channel Configuration

3. Using Windows Explorer, go to "C:\Program Files\Anritsu Company\VectorStar\Bin directory

- Launch Windows Explorer by pressing **WINDOWS Key + E** on the keyboard.

4. Locate the file named "AC_GUIMain.exe.config".

5. Copy the file and rename the copy as "BACKUP_AC_GUIMain.exe.config".

6. Open "AC_GUIMain.exe.config" using Windows Notepad or a similar text processor.

Change the Resize Setting

7. To change the resize setting, search for the "PreventResize" attribute which looks like this.

```
<setting name="PreventResize" serializeAs="String">
     <value>True</value>
</setting>
```

8. Change its value from "True" to "False" so that it now looks as follows:

```
<setting name="PreventResize" serializeAs="String">
            <value>False</value>
</setting>
```

Change the Task Bar Setting

9. To change the Task Bar setting, search for the "HideTaskBar" attribute which looks like this.

```
<setting name="HideTaskBar" serializeAs="String">
     <value>True</value>
</setting>
```

10. Change its value from "True" to "False" so that it now looks as follows:

```
<setting name="HideTaskBar" serializeAs="String">
     <value>False</value>
</setting>
```

11. Save and close the file.

12. Re-start the VectorStar application.

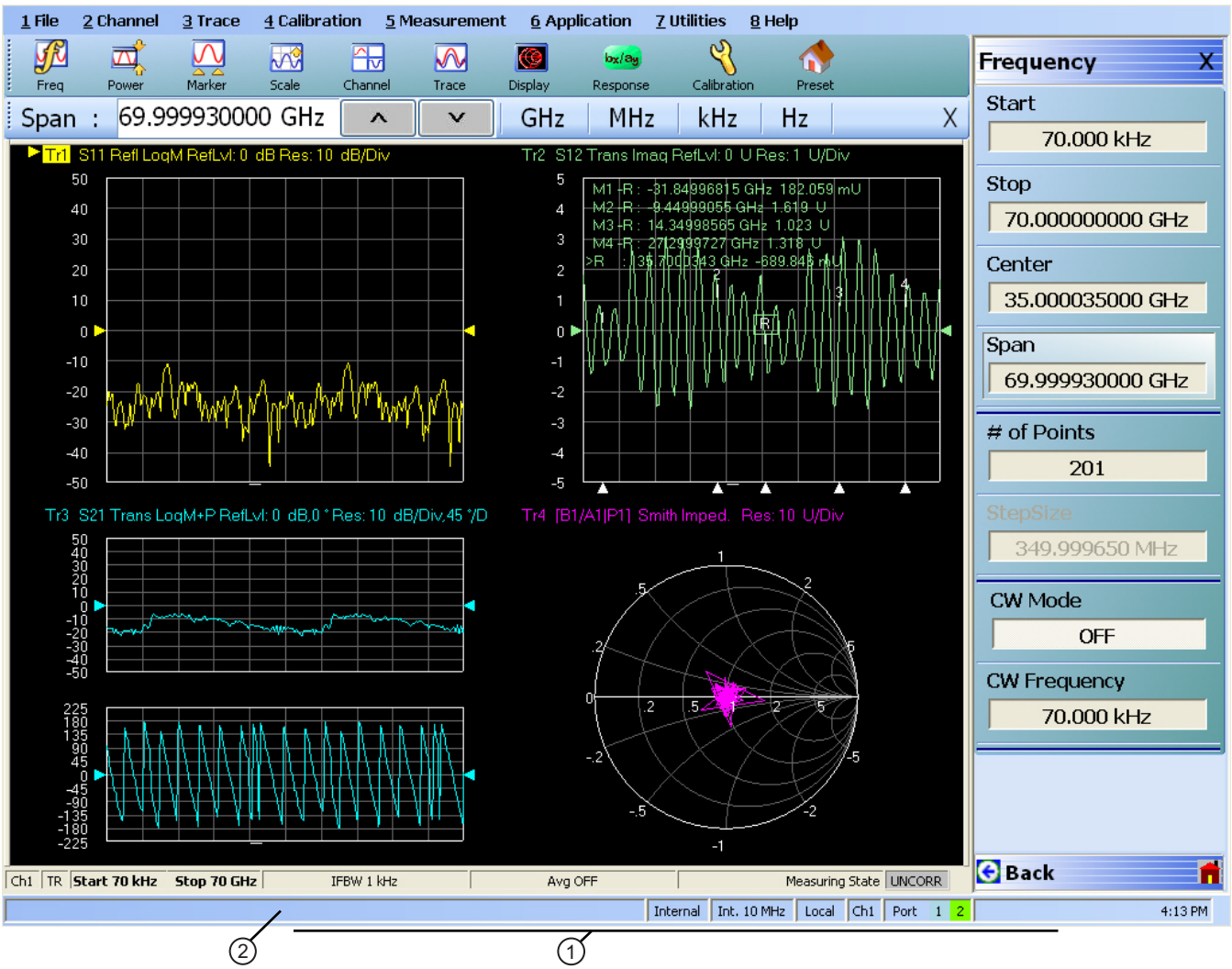
13. Depending on the changes made above, the VNA Main Display can now be minimized or maximized and/or the Task Bar is now visible.

Change the Settings for 100,000 Point One Channel Configuration

14. If required, repeat the steps above for the 100,000 point configuration file located at C:\Program Files\Anritsu Company\VectorStar_100k\Bin. Edit as above the AC_GUIMain.exe.config file.

4-10 Instrument Status Display Area

At the bottom of the instrument display is the status bar where instrument states and conditions are reported.



1. Instrument Status Area.	2. Channel Status Area. If a multichannel display has been set, each channel has a separate status bar. Maximizing the channel display provides readability.

Figure 4-15. Typical Instrument Status Display

Instrument Status Messages

Table 4-4. Instrument Status Display Abbreviations

Status Display	Description
Warning Messages	If warning messages occur, they appear on the left side of the Instrument Status Area. For example: **Target Value not found for Mkr3**.
Internal Manual External GPIB	Defines the status of the system triggering.
Ext. 10 MHz	Indicates that an external 10 MHz reference is in use.
Int. 10 MHz	Indicates that an internal 10 MHz reference is in use.
Local Remote	Local means the instrument is being controlled from its front panel and menu system. Remote means a remote control such as a GPIB controller is in use.
Ch#	Displays the channel number of the active channel. For example, Ch2 means that Channel 2 is selected and active.
Port 1/Port 2/Port 3/Port 4	Highlights the port that is being driven. 2-Port VNAs cycle between Port 1 and 2. 4-Port VNAs cycle between 1 and 4.
Time	Displays the system time.

4-11 Channel Status Display Area

At the bottom of each channel display is the channel status bar where the following information is reported. The displayed parameters are context and setting dependent. Not all parameters are displayed all the time. In a multi-channel display, the display may be truncated. To maximize the channel display, select any of the following:

- Keyboard: **CTRL + 1**
- Keyboard: **ALT + 2 then 6**
- MAIN | Channel | CHANNEL | Chan. Max

Table 4-5. Channel Status Bar Abbreviations

Status Display	Description
Ch#	Displays the channel number. For example, Ch2 means that the display is for Channel 2.
TR	Displays the measurement mode as transmission/reflection.
[Start]	In general, the left-side parameters define the starting position of distance, frequency, time, or power.
[End]	In general, the right-side parameters define the ending position of distance, frequency, time, or power.
CW Frequency # Units	From the FREQUENCY menu, if CW Mode is set to on, displays the current CW Frequency value with units of kHz, MHz, or GHz.
Start # Units	From the FREQUENCY menu, if CW Mode is set to off, displays the current Start Frequency value with units of kHz, MHz, or GHz.
Stop # Units	From the FREQUENCY menu, if CW Mode is set to off, displays the current Stop Frequency value with units of kHz, MHz, or GHz.
# Units	From the AVERAGING menu, reports the Frequency setting with units of Hz, kHz, or MHz.
Avg OFF	From the AVERAGING menu, reports that Averaging is off, or if values are present, Averaging is on.
Avg #	If Averaging is on, and the Averaging Type is Per-Point, reports the Averaging factor.
# / #	If Averaging is on, and the Averaging Type is Per-Sweep, the left-side number reports the number of average sweeps; the right-side number displays the Averaging Factor.
Measuring State Calibrating State	Indicates whether the instrument is measuring or being calibrated.
UNCORR CORRECTED	UNCORR (with a dark gray background) indicates that a calibration is not being applied. CORRECTED (with a green background) indicates that the calibration for the active channel is being applied.

4-12 Working with the Number of Points

The VectorStar MS4640A Series VNAs can be set to either 25,000 or 100,000 total measurement points through the user interface. If the total points setting is changed, the instrument must be restarted.

Maximum Points Set to 25,000

If 25,000 points is selected, the instrument can have:

- Up to 16 channels.
- Each channel can have up to 16 trace displays.
- Each trace display can have up to 12 regular markers and 1 reference marker.
- The total instrument measurement points are limited to a total of 25,000 points in any combination between channels and trace displays/

Maximum Points Set to 100,000

If 100,000 points is selected, the instrument can have:

- Only 1 (one) channel.
- The single channel can have up to 16 trace displays.
- Each trace display can have up to 12 regular markers and one reference marker.
- The total instrument measurement points is limited to a total of 100,000 points in any combination between the 16 trace displays/

To Change the Number of Points

1. Be sure the instrument is not connected to a test setup and can be restarted.

2. Navigate to the change menu:

- MAIN | System | SYSTEM | Setup | SETUP | Max Points Setup | MAX POINTS
- The MAX POINTS menu appears.

3. Select either the 25000 or 100000 points button.

- If 25,000 points are selected, the system can have up to 16 channels, each with up to 16 trace graph displays. The 25,000 points can be allocated between the channels and traces in any combination.
- If 100,000 points are selected, the system can have 1 (one) channel with up to 16 trace graph displays. The 100,0000 points can be allocated between the 16 traces in any combination.

4. After the selection is made, click Back or Home.

5. Then exit VectorStar and reboot the instrument to activate the new points setting.

4-13 Working with Channels

Each VNA channel is like a separate VNA, with its own frequency list, calibrations, power setup and other parameters. Each channel can display up to 16 individual trace graph displays.

The number of VNA channels is user-definable, subject to the limits of the Maximum Point Mode of the instrument described in the section above.

25,000 Point Mode

If the instrument is set to the 25,000 point mode, up to 16 channels, each with up to 16 traces can be defined for a total of 256 traces. The number of sweep points can be distributed to the defined channels and traces in any combination. The screen layout of the VNA channels is also user-definable by selecting from multiple pre-defined layouts. If many channels and trace graphs are used, the user can quickly maximize any channel and/or trace display for ease of viewing and closer inspection.

100,000 Point Mode

If the instrument is set to 100,000 point mode, the instrument is limited to 1 channel with 16 traces. The 100,000 sweep points can be distributed across the defined traces in any combination. On the MENU BAR, the CHANNEL drop-down menu is limited to four choices: Frequency, Power, Sweep, and Averaging. On the right-side menus, the CHANNEL menu buttons are unavailable.

4-14 Working with Traces

Types of Trace Displays

For each channel defined above, from 1 (one) to 16 trace graphs (called “traces”) can be defined where each trace is a data display within a specific channel. Each trace is defined by a response parameter (such as S11), a graph type display (such as a rectilinear graph, a polar display or Smith chart), a scale, and possibly post-processing elements such as time domain and smoothing. There are four general graph types available and within each general type are multiple sub-types:

- Rectilinear single graph
- Rectilinear dual graph
- Polar plot graph
- Smith chart

Trace Data Types

The data types generated by the VNA (real, imaginary, magnitude, phase) are used in the display graph to show the possible ways in which S-Parameter data can be represented. For example, complex data, that is data in which both phase and magnitude are graphed, may be displayed in any of the following ways:

- **Complex Impedance**

  Displayed on a Smith chart graph as impedance or as admittance

- **Real and Imaginary**

  If simultaneous displays are required, displayed on a real and imaginary rectilinear (a Cartesian plot) graph. If only one type is required, a single rectilinear real graph or single rectilinear imaginary graph.

- **Phase and Magnitude**

  Displayed on a single rectilinear graph, as paired rectilinear graphs, or as a polar graph

- **Group Delay**

  Group delay measurements are time of the associated aperture are frequency and SWR. The quantity group delay is displayed using a modified rectilinear-magnitude format. In this format, the vertical scale is linear units of time (either ps, ns, or us). With one exception, the reference value and reference line functions operate the same as they do with a normal magnitude display.

Trace Display Graphs

A separate graph can be assigned to each active channel and display area. The following available display graph types are listed in Table 4-6 below.

Table 4-6. Available Trace Display Types (1 of 3)

Menu Name	Definition and Display Options	Y-Axis Dependent Variable	X-Axis Independent Variable	Measurement Applications
Rectilinear Single Graphs				
Log Mag	Log magnitude rectilinear format graph Magnitude		Y = dB	Return loss measurement Insertion loss measurement Gain measurement
Linear Mag	Linear magnitude rectilinear format graph	Magnitude	Linear units	Reflection coefficient measurement
Phase	Phase rectilinear format graph	Phase displayed in range from -180 to + 180 degrees	Degrees	Linear phase deviation measurements
Imaginary	Imaginary rectilinear format graph	Imaginary part of measured complex parameter	Linear units	
Real	Real rectilinear format graph	Real part of measured complex parameter	Linear units	
SWR	Standing Wave Ratio rectilinear format graph	$SWR = \frac{1+\rho}{1-\rho}$ where ρ = Reflection Coefficient	Linear units	Standing wave measurements Antenna analysis
Impedance	Impedance rectilinear format graph Four options are: • Real • Imaginary • Magnitude • Real & Imaginary			

Table 4-6. Available Trace Display Types (2 of 3)

Menu Name	Definition and Display Options	Y-Axis Dependent Variable	X-Axis Independent Variable	Measurement Applications
		Polar Graphs		
Linear Polar	Linear polar plot graph The polar graph format traces are used to display one magnitude value and phase on the same chart. Plot options: • Lin/Phase • Real/Imag.		Chart mode options: • Magnitude/Phase • Magnitude/Swap Position	
Log Polar	Plot options: • Log/Phase • Real/Imag.		Chart mode options: • Magnitude/Phase • Magnitude/Swap Position	
		Smith Chart Graphs		
Smith (R + jX)	Smith Chart graphs with impedance (circuit resistance and reactance) Four read out style options are available: • Lin/Phase • Log/Phase • Real/Imag. • Impedance		The impedance is the measure of a circuit's opposition to alternating current which consists of the circuit resistance and the circuit reactance, together they determine the magnitude and phase of the impedance.	• Reflection measurements
Smith (G + jB)	Smith Chart graphs showing admittance (conductance and susceptance). Four read out style options are available: • Lin/Phase • Log/Phase • Real/Imag. • Admittance		The admittance (Y) is the inverse of the impedance (Z) and is a measure of how easily a circuit will allow current to flow, a combination of conductance (the inverse of resistance) and the dynamic susceptance (the inverse of reactance).	

Table 4-6. Available Trace Display Types (3 of 3)

Menu Name	Definition and Display Options	Y-Axis Dependent Variable	X-Axis Independent Variable	Measurement Applications
Rectilinear Paired Graphs				
Log Magnitude and Phase	Paired graphs with Log Magnitude on top and Phase on bottom	As above	As above	Same as having one trace with a Log Magnitude display and a second trace with a Phase rectilinear display.
Linear Magnitude and Phase	Paired graphs with Linear Magnitude on top and Phase on bottom	As above	As above	Same as having one trace with a Linear Magnitude display and a second trace with a Phase rectilinear display.
Real and Imaginary	Paired graphs with Real on top and Imaginary on bottom	As above	As above	Same as having one trace with a Real rectilinear display and a second trace with an Imaginary rectilinear display.
Group Delay / Power Graphs				
Group Delay	Displays the time lag through a DUT measured in ps, ns, or ms.	Time measured in ps, ns, or ms.	Frequency	Bandpass filter design Transmission studies
Power In	Displays power in measurement through a DUT measured in dBm.	Absolute power measured in dBm.	Frequency	Efficiency Receiver calibration Power consumption Power and heat dissipation
Power Out	Displays power out measurement through a DUT measured in dBm.	Absolute power measured in dBm.	Frequency	Efficiency Receiver calibration Power consumption Power and heat dissipation

Each graph type is described in greater detail below with sample graphs, and explanation of supporting trace displays.

Trace Labels

Each trace (i.e. each graph display) is labeled with information such as its trace number, the graph type, scaling, reference delay, and S-parameter associated with that trace. Depending on the trace settings and the graph type, other information may be displayed.

The general format of trace label consists of the following parameters and their associated abbreviations appearing from left to right in the trace label. Some parameters may not appear depending on the instrument settings.

- Trace Number
- Measurement Type
- Time Domain
- Graph Type
- Reference Level
- Resolution Units
- Conversion Factor
- Inter-Trace Math Factor
- Trace Memory Statistics

Trace labels can be customized by the user in the DISPLAY SETUP menu and toggled on or off as an alternate trace name.

- MAIN |Display | DISPLAY | Display Area Setup | DISPLAY SETUP | Edit Alternative Trace Name | EDIT ALTERNATE TRACE NAME dialog box

Trace Label Abbreviations

The trace label abbreviations are described in the three tables below:

- Table 4-7, “Trace Labels - Trace Number, Measurement Type
- Table 4-8, “Trace Labels - Abbreviation, Type and Name, Reference Level Units, Resolution Units
- Table 4-9, “Trace Labels - Conversion, Inter-Trace Math, Trace Memory Abbreviations

Table 4-7. Trace Labels - Trace Number, Measurement Type (1 of 2)

Abbreviation	Definition	Description
Trace Number Abbreviation		
Tr#	Trace number	Trace 1 through Trace 16.
Measurement Type Abbreviations		
S11 Refl	S11 Port 1 forward reflection	S-parameters are selected on the RESPONSE menu.
S12 Trans	S12 Port 1 reverse transmission	
S21 Trans	S21 Port 2 forward transmission	
S22 Refl	S22 Port 2 reverse reflection	
Gain Compression		
--	If Gain Compression is off, the @CP trace label does not appear after the Measurement Type.	For example, Tr3 S21 Trans LogM
@CP	If Gain Compression is on, the @CP (at Compression Point) appears after the Measurement Type.	For example, Tr3 S21@CP Trans LogM

Table 4-7. Trace Labels - Trace Number, Measurement Type (2 of 2)

Abbreviation	Definition	Description
NN / DD | Port #	NN is user-defined numerator value. DD is user-defined denominator value. Port number	User-defined numerator, denominator, and driver port are selected on the RESPONSE | User-defined | USER-DEFINED menu. Numerator and denominator options are A1, B1, A2, B2, or 1. Port number selection options are Port 1 or Port 2.
Ext.In [DC1 | P#]	External Analog Input 1 Driver Port number	User-defined External Analog Input 1 port is selected on the RESPONSE | Ext. Analog In 1 | EXT. ANALOG IN 1 menu. Port number selection options are Port 1 or Port 2.
Ext.In [DC2 | P#]	External Analog Input 2 Driver Port number	User-defined External Analog Input 2 port is selected on the RESPONSE | Ext. Analog In 2 | EXT. ANALOG IN 2 menu. Port number selection options are Port 1 or Port 2.

Rectilinear Single Graph

Table 4-8. Trace Labels - Abbreviation, Type and Name, Reference Level Units, Resolution Units (1 of 2)

Graph Abbreviation	Graph Name and Type	Reference Level (RefLvl)	Resolution Units (Res)
Rectilinear Single Graph			
LogM	Log Mag (Log Magnitude) rectilinear	# dB	# dB / Div
LinM	Linear Mag (Linear Magnitude) rectilinear	# U	# U / Div
Phase	Phase rectilinear with units in degrees (º)	# º	# º / Div
Real	Real rectilinear	# U	# U / Div
Imag	Imaginary rectilinear	# U	# U / Div
SWR	SWR rectilinear	# U	# U / Div
Imped Real	Impedance Real rectilinear with units in Ohms (Ω)	# Ω	# Ω / Div
Imped Imag	Impedance Imaginary rectilinear	# Ω	# Ω / Div
Imped Mag	Impedance Magnitude rectilinear	# Ω	# Ω / Div
Imped R + I	Impedance Real and Imaginary rectilinear. A rectilinear paired graph.	# Ω	# Ω / Div
Smith Charts with Impedance or Admittance			
Smith Imped	The display can be one of four possible Smith Chart with impedance displays: • Smith (R+jX) Linear/Phase Smith Chart • Smith (R+jX) Log/Phase Smith Chart • Smith (R+jX) Real/Imaginary Smith Chart • Smith (R+jX) Impedance Smith Chart	—	# U / Div
Smith Admitt	The display can be one of four possible Smith Chart with admittance displays: • Smith (G+jB) Linear Phase Smith Chart • Smith (G+jB) Log Phase Smith Chart • Smith (G+jB) Real/Imaginary Smith Chart • Smith (G+jB) Impedance Smith Chart	—	# U/Div
Polar Graphs			
Lin Pol	Linear Polar, Linear/Phase polar	# U	# U/Div
Lin Pol, RI	Linear Polar, Read/Imaginary polar	# U	# U/Div
Log Pol	Log Polar, Log/Phase polar	# dB	# dB/Div
Log Pol, RI	Log Polar, Real/Imaginary polar	# dB	# dB/Div
Rectilinear Paired Graphs			
LogM + P	Log Magnitude and Phase rectilinear paired graphs.	# dB	º Res: # dB/Div, #º/Div

Table 4-8. Trace Labels - Abbreviation, Type and Name, Reference Level Units, Resolution Units (2 of 2)

Graph Abbreviation	Graph Name and Type	Reference Level (RefLvl)	Resolution Units (Res)
LinM + P	Linear Magnitude and Phase rectilinear paired graphs	# dB	º Res: # dB/Div, #º/Div
R + I	Real and Imaginary rectilinear paired graphs	# U	Res: # U/Div, # U/Div
Group Delay and Power Rectilinear Graphs			
Grp Dly	Group Delay rectilinear with units of seconds	# s	Res: # s/Div
Pwr Out	Power Out rectilinear	# dBm	dB/Div
Pwr In	Power In rectilinear	# dBm	dB/Div

Table 4-9. Trace Labels - Conversion, Inter-Trace Math, Trace Memory Abbreviations (1 of 2)

Abbreviation	Definition	Description
Conversion (Con) Abbreviations		
—	If Conversion is off, no abbreviation appears.	
[Con]	If Conversion is on, the conversion factor is appended to the right of the trace annotation.	
[Zr]	Z: Reflection	
[Zt]	Z: Transmission	
[Yr]	Y: Reflection	
[Yt]	Y: Transmission	
[1/S]	1/S	
Inter-Trace Math (ITM) Abbreviations		
—	If Inter-trace math is off, no abbreviation appears.	
[ITM]	If Inter-Trace Math is on, the math factor abbreviation (described below) is appended to the right of the trace annotation.	
[Con, ITM]	If Conversion (above) is on, the Inter-Trace Math abbreviation appears to its right, separated by a comma.	
Tr#	Trace number	Inter-trace math can utilize any trace number that is currently defined.
[Tr# + Tr#]	Inter-trace math addition.	The trace number assigned to Operand 1 plus value of the trace number assigned to Operand 2.
Tr# - Tr#]	Inter-trace math subtraction.	The trace number assigned to Operand 1 plus value of the trace number assigned to Operand 2.

Table 4-9. Trace Labels - Conversion, Inter-Trace Math, Trace Memory Abbreviations (2 of 2)

Abbreviation	Definition	Description
[Tr# * Tr#]	Inter-trace math multiplication.	The trace number assigned to Operand 1 times value of the trace number assigned to Operand 2.
[Tr# / Tr#]	Inter-trace math division.	The trace number assigned to Operand 1 divided by the value of the trace number assigned to Operand 2.

A rectilinear graph is a display of a Cartesian coordinate system or plan consisting of an X-axis and a Y-axis. The X-axis displays the independent variable (such as frequency or time) and the Y-axis displays the dependent value.

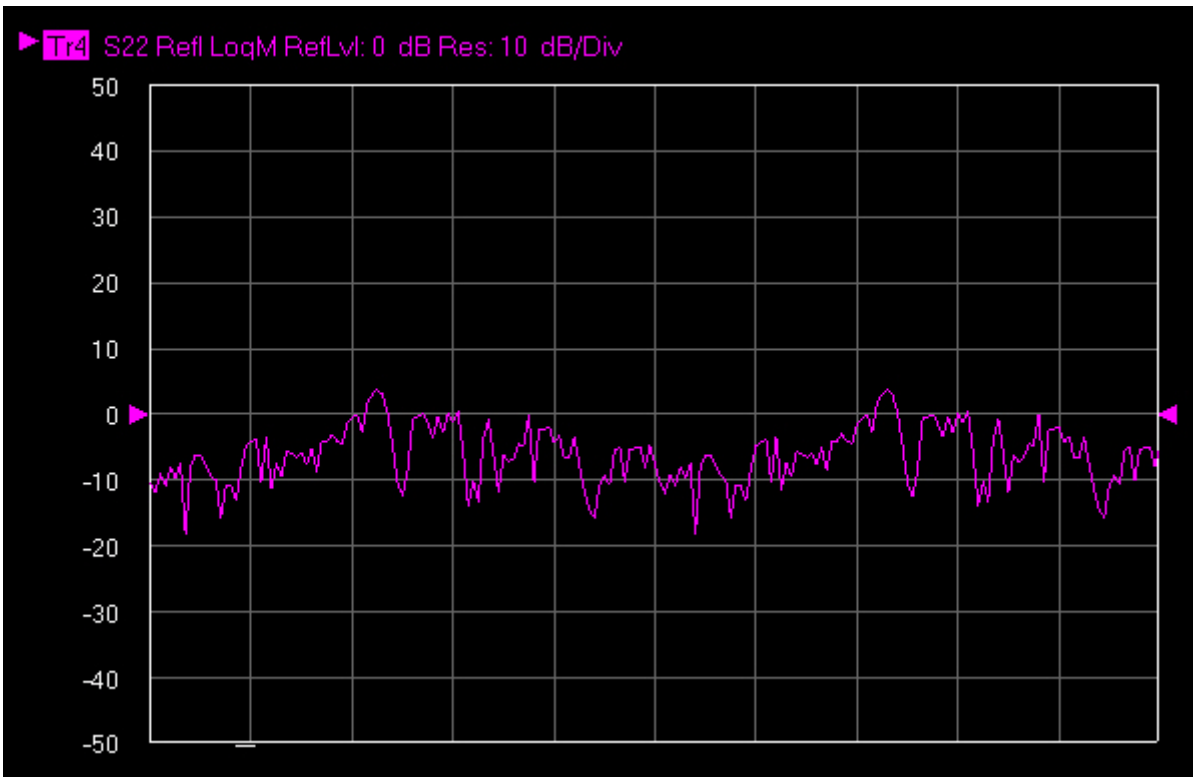


Figure 4-16. Trace Graph - Rectilinear Single - Log Magnitude (Log Mag) Trace Display Graph

Rectilinear Paired Graphs

As above, but paired with a phase rectilinear graph below. Useful to save a channel, or provide immediate comparison with a function value and its phase.

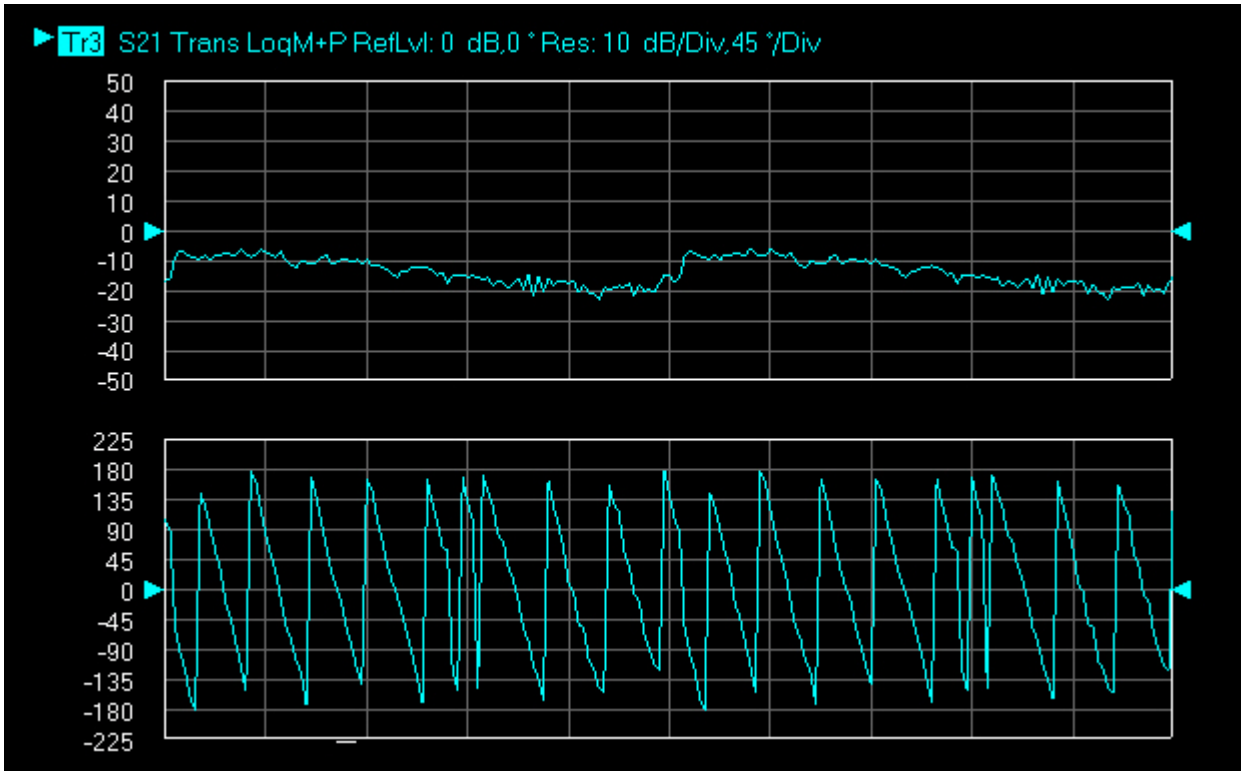


Figure 4-17. Trace Graph - Rectilinear Paired - Trace Log Magnitude and Phase Trace Display

Smith Charts

The power reflected from a DUT has both magnitude and phase because the impedance of the device has both a resistive and a reactive term of the form $r+jx$. We refer to the r as the real or resistive term, while we call x the imaginary or reactive term. The j, which we sometimes denote as i, is an imaginary number. It is the square root of –1. If x is positive, the impedance is inductive, if x is negative the impedance is capacitive. The size and polarity of the reactive component x is important in impedance matching. The best match to a complex impedance is the complex conjugate which means an impedance with the same value of r and x, but with x of opposite polarity. This term is best analyzed using a Smith Chart, which is a plot of r and x.

To display all the information on a single S-parameter requires one or two traces, depending upon the format we want. A very common requirement is to view forward reflection on a Smith Chart (one trace) while observing forward transmission.

Smith Chart with Impedance (Circuit Resistance and Reactance)

The Smith Chart with impedance (Smith R + jX) has four display options:

- Lin/Phase
- Log/Phase
- Real/Imag.
- Impedance

The impedance is the measure of a circuit's opposition to alternating current which consists of the circuit resistance and the circuit reactance, together they determine the magnitude and phase of the impedance.

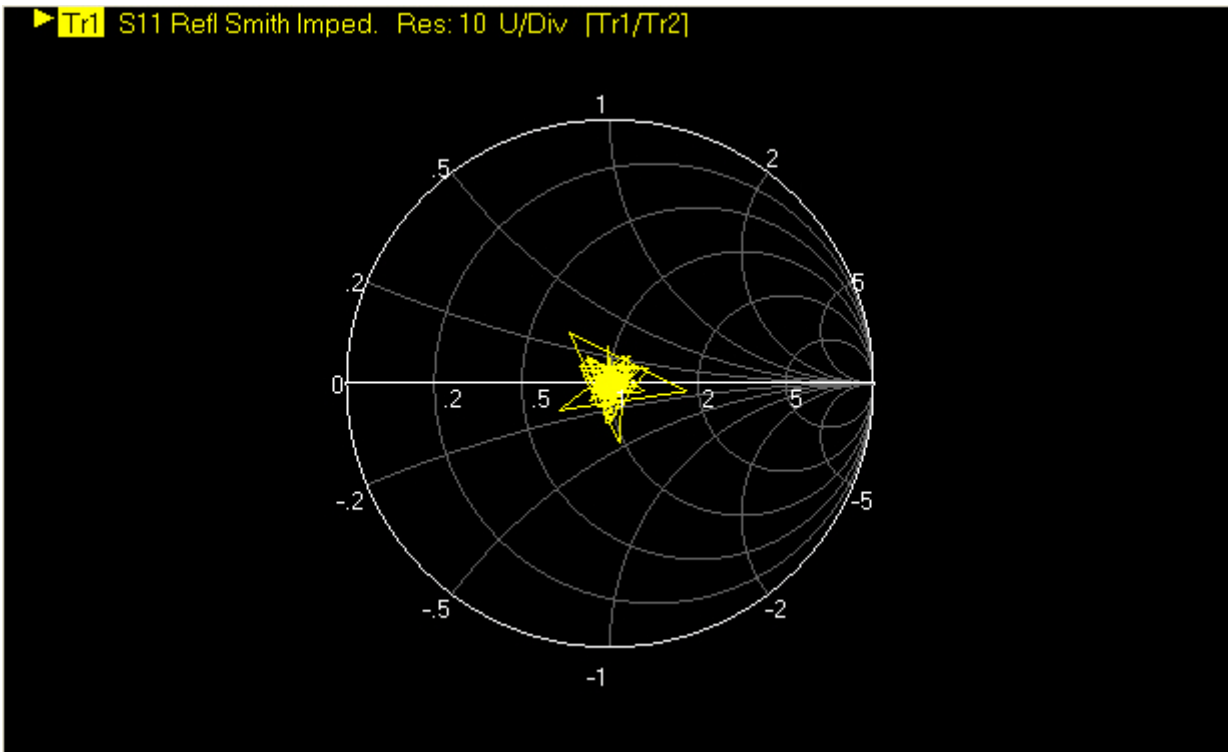


Figure 4-18. Smith Chart with Impedance (R+jX)

Smith Chart with Admittance (Conductance and Susceptance)

The admittance (Y) is the inverse of the impedance (Z) and is a measure of how easily a circuit will allow current to flow, a combination of conductance (the inverse of resistance) and the dynamic susceptance (the inverse of reactance). Smith Chart graph display showing admittance (conductance and susceptance) has four read out style options are available:

- Lin/Phase
- Log/Phase
- Real/Imag.

- Admittance

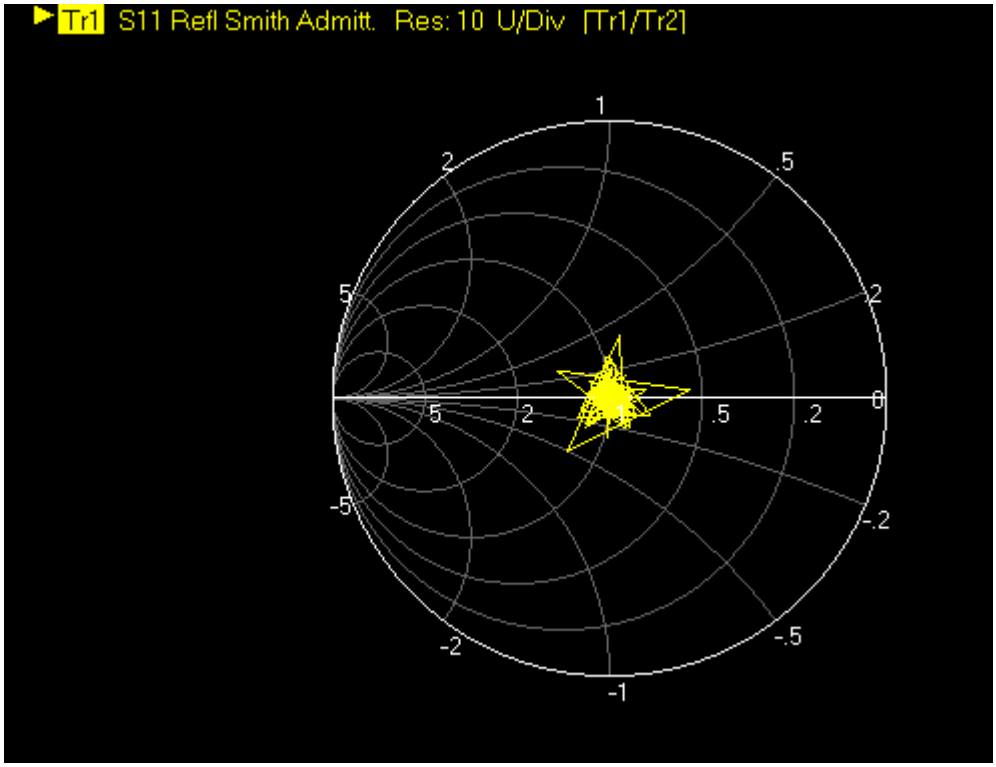


Figure 4-19. Smith Chart with Admittance (G+jB)

Polar Graphs

A polar graph represents a two-dimensional coordinate system where each point is determined by an angle and a distance. The polar coordinate system is especially useful in situations where the relationship between two points is most easily expressed in terms of angles and distance such as in phase relationships in antenna and feedline design. The magnitude parameter can use either a linear or log scale. As the coordinate system is two-dimensional, each point is determined by two polar coordinates: the radial coordinate (distance from the center) and the angular coordinate (degrees counterclockwise from the right edge). Polar displays are used for transmission measurements, especially for cascaded devices in series. The transmission result is the addition of the phase and log magnitude (dB) information in the polar display of each device.

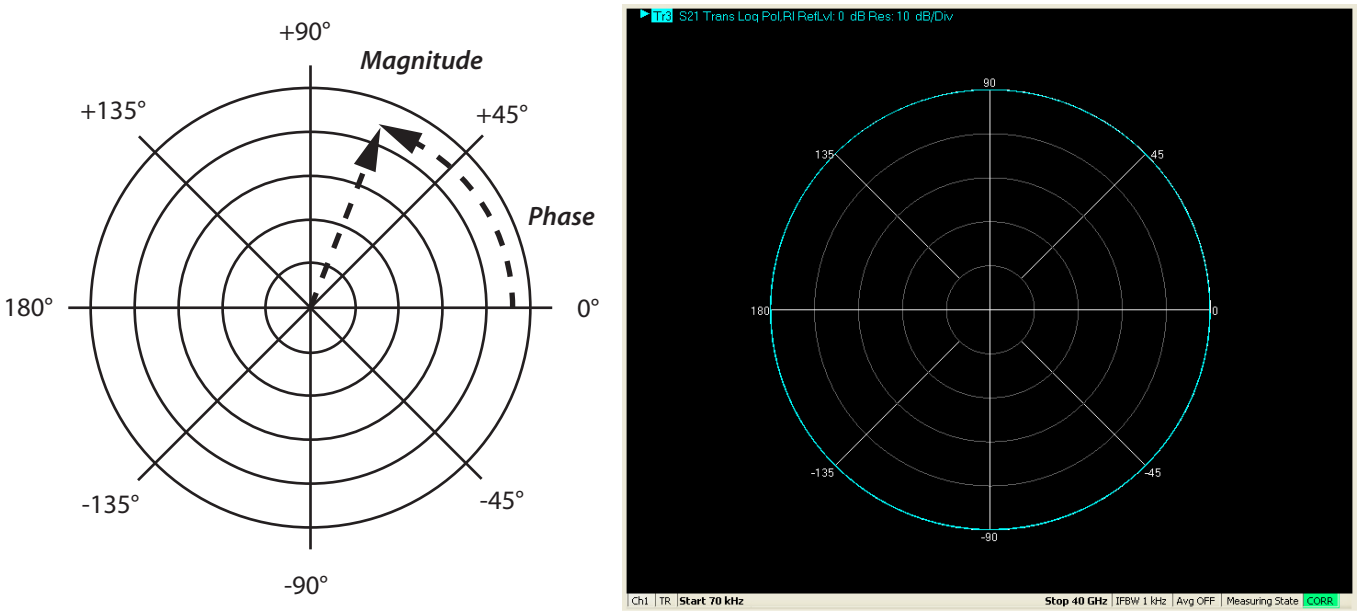


Figure 4-20. Log Polar Diagram and Trace Graph Example

Group Delay Graphs

The quantity group delay is displayed using a modified rectilinear-magnitude format. In this format the vertical scale is in linear units of time (ps-ns-s). With one exception, the reference value and reference line functions operate the same as they do with a normal magnitude display. The exception is that they appear in units of time instead of magnitude.

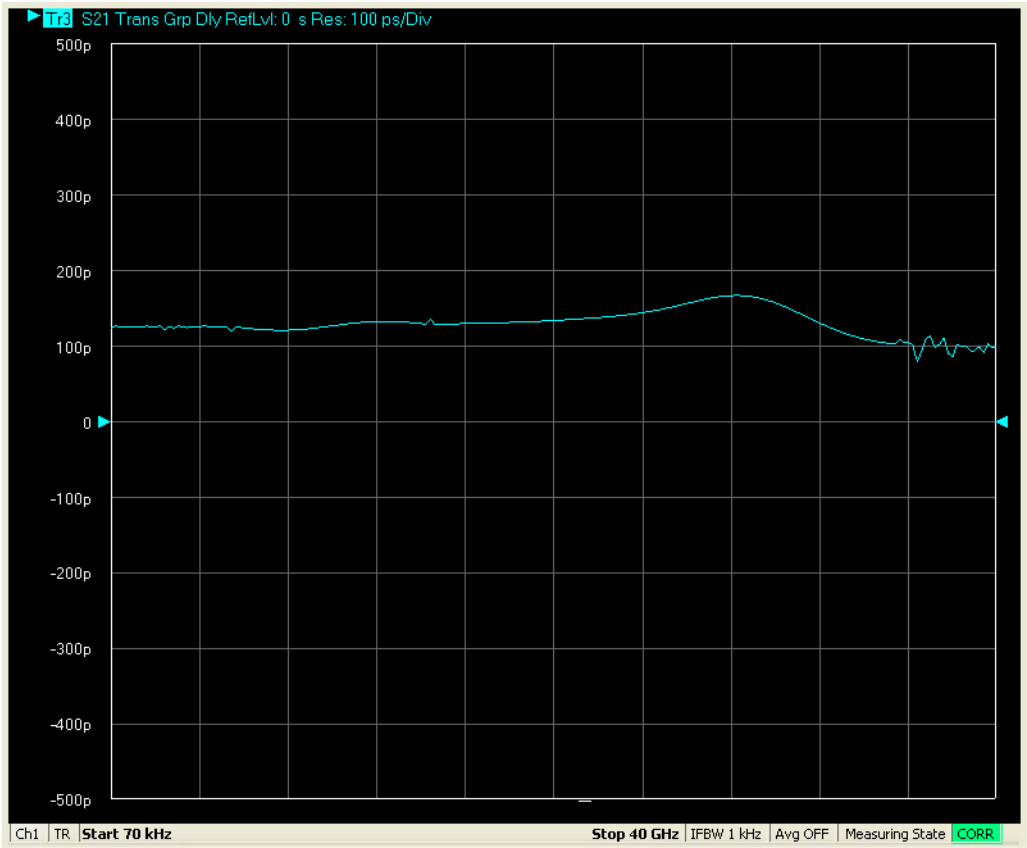


Figure 4-21. Group Delay Trace Graph Example

Power Graphs

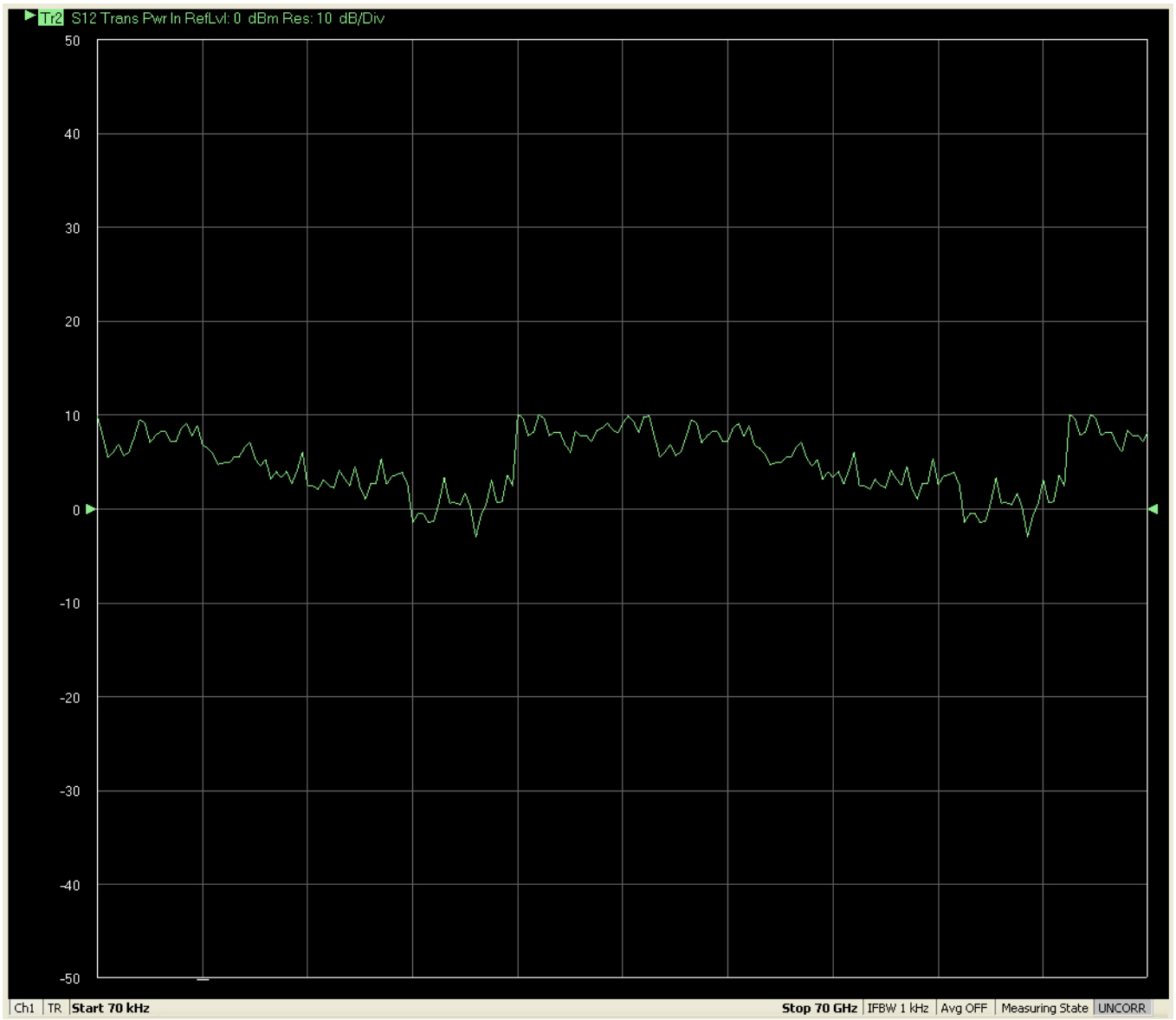
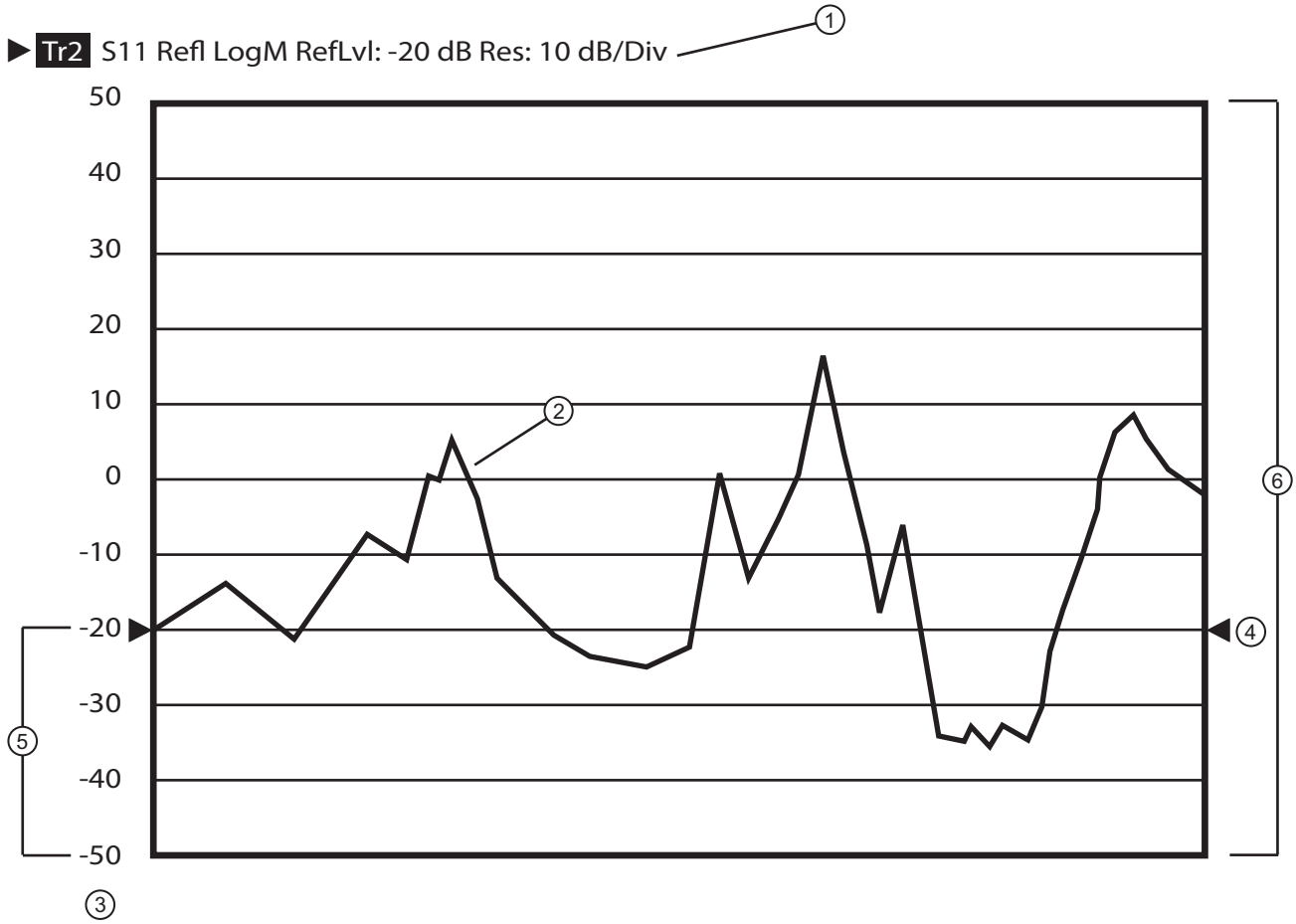


Figure 4-22. Power In Trace Graph Example

4-15 Working with Reference Lines and Reference Position

You can manipulate the display elements in a rectilinear trace graph from either the trace itself or from the right-side menus.



1. Trace Label – The trace label appears above the trace graph. The example above shows Trace 2 measuring S11, displayed on a Log Magnitude graph, with a Reference Level of -20 dB, and a graph resolution of 10 dB per vertical division.
2. Response Graph – A typical S11 response graph.
3. Resolution in Units per Division – The example shows 10 dB per division.
4. Reference Line Pointers – Reference lines are only available in rectilinear trace graphs and are indicated by the paired arrows on the trace graph display and show the position of the reference value on the Y-axis scale. The example Reference Value is set to -20 dB. Click-hold-and-drag the line pointers to change the reference line value.
5. Reference Position – The example Reference Position is set to 3. Click-hold-and-drag the reference position scale to change the position of the graph on the Y-axis up or down. The value of the Reference Line Points does not change.
6. Number (#) of Vertical Divisions – The example number of vertical divisions is set to 10.

Figure 4-23. Trace Display Controls and Settings

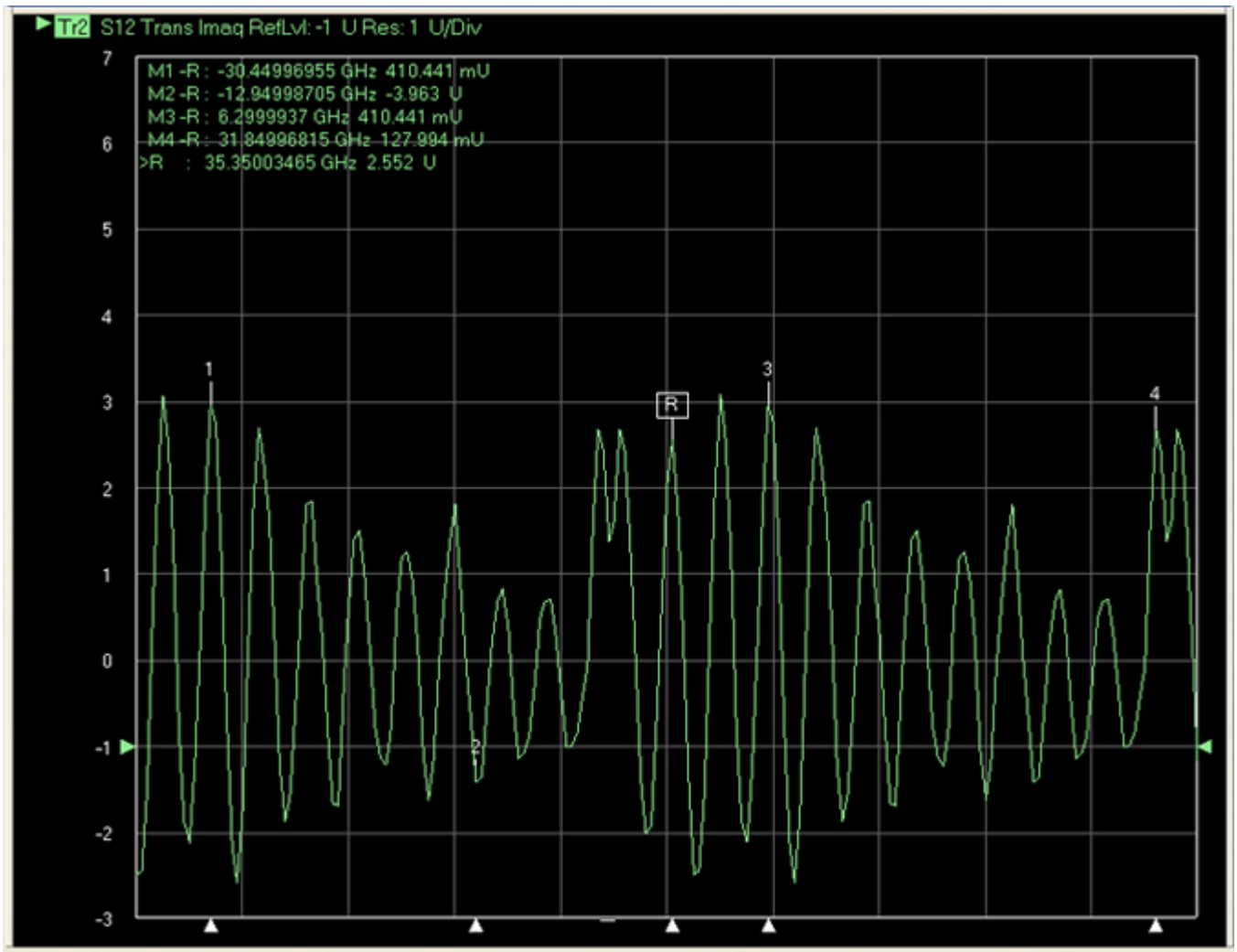
4-16 Working with Limit Lines

Limit lines are a powerful tool to help compare a set of measured DUT data against specifications or expectations. Limit lines are:

- Can be configured as settable maximum and/or minimum indicators for the value of displayed data on a per-trace basis
- Available only for VectorStar rectilinear displays only
- Not available for VectorStar circular polar and Smith charts.
- Settable in the basic units of each trace
- Rescaled automatically and maintain their correct value if the trace display is rescaled.
- Are limited to a total of 50 segments (upper and lower combined) per-trace.
- For dual displays, such as the Log Mag And Phase display, the segment limit is 50 segments for the top display and 50 segments for the bottom display.

4-17 Working with Frequency Blanking

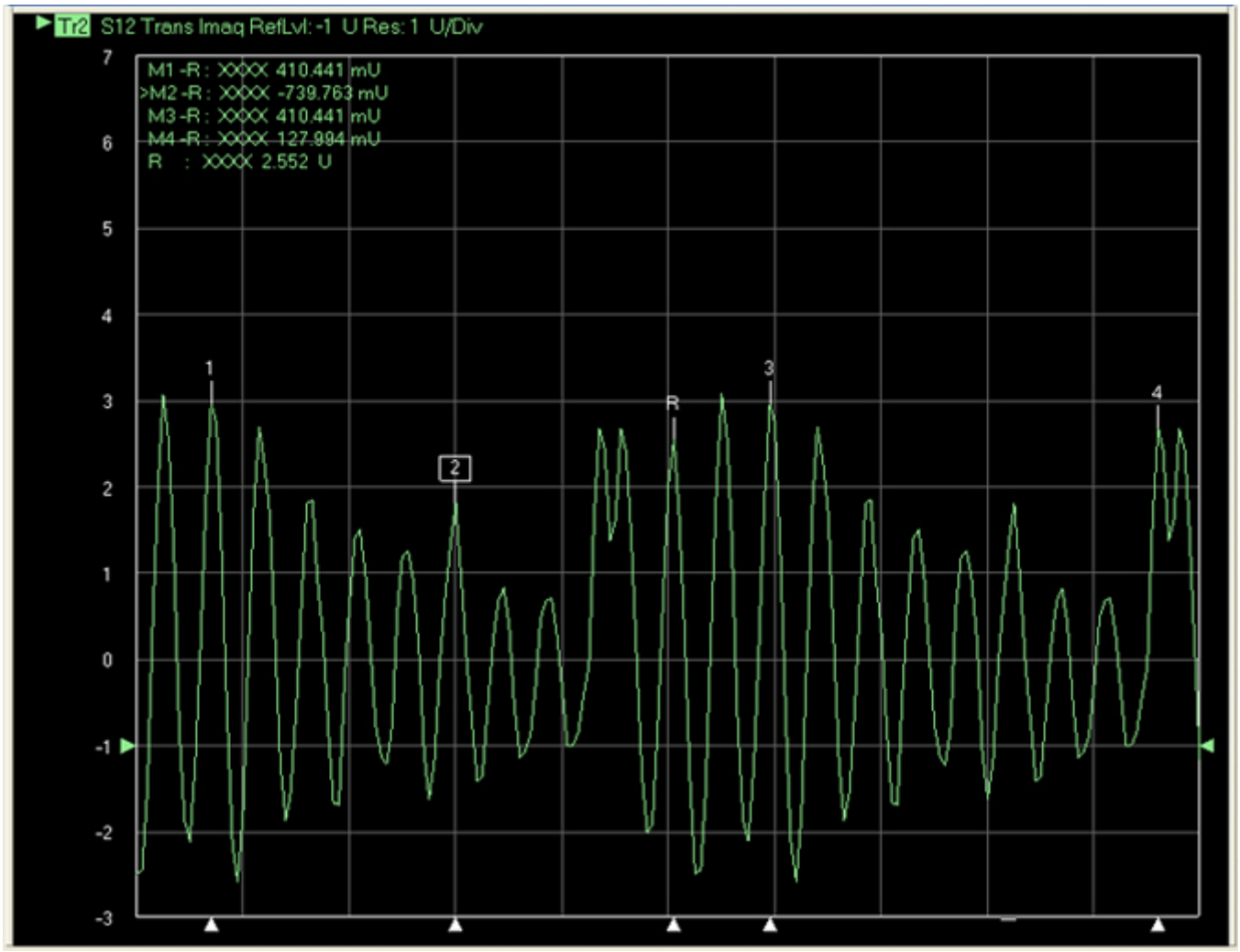
Use frequency blanking when the measured frequency must not appear on the screen display for security or proprietary reasons. Below, Figure 4-24 shows a normal display with five reference markers and their associated frequencies.



Trace display with five markers and frequencies and frequencies displayed.

Figure 4-24. Frequency Blanking OFF

After frequency blanking is implemented, the frequency values and units are replaced with XXXX as shown below in Figure 4-25.



Trace display with five markers and frequencies blanked.

Figure 4-25. Frequency Blanking ON

Frequency Blanking Procedure

1. Setup the number of channels, number of traces, and the trace displays as required.
2. Save the setup as a setup file by opening the SAVE SETUP dialog box.
   - MENU BAR | File | Save Setup | SAVE SETUP Dialog Box

Save the Setup

3. Save the setup with a memorable file name as one of the file types below.
   - Active Channel Setup & Cal (.chx)
   - Active Channel Setup (.stx)
   - All Channel Setup and Cal (.cha)
   - Active Channel Setup (.sta)

Blank the Frequency Display

4. On the right side menu, navigate to the Frequency Blanking button:

- MAIN | System | SYSTEM | Utility | UTILITY | Frequency Blanking
- The Frequency Blanking button is a one-way toggle button.

5. Click the Frequency Blanking button.

- All displayed frequency values and units are blanked and replaced with XXXX as shown above in Figure 4-25 above.

Restore the Frequency Display

6. Use the Preset function to return the instrument to its prior setting. Use one of the following methods:

- **Preset Key**
- ICON TOOLBAR | Preset icon
- MENU BAR | Utilities | Preset

7. The instrument is restored to its prior configuration state and frequency values and units are again displayed as in Figure 4-24 above.

Chapter 5 — Main Menu

5-1 Chapter Overview

This user interface (UI) reference chapter summary operational information about the UI and detailed overview of the primary controls on the top-of-screen Menu Bar and Icon Bar, and the right-side application Main Menu. The Main Menu is available for VectorStar VNAs. The Menu Bar provides drop-down menu interface to major instrument functions. The Icon Bar provides single-click access many instrument functions and is user-configurable to meet individual needs. The description of the Main Menu (MAIN) provides top level descriptions of each major function with links to detailed descriptions of menus and dialog boxes in subsequent chapters.

5-2 MAIN Menu

The Main Menu (or MAIN) provides 15 arrow buttons that link to lower-level submenus. The bulleted navigation paths presented in the sections below use the following conventions:

- Buttons are in initial capitals, such as Channel for the Channel button. For brevity, buttons are not named.
- Menus, toolbars, and dialog box names are in all capitals, such as FREQUENCY for the Frequency menu.
    - For brevity, menus are not labeled with the word “menu.”
    - Dialog boxes are labeled such as the SAVE FILE dialog box.
    - Toolbars are labeled such as the START FREQUENCY field toolbar.

MAIN Menu

Navigation paths to all menus, toolbars, and dialog boxes start with the MAIN menu.

- MAIN

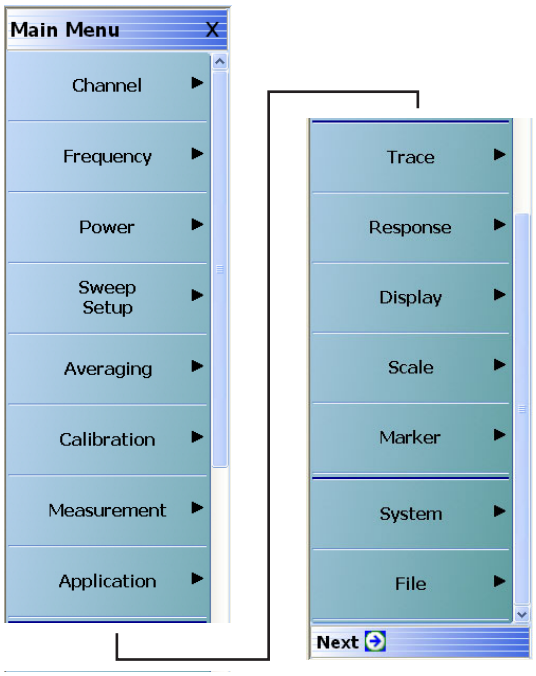


Figure 5-1. MAIN Menu

Channel

Select displays the CHANNEL menu.

Frequency

Select displays the FREQUENCY menu.

Power

Select displays the POWER menu.

Sweep Setup

Select displays the SWEEP SETUP menu.

Averaging

Select displays the AVERAGING menu.

Calibration

Select displays the CALIBRATION menu for 2-Port or 4-Port VNAs.

Measurement

Select displays the MEASUREMENT menu.

Application

Select displays the APPLICATION menu.

Trace

Select displays the TRACE menu.

Response

Select displays the RESPONSE menu for 2-Port or 4-Port VNAs.

Display

Select displays the DISPLAY menu.

Scale

Select displays the SCALE menu which allows the user to change the scaling and other attributes of a trace display. The available SCALE menu buttons change based on the settings on the TRACE FORMAT menu.

Marker

Select displays the MARKER [1] menu.

System

Select displays the SYSTEM menu.

File

Select displays the FILE menu.

Appendix A — Vector Network Analyzer Primer

A-1 Appendix Overview

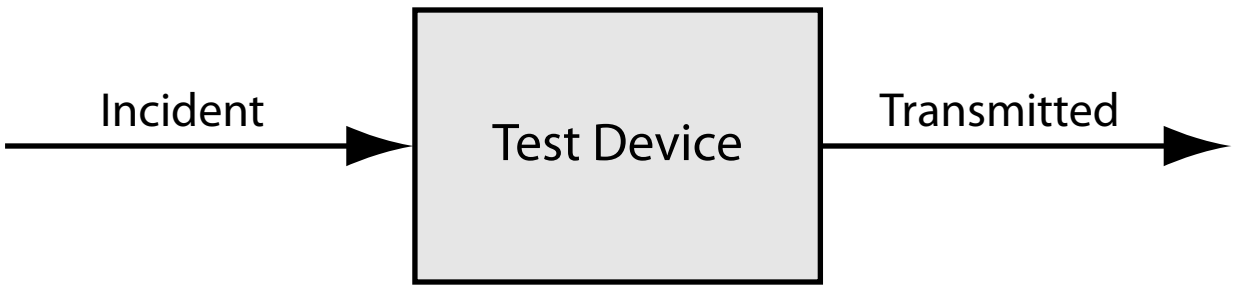
This chapter describes the basic functions of a Vector Network Analyzer (VNA) and how it measures magnitude and phase characteristics of networks, amplifiers, attenuators, and antennas. Scattering parameters (S-parameters) are defined.

This section provides front panel operating and measurement application information and data. It includes discussions on the following topics:

- System description
- General discussion about network analyzers
- Basic measurements and how to make them
- Error correction
- General discussion on test sets

A-2 General Description

The VectorStar MS4640A-Series Vector Network Analyzer (VNA) System measures the magnitude and phase characteristics of networks, amplifiers, attenuators, and antennas. It compares the incident signal that leaves the analyzer with either the signal that is transmitted through the test device or the signal that is reflected from its input. Figure A-1 and Figure A-2 illustrate the types of measurements that the MS4640A-Series VNA can make.



Gain (dB)
Insertion Loss (dB)
Insertion Phase (degrees)
Transmission Coessicients (S12, S21)
Separation of Transmission Components (Read and Imaginary)
Electrical Length (m)
Electrical Delay (s)
Deviation from Linear Phase (degrees)
Group Delay (s)

Figure A-1. Transmission Measurements

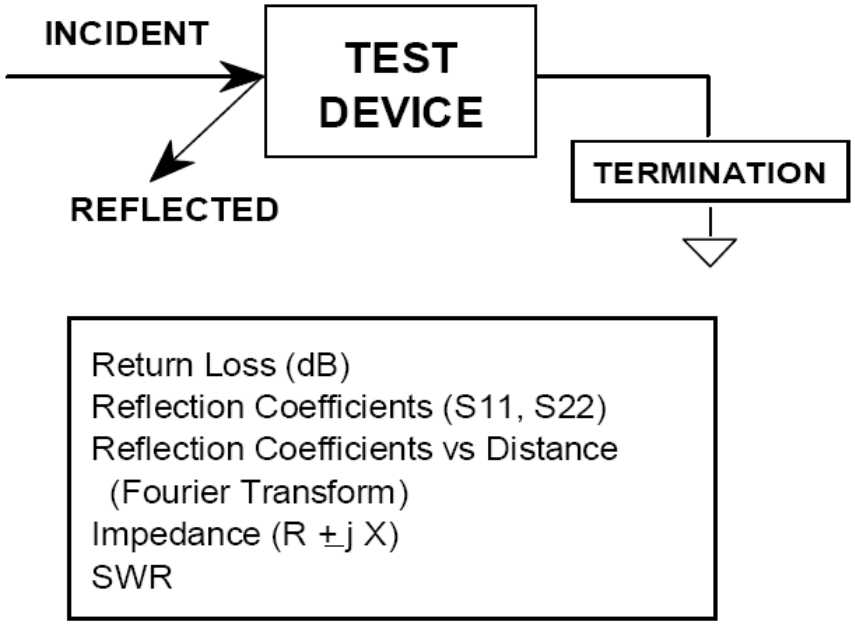


Figure A-2. Reflection Measurements

A-3 Instrument Description

The VectorStar MS4640A Series VNA is a self-contained, fully integrated measurement system that includes an optional time domain capability. The system hardware consists of the following:

- Analyzer
- Precision components required for calibration and performance verification

The VectorStar MS4640A-Series VNA internal system modules perform the following functions:

Source Module

This module provides the stimulus to the device under test (DUT). The frequency range of the source and test set modules establish the frequency range of the system. The frequency stability of the source is an important factor in the accuracy (especially phase accuracy) of the network analyzer. Hence, the MS4640A-Series VNA always phase locks the source to an internal 10 MHz crystal reference.

Test Set Module

The test set module routes the stimulus signal to the DUT and samples the reflected and transmitted signals. The type of connector used is important, as is the “Auto Reversing” feature. Auto Reversing means that it applies the stimulus signal in both the forward and reverse direction. The direction is reversed automatically. This saves you from having to reverse the test device physically to measure all four scattering parameters (S-parameters). Frequency conversion occurs in the test set module.

Analyzer Module

The analyzer module receives, and interprets the 3rd IF signal for phase and magnitude data. It then displays the results of this analysis on a large color display. This display can show all four S-parameters simultaneously. In addition to the installed display, you can also view the measurement results on an external color monitor.

A-4 Network Analyzers

We will begin this discussion with a subject familiar to most Anritsu customers: scalar network analysis. After showing comparisons, we will proceed to the fundamentals of network analyzer terminology and techniques. This discussion serves as an introduction to topics presented in greater detail later in this section. This discussion will touch on new concepts that include the following:

- Reference Delay
- S-parameters: what they are and how they are displayed
- Complex Impedance and Smith Charts

Scalar Analyzer Comparison

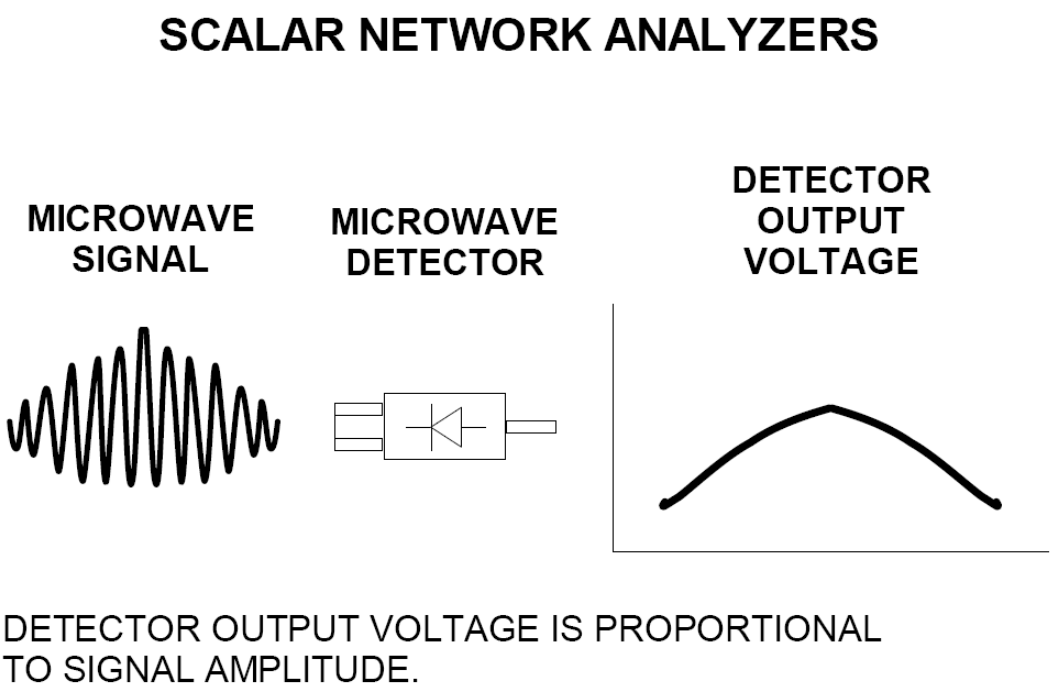


Figure A-3. Scalar Analyzer Detection

Network Analyzers do everything that scalar analyzers do except display absolute power, although absolute power can be displayed on a network analyzer through the use of a receiver calibration. In addition, they add the ability to measure the phase characteristics of microwave devices and allow greater dynamic range.

If all a Network Analyzer added was the capability for measuring phase characteristics, its usefulness would be limited. While phase measurements are important in themselves, it is the availability of this phase information that unlocks many new features for complex measurements. These features include Smith Charts, Time Domain, and Group Delay. Phase information also allows greater accuracy through *vector error correction* of the measured signal.

First, let us look at scalar network analyzers (SNAs). SNAs measure microwave signals by converting them to a DC voltage using a diode detector (Figure A-3). This DC voltage is proportional to the magnitude of the incoming signal. The detection process, however, ignores any information regarding the phase of the microwave signal.

In a network analyzer, access is needed to both the magnitude and phase of a microwave signal. There are several different ways to perform the measurement. The method Anritsu employs (called Harmonic Sampling or Harmonic Mixing) is to down-convert the signal to a lower intermediate frequency (IF). This signal can then be measured directly by a tuned receiver. The tuned receiver approach gives the system greater dynamic range. The system is also much less sensitive to interfering signals, including harmonics.

Vector Network Analyzer Basics

The network analyzer is a tuned receiver (Figure A-4). The microwave signal is down converted into the pass band of the IF. To measure the phase of this signal, we must have a reference to compare it with. If the phase of a signal is 90 degrees, it is 90 degrees different from the reference signal (Figure A-5). The network analyzer would read this as –90 degrees, since the test signal is delayed by 90 degrees with respect to the reference signal.

This phase reference can be obtained by splitting off some of the microwave signal before the measurement (Figure A-7).

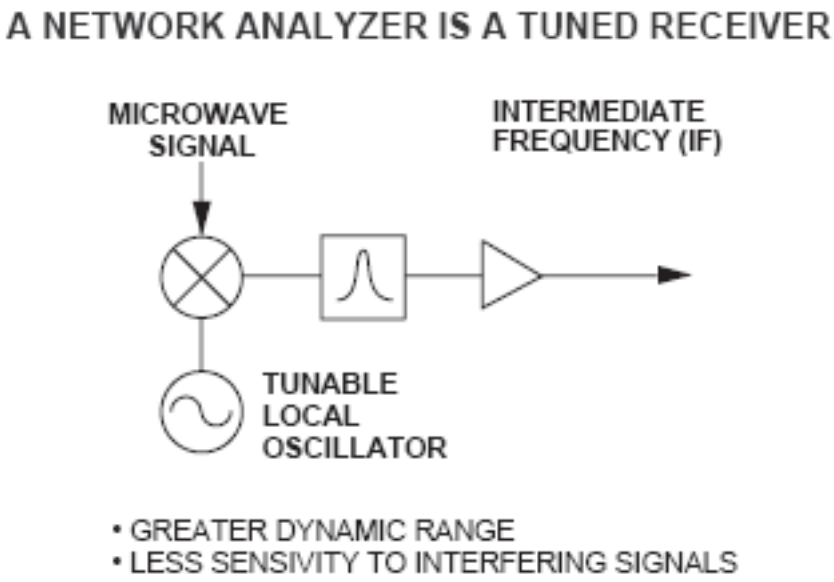


Figure A-4. Network Analyzer as a Tuned Receiver

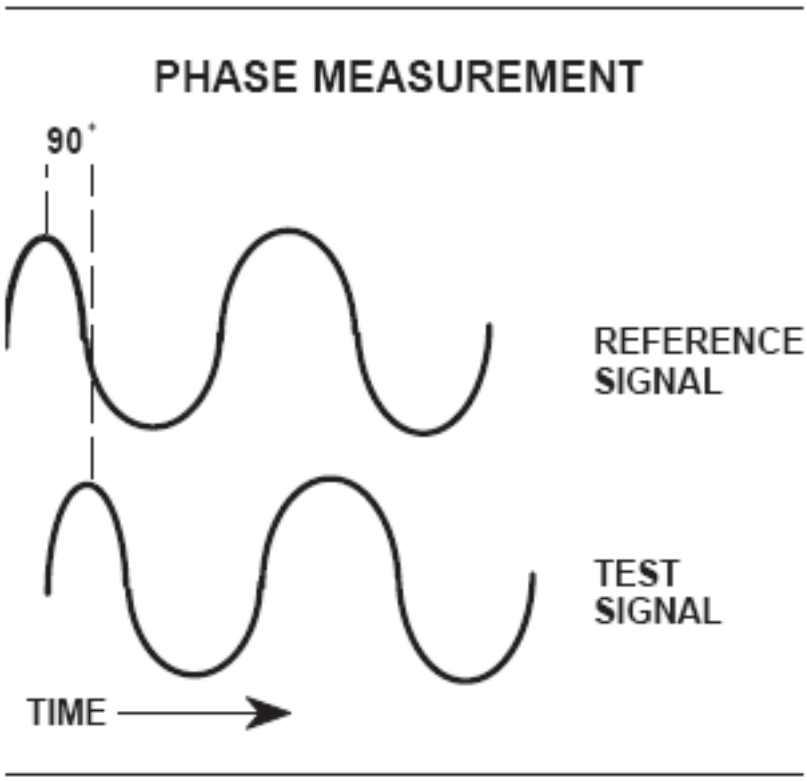


Figure A-5. Signals with a 90 Degree Phase Difference

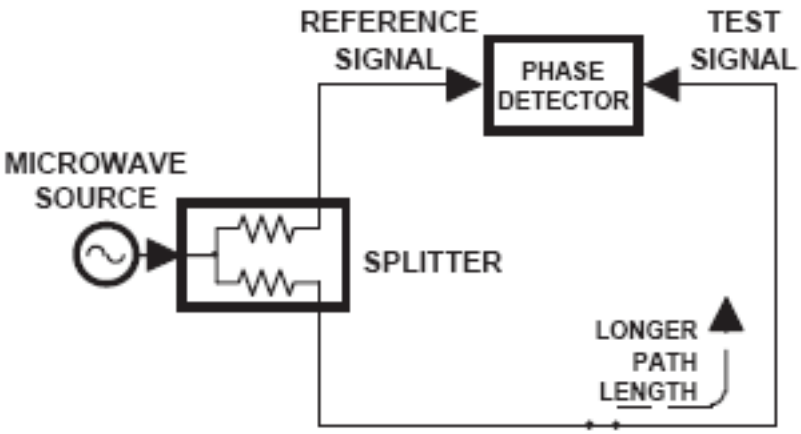


Figure A-6. Split Signal where a Length of Line Replaces the DUT

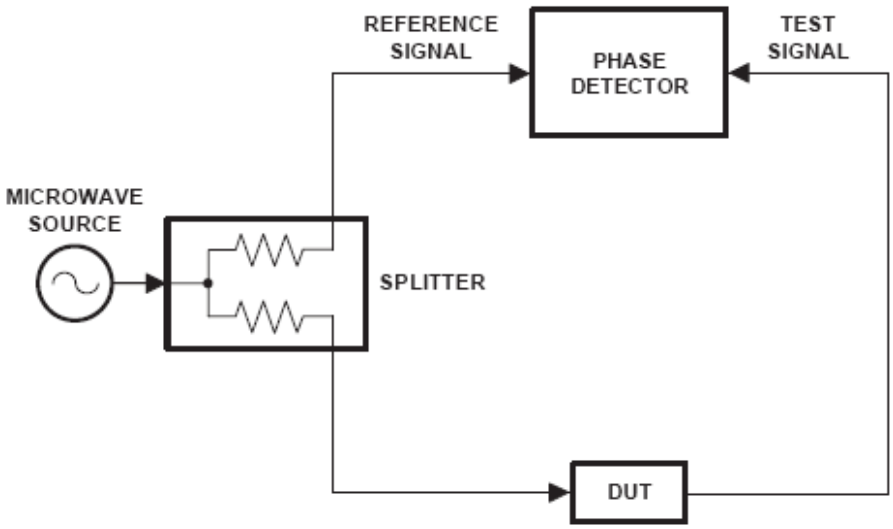


Figure A-7. Splitting the Microwave Signal

The phase of the microwave signal after it has passed through the device under test (DUT) is then compared with the reference signal. A network analyzer test set automatically samples the reference signal, so no external hardware is needed.

Let us consider for a moment that you remove the DUT and substitute a length of transmission line (Figure A-6). Note that the path length of the test signal is longer than that of the reference signal. Now let us see how this affects our measurement.

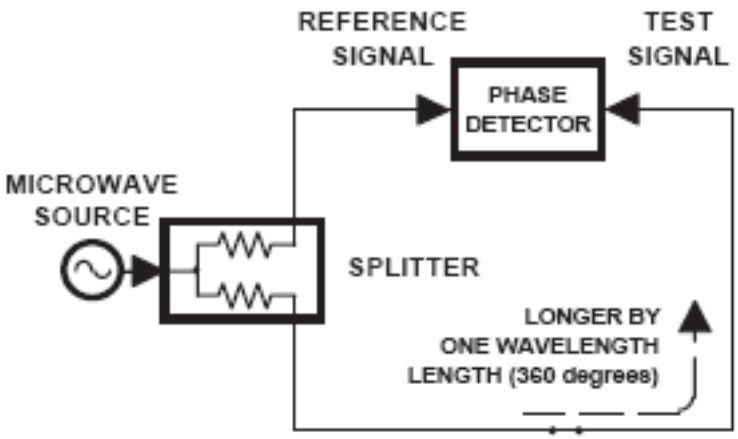


Figure A-8. Split Signal where Path Length is Different by Exactly One Wavelength

Assume that we are making a measurement at 1 GHz and that the difference in path-length between the two signals is exactly 1 wavelength. This means that test signal is lagging the reference signal by 360 degrees (Figure A-8).We cannot really tell the difference between one sine wave maxima and the next (they are all identical), so the network analyzer would measure a phase difference of 0 degrees.

Now consider that we make this same measurement at 1.1 GHz. The frequency is higher by 10 percent so therefore the wavelength is shorter by 10 percent. The test signal path length is now 0.1 wavelength longer than that of the reference signal (Figure A-9). This test signal is:

```
1.1 X 360 = 396 degrees
```

This is 36 degrees different from the phase measurement at 1 GHz. The network analyzer will display this phase difference as –36 degrees. The test signal at 1.1 GHz is delayed by 36 degrees more than the test signal at 1 GHz.

You can see that if the measurement frequency is 1.2 GHz, we will get a reading of –72 degrees, –108 degrees for 1.3 GHz, etc. (Figure A-10). There is an electrical delay between the reference and test signals. For this delay we will use the common industry term of reference delay.

You also may hear it called phase delay. In older network analyzers you had to equalize the length of the reference arm with that of the test arm to make an appropriate measurement of phase vs. frequency.

To measure phase on a DUT, we want to remove this phase-change-vs.-frequency due to changes in the electrical length. This will allow us to view the actual phase characteristics. These characteristics may be much smaller than the phase change due to electrical length difference.

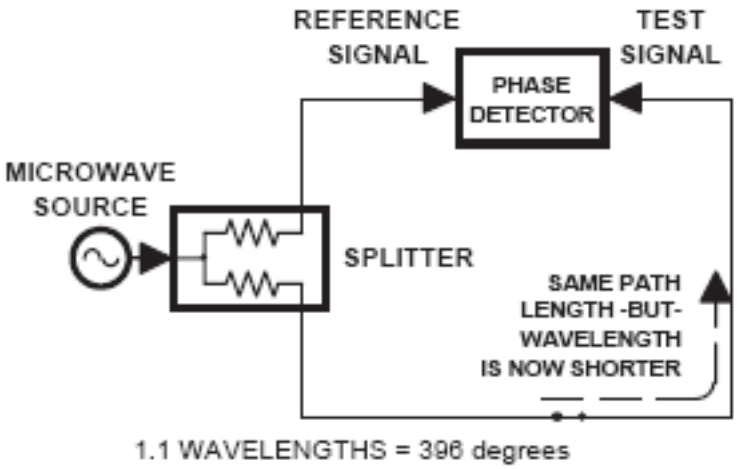


Figure A-9. Split Signal where Path Length is Longer than One Wavelength

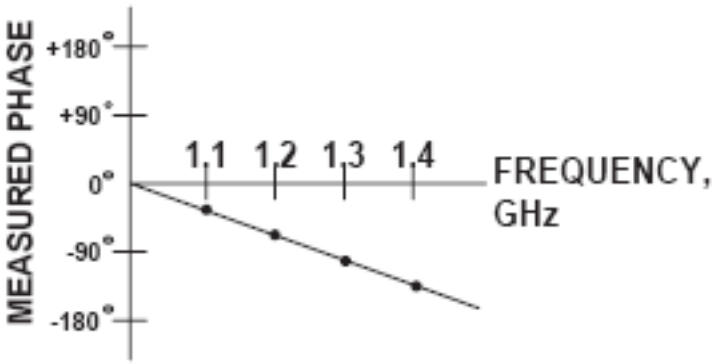


Figure A-10. Electrical Delay

There are two ways of accomplishing this. The most obvious way is to insert a length of line into the reference signal path to make both paths of equal length (Figure A-11).With perfect transmission lines and a perfect splitter, we would then measure a constant phase as we change the frequency. The problem using this approach is that we must change the line length with each measurement setup.

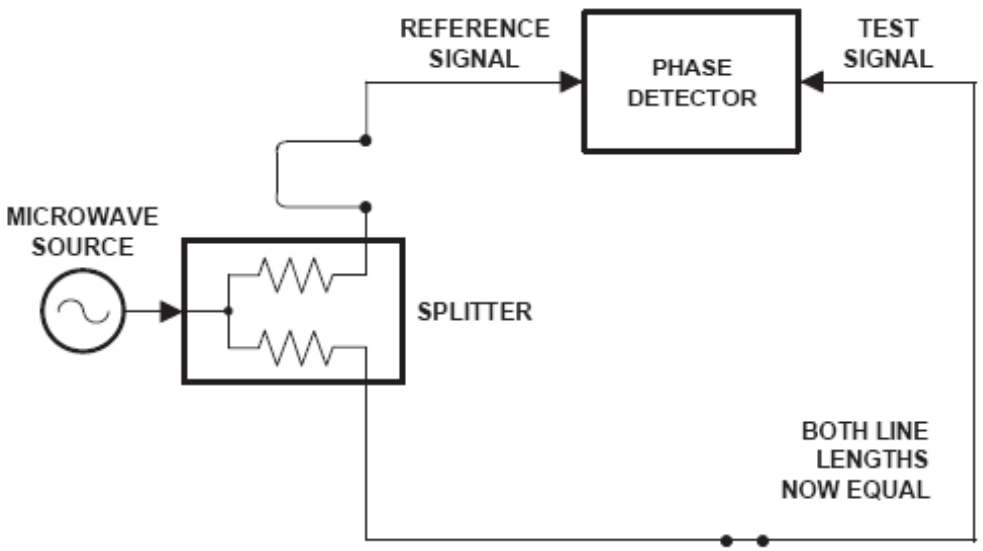


Figure A-11. Split Signal where Paths are of Equal Length

Another approach is to handle the path length difference in software. Figure A-12 displays the phase-vs.-frequency of a device. This device has different effects on the output phase at different frequencies. Because of these differences, we do not have a perfectly linear phase response. We can easily detect this phase deviation by compensating for the linear phase. The size of the phase difference increases linearly with frequency so we can modify the phase display to eliminate this delay.

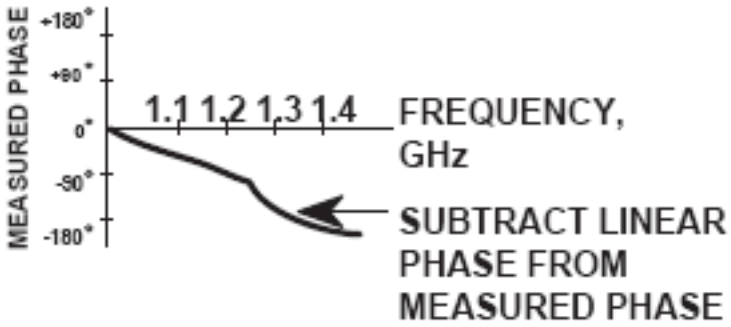


Figure A-12. Phase Difference Increases Linearly with Frequency

The VectorStar MS4640A-Series VNA offers automatic reference delay compensation with the push of a button. Figure A-13 shows the resultant measurement when we compensate path length. In a system application you can usually correct for length differences; however, the residual phase characteristics are critical.

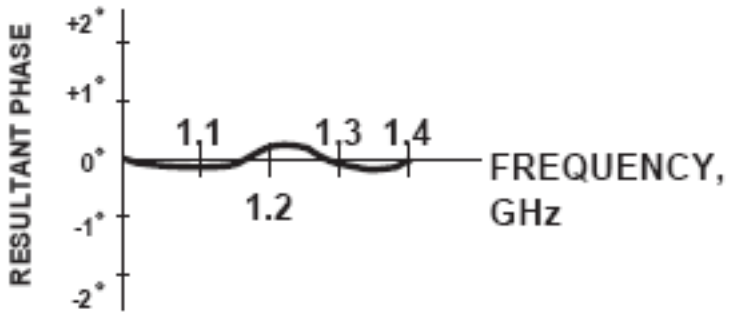


Figure A-13. Resultant Phase with Path Length

Now let us consider measuring the DUT. Consider a two port device; that is, a device with a connector on each end. What measurements would be of interest?

First, we could measure the reflection characteristics at either end with the other end terminated into 50 ohms. If we designate one end as the normal place for the input that gives a reference, we can then define the reflection characteristics from the reference end as forward reflection, and those from the other end as reverse reflection (Figure3-14).

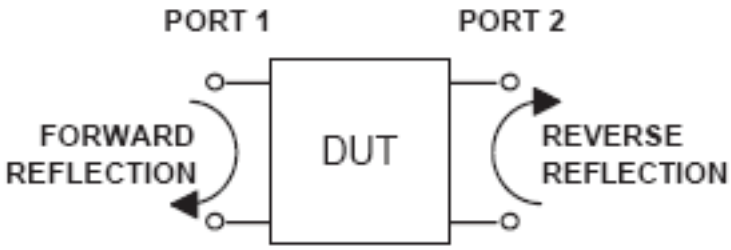


Figure A-14. Forward and Reverse Measurements

Second, we can measure the forward and reverse transmission characteristics. However, instead of saying "forward," "reverse," "reflection," and "transmission" all the time, we use a shorthand. That is all that S-parameters are, a shorthand! The "S" stands for scattering. The second number is the device port that the signal is being injected into, while the first is the device port that the signal is leaving. S11, therefore, is the signal being injected into port 1 relative to the signal leaving port 1. The four scattering parameters (Figure A-15) are:

- S11: Forward Reflection
- S21: Forward Transmission
- S22: Reverse Reflection
- S12: Reverse Transmission

S-parameters can be displayed in many ways. An S-parameter consists of a magnitude and a phase. We can display the magnitude in dB, just like a scalar network analyzer. We often call this term log magnitude. We can display phase as “linear phase” (Figure A-16). As discussed earlier, we cannot tell the difference between one cycle and the next. Therefore, after going through 360 degrees, we are back to where we began. We can display the measurement from –180 to +180 degrees. The –180 to +180 approach is more common. It keeps the display discontinuity removed from the important 0 degree area used as the phase reference.

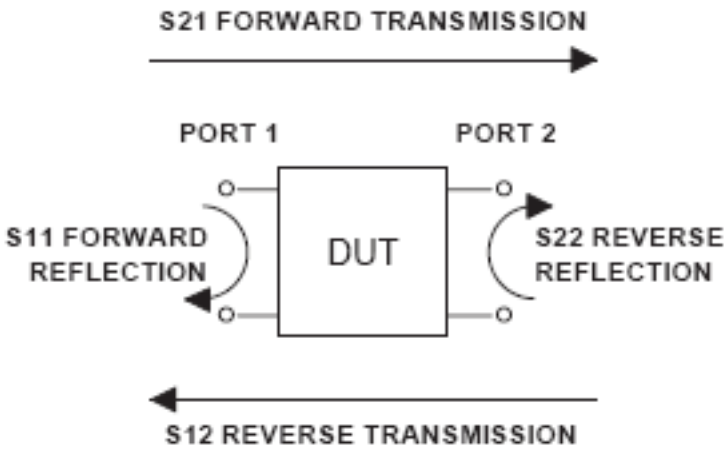


Figure A-15. S-Parameters

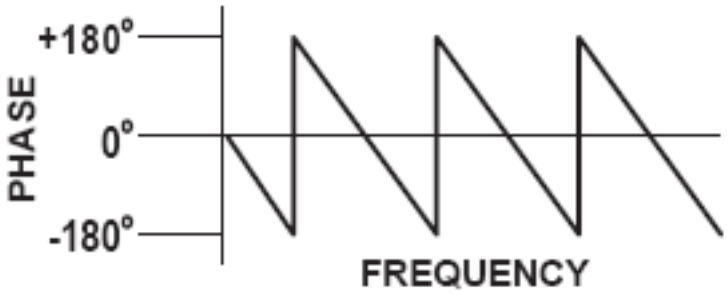


Figure A-16. Linear Phase with Frequency Waveform

There are several ways in which all the information can be displayed on one trace.

A-5 Polar Display

One method is a polar display (Figure A-17). The radial parameter (distance from the center) is magnitude. The rotation around the circle is phase. We sometimes use polar displays to view transmission measurements, especially on cascaded devices (devices in series). The transmission result is the addition of the phase and log magnitude (dB) information of each device's polar display.

Resistive and Reactive Terms

As we have discussed, the signal reflected from a DUT has both magnitude and phase. This is because the impedance of the device has both a resistive and a reactive term of the form $r+jx$. We refer to the r as the real or resistive term, while we call x the imaginary or reactive term. The j, which we sometimes denote as i, is an imaginary number.

It is the square root of –1. If x is positive, the impedance is inductive; if x is negative, the impedance is capacitive.

The size and polarity of the reactive component x is important in impedance matching. The best match to a complex impedance is the complex conjugate. This complex-sounding term simply means an impedance with the same value of r and x, but with x of opposite polarity.

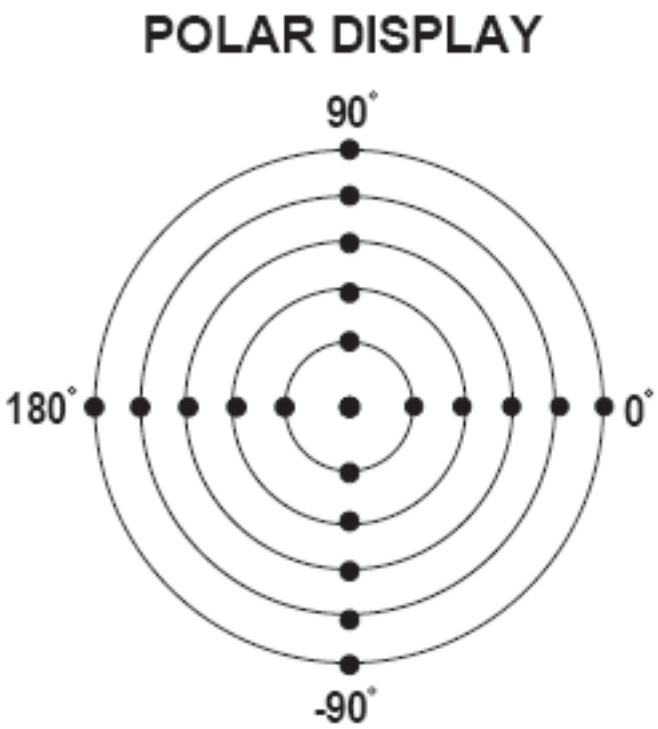


Figure A-17. Polar Display

A-6 Smith Chart

This term is best analyzed using a Smith Chart (Figure A-18), which is a plot of *r* and *x*. To display all the information on a single S-parameter requires one or two traces, depending upon the format we want. A very common requirement is to view forward reflection on a Smith Chart (one trace) while observing forward transmission in Log Magnitude and Phase (two traces). Let us see how to accomplish this in the VectorStar MS4640A-Series VNA.

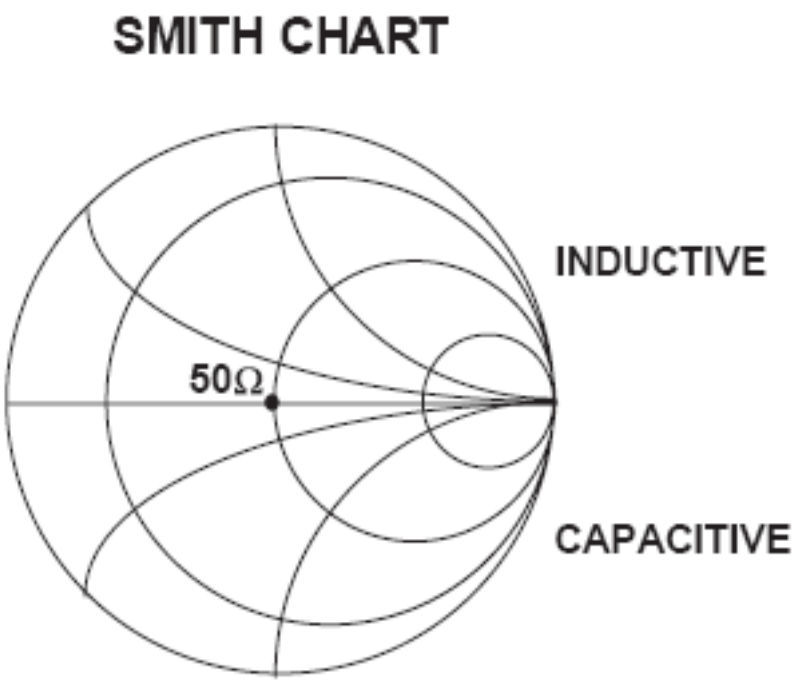


Figure A-18. Smith Chart

The VectorStar MS4640A-Series VNA has 16 channels and each channel can display a complete S-parameter in any format on up to 16 traces. All four S-parameters can be seen simultaneously in any desired format. A total of 16x16 traces can be viewed at the same time. While this is a lot of information to digest, the large color display of the VectorStar MS4640A-Series VNA makes recognizing and analyzing the data surprisingly easy.

Another important parameter we can measure when phase information is available is group delay. In linear devices, the phase change through the DUT is linear-with-frequency. Thus, doubling the frequency also doubles the phase change. An important measurement, especially for communications system users, is the rate of change-of-phase-vs.-frequency (group delay). If the rate of phase-change-vs.-frequency is not constant, the DUT is nonlinear. This nonlinearity can create distortion in communications systems.

Measurement Error Correction

Since we can measure microwave signals in both magnitude and phase, it is possible to correct for six major error terms:

- Source Test Port Match
- Load Test Port Match
- Directivity
- Isolation
- Transmission Frequency Response
- Reflection Frequency Response

We can correct for each of these six error terms in both the forward and reverse directions, hence the name 12-term error correction. Since 12-term error correction requires both forward and reverse measurement information, the test set must be *reversing*. "Reversing" means that it must be able to apply the measurement signal in either the forward or reverse direction.

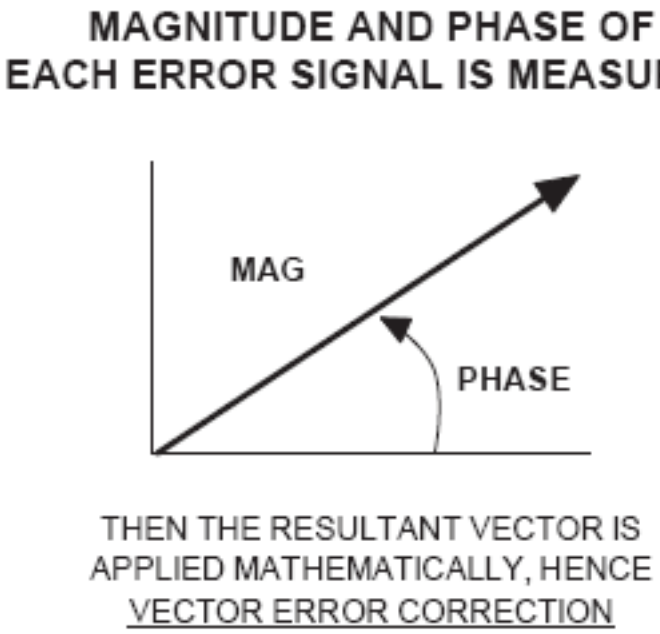


Figure A-19. Magnitude and Phase

To accomplish this error correction, we measure the magnitude and phase of each error signal (Figure A-19). Magnitude and phase information appear as a vector that is mathematically applied to the measurement signal. This process is termed *vector error correction*.

Appendix B — Initial Checkout Procedures

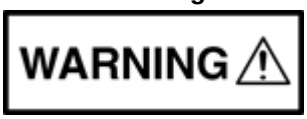
B-1 Introduction

The initial checkout procedure chapter describes the detailed procedures for initial operational checkout (such as those performed by incoming quality inspectors) to ensure that the MS4640A Series VNA is fully operational. A quick check procedure is described along with how to determine the instrument's installed options, current operating system, application software, and firmware versions. Other procedures provided are self-test, non-ratio power, high-level signal, and system noise floor test.

For full performance verification and calibration routines, see the following documents:

- **VectorStar MS4640A Series VNA Measurement Guide – 10410-00269**
- **VectorStar MS4640A Series VNA Maintenance Manual – 10410-00268**

Warning



This equipment can not be repaired by the operator. DO NOT attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

B-2 Checkout Introduction

This chapter provides quick operational checkout procedures that may be used by incoming inspectors to ensure that the MS4640A Series Vector Network Analyzer is operational. The following procedures are provided:

- Self test procedure
- Non-ratio power procedure
- High-level noise test
- System noise floor test

B-3 Required Equipment

The following equipment is required for the procedures in this chapter:

- Flexible microwave cable (through line)

B-4 Self Test Procedure

Overview

This procedure uses internal routines to test basic system operation and performance. The procedure uses a mixture of commands from:

- Drop-down menus from the top Menu Bar
- Icons from the Icon Toolbar
- Application menus and buttons from the right-side user interface

Procedure

1. Before starting the performance tests:

a. Locate the appropriate AC source with:

- 90 VAC minimum to 264 VAC maximum
- Single phase
- 47 to 63 Hz power factor controlled
- Power output capable of 350 VA maximum

b. Connect the instrument to the AC source with the provided power cable.

c. On the instrument rear panel, turn the **AC Input On/Off (I/O)** switch to ON (**I**).

d. On the instrument front panel, press the instrument power key which is labeled **Standby Operate Key**.

- The key is located on the left side of the front panel, just above the test loops and the grounding banana jack.

e. The green **Operate LED** illuminates and system is on.

Note	Allow the system to warm up for at least 90 minutes to ensure operation to performance specifications.

2. Perform an instrument self-test to ensure that the VNA is operating properly.

a. To start the instrument self test, use the Menu Bar at the top of the display.

b. Select MENU BAR | Utilities | System.

c. The right side SYSTEM menu appears.

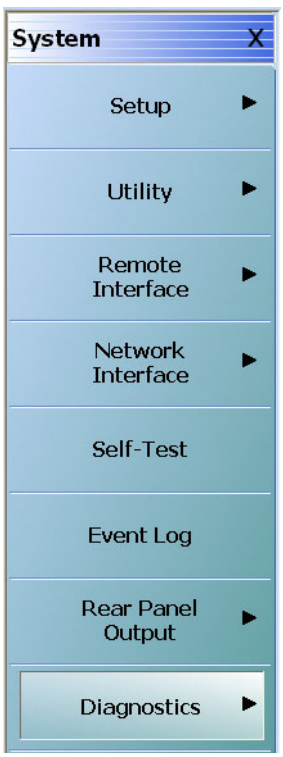
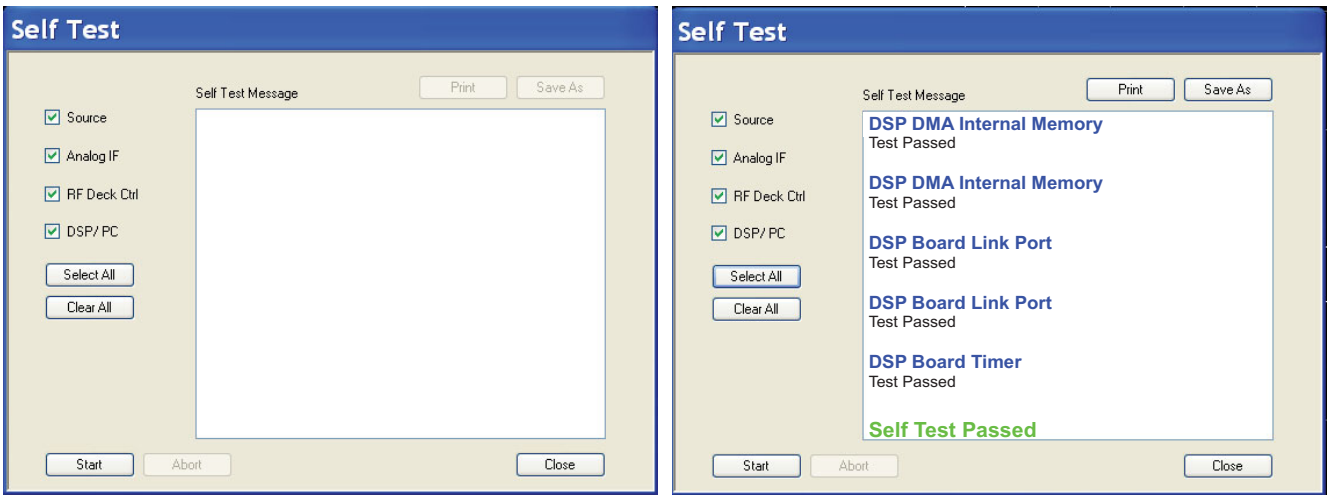


Figure B-1. SYSTEM Menu

3. Select the Self-Test button. The SELF TEST dialog box appears.



① ②

1. SELF TEST dialog box before test at left.	2. SELF TEST dialog box after successful test at right.

Figure B-2. SELF TEST Dialog Box

Self-Test Selections

4. Select all check boxes:

- Source
- Analog IF
- RF Deck Ctrl
- DSP/PC

Self-Test Results

5. Click Start to begin the initial self-test process.

- If the test is successful, the "`Self Test Passed`" message is displayed.

6. Click Close to exit the dialog box.

B-5 Non-Ratio Power Procedure

Overview

This test verifies that each individual receiver operates properly. Measurement calibration of the system is *not* required for this test. This test requires that you press specified front panel keys, or use a mouse to make choices from the displayed menus and is valid for all instrument model and option combinations. The key and menu selections used in this test are shown below.

Procedure

1. Connect Test Ports 1 and 2 together using a high-quality through line.

2. At the top of the display, select MENU BAR | Utilities | System. The right-side SYSTEM menu appears:

- Click Setup. The SETUP menu appears.
- Click Preset Setup. The PRESET SETUP menu appears.
- Select Default.
  - The default setting associates both the front panel **Preset Key** and the MENU BAR | Utilities | Preset command with the factory-default preset configuration.

3. Reset the VNA by pressing the front panel **Preset Key.**

- The VNA resets to the factory-default as-shipped configuration.
- The right-side menu returns to the MAIN MENU.

4. At the top of the display, select MENU BAR | Utilities | System.

- The right side SYSTEM menu appears.

5. On the right-side, select SYSTEM | Utility | UTILITY | Factory Receiver Cal and toggle the Factory Receiver Cal button to OFF.

Check Frequency and Set Power

6. On the right side MAIN MENU, select Frequency.

a. The FREQUENCY menu appears.

b. Observe the displayed Frequency menu.

c. Note that the Start and Stop values are the low-end and high-end frequencies.

7. At the top of the display, select MENU BAR | Channel | Power.

a. The right side POWER menu appears.

b. Click on the Port 1 Power button.

c. In the displayed field toolbar, enter -10.0000 dBm.

d. Click the X at the end of the toolbar to close it.

Set Channel and Trace Display

8. Select the upper left LCD channel using the mouse by clicking on Tr1 S11 Refl Smith Imped.

- The trace name has additional resolution and unit information appended to the displayed label.

9. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click the Trace Format button, the TRACE FORMAT menu appears.

b. Select Log Mag.

10. On the icon toolbar, select the Response icon.

a. The RESPONSE menu appears.

b. Click on User-Defined, the USER DEFINED menu appears.

c. Click on Numerator and on the NUMERATOR menu, set it to A1.

d. Click on Denominator and on the DENOMINATOR menu, set it to 1.

e. Set Driver Port to Port 1.

Select Lower Left Channel

11. Select the lower left channel by clicking trace label that starts with Tr3 S21 Trans LogM+P.

- The trace name has additional resolution and unit information appended to the displayed label.

12. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click on the Trace Format button, the TRACE FORMAT menu appears.

b. Select Log Mag.

13. On the icon toolbar, select the Response icon. The RESPONSE menu appears.

a. Click on User-Defined, the USER DEFINED menu appears.

b. Click on Numerator and on the NUMERATOR menu, set it to B2.

c. Click on Denominator and on the DENOMINATOR menu, and set it to 1.

d. Set Driver Port to Port 1.

Select Upper Right LCD Channel

14. Select the upper right LCD channel using the mouse by clicking on Tr2 S12 Trans Log M+P.

- The trace name has additional resolution and unit information appended to the displayed label.

15. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click on the Trace Format button, the TRACE FORMAT menu appears.

b. Select Log Mag.

16. At the top of the display, select MENU BAR | Trace | Response. The right side RESPONSE menu appears.

a. Click on User-Defined, the USER DEFINED menu appears.

b. Click on Numerator and on the NUMERATOR menu, and set it to A2.

c. Click on Denominator and on the DENOMINATOR menu, set it to 1.

d. Set Driver Port to Port 2.

Select Lower Right Channel

17. Select the lower right channel by clicking on Tr4 S22 Refl Smith Imped.

- The trace name has additional resolution and unit information appended to the displayed label.

18. On the top menu bar, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

- Click on the Trace Format button. The TRACE FORMAT menu appears.
- Select Log Mag.

19. On the top menu bar, select MENU BAR | Trace | Response. The RESPONSE menu appears.

a. Click on User-Defined, the USER DEFINED menu appears.

b. Click on Numerator and on the NUMERATOR menu, and set it to B1.

c. Click on Denominator and on the DENOMINATOR menu, and set it to 1.

d. Set Driver Port to Port 2.

Review Amplitude Slopes for Maximum and Minimum Values

20. After at least one complete forward and reverse sweep has occurred, verify that the maximum-value to minimum-value amplitude slope meets the specification below in Table B-1.

Table B-1. Maximum-Value to Minimum-Value Amplitude Slope Specifications

Model	F-High	Test Channel (b1,b2) Max	Test Channel (b1,b2) Min	Ref Channel (a1,a2) Max	Ref Channel (a1,a2) Min
MS4642A	20 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4642A-061	20 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4642A-062	20 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4642A-051	20 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4644A	40 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4644A-061	40 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4644A-062	40 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4644A-051	40 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4645A	50 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4645A-061	50 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4645A-062	50 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4645A-051	50 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4647A	70 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4647A-061	70 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4647A-062	70 GHz	–10 dB	–55 dB	–20 dB	–50 dB
MS4647A-051	70 GHz	–10 dB	–55 dB	–20 dB	–50 dB

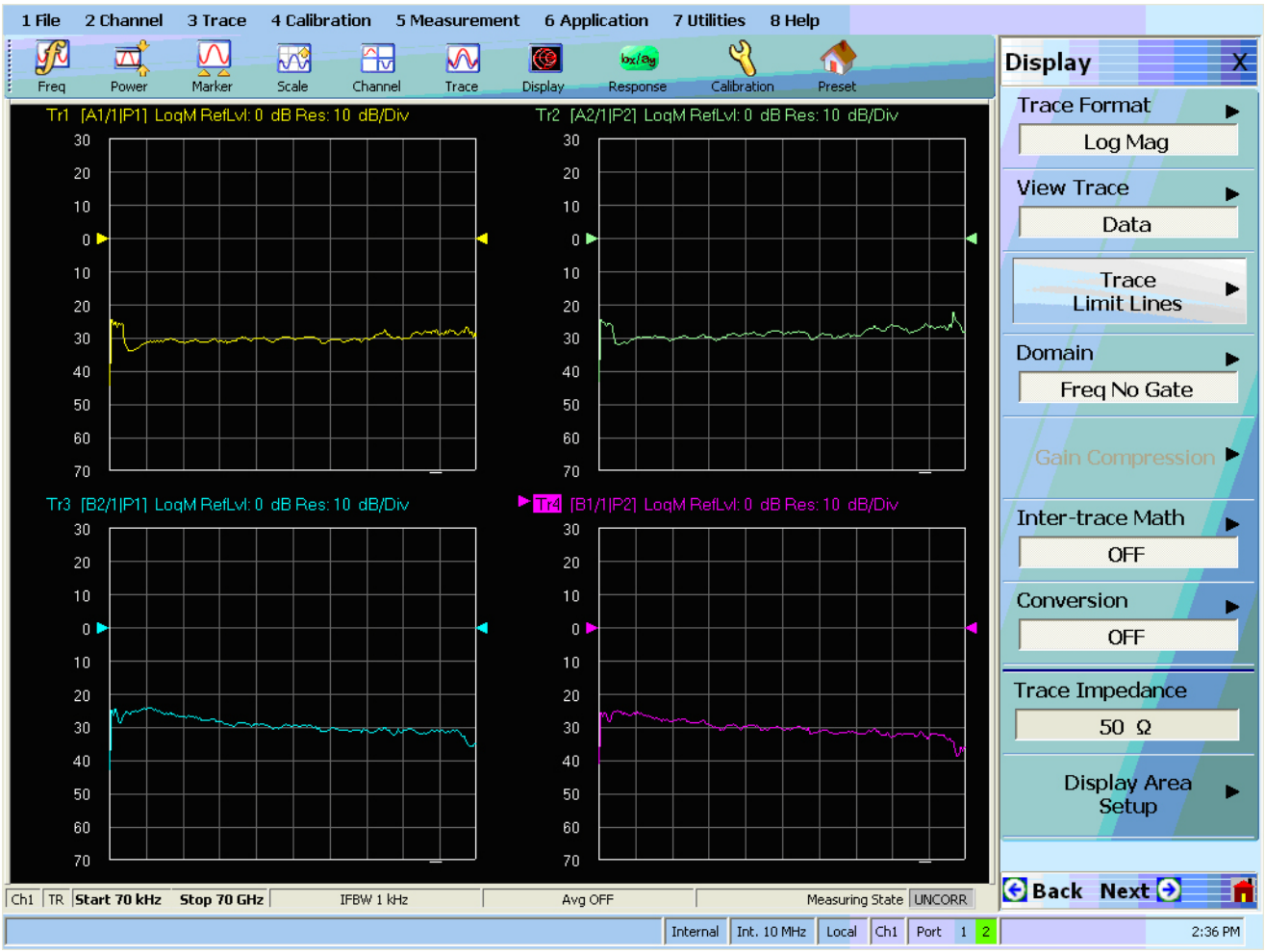


Figure B-3. Typical Display

21. Conclude this test by pressing the front panel **Preset Key** to return the system to the factory default preset condition.

B-6 High Level Noise Test

Overview

This test verifies that high-level signal noise will not significantly affect the accuracy of subsequent measurements. Measurement calibration of the system is not required for this test. This test requires that you press specified front panel keys, or use a mouse to make choices from the displayed menu(s). The key and menu selections used in this test are shown below. The test below is valid for all models and option combinations.

Procedure

1. Connect Test Ports 1 and 2 together using a high-quality through line.

2. At the top of the display, select MENU BAR | Utilities | System. The right side SYSTEM menu appears.

- **a.** Click on Setup. The SETUP menu appears.
- **b.** Click on Preset Setup. The PRESET SETUP menu appears.
- **c.** Select Default.

3. Reset the VNA by pressing the front panel **Preset Key**.

Frequency and Set Power

4. On the right side menus, select MAIN MENU | Frequency. The FREQUENCY menu appears.

- **a.** Observe that the displayed FREQUENCY menu.
- **b.** Note that the Start and Stop values are the low-end and high-end frequencies.

5. At the top of the display, select MENU BAR | Channel | Averaging. The right side AVERAGING menu appears.

- **a.** Click on the Averaging Factor button. On the displayed field toolbar, enter 40. Click the Enter button and then click the X at the end of the toolbar to close it.
- **b.** Click on the Averaging toggle button and toggle to ON.

Select Upper Left LCD Channel

6. Select the upper left LCD channel using the mouse by clicking on Tr1 S11 Refl Smith Imped.

- The trace name has additional resolution and unit information appended to the displayed label.

7. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

- **a.** Click Trace Format button. The TRACE FORMAT menu appears.
- **b.** Select Log Mag.

8. At the top of the display, select MENU BAR | Trace | Response.

- **a.** The right side RESPONSE menu appears.
- **b.** Click S21.

9. At the top of the display, select MENU BAR | Trace | Marker. The right side MARKERS [1] menu appears.

- **a.** Click Marker Setup. The MARKER SETUP menu appears.
- **b.** Toggle the Statistics Display button to ON.

10. At the top of the display, select MENU BAR | Trace | Display. The right-side DISPLAY menu appears.

- **a.** Click on the View Trace button, the right-side VIEW TRACE menu appears.
- **b.** After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.
- **c.** On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data, Memory Math, and Off buttons become available.
- **d.** Select the Data, Memory Math button.

11. At the top of the display, select MENU BAR | Trace | Scale. The right-side SCALE menu appears.

a. Click on the Resolution button. The Resolution field toolbar appears above the main display.

b. Enter 0.01 dB/Div.

c. Click the X to close the field toolbar.

d. After at least one complete forward and reverse sweep has occurred, view the trace statistics display titled Stat. Range: Entire Sweep.

e. Verify that the Std. Dev. measurement for this trace is less than 0.08 dB.

Select Upper Right LCD Channel - TR2

12. Select the upper right LCD channel using the mouse by clicking on Tr2 S12 Trans Log M+P.

- The trace name has additional resolution and unit information appended to the displayed label.

13. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click Trace Format button.

b. The TRACE FORMAT menu appears.

c. Select Log Mag.

14. At the top of the display, select MENU BAR | Trace | Response.

a. The right side RESPONSE menu appears.

b. Click S12.

15. At the top of the display, select MENU BAR | Trace | Marker. The right side MARKERS [1] menu appears.

a. Click Marker Setup. The MARKER SETUP menu appears.

b. Toggle the Statistics Display button to ON.

16. At the top of the display, select MENU BAR | Trace | Display. The right-side DISPLAY menu appears.

a. Click on the View Trace button, the right-side VIEW TRACE menu appears.

b. After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.

c. On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data, Memory Math, and Off buttons become available.

d. Select the Data, Memory Math button.

17. At the top of the display, select MENU BAR | Trace | Scale. The right-side SCALE menu appears.

a. Click on the Resolution button. The Resolution field toolbar appears above the main display.

b. Enter 0.1 dB/Div.

c. Click the X to close the field toolbar.

d. After at least one complete forward and reverse sweep has occurred, view the trace statistics display titled Stat. Range: Entire Sweep.

e. Verify that the Std. Dev. measurement for this trace is less than 0.008 dB.

Select Lower Left LCD Channel - TR3

18. Select the lower left LCD channel using the mouse by clicking on Tr3 S21 Trans LogM+P.

- The trace name has additional resolution and unit information appended to the displayed label.

19. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click Trace Format button. The TRACE FORMAT menu appears.

b. Select Phase.

20. At the top of the display, select MENU BAR | Trace | Response.

a. The right side RESPONSE menu appears.

b. Click S21.

21. At the top of the display, select MENU BAR | Trace | Marker. The right side MARKERS [1] menu appears.

a. Click Marker Setup. The MARKER SETUP menu appears.

b. Toggle the Statistics Display button to ON.

22. At the top of the display, select MENU BAR | Trace | Display. The right-side DISPLAY menu appears.

a. Click on the View Trace button, the right-side VIEW TRACE menu appears.

b. After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.

c. On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data, Memory Math, and Off buttons become available.

d. Select the Data, Memory Math button.

23. At the top of the display, select MENU BAR | Trace | Scale. The right-side SCALE menu appears.

a. Click on the Resolution button. The Resolution field toolbar appears above the main display.

b. Enter 0.1 º(Deg)/Div.

c. Click the X to close the field toolbar.

d. After at least one complete forward and reverse sweep has occurred, view the trace statistics display titled Stat. Range: Entire Sweep.

e. Verify that the Std. Dev. measurement for this trace is less than 0.08 º(Deg).

Select Lower Right LCD Channel - TR4

24. Select the lower right LCD channel using the mouse by clicking on Tr4 S22 Refl Smith Imped.

- The trace name has additional resolution and unit information appended to the displayed label.

25. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click Trace Format button. The TRACE FORMAT menu appears.

b. Select Phase.

26. At the top of the display, select MENU BAR | Trace | Response.

a. The right side RESPONSE menu appears.

b. Click S12.

27. At the top of the display, select MENU BAR | Trace | Marker. The right side MARKERS [1] menu appears.

a. Click Marker Setup. The MARKER SETUP menu appears.

b. Toggle the Statistics Display button to ON.

28. At the top of the display, select MENU BAR | Trace | Display. The right-side DISPLAY menu appears.

a. Click on the View Trace button, the right-side VIEW TRACE menu appears.

b. After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.

c. On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data Memory Math, and Off buttons become available.

d. Select the Data, Memory Math button.

29. At the top of the display, select MENU BAR | Trace | Scale. The right-side SCALE menu appears.

a. Click on the Resolution button. The Resolution field toolbar appears above the main display.

b. In the toolbar, enter 0.1 º(Deg)/Div and then click the Enter button.

c. Resolution is now set to 0.1 º(Deg)/Div in the stated Resolution.

d. Click the X to close the field toolbar.

e. After at least one complete forward and reverse sweep has occurred, view the trace statistics display titled Stat. Range: Entire Sweep.

f. Verify that the Std. Dev. measurement for this trace is less than 0.08 º(Deg).

B-7 System Noise Floor Test

Overview

This test verifies that System Noise Floor performance will not significantly affect the accuracy of subsequent measurements. Measurement calibration of the system is not required for this test. This test requires that you press specified front panel keys, or use a mouse to make choices from the displayed menu(s). The key and menu selections used in this test are shown below. The test below is valid for all models and option combinations.

Procedure

Connect Test Ports and Preset

1. Connect Test Ports 1 and 2 together using a high quality through line.
2. At the top of the display, select MENU BAR | Utilities | System. The right side SYSTEM menu appears.
   a. Click on Setup. The SETUP menu appears.
   b. Click on Preset Setup. The PRESET SETUP menu appears.
   c. Select Default.
3. Reset the VNA using the front panel **Preset Key**.

Check Frequency and Set Power

4. At the top of the display, select MENU BAR | Channel | Frequency. The right side FREQUENCY menu appears.
   a. Observe that the displayed FREQUENCY menu values.
   b. Note that the Start and Stop values are the low-end and high-end frequencies.
5. At the top of the display, select MENU BAR | Channel | Averaging. The right side AVERAGING menu appears.
   a. Click on the Averaging Factor button. On the displayed field toolbar, enter 40. Click the X at the end of the toolbar to close it.
   b. Click on the Averaging button and toggle to ON.

Check Frequency Sub-Bands

6. Repeat the steps below for only the frequency sub-bands that fall within the START and STOP limits of your system configuration.

Table B-2. Frequency Sub-Bands within Start and Stop System Limits (1 of 2)

Sub-Band	Model Number Applicability	Start and Stop Frequency
Band 1	All instrument models.	• 0.07 MHz to 0.3 MHz
Band 2	All instrument models.	• 0.3 MHz to 2 MHz
Band 3	All instrument models.	• 0.3 MHz to 2 MHz
Band 4	All instrument models.	• 0.01 GHz to 2.5 GHz
Band 5	Depends on instrument model.	• MS4642A: 2.5 GHz to 20 GHz • MS4644A: 2.5 GHz to 40 GHz • MS4645A: 2.5 GHz to 38 GHz • MS4647A: 2.5 GHz to 38 GHz
Band 6	Applies only to MS4645A and MS4647A.	• 38 GHz to 50 GHz
Band 7	Applies only to MS4647A.	• 50 GHz to 65 GHz

Table B-2. Frequency Sub-Bands within Start and Stop System Limits (2 of 2)

Sub-Band	Model Number Applicability	Start and Stop Frequency
Band 8	Applies only to MS4647A.	• 65 GHz to 67 GHz
Band 9	Applies only to MS4647A.	• 67 GHz to 70 GHz

Set Channel

7. At the top of the display, select MENU BAR | Channel | Frequency.

a. The right side FREQUENCY menu appears.

b. Set the START and STOP frequencies for the sub-band to be verified.

8. At the top of the display, select MENU BAR | Channel | Power.

a. The right side POWER menu appears.

b. Click Port 1 Power, and on the field toolbar that appears, enter –10 dBm.

9. At the top of the display, select MENU BAR | Channel | Averaging.

a. The right side AVERAGING menu appears.

b. Click and on the toolbar that appears, enter 10 Hz.

Set Traces

10. At the top of the display, select MENU BAR | Trace | Trace Menu. The right side TRACE menu appears.

a. Click # of Traces button, and on the field toolbar that appears, enter 2.

b. Click on Trace Layout. The right side TRACE LAYOUT menu appears.

c. Select the 2 vertically stacked horizontal rectangle display configuration (third button from top).

Select Upper Trace TR1

11. Select the upper LCD channel by clicking on Tr1 S11 Refl Smith Imped.

- The trace name has additional resolution and unit information appended to the displayed label.

12. At the top of the display, select MENU BAR | Trace | Display. The right side DISPLAY menu appears.

a. Click Trace Format button. The TRACE FORMAT menu appears.

b. Select Log Mag.

13. At the top of the display, select MENU BAR | Trace | Response.

a. The right side RESPONSE menu appears.

b. Click S21.

14. At the top of the display, select MENU BAR | Trace | Display.

a. The right-side DISPLAY menu appears.

b. Click on the View Trace button, the right-side VIEW TRACE menu appears.

c. After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.

d. On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data, Memory Math, and Off buttons become available.

e. Select the Data, Memory Math button.

Select Lower Trace TR2

15. Select the lower LCD channel by clicking on Tr2 S12 Trans Log M+P.

- The trace name has additional resolution and unit information appended to the displayed label.

16. At the top of the display, select MENU BAR | Trace | Display.

a. The right side DISPLAY menu appears.

b. Click Trace Format button. The TRACE FORMAT menu appears.

c. Select Log Mag.

17. At the top of the display, select MENU BAR | Trace | Response.

a. The right side RESPONSE menu appears.

b. Click S12.

18. At the top of the display, select MENU BAR | Trace | Display.

a. The right-side DISPLAY menu appears.

b. Click on the View Trace button, the right-side VIEW TRACE menu appears.

c. After at least one complete forward and reverse sweep has occurred, select the Store Data to Memory button.

d. On the VIEW TRACE menu, the Data, Memory, Data & Memory, Data, Memory Math, and Off buttons become available.

e. Select the Data, Memory Math button.

Reverse Terminations and Test Port Cable

19. Disconnect the Test Port cable from Port 1.

20. Place terminations on Port 1 and the Test Port cable connected to Port 2.

21. At the top of the display, select MENU BAR | Channel | Averaging.

a. The right side AVERAGING menu appears.

b. Click and on the toolbar that appears, enter 1 (one) Hz.

Select Upper Trace TR1

22. Select the upper LCD channel by clicking on Tr1 S21 Trans Log M+P.

- The trace name has additional resolution and unit information appended to the displayed label.

23. At the top of the display, select MENU BAR | Trace | Scale.

a. The right-side SCALE menu appears.

b. Click on the Reference Value button and, on the field toolbar that appears, enter –70 dB.

c. Click on the Reference Position button and, on the field toolbar that appears, enter 8.

24. At the top of the display, select MENU BAR | Trace | Display.

a. The right side DISPLAY menu appears.

b. Click the Trace Limit Lines button. The LIMIT menu appears.

c. Click on Limit Line and toggle to ON.

d. Click on the Edit Limit Line button. The EDIT LIMIT LINE menu appears on the right, and the LIMIT LINE TABLEAU appears at the bottom of the screen.

e. Click the Add button and use the table below to enter limit-line data for the sub-band.

Table B-3. Sub-Band Limit Line Data - X Offset and Y Offset Remain Blank (1 of 2)

Sub-Band	X1 to X2	Standard VNAs Y1 and Y2	VNAs with Option 051 Y1 and Y2	VNAs with Option 061/062 Y1 and Y2
Band 1	0.07 MHz to 0.3 MHz	–65 dB	–64 dB	–63 dB
Band 2	0.3 MHz to 2 MHz	–82 dB	–81 dB	–80 dB

Table B-3. Sub-Band Limit Line Data - X Offset and Y Offset Remain Blank (2 of 2)

Sub-Band	X1 to X2	Standard VNAs Y1 and Y2	VNAs with Option 051 Y1 and Y2	VNAs with Option 061/062 Y1 and Y2
Band 3	2 MHz to 10 MHz	–95 dB	–94 dB	–93 dB
Band 4	0.01 GHz to 2.5 GHz	–100 dB	–98 dB	–94 dB
Band 5	Depends on the instrument model: • MS4642A: 2.5 to 20 GHz • MS4644A: 2.5 to 40 GHz • MS4645A: 2.5 to 38 GHz • MS4647A: 2.5 to 38 GHz	–100 dB	–97 dB	–93 dB
Band 6	Applies only to MS4645A and MS4647A: • 38 GHz to 50 GHz	–100 dB	–96 dB	–93 dB
Band 7	Applies only to MS4647A: • 50 GHz to 65 GHz	–97 dB	–93 dB	–91 dB
Band 8	Applies only to MS4647A: • 65 GHz to 67 GHz	–95 dB	–90 dB	–86 dB
Band 9	Applies only to MS4647A: • 67 GHz to 70 GHz	–93 dB	–87 dB	–84 dB

25. When all sub-band data is entered, at the bottom of the right side menu, click Back to return to the LIMIT menu.

26. After at least one complete forward and reverse sweep has occurred, verify that trace data is below the limit line.

Select Trace 2 (TR2)

27. Select the lower LCD channel by clicking on Tr2 S12 Trans Log M+P.

- The trace name has additional resolution and unit information appended to the displayed label.

28. At the top of the display, select MENU BAR | Trace | Scale.

a. The right-side SCALE menu appears.

b. Click on the Reference Value button and, on the field toolbar that appears, enter –70 dB.

c. Click on the Reference Position button and, on the field toolbar that appears, enter 8.

29. At the top of the display, select MENU BAR | Trace | Display.

a. The right side DISPLAY menu appears.

b. Click the Trace Limit Lines button. The LIMIT menu appears.

c. Click on Limit Line and toggle to ON.

d. Click on the Edit Limit Line button. The EDIT LIMIT LINE menu appears on the right, and the LIMIT LINE TABLEAU appears at the bottom of the screen.

30. Click the Add button and use the table below to enter limit line data for the sub-band:

Table B-4. Sub-Band Limit Line Data - X Offset and Y Offset Remain Blank

Sub-Band	X1 to X2	Standard Y1 and Y2	Option 051 Y1 and Y2	Option 061/062 Y1 and Y2
Band 1	0.07 MHz to 0.3 MHz	–65 dB	–64 dB	–63 dB
Band 2	0.3 MHz to 2 MHz	–82 dB	–81 dB	–80 dB
Band 3	2 MHz to 10 MHz	–95 dB	–94 dB	–93 dB
Band 4	0.01 GHz to 2.5 GHz	–100 dB	–98 dB	–94 dB
Band 5	Depends on the instrument model: • MS4642A: 2.5 GHz to 20 GHz • MS4644A: 2.5 GHz to 40 GHz • MS4645A: 2.5 GHz to 38 GHz • MS4647A: 2.5 GHz to 38 GHz	–100 dB	–97 dB	–93 dB
Band 6	Applies only to MS4645A and MS4645A: • 38 GHz to 50 GHz	–100 dB	–96 dB	–93 dB
Band 7	Applies only to MS4647A: • 50 GHz to 65 GHz	–97 dB	–93 dB	–91 dB
Band 8	Applies only to MS4647A: • 65 GHz to 67 GHz	–95 dB	–90 dB	–86 dB
Band 9	Applies only to MS4647A: • 67 GHz to 70 GHz	–93 dB	–87 dB	–84 dB

31. When all sub-band data is entered, at the bottom of the right side menu, click Back to return to the LIMIT menu.

32. After at least one complete forward and reverse sweep has occurred, verify that trace data is below the limit line.

Repeat for Each Sub-Band

33. Return to section "Check Frequency Sub-Bands" on page B-12 above and repeat Step 6 through Step 32 for the next sub-band.

Appendix C — Abbreviation Glossary

C-1 Appendix Overview

This glossary defines the abbreviations and terms that appear on the connectors, hard keys, menus, and buttons of the MS4640A Series VNA. In some cases, due to space limitations, multiple abbreviations are used for the same term or the same abbreviation is used with different punctuation.

C-2 Glossary

Abbreviation or Term	Meaning / Definition (1 of 14)
%	Percentage
#	Number
(1:2):3	One differential pair and one singleton. Trace and dialog labeling for Mixed-mode with one differential pair and one singleton. In this example, The DUT port differential is measured from 1 to 2 and 3 is the singleton.
(1:2):3:4	One differential pair and two singletons. Trace and dialog labeling for Mixed-mode with one differential pair and two singletons. In this example, the DUT port differential is measured from 1 to 2 while 3 and 4 are the singletons.
(4:1):(2:3)	Two differential pairs. Trace and dialog labeling for Mixed-mode with two differential pairs. In this example, the first port pair is measured from 4 to 1 and the second port pair is measured from 2 to 3.
(4:2):1	One differential pair and one singletons. Trace and dialog labeling for Mixed-mode with one differential pair and one singleton. The DUT port differential is measured from 4 to 2 and 1 is the singleton.
(4:2):1:3	One differential pair and two singletons. Trace and dialog labeling for Mixed-mode with one differential pair and two singletons. In this example, the DUT port differential is measured from 4 to 2 while 1 and 3 are the singletons.
1:2):(3:4)	Two differential pairs. Trace and dialog labeling for Mixed-mode with two differential pairs. In this example, the first port pair is measured from 1 to 2 and the second port pair is measured from 3 to 4.
1P2PF	Abbreviation for one-path two-port calibration forward direction. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:1P2PF to simulate the calibration.
1P2PR	Abbreviation for one path two port calibration reverse direction. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:1P2PR to simulate the calibration.
A1 a1	Reference 1 or Reference a
A2 a2	Reference 2 or Reference b
Actv.	Active
Addr.	Address
ALC	Automatic Level Control

Abbreviation or Term	Meaning / Definition (2 of 14)
ALRM A-LRM™	Calibration menu. Advanced-Line-Reflect-Match calibration algorithm and method. A-LRM is a trademark of Anritsu Company.
AutoCal™	Automatic calibrator module. Automatic Calibration Routine. AutoCal is a trademark of Anritsu Company.
Auto-Return Auto-return	User interface. After a button selection, the instrument automatically returns to previous menu where the user selection is usually displayed on a field button. Auto-return buttons are usually a member of a button selection group (“a radio button” group) described below.
Avg.	Average
B1 b1	S-Parameter. Test 1 or Test a
B2 b2	S-Parameter. Test 2 or Test b
Bal.	Balance
BB	Broadband
BeginningSwp	Beginning sweep
Button Selection Group	Popular name is “radio button” group. A group of two or more soft buttons where selection of one button de-selects all other button members of the group. Often combined with auto-return function (described above) where the interface automatically returns to previous menu after the button selection is made.
Button Buttons	Individual elements of the right-side user interface menus. Button come in a variety of types such as toggle buttons, or menu buttons. See also “Soft buttons.” Compare with “hard keys.”
C(P) C(S) C(S)-L(P) C(P)-L(S)	Abbreviation for LC circuit primitives. Capacitance (Parallel), Capacitance (S), Capacitance (Series)-Inductor (Parallel), and Capacitance (Parallel)-Inductor (Series).
CAL (.CAL) File	File type extension.
Cal. Eff. Pwr	Calculated effective power
Cal Cal.	Calibrate Calibration
Cals Cals.	Calibrations
CCKTFour	A four-node capacitance C circuit. Port assignments are defined in separate commands. Available if the instrument is in 4-Port VNA mode.
Charac.	Characterize Characterization
Ch Chan.	Channel Channels
cm	Distance units abbreviation. Centimeter.
Cnt	Count
Coax	Coaxial cable
Coef.	Coefficient
Comm.	Communication

Abbreviation or Term	Meaning / Definition (3 of 14)
Compress	Compression
Config.	Configure Configuration
CPLS	Parallel capacitance with series inductance. Available if the instrument is in 2-Port VNA mode.
CSLP	Series capacitance with parallel inductance. For capacitance only, set L to zero. Available if the instrument is in 2-Port VNA mode.
CW	Continuous Wave
D1S0	D One S Zero. In 4-Port VNAs, one differential pair and no singletons. Used in the MXP SETUP dialog box and the :CALCulate{1-16}:MXP SCPI commands. • MAIN | System | SYSTEM | Setup | SETUP | Misc. Setup | MISC. SETUP | MnP Files Setup | MXP SETUP Dialog Box
D1S1	D One S One. In 4-Port VNAs, one differential pair and one singleton. Used in the MXP SETUP dialog box and the :CALCulate{1-16}:MXP SCPI commands. • MAIN | System | SYSTEM | Setup | SETUP | Misc. Setup | MISC. SETUP | MnP Files Setup | MXP SETUP Dialog Box
D1S2	D One S Two. In 4-Port VNAs, one differential pair and two singletons. Used in the MXP SETUP dialog box and the :CALCulate{1-16}:MXP SCPI commands. • MAIN | System | SYSTEM | Setup | SETUP | Misc. Setup | MISC. SETUP | MnP Files Setup | MXP SETUP Dialog Box
D2S0	D Two S Zero. In 4-Port VNAs, two differential pairs and no singletons. Used in the MXP SETUP dialog box and the :CALCulate{1-16}:MXP SCPI commands. • MAIN | System | SYSTEM | Setup | SETUP | Misc. Setup | MISC. SETUP | MnP Files Setup | MXP SETUP Dialog Box
DAC	Digital to Analog Converter
Data/Mem	Data value divided by the memory value.
Data+Mem	Data value plus the memory value.
DataMem	Data value times the memory value.
Data-Mem	Data value minus the memory value.
DataMemMath	Data and memory mathematical equations.
dB	Decibels
dB/Div	SCALE menu toolbar function. Decibels per trace display division.
DDS	Direct Digital Synthesis
De-embed De-Embed Deembed	De-embedding. Process where calibration parameters for a test fixture are removed from the calibrated instrument and connection cables.
Deg Degs	Degree Degrees
Degs/Div	SCALE menu toolbar function. Degrees per trace display division. For circular Polar or Smith Chart displays only.
Diff.	Differential
Div.	Division

Abbreviation or Term	Meaning / Definition (4 of 14)
DTF	Distance to fault
DUT	Device under test
E/DE EDE Embed Embedding	Embedding/De-Embedding. Process where known calibration parameters for a test fixture are added to the instrument calibration consisting of just the instrument and connection cables.
EMC	Electromagnetic Compliance
Eqn	Equation
Ext.	External
Ext. Src. Addr.	External source address
Extrap	Extrapolation
Fctry	Factory
Field Toolbar	When some buttons are selected, the field toolbar that appears near the top of the screen display just below the icon toolbar. The toolbar provides user control to select the value of the required input such as a frequency, attenuation level, or device address. Some toolbar fields allow the selection of units; for example, frequency field toolbars allow selection of Hz, kHz, MHz, or GHz units. Some field toolbars appear at the bottom of the display area when editing table information such as for Segmented Sweep operations.
Flash drive	See USB Memory Device.
Freq-Base	Frequency-Based
Freq Freq.	Frequency
FreqIniTable.ini	File type.
FreqTable.mft	File type.
Full 2-port Full Two port	Calibration method. Also called “12 Term Calibration.”
FULL1	Abbreviation for full one port calibration. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:FULL1 to simulate the calibration.
FULL2	Abbreviation for full two port calibration. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:FULL2 to simulate the calibration.
FULLB	Abbreviation for full one port reflection calibration both ports. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:FULLB to simulate the calibration.
GHz	Gigahertz. 10E9 Hertz.
GPIB	IEEE-488.2 General Purpose Interface Bus. GPIB Command.
GUI	Graphical User Interface
Hard keys, keys	Physical front panel keys or physical buttons on the MS4640A VNA. In text, keys are identified with a distinctive font such as the **Preset Key**. Compare with “soft buttons” described below.
HD	Hard Disk Drive
Het.	Heterodyne

Abbreviation or Term	Meaning / Definition (5 of 14)
ID	Identification number
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEEE-488.2	IEEE Specification 488.2 for General Purpose Interface Bus (GPIB)
IF	Intermediate Frequency
IFBW	Intermediate Frequency Bandwidth
Imag.	Imaginary
IMD	Intermodulation distortion
Imped.	Impedance
Imped. Transf.	Impedance transformation
Indep.	Independent
Inter.	Interface Interference
IntraTrace	Mathematical operations within the same trace display. As opposed to inter-trace operations.
IP	Internet Protocol
j	Imaginary number
jX	Reactance term in Ohms
K Connector™	Connector type. Compatible with SMA, WSM and 3.5 mm connectors, it has a rated frequency range from DC to 40 GHz. K Connector is a tradmark of Anritsu Company.
key	See “Hard keys” above.
kHz	Kilohertz. 10E3 Hertz.
km	Distance units abbreviation. Kilometer.
L(P) L(S) L(P)-C(S) L(S)-C(P)	Abbreviation for LC circuit primitives. Inductor (Parallel), Inductor (Series), Inductor (Series)-Capacitance (Parallel), and Inductor (Parallel) and Capacitance (Series).
Lang.	Language
LCD	Liquid Crystal Display
LCKTFour	A four-node inductance L circuit. Port assignments are defined in separate commands. Available if the instrument is in 4-Port VNA mode.
Lft	Left
Lin	Linear
LO	Local Oscillator
Log	Logarithmic
LogMag	Logarithmic Magnitude
LRL/LRM	Calibration method. Line-reflect-line calibration algorithm. Line-reflect-match calibration algorithm.
LSCP	Series inductance with parallel capacitance. For inductance only, set C to zero. Available if the instrument is in 2-Port VNA mode.
LSCS	Parallel inductance with series capacitance. Available if the instrument is in 2-Port VNA mode.

Abbreviation or Term	Meaning / Definition (6 of 14)
LVD	Low Voltage Directive
m	Distance unit abbreviation. Meter.
Mag Mag.	Magnitude
Max. Num	Maximum Number
Max Max.	Maximum
MB/s	Megabytes per second
Mb Mbit	Megabit. 1 megabit equals 10E6 bits or 1,000,000 bits.
MB Mbyte	Megabyte. In SI decimal units, 1 megabyte equals 1000E2 bytes or 1,000,000 bytes. In IEC binary units, a “mebibyte or Mi” equals 1024E2 bytes or 1,048,576 bytes but is also commonly called a “megabyte.”
Mem Mem.	Memory
Memory stick	See USB Memory Device.
menu	Available menus in the top level menu-bar command interface.
Menu command	Individual commands listed on a drop-down menu from the top menu bar. For example, on the File menu, the first command is Recall.
MFT (.mft) Files	File type extension.
MG	Anritsu Measurement Guide
MHz	Megahertz. 10E6 Hertz. 1,000,000 Hertz
Micr.	Microporous Teflon dielectric type
Min Min.	Minimum
Misc.	Miscellaneous
Mkr # [OFF]	Marker number with the Reference Marker function toggled off and the marker also toggled off; for example, Mkr 1 [OFF] for Marker 1.
Mkr # [ON]	Marker number with the Reference Marker function toggled off and the marker toggled on; for example, Mkr 1 [ON] for Marker 1.
Mkr#-Ref [OFF]	Marker number with the Reference Marker function toggled on and the marker toggled off; for example, Mkr1-Ref [OFF] for Marker 1.
Mkr#-Ref [ON]	Marker number with the Reference Marker function toggled on and the marker also toggled on; for example, Mkr1-Ref [ON] for Marker 1.
Mkr Mkrs	Marker, Markers
mm	Units abbreviation. Millimeter.
MM	Anritsu Maintenance Manual
mmWave mm-Wave	Millimeter wavelength
Model#‘	Model Number
ms	Time units abbreviation. Millisecond.
MS4640A Series VNA	The function or feature refers to any of the MS4640A VNA models: MS4642A, MS4644A, and the MS4647A VNAs.

Abbreviation or Term	Meaning / Definition (7 of 14)
MS4642A VNA	VNA Model MS4642A, 10 MHz to 20 GHz, K connectors. With Low Frequency Extension option, lower frequency limit is 70 kHz.
MS4644A VNA	VNA Model MS4644A, 10 MHz to 40 GHz, K connectors. With Low Frequency Extension option, lower frequency limit is 70 kHz.
MS4645A VNA	VNA Model MS4645A, 10 MHz to 50 GHz, V Connectors. With Low Frequency Extension option, lower frequency limit is 70 kHz.
MS4647A VNA	VNA Model MS4647A, 10 MHz to 70 GHz, V connectors. With Low Frequency Extension option, lower frequency limit is 70 kHz.
Navigation paths	Navigation to a menu or dialog box of interest is entered using navigation notation where the pipe (" | ") symbol is used to separate elements. The starting menu is usually the MAIN Menu. The general format is with menu and dialog boxes in ALL CAPS and buttons in Title Case; both use this distinctive Sans Serif Font in the general format: MAIN | Button | MENU | ... | Button | DESTINATION MENU/DIALOG BOX For example, the navigation path to the REFERENCE PLANE menu is: MAIN | Measurement | MEASUREMENT | Reference Plane | REFERENCE PLANE
NIST	National Institute of Standards and Technology.
ns	Time units abbreviation. Nanosecond.
Ntwk Ntwk.	Network
Ohms/Div	SCALE menu toolbar function. Ohms (Ω) per trace display division.
OM	Anritsu Operations Manual
Op.	Operand Operation Operations
Out.	Output
Param.	Parameter Parameters
PDF	Proprietary Portable Document Format from Adobe Corporation.
PM	Anritsu Programming Manual
Prev Prev.	Previous
ps	Time units abbreviation. Picosecond.
Pwr Pwr.	Power
R	Resistance
R(P), R(S)	Parallel Resistance, Series Resistance
R-Circuit	Resistive element of an L-C circuit
RCKTFour	A four-node resistive R circuit. Port assignments are defined in separate commands. Available if the instrument is in 4-Port VNA mode.
Rcvr Rcvr.	Receiver

Abbreviation or Term	Meaning / Definition (8 of 14)
Rect.	Reactance Rectangle Rectangular
Ref.Mkr	Reference Marker
Ref Ref.	Reference
RESP1	Abbreviation for one-port response calibration. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:RESP1 to simulate the calibration.
RESPB	Abbreviation for one-port response calibration both ports. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:RESPB to simulate the calibration.
RF	Radio Frequency
RP	Resistice parallel network. Available if the instrument is in 2-Port VNA mode.
RS	Resistive series network. Available if the instrument is in 2-Port VNA mode.
Rt	Right
s	Time units abbreviation. Second.
S11	S-Parameter. Used in text for S-parameter measurement of input reflection coefficient. In text written as “S11”. Mathematical version uses subscripts as S_{11}. Available in 2-Port and 4-Port VNAs.
S12	S-Parameter. Used in text for S-parameter measurement of reverse transmission coefficient. Mathematical version uses subscripts as S_{12}. Available in 2-Port and 4-Port VNAs.
S13	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{13}. Available only in 4-Port VNAs.
S14	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{14}. Available only in 4-Port VNAs.
S21	S-Parameter. Used in text for S-parameter measurement of forward transmission coefficient. Mathematical version uses subscripts as S_{21}. Available in 2-Port and 4-Port VNAs.
S22	S-Parameter. Used in text for S- parameter measurement of output reflection coefficient. Mathematical version uses subscripts as S_{22}. Available in 2-Port and 4-Port VNAs.
S23	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{23}. Available only in 4-Port VNAs.
S24	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{23}. Available only in 4-Port VNAs.

Abbreviation or Term	Meaning / Definition (9 of 14)
s2p	File extension. Abbreviation for S-parameter 2-Port configuration file. The general type of file extension is refered to an ".snp" file where the "n" refers to the number of ports, such as ".s1p" for an S-parameter 1-Port configuration file.
S2Pfile	Allows an S2P calibration file to be used. Available if the instrument is in 2-Port VNA mode.
S31	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{31}. Available only in 4-Port VNAs.
S32	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{32}. Available only in 4-Port VNAs.
S34	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{34}. Available only in 4-Port VNAs.
S41	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{41}. Available only in 4-Port VNAs.
S42	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{42}. Available only in 4-Port VNAs.
S43	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{43}. Available only in 4-Port VNAs.
S44	S-Parameter. Used in test for S-parameter measurement. Mathematical version used subscripts as S_{44}. Available only in 4-Port VNAs.
S4Pfile	Allows an S4P calibration file to be used. Available if the instrument is in 4-Port VNA mode.
SC1C1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 1 and common-mode drive at Pair 1.
SC1C2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 1 and common-mode drive at Pair 2.
SC1D1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 1 and differential drive at Pair 1.
SC1D2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 1 and differential drive at Pair 2.
SC2C1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 2 and common-mode drive at Pair 1.
SC2C2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 2 and common-mode drive at Pair 2.

Abbreviation or Term	Meaning / Definition (10 of 14)
SC2D1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 2 and differential drive at Pair 1.
SC2D2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for common-mode reception at Pair 2 and differential drive at Pair 2.
SCC	One differential pair and one singleton. Trace labeling for Mixed-mode with common-mode reception at Pair 1 and common-mode drive at Pair 1. S-Parameter for common-mode reception at Pair 1 and common-mode drive at Pair 1.
SCC	One differential pair and two singletons. Trace labeling for Mixed-mode for Pair 1 common-mode reception and Pair 1 drive drive.S-Parameter for common-mode reception at Pair 1 and common-mode drive at Pair 1.
SCC	Trace labeling for Mixed-mode with common-mode reception at Pair 1 and common-mode drive at Pair 2. S-Parameter for common-mode reception at Pair 1 and common-mode drive at Pair 1.
SCD	One differential pair and one singleton. Trace labeling for Mixed-mode for Pair 1 reception and Pair 1 drive drive. S-Parameter for common-mode reception at Pair 1 and differential drive at Pair 1.
SCD	One differential pair and two singletons. Trace labeling for Mixed-mode with common-mode reception at Pair 1 and differential drive at Pair 2. S-Parameter for common-mode reception at Pair 1 and differential drive at Pair 1.
SCX	One differential pair and one singleton. Trace labeling for Mixed-mode with Pair 1 common-mode receiption and singleton drive. S-Parameter for common-mode reception at Pair 1 and singleton drive.
SCX	One differential pair and two singletons. Trace labeling for Mixed-mode with common-mode reception at Pair 1 and drive at first singleton. S-Parameter for common-mode reception at Pair 1 and first singleton drive.
SCY	One differential pair and two singletons. Trace labeling for Mixed-mode with common-mode at Pair 1 and drive at second singleton. S-Parameter for common-mode reception at Pair 1 and second singleton drive.
SD1C1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 1 and common-mode drive at Pair 2.
SD1C2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 1 and common-mode drive at Pair 2.
SD1D1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 1 and differential drive at Pair 2.
SD1D2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 1 and differential drive at Pair 2.

Abbreviation or Term	Meaning / Definition (11 of 14)
SD2C1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 2 and common-mode drive at Pair 1.
SD2C2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 2 and common-mode drive at Pair 2.
SD2D1	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 2 and differential drive at Pair 1.
SD2D2	Two differential pairs. Trace labeling for Mixed-mode with two differential pairs. S-parameter for differential reception at Pair 2 and differential drive at Pair 2.
SDC	One differential pair and one singleton. Trace labeling for Mixed-mode for Pair 1 reception and Pair 1 drive drive. S-Parameter for differential reception at Pair 1 and common-mode drive at the port pair.
SDC	One differential pair and two singletons. Trace labeling for Mixed-mode with differential reception at Pair 1 and common-mode drive at Pair 2. S-Parameter for differential reception at Pair 1 and common-mode drive at Pair 2
SDD	One differential pair and one singleton. Trace labeling for Mixed-mode for Pair 1 reception and Pair 1 drive drive. S-Parameter for differential reception at Pair 1 and differential drive at Pair 1
SDD	One differential pair and two singletons. Trace labeling for Mixed-mode with differential reception at Pair 1 and differential drive at Pair 2. S-Parameter for differential reception at Pair 1 and differential drive at Pair 1.
SDX	One differential pair and one singleton. Trace labeling for Mixed-mode for Pair 1 reception and singleton drive.S-Parameter for differential reception at Pair 1 and singleton drive.
SDX	One differential pair and two singletons. Trace labeling for Mixed-mode with differential reception at Pair 1 and drive at first singleton. S-Parameter for differential reception at Pair 1 and first singleton drive.
SDY	One differential pair and two singletons. Trace labeling for Mixed-mode with differential reception at Pair 1 and drive at second singleton. S-Parameter for differential reception at Pair 1 and second singleton drive.
Seg.	Segment Segmented
SerNum	Serial Number
Set.	Settings
SI	Insternational System of Units
Single Offset	Calibration method
Soft buttons	Buttons that appear in the right side menu interface on the MS4640A Series VNA screen. In text, the name of the menu is formated with a distinctive font in capitals, such as the FREQUENCY menu. Soft buttons on each menu, such as the Select Port toggle button are formatted in the same font with initial capitals.

Abbreviation or Term	Meaning / Definition (12 of 14)
Soft key	Not used. See “soft button” above. The word “key” is reserved for the front panel “hard keys” (described above). Other Anritsu products use this term to describe display screen buttons.
SOLT/SOLR	Calibration methods. Short-open-load-thru or short-open-load-reciprocal calibration algorithm.
Sparam	S-Parameters or scattering parameters
S-Parameters s-parameters	Scattering parameters.
Src Src.	Source
SRPRP SRR SXR SRX SXX	General button format for mixed mode settings. In 4-port VNA mixed mode settings, this is the name format of the selectable button names. For buttons with five letters, “S” indicates a mixed mode S-Paramter, “R” is the selected response type of either “D” for differential or “C” for common mode, and “P” is the Port number between 1 and 4. For buttons with three letters, “S” indicates a mixed-mode S-Parameter, “R” is the selected response type of either “D” for differential or “C” for common mode, and “X” is the singleton drive.
SSLT/SSLR	Calibration methods. Short-short-load-thru or short-short-load-reciprocal calibration algorithm
SSST/SSSR	Calibration methods. Short-short-short-thru or short-short-short-receprocal calibration algorithm. Also called “Triple Offset Short”.
Swp	Sweep
SWR	Standing Wave Ratio
SXC	One differential pair and one singleton. Trace labeling for Mixed-mode with first singleton reception and common-mode drive at Pair 1. S-Parameter for first singleton reception and common-mode drive at Pair 1.
SXC	One differential pair and two singletons. Trace labeling for Mixed-mode with singleton reception and differential drive. S-Parameter for singleton reception and common-mode drive at Pair 1.
SXD	One differential pair and one singleton. Trace labeling for Mixed-mode with singleton reception and Pair 1 drive. S-Parameter for singleton reception and differential drive at Pair 1.
SXD	One differential pair and two singletons. Trace labeling for Mixed-mode with first singleton reception and differential drive at Pair 1. S-Parameter for first singleton reception and differential drive at Pair 1.
SXX	One differential pair and one singleton. Trace labeling for Mixed-mode with singleton reception and singleton drive. S-Parameter for singleton reception and singleton drive.
SXX	One differential pair and two singletons. Trace labeling for Mixed-mode with first singleton reception and first singleton drive. S-Parameter for first singleton reception and first singleton drive.
SXY	One differential pair and two singletons. Trace labeling for Mixed-mode with first singleton reception and first singleton drive. S-Parameter for first singleton reception and second singleton drive.

Abbreviation or Term	Meaning / Definition (13 of 14)
SYC	One differential pair and two singletons. Trace labeling for Mixed-mode with second singleton reception and common-mode drive at Pair 1. S-Parameter for second singleton reception and common-mode drive at Pair 1.
SYD	One differential pair and two singletons. Trace labeling for Mixed-mode with second singleton reception and differential drive at Pair 1. S-Parameter for second singleton reception and differential drive at Pair 1.
SYX	One differential pair and two singletons. Trace labeling for Mixed-mode with second singleton reception and first singleton drive. S-Parameter for second singleton reception and first singleton drive.
SYY	One differential pair and two singletons. Trace labeling for Mixed-mode with second singleton reception and second singleton drive. S-Parameter for second singleton reception and second singleton drive.
TCP	Transmission Control Protocol. Part of the Ethernet network communication protocol.
TDS	Anritsu Technical Data Sheet. Document location of the most recent instrument performance specifications.
TFRB	Abbreviation for transmission frequency response calibration both directions. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:TFRB to simulate the calibration.
TFRF	Abbreviation for transmission frequency response calibration forward direction. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:TFRF to simulate the calibration.
TFRR	Abbreviation for transmission frequency response calibration reverse direction. Used in the SCPI command :SENSe{1-16}:CORRection:COLLect[:METHod]:TFRR to simulate the calibration.
TLine	A defined transmission line with specifications for Impedance (Ohms), Length (meters), Loss (dB/mm), @ Frequency (GHz), and Dielectric Value. Note that programmatically, length is entered in meters. From the user interface, length is usually entered in millimeters. Available if the instrument is in 2-Port VNA mode.
T-Line	Transmission line
TLINEFour	Allows two separate through (“thru”) lines to be used. In separate commands, each linke is defined by Length (meters) , @ Frequency (GHz), Z0-Odd (Ohms), Loss-Odd (dB/mm), Dielectric Odd (unitless number), Z0Even (Ohms), Loss-Even (dB/mm), and Dielectric Even (unitless number). Note that programmatically, length is entered in meters. From the user interface, length is usually entered in millimeters. Available if the instrument is in 4-Port VNA mode.
Toggle Button	A software (“Soft Key”) button that toggles between two or more states such as ON and OFF or Port 1 and Port 2.
TR	Instrument mode. Transmission/reflection mode.
Transf Transf.	Transfer Transformation

Abbreviation or Term	Meaning / Definition (14 of 14)
Triple Offset Short	Calibration method. Short-short-short-thru. Commonly abbreviated as "SSST."
TRL	Calibration method. See LRL.
TRM	Calibration method. See ALRM.
Tr Tr.	Trace
TS	Troubleshooting
TS Mode	Troubleshooting Mode
TTL	Transistor Transistor Logic
U	Units
um	Distance units abbreviation. Micrometer.
Units/Div	SCALE menu toolbar function. Measurement units per trace display division.
us	Time units abbreviation. Microsecond.
USB	Universal Serial Bus
USB key	See USB Memory Device.
USB Memory Device	Also called a "USB flash drive", "USB stick", "thumb drive", or "memory stick." In the context of Anritsu documentation, a USB memory device is used to transfer calibration, certification, and/or operating system updates to the MS4640A instrument. When the instrument interface or hardware uses another term such as "Calibration Memory Device," its first use is always followed by the "USB Memory Device" in parenthesis. For example: "...use the Calibration Memory Device (USB Memory Device) to load the characterization parameters for the calibration kit..."
USB stick	See USB Memory Device.
UTF	Universal Test Fixture
V	Volts Voltage
V AC	Volts Alternating Current.
V Connector™	Anritsu Company trademarked connector name. Connector type. A 1.85 mm coaxial connector with a rated frequency range from DC to 65 GHz. V Connector is a tradmark of Anritsu Company.
V DC	Volts Direct Current
VCO	Voltage Control Oscillator
VISA	Virtual Instrument System Architecture
VNA	Vector Network Analyzer
VSWR	Voltage Standing Wave Ratio

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