User Guide

VNA Master™ Model MS20xxC Vector Network Analyzer with Spectrum Analyzer

MS2026C
VNA Frequency: 5 kHz to 6 GHz

MS2027C
VNA Frequency: 5 kHz to 15 GHz

MS2028C
VNA Frequency: 5 kHz to 20 GHz

MS2036C
VNA Frequency: 5 kHz to 6 GHz
SPA Frequency: 9 kHz to 9 GHz

MS2037C
VNA Frequency: 5 kHz to 15 GHz
SPA Frequency: 9 kHz to 15 GHz

MS2038C
VNA Frequency: 5 kHz to 20 GHz
SPA Frequency: 9 kHz to 20 GHz

Anritsu

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

Part Number: 10580-00305
Revision: J
Published: October 2014

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DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

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

declares that the product specified below:

Product Name: **VNA Master**

Model Number: MS2026C, MS2027C, MS2028C, MS2036C, MS2037C, MS2038C

conforms to the requirement of:

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

Electromagnetic Compatibility: EN61326-1:2006

Emissions: EN55011:2009 +A1:2010 Group 1 Class A

Immunity:	EN 61000-4-2:2009	4 kV CD, 8 kV AD
	EN 61000-4-3:2006 +A2:2010	3 V/m
	EN 61000-4-4:2004	0.5 kV S-L, 1 kV P-L
	EN 61000-4-5:2006	0.5 kV L-L, 1 kV L-E
	EN 61000-4-6: 2009	3 V
	EN 61000-4-11: 2004	100% @ 20 ms

Electrical Safety Requirement:

Product Safety: EN 61010-1:2010

Eric McLean, Corporate Quality Director

Morgan Hill, CA

1 Jan 2013
Date

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

CE Conformity Marking

Anritsu affixes the CE Conformity marking onto its conforming products in accordance with Council Directives of The Council Of The European Communities in order to indicate that these products conform to the EMC and LVD directive of the European Union (EU).

CE

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N274

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产品中有毒有害物质或元素的名称及含量　For Chinese Customers Only　YLYB

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
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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(如 S/N 0728XXXX 为07 年第 28 周生产)。

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For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

Symbols Used in Manuals

Danger

This indicates a risk from a very dangerous condition or procedure that could result in serious injury or death and possible loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Warning

WARNING ⚠

This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Caution

This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

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.

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 a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Warning

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.

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.

Warning

This product is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof plastic container. Follow the environmental storage requirements specified in the product technical data sheet.

Table of Contents

Chapter 6—System Operations

Chapter 7—GPS Receiver, Option 31

Chapter 1 — General Information

1-1 Introduction

This chapter covers general information that includes a description, optional accessories, preventive maintenance, ESD verifications, and calibration requirements for the VNA Master model MS20xxC. Throughout this manual, the terms VNA Master and MS20xxC refer to the Anritsu MS2026C, MS2027C, MS2028C, MS2036C, MS2037C, and MS2038C Vector Network Analyzers.

MS2026C
VNA Frequency: 5 kHz to 6 GHz

MS2027C
VNA Frequency: 5 kHz to 15 GHz

MS2028C
VNA Frequency: 5 kHz to 20 GHz

MS2036C
VNA Frequency: 5 kHz to 6 GHz
SPA Frequency: 9 kHz to 9 GHz

MS2037C
VNA Frequency: 5 kHz to 15 GHz
SPA Frequency: 9 kHz to 15 GHz

MS2038C
VNA Frequency: 5 kHz to 20 GHz
SPA Frequency: 9 kHz to 20 GHz

1-2 Contacting Anritsu

To contact Anritsu, please visit:

http://www.anritsu.com/contact.asp

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

Updated product information can be found on the Anritsu web site: http://www.anritsu.com/

Search for the product model number. The latest documentation is on the product page under the Library tab.

http://www.anritsu.com/en-us/products-solutions/products/MS2026C.aspx

http://www.anritsu.com/en-us/products-solutions/products/MS2027C.aspx

http://www.anritsu.com/en-us/products-solutions/products/MS2028C.aspx

http://www.anritsu.com/en-us/products-solutions/products/MS2036C.aspx

http://www.anritsu.com/en-us/products-solutions/products/MS2037C.aspx

http://www.anritsu.com/en-us/products-solutions/products/MS2038C.aspx

1-3 Anritsu Service Centers

For the latest service and sales information in your area, please visit the following URL:

http://www.anritsu.com/Contact.asp and choose a country for regional contact information.

1-4 Additional Documents

This user guide is specific to the VNA Master MS20xxC (models MS2026C, MS2027C, MS2028C, MS2036C, MS2037C, and MS2038C). Additional instrument functions and descriptions of optional measurement capabilities are described in measurement guides.

Refer to Appendix A, "Supplemental Documentation" for a list of measurement guides and their Anritsu part numbers. Measurement guides are provided on the document disc that is shipped with each instrument. Updated measurement guides are available for download (at no charge) from the VNA Master product Web pages listed previously.

General and performance specifications, instrument options, standard accessories, and optional accessories are described in the VNA Master Technical Data Sheet, Anritsu part number 11410-00548.

1-5 VNA Master Specifications

General and performance specifications, instrument options, standard accessories, and optional accessories are described in the VNA Master Technical Data Sheet, (Anritsu part number 11410-00548). The technical data sheet is available on the Anritsu Web site: http://www.anritsu.com

1-6 Identifying the Connections

The VNA Master MS2026C, MS2027C, and MS2028C have the connectors shown in Figure 1-1.For details, refer to Figure 2-13 on page 2-20.

Figure 1-1. MS202xC Connectors

The VNA Master MS2036C, MS2037C, and MS2038C have the connectors shown in Figure 1-2.For details, refer to Figure 2-14 on page 2-21

Figure 1-2. MS203xC Connectors

1-7 Description

The Anritsu VNA Master instruments are portable handheld vector network analyzers (VNAs) featuring precise performance and essential RF capabilities. These VNA Master instruments are designed to conduct accurate vector-corrected 1-port magnitude, phase, and fault location measurements and 2-port magnitude, phase, and group delay measurements from 5 kHz to 20 GHz. The MS203xC models add Spectrum Analyzer capabilities that provide quick and accurate measurement results for monitoring, measuring, and analyzing signal environments. The Spectrum Analyzer offers broad spectrum analysis with frequency coverage to 20 GHz, impressive dynamic range, and excellent phase noise performance. Standard measurements include field strength, occupied bandwidth (OBW), channel power, adjacent channel power ratio (ACPR), and carrier to interference (C/I) ratio.

This one instrument provides all essential RF capabilities in a portable, high-performance platform.

Measurements:

S-parameters, magnitude, phase, real, imaginary, SWR, Cable Loss, group delay, Smith Chart, time domain, distance domain, field strength, occupied bandwidth, channel power, adjacent channel power ratio, carrier to interference (C/I) ratio.

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of up to 1000 measurement setups and up to 1000 traces. External storage can be used for bulk measurement storage. Measurements and setups can be stored in a USB flash drive or transferred to a PC by using the included USB cable. Use Line Sweep Tools (LST) for certain VNA measurements and Master Software Tools (MST) for spectral analysis measurements (refer to Chapter 8, “Anritsu PC Software Tools” for a brief overview of these software tools).

Note	Not all after-market USB drives are compatible with the VNA Master. Many drives come with a second partition that contains proprietary firmware. This partition must be removed. Only one partition is allowed. Refer to the individual manufacturer for instructions on how to remove it. You might also try reformatting a drive that contains a single partition using FAT32 format.

1-8 Soft Carrying Case and Tilt Bail

The soft carrying cases for the MS202xC and the MS203xC accommodate the different instrument sizes. The part numbers are in the Technical Data Sheet. The tilt bail is factory-installed on the VNA Master for use with or without the soft carrying case.

VNA Master Soft Carrying Case

The MS20xxC can be operated while in the soft carrying case. On the back of the case is a large storage pouch for accessories and supplies.

To install the MS20xxC into the soft carrying case, perform the following:

1. The front panel of the case is secured with hook and loop fasteners. Fully open the front panel of the case.
2. Place the soft carrying case face down on a stable surface, with the front panel fully open and laying flat.
3. Fully open the zippered back of the case.

Note	Two zippers are located around the back of the case. The zipper closer to the MS20xxC compartment of the case opens the case back and allows access to install and remove the MS20xxC. The other zipper closer to the back of the case opens a support panel that can be used to provide support for improved stability and air flow while in the case. This support panel also contains the storage pouch.

4. Insert the MS20xxC face down into the case, taking care that the connectors are properly situated in the case top opening. Figure 1-3 shows the MS20xxC in the case.

Figure 1-3. Instrument Inserted Into the Soft Carrying Case

5. Close the back panel and secure it with the zipper .

Figure 1-4. VNA Master Installed in Soft Case

The soft carrying case includes a detachable shoulder strap that can be connected to the D-rings on the upper corners of the case as required for comfort or convenience. The velcro strap acts as a tilt bail when using the soft case as shown in Figure 1-4.

VNA Master Tilt Bail Stand

The supplied Tilt Bail can be used for desktop operation. The tilt bail provides a backward tilt for improved stability and air flow. Refer to Figure 1-5.

To deploy the tilt bail, pull the bottom of the tilt bail away from the back of the unit.

Figure 1-5. Tilt Bail Extended on VNA Master

To store the tilt bail, push the bottom of the bail toward the back of the unit and snap the bottom of the bail into the clip on the back of the unit.

1-9 Preventive Maintenance

VNA Master preventive maintenance consists of cleaning the unit and inspecting and cleaning the RF connector on the instrument and all accessories. Clean the VNA Master with a soft, lint-free cloth dampened with water or water and a mild cleaning solution.

Caution	To avoid damaging the display or case, do not use solvents or abrasive cleaners.

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of N(f) and K(f) connectors and the pins of N(m) and K(m) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are good, then gauge the connectors to confirm that their dimensions are correct. Type K(f) test port connectors are availableon some models with Option 11.

Visually inspect the test port cables. The test port cable should be uniform in appearance, not stretched, kinked, dented, or broken.

1-10 Calibration Requirements – Vector Network Analyzer

The VNA Master is a field portable unit operating in the rigors of the test environment. In order to ensure measurement accuracy, RF calibration (OSLT or SSLT, for example) must be performed prior to making a measurement in the field.

The VNA Master has no field-adjustable components. The RF (OSLT, SSLT, and SSST) calibration components, however, are crucial to the integrity of the calibration and should be periodically verified to ensure their performance. This is especially important if the components have been dropped or over-torqued.

Note	For best calibration results (compensation for all measurement uncertainties), ensure that the calibration is performed at the end of the test port or optional extension cable; that is, at the same point that the device that is to be tested will be connected.

Caution	For best results, use an Anritsu phase stable Test Port Extension Cable, such as those listed in the Technical Data Sheet for your instrument (refer to Appendix A). Use of a typical laboratory cable to extend the VNA Master test port to the device under test, or any bending of the cable subsequent to the OSL or OSLT calibration, may cause uncompensated phase reflections inside the cable. Reflections of this type cause measurement errors, which are more pronounced at higher frequencies.

1-11 Annual Verification

Anritsu recommends an annual calibration and performance verification of the VNA Master and the calibration components by local Anritsu service centers. Anritsu service centers are listed our web site at:
http://www.anritsu.com/Contact.asp

1-12 Battery Replacement

The battery can be replaced without the use of tools. The battery compartment is located on the lower left side of the instrument. Slide the battery door down (towards the bottom of the instrument) to remove the door. Remove the battery pack from the instrument by pulling straight out on the battery lanyard. Replacement is the opposite of removal.

Caution	Use only Anritsu approved batteries, adapters and chargers with these instruments.

1	Battery Compartment Door

Figure 1-6. MS20xxC VNA Master Battery Compartment Door

The battery that is supplied with the VNA Master may need charging before use. The battery can be charged in the VNA Master by using either the AC-DC Adapter or the 12 Volt DC adapter, or can be charged separately in the optional Dual Battery Charger.

Caution	When using the Automotive 12 VDC Adapter, always verify that the supply is rated for a minimum of 60 Watts at 12 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

Warning	VNA Masters are supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product data sheet.

1-13 ESD Cautions

The VNA Master, like other high performance instruments, is susceptible to ESD damage. Coaxial cables and antennas can easily build up a static charge, which (if allowed to discharge by connecting directly to the VNA Master without first discharging the static charge) may damage the instrument input circuitry. Operators must be aware of the potential for ESD damage and must take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. Because these standards apply to the VNA Master, Anritsu Company recommends that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the VNA Master. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the VNA Master. Remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in these standards helps to ensure that a safe environment exists for both personnel and equipment.

Chapter 2 — Quick Start Guide

2-1 Introduction

This chapter provides a brief overview of the Anritsu MS20xxC VNA Master handheld Vector Network Analyzer. The intent of this chapter is to provide you with a starting point for making basic measurements. For more detailed information, refer to the specific measurement mode chapters in this manual.

2-2 Turning the VNA Master On for the First Time

The Anritsu VNA Master is capable of greater than two hours of continuous operation from a fully charged, field-replaceable battery (refer to "Battery Replacement" on page 1-9 in Chapter 1, "General Information"). The VNA Master can also be operated from a 12 VDC source (which also simultaneously charges the battery). This can be achieved with either the Anritsu AC-DC Adapter or 12 VDC Automotive Adapter. Both items are included as standard accessories (refer to the Standard and Optional Accessories in the Technical Data Sheet for your instrument, as listed in Appendix A).

Caution	When using the Automotive 12 VDC Adapter,, always verify that the supply is rated for a minimum of 60 Watts at 12 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

To turn on the VNA Master, press the **On/Off** front panel button (Figure 2-1).

1	On/Off Button

Figure 2-1. VNA Master On/Off Button (MS2028C shown)

The VNA Master requires approximately thirty-five seconds to complete the power-on cycle and load the application software. At the completion of this process, the instrument is ready to use.

The VNA Master performs a self test during each power-on cycle. If the self test fails, then refer to "Self Test or Application Self Test Error Messages" on page C-2 in Appendix C, "Error Messages". For maximum accuracy, letting the instrument warm up for approximately 15 minutes is a good practice before performing a calibration.

2-3 Front Panel Overview

The VNA Master menu-driven flexible interface is intuitive and easy to use. Hard keys on the front panel are used to initiate function-specific menus. Five function hard keys (unlabeled) are located below the display. These keys vary in function depending upon the current mode of operation. If a function hard key has no function in the current mode, then the key label in the measurement display area is blank adjacent to that key.

Note	Users who are familiar with the operation of previous VNA Master instruments will find that those menus are quite different from the menus for this current MS20xxC VNA Master. Some menus are the same, but those related to measurement setups and sweeps are very different. The intent with the MS20xxC is to provide you with more flexibility and choice in measurement configurations even if these choices result in configurations that are not very practical (such as the overlay of a Smith Chart on top of a rectilinear chart).

Located to the right of the display, the VNA Master has eight soft keys (unlabeled buttons), hard keys, arrow keys, and a rotary knob. The locations of all of the keys are shown in Figure 2-2.

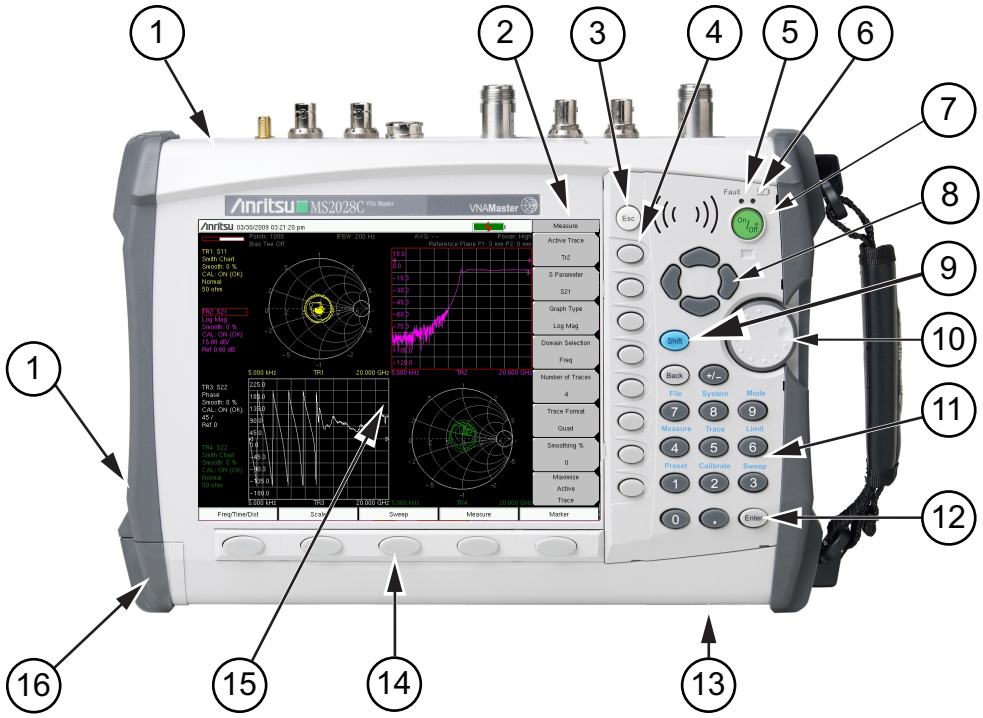
Nine of these hard keys (the number keys 1 through 9) are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself and with the alternate function printed in blue (same color as the **Shift** key) on the panel above the key. Use the **Shift** key to access the functions printed on the panel above the number keys.

The eight soft keys (unlabeled buttons) are located adjacent to the right edge of the measurement display screen (or sweep window). These eight soft keys change function depending upon the current mode of operation and the menu selection. The current soft key function is indicated at the top of the active function block, which is located within the measurement display screen (or sweep window). The active function block displays a label for each active soft key. If a soft key has no function in the current mode, then the active function block display is blank adjacent to that soft key.

The **Escape** key (labeled **Esc** and used for aborting data entry) is the round button located above the eight (unlabeled) soft keys.

The rotary knob and the keypad (and sometimes the arrow keys) can be used to change the value of an active parameter. The rotary knob can also be pressed to duplicate the action of the **Enter** key.

Front Panel Overview Image



1	Fan Exhaust Ports
2	Active Function Block or Soft Key Menu
3	Escape Key
4	Soft Keys (8 buttons)
5	Charge Fault LED
6	Battery Charge LED
7	On/Off Key
8	Directional Arrow Keys
9	Shift Key
10	Rotary Knob
11	Number Keypad
12	Enter Key
13	Fan Inlet Port
14	Function Hard Keys (5 buttons)
15	Measurement Display Screen (or Sweep Window)
16	Battery Compartment

Figure 2-2. Front Panel Overview

Other Features on the Front Panel

Battery Charge LED (Green)

The green Battery Charge LED (Figure 2-2, item 6) will flash if the battery is charging and will remain on and steady when the battery is fully charged.

Power LED (Green)

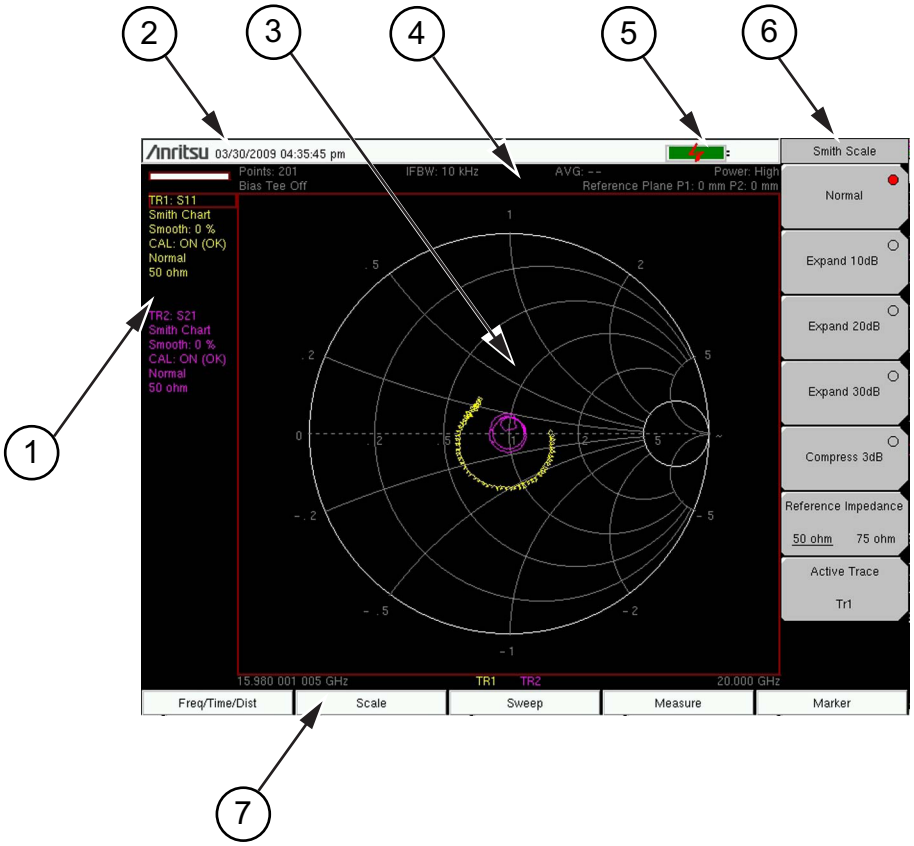
The Power LED (Figure 2-2, item 5) is located toward the left edge of the On/Off button. It remains on steady when the VNA Master is On, and blinks slowly when the VNA Master is Off but has external power.

Fan Inlet and Exhaust Ports

The fan inlet (Figure 2-2, item 13) and exhaust ports (Figure 2-2, item 1) must be kept clear of obstructions at all times for proper ventilation and cooling of the instrument.

2-4 Typical Vector Network Analyzer Display

Figure 2-3 illustrates some of the key information areas of the vector network analyzer display screen on the VNA Master MS20xxC. The measurement and the display type that are illustrated here may not be the same as currently shown on your instrument. The purpose of the figure is to show the general areas of the display, which are labeled in the figure. Refer to the VNA Measurement Guide, Chapter 6, "VNA Menus" for more detailed soft key descriptions (refer to Appendix A for document part numbers).



1	Instrument Settings Summary (unique to each trace)
2	Real Time Clock
3	Measurement Display Area (or Sweep Window)
4	Instrument Settings Summary (applies to all traces)
5	Battery Charge Indicator
6	Soft Key Labels (or Active Function Block)
7	Function Hard Key Labels

Figure 2-3. Vector Network Analyzer Smith Chart Display

The MS20xxC features a versatile new display option for better measurement convenience. Because the VNA Master measures all four S-parameters simultaneously, with fully-reversing test signals at both Port 1 and Port 2, the measurement display provides up to 4 simultaneous window images. As shown in Figure 2-4, each one of the S-parameters could be displayed in its own quarter window. Additionally, the display could be divided into three, two, or one graph areas. An example of four S-parameters overlaid onto one graph area is shown in Figure 2-5.

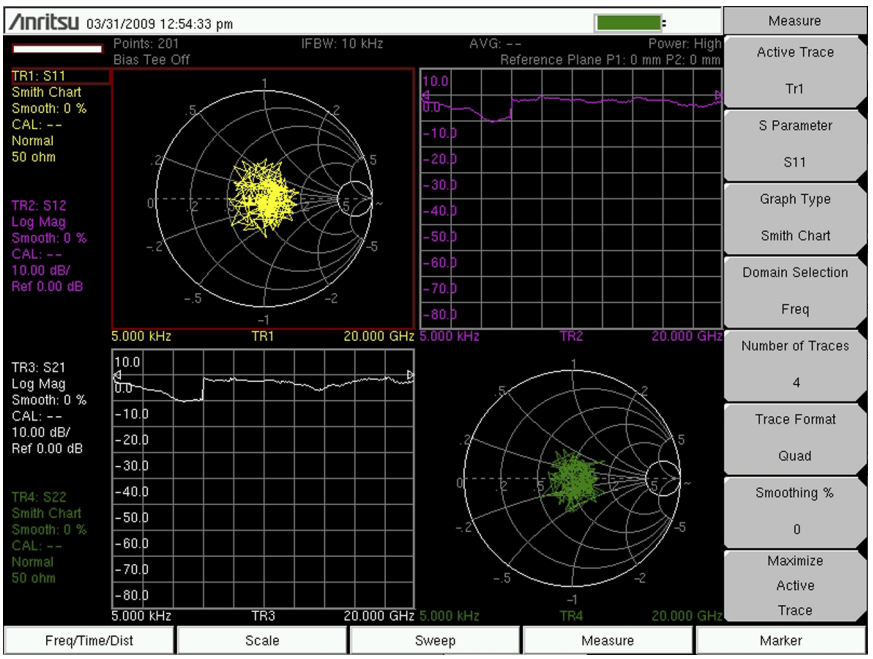


Figure 2-4. 4 Traces in 4 Window Images (Quad Trace Format)

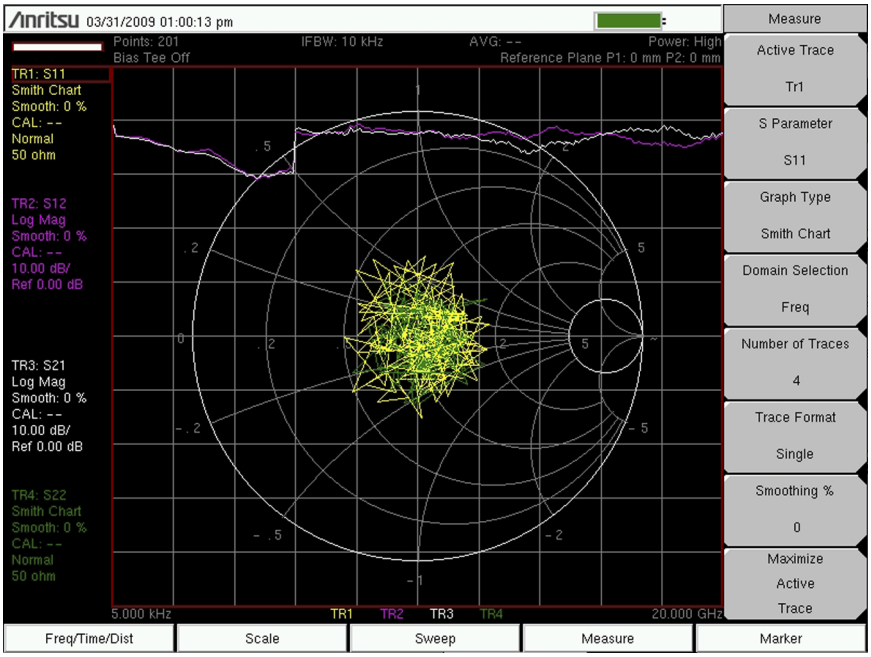
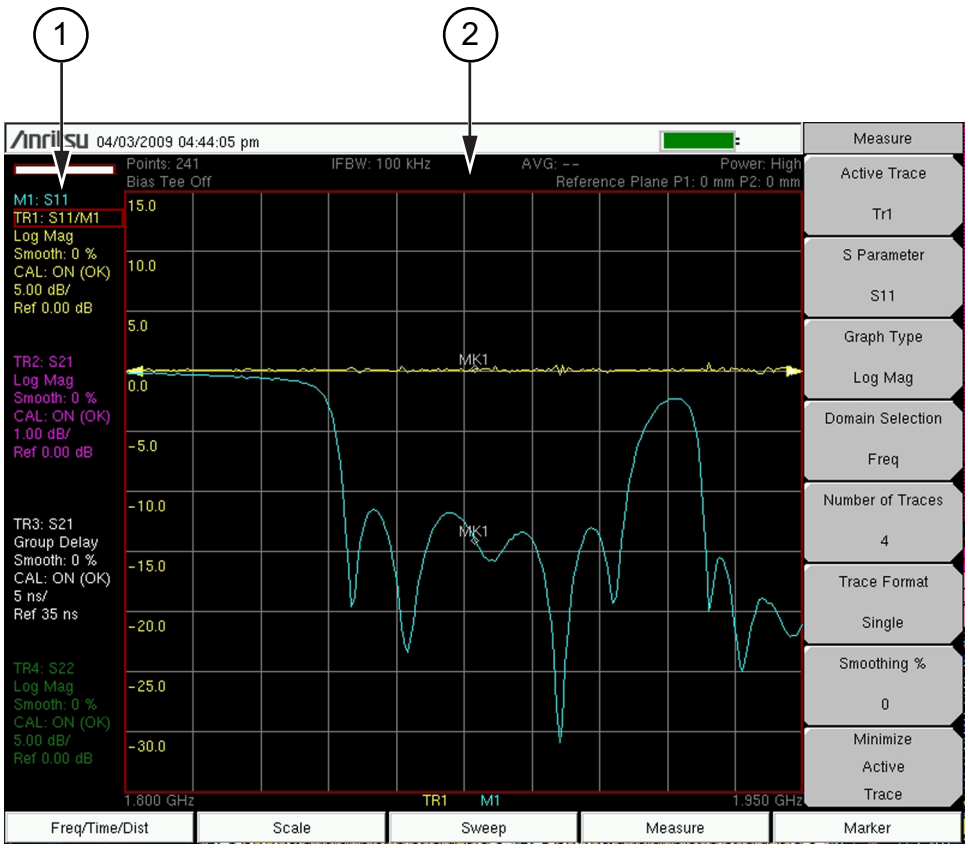


Figure 2-5. 4 Traces in 1 Window Image (Single Trace Format)

Instrument Settings Summary

The instrument settings that apply to all traces are summarized in the top two rows of the measurement display screen (refer to item 2 in Figure 2-6). The summary includes the Number of Points, the IF Bandwidth, the Averaging count, the Port Power level, and the Bias Tee status, all of which apply to both ports. The summary also includes the Reference Plane Extension values, which differ for each port.



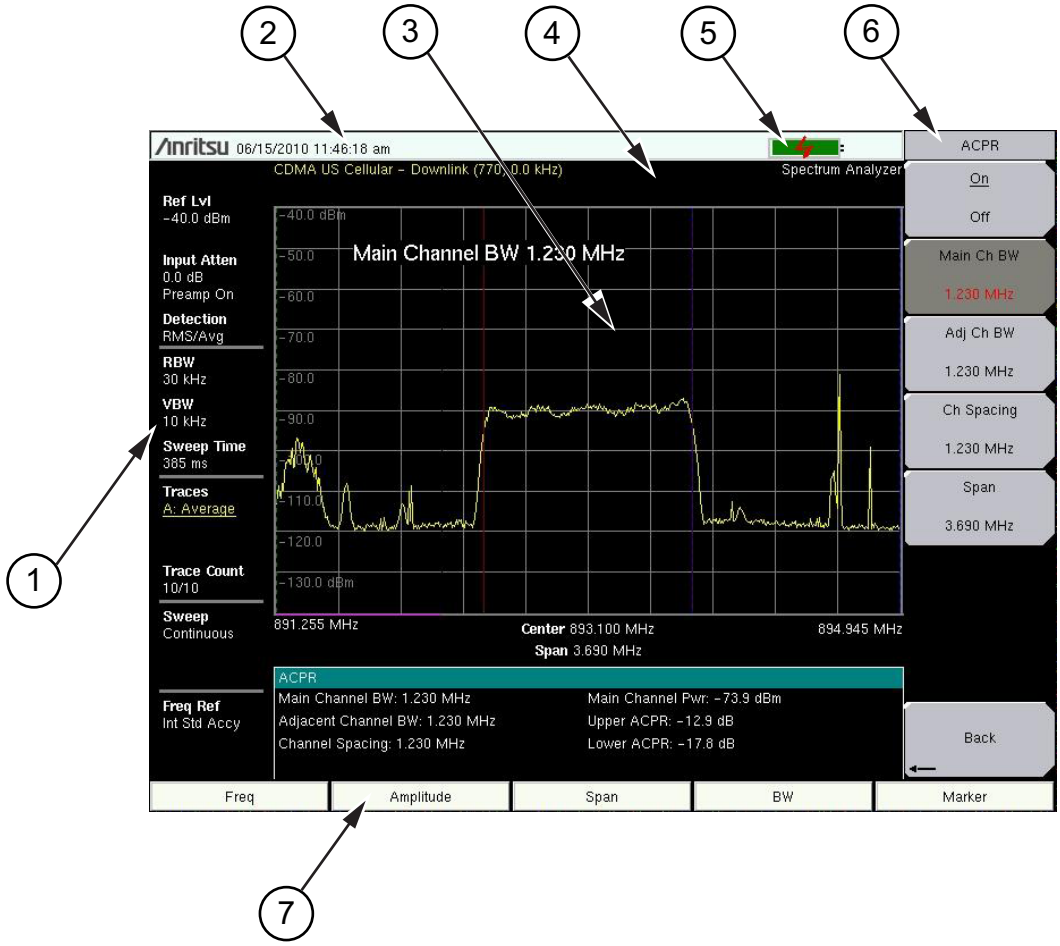
1	Instrument Settings Summary (unique to each trace)
2	Instrument Settings Summary (applies to all traces)

Figure 2-6. Instrument Settings Summary on Measurement Display Screen

The instrument settings that are unique to each trace are summarized in an information block on the left side of the measurement display screen (refer to item 1 in Figure 2-6). Each block contains the trace number followed by the S-parameter that is assigned to that trace (**TR4: S22**, for example). If the trace has Trace Math applied to it, then the math function is also displayed on that line (**TR1: S11/M1**, for example), where M1 is the memory that is associated with TR1, and the math function is Trace/Memory). The S-parameter that is assigned to the trace memory is shown (if enabled) at the top of each trace information block (**M1: S11**, for example). Each trace block also includes the Graph type, the smoothing percentage, the calibration status, and the scale (Resolution per Division and the Reference Value). The calibration status indicates whether the calibration is ON, OFF, or non-existent (--) for the specific S-parameter that is assigned to each trace. If the Calibration is ON, then its validity is also displayed (**OK**,**?**, or **X**).

2-5 Typical Spectrum Analyzer Display

Figure 2-7 illustrates some of the key information areas of the spectrum analyzer display screen on the VNA Master MS20xxC. The measurement and the display type that are illustrated here may not be the same as currently shown on your instrument. The purpose of the figure is to show the general areas of the display, which are labeled in the figure. Refer to the Spectrum Analyzer Measurement Guide for more detailed soft key descriptions. Measurement Guide part numbers are listed in Table A-1, “Measurement Guides” on page A-1



1	Instrument Settings Summary (unique to each trace)
2	Real Time Clock
3	Measurement Display Area (or Sweep Window)
4	Instrument Settings Summary (applies to all traces)
5	Battery Charge Indicator
6	Soft Key Labels (or Active Function Block)
7	Function Hard Key Labels (specific to instrument Mode settings)

Figure 2-7. Typical Spectrum Analyzer Display Screen

2-6 Front Panel Keys

The term hard key refers to all of the buttons on the instrument face except for the vertical row of gray buttons adjacent to the measurement display. These eight gray buttons are called soft keys, and they are used to activate virtual soft key buttons within the measurement display screen. This soft key display area (soft key menu) is also called the active function block. Refer to Figure 2-2 (item 2) and Figure 2-3 (item 6) and Figure 2-7 (item 6).

Esc Key

Pressing this key cancels any setting that is currently being made. Refer to Figure 2-2 (item 3). The **Esc** key is located directly above the eight soft keys.

Enter Key

Press this key to finalize data input. Pressing the rotary knob performs this same function. Refer to Figure 2-2 (item 12). The **Enter** key is located directly below the Number **3** key in the number keypad.

Arrow Keys

The four arrow keys (between the rotary knob and the **Esc** key) are used to scroll up, down, left, or right. Refer to Figure 2-2 (item 8). The arrow keys can often be used to change a value or to change a selection from a list. This function is similar to the function of the rotary knob. The arrow keys are also used to move markers.

Shift Key

Pressing the **Shift** key (refer to Figure 2-2, item 9 and Figure 2-8) and then a number key executes the function that is indicated in blue text above the number key. When the **Shift** key is pressed (when it is active), its icon is displayed in the upper right corner of the measurement display area between the battery charge indicator and the soft key menu label.

Figure 2-8. Shift Key Icon

Back Key

Press this key to delete only one character, one number, or the range that is specified by the cursor. The **Back** key is located directly above the Number **7** key in the number keypad.

Plus/Minus (+/–) Key

Press this key to change the sign of numbers that are entered with the number keys. The **Plus/Minus (+/-)** key is located directly above the Number **8** key in the number keypad.

Number Keypad

These keys are used to directly input numeric values.

Rotary Knob

Turning the rotary knob (refer to Figure 2-2, item 10) changes numerical values, scrolls through selectable items from a list, and moves markers. Values or items may be within a dialog box or an edit window. Markers are moved within the sweep window.

Pressing this knob finalizes the input function in the same manner as pressing the **Enter** key.

Function Hard Keys

These five function keys (refer to Figure 2-2, item 14) are horizontally arranged adjacent to the measurement display screen along the lower edge. These buttons have no labels. As with the soft keys, they are positioned to accompany virtual key labels that are displayed to match instrument modes and functions. These function hard key labels change to match specific instrument Mode settings. Each Mode uses a specific set of Function Hard Keys. For details about selecting the Mode, refer to the Section "Mode Selector" on page 2-19. In some manuals, such as Measurement Guides, the Function Hard Keys are referred to as Main Menu Keys.

Soft Keys

These eight gray keys have no labels (refer to Figure 2-2, item 4). They are arranged adjacent to the measurement display screen along the right-hand edge. They are positioned to accompany virtual soft key labels that are displayed to match instrument modes and measurement functions. These soft key labels (also called the Active Function Block) change as instrument measurement settings change. In some manuals, such as Measurement Guides, the Soft Keys are referred to as Submenu Keys.

The following Section 2-7 "Soft Key Types" describes how these keys are used:

2-7 Soft Key Types

Select

A **Select** soft key has a small circle in the upper right corner of the virtual key face and is used to select the function or item that is displayed on the virtual soft key label. When not selected, the circle is gray. When selected, the circle is red to indicate that the function is active.

Press the key to make the selection. Press a different key to make a different selection.

A **Select** soft key may also be a **Switching** soft key. Switching soft keys show both a gray circle and an arrow mark (-->).

A **Select** soft key may change to a **Switching** soft key when active. These keys show only the gray circle when not active, but show the arrow mark as well as the red circle when active. Refer to section "Switching" on page 2-14.

Input

An **Input** soft key is used to select an item or a value. This type of soft key displays the setting parameter and the setting value on the virtual key face. When the key is pressed, a select box or edit box may open on the display screen, or the key face may turn a darker gray color to show that the setting is being made. At any time before finalizing the input, press the escape (**Esc**) key to abort the change and retain the previously existing setting.

To set or select an item or a value, use the number keys, the arrow keys, or the rotary knob. Press the rotary knob or the **Enter** key to finalize data input. If a value is being selected or entered, then the soft key Active Function Block may change to provide one or more soft keys for units, such a Hz or dB. Pressing a unit soft key sometimes finalizes the data input in the same manner as pressing the **Enter** key. If more than one unit key is displayed, then pressing the **Enter** key without first pressing a unit key selects a specific unit by default. The specific default units are described along with soft key descriptions that are included in the analyzer chapters and the Measurement Guides.

With some functions, only a specific set of values are valid. When scrolling with the **Up/Down** arrow keys or the rotary knob, only valid values are offered. If different values are set with the number keypad, then those values might not be accepted. Even if different values are accepted on the soft key face, the values may not be valid for the selected measurement. Your knowledge of measurement functions must be used to determine acceptable values.

Toggle

A **Toggle** soft key displays the setup item and the toggle states. Toggle states may be On and Off or may be a selection of types or values such as Reference Impedance: 50 ohm or 75 ohm.

Each press of the **Toggle** soft key moves the selection to the next value or item in sequence. The selected item or value is underlined on the virtual key face.

Switching

A **Switching** soft key is used to open an additional soft key menu, and it has an arrow mark (-->) in the lower right corner of the virtual key face.

Some **Select** soft keys become **Switching** soft keys after being pressed (after becoming active). These keys may not display the arrow mark until they are active (their circle is red). An additional press, after the circle is red and the arrow mark is displayed, opens the additional soft key menu. Refer to section "Select" on page 2-13.

The **Switching** soft key that is labeled More opens a menu with additional soft key functions. The **Switching** soft key that is labeled Back returns to a previous soft key menu. The Back key has the arrow mark (<--) in the lower left corner of the virtual key face.

2-8 Parameter Setting

Pop-up list boxes, edit boxes, and dialog boxes are used to provide selection lists and selection editors. Scroll through a list of items or parameters with the arrow keys or the rotary knob. Select numerical values by scrolling with the arrow keys or rotary knob or by entering the digits directly from the number keypad. These list boxes and edit boxes frequently display a range of possible values or limits for possible values.

Finalize the input by pressing the rotary knob or the **Enter** key. At any time before finalizing the input, press the escape (**Esc**) key to abort the change and retain the previously existing setting.

Cable parameters can be added to list boxes by creating them in Line Sweep Tools (LST). Signal Standard parameters can be added to list boxes by creating them in Master Software Tools (MST). Refer to Chapter 8, “Anritsu PC Software Tools” for a brief overview of these software tools.

2-9 Text Entry

When entering text (as when saving a measurement) the soft key menu for Text Entry displays the characters (alphabet, hyphen, and underscore) in groups of 6 letters per soft key. Characters can be entered by using the rotary knob, the arrow keys, or the soft keys.

The rotary knob scrolls through the characters in a pop-up window and is pressed to select each character in sequence.

Alternatively, press the a b c / d e f soft key (for example) to open another soft key menu with a separate key for each of these letters. The menu returns to the complete character set after each individual letter is entered.

Use the arrow keys to navigate within a name or character string. Use the **Shift** key for capital letters. Press the **Enter** key or the rotary knob to finalize a text entry.

Refer to Figure 2-9, Figure 2-10, and Figure 2-11.

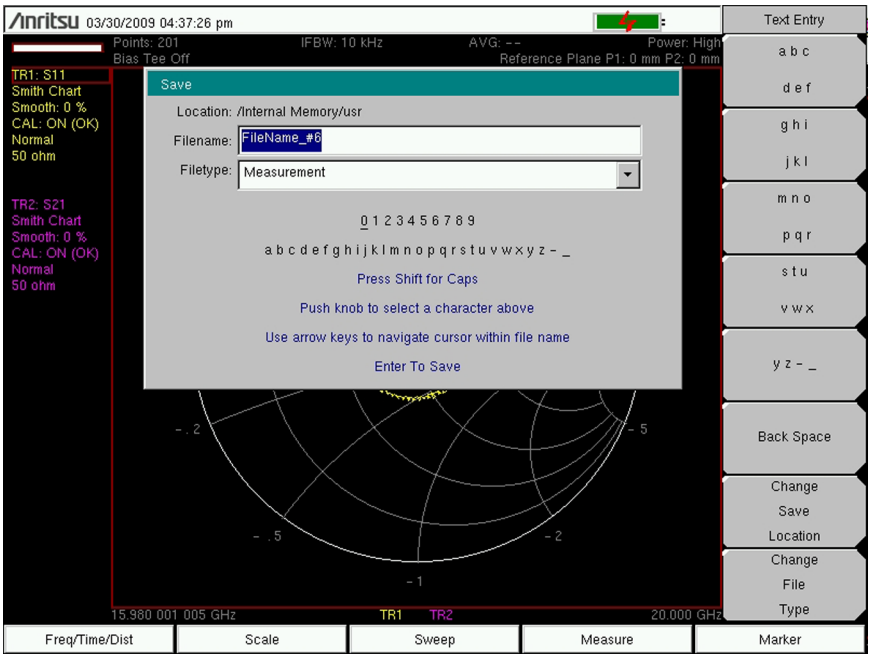


Figure 2-9. Text Entry Menu – Lower Case

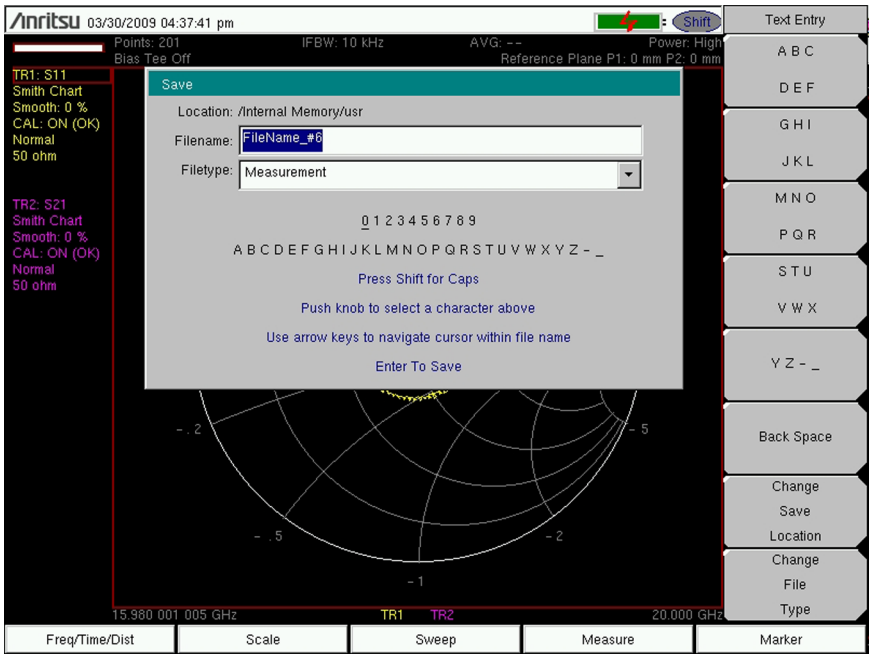


Figure 2-10. Text Entry Menu – Upper Case

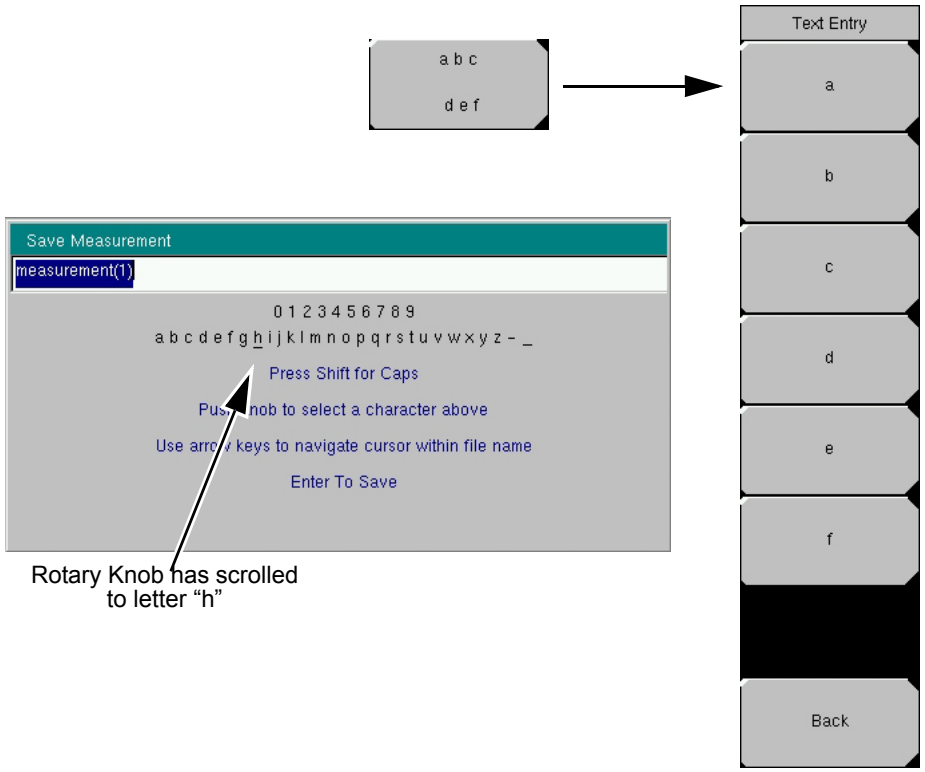


Figure 2-11. Text Entry Menu – Selecting Characters

2-10 Mode Selector

Select a VNA Master measurement mode (such as Vector Network Analyzer or Vector Volt Meter) by opening the Mode Selector List Box. Press the **Shift** key, then the **Mode** (9) key, and choose a mode from the menu. Use the directional arrow keys or the rotary knob to highlight your selection, and then press the **Enter** key.

The modes that are available on your VNA Master depend upon the options that are installed and activated. Your instrument may not show the same list as Figure 2-12.

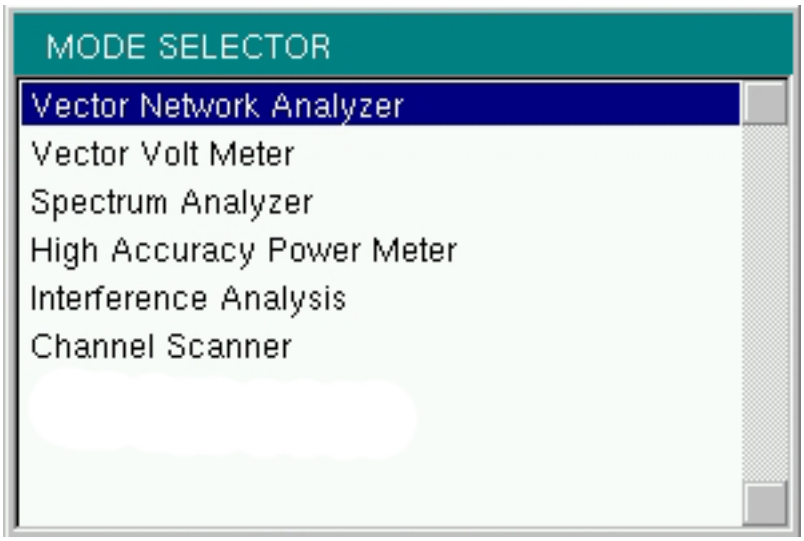


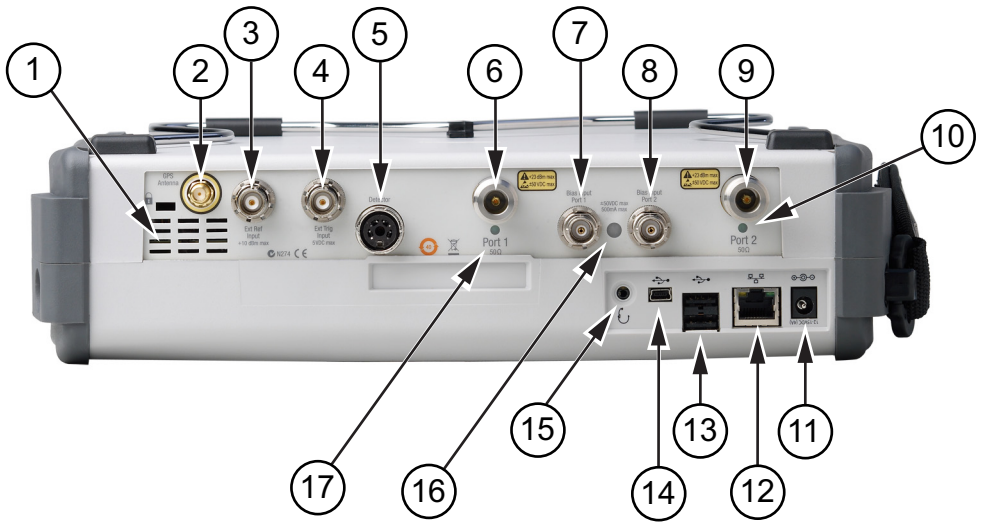
Figure 2-12. Mode Selector List Box

2-11 Test Panel Connectors

The connectors and indicators that are located on the test panel of the VNA Master are shown and described in the following sections.

MS202xC Test Panel Connectors

The connectors and indicators that are located on the test panel of the MS2026C, MS2027C, and MS2028C are shown in Figure 2-13 and are described in the table below the figure.

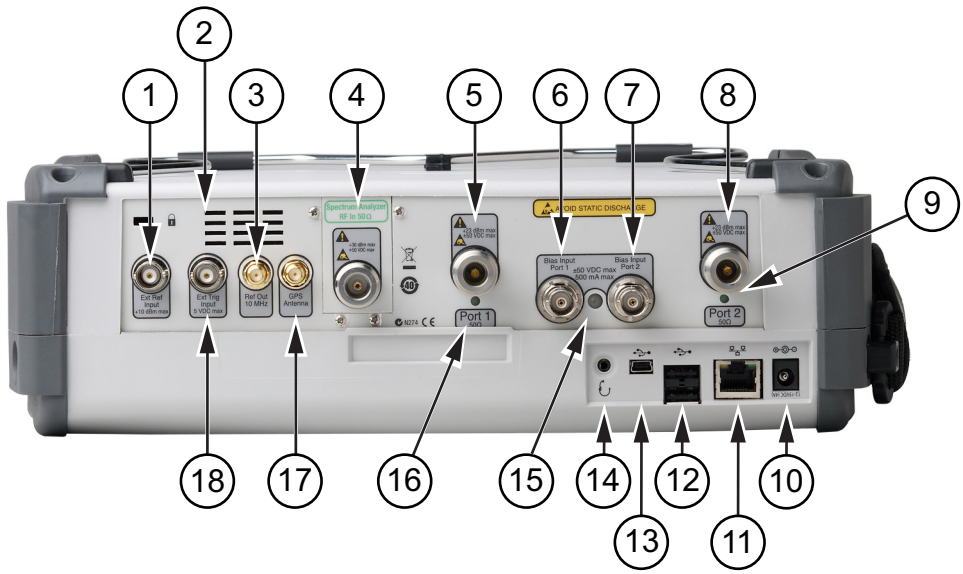


1	Fan Exhaust Port
2	GPS Antenna Input for Option 31
3	External Reference Input
4	External Trigger Input
5	RF Detector Interface (for Option 5)
6	Test Port 1 (50 ohm) The corresponding LED turns green when the port is transmitting.
7	Bias Input Port 1
8	Bias Input Port 2
9	Test Port 2 (50 ohm) The corresponding LED turns green when the port is transmitting.
10	Port 2 LED
11	External Power Input
12	LAN Connection
13	USB Interface, Type A (2 connectors, Full Speed USB 2.0)
14	USB Interface, Type Mini-B (Full Speed USB 2.0)
15	Headset Jack
16	Bias Status LED
17	Port 1 LED

Figure 2-13. MS202xC Test Panel Connectors

MS203xC Test Panel Connectors

The connectors and indicators that are located on the test panel of the MS2036C, MS2037C, and MS2038C are shown in Figure 2-14 and are described in the table below the figure.



1	External Reference Input
2	Fan Exhaust Port
3	Reference Out (10 MHz)
4	Spectrum Analyzer RF Input (50 ohm)
5	Test Port 1 (50 ohm) The corresponding LED turns green when the port is transmitting.
6	Bias Input Port 1
7	Bias Input Port 2
8	Test Port 2 (50 ohm) The corresponding LED turns green when the port is transmitting.
9	Port 2 LED
10	External Power Input
11	LAN Connection
12	USB Interface, Type A (2 connectors, Full Speed USB 2.0)
13	USB Interface, Type Mini-B (Full Speed USB 2.0)
14	Headset Jack
15	Bias Status LED
16	Port 1 LED
17	GPS Antenna Input for Option 31
18	External Trigger Input

Figure 2-14. MS203xC Test Panel Connectors

In Figure 2-15, a waveguide-coax adapter at Test Port 1 provides test connections, and typical waveguide calibration components are shown below the VNA Master.

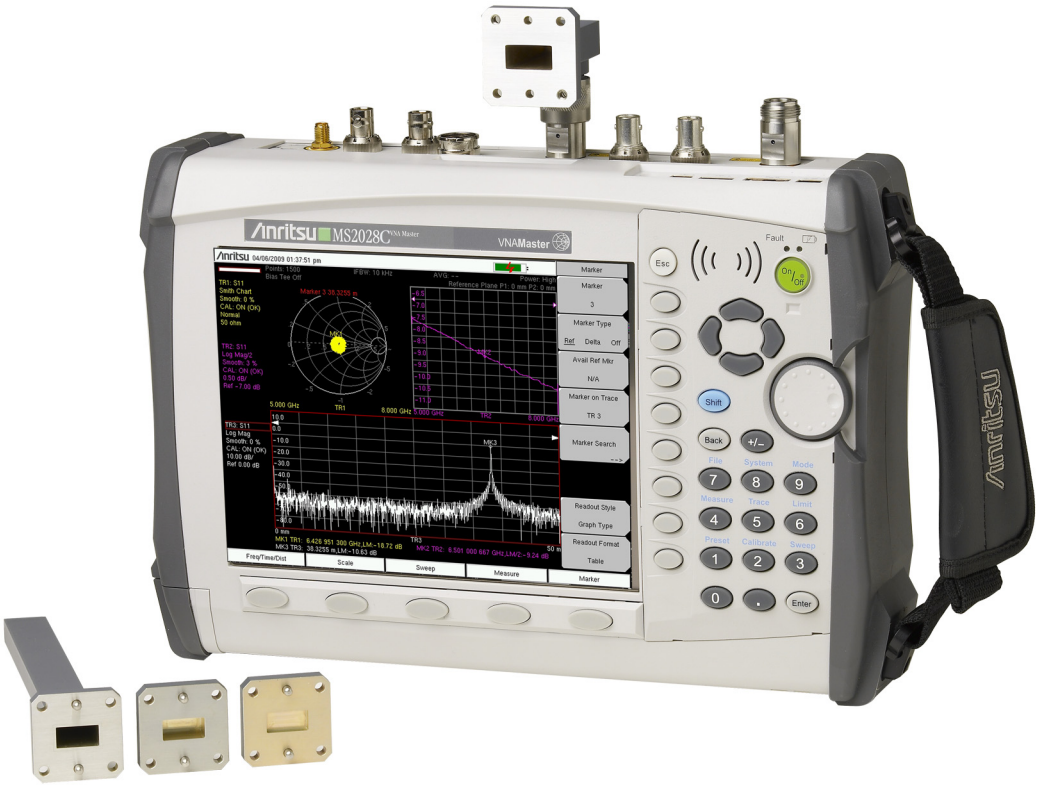


Figure 2-15. Waveguide-Coax Adaptor and Waveguide Calibration Components

LAN Connection

The RJ45 connector is used to connect the VNA Master to a local area network. Refer to Figure 2-13, item "12" on page 2-20. Integrated into this connector are two LEDs. The amber LED indicates the speed of the LAN connection (ON for 10 Mb/s and OFF for 100 Mb/s), and the green LED flashes to show that LAN traffic is present. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address, and subnet mask. These settings are described in more detail in Appendix G, "More About DHCP".

Note	An active Ethernet cable must be connected to the MS20xxC before it is turned ON in order to enable the Ethernet port for DHCP or for a static IP address. Depending upon local conditions, the port may remain enabled when changing from DHCP to static IP address, when changing from static IP address to DHCP, or when temporarily disconnecting the Ethernet cable. If the port becomes disabled, then ensure that an active Ethernet cable is attached to the MS20xxC before cycling the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the VNA Master to the network and select DHCP protocol in the Ethernet Config menu.

Turn the VNA Master off, and then on. If the network is set up for DHCP, then the assigned IP address should be displayed briefly after the power-on sequence.

Note	In order to acquire an address from a DHCP protocol network, the VNA Master MUST be connected to the network BEFORE being switched on.

To display the IP address with the instrument on, press the **Shift** key, then the **System** (8) key, then the System Options soft key and the Ethernet Config soft key. The IP address is displayed as shown in Figure 2-16. For more information about DHCP, refer to Appendix G, "More About DHCP".

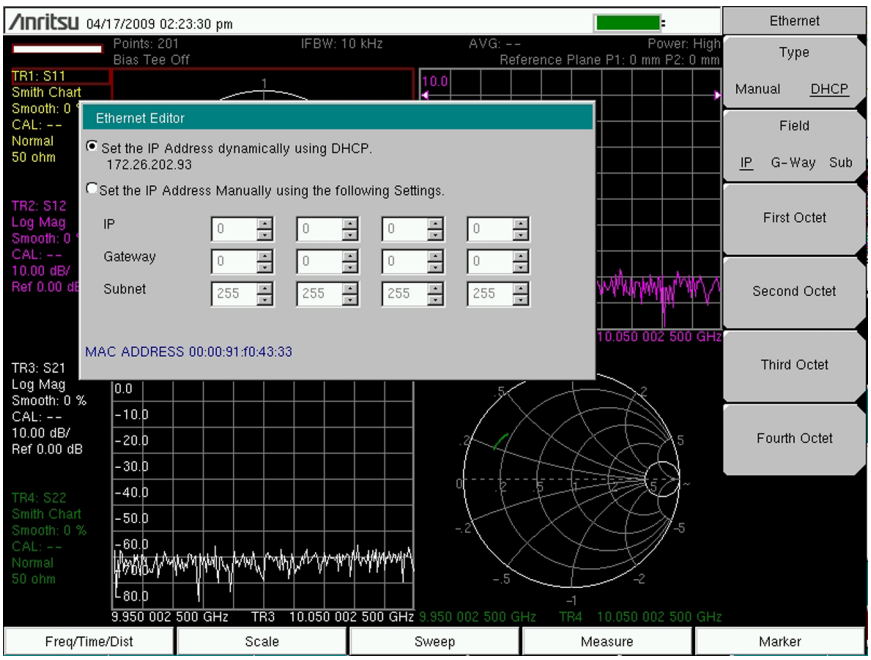


Figure 2-16. IP Address Assigned Using DHCP

USB Interface - USB Type Mini-B

The USB 2.0 interface can be used to connect the VNA Master directly to a PC. Refer to Figure 2-13, item "14" on page 2-20 for the USB connector location. Refer to Figure 2-17 for an example of a PC connection that is also using Master Software Tools. The first time that the VNA Master is connected to a PC, the normal USB device detection will be performed by the computer operating system. The CD-ROM that is shipped with the instrument contains a driver (for Windows 2000 and Windows XP) that is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

Note	For proper detection, either Line Sweep Tools or Master Software Tools must be installed on the PC prior to connecting the VNA Master to the PC USB port.

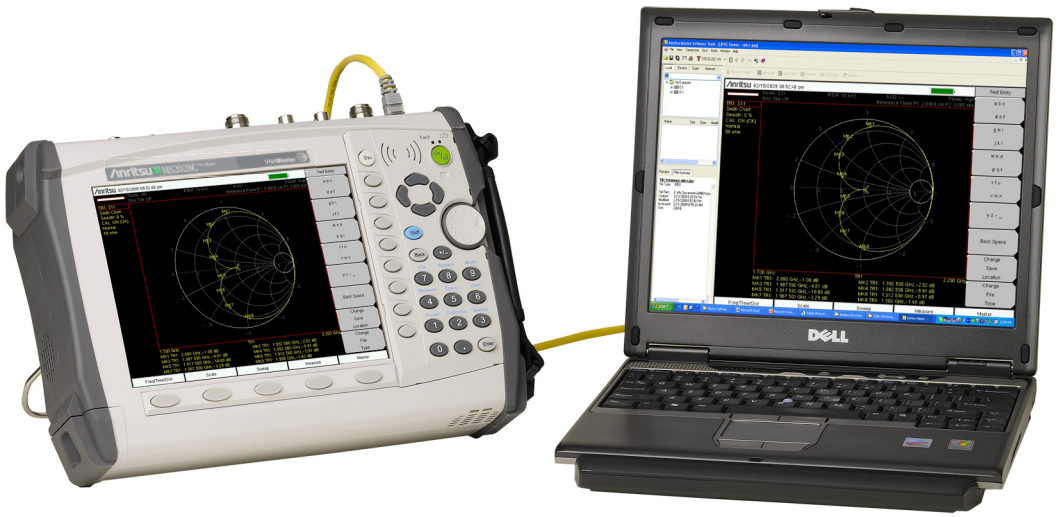


Figure 2-17. MS2028C Connected to PC via USB Mini-B

USB Interface - USB Type A

The VNA Master can also act as a USB Host, which allows various USB Flash Memory devices to be connected to the instrument for storing measurements and setups. Refer to Figure 2-13, item "13" on page 2-20.

Note	For proper operation with the instrument, USB Flash Drives should be formatted using either FAT (for drives that are 2GB or less) or FAT32. USB drives with NTFS formatting may not be correctly recognized by the instruments.

2-12 VNA Master Connectors

External Power

This is a 2.1 mm by 5.5 mm barrel connector, 12 VDC to 15 VDC, < 5.0 A. The external power connector is used to power the unit and for battery charging. Refer to Figure 2-13, item "11" on page 2-20. Input is 12 VDC to 15 VDC at up to 5.0 A. A green flashing indicator light near the power switch shows that the instrument battery is being charged by the external charging unit. The indicator is steadily illuminated when the battery is fully charged.

Warning	When using the AC-DC Adapter, always use a three-wire power cable connected to a three-wire power line outlet. If power is supplied without grounding the equipment in this manner, then the user is at risk of receiving a severe or fatal electric shock.

Note	If the battery is completely depleted, then the VNA Master may not turn on even when the external power supply is plugged into the unit. In that case, allow the battery to charge while the instrument is turned off before attempting to turn on the instrument.

Ext Trigger (50 ohm)

Refer to Figure 2-13, item "4" on page 2-20. This connector is currently supported only in Spectrum Analyzer mode. It may be supported in the Vector Analyzer mode in future firmware releases.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

Ext Freq Ref (50 ohm)

The BNC female connector (refer to Figure 2-13, item "3" on page 2-20) is used for connection of an external frequency reference. Press the External Reference soft key under the System menu and then the Application Options menu to set the reference to external (10 MHz). The amplitude of the External Reference should be between –10 dBm and +10 dBm.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

RF Detector (DIN)

The RF detector connector (refer to Figure 2-13, item "5" on page 2-20) is used for Power Monitor measurements (Option 5). Refer to the table of available RF Detectors in the Technical Data Sheet for your instrument (refer to Appendix A). Note that this option is available only on the MS202xC models.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the RF detector connector. This 4-pin DIN connector has a bayonet shell that locks in a manner similar to a BNC connector. Do not overtighten this connector.

Port 1 (50 ohm)

This Type-N connector (refer to Figure 2-13, item "6" on page 2-20) provides the input/output 50 ohm interface for transmission and reflection measurements of the Vector Network Analyzer at Port 1. Maximum input is +23 dBm at ±50 VDC. Bias Tee output is also available from this port (with Option 0010). The Port 1 green LED (refer to Figure 2-13, item "17" on page 2-20) indicates (is illuminated) when the port is transmitting power.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

Port 2 (50 ohm)

This Type-N connector (refer to Figure 2-13, item "9" on page 2-20) provides the input/output 50 ohm interface for transmission and reflection measurements of the Vector Network Analyzer at Port 2. Maximum input is +23 dBm at ±50 VDC. Bias Tee output is also available from this port (with Option 0010). The Port 2 green LED (refer to Figure 2-13, item "10" on page 2-20) indicates (is illuminated) when the port is transmitting power.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

Type K Connectors (Option 0011) for VNA Ports

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-K connector. Do not overtighten the connector. The recommended torque is 8 lbf ·in (0.9 N ·m or 90 N ·cm).

Bias Input Port 1

The BNC female connector (refer to Figure 2-13, item "7" on page 2-20) is used for external bias tee input that will be routed to Port 1 of the Vector Network Analyzer. Maximum input is ±50 VDC and 500 mA.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

Bias Input Port 2

The BNC female connector (refer to Figure 2-13, item "8" on page 2-20) is used for external bias tee input that will be routed to Port 2 of the Vector Network Analyzer. Maximum input is ±50 VDC and 500 mA.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

Bias Status LED

This LED (refer to Figure 2-13, item "16" on page 2-20) illuminates green when Internal or External Bias is selected. It illuminates red for any overload condition (current or voltage).

Headset Jack

This connector (refer to Figure 2-13, item "15" on page 2-20) is not currently used in the applications that are supported by these VNA Masters. The headset jack accepts a 3.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones.

2-13 Connector Care

Visually inspect connectors for general wear, for cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can damage the instrument. Connection of cables carrying an electrostatic potential, excess power, or excess voltage can damage the connector or the instrument or both. Connection of cables with inadequate torque settings can affect measurement accuracy. Over torquing connectors can damage the cable, the connector, the instrument, or all of these items.

Torque values are written as (for example) 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m), where “lbf ·in” means pounds (force) inches or “inch pounds of force”, and “N ·m” means “Newton meters of force”.

Connecting Procedure (for Type-N and Type-K)

1. Carefully align the connectors.

   The male connector center pin must slip concentrically into the contact fingers of the female connector.

2. Push connectors straight together. Do not twist or screw them together. A slight resistance can usually be felt as the center conductors mate.

3. To tighten, turn the connector nut, not the connector body. Major damage can occur to the center conductor and to the outer conductor if the connector body is twisted.

4. If you use a torque wrench, then initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

   Relieve any side pressure on the connection (such as from long or heavy cables) in order to assure consistent torque. Use an open-end wrench to keep the connector body from turning while tightening with the torque wrench.

   Do not over torque the connector.

Disconnecting Procedure

1. If a wrench is needed, then use an open-end wrench to keep the connector body from turning while loosening with a second wrench.

2. Complete the disconnection by hand, turning only the connector nut.

3. Pull the connectors straight apart without twisting or bending.

GPS Antenna Connector

This GPS antenna connection is for GPS only (Option 31 only). Refer to Figure 2-13, item "2" on page 2-20.

Note	The GPS antenna connection on the VNA Master is fitted with an SMA connector. A DC voltage (3.3 V or 5.0 V) is present on this connector to support active GPS antennas. Connect only supported antennas, such as the Anritsu GPS antenna (part number 2000-1528-R) to this port.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the SMA connector. Do not overtighten the connector. The recommended torque is 8 lbf ·in (0.9 N ·m or 90 N ·cm).

Reference Output, 10 MHz (50 ohm)

The SMA female connector (refer to Figure 2-14, item "3" on page 2-21) provides an output to the internally generated 10 MHz reference signal.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the SMA connector. Do not overtighten the connector. The recommended torque is 8 lbf ·in (0.9 N ·m or 90 N ·cm).

Spectrum Analyzer RF In (50 ohm)

This connector (refer to Figure 2-14, item "4" on page 2-21) provides the input 50 ohm interface for the Spectrum Analyzer function.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

Type K Connectors (Option 0011) for RF In Port

The K connector option configures the VNA Master with K connectors at the Spectrum Analyzer RF In port and at the VNA Ports.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the K connector. Do not overtighten the connector. The recommended torque is 8 lbf ·in (0.9 N ·m or 90 N ·cm).

2-14 Symbols and Indicators

The symbols and indicators that appear on the display screen convey the instrument status or condition on the display.

Battery Symbol

The battery symbol (Figure 2-18) above the display indicates the charge remaining in the battery. The colored section that is inside the symbol changes size and color with the charge level.

Figure 2-18. Battery Symbol

Green with Black Plug body: Battery is fully charged and external power is applied

Green: Battery is 30% to 100% charged.

Yellow: Battery is 10% to 30% charged.

Red: Battery is 0% to 10% charged. When the Battery Indicator is red, approximately 8 to 10 minutes of battery life remain.

Lightning Bolt: Battery is being charged (any color symbol)

When the battery is charging, either from the AC-DC Adapter or the 12 Volt DC adapter, the symbol will change to that shown in Figure 2-19:

Figure 2-19. Battery Symbol While charging

The Battery Charge LED flashes when the battery is charging and remains on and steady when the battery is fully charged.

Note	Use only Anritsu approved batteries, adapters, and chargers with this instrument.

When the battery is not present, the battery symbol is replaced by a red plug body (Figure 2-20) to indicate that the instrument is running from external power. When the external AC adaptor is connected, the battery automatically receives a charge, and the battery symbol with the lightning bolt is displayed (Figure 2-19). When the battery is fully charged, the charging circuit shuts off and the green battery symbol (100% charged) is displayed without the lighting bolt (Figure 2-18)..

Figure 2-20. Battery Not Charging or Not Available

Hold

A Hold message is displayed when the VNA Master is on hold. To resume sweeping, toggle from Hold to Run in the Sweep menu.

Single Sweep

The Single Sweep symbol is displayed when Single Sweep is selected. Single or Continuous sweep can be selected under the Sweep Menu.

2-15 Memory Profile and Security Issues

This section describes the profiles of the various types of memory that are used in the MS20xxC VNA Master and the associated security issues that are related to those memory devices.

The MS20xxC has 1 GB of Flash non-volatile memory, has EEPROM memory, and has sufficient DRAM volatile memory for normal operation. The instrument is supplied with a USB memory device that plugs into the USB Type A connector. The MS20xxC does not have a hard drive or any other type of volatile or non-volatile memory.

The following sections describe how memory is used in the VNA Master and how it can be erased.

Internal Flash Memory

This memory space is used to store the instrument firmware and factory calibration, and can be used to store measurements and setups that are saved by the user.

Saved measurements and setups that are stored in the Flash memory are all deleted by the master reset process that is described in Section "MS20xxC Master Reset Instructions" on the following page.

Note	With Option 7 enabled, the user is not able to store any measurements or setups to this internal flash memory.

USB Memory Device

The USB memory device is not required for proper operation of the instrument. The instrument may be directed to store measurements and setups directly to the USB memory device, or you may transfer the contents of the internal flash memory into the USB memory device for storage or data transfer purposes. The device is removable and therefore does not pose a security risk because it can remain in a secured area, can be externally erased by a computer, or can be destroyed.

Note	With Option 7 enabled, the user does not have access to the internal flash memory and, therefore, cannot transfer any contents of the internal flash memory into the USB memory device.

RAM Memory

This is volatile memory that is used to store many parameters that are needed for the normal operation of the MS20xxC along with current measurements. This memory is reset whenever the instrument is restarted.

EEPROM

This memory holds information such as the model number, serial number, and calibration data for the instrument. Also stored here are the operating parameters, such as frequency range, that are set by the user. During the master reset process, all operating parameters that are stored in the EEPROM are set to standard factory default values.

MS20xxC Master Reset Instructions

1. Turn the MS202xC or MS203xC On.
2. Press the **Shift** key then the **System** (8) key.
3. Press the System Options soft key.
4. Press the Reset soft key.
5. Press the Master Reset soft key.
6. A dialog box is displayed on the instrument screen to warn that all settings will be returned to factory default values, and that all user files will be deleted.
7. Press the **Enter** key to complete the master reset, or press the **Esc** key to abort.
8. After several seconds (which can grow to several minutes if a very large number of measurements have been saved in the instrument), the instrument reboots.

2-16 System Settings

To access the System menu, press the **Shift** key, then the **System** (8) key. Refer to Chapter 6, "System Operations ".

Power On Self Test

At power on, the VNA Master runs through a series of quick checks to ensure that the system hardware is functioning properly. Refer to "Power On Self Test" on page 6-13 and to "Self Test" on page 6-4.

Vector Network Analyzer Mode

The "Application Options Menu (VNA Mode)" on page 6-7 contains the selections for Units, External Reference, Trace Label, Measurement Gain Range, and Time Domain (if applicable).

Time Domain

When the Time Domain Option (Option 2) is enabled, certain aspects of the measurements are determined by the settings in this menu. Refer to the Vector Network Analyzer Measurement Guide (listed in Appendix A) for a detailed description of this menu.

Spectrum Analyzer Mode

The "Application Options Menu (SPA Mode)" on page 6-9 contains the Impedance setting selection and an Auto Ref Level selection.

Frequency Blanking

This feature is available with Option 7 installed. Refer to "Frequency Blanking" on page 4-5.

2-17 File Types

Filename extensions that are used in the VNA Master:

`*.jpg` JPEG images, `filename.jpg`

`*.mna` Measurements, `filename.mna`

`*.stp` Setups, `filename.stp`

`*.s2p` S2P (SnP), `filename.s2p`

`*.spa` Spectrum Analyzer measurements, `filename.spa`

`*.csv` Text file with Comma Separated Values (CSV), `filename.csv`

`*.txt` Text file with tab separated values, `filename.txt`

`*.lim` Limit lines, `filename.lim` (Limit lines are available only in Spectrum Analyzer mode.)

Note	S2P is a standard ASCII text file format that is used for scattering parameters from a 2-Port measurement. This is a subset of SnP (where n equals the number of ports). An S2P file can be used as input for signal analysis. The CSV and Text files contain setup information and final formatted data that are shown on the instrument display screen. This file information includes any post-processing that was done on the data (smoothing, trace math, time domain, and so forth). These files contain the data for any traces that are displayed, including the memory traces. They also contain the markers that are turned on when the file is saved.

File Management

A description of the file menu group is in the VNA Menus chapter of the VNA Measurement Guide (refer to Appendix A). That section includes instructions for saving, recalling, copying, and deleting files.

Chapter 3 — Power Monitor, Option 5

3-1 Introduction

When equipped with Option 5, Power Monitor, the MS202xC VNA Master can be used for making power measurements with broadband RF detectors, such as those listed in the Technical Data Sheet for your instrument, as listed in Appendix A. The power monitor displays the measured power results in dBm or Watts.

Note	Option 5 is not available in the MS203xC VNA Master models.

The function hard keys that are displayed in this mode are:

Freq, Scale, Save/Recall, Measure, Marker

Only the **Save/Recall** and **Measure** function hard keys are functional in this mode. The other three function hard keys provide no valid functions.

3-2 Using the Power Monitor

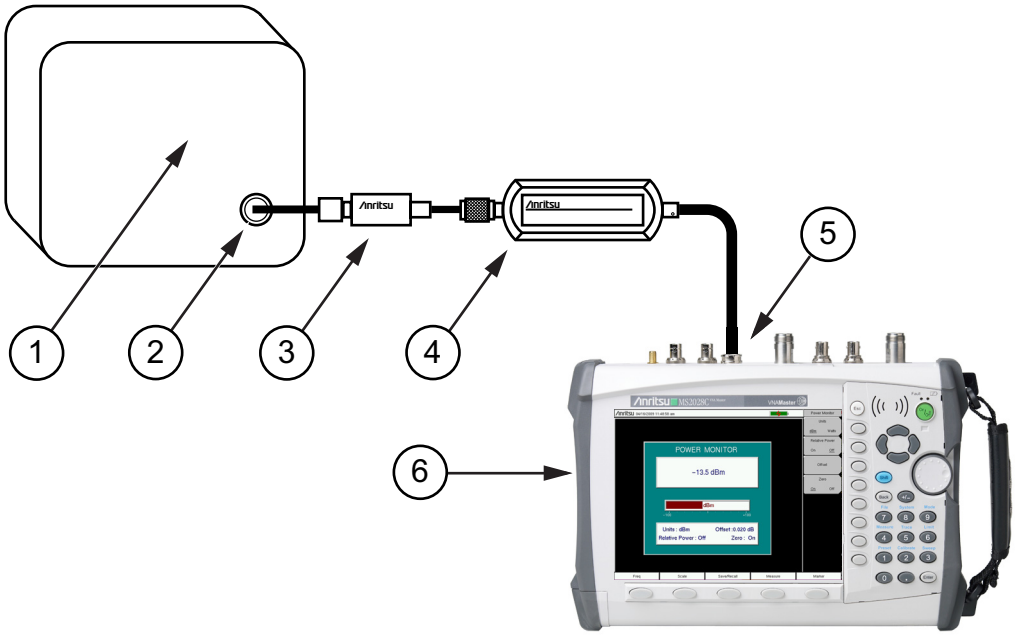
1. On the VNA Master, press the **Shift** key, then the **Mode** (9) key.
2. Use the directional arrow keys or the rotary knob to highlight Power Monitor and then press the **Enter** key.
3. Connect the power sensor to the VNA Master RF Detector port.

Zeroing the Power Monitor

1. With no power applied to the Power Detector input, press the Zero soft key. Wait for a few seconds while the VNA Master accumulates data samples of the quiescent power.
2. When complete, Zero: On is displayed in the message area.

Measuring High Input Power Levels

1. Insert an attenuator between the DUT and the RF Detector to protect the VNA Master so that the power level is less than or equal to +16 dBm.
2. Press the Offset soft key and enter the attenuation by using the keypad, the arrow keys, or the rotary knob.
3. Press the **Enter** key to complete the entry.



1	DUT (Device Under Test)
2	RF Out
3	Attenuator
4	RF Detector (Power Sensor)
5	RF Detector Interface (for Option 5)
6	VNA Master

Figure 3-1. Power Measurement Setup With Attenuator

Displaying Power in dBm or in Watts

Press the Units soft key to toggle between dBm and Watts.

Setting Relative Power

1. With the desired base power level input to the VNA Master, press the Relative soft key. The power reading shows 100% because it is measuring the same power level.
2. If the power is lowered by 3 dB, then the relative power will show 50%.
3. If the power in Watts is increased from 1 Watt to 2 Watts, then the relative power will show 200%.

In Figure 3-2, the Units are set for dBm, the Relative Power function is Off, the Offset is 1 dBm, and the Zero function is set to Off. The figure is intended to illustrate the general layout of the Power Monitor display. The displayed image on your instrument may be different.

3-3 Power Monitor Display

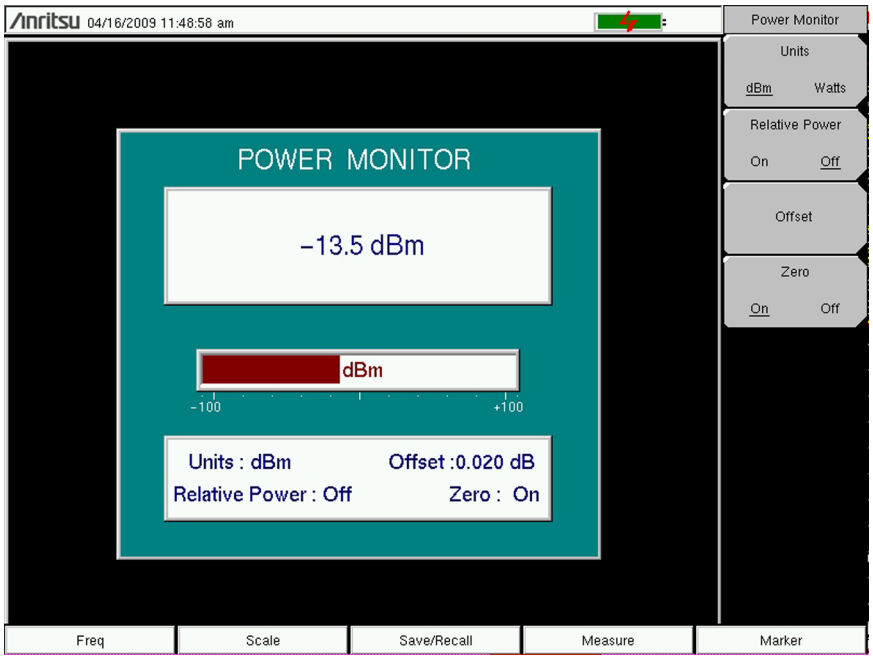
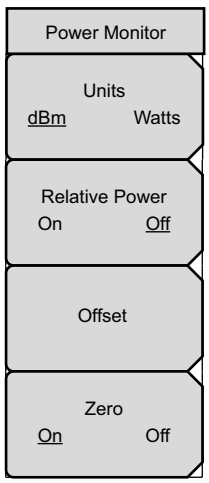


Figure 3-2. Power Monitor Display

3-4 Power Monitor Menu



Units
dBm Watts: Press this soft key to toggle units between dBm and Watts.

Relative Power
On Off: Press this soft key to turn relative power On or Off.

Offset: Press this soft key to enter an offset value to account for any external attenuator that is used during a measurement.

Zero
On Off: Press this soft key to toggle zeroing On in order to perform Zeroing of the power monitor detector.

Figure 3-3. Power Monitor Menu

Chapter 4 — Secure Data Option 7

4-1 Introduction

When equipped with Option 7, the MS20xxC VNA Master provides for careful management of confidential data for both the setup parameters and the resulting measured data.

Highly sophisticated systems and equipment have technical applications that must remain secure in their operations. The particular parameters that must remain secure usually involve operating frequencies and a variety of other setup configurations.

To accommodate the measurements and yet preserve the data as confidential, Option 7 can be used to prevent any setup data or measured data from being stored on any internal memory location of the VNA Master. Instead, all such data are forced to be stored on removable memory such as an external USB memory device.

Caution	Note that even with Option 7 enabled, operating parameters (such as frequency range, power level, number of points) that are set by the user are stored in the VNA Master EEPROM when the VNA Master is turned OFF. These parameters can be erased, however, via a Master Reset operation, as described later in this chapter.

4-2 Procedure

When saving data (setups, measurements, JPEG, and so forth) in a VNA Master with Option 7, the save location must be an external USB memory device. If a USB memory device is not connected to the instrument, then you cannot perform the save function.

You can use the following steps to change the save location while saving a file:

1. Press the **Shift** key, then the **File** (7) key.
2. Press the Save soft key.
3. Press the Change Save Location soft key.
4. Use the rotary knob or arrow keys to highlight the external USB memory device or any desired folder on that device.
5. Press the Create Folder soft key to create a new folder, if desired.
6. Press the Set Location soft key to set the highlighted folder or drive as the target location.
7. Press the Change File Type soft key to pick a different file type, if desired.
8. Use the Text Entry soft keys to enter the desired file name.
9. Press **Enter** to save the file.

4-3 Calibration Setup

After any user calibration, the VNA Master automatically writes the calibration file to internal memory. This is done so that when the instrument is turned Off and then back On, the user calibration data are recalled, and the calibration can be applied.

With Option 7 enabled, however, the VNA Master cannot write to internal memory. Therefore, the user calibration file is not automatically saved. With Option 7 enabled, when the instrument is turned Off and then back On, the user calibration data are not recalled, and the calibration cannot be applied. To save and recall the calibration, use the file save menu to save the setup with calibration to USB memory. Then use the file recall menu to retrieve the calibration.

4-4 Memory Profile and Security Issues

This section describes the profiles of the various types of memory that are used in the MS20xxC VNA Master and the associated security issues that are related to those memory devices.

The MS20xxC has 1 GB of Flash non-volatile memory, has EEPROM memory, and has sufficient DRAM volatile memory for normal operation. The instrument is supplied with a USB memory device that plugs into the USB Type A connector. The MS20xxC does not have a hard drive or any other type of volatile or non-volatile memory.

The following sections describe how memory is used in the VNA Master and how it can be erased.

Internal Flash Memory

This memory space is used to store the instrument firmware and factory calibration, and can be used to store measurements and setups that are saved by the user.

Saved measurements and setups that are stored in the Flash memory are all deleted by the master reset process that is described in Section "MS20xxC Master Reset Instructions" on the following page.

Note	With Option 7 enabled, the user is not able to store any measurements or setups to this internal flash memory.

USB Memory Device

The USB memory device is not required for proper operation of the instrument. The instrument may be directed to store measurements and setups directly to the USB memory device, or you may transfer the contents of the internal flash memory into the USB memory device for storage or data transfer purposes. The device is removable and therefore does not pose a security risk because it can remain in a secured area, can be externally erased by a computer, or can be destroyed.

Note	With Option 7 enabled, the user does not have access to the internal flash memory and, therefore, cannot transfer any contents of the internal flash memory into the USB memory device.

RAM Memory

This is volatile memory that is used to store many parameters that are needed for the normal operation of the MS20xxC along with current measurements. This memory is reset whenever the instrument is restarted.

EEPROM

This memory holds information such as the model number, serial number, and calibration data for the instrument. Also stored here are the operating parameters, such as frequency range, that are set by the user. During the master reset process, all operating parameters that are stored in the EEPROM are set to standard factory default values.

MS20xxC Master Reset Instructions

1. Turn the MS202xC or MS203xC On.
2. Press the **Shift** key then the **System** (8) key.
3. Press the System Options soft key.
4. Press the Reset soft key.
5. Press the Master Reset soft key.
6. A dialog box is displayed on the instrument screen to warn that all settings will be returned to factory default values, and that all user files will be deleted.
7. Press the **Enter** key to complete the master reset, or press the **Esc** key to abort.
8. After several seconds (which can grow to several minutes if a very large number of measurements have been saved in the instrument), the instrument reboots.

4-5 Frequency Blanking

With Option 7 enabled, you have the ability to blank the frequency values that are displayed on the screen, as shown in Figure 4-1. This extra security measure allows you to use the instrument in any environment with sensitive frequency information blanked from the screen. To enable frequency blanking, navigate to the Reset menu and toggle the Frequency Blanking button to On (**Shift-8** (System), System Options, Reset). The Reset menu and the Frequency Blanking button are shown in Figure 4-2.

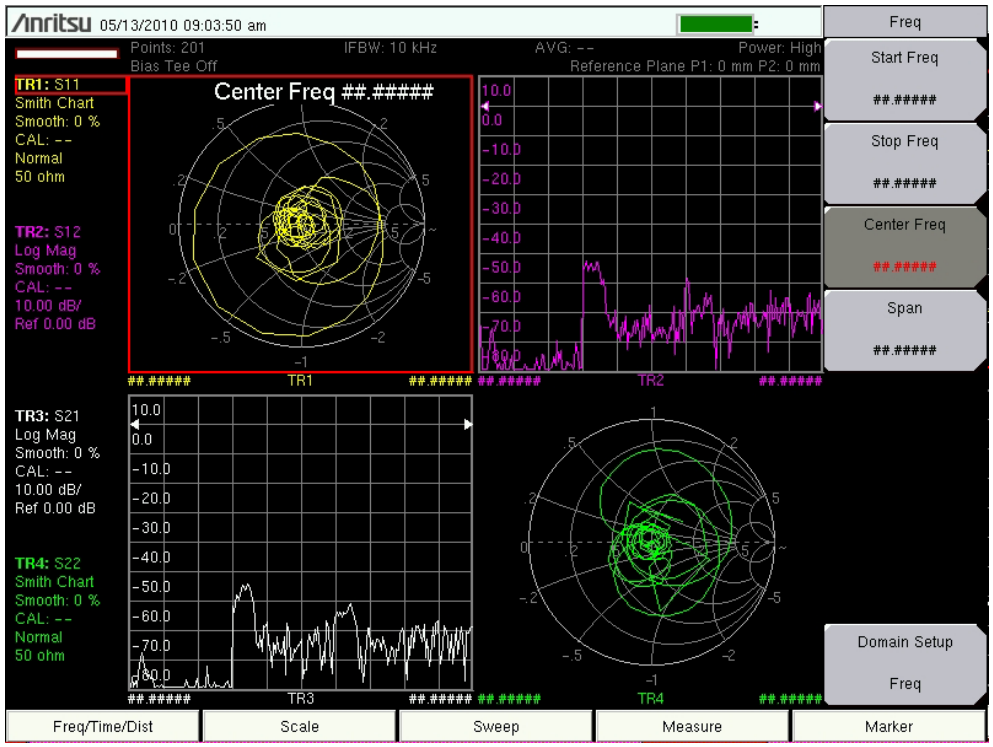


Figure 4-1. Frequency Blanking Turned On

Warning	Note that user files can still be stored to an external USB drive, and that frequency information is not blanked in those files. You must therefore ensure that no external USB devices are used to unintentionally store measurement or setup files when working with secure frequencies. Also, frequency information is not blanked from the SCPI commands that are used to remotely control the instrument. It is therefore up to you to ensure that no remote connections are made to the instrument when frequency information is being protected.

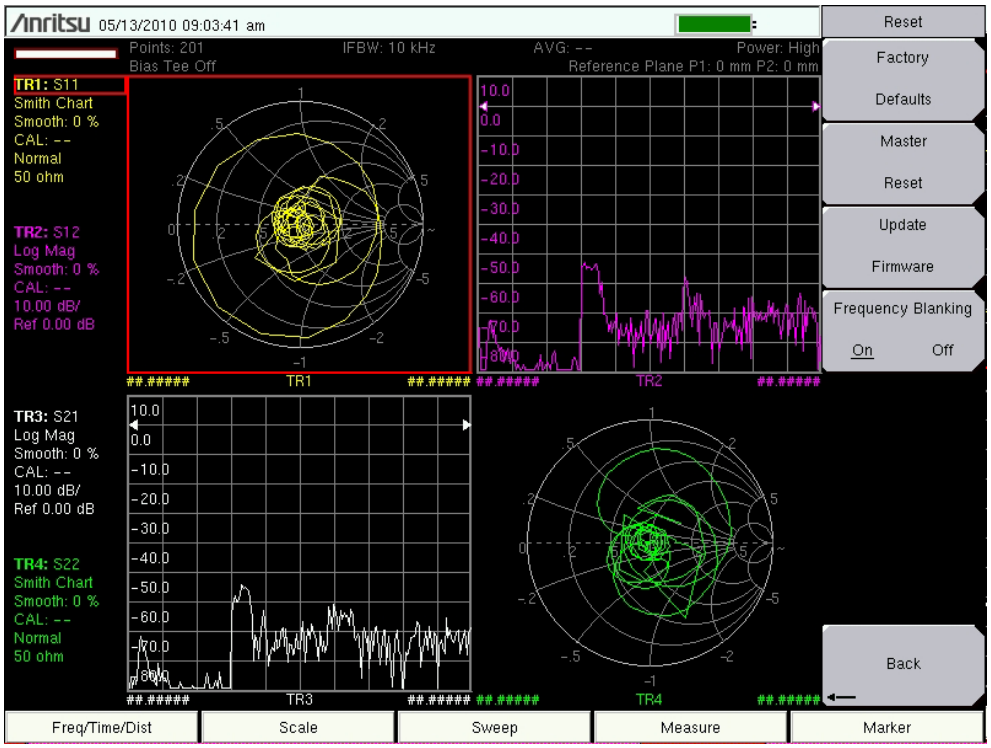


Figure 4-2. Frequency Blanking Menu

After frequency blanking is enabled, you are not able to restore the frequency readouts. This feature was designed as an added security measure to ensure that the sensitive frequency information is protected and cannot be recovered. Following is a list of the security measures that have been taken to protect the frequency information:

1. Turning off frequency blanking presets the instrument (and the frequencies) to the factory default settings.
2. Turning off the instrument presets the instrument to the factory default settings and turns off frequency blanking.
3. Presetting the instrument turns off frequency blanking and restores the factory default settings.
4. Frequency blanking is available only with Option 7 to ensure that user files and calibration files are not stored in the internal memory of the instrument.

When you have completed making your measurements with frequency blanking turned on, simply turn off frequency blanking or turn off the instrument, and you can be assured that your sensitive frequency information cannot be restored or viewed by any other user.

Chapter 5 — File Management

5-1 Introduction

This chapter describes the file management features of the VNA Master and describes the **File** menu. The submenus under this menu allow you to save, recall, copy, and delete files in the internal memory or an external USB flash drive.

5-2 File Types

Filename extensions that are used in the VNA Master:

`*.jpg` JPEG images, `filename.jpg`

`*.mna` Vector Network Analyzer Measurements, `filename.mna`

`*.stp` Setups, `filename.stp`

`*.s2p` S2P (SnP), `filename.s2p`

`*.spa` Spectrum Analyzer Measurements, `filename.spa`

`*.csv` Text file with Comma Separated Values (CSV), `filename.csv`

`*.txt` Text file with tab separated values, `filename.txt`

`*.lim` Limit lines, `filename.lim` (Limit lines are available only in Spectrum Analyzer mode.)

Note	S2P is a standard ASCII text file format that is used for scattering parameters from a 2-Port measurement. This is a subset of SnP (where n equals the number of ports). An S2P file can be used as input for signal analysis. The CSV and Text files contain setup information and final formatted data that are shown on the instrument display screen. This file information includes any post-processing that was done on the data (smoothing, trace math, time domain, and so forth). These files contain the data for any traces that are displayed, including the memory traces. They also contain the markers that are turned on when the file is saved.

5-3 Managing Files

Press the **Shift** key then the **File** (**7**) key on the number keypad to display the **File** menu. Follow the additional steps below.

Note	When navigating through the **File** menu, pressing the **Esc** key returns to the previous menu.

Save Files

Set the Save Location

Press Save then the Change Save Location submenu key and select the location to save files. You can save files to the internal memory or to an external USB flash drive. You can also create new folders. If an external USB flash drive is connected or disconnected, press Refresh Directories to update the location tree. Press the Set Location key to store the save location.

Save Measurement As

The Save Measurement As key is used to quickly save measurements with a specific file name. The VNA Master saves the measurement with the latest file name that was used to save a measurement and with a number that is automatically incremented and appended to the end of the file name. For instance, if the last measurement was saved with the name System Return Loss, Save Measurement As saves the next measurements as System Return Loss_#1, System Return Loss_#2, and so forth. The file name can be changed using the Save dialog box (Figure 5-1).

Save a Measurement

Press the Save Measurement key and enter the name for the measurement file. The measurement file can be stored as `.MNA`.

Save a Setup

Press the Save submenu key, type a name for the setup file, confirm that the file type is Setup by using the Change Type key, and then press **Enter** to save.

Save a Measurement Screen as JPEG

Press the Save submenu key, type a name for the JPEG file, confirm that the file type is JPEG, and press **Enter** to save.

Save Dialog Box

The save dialog box (Figure 5-1) is used to store files on the internal memory or an external USB flash drive. The file type, file name, and save location are set starting with this display. Refer to "Save Menu" on page 5-9 and "Save Location Menu" on page 5-10 for details.

Note	The figures in this user guide are typical examples. Images on your instrument may not match these examples.

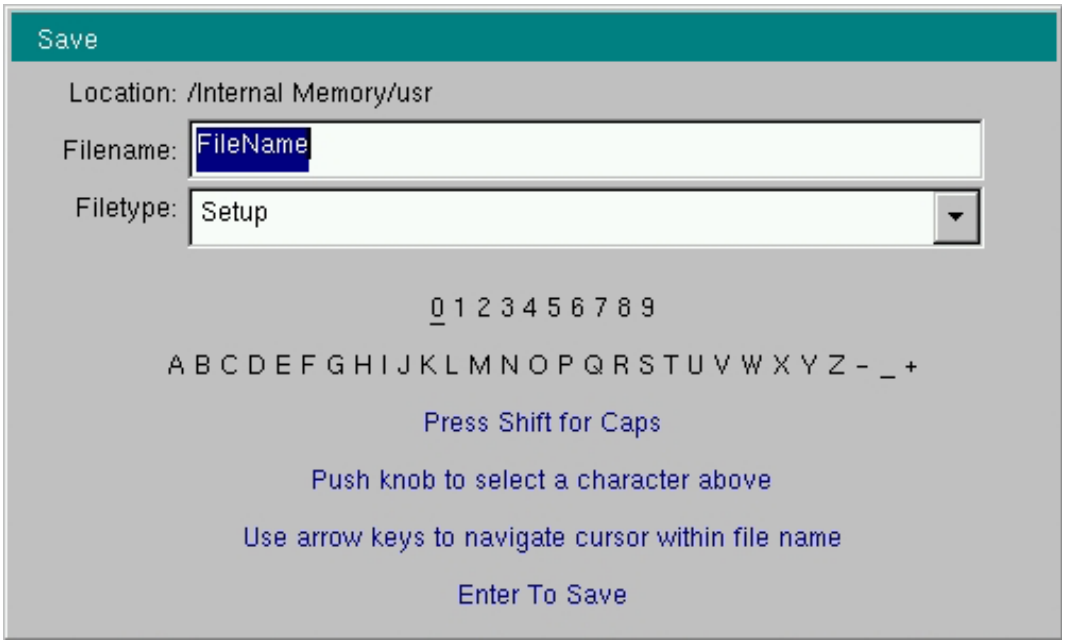


Figure 5-1. Save Dialog Box

Recall Files

The recall menu enables you to view all of the Measurement and Setup files in the internal memory and in an external USB flash drive.

You can sort the recall menu by name, date, or type. You can also choose to view only measurement files or setup files by pressing File Type on the Recall dialog box and then by selecting the file type that you want to view.

Recall a Measurement

From the **File** menu, press the Recall Measurement submenu key, select the measurement with the rotary knob or the **Up/Down** arrow keys, and then press **Enter**.

Recall a Setup

Press the Recall submenu key. Confirm that the file type is Setup or All. Select the setup file (`.stp`) with the rotary knob or the **Up/Down** arrow keys, and then press **Enter**.

Recall Dialog Box

The Recall dialog box (Figure 5-2) opens previously saved measurements and setups. Refer to the "Recall Menu" on page 5-13 for additional information.

Figure 5-2. Recall Dialog Box

Copy Files

The steps below describe copying a file from internal memory to an external USB flash drive. (Copying in the reverse from USB to internal memory is accomplished by using the Scroll Src Dst submenu key.) Select the files to copy in the top window and the location for the files (to be copied) in the bottom window (Figure 5-3). Refer to the "Copy Menu" on page 5-14 for additional information.

1. Insert a USB drive into either USB Type A port of the VNA Master.
2. From the **File** main menu, press the Copy submenu key. The Copy menu and Copy dialog box are displayed.
3. Select the files that are to be copied. To select multiple files, highlight the first file, then press the Select or De-Select key to keep the file selected. The selected file is outlined in blue. Repeat with all the files that are to be copied. To display files in a folder, select the folder and press the **Enter** key.
4. Press the Scroll key and highlight the USB drive in the lower window using the **Up/Down** arrow keys. The Scroll submenu key toggles between source and destination, Src (top window) and Dst (bottom window).
5. Press the Copy key to copy the files to the USB flash drive.

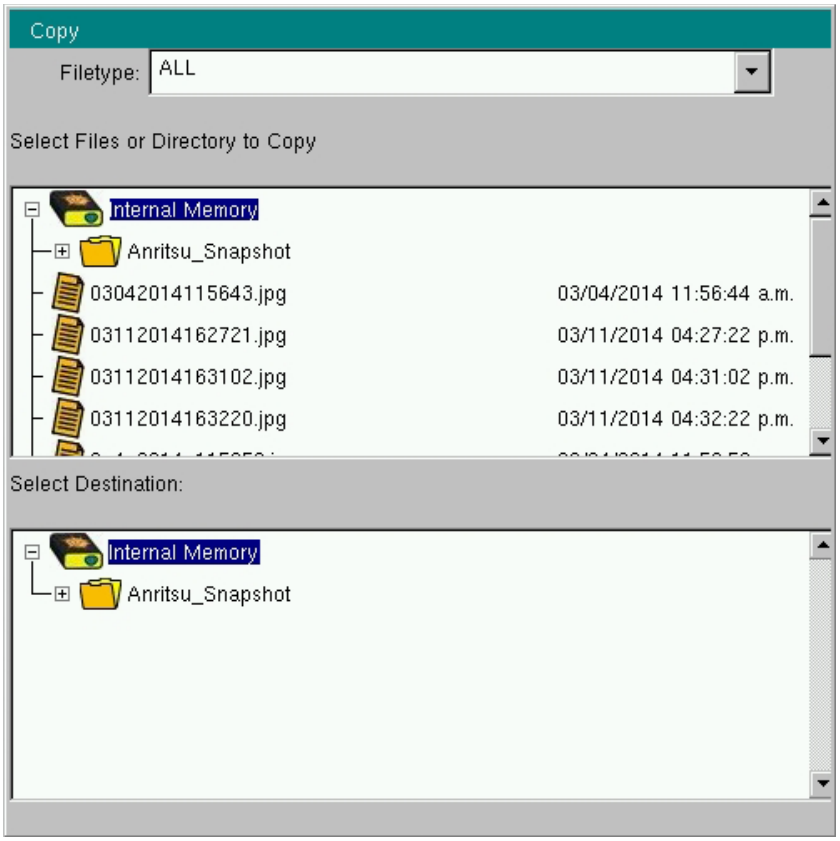


Figure 5-3. Copy Dialog Box

Delete Files

Press the Delete submenu key. Highlight the file to be deleted with the **Up/Down** arrow keys. Press the Select or De-Select key. Selected files are outlined in blue. Press the Delete key and then press **Enter** to delete the selected file.

Delete Dialog Box

Press the Delete submenu key to open the Delete dialog box (Figure 5-4). The menus allow sorting by file type, name, and saved date. Refer to the "Delete Menu" on page 5-15 for additional information.

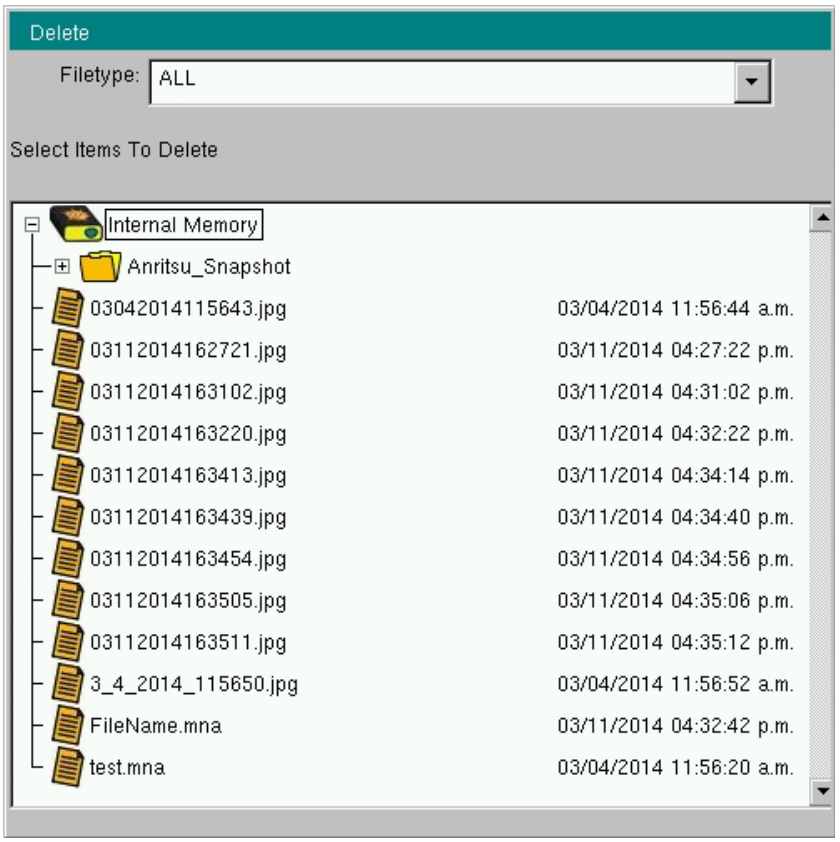


Figure 5-4. Delete Dialog Box

5-4 File Menu Overview

Open this menu by pressing the **Shift** key, then the **File** (**7**) key.

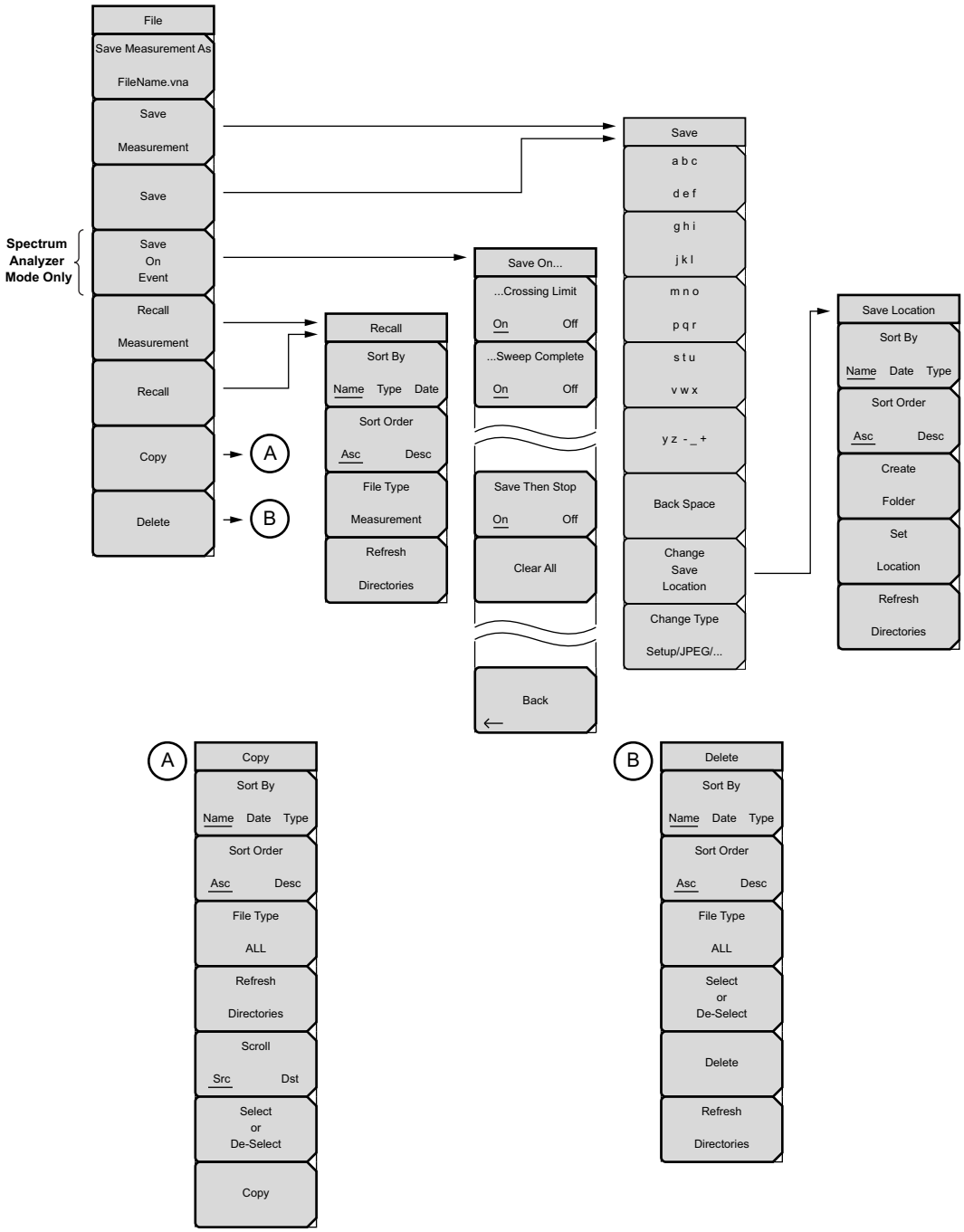
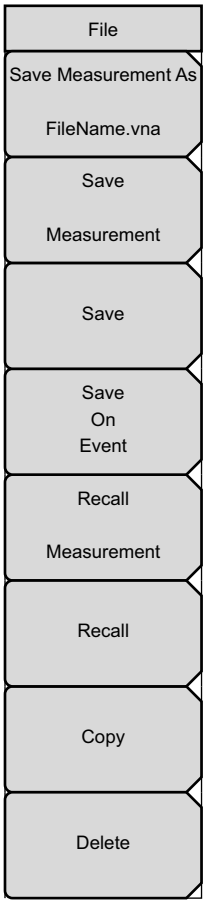


Figure 5-5. File Menu

5-5 File Menu

Key Sequence: **File**



Save Measurement As: Press this soft key (submenu key) to save the current setup with a user defined filename. The default filename is changed using the Save menu. To change the default filename, type in a new filename with the number keyboard and press **Enter**. After a few seconds, the screen returns to File menu. Press the Save Measurement As key again and the new file name is used.

Save Measurement: Press this submenu key to display the "Save Menu" on page 5-9. Measurements can be saved to internal memory or to a USB flash drive. The saved measurement can be named by using the Save menu keys. By default, measurements are saved to internal memory in a directory named **/user**. The save destination is set with the "Save Location Menu" on page 5-10.

Save: Press this submenu key to display the "Save Menu" on page 5-9 and the touch screen keyboard. Measurements can be saved to internal memory or to a USB flash drive. The saved setup, measurement, or JPEG file can be named in the Save menu. By default, measurements are saved to internal memory in a directory named **/user**. The save destination is set with the "Save Location Menu" on page 5-10.

Save on Event: Press this submenu key to display the "Save On ... Menu" on page 5-12. This Save on Event submenu key is displayed only in Spectrum Analyzer and Interference Analyzer modes (models MS203xC).

Recall Measurement: Press this submenu key to display the "Recall Menu" on page 5-13. This menu is for recalling measurements from internal memory or from a USB flash drive.

Recall: Press this submenu key to display the "Recall Menu" on page 5-13. This menu is for recalling measurement or setup data from internal memory or from a USB flash drive.

Copy: Press this submenu key to display the "Copy Menu" on page 5-14. The Copy menu is for copying files or folders from internal memory or a USB flash drive.

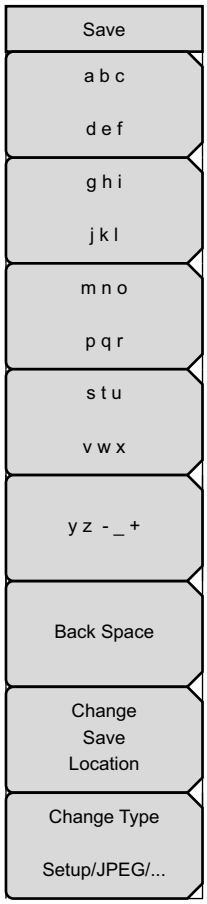
Delete: Press this submenu key to display the "Delete Menu" on page 5-15 and a selection box that shows the setup and measurement names and the type, date, and time that the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file that is to be deleted, and then press the Delete submenu key, then press **Enter**. Press the **Esc** key to cancel the operation. Note that deleted files cannot be recovered.

Figure 5-6. File Menu

Caution	Deleted files cannot be recoverd.

Save Menu

Key Sequence: **File** > Save



a b c: Use the top five submenu keys to enter letters and symbols in filenames. Press the **Shift** key for uppercase letters.

Use the **Left/Right** Arrow keys to move left and right within the text. Use the Back Space submenu key to move left, deleting characters.

Back Space: Press this submenu key to delete characters to the left.

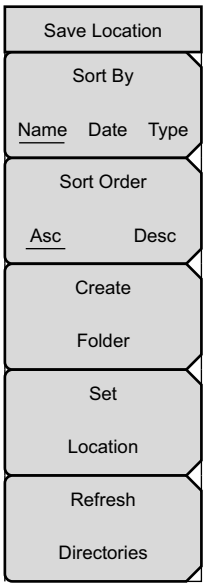
Change Save Location: Press this submenu key to open the "Save Location Menu" on page 5-10.

Change Type Setup/JPG/... Press this submenu key in VNA and VVM modes to select among the various file types available for setup and measurement data. This submenu key also opens the File Type menu with a submenu key to select Full screen or Graph Only images for JPEG file types. This submenu key is not displayed in Spectrum Analyzer or Interference Analyzer modes

Figure 5-7. Save Menu

Save Location Menu

Key Sequence: **File** > Save > Change Save Location



Sort By
Name Date Type: Press this submenu key to sort the folders by Name, Type, or Date.

Sort Order
Asc Desc: Press this submenu key to display the folder names in ascending or descending order.

Create Folder: Press this submenu key to create a new folder in the highlighted location or folder. Name the new folder in the create directory dialog box.

Set Location: Press this submenu key to set the current location for saving files and then return to the "Save Menu" on page 5-9.

Refresh Directories: Press this submenu key to update the display.

Figure 5-8. Save Location Menu

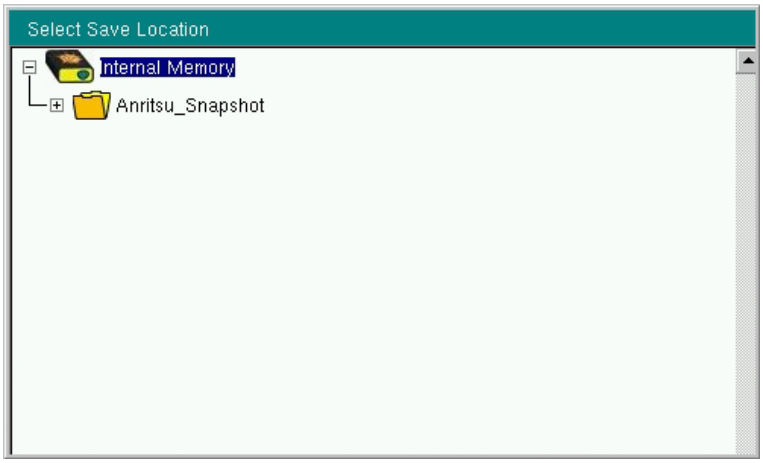
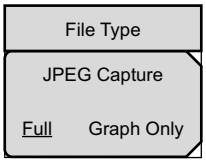


Figure 5-9. Select Save Location Dialog Box

File Type Menu

When saving a file, use this menu to change the file type. Typical file types are shown in Figure 5-11 and Figure 5-12.

Key Sequence: **File** > Save > Change Type



JPEG Capture
Full Graph Only: Toggling this submenu key to Full sets the VNA Master to save the file with measurement data. Toggling to Graph Only saves the file as an image of the screen.

Figure 5-10. File Type Menu

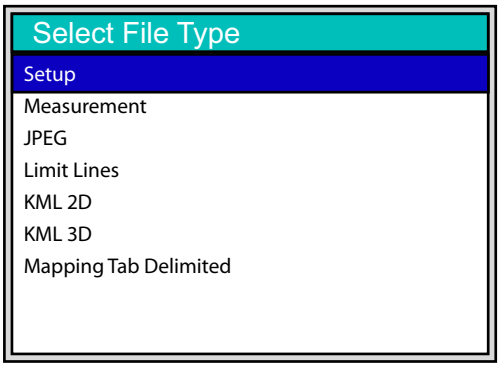


Figure 5-11. Select File Type List Box (Spectrum Analyzer Mode)

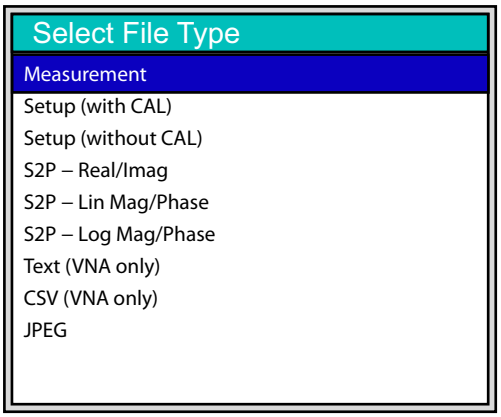
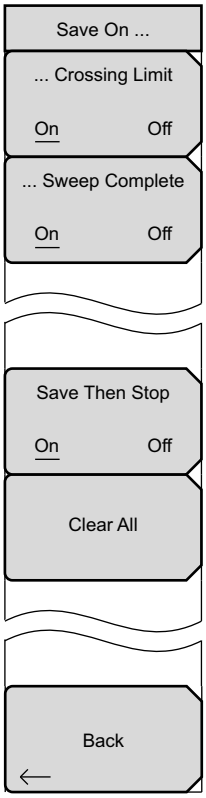


Figure 5-12. Select File Type List Box (VNA Mode)

Save On ... Menu

In Spectrum Analyzer and Interference Analyzer modes, this menu is used to auto save measurements to internal memory after specific events occur.

Key Sequence: **File** > Save On Event



... Crossing Limit
On Off: Press this soft key (submenu key) to toggle the Crossing Limit On or Off. When On, measurements are saved to internal memory when the measurement has crossed a defined limit line that has been created with the **Limit** menu.

... Sweep Complete
On Off: Press this submenu key to toggle the Sweep Complete setting On or Off. When On, measurements are saved to internal memory after the current sweep is complete. When Off, a measurement is saved after every sweep.

Save Then Stop
On Off: Press this submenu key to toggle the Save Then Stop setting On or Off. When On, the sweep is stopped after a measurement is saved. When Off with Sweep Complete On, a measurement is saved after every sweep.

Clear All: Press this key to turn Off all three save-on-event keys:

Crossing Limit

Sweep Complete

Save Then Stop

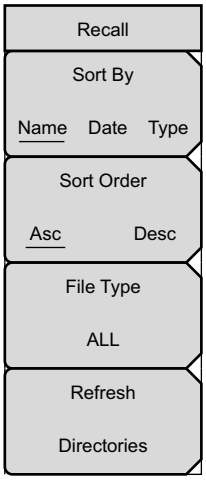
Back: Press this key to return to the "File Menu" on page 5-8.

Figure 5-13. Save On ... Menu

Recall Menu

This menu and its dialog box are used to select the location from which the VNA Master recalls a file. Select folders or locations with the **Up/Down** arrow keys or the rotary knob.

Key Sequence: **File** > Recall



Sort By
Name Date Type: Press this soft key (submenu key) to sort files and folders by the file name, by the type of file, or by the date that the file or folder was saved.

Sort Order
Asc Desc: Displays the folder or file in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select the type of file to be viewed. The file type can be changed with the **Up/Down** arrow keys, the rotary knob, or the touch screen. Press **Enter** to make the selection. Refer to Section 5-2 “File Types” for file type descriptions.

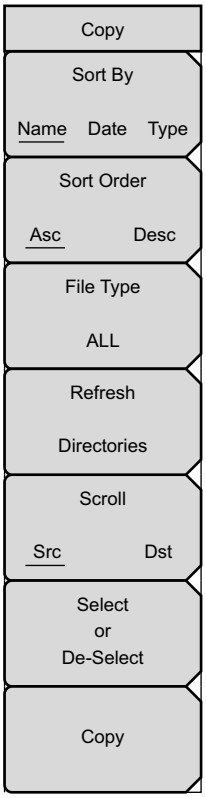
Refresh Directories: Press this key to update the display.

Figure 5-14. Recall Menu

Copy Menu

This menu and dialog box are used to copy folders and files. Select folders or files with the **Up/Down** arrow keys or the rotary knob. Highlight a folder and press **Enter** to view the contents. You can all use the **Arrow** keys. **Right Arrow** opens a folder to view files or subfolders. **Left Arrow** closes a folder (if it has files or subfolders).

Key Sequence: **File** > Copy



Sort By
Name Type Date: Press this soft key (submenu key) to sort file and folder lists by name, by type of file, or by the date that a file was saved.

Sort Order
Asc Desc: Press this submenu key to display the folders or files in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select the type of files to view for copying. The file type can be changed with the **Up/Down** arrow keys, the rotary knob, or the touch screen. Press **Enter** to make the selection. Refer to Section 5-2 “File Types” for file type descriptions.

Refresh Directories: Press this submenu key to update the display.

Scroll
Src Dst: Press this submenu key to use the scroll function in the Source Folder (Src or top panel) or in the Destination Folder (Dst or bottom panel). Refer to Figure 5-3.

Select or De-Select: Press this submenu key to select or deselect the files or folders to be copied. When selected, a file or folder is outlined in blue. Refer to Figure 5-3.

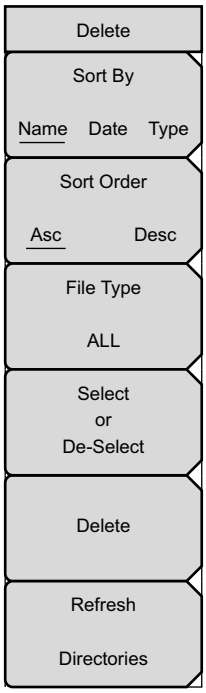
Copy: Press this submenu key to copy the files or folders that are selected in the top window to the destination that is selected in the bottom window. A dialog box indicates when the copying is complete. If a file with the same name exists in the destination folder, then a warning box is displayed to allow file overwrite or cancel.

Figure 5-15. Copy Menu

Delete Menu

This menu and dialog box are used to delete folders and files. Select folders or files with the **Up/Down** arrow keys or the rotary knob. The Delete dialog box is shown in Figure 5-4 on page 5-6.

Key Sequence: **File** > Delete



Sort By
Name Date Type: Press this soft key (submenu key) to sort files and folders by name, by the type of file, or by the date that the file or folder was saved or created.

Sort Order
Asc Desc: Press this submenu key to display the folders or files in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select the type of file to be deleted. The file type can be changed with the **Up/Down** arrow keys or the rotary knob. Press **Enter** to make the selection. Refer to Section 5-2 “File Types” for file type descriptions.

Select or De-Select: Press this submenu key to select or deselect the files or folders to be deleted. When selected, a file or folder is outlined in blue.

Delete: Press this submenu key to open the Delete dialog box. Press **Enter** to delete the selected item, or press **Esc** to Cancel.

Refresh Directories: Press this submenu key to update the display.

Figure 5-16. Delete Menu

Chapter 6 — System Operations

6-1 Introduction

This chapter describes the VNA Master system operations.

The other menus (Sweep, Measure, Trace, and Limit) are described in the Measurement Guides that are listed in Appendix A.

6-2 System Menu Group Overview

To access the functions under the System menu, press the **Shift** key, then the **System** (**8**) key. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages).

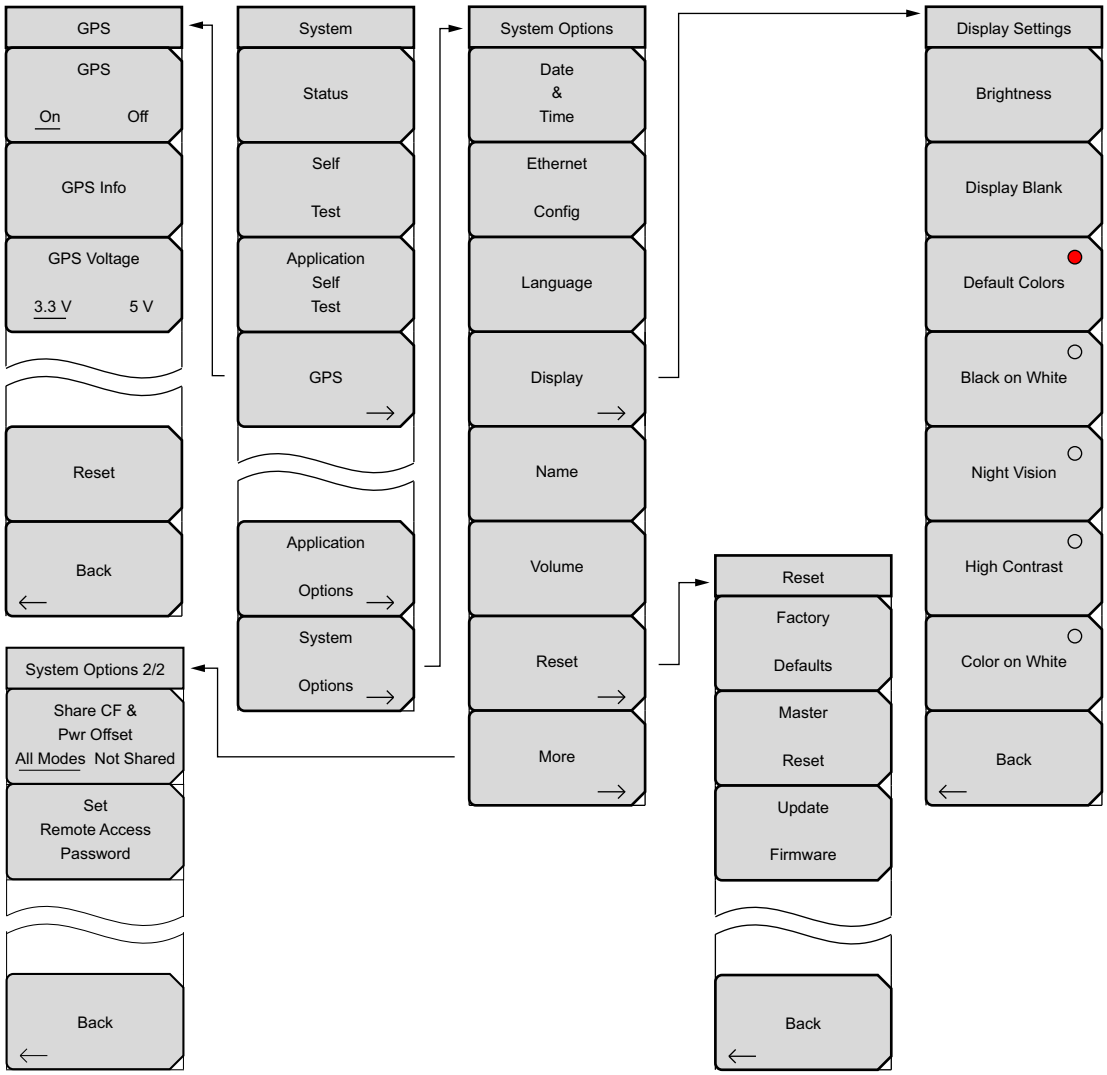


Figure 6-1. System Menu Map

Application Options are specific to each operating mode, such as VNA or SPA (refer to "Application Options Menu (VNA Mode)" on page 6-7 and "Application Options Menu (SPA Mode)" on page 6-9). Consult the measurement guides for other Application Options.

6-3 Additional Menu Group

Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages).

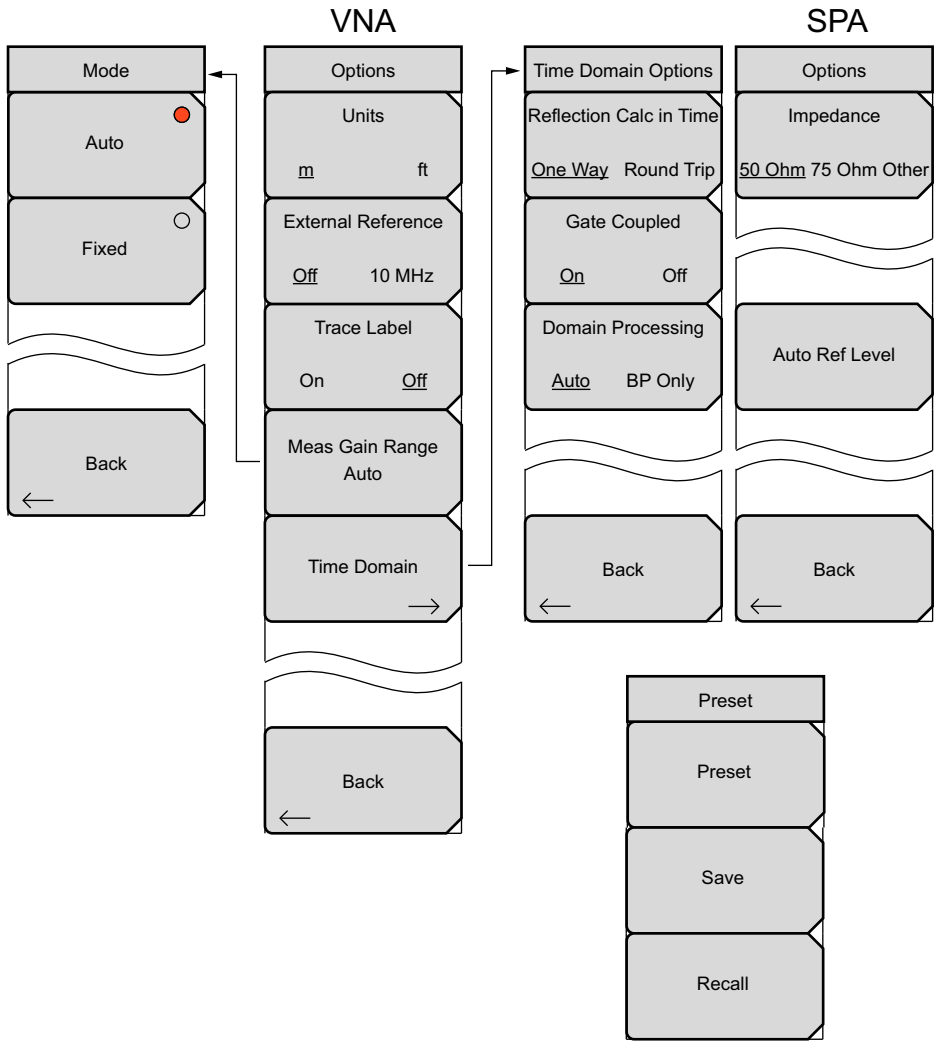
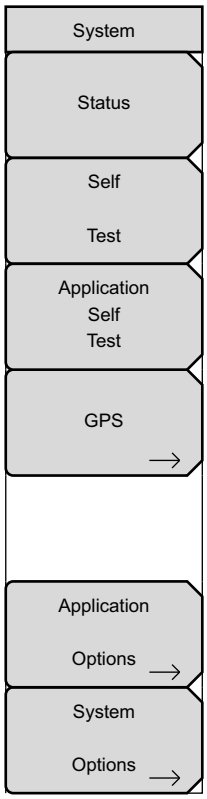


Figure 6-2. Additional Menu Map

6-4 System Menu

Key Sequence: **Shift**, **System** (**8**)



Status: Press this submenu key to display the current system status, including the operating system and firmware versions, temperatures, and other details such as current battery information. Press **Esc** or **Enter** to return to normal operation.

Self Test: **P**ress this submenu key to run a series of tests that are related to the performance of the motherboard hardware. Press the **Esc** key to abort at any time. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification.

If the Self Test fails when the battery is fully charged and the instrument is within the specified operating temperature, then contact your Anritsu Service Center and report the test results. Press **Esc** or **Enter** to return to normal operation.

Application Self Test: Press this submenu key to run a series of tests that are related to the performance of the instrument hardware and that are specific to the current instrument application. Because high power levels are present at the ports during this self test, diconnect any sensitive devices before proceeding. Press the **Esc** key to abort, or press the **Enter** key to continue. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification. If any test fails, then contact your Anritsu Service Center and report the test results.

GPS: Press this submenu key to open the GSP Menu. Refer to Chapter 7, “GPS Receiver, Option 31” for additional information.

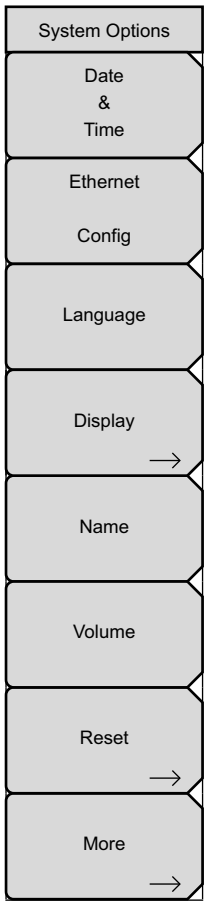
Application Options: Submenu keys are specific to each measurement mode: “Application Options Menu (VNA Mode)” on page 6-7, “Application Options Menu (SPA Mode)” on page 6-9.

System Options: Press this submenu key to open the “System Options Menu” on page 6-5.

Figure 6-3. System Menu

System Options Menu

Key Sequence: **Shift**, **System** (**8**) > System Options



Date & Time: Press this submenu key to display a dialog box for setting the current date and time. Use the submenu keys or the **Left/Right** arrow keys to select the field to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to select the date and time. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Ethernet Config: Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box to set the IP address of the instrument. For details, refer to section "Ethernet Configuration" on page G-1 in Appendix G, "More About DHCP".

Language: Press this submenu key to open a list box and select a built-in language for the VNA Master displays. The languages that are currently available are: English, French, German, Spanish, Japanese, Chinese, Korean, Italian, and Russian. In addition, a custom language may be selected if it has been defined by using Master Software Tools and loaded into the VNA Master. The custom language may be loaded into the instrument via Master Software Tools. If a mode does not have language translations available, then English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changes.

In addition, any existing language (except English) may be edited for a better local translation.

Caution: A Factory Default reset (**Esc** + **On**) or Master reset (**8** + **On**) will overwrite any custom settings within the VNA Master and will require that you reload a custom language file via Master Software Tools.

Display: The Display submenu key opens the "Display Settings Menu" on page 6-10 allowing brightness control and the selection of the default color display, black & white display, night vision display, or a high contrast display.

Name: Press this submenu key to open a dialog box to name the instrument. The VNA Master can be named by using the text entry controls as described in section "Text Entry" on page 2-15. Press **Enter** to save the name.

Volume: Press this submenu key to set the speaker volume. The current volume setting is displayed on the screen. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to change the volume, and press the **Enter** key to accept the change.

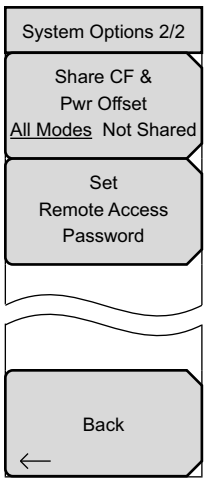
Reset: Press this submenu key to open the "Reset Menu" on page 6-11.

More: Press this submenu key to open the "System Options 2/2 Menu" on page 6-6.

Figure 6-4. System Options Menu

System Options 2/2 Menu

Key Sequence: **Shift**, **System** (**8**) > System Options > More



Share CF & Pwr Offset
All Modes Not Shared: Press this submenu key to toggle the setting to All Modes or to Not Shared. Select All Modes to have the current center frequency setting and power offset setting carried over when changing measurement modes. This function is not applicable to measurements that do not have a center frequency or power offset setting or to measurements in which the current center frequency or power offset setting is outside the range of the new measurement.

Note: This key is used only for spectrum analysis.

Set Remote Access Password: Press this submenu key to open the Password text box (Figure 6-6) and Text Entry menu. Type in the desired password. Upper case and lower case letters and the symbols - _ + . are the allowed password characters. Press **Enter** to save or **Esc** to cancel.

Back: Press this submenu key to return to the "System Options Menu" on page 6-5.

Figure 6-5. System Options Menu 2/2)

Remote Access Password

Warning	Do not use SCPI commands with this feature.

This function is valid only with Master Software Tools (MST) v2.21.1 or later. After setting the password, reboot the instrument (normal power **OFF** then **ON**) to provide remote access security. Only one user then has access at any one time.

The password is first set into the instrument, then used in MST. When prompted in MST, enter the password into the password text box. The password text box shown in Figure 6-6 may differ from the text box that is displayed on your instrument.

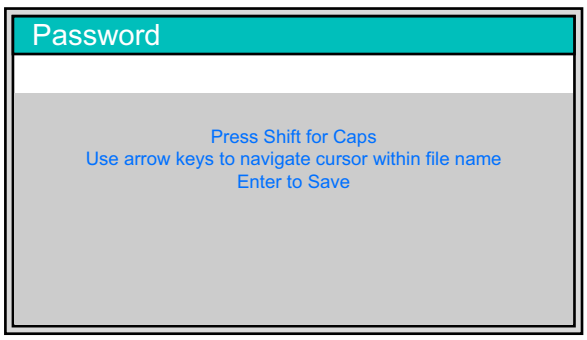


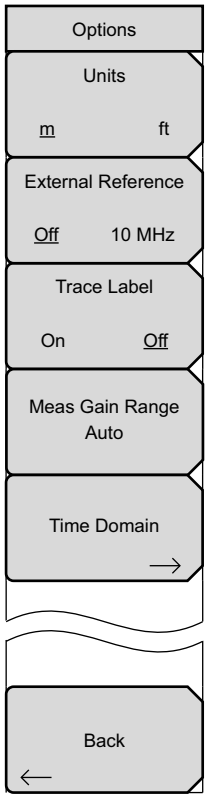
Figure 6-6. Remote Access Password Text Box

The password can be removed or reset by a Master Reset, by a Factory Default reset, or by a firmware update (which includes a restart).

6-5 Application Options Menu (VNA Mode)

This menu is specific to the VNA application.

Key Sequence: **Shift**, **System** (**8**) > Application Options



Standard VNA menus selected.

Units
m ft: Press this soft key (submenu key) to toggle the units setting to metric (meters, or m) or to U.S. (feet, or ft). Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing the setting.

External Reference: Press this soft key to toggle between the two choices of turning Off the external reference or selecting the external reference.

Trace Label
On Off: Press this soft key (submenu key) to toggle the trace labels On or Off.

Meas Gain Range: Press this soft key to open the "Meas Gain Range Menu (VNA Mode)" on page 6-9. Then select Auto or Fixed.

Time Domain
On Off: Press this submenu key to open the "Time Domain Options Menu (VNA Mode)" on page 6-8.

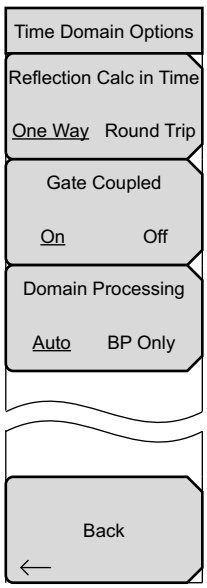
Back: Press this soft key to return to the "System Menu" on page 6-4.

Figure 6-7. Application Options Menu (VNA Mode)

6-6 Time Domain Options Menu (VNA Mode)

This menu is available only when Option 2, the Time Domain Option, is installed. More information is available in the Vector Network Analyzer Measurement Guide (listed in Appendix A).

Key Sequence: **Shift**, **System** (**8**) > Application Options > Time Domain



VNA mode selected

Reflection Calc in Time
One Way Round Trip: Press this soft key (submenu key) to toggle the setting for the calculation method that is used in the time domain (not distance) reflection measurements. The method can be either One Way (divide the total time by 2) or Round Trip.

Gate Coupled
On Off: Press this soft key (submenu key) to toggle the gate coupling On or Off. When set to On, the gate settings (start, stop, and so forth) for all traces are the same. When set to Off, each trace has a gate whose settings are independent of any of the other gates that are being used.

Domain Processing
Auto BP Only: Press this soft key to toggle domain processing to Auto or to BP Only. In Auto, the instrument selects Low Pass processing whenever possible and switches to Band Pass if not possible. In BP Only, the setting will never be Low Pass.

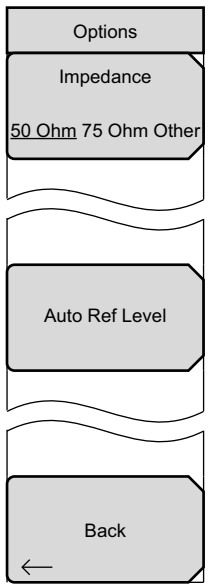
Back: Press this soft key to return to the "Application Options Menu (VNA Mode)" on page 6-7.

Figure 6-8. Application Options Menu (VNA Mode)

6-7 Application Options Menu (SPA Mode)

This menu is specific to the Spectrum Analyzer application.

Key Sequence: **Shift**, **System** (**8**) > Application Options



SPA mode selected

Impedance
50 Ohm 75 Ohm Other: Press this soft key (submenu key) to toggle the impedance setting to 50 ohm, 75 ohm, or Other impedance value. Selecting 75 ohm selects the 7.5 dB loss of the Anritsu 12N50-75B adapter. For other adapters, select Other and enter the appropriate loss value.

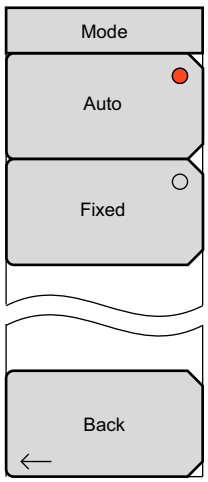
Auto Ref Level: Press this soft key (submenu key) to adjust the position of a signal on the display screen so that it is approximately two divisions down from the top, if possible. When the key is pressed, the reference level is adjusted once. Auto Ref Level has no effect on the settings for the preamplifier or the vertical scaling.

Back: Press this soft key to return to the "System Menu" on page 6-4.

Figure 6-9. Application Options Menu (SPA Mode)

6-8 Meas Gain Range Menu (VNA Mode)

Key Sequence: **Shift**, **System** (**8**) > Application Options > Meas Gain Range



Auto: Press this soft key to set the Measurement Gain Range Mode to Auto. In this mode, the instrument adjusts the gain automatically to provide the best overall system performance (dynamic range and high level noise).

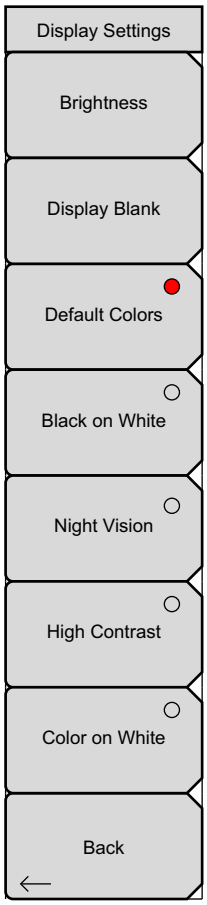
Fixed: Press this soft key to set the Measurement Gain Range Mode to Fixed. In this mode, the gain of the instrument is always set to the low gain setting. For most applications, Auto mode is recommended. For certain types of filter measurements (mostly in the range less than 500 MHz), the instrument may toggle between low gain and high gain modes as the signal level rises from the noise to the pass band of the filter, resulting in extra ripple. Setting the Gain Range to Fixed may address that problem.

Back: Press this soft key to return to the "Application Options Menu (VNA Mode)".

Figure 6-10. VNA Mode (Measurement Gain Range) Menu

6-9 Display Settings Menu

Key Sequence: **Shift**, **System** (**8**) > System Options > Display



Brightness: Press this soft key to adjust the brightness of the display to optimize viewing under a wide variety of lighting conditions. Use the **Up/Down** arrow keys (increments of **25**), the rotary knob (increments of **5**), or the **Left/Right** arrow keys (**0** or **100**) to select a brightness level. Press **Enter** to accept the change.

Display Blank: Press this soft key to open a note box. Then press **Enter** to turn Off the display, or press **Esc** to abort. When the display is Off, turn On the display by three rapid key presses of any key except the power key, or by turning instrument power Off and On.

Default Colors: Press this soft key to set the display colors to their factory default condition. Use for normal viewing.

Black on White: Press this soft key to set the display colors to black and white. Use for printing and viewing in broad daylight conditions.

Night Vision: Press this soft key to set the display to a red-tinted color, which is optimized for night-time viewing.

High Contrast: Press this soft key to increase the contrast of the default display colors. Used for other challenging viewing conditions.

Color on White: Press this soft key to invert the black and white colors to produce a white background and black reticle lines with colored traces. Use for viewing in broad daylight conditions and for color printing.

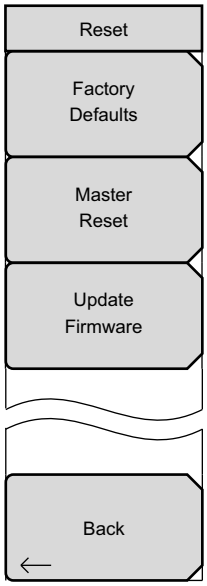
Back: Press this soft key to return to the "System Options Menu" on page 6-5.

Figure 6-11. Display Settings Menu

6-10 Reset Menu

Key Sequence: **Shift**, **System** (**8**) > System Options > Reset

Caution	Factory Default resets erase Ethernet settings, Language, Volume, and Brightness. Master Resets erase all system parameters, all user saved setups and measurement traces, plus delete all user files in the internal memory. The instrument power cycles after of either of these resets.



Factory Defaults: Press this soft key to restore the instrument to the factory default values, including language, volume, brightness setting, and user created shortcut icons on the Menu screen. Press the **Enter** key to initiate the reset, and power cycle the instrument.

Master Reset: In addition to the functions described in Factory Defaults above, all user files in the internal memory are deleted, and the original language and antenna files are restored. Press the **Enter** key to initiate the Master Reset and power-cycle the instrument. Press **Esc** to return to normal operation without resetting.

Update Firmware: This soft key is used for updating the instruments's firmware. Refer to "Updating the VNA Master Firmware" on page 6-14 for additional information on firmware update.

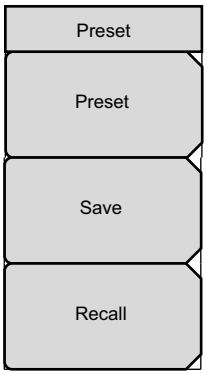
Back: Press this soft key to return to the "System Options Menu" on page 6-5.

Figure 6-12. Reset Menu

Note	Reset to factory defaults with either Factory Reset (**ESC**+**ON**), or Master Reset (**System**+**ON**). The **System** button is also referred to as **System** (**8**).

6-11 Preset Menu

Key Sequence: **Shift, Preset** (**1**)



Preset: Press this soft key to reset the instrument to the default starting conditions.

Save Setup: Press this soft key to open the Save dialog box (Figure 5-1) to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved.

The saved setup can be named using the touch screen keyboard. Use the Caps key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Note: Set the File type as Setup. Refer to “Save Menu” on page 5-9 for details.

Recall Setup: Press this soft key to select and recall a previously stored instrument setup using the “Recall Menu” on page 5-13. Use the rotary knob, the **Up/Down** arrow keys, or the touchscreen to highlight the saved setup, and press **Enter**. All current instrument settings are replaced by the stored setup information.

Figure 6-13. Preset Menu

6-12 Power On Self Test

At power On, the VNA Master runs through a series of quick checks to ensure that the system is functioning properly.

From the "System Menu", the System Self Test ("Self Test" on page 6-4) runs a series of tests that are related to the instrument itself. The Application Self Test ("Application Self Test" on page 6-4) runs a series of tests that are related to the current operating mode of the instrument.

If the VNA Master is within the specified operating range with a charged battery, and if the self test fails, then contact your Anritsu Service Center (http://www.anritsu.com/Contact.asp).

To start a self test when the system is already powered up:

1. Press the **Shift** key and then the **System** (**8**) key.
2. Press the Self Test soft key (submenu key). The Self Test results are displayed.
3. Press **Esc** to continue.

6-13 Updating the VNA Master Firmware

The VNA Master is updated using a USB memory stick. Updated product information can be found on the Anritsu web site:

http://www.anritsu.com

1. Search for the product model number. The firmware updates are on the product page under the Library tab in the "Drivers, Software Downloads" section. Follow the instructions on the Download Page and during the installation process.
2. After the firmware is loaded, insert the USB memory device into the USB port of the instrument.
3. Press the following key sequence: **Shift** > **System** (**8**) > System Options > Reset > Update Firmware. The Load Firmware main menu key (hard key) is displayed.
4. Press the **Load Firmware** main menu key (hard key) to display the Firmware Update menu and Update Application Firmware soft key.
5. Press the Update Application Firmware soft key, and the Firmware Update dialog opens.
6. Highlight each of the save choices: Save None, Save User Data, and Save & Restore User Data. Read through each choice carefully and then select the desired save mode.
   - **Save None:** No attempt is made to save any user data.
   - **Save User Data:** User data is saved to the selected external media device.

Warning	If not enough memory space is available for all user data, then some data may be lost during this process.

   - **Save & Restore:** User data is saved to the selected external media device. The instrument also attempts to restore the files to the instrument after the update.

Warning	If not enough memory space is available for all user data, then some data may be lost during this process.

7. Press **Enter** to begin the firmware update process. To abort the process, press **Esc**, then choose another analyzer mode or power down.
8. The Firmware Update dialog will query you to confirm the process by pressing **Enter** to continue or by pressing **Esc** to abort.
9. Press **Enter**, and the firmware update process begins, and the Firmware Update dialog displays the following message:

   Updating firmware. Please Wait.
10. When complete, the instrument restarts.

Chapter 7 — GPS Receiver, Option 31

7-1 Introduction

The VNA Master is available with a built-in GPS receiver feature (Option 31) that can provide latitude, longitude, altitude, and UTC timing information. A GPS antenna is not included with Option 31. The antenna must be ordered separately.

In order to acquire data from the GPS satellites, the user must have line-of-sight to the satellites or the antenna must be placed outside without any obstructions. The GPS antenna must be ordered separately. Refer to the Technical Data Sheet for ordering information.

7-2 Activating the GPS Feature

Install the Anritsu GPS antenna onto the GPS Antenna connector on the VNA Master.

Note	The GPS antenna connection on the VNA Master is fitted with an SMA female connector. A DC voltage is present on this connector. Do not connect anything other than the Anritsu GPS antenna to this port.

1. Press the **Shift** key, then the **System** (8) key.
2. Press the GPS soft key.
3. Press the GPS On/Off soft key to toggle the GPS feature On or Off. When GPS is first turned on, a RED GPS icon appears at the top of the display.

Figure 7-1. GPS - Red

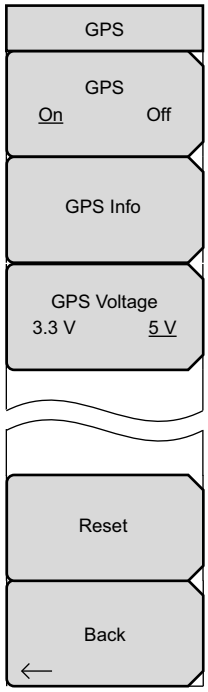
4. When the GPS receiver has tracked at least three satellites, the GPS icon changes to GREEN. Latitude and Longitude information is displayed in the white bar on top of the measurement display screen. Acquiring satellites may take as long as three minutes.

Figure 7-2. GPS - Green

5. Press the GPS Info soft key to view the number of tracked satellites, latitude, longitude, altitude, and UTC timing information, and so forth.
6. Press the Reset soft key to reset the GPS.
7. The GREEN GPS icon with a RED CROSS through it, as shown below, appears when GPS satellite tracking is lost (after actively tracking 3 or more satellites). The GPS longitude and latitude are saved in the instrument memory until the VNA Master is turned off or until GPS is turned off by using the GPS On/Off soft key.

Figure 7-3. GPS - Crossed

7-3 GPS Menu



GPS
On Off: Press this soft key to toggle the GPS feature On and Off.

GPS Info: Press this soft key to open a window with additional GPS information. Press the **Esc** key to close the window.

GPS Voltage
3.3 V 5 V: Press this soft key to toggle the voltage to 3.3 volts or 5 volts. This voltage is supplied by the instrument to the GPS antenna.

Reset: Press this soft key to set the number of tracked satellites to 0 and to erase any almanac data, along with saved coordinates. The process of searching for and reacquiring satellites will begin again.

Back: Press this soft key to return to the.previous menu

Figure 7-4. GPS Menu

7-4 GPS Info Window

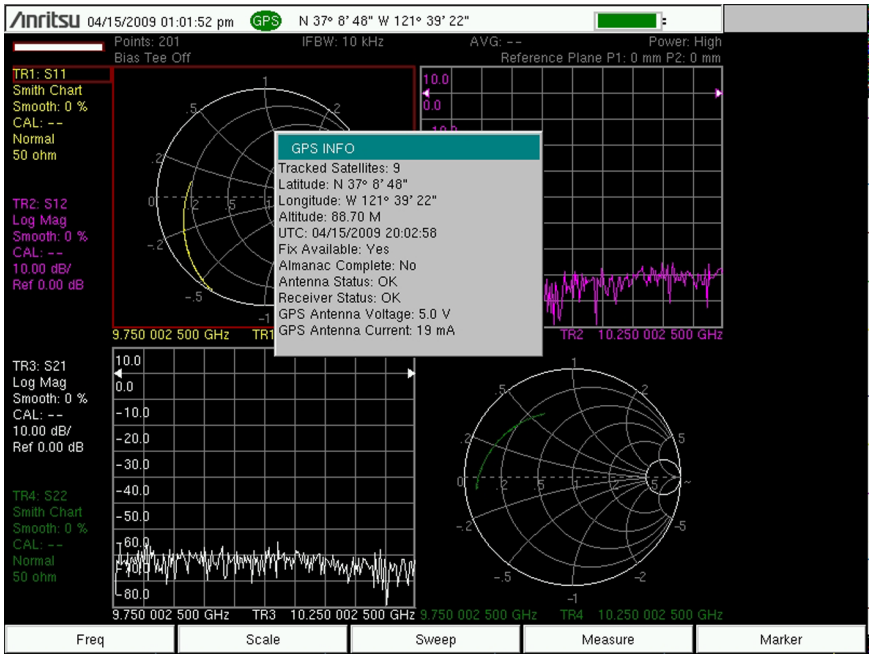


Figure 7-5. GPS Info Window

The GPS Info window provides the following GPS information:

Tracked Satellites

Shows the number of tracked satellites (three are required to retrieve latitude and longitude, four are required to resolve altitude). Generally, the larger the number of satellites tracked, the more accurate the information.

Latitude and Longitude

Shows location in degrees, minutes, and seconds.

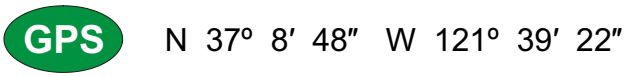


Figure 7-6. GPS Latitude and Longitude

Altitude

Shows altitude information in meters.

UTC

Universal Coordinated Time.

Fix Available

The cold start search sets are established to ensure that at least three satellites are acquired within the first couple minutes of GPS activation. When three satellites are found, the receiver computes an initial fix (typically in less than two minutes). Fix Not Available means that the initial position has not been established.

Almanac Complete

The system Almanac contains information about the satellites in the constellation, ionospheric data, and special system messages. In a cold start, the GPS receiver does not have any navigation data, so the receiver does not have a current almanac. A complete system almanac is not required to achieve a first position fix. The availability of the almanac, however, can significantly reduce the time to first fix.

Antenna Status

OK:

Antenna is connected properly, and antenna is working properly.

Short/Open:

A short or open exists between the antenna and the connection. If this message is displayed, then remove and replace the GPS antenna. If the message persists, then try another Anritsu GPS antenna (part number 2000-1528-R). If the message still persists, then contact your nearest Anritsu Service Center (refer to section "Anritsu Service Centers" on page 1-2).

Receiver Status

OK:

Receiver is working properly.

No GPS Time Yet:

The receiver does not have any input signal, which is usually the case when the antenna status is not OK. Check the antenna connection. If the antenna status is OK and if this message persists, then contact your nearest Anritsu Service Center.

Other Status Messages

If any of the status messages (in the following list) persist, then the GPS receiver may be not working properly. In that case, contact your nearest Anritsu Service Center: http://www.anritsu.com/Contact.asp

- Only 1 Satellite
- Only 2 Satellites
- Only 3 Satellites
- No Usable Satellites
- Satellite unusable
- Need Initialization
- PDOP is Too Hi
- Undecoded Error

GPS Antenna Voltage

Lists the voltage that is being used by the GPS antenna (3.3 V or 5 V).

GPS Antenna Current

Lists the current draw from the GPS antenna when the voltage is applied.

7-5 Saving and Recalling Traces with GPS Information

Saving Traces with GPS Information

The GPS coordinates of a location can be saved along with a measurement trace. Refer to the File menu in Chapter 5 of the VNA Measurement Guide (listed in Appendix A) for Save and Recall menu information.

The current GPS coordinates are saved with the measurement traces whenever GPS is On and actively tracking satellites.

Recalling GPS Information

If the GPS coordinates were saved with a measurement trace, then when the trace is recalled, the coordinates that were saved are recalled as well. Refer to the File menu in Chapter 5 of the VNA Measurement Guide (listed in Appendix A) for more information about recalling a saved trace.

Chapter 8 — Anritsu PC Software Tools

8-1 Introduction

This chapter provides a brief overview of the available PC software tools from Anritsu. For detailed information about specific software, refer to the Anritsu web site or the program's built-in Help. Software is included with the instrument and is also available from the Anritsu web site: http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx.

8-2 Anritsu Tool Box

The Anritsu Tool Box is a central location to open an Anritsu measurement, visit the Anritsu web site, or launch several Anritsu applications. To open the Anritsu Tool Box, either click on the shortcut icon on the desktop or click Start and navigate through the Programs folder to the Anritsu folder and select Anritsu Tool Box.

Once the Tool Box is open, move the mouse pointer over any of the application icons to view a short description of the application. The following pages describe three software programs that can be launched from the Tool Box, Line Sweep Tools, Master Software Tools (MST), and easyMap Tools™.

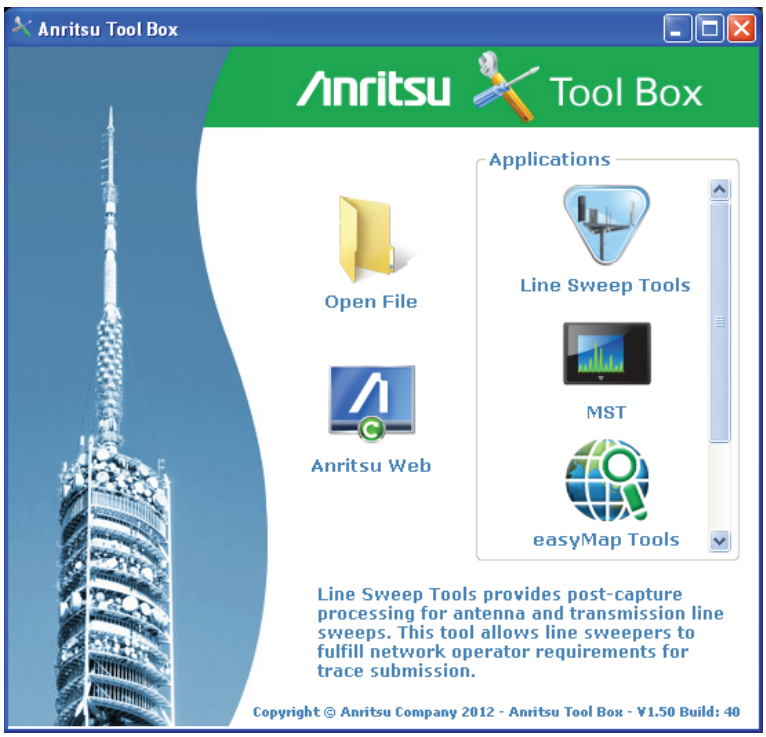


Figure 8-1. Anritsu Tool Box

The Anritsu PC Software tools do not support all of Anritsu's handheld instruments or all of their measurements. Compatibility information is provided in the program's Help.

Note Line Sweep Tools (LST) can be used for downloading and post-processing of certain VNA measurements and cable & antenna analysis sweeps.

Master Software Tools (MST) is primarily used for spectrum analysis measurements.

8-3 Line Sweep Tools

Line Sweep Tools is a program designed to increase productivity for people who work with dozens of Cable traces, Antenna traces, and Passive Intermodulation (PIM) traces every day. Line Sweep Tools will:

- Collect sweeps from Anritsu PIM and Line Sweep gear.
- Help verify that those sweeps are done properly and that the Cable, Antenna and PIM sweeps meet specifications.
- Help create reports of the findings quickly and to a professional standard.

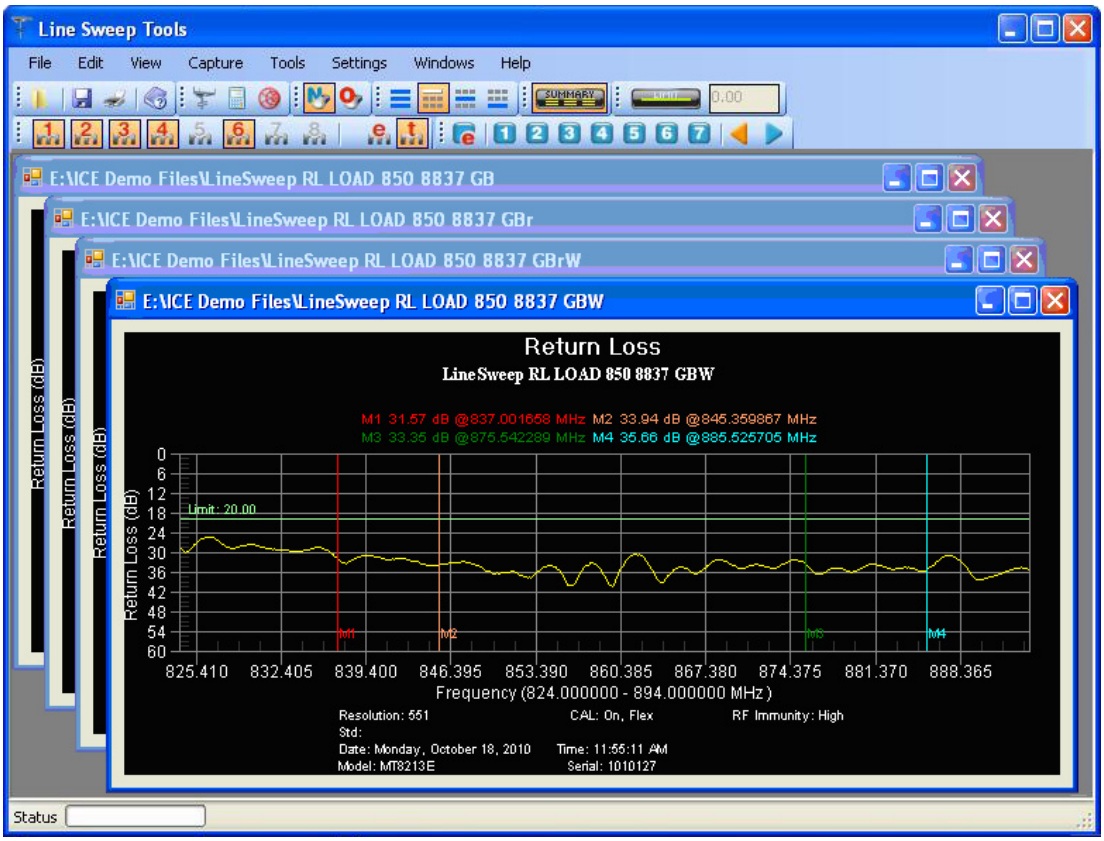


Figure 8-2. Line Sweep Tools

8-4 Master Software Tools

Anritsu Master Software Tools is a PC program for transferring and editing saved measurements, markers, and limit lines to a PC. MST is recommended for Spectrum Analyzer instruments or instruments that perform spectrum analysis measurements.

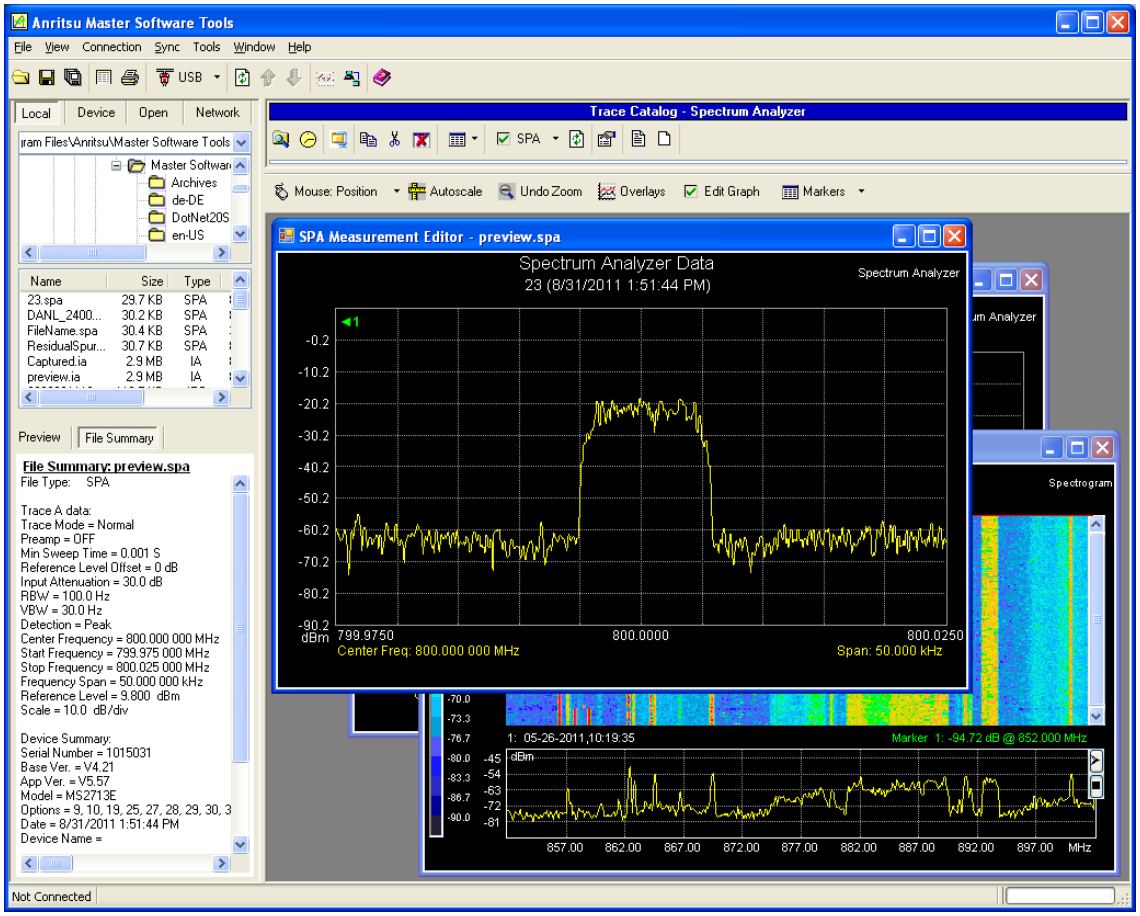


Figure 8-3. Master Software Tools

8-5 easyMap Tools

easyMap Tools creates geo-referenced maps and can also convert floor plans for use by Anritsu mapping spectrum analyzers. It can also create single panel maps (.map) for legacy instruments or pan and zoom maps (.azm) for current instruments. Mapping of both interference and coverage is available while indoors or outdoors.

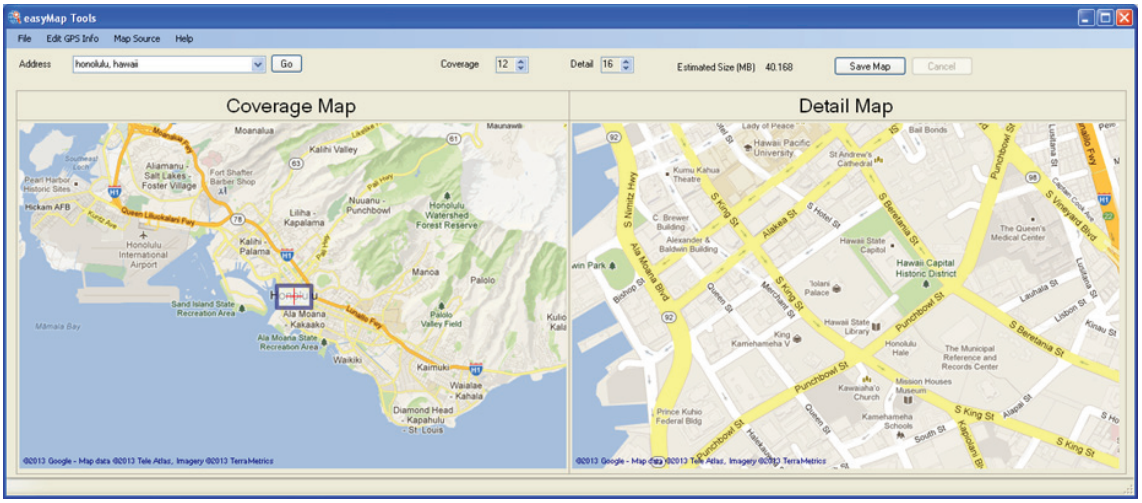


Figure 8-4. Captured Geo-referenced Map Ready for the Analyzer

Appendix A — Supplemental Documentation

A-1 Introduction

This appendix provides a list of supplemental documentation and software associated with this User Guide. The measurement guides are available as PDF files on the document disc that is provided with the instrument. Updated documents are available from the Anritsu Web site. The Web site also has links to download application notes, brochures, and online help.

Table A-1. Measurement Guides

Title	Part Number
Vector Network Analyzer Measurement Guide	10580-00289
Spectrum Analyzer Measurement Guide – Interference Analyzer, Channel Scanner, IF Output, Gated Sweep, CW Generator, AM/FM/PM Analyzer	10580-00244
Power Meter Measurement Guide – Power Meter, High Accuracy Power Meter	10580-00240

Table A-2. VNA Master Related Documents and Software

Title	Part Number
VNA Master MS20xxC Technical Data Sheet	11410-00548
Programming Manual	10580-00306
VNA Master MS20xxC Maintenance Manual	10580-00307

A complete suite of computer software applications are available for download:

http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx

Appendix B — Signal Standards

B-1 Introduction

This appendix provides a sample list of signal standards. This list can be used as a reference when making measurements with the VNA Master.

Table B-1. Signal Standards

Signal Standard	Center (MHz)	Span (MHz)	Valid Channels
AMPS / EIA 553 - Uplink	859	70	1-799, 990-1023
AMPS / EIA 553 - Downlink	859	70	1-799, 990-1023
C-450 (P) - Uplink	463.5	21	1-800
C-450 (P) - Downlink	463.5	21	1-800
C-450 (SA) - Uplink	462.5	15	1-247
C-450 (SA) - Downlink	462.5	15	1-247
CDMA US Cellular - Uplink	859	70	1-799, 990-1023
CDMA US Cellular - Downlink	859	70	1-799, 990-1023
CDMA US PCS - Uplink	1920	140	1-1199
CDMA US PCS - Downlink	1920	140	1-1199
CDMA Korea PCS - Uplink	1810	120	1-599
CDMA Korea PCS - Downlink	1810	120	1-599
CDMA Japan / ARIB - Uplink	878.5	93	1-799, 801-1039, 1041-1199
CDMA Japan / ARIB - Downlink	878.5	93	1-799, 801-1039, 1041-1199
CDMA China - 1 - Uplink	916	88	0-1000, 1329-2047
CDMA China - 1 - Downlink	916	88	0-1000, 1329-2047
CDMA China - 2 - Uplink	910	76	0-1000
CDMA China - 2 - Downlink	910	76	0-1000
cdma2000 Class 0, Korea Cellular - Uplink	859	70	1-799, 990-1023
cdma2000 Class 0, Korea Cellular - Downlink	859	70	1-799, 990-1023
cdma2000 Class 0, N.A. Cellular - Uplink	859	70	1-799, 990-1023
cdma2000 Class 0, N.A. Cellular - Downlink	859	70	1-799, 990-1023
cdma2000 Class 1, N.A. PCS - Uplink	1920	140	0-1199
cdma2000 Class 1, N.A. PCS - Downlink	1920	140	0-1199
cdma2000 Class 2, (TACS Band) - Uplink	916	88	0-1100, 1329-2047
cdma2000 Class 2, (TACS Band) - Downlink	916	88	0-1100, 1329-2047
cdma2000 Class 3, (JTACS Band) - Uplink	878.5	93	1-799, 801-1039, 1041-1199
cdma2000 Class 3, (JTACS Band) - Downlink	878.5	93	1-799, 801-1039, 1041-1199
cdma2000 Class 4, Korea PCS - Uplink	1810	120	0-599
cdma2000 Class 4, Korea PCS - Downlink	1810	120	0-599

Table B-1. Signal Standards

Signal Standard	Center (MHz)	Span (MHz)	Valid Channels
cdma2000 Class 5, (NMT-450-20 kHz) - Uplink	472.5	43	1039-1473, 1792-2016
cdma2000 Class 5, (NMT-450-20 kHz) - Downlink	472.5	43	1039-1473, 1792-2016
cdma2000 Class 5, (NMT-450-25 kHz) - Uplink	439.5	57	1-300, 539-871
cdma2000 Class 5, (NMT-450-25 kHz) - Downlink	439.5	57	1-300, 539-871
cdma2000 Class 6, IMT-2000 - Uplink	2045	250	0-1199
cdma2000 Class 6, IMT-2000 - Downlink	2045	250	0-1199
cdma2000 Class 7, N.A. 700 MHz Cellular - Uplink	770	48	0-359
cdma2000 Class 7, N.A. 700 MHz Cellular - Downlink	770	48	0-359
ETACS - Uplink	916	88	0-1000, 1329-2047
ETACS - Downlink	916	88	0-1000, 1329-2047
GSM 900 - Uplink	897.4	40	1-124, 975-1023
GSM 900 - Downlink	942.4	40	1-124, 975-1023
GSM 1800 - Uplink	1747.4	80	512-885
GSM 1800 - Downlink	1842.4	80	512-885
GSM 1900 - Uplink	1879.8	80	512-810
GSM 1900 - Downlink	1959.8	80	512-810
JTACS - Uplink	878.5	93	0-1198 (even numbers only)
JTACS - Downlink	878.5	93	0-1198 (even numbers only)
MATS-E - Uplink	925	70	1-1000
MATS-E - Downlink	925	70	1-1000
N-AMPS / IS-88L - Uplink	859	70	1-799, 990-1023
N-AMPS / IS-88L - Downlink	859	70	1-799, 990-1023
N-AMPS / IS-88M - Uplink	859	70	1-799, 990-1023
N-AMPS / IS-88M - Downlink	859	70	1-799, 990-1023
N-AMPS / IS-88U - Uplink	897.5	147	1-799, 990-1023
N-AMPS / IS-88U - Downlink	897.5	147	1-799, 990-1023
NADC IS136 Cellular - Uplink	859	70	1-799, 990-1023
NADC IS136 Cellular - Downlink	859	70	1-799, 990-1023
NADC IS136 PCS - Uplink	1920	140	1-1199
NADC IS136 PCS - Downlink	1920	140	1-1199
NMT-411-25 kHz - Uplink	420.5	19	539-871
NMT-411-25 kHz - Downlink	420.5	19	539-871
NMT-450-20 kHz - Uplink	460.5	19	1039-1473
NMT-450-20 kHz - Downlink	460.5	19	1039-1473

Table B-1. Signal Standards

Signal Standard	Center (MHz)	Span (MHz)	Valid Channels
NMT-450-25 kHz - Uplink	459	18	1-300
NMT-450-25 kHz - Downlink	459	18	1-300
NMT-470-20 kHz - Uplink	486.5	15	1972-2016
NMT-470-20 kHz - Downlink	486.5	15	1972-2016
NMT-900 - Uplink	925	70	1-1000
NMT-900 - Downlink	925	70	1-1000
NMT-900 (Offset) - Uplink	925	70	1025-2023
NMT-900 (Offset) - Downlink	925	70	1025-2023
NTACS - Uplink	878.5	93	1-1199
NTACS - Downlink	878.5	93	1-1199
PDC 800 Analog - Uplink	891.5	97	0-1680
PDC 800 Analog - Downlink	891.5	97	0-1680
PDC 1500 (JDC) - Uplink	1513	72	0-960
PDC 1500 (JDC) - Downlink	1513	72	0-960
PHS - Uplink	1906.5	23	1-77
PHS - Downlink	1906.5	23	1-77
SMR 800 - 12.5 kHz - Uplink	836	60	1-1199
SMR 800 - 12.5 kHz - Downlink	836	60	1-1199
SMR 800 - 25 kHz - Uplink	836	60	1-600
SMR 800 - 25 kHz - Downlink	836	60	1-600
SMR 1500 - Uplink	1483	60	1-479
SMR 1500 - Downlink	1483	60	1-479
TACS - Uplink	925	70	1-1000
TACS - Downlink	925	70	1-1000
UMTS/WCDMA - Uplink	1920	70	9600-9900
UMTS/WCDMA - Downlink	2110	70	10550-10850
UMTS/Region 2 - Uplink	1850	70	9250-9550
UMTS/Region 2 - Downlink	1930	70	9650-9950
802.11a	5170	84	34-161 (not all valid)
802.11b	2442	84	1-14
802.11 DS	2448	72	1-14
802.11 FH	2448.5	93	2-95
802.11g	2442	84	1-14

Appendix C — Error Messages

C-1 Introduction

This appendix provides a list of information and error messages that could be displayed on the VNA Master. If any error condition persists, then contact your local Anritsu Service Center.

C-2 Reset Options

You can reset your VNA Master to Factory Defaults or use a Master Reset to return to the FULL Factory Default condition from the menu system or from the Off condition.

Reset Via Instrument Menus

From the VNA Master menu system, press the **Shift** key, then the **System** (8) key to open the System menu. Then press the System Options soft key to open the System Options menu. Then press the Reset soft key to open the Reset menu (refer to the Reset menu in Chapter 5 of the VNA Measurement Guide (listed in Appendix A). From the Reset menu, press either the Factory Defaults soft key or the Master Reset soft key.

Reset from OFF Condition

You can also reset the VNA Master by turning it Off and then restarting under one of the following conditions:

Factory Defaults Reset:

Hold the **Esc** button while pressing the **On/Off** button. Continue holding the **Esc** button until the Anritsu splash screen appears. You can then release the button. The VNA Master starts up with Factory Default settings (refer to section "Reset Menu" on page 6-11). Throughout this appendix, this sequence is abbreviated as Factory Defaults (**Esc**+**On**).

Master Reset:

Hold the **8** key in the number keypad (also referred to as the **System** (8) key) while pressing the **On/Off** button. Continue holding the **8** key until the Anritsu splash screen appears. You can then release the key. The VNA Master starts up in FULL Factory Default condition (refer to section "Reset Menu" on page 6-11). Throughout this appendix, this sequence is abbreviated as Master Reset (**System**+**On**).

C-3 Self Test or Application Self Test Error Messages

Self Test

To run self test, press **Shift** and **System** (8) and then Self Test. Refer to the results window in Figure C-1, which summarizes the status of several key functions in the instrument that are common to all applications (note that your instrument display may differ from this image). If any subtest shows FAILED, then check that the battery level is adequate for operation, or check that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults (**Esc**+**On**), or Master Reset (**System**+**On**).

Caution	Use of Master Reset (**System**+**On**), will erase all user saved setups and measurement traces and will return the VNA Master to a full Factory Default condition. If the error persists, then contact your Anritsu Service Center.

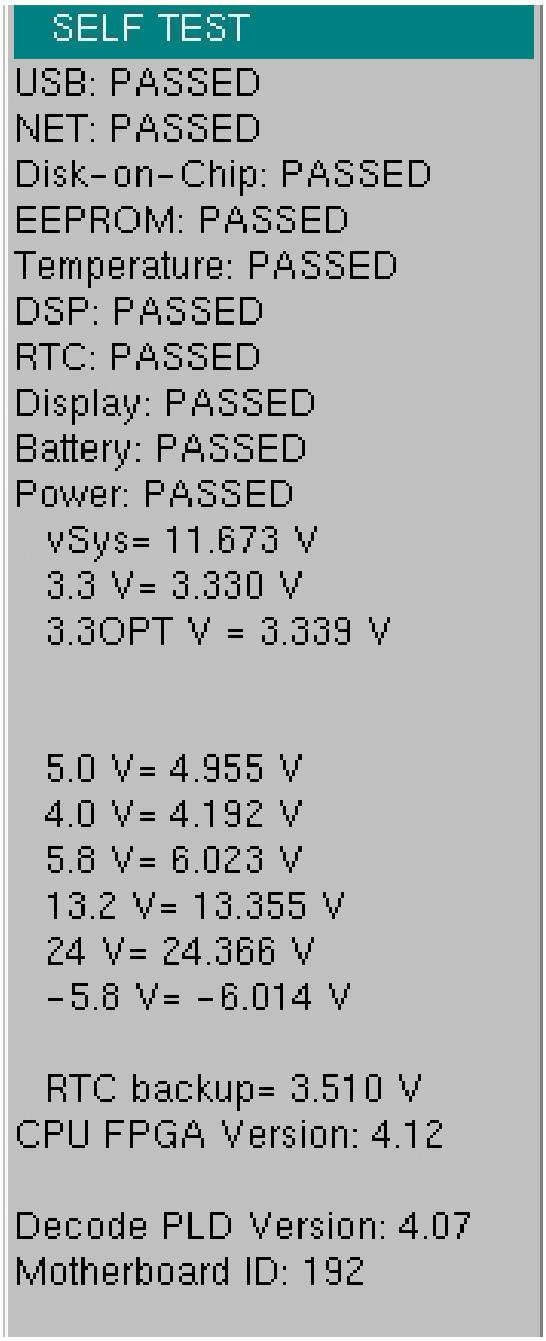


Figure C-1. Self Test Results Window (Vector Network Analyzer mode)

Caution	Depending upon the set mode of instrument operation, you may (or may not) see the full results in the Self Test list.

Application Self Test Results Window — VNA

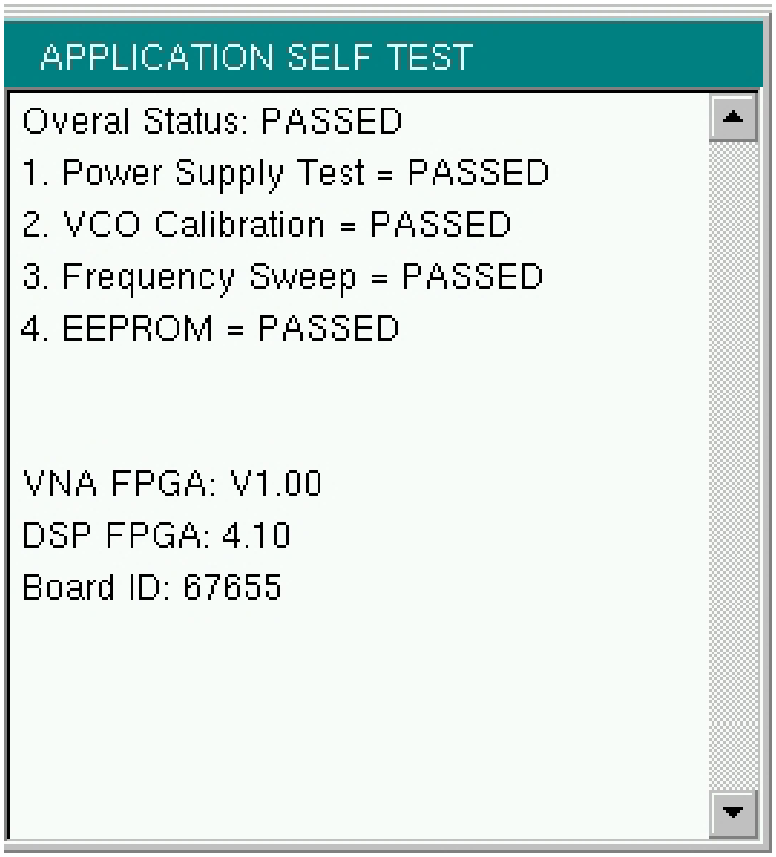


Figure C-2. Application Self Test Results Window (Vector Network Analyzer mode)

Application Self Test (Vector Network Analyzer mode only)

To run the application self test, press **Shift** and **System** (8) and then Application Self Test from within the desired mode. When you are in Vector Network Analyzer mode, you will see the results window that is shown in Figure C-2 (note that your instrument display may differ from this image), which summarizes the status of several key functions that are specific to this application.

If the Overall Status shows Failed, then one or more elements of the Application Self Test have failed. This self test consists of 4 subtests:

Power Supply Test: Lists any power supply voltages that are not meeting tolerance specification

VCO Calibration: Lists any frequency range over which the VCO calibration is failing

Frequency Sweep: Lists any frequency range over which errors in the sweep are occurring

EEPROM: Indicates whether reading or writing (or both) to the EPPROM has failed

If any of the subtests shows FAILED, then check that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults (**Esc**+**On**), or Master Reset (**System**+**On**).

Caution	Use of Master Reset (**System**+**On**), will erase all user saved setups and measurement traces and will return the VNA Master to a full Factory Default condition. If the error persists, then contact your Anritsu Service Center.

Application Self Test Results Window — SPA

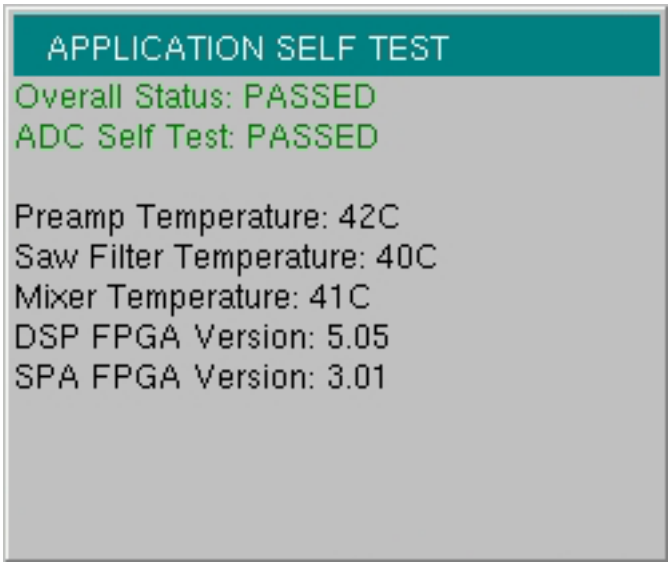


Figure C-3. Application Self Test Results Window (Spectrum Analyzer mode)

C-4 Operation Error Messages

Fan Failure

The system has determined that the fan should be running due to the internal temperature of the unit, but cannot detect that the fan is actually running.

It is important to keep the fan inlet and exhaust ports clear of obstructions. The cooling fan will vary the speed in relation to the internal temperature of the instrument (refer to Figure C-4). The fan will turn on at low speed when the internal temperature of the instrument reaches 44°C, and will increase the fan speed to maximum at 54°C. As the internal temperature of the instrument decreases, the fan will reduce speed until the temperature reaches 39°C, at which point the fan will turn off.

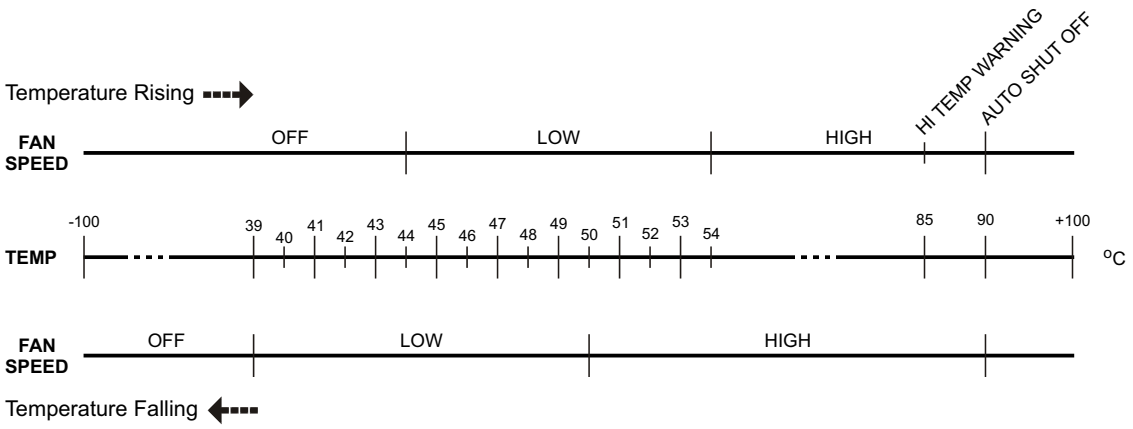


Figure C-4. Fan Speed vs. Temperature

High Temp Warning

The internal temperature has reached an excessive level, 85°C. Verify that the ventilation openings are unobstructed and that the fan is running. Internal temperatures may be manually verified by using the SELF TEST function. Turn off the unit and allow the temperature to cool down. If the fault is not resolved and the internal temperature reaches 90°C, then a countdown of 10 seconds will begin. The countdown gives the user a chance to save the current setup before the instrument turns itself off (before internal temperatures can cause any damage). If the error persists after removing any obstructions and allowing the unit to cool, then reset to the factory defaults with Factory Defaults (**Esc**+**On**), or Master Reset (**System**+**On**).

Caution	Use of Master Reset (**System**+**On**), will erase all user saved setups and measurement traces and will return the VNA Master to a full Factory Default condition. If the error persists, then contact your Anritsu Service Center.

Operation not Permitted in Recall Mode

Attempted to perform an operation on a recalled trace. Many operations are valid only on a live or active trace.

PMON PLD Fail

Unable to communicate with the Power Monitor PCBA.

Power Supply

Power Supply failed. Charge the battery.

Error Saving File. General Error Saving File

An error was detected while saving a file. Try again.

C-5 Vector Network Analyzer Specific Warning Messages

Bias Tee cannot be enabled for start freq < 2MHz.

Adjust frequency before turning On the Bias Tee.

The start frequency cannot be set less than 2 MHz when the internal or external Bias Tee is turned On. Set the frequency to a value larger than or equal to 2 MHz, and then turn on the Bias Tee.

Bias Tee is not allowed for start freq < 2MHz.

Turn Off Bias Tee before changing the freq.

The internal or external Bias Tee cannot be turned on when the start frequency is set to less than 2 MHz. Turn off the Bias Tee, and then adjust the start frequency to the desired value less than 2 MHz.

Changing Source Power

Changing Source Power will affect the accuracy of the current calibration.

While Cal Correction is turned On, changing the source power level will affect the accuracy of the current calibration. The correction will remain On and can be used, but an indicator (?P) will appear next to the left-hand status column (CAL: ON) to note that the current power setting is different from the one used during the calibration processes.

No valid calibration to change correction.

There is no valid calibration in volatile memory that can be used to turn Cal Correction On. A new calibration must be performed.

Cannot continue with calculating.

Cannot continue with calculating. Not all required cal steps are completed.

When performing a calibration, you must complete all of the required steps before applying the “Calculate and Finish Cal” step.

Bias Tee state cannot be changed during calibration.

While performing a calibration, and before completing all of the calibration steps, you cannot turn on the Bias Tee. You must wait till after all of the calibration steps are complete before turning on the Bias Tee. This precaution is enforced to protect the calibration components from getting damaged by the Bias Tee current.

Turning Bias Tee to OFF.

Bias Tee was turned on when a new calibration sequence was started. The Bias Tee was turned off to protect the calibration components. After all the calibration steps are completed, you can turn the Bias Tee back on as required.

Turning Bias Tee to OFF.

Turning Bias Tee to OFF. Recalling measurement does not match with current setup.

The recalled measurement file does not match the current setup. To ensure DUT safety, the Bias Tee function is turned off.

Turning Bias Tee to OFF.

Turning Bias Tee to OFF. Recalling setup does not match with current setup.

The recalled setup file does not match the current setup. To ensure DUT safety, the Bias Tee function is turned off.

Calibration will be lost after change.

Calibration will be lost after change. Press the button again to continue.

While performing a calibration, and before completing all the calibration steps, if you change any of the frequency parameters (start, stop, center, span) or the number of points, then the calibration must be invalidated.

Changes not allowed during calibration.

Changes not allowed during calibration. Press Esc to abort calibration.

Certain parameters (such as frequency and number of points) are able to be changed while the calibration process is underway. Changing these parameters is not allowed unless the calibration is aborted first.

Option 10 (Bias Tee) not enabled.

To turn on the internal or external Bias Tee, Option 10 must be enabled in the instrument. Contact your Anritsu Service Center to inquire about enabling this option.

No External Reference signal detected.

External Reference was switched to 10 MHz but no external 10 MHz signal was detected. The External Reference setting is turned back to Off. Check the external reference level and frequency, and then try again.

Limit is not available for this Graph type.

Limits are supported only for rectilinear graph types (not for Smith Charts, for example).

Appendix D — Tower Mounted Amplifiers

D-1 Introduction

A Tower Mounted Amplifier (TMA) can be used to amplify the received signal. There are different types of TMA depending on the system requirements. Three commonly used types are:

- TMA-D - A duplex tower mounted amplifier that combines transmit and receive ports from the radio system and connects to a single antenna. This configuration is specific to systems that use a single antenna configuration.
- TMA-S - A receive-only tower mounted amplifier is installed between the receiving antenna and the radio to boost weak signals. This configuration is common on systems that implement separate antennas for transmitting and receiving.
- TMA-DD - A dual-duplex tower mounted amplifier used for radios systems with a single transmission line connection for transmit and receive. These systems are commonly called transceivers.

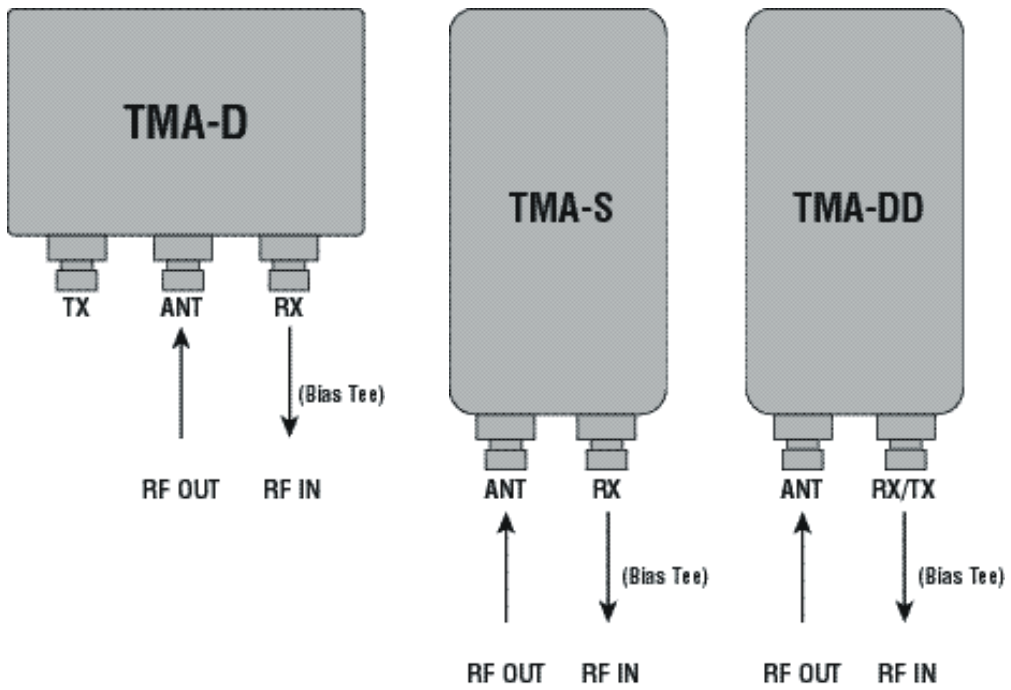


Figure D-1. Tower Mounted Amplifiers

Appendix E — Coaxial Cable Technical Data

E-1 Coaxial Cable Technical Data

The table below provides a list of common coaxial cables.

Table E-1. Coaxial Cable Technical Data (Sheet 1 of 4)

Manufacturer	Cable	Prop. Vel.	Freq 1	Loss 1	Freq 2	Loss 2	Freq 3	Loss 3
Andrew	FSJ1-50A (6 GHz)	0.84	1000	0.196	2500	0.313	6000	0.532
Andrew	FSJ2-50 (6 GHz)	0.83	1000	0.133	2500	0.223	6000	0.374
Andrew	FSJ4-50B (6 GHz)	0.81	1000	0.118	2500	0.201	6000	0.348
Andrew	EFX2-50 (6 GHz)	0.85	1000	0.121	2500	0.202	6000	0.341
Andrew	LDF1-50 (6 GHz)	0.86	6000	0.306	6000	0.306	6000	0.306
Andrew	LDF2-50 (6 GHz)	0.88	6000	0.323	6000	0.323	6000	0.323
Andrew	LDF4-50A (6 GHz)	0.88	1000	0.073	2500	0.121	6000	0.218
Andrew	HJ4-50 (6 GHz)	0.914	1000	0.092	2500	0.156	6000	0.257
Andrew	HJ4.5-50 (6 GHz)	0.92	1000	0.054	2500	0.089	6000	0.148
Andrew	AVA5-50 7/8	0.91	1000	0.038	2000	0.055	2500	0.063
Andrew	AVA7-50 1-5/8	0.92	1000	0.022	2000	0.034	2500	0.038
Andrew	EFX2-50	0.85	1000	0.121	2000	0.177	2500	0.202
Andrew	FLC 12-50J	0.88	1000	0.075	2000	0.11	2500	0.134
Andrew	FLC 38-50J	0.88	1000	0.115	2000	0.169	2500	0.19
Andrew	FLC 78-50J	0.88	1000	0.041	2000	0.061	2500	0.072
Andrew	FLC 114-50J	0.88	1000	0.033	2000	0.05	2500	0.059
Andrew	FLC 158-50J	0.88	1000	0.025	2000	0.038	2500	0.042
Andrew	FSJ1-50A	0.84	1000	0.196	2000	0.285	2500	0.313
Andrew	FSJ2-50	0.83	1000	0.133	2000	0.196	2500	0.223
Andrew	FSJ4-50B	0.81	1000	0.118	2000	0.176	2500	0.201
Andrew	HJ4-50	0.91	1000	0.092	2000	0.137	2500	0.156
Andrew	HJ4.5-50	0.92	1000	0.054	2000	0.079	2500	0.089
Andrew	HJ5-50	0.916	1000	0.042	2000	0.063	2500	0.071
Andrew	HJ7-50A	0.921	1000	0.023	2000	0.034	2500	0.039
Andrew	HJ12-50	0.931	1000	0.019	2000	0.029	2000	0.029
Andrew	HL4RP-50A	0.88	1000	0.074	2000	0.109	2500	0.123
Andrew	LDF4-50A	0.88	1000	0.073	2000	0.107	2500	0.12

Table E-1. Coaxial Cable Technical Data (Sheet 2 of 4)

Manufacturer	Cable	Prop. Vel.	Freq 1	Loss 1	Freq 2	Loss 2	Freq 3	Loss 3
Andrew	LDF4.5-50	0.89	1000	0.054	2000	0.08	2500	0.091
Andrew	LDF5-50A	0.89	1000	0.041	2000	0.061	2500	0.07
Andrew	LDF5-50B	0.91	1000	0.041	2000	0.061	2500	0.07
Andrew	LDF6-50	0.89	1000	0.028	2000	0.042	2500	0.048
Andrew	LDF7-50A	0.88	1000	0.024	2000	0.037	2500	0.043
Andrew	LDF12-50	0.88	1000	0.021	2000	0.033	2000	0.033
Andrew	VXL5-50 7/8	0.88	1000	0.045	2000	0.066	2500	0.075
Andrew	VXL6-50 1-1/4	0.88	1000	0.032	2000	0.048	2500	0.055
Andrew	VXL7-50 1-5/8	0.88	1000	0.024	2000	0.037	2500	0.043
Belden	RG-8/8A	0.86	1000	0.132	2000	0.33	2500	0.22
Belden	RG-9/9A	0.659	1000	0.289	1000	0.289	1000	0.289
Belden	RG-17/17A	0.659	1000	0.18	1000	0.18	1000	0.18
Belden	RG-55/55A/55B	0.659	1000	0.541	1000	0.541	1000	0.541
Belden	RG-58/58B	0.77	1000	0.356	2000	0.528	2500	0.6
Belden	RG-58A/58C	0.73	1000	0.594	1000	0.594	1000	0.594
Belden	RG-142	0.7	1000	0.43	2000	0.663	2500	0.713
Belden	RG-174	0.66	1000	1.115	1000	1.115	1000	1.115
Belden	RG-178B	0.695	1000	1.509	1000	1.509	1000	1.509
Belden	RG-188	0.69	1000	0.951	1000	0.951	1000	0.951
Belden	RG-213	0.66	1000	0.262	1000	0.269	1000	0.269
Belden	RG-214	0.659	1000	0.229	1000	0.292	1000	0.292
Belden	RG-223	0.66	1000	0.476	1000	0.478	1000	0.478
Cablewave	HCC 12-50J	0.915	1000	0.087	2000	0.126	2500	0.137
Cablewave	HCC 78-50J	0.915	1000	0.041	2000	0.061	2500	0.066
Cablewave	HCC 158-50J	0.95	1000	0.022	2000	0.031	2500	0.033
Cablewave	HCC 300-50J	0.96	1000	0.015	1000	0.015	1000	0.015
Cablewave	HCC 312-50J	0.96	1000	0.013	1000	0.013	1000	0.013
Cablewave	HF 4 1/8 Cu2Y	0.97	1000	0.01	1000	0.01	1000	0.01
Cablewave	HF 5 Cu2Y	0.96	1000	0.007	1000	0.007	1000	0.007
Cablewave	HF 6 1/8 Cu2Y	0.97	1000	0.006	1000	0.006	1000	0.006
Cellflex	LCF78-50JA	0.9	1000	0.039	2000	0.058	2500	0.066
Cellflex	LCFS114-50JA	0.9	1000	0.029	2000	0.044	2500	0.051
Cellflex	LCF158-50JA	0.9	1000	0.024	2000	0.036	2500	0.042
Cellflex	LCF214-50JA	0.88	1000	0.021	2000	0.033	2000	0.033
Cellflex	UCF114-50JA	0.89	1000	0.031	2000	0.047	2000	0.047

Table E-1. Coaxial Cable Technical Data (Sheet 3 of 4)

Manufacturer	Cable	Prop. Vel.	Freq 1	Loss 1	Freq 2	Loss 2	Freq 3	Loss 3
Comscope	CR50 540PE	0.88	1000	0.069	2000	0.103	2500	0.116
Comscope	CR50 1070PE	0.88	1000	0.037	2000	0.055	2500	0.064
Comscope	CR50 1873PE	0.88	1000	0.022	2000	0.034	2500	0.04
Eupen	EC4-50-HF 1/2	0.82	1000	0.108	2000	0.161	2500	0.183
Eupen	EC4-50 1/2	0.88	1000	0.074	2000	0.109	2500	0.121
Eupen	EC4.5-50 5/8	0.88	1000	0.056	2000	0.083	2500	0.094
Eupen	EC5-50 7/8	0.88	1000	0.04	2000	0.058	2500	0.066
Eupen	EC6-50 1-1/4	0.88	1000	0.028	2000	0.043	2500	0.048
Eupen	EC7-50 1-5/8	0.88	1000	0.024	2000	0.037	2500	0.042
Eupen	EC7-50A 1-5/8	0.89	1000	0.023	2000	0.035	2500	0.039
Eupen	EC12-50 2-1/4	0.88	1000	0.022	2000	0.034	2500	0.039
Nk Cables	RF1/2-50	0.88	1000	0.073	2000	0.107	2500	0.127
Nk Cables	RF1/2-50GHF	0.88	1000	0.073	2000	0.107	2500	0.127
Nk Cables	RF1/2-50BHF	0.88	1000	0.073	2000	0.107	2500	0.127
Nk Cables	RF5/8-50	0.88	1000	0.051	2000	0.075	2500	0.087
Nk Cables	RF5/8-50GHF	0.88	1000	0.051	2000	0.075	2500	0.087
Nk Cables	RF5/8-50BHF	0.88	1000	0.051	2000	0.075	2500	0.087
Nk Cables	RF7/8-50	0.88	1000	0.04	2000	0.059	2500	0.07
Nk Cables	RF7/8-50GHF	0.88	1000	0.04	2000	0.059	2500	0.07
Nk Cables	RF7/8-50BHF	0.88	1000	0.04	2000	0.059	2500	0.07
Nk Cables	RF1 5/8-50	0.88	1000	0.024	2000	0.036	2500	0.042
Nk Cables	RF1 5/8-50GHF	0.88	1000	0.024	2000	0.036	2500	0.042
Nk Cables	RF1 5/8-50BHF	0.88	1000	0.024	2000	0.036	2500	0.042
Nk Cables	RF2 1/4-50	0.88	1000	0.021	2000	0.032	2500	0.041
Nk Cables	RF2 1/4-50GHF	0.88	1000	0.021	2000	0.032	2500	0.041
Nk Cables	RF2 1/4-50BHF	0.88	1000	0.021	2000	0.032	2500	0.041
Nk Cables	RFF3/8-50	0.81	1000	0.147	2000	0.218	2500	0.25
Nk Cables	RFF3/8-50GHF	0.81	1000	0.147	2000	0.218	2500	0.25
Nk Cables	RFF3/8-50BHF	0.81	1000	0.147	2000	0.218	2500	0.25
Nk Cables	RFF1/2-50	0.82	1000	0.112	2000	0.167	2500	0.19
Nk Cables	RFF1/2-50GHF	0.82	1000	0.112	2000	0.167	2500	0.19
Nk Cables	RFF1/2-50BHF	0.82	1000	0.112	2000	0.167	2500	0.19
Nk Cables	RFF7/8-50	0.88	1000	0.04	2000	0.066	2500	0.076
Nk Cables	RFF7/8-50GHF	0.88	1000	0.04	2000	0.066	2500	0.076
Nk Cables	RFF7/8-50BHF	0.88	1000	0.04	2000	0.066	2500	0.076

Table E-1. Coaxial Cable Technical Data (Sheet 4 of 4)

Manufacturer	Cable	Prop. Vel.	Freq 1	Loss 1	Freq 2	Loss 2	Freq 3	Loss 3
Times	LMR100	0.66	1000	0.789	2000	1.15	2500	1.31
Times	LMR200	0.83	1000	0.342	2000	0.49	2500	0.554
Times	LMR240	0.84	1000	0.261	2000	0.377	2500	0.424
Times	LMR400	0.85	1000	0.135	2000	0.196	2500	0.222
Times	LMR500	0.86	1000	0.109	2000	0.159	2500	0.18
Times	LMR600	0.87	1000	0.087	2000	0.128	2500	0.145
Times	LMR900	0.87	1000	0.059	2000	0.086	2500	0.098
Times	LMR1200	0.88	1000	0.044	2000	0.065	2500	0.074
Times	LMR1700	0.89	1000	0.033	2000	0.049	2500	0.057
	310801	0.821	1000	0.115	1000	0.115	1000	0.115
	311201	0.82	1000	0.18	1000	0.18	1000	0.18
	311501	0.8	1000	0.23	1000	0.23	1000	0.23
	311601	0.8	1000	0.262	1000	0.262	1000	0.262
	311901	0.8	1000	0.377	1000	0.377	1000	0.377
	352001	0.8	1000	0.377	1000	0.377	1000	0.377

Appendix F — Waveguide Data

F-1 Introduction

This appendix provides lists of waveguide components and their characteristics.

F-2 Calibration Components

The calibration components part numbers in the following table are broken down as follows, where the **xx** in the part number column (as in **xx**UM70) is replaced as follows:

```
xx:     23 = 1/8 Offset Short
        24 = 3/8 Offset Short
        26 = Precision Load
```

Table F-1. Precision Waveguide Calibration Components

Part Number	Freq. Range (GHz)	Waveguide Type	Compatible Flanges
xxUM70	5.85 to 8.20	WR137, WG14	CAR70, PAR70, UAR 70, PDR70
xxUM84	7.05 to 10.00	WR112, WG15	CBR84, UBR84, PBR84, PDR84
xxUM100	8.20 to 12.40	WR90, WG16	CBR100, UBR100, PBR100, PDR100
xxUM120	10.00 to 15.00	WR75, WG17	CBR120, UBR120, PBR120, PDR120
xxUA187	3.95 to 5.85	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
xxUA137	5.85 to 8.20	WR137, WG14	CPR137F, CPR137G, UG-1356/U, UG-1357/U, UG-1732/U, UG-1733/U, UG-343B/U, UG-344/U, UG-440B/U, UG-441/U
xxUA112	7.05 to 10.00	WR112, WG15	CPR112F, CPR112G, UG-1358/U, UG-1359/U, UG-1734/U, UG-1735/U, UG-52B/U, UG-51/U, UG-137B/U, UG-138/U
xxUA90	8.20 to 12.40	WR90, WG16	CPR90F, CPR90G, UG-1360/U, UG-1361/U, UG-1736/U, UG-1737/U, UG-40B/U, UG-39/U, UG-135/U, UG-136B/U

Table F-1. Precision Waveguide Calibration Components (Continued)

Part Number	Freq. Range (GHz)	Waveguide Type	Compatible Flanges
xxUA62	12.40 to 18.00	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
xxUA42	17.00 to 26.50	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

F-3 Waveguide-to-Coaxial Adapters

Part numbers that end with N have Type N connectors, part numbers that end with K have K Connectors.

Table F-2. Coaxial to Universal Waveguide Adapters

Part Number	Freq. Range (GHz)	Waveguide Type	Compatible Flanges
35UM70N	5.85 to 8.20	WR137, WG14	CAR70, PAR70, UAR 70, PDR70
35UM84N	7.05 to 10.00	WR112, WG15	CBR84, UBR84, PBR84, PDR84
35UM100N	8.20 to 12.40	WR90, WG16	CBR100, UBR100, PBR100, PDR100
35UM120N	10.00 to 15.00	WR75, WG17	CBR120, UBR120, PBR120, PDR120
35UA187N	3.95 to 5.85	WR187, WG12	CPR187F, CPR187G, UG-1352/U, UG-1353/U, UG-1728/U, UG-1729/U, UG-148/U, UG-149A/U
35UA137N	5.85 to 8.20	WR137, WG14	CPR137F, CPR137G, UG-1356/U, UG-1357/U, UG-1732/U, UG-1733/U, UG-343B/U, UG-344/U, UG-440B/U, UG-441/U
35UA112N	7.05 to 10.00	WR112, WG15	CPR112F, CPR112G, UG-1358/U, UG-1359/U, UG-1734/U, UG-1735/U, UG-52B/U, UG-51/U, UG-137B/U, UG-138/U
35UA90N	8.20 to 12.40	WR90, WG16	CPR90F, CPR90G, UG-1360/U, UG-1361/U, UG-1736/U, UG-1737/U, UG-40B/U, UG-39/U, UG-135/U, UG-136B/U
35UA62N	12.40 to 18.00	WR62, WG18	UG-541A/U, UG-419/U, UG-1665/U, UG1666/U
35UA42K	7.00 to 26.50	WR42, WG20	UG-596A/U, UG-595/U, UG-597/U, UG-598A/U

F-4 Flange Compatibility

Table F-3. Universal Flange Compatibility (1 of 3)

Calibration Component Part Number	Start Frequency (GHz)	Stop Frequency (GHz)	Waveguide Type	Flange Type	Compatible Flanges
xxUM40	3.300	4.900	WR229 WG11A	UnivM-229	PDR40
xxUM48	3.950	5.850	WR187 WG12	UnivM-187	CAR48 PAR48 UAR48 PDR48
xxUM58	4.900	7.050	WR159 WG13	UnivM-159	CAR58 PAR58 UAR58 PDR58
xxUM70	5.850	8.200	WR137 WG14	UnivM-137	CAR70 PAR70 UAR70 PDR70
xxUM84	7.050	10.000	WR112 WG15	UnivM-112	CBR84 UBR84 PBR84 PDR84
xxUM100	8.200	12.400	WR90 WG16	UnivM-90	CBR100 UBR100 PBR100 PDR100
xxUM120	10.000	15.000	WR75 WG17	UnivM-75	CBR120 UBR120 PBR120 PDR120
xxUM140	12.400	18.000	WR62 WG18	UnivM-62	CBR140 UBR140 PBR140 PDR140
xxUM220	17.000	26.500	WR42 WG20	UnivM-42	CBR220 UBR220 PBR220 PDR220
xxUA229	3.300	4.900	WR229 WG11A	UnivUS-229	CPR229F CPR229G UG-1350/U UG-1351/U UG-1726/U UG-1727/U

Universal Flange Compatibility

Table F-4. Universal Flange Compatibility (2 of 3)

Calibration Component Part Number	Start Frequency (GHz)	Stop Frequency (GHz)	Waveguide Type	Flange Type	Compatible Flanges
xxUA187	3.950	5.850	WR187 WG12	UnivUS-187	CPR187F CPR187G UG-1352/U UG-1353/U UG-1728/U UG-1729/U UG-148/U UG-149A/U
xxUA159	4.900	7.050	WR159 WG13	UnivUS-159	CPR159F CPR159G UG-1354/U UG-1355/U UG-1730/U UG-1731/U
xxUA137	5.850	8.200	WR137 WG14	UnivUS-137	CPR137F CPR137G UG-1356/U UG-1357/U UG-1732/U UG-1733/U UG-343B/U UG-344/U UG-440B/U UG-441/U
xxUA112	7.050	10.00	WR112 WG15	UnivUS-112	CPR112F CPR112G UG-1358/U UG-1359/U UG-1734/U UG-1735/U UG-52B/U UG-51/U UG-137B/U UG-138/U

Table F-4. Universal Flange Compatibility (2 of 3) (Continued)

Calibration Component Part Number	Start Frequency (GHz)	Stop Frequency (GHz)	Waveguide Type	Flange Type	Compatible Flanges
xxUA90	8.200	12.400	WR90 WG16	UnivUS-90	CPR90F CPR90G UG-1360/U UG-1361/U UG-1736/U UG-1737/U UG-40B/U UG-39/U UG-135/U UG-136B/U
xxUA75	10.000	15.000	WR75 WG17	UnivUS-75	WR75

Universal Flange Compatibility

Table F-5. Universal Flange Compatibility (3 of 3)

Calibration Component Part Number	Start Frequency (GHz)	Stop Frequency (GHz)	Waveguide Type	Flange Type	Compatible Flanges
xxUA62	12.400	18.000	WR62 WG18	UnivUS-62	UG-541A/U UG-419/U UG-1665/U UG-1666/U
xxUA42	17.000	26.500	WR42 WG20	UnivUS-42	UG-596A/U UG-595/U UG-597/U UG-598A/U
xxCMR229	3.300	4.900	WR229 WG11A	CMR229	CMR229
xxCMR187	3.950	5.850	WR187 WG12	CMR187	CMR187 UG-1475/U UG-1480/U
xxCMR159	4.900	7.050	WR159 WG13	CMR159	CMR159
xxCMR137	5.850	8.200	WR137 WG14	CMR137	CMR137 UG-1476/U UG-1481/U
xxCMR112	7.050	10.000	WR112 WG15	CMR112	CMR112 UG-1477/U UG-1482/U
xxCMR90	8.200	12.400	WR90 WG16	CMR90	CMR90 UG-1478/U UG-1483/U
xxUER40	3.300	4.900	WR229 WG11A	UER40	UER40
xxUER48	3.950	5.850	WR187 WG12	UER48	UER48
xxUER58	4.900	7.050	WR159 WG13	UER58	UER58
xxUER70	5.850	8.200	WR137 WG14	UER70	UER70
xxUER84	7.050	10.000	WR112 WG15	UER84	UER84
xxUER100	8.200	12.400	WR90 WG16	UER100	UER100

F-5 Waveguide Technical Data

Table F-6. Waveguide Offset Short[a] Specifications

Offset Short P/N	Frequency (GHz)	Length (mm)
24UM70	6.926	20,710 +/- 0.08
24UM84	8.396	17,040 +/- 0.05
24UM100	10.084	14,675 +/- 0.05
24UM120	12.247	11,978 +/- 0.04
24UA187	4.807	30,979 +/- 0.11
24UA137	6.926	20,710 +/- 0.08
24UA112	8.396	17,040 +/- 0.05
24UA90	10.084	14,675 +/- 0.05
24UA62	14.940	9,742 +/- 0.04
24UA42	21.225	7,067 +/- 0.03
24CMR187	4.807	30,979 +/- 0.11
24CMR137	6.926	20,710 +/- 0.08
24CMR112	8.396	17,040 +/- 0.05
24CMR90	10.084	14,675 +/- 0.05
24UER70	6.926	20,710 +/- 0.08
24UER84	8.396	17,040 +/- 0.05
24UER100	10.084	14,675 +/- 0.05

a.Offset shorts are 3/8 wave at the geometric mean frequency waveguide band and dimensionally accurate to <0.5 degree at the maximum operating frequency of the corresponding wavelength.

Waveguide Technical Data

Table F-7. Waveguide Technical Data (Sheet 1 of 2)

Waveguide Type/Model	Start Frequency (GHz)	Stop Frequency (GHz)	Cutoff Frequency (GHz)	Mid-Band Loss (dB/m)
WR229, WG11A	3.300	4.900	2.577	0.0374
WR187, WG12	3.950	5.850	3.152	0.0515
WR159, WG13	4.900	7.050	3.711	0.0591
WR137, WG14	5.850	8.200	4.301	0.0738
WR112, WG15	7.050	10.000	5.259	0.1024
WR102	7.000	11.000	5.786	0.1083
WR90, WG16	8.200	12.400	6.557	0.1578
WR75, WG17	10.000	15.000	7.868	0.1913
WR67	11.000	17.000	8.578	0.2159
WR62, WG18	12.400	18.000	9.486	0.2411
WR51, WG19	15.000	22.000	11.574	0.3691
WR42, WG20	17.000	26.500	14.047	0.5200
Andrew				
EW17	1.700	2.400	1.364	0.012
EW20	1.900	2.700	1.57	0.015
EW28	2.600	3.400	2.2	0.021
EW34	3.100	4.200	2.376	0.0223
EW37	3.300	4.300	2.790	0.0292
EW43	4.400	5.000	2.780	0.0289
EW52	4.600	6.425	3.650	0.042
EW63	5.580	7.125	4.000	0.0453
EW64	5.300	7.750	4.320	0.052
EW77	6.100	8.500	4.720	0.061
EW85	7.700	9.800	6.460	0.1086
EW90	8.300	11.700	6.500	0.108
EW127	10.000	13.250	7.670	0.124
EW132	11.000	15.350	9.220	0.17
EW180	14.000	19.700	11.150	0.1939
EW220	17.000	23.600	13.340	0.2822

Table F-7. Waveguide Technical Data (Sheet 2 of 2)

Waveguide Type/Model	Start Frequency (GHz)	Stop Frequency (GHz)	Cutoff Frequency (GHz)	Mid-Band Loss (dB/m)
Cablewave				
WE37	3.600	4.200	2.830	0.0269
WE46	4.400	5.000	3.000	0.0354
WE61	5.925	6.425	3.600	0.0390
WE65	6.425	7.125	4.000	0.0453
WE70	7.125	7.750	4.300	0.0404
WE78	7.125	8.500	4.670	0.0446
WE108	10.500	11.700	6.570	0.0978
WE130	11.700	13.250	7.430	0.1142
WE150	14.000	15.350	8.600	0.1398
WE191	17.700	19.700	10.680	0.1952
RFS Cablewave				
E20	1.700	2.300	1.38	0.012
E30	2.300	3.100	1.8	0.016
E38	3.000	4.200	2.4	0.025
E46	3.650	5.000	2.88	0.028
ES46	3.900	5.000	3.08	0.036
E60	4.500	6.425	3.65	0.045
E65	5.000	7.125	4.01	0.05
E78	5.900	8.500	4.72	0.06
E105	8.100	11.700	6.49	0.09
E130	9.300	13.250	7.43	0.12
E150	10.800	15.350	8.64	0.15
E185	13.700	19.700	11.06	0.2
E220	16.700	23.600	13.36	0.29

Appendix G — More About DHCP

G-1 Introduction

DHCP stands for Dynamic Host Configuration Protocol. This protocol allows a server to dynamically assign IP addresses to devices that are connected to the network. Most networks include a DHCP server to manage IP addresses. When a DHCP server is available on the network, DHCP is the preferred IP address mode.

G-2 Ethernet Configuration

LAN Connection

The RJ-45 connector is used to connect the VNA Master to a local area network. Integrated into this connector are two LEDs. The amber LED shows the presence of a 10 Mbit/s LAN connection when on, and a 100 Mbit/s LAN connection when off. The green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (**8**) key followed by the System Options submenu key and the Ethernet Config submenu key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address, and subnet mask.

Note	An active Ethernet cable must be connected to the instrument before it is turned ON in order to enable the Ethernet port for DHCP or for a static IP address. Depending upon local conditions, the port may remain enabled when changing from DHCP to static IP address, when changing from static IP address to DHCP, or when temporarily disconnecting the Ethernet cable. If the port becomes disabled, then ensure that an active Ethernet cable is attached to the instrument before cycling the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the MS20xxC to the network and select DHCP protocol in the Ethernet Config menu.

Turn the VNA Master off, and then on. If the network is set up for DHCP, then the assigned IP address should be displayed briefly after the power up sequence.

To display the IP address with the instrument on, press the **Shift** key, then the **System** (**8**) key, then the System Options submenu key and the Ethernet Config submenu key. The IP address will be displayed as shown in Figure G-1. The image on the display panel of your VNA Master may differ from the image shown here.

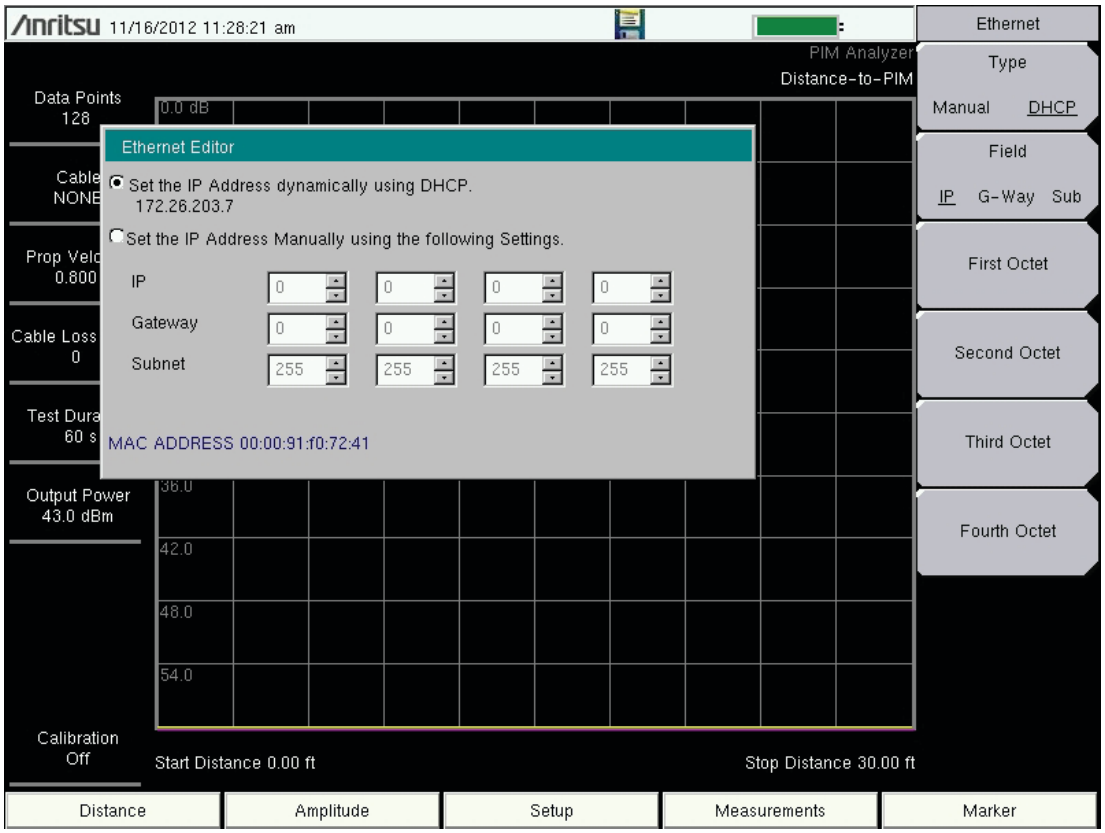


Figure G-1. IP Address Assigned Using DHCP

Ethernet Config

Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box in order to set the IP address of the instrument.

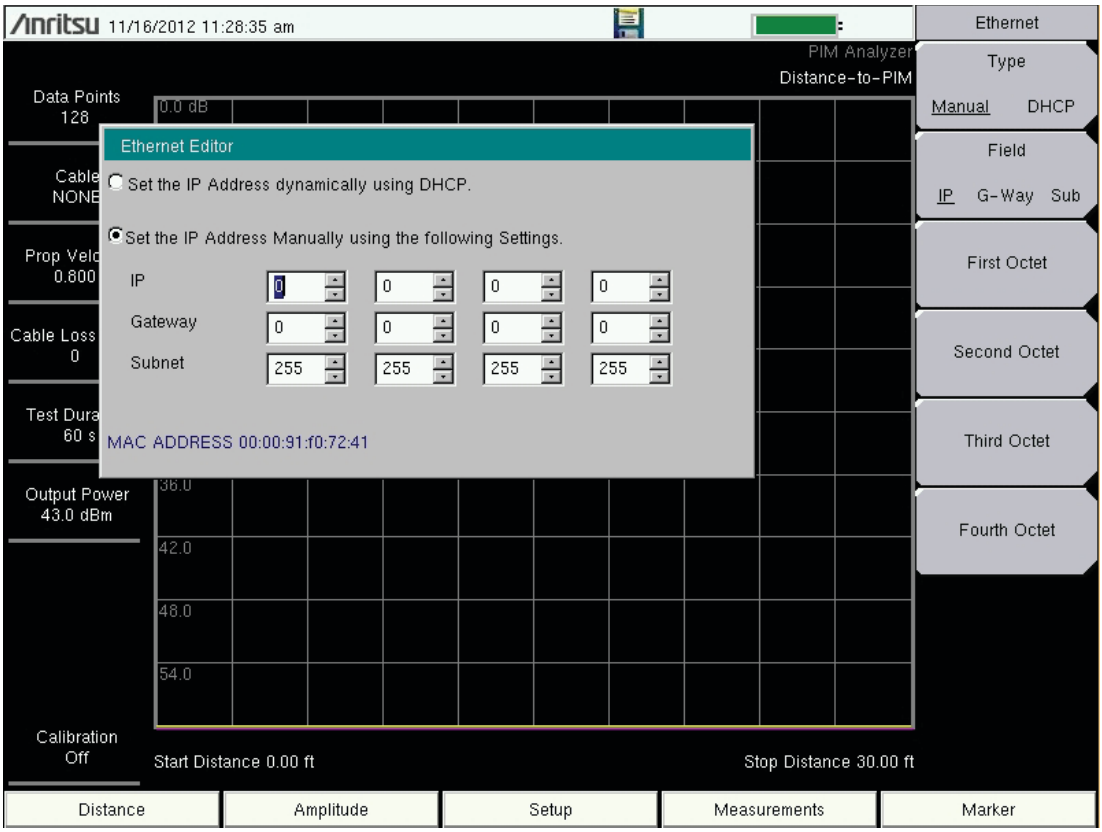
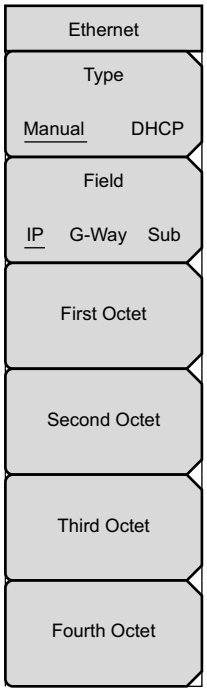


Figure G-2. Setting IP Address Manually

Ethernet Menu

Key Sequence: **Shift**, **System** (**8**) > **System Options >** Ethernet Config



Type

Manual DHCP: Press this submenu key to select whether the address will be entered manually, or will be supplied automatically by a network DHCP server. If Manual is selected, then use the submenu keys or the **Left/Right** arrow keys to select the field that is to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to enter the input. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Field

IP G-Way Sub: Press this submenu key to select the desired Internet Protocol Property to be edited.

First Octet: Moves the cursor to the left most column of the selected IP properties field.

Second Octet: Moves the cursor to the second column from the left of the selected IP properties field.

Third Octet: Moves the cursor to the third column from the left of the selected IP properties field.

Fourth Octet: Moves the cursor to the forth column from the left of the selected IP properties field.

Figure G-3. Ethernet Menu

G-3 Using DHCP

When using DHCP, no setup is required to lease and use a dynamic IP address. In a dynamic IP operation, the assigned IP address may change from use to use. The DHCP server assigns IP addresses on a time rotation basis. As soon as the device is disconnected from the network, the IP address that it was using becomes available to lease to the next unit requesting an IP address. Normally, some amount of lag time occurs on the DHCP server end, so if the device is connected again reasonably soon, it may receive the same address.

Note	The VNA Master must be connected to the network *before* it is turned on in order to allow DHCP to work. Key elements of the DHCP lease are performed only during the instrument startup operations or when switching from manual to DHCP.

G-4 Static IP Address

When a DHCP server is not available, a Static IP address can be used. A Static IP address is a fixed address. After being set, it will always remain the same, and care must be taken to avoid conflict with other equipment on the network.

When using a static IP address on an established network, always request a Static IP address from the network administrator. Randomly choosing a Static IP address on an established network may result in duplicate IP addresses or other conflicts.

Three parameters must be set prior to using a Static IP address:

IP Address

This is the Static IP address on the network.

Default Gateway

Often when a static IP address is assigned, a default gateway is also identified. If the default gateway is unknown, then type in the Static IP address so that the Static IP address and Default Gateway are the same number.

Subnet Mask

This parameter is usually extracted from the Static IP address based upon the class of the address. It determines the destination of any broadcast messages that might be sent from the instrument. It can be customized if necessary. The subnet mask may also be provided with the Static IP address.

Example 1

In this example, a Static IP address has been chosen because no network is available. The instrument is connected to the network port on the PC with a crossover Ethernet cable (not included). This is also referred to as Direct Connect:

```
IP Address: 10.0.0.2
Default Gateway: 10.0.0.2
Subnet Mask: 255.255.0.0
```

Example 2

In this example, the Static IP address has been assigned with an associated gateway and subnet mask:

```
IP Address: 153.56.100.42
Default Gateway: 153.56.100.1
Subnet Mask: 255.255.252.0
```

G-5 Operating System Tools

A few tools that are built into the Microsoft Windows operating system can assist in making some determinations about the network that the PC is plugged into.

Ipconfig Tool

Typing ipconfig at a command prompt will display information about the in-use parameters of the PC and its network connection. Below is an example of the typical results expected.

Note	The ipconfig display does not report if the information is from a DHCP server or a Static IP setup

```
Y:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix. : us.anritsu.com
IP Address . . . . . . . . . . . . : 172.26.202.172
Subnet Mask . . . . . . . . . . . . : 255.255.252.0
Default Gateway . . . . . . . . . : 172.26.200.1
```

Ping Tool

Another tool that can find out if a selected IP address is already on the network is ping. Ping is a harmless way to determine if an address is found on the network and, if it is found, for it to reply. Greatly simplified, ping sends out a request to a specific address to determine if it is there. If the specific address is found, then it will respond by sending back the same message that was received. If it is not found, then the response will be "request timed out." This means that no reply was received from that IP address.

```
Y:\>ping 172.26.202.172
Pinging 172.26.202.172 with 32 bytes of data:
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Ping statistics for 172.26.202.172:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milliseconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Appendix H — Glossary of Terms

Introduction

The following terms are used in this manual.

Glossary Terms

Adapter : A fitting that supplies a passage between two sets of equipment when they cannot be directly interconnected.

Attenuation : Attenuation refers to decreasing in signal magnitude between two points. These points may be along a radio path, transmission line or other devices.

Attenuator : Attenuator is a device specifically designed to decrease the magnitude of a signal transmitted through it.

Band Pass Filter : A Band Pass Filter is a radio wave filter with a specific range of frequencies in which it is designed to pass. It rejects frequencies outside the pass-band range. A resistor-inductor-capacitor circuit is an example of a Band Pass Filter.

BER : Bit Error Rate or Bit Error Ratio (link quality specification/testing) (BER) BER is a measure of transmission quality. The ratio of error bits to the total number of bits transmitted. A bit error rate of 10-6 refers to an average of one error per million bits. It is generally shown as a negative exponent, (for example, 10-7 which means 1 out of 107 bits are in error or 1 out of 10,000,000 bits are in error).   Bit Error Rate (BER) is the fraction of a sequence of message bits that are in error.

BERT : Bit Error Rate Test/Tester (BERT) BERT is a test that gauges the quality of the T1 or digital line. By sending a known pattern to another device across the span the far end device can compare incoming pattern to its' own, thereby indicating bit errors on the line.

Broadband : Broadband refers to telecommunication that provides multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing. It is a service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

Coaxial Cable : Coaxial Cable (Coax) is a type of electrical communications medium used in the LAN environment. This cable consists of an outer conductor concentric to an inner conductor, separated from each other by insulating material, and covered by some protective outer material. This medium offers large bandwidth, supporting high data rates with high immunity to electrical interference and a low incidence of errors. Coax is subject to distance limitations and is relatively expensive and difficult to install.

DANL : Displayed Average Noise Level (DANL): Displayed average noise level is sometimes confused with the term Sensitivity. While related, these terms have different meanings. Sensitivity is a measure of the minimum signal level that yields a defined signal-to-noise ratio (SNR) or bit error rate (BER). It is a common metric of radio receiver performance. Spectrum analyzer specifications are always given in terms of the DANL. One of the primary uses of a spectrum analyzer is to search out and measure low-level signals. The limitation in these measurements is the noise generated within the spectrum analyzer

itself. This noise, generated by the random electron motion in various circuit elements, is amplified by multiple gain stages in the analyzer and appears on the display as a noise signal. On a spectrum analyzer, this noise is commonly referred to as the Displayed Average Noise Level, or DANL 1. While there are techniques to measure signals slightly below the DANL, this noise power ultimately limits our ability to make measurements of low-level signals.

dB : Decibel or deciBel (dB) is a unit for measuring relative power ratios in terms of gain or loss. The units of dB are expressed in terms of the logarithm to base 10 of a ratio and typically are expressed in watts. For example, a -3dB loss indicates a 50% loss in power; a +3dB reading is a doubling of power; 10 dB indicates an increase (or a loss) by a factor of 10; 20 dB indicates an increase (or a loss) of a factor of 100; 30 dB indicates an increase (or a loss) by a factor of 1000.

dBc : Decibels referenced to the carrier (dBc) is a technique for expressing a power measurement in logarithmic form using the carrier power as a reference. The units are used to describe how far down signals and noise are relative to a known signal. A typical use of this term is to describe spurious signals and noise compared to a desired transmit signal.

dBm : dBm is a decibel value referenced to a milliWatt (dBm) This is a technique for expressing a power measurement in logarithmic form using 1 mW as a reference. dBm is a decibel ratio (log 10) of Watts (W) to one milliwatt (1mW). dBm therefore represents absolute power.

DTF : Distance-To-Fault (DTF)   DTF is the distance from the instrument output connector (or the end of a test lead) to a problem area, as indicated by a peak in the displayed signal.

FFT : Fast Fourier Transform (FFT) is an efficient algorithm to compute the Discrete Fourier transform (DFT) and its inverse. FFTs are of great importance to a wide variety of applications, from digital signal processing to solving partial differential equations to algorithms for quickly multiplying large integers.

Flash Memory : Flash memory is a non-volatile solid state storage device that is packaged as a chip. It can be electrically erased and reprogrammed. It is primarily used in memory cards, USB flash drives, MP3 players, and solid-state drives for general storage and transfer of data between computers and other digital products. It is a specific type of EEPROM (electrically erasable programmable read-only memory) that is erased and programmed in large blocks.

GPS : The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times when and where an unobstructed line of sight is available to four or more GPS satellites. The system is maintained by the United States government and is freely accessible by anyone with a GPS receiver. The Global Positioning System is making it possible for people using ground receivers to determine their geographic location within 10 to 100 meters. The satellites use simple mathematical calculations to broadcast

information that is translated as longitude, latitude, and altitude by Earth-based receivers.

IF : Intermediate Frequency (IF) is a frequency to which a carrier frequency is shifted as an intermediate step in transmission or reception. An intermediate electromagnetic frequency is generated by a superheterodyne radio receiver.

IP Address : An Internet Protocol address (IP address) is usually a numerical label that is assigned to each device (computer or printer for example) that is participating in a computer network that uses the Internet Protocol for communication. An IP address serves two main functions: location addressing and host (or network) interface identification. The Internet Protocol originally defined an IP address as a 32-bit number. This was known as Internet Protocol Version 4 (IPv4), which is still in use. Growth of the Internet requires a new addressing system. An Internet Protocol Version 6 (IPv6) that uses 128 bits for the address was developed in 1995, and it is standardized as RFC 2460. IPv6 began being deployed worldwide in the year 2000. IP addresses are binary

numbers, but they are usually stored in text files and displayed in human-readable notations, such as decimal nnn.nnn.nnn.nnn or 172.16.255.1 (for IPv4), and hexadecimal nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn or 2C01:AB18:0:1234:FF03:567C:8:1 (for IPv6). In IPv4, each decimal group (nnn) represents values from 000 to 255, or binary values of 8 bits. In IPv6, each hexadecimal group (nnnn) represents values from 0000 to FFFF, or binary values of 16 bits (0000 0000 0000 0000 to 1111 1111 1111 1111).

IPv6 : Internet Protocol Version 6 (IPv6) is a numerical label that is used to identify a network interface of a computer or other network node participating in an IPV6-enabled computer network. IPv6 uses 128 bits for the address (as compared to an IPv4 address, which is defined as a 32-bit number). IPv6 was developed in 1995, and it is standardized as RFC 2460. IPv6 began being deployed worldwide in the year 2000. IP addresses are binary numbers, but they are usually stored in text files and displayed in human-readable notations, such as hexadecimal nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn or 2C01:AB18:0:1234:FF03:567C:8:1 (where FFFF [Hex] = 65535 [Dec]). Each hexadecimal group (nnnn) represents values from 0000 to FFFF, or binary values of 16 bits (0000 0000 0000 0000 to 1111 1111 1111 1111).

LPA : Linear Power Amplifier (LPA) is the final amplification stage in a multicarrier transmitter that has been designed and optimized to produce a linear response. By operating in the linear mode, the amplifier reduces the non-linear effects that produce intermodulation products and side-lobe spectra that cause adjacent channel interference.

NF : Noise Figure (NF) is a measure of degradation of the signal-to-noise ratio (SNR) that is caused by components in a radio frequency (RF) device. The noise factor (F) of a system is defined as the signal-to-noise ratio of the input power of the system divided by the signal-to-noise ratio of the output power of that system. NF (the noise figure) is defined as the decibel value of the noise factor. NF = 10log (F) where log uses the base 10, or common log. This formula is valid only then the input termination is at standard noise temperature.

OBW : Occupied Bandwidth (OBW) Occupied Bandwidth is a measure of the bandwidth containing 99% of the total integrated power of the transmitted spectrum, centered on the assigned channel frequency. Interference to other channels or to other systems can occur if OWB is too large.

OTA : Over The Air (OTA): OTA refers generally to any transfer of information or signal that takes place in a wireless environment, rather than using a wired connection. OTA is usually used in connection with a standard defining the provisioning of mobile devices and applications, such as downloading or uploading content or software, and commonly used in conjunction with the Short Messaging Service (SMS). SMS OTA Messages contain information that is used to configure the settings of a WAP browser in a mobile phone (refer to SMS and WAP).

RBW : Resolution Bandwidth (RBW) With spectrum analyzers, a narrow band filter is swept across a frequency span to create the spectrum display. The filter bandwidth (RBW) determines the frequency resolution across the frequency axis.

Signal loss : Signal loss is the amount of signal strength that's lost in antenna cable, connectors, and free space. Signal loss is measured in decibels.

Smith Chart : A Smith Chart is a graphical aid for electrical and electronics characteristics in radio frequency (RF) circuits. Smith Chart was invented by Phillip Smith at Bell Laboratories in 1939. The chart can be used to display multiple parameters, such as impedance, and admittance.

S-parameter : S-parameters are scattering parameters, and are a signal ratio of reflection and transmission measurements. For a 2-port network, four fundamental S-parameters can be measured, and they are defined as Sxy (where x and y are subscripts of S). The first number (x) is the port number into which the signal is being injected, and the second number (y) is the port number from which the signal is leaving. The S-parameter is the ratio of these two signals. S11 is Forward Reflection. S21 is Forward Transmisssion. S12 is Reverse Transmission. S22 is Reverese Reflection.

TMA : A Tower Mounted Amplifier (TMA) amplifies signals from an antenna to reduce the noise figure of a base transceiver station (BTS). This helps to improve the overall sensitivity of the BTS. A TMA is a low-noise amplifier (LNA) that is usually mounted as close as practical to the antenna in Base Transceiver Stations or in mobile masts. When using a TMA, the antenna is able to receive weaker signals.

Index

A

B

C

D

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

Z

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USA
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