

## User Guide

# BTS Master™ MT8220T

## High Performance Handheld Base Station Analyzer

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[Appendix A](#) provides a list of supplemental documentation for the BTS Master features and options.

This set of documents is available as PDF files on the Handheld Instruments Documentation Disc and on the Anritsu website.

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The Anritsu logo consists of the word "Anritsu" in a bold, sans-serif font. The letter "A" is stylized with a diagonal slash through it. The logo is positioned in the bottom right corner of the page.

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For Chinese Customers Only YL(NM)YB

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)	×	○	×	×	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。  
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**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:** BTS Master

**Model Number:** MT8220T

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

Morgan Hill, CA

  
Eric McLean, Corporate Quality Director

15 AUG 2013  
Date

European Contact: For Anritsu product CE information, contact Anritsu EMEA Limited, 200 Capability Green, Luton, Bedfordshire, LU1 3LU, England. (Telephone: +44 (0)1582 433200; Email: [bert.francis@anritsu.com](mailto:bert.francis@anritsu.com))

## Safety Symbols

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



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.

## For Safety

### Warning



Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced. Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

### Warning



or



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

### Warning

**WARNING** 

This equipment cannot 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.



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# Chapter 1 — General Information

## 1-1 Introduction

This chapter provides a description of the handheld Anritsu model MT8220T. It also briefly describes preventive maintenance, calibration requirements, ESD cautions, and additional documents.

General and performance specifications, instrument options, standard accessories, and optional accessories are in the BTS Master Technical Data Sheet (part number 11410-00698)

Refer to [Appendix A, “Related Documents”](#), for additional information. Throughout this manual, these instruments may be referred to as a BTS Master or as a model MT8220T.

## 1-2 Contacting Anritsu

To contact Anritsu, please visit:

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

On this page you can find links to sales, service, and support contact information for your country or region. You can also 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.

Example URL for MT8220T:

<http://www.anritsu.com/en-us/products-solutions/products/MT8220T.aspx>

## 1-3 Additional Options

Additional options for the BTS Master are listed in [Table 1-1](#). Most of these options are described in Measurement Guides (refer to [Appendix A](#)).

**Table 1-1.** Additional Options

Option	Description
MT8220T-0010	Bias-Tee
MT8220T-0019	High-Accuracy Power Meter (sensor not included)
MT8220T-0023	Vector Signal Generator
MT8220T-0024	I/Q Waveform Capture
MT8220T-0025	Interference Analyzer
MT8220T-0027	Channel Scanner
MT8220T-0089	Zero-Span IF Output
MT8220T-0090	Gated Sweep
MT8220T-0431	Coverage Mapping
MT8220T-0750	CPRI RF Measurements
MT8220T-0880	GSM/GPRS/EDGE Measurements
MT8220T-0881	W-CDMA/HSPA+ Measurements
MT8220T-0882	TD-SCDMA/HSPA+ Measurements
MT8220T-0883	LTE/LTE-A FDD/TDD Measurements
MT8220T-0884	CDMA/EV-DO Measurements
MT8220T-0885	WiMAX Fixed/Mobile Measurements
MT8220T-0098	Standard Calibration to ISO/IEC 17025:2005
MT8220T-0099	Premium Calibration to ISO/IEC 17025:2005 plus test data

## 1-4 Standard and Optional Accessories

The Anritsu BTS Master includes a three-year warranty (refer to “[WARRANTY](#)”).

Accessories are listed in the BTS Master Technical Data Sheet. Refer to [Table A-2](#) on [page A-3](#). The Technical Data Sheet contains a list and description of available accessories. The data sheet is available on the Anritsu Web site: <http://www.anritsu.com>.



## 1-5 Additional Documents

This user guide is specific to the BTS Master MT8220T. Additional instrument functions and descriptions of optional measurement capabilities are described in measurement guides. Refer to [Appendix A, “Related Documents”](#) for a list of these guides and their Anritsu part numbers. Measurement guides are provided on the Documentation disc that is shipped with the instrument and are also available for download (at no charge) from the Anritsu web site.

A URL (an Internet link) to the BTS Master product page is provided in [Section 1-2 “Contacting Anritsu” on page 1-1](#).

A table at the bottom of the BTS Master Web page presents Internet links to related literature and software. Examples include the following types of documents:

- Application Notes
- Brochures
- Data Sheets
- Instruction Sheets
- Technical Notes
- White Papers
- Master Software Tools

## 1-6 Instrument Description

The MT8220T BTS Master is an integrated multi-functional base station test tool that eliminates the need to carry and to learn to use multiple test sets. The measurement capabilities include: spectrum analyzer smart measurements, precision return loss, VSWR, cable loss, distance-to-fault, two port gain/loss, one-port and two-port magnitude and phase, interference analysis, spectrogram, and power meter.

RF, advanced demodulation, and over-the-air (OTA) measurements can be applied to GSM/GPRS/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE FDD/TDD, CDMA/EV-DO, and WiMAX Fixed/Mobile signals.

Additional capabilities include a Vector Signal Generator (VSG), GPS location information, and enhanced external frequency reference oscillator accuracy.

The MT8220T model has cable and antenna analysis (400 MHz to 6.0 GHz), spectrum analysis (150 kHz to 7.1 GHz), and an internal power meter (10 MHz to 7.1 GHz). The cable and antenna analysis is performed by a Vector Network Analyzer that is designed to make accurate vector-corrected 1-port and 1-path, 2-port magnitude and phase measurements from 400 MHz to 6 GHz.

The MT8220T is also a synthesizer-based spectrum analyzer that provides quick and accurate measurement results. Measurements can be easily made by using the main instrument functions: frequency, span, amplitude, and bandwidth. Dedicated keys for one-button measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR), and Carrier to Interference Ratio (C/I) make the handheld MT8220T the ideal choice for the field. A familiar calculator-type keypad allows for fast data entry.

In transmitter analyzer mode, the MT8220T displays 6 markers and the marker table in Code Domain Power and Codogram displays. In Spectrum Analyzer mode, a full range of marker capabilities (such as peak, center, and delta functions) are provided for faster, more comprehensive analysis of displayed signals. Upper and lower multi-segmented limit lines are available to create quick, simple pass/fail measurements. A menu option provides for an audible alert when a limit value is exceeded.

Time and date stamping of measurement data is automatic. The internal memory provides for storage and recall of traces and measurement setups. The bright daylight-viewable, high-resolution, color liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions. The MT8220T is capable of approximately 2.5 hours of continuous operation from a fully charged battery and can be operated from a 12 VDC source, which also simultaneously charges the battery.

Several PC-based software programs are available free-of-charge from Anritsu. Refer to [Chapter 7](#) for a brief overview.

- Anritsu Master Software Tools (MST) provides a convenient means for storing measurement data. Master Software Tools can also convert measurements from the display into several graphic formats. Master Software Tools supports all of the options that are provided with the instrument.
- Line Sweep Tools (LST) can be used with Cable & Antenna measurements to create reports, view and organize data, analyze historical data, edit markers and limit lines, rename traces and trace analysis.
- easyMap Tools is used to create maps for coverage and interference mappings.

Additional information for specific software programs is available under the software's **Help** menu.

Measurements may be stored in internal memory, on a USB flash drive, or a FAT32-formatted external disk. Stored measurements can be downloaded to a PC by using the included USB and Ethernet cables. After being stored, the graphic trace can then be displayed, scaled, or enhanced with markers and limit lines. Historical graphs can be overlaid with current data by using the PC mouse in a drag-and-drop fashion. The underlying data can be extracted and used in spreadsheets or for other analytical tasks.

**Note**

Not all USB drives are compatible with the instrument. 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. Some drives can be made to work by reformatting them using the FAT32 format.

## 1-7 BTS Master Specifications

Refer to the Technical Data Sheet listed in [Section 1-1](#) for general specifications, detailed measurement specifications for all available measurement modes, ordering information, power sensors, and available accessories. The data sheet is available on the Anritsu web site: <http://www.anritsu.com>.

## 1-8 Calibration Requirements

The MT8220T loads factory calibration data during start-up, eliminating the need for daily calibration checks. In W-CDMA modes, an additional automatic calibration is performed as the internal temperature of the MT8220T changes (to insure the best possible measurement results).

Although the MT8220T does not require daily field calibration, Anritsu Company recommends annual calibration and performance verification by local Anritsu service centers.

The Cable and Antenna Analyzer requires calibration standards for OPEN, SHORT, and LOAD, which are sold separately. The Cable and Antenna Analyzer Measurement Guide is available on the documentation disc and the Anritsu web site. Refer to [Appendix A, “Related Documents”](#), for a list of measurement guides and their Anritsu part numbers.

<b>Note</b>	Anritsu recommends allowing the instrument to warm up to typical operation temperature (~15 minutes) before calibrating.
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## 1-9 Preventive Maintenance

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

<b>Caution</b>	To avoid damage to the display or case, do not use solvents or abrasive cleaners.
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Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of N(f) connectors and the pins of N(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.

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

## 1-10 ESD Cautions

The MT8220T, like other high performance instruments, is susceptible to ESD (electrostatic discharge) damage. Coaxial cables and antennas often build up a static charge, which may damage the MT8220T input circuitry (if allowed to discharge by connecting directly to the MT8220T without previously discharging the static charge). MT8220T operators **must be aware** of the potential for ESD damage and 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 apply to the MT8220T, Anritsu Company recommends that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the MT8220T. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the MT8220T. Remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards ensures a safe environment for both personnel and equipment.

## 1-11 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.

## 1-12 Battery Replacement

The battery can be replaced without the need for any tools. The battery compartment is located on the lower left side of the instrument, with the measurement display facing you. Slide the battery door down, towards the bottom of the instrument. To remove the battery pack, pull straight out on the battery lanyard.



**Figure 1-1.** Battery Compartment Door

**Warning** To avoid damage, use only Anritsu approved batteries, adapters, and chargers with this instrument.

The battery that is supplied with the BTS Master may need charging before use. The battery can be charged while it is installed in the BTS Master by using either the AC Adapter or the 12-Volt DC adapter, or separately in the optional Dual Battery Charger. Refer to “[Symbols and Indicators](#)” on [page 2-20](#) for a description of battery symbols. The battery charging temperature limits are specified in the Technical Data Sheet (refer to [Table A-2 on page A-3](#))

**Caution** When using the Automotive 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.

**Note** Anritsu Company recommends removing the battery for long-term storage of the instrument.

## 1-13 Soft Carrying Case

The instrument can be operated while in the soft carrying case. On the back of the case is a storage pouch for accessories and supplies. Inside the pouch is a D-ring that can be used to securely attach a small accessory.

To install the instrument into the soft carrying case:

1. The front panel of the case is secured with hook-and-loop fasteners. Fully close the front panel of the case. When closed, the front panel supports the shape of the case while you are inserting the BTS Master.
2. Place the soft carrying case face down on a stable surface, with the front panel fully closed and laying flat.
3. Fully open the zippered back of the case.

4. Insert the instrument face down into the case, taking care that the connectors are properly situated in the case top opening. You may find it easier to insert the connectors first, then pull the corners over the bottom of the BTS Master.



**Figure 1-2.** Soft Carrying Case

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

The soft carrying case includes a detachable shoulder strap, which can be connected to the D-rings on the corners of the case, as required for comfort or convenience. Using one upper corner and one lower corner holds the bottom of the instrument close to your chest and allows hands-free operation.

**Note**

Two zippers provide access around the back of the case. The zipper closer to the front of the case opens the case back, and allows access to install and remove the instrument. The 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 the instrument is in the case. The support panel angle is adjustable. This support panel also contains the storage pouch.

## 1-14 Tilt Bail Stand

The attached tilt bail can be used for desktop operation when the instrument is not installed in the soft case. The tilt bail provides a backward tilt for improved stability and air flow. To deploy the tilt bail, pull the bottom of the tilt bail away from the back of the instrument. To store the tilt bail, push the bottom of the bail towards the back of the instrument and snap the bail into the clip on the back of the instrument.



**Figure 1-3.** Tilt Bail Housed and Extended

## 1-15 Secure Environment Workplace

This section details the types of memory in the MT8220T, how to delete stored user files in internal memory, and recommended usage in a secure environment workplace.

### BTS Master Memory Types

The instrument contains non-volatile disk-on-a-chip memory, EEPROM, and volatile DRAM memory. The instrument is also supplied with an external USB flash drive. The instrument does not have a hard disk drive or any other type of volatile or non-volatile memory.

#### Disk-On-A-Chip (DOC)

DOC is used for storage of instrument firmware, factory calibration information, user measurements, setups, and .jpg screen images. User information stored on the DOC is erased by the master reset process described below.

#### EEPROM

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

#### RAM Memory

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

#### External USB Flash Drive

This memory may be selected as the destination for saved measurements and setups for the instrument. The user can also copy the contents of the internal disk-on-chip memory to the external flash memory for storage or data transfer. The external Flash USB can be reformatted or sanitized using software on a PC.

Refer to the [Chapter 4, “File Management”](#) for additional information on saving and copying files to the USB flash drive.

### Erase All User Files in Internal Memory

Perform a Master Reset:

1. Turn the instrument on.
2. Press the **Shift** button then the **System** (8) button.
3. Press the **System Options** submenu key.
4. Press the **Reset** submenu key, then the **Master Reset** key.
5. A dialog box will be displayed on the screen warning that all settings will be returned to factory default values and all user files will be deleted. This deletion is a standard file delete and does not involve overwriting exiting information.
6. Press the **Enter** button to complete the master reset.
7. The instrument will reboot and the reset is complete.



## Recommended Usage in a Secure Environment

The MT8220T does not currently provide a secure erase feature. In environments where data security is an issue, it is recommended that users store their BTS Master created files on an external USB Flash drive that is then securely retained, sanitized, or destroyed after use.

To set the BTS Master to save files to an external USB Flash drive:

1. Attach the external Flash drive and turn the instrument on.
2. Press the **Shift** button then the **File (7)** button.
3. Press the **Save** submenu key.
4. Press the **Change Save Location** submenu key, then select the USB drive using the rotary knob, **Up/Down** arrow keys, or the touchscreen.
5. Press the **Set Location** key.

The external USB drive is now the default location for saving files.

**Note**

For USB storage, not all after-market USB drives are compatible with the instrument. 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. Some drives can be made to work by reformatting them using the FAT32 format.



# Chapter 2 — Instrument Overview

## 2-1 Introduction

This chapter provides a brief overview of the Anritsu MT8220T BTS Master. The intent of this chapter is to acquaint the user with the instrument. To begin using the instrument immediately, go to [Chapter 3, “Quick Start”](#) to find directions explaining frequency, bandwidth, amplitude, limit line, marker, file management procedures, and firmware update. For more detailed information on measurement setups, refer to the specific measurement guides.

Measurement guides are available for Spectrum Analyzer mode, Cable & Antenna Analyzer mode, and the available measurement options which can be purchased for the instrument. The measurement guides and a copy of this user guide are available as PDF files on the Documentation disc or the Anritsu web site (<http://www.anritsu.com>). Refer to [Appendix A, “Related Documents”](#).

## 2-2 Hardware Overview

### Turning On the MT8220T for the First Time

The Anritsu MT8220T BTS Master is capable of approximately 2.5 hours of continuous operation from a fully charged, field-replaceable battery (refer to “[Battery Replacement](#)” on page 1-6). The MT8220T can also be operated from a 12 VDC source (which will also simultaneously charge the battery). This can be achieved with either the Anritsu AC Adapter or Automotive Adapter. Both items are included as standard accessories (refer to the list of accessories in the Technical Data Sheet).

**Caution**

When using the Automotive 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 MT8220T, press the **On/Off** button on the front panel ([Figure 2-1](#)).

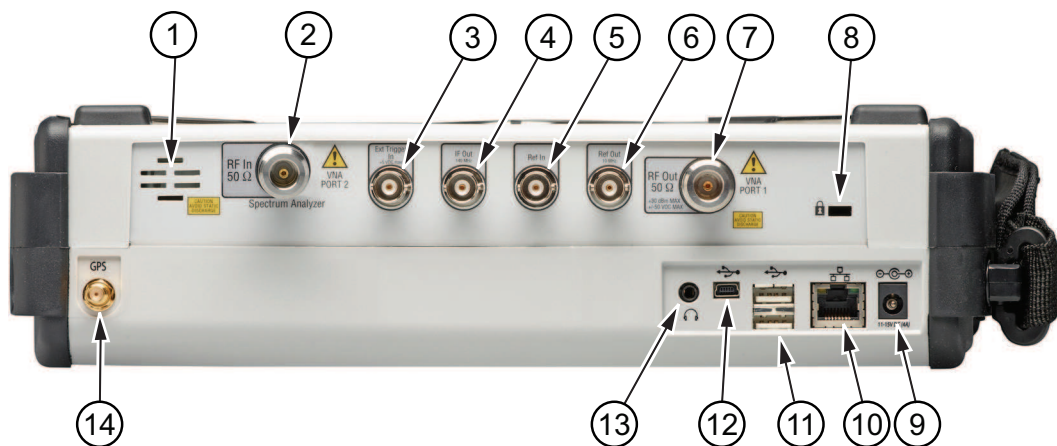


**Figure 2-1.** MT8220T On/Off Button

The MT8220T BTS Master takes approximately a minute to complete power-up and to load the application software. At the completion of this process, the instrument is ready to be used.

## 2-3 Test Panel Connectors

The test connector panel is shown in [Figure 2-2](#). The connectors are described in the following text.



1	Fan Exhaust Port
2	Spectrum Analyzer RF In / VNA PORT 2
3	Ext (External) Trigger In
4	IF Out (option) 140 MHz
5	Ref In
6	Ref Out 10 MHz
7	RF Output / VNA PORT 1
8	Attachment for Locking Hardware
9	External Power
10	LAN Ethernet
11	USB Interface, Type A
12	USB Interface, Type Mini-B
13	Headset Jack
14	GPS Antenna Connector

**Figure 2-2.** Test Panel Connectors for the MT8220T

### Spectrum Analyzer RF In / VNA PORT 2

This is a 50  $\Omega$  Type-N female connector. 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).

### Ext Trigger In

A TTL signal that is applied to the External Trigger 50  $\Omega$  female BNC input connector causes a single sweep to occur. In the Spectrum Analyzer mode, it is used in zero span, and can be used to cause triggering to occur on the selected edge of the signal, either rising or falling. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives. To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

### IF Out 140 MHz (Option 89)

This 50  $\Omega$  BNC connector is for Zero Span 140 MHz IF Output with Option 89. To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

### Ext Ref In

The External Reference In port is a 50  $\Omega$  BNC female connector that provides for input of an external frequency reference. Refer to your Technical Data Sheet for valid frequencies. To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

### Ref Out 10 MHz

The External Reference Out port is a 50  $\Omega$  BNC female connector that provides 10 MHz at approximately 0 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 Out / VNA PORT 1

This is a 50  $\Omega$  Type N female connector. 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).

### External Power

This is a 2.1 mm by 5.5 mm barrel connector, 12 to 15 VDC, < 5.0 A. The external power connector is used to power the unit and for battery charging. 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 Adapter, always use a three-wire power cable that is 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.

### LAN Connection

The RJ48C connector is used to connect the BTS Master to a local area network (LAN). 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. For additional information about the LAN connection, Ethernet connection, and DHCP, refer to [Appendix C, “LAN and DHCP”](#).

### USB Interface – Type A

The MT8220T BTS Master can also be a USB Host and allow power sensors and USB memory devices to be connected to the instrument for storing measurements, setups, and files.

### USB Interface – Type Mini-B

The 5-pin mini-B USB 2.0 interface can be used to connect the MT8220T BTS Master directly to a PC. The first time the MT8220T is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM that shipped with the instrument contains a driver for 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.

<b>Note</b>	For proper detection, Master Software Tools should be installed on the PC prior to connecting the BTS Master to the USB port.
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### Headset Jack

The 3-wire headset jack provides audio output from the built-in AM/FM/SSB demodulator and from other sounds generated by the instrument. The jack accepts a 3.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones.

### GPS Antenna Connector

The GPS antenna connection on the BTS Master is type SMA(F). Selectable +3 VDC or +5 VDC antenna power. 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).

The MT8220T BTS Master includes a passive GPS antenna (2000-1733-R) which can be connected for acquiring GPS location data.

## 2-4 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

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.
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.



## 2-5 Front Panel Overview

The BTS Master menu-driven interface is easy to use and requires little training.



1, 11	Fan Ports
2	Instrument Settings Summary (menu shortcuts)
3	Touch Screen Submenu Keys (Active Menu or Active Function Block)
4	Menu Button
5	Speaker
6	Power LED and Battery Charge LED
7	On/Off Button
8	Enter Key and Arrow Keys
9	Rotary Knob
10	Number Keypad (includes Shift and Esc)
12	Touch Screen Main Menu Keys

**Figure 2-3.** Front Panel Overview for the MT8220T

## Front Panel Hardware

A rotary knob and buttons (hard keys) are located to the right of the measurement display. See [Figure 2-3](#). Ten of the hard keys (0 through 9) are dual purpose, depending upon the current mode of operation, and these dual-purpose keys (0 through 9) are labeled with a number on the key itself and the alternate function printed above each number. Use the **Shift** key to access the alternate functions that are printed on these keys. For example, use the **Shift** key plus the **0** (zero) key for “[Touch Screen Calibration](#)” on [page 2-14](#).

The Escape key (**Esc**) is used for aborting data entry and is located beside the **Shift** key, just above the numbered keys. The rotary knob, the four **Arrow** keys, and the keypad can be used to change the value of an active parameter.

<b>Note</b>	Some alternate functions are not applicable to specific measurement modes. The Cal (Calibration) alternation function (Shift-2) is only applicable in Cable & Antenna mode.  Refer to the applicable Measurement Guide listed in <a href="#">Appendix A, “Related Documents”</a> .
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### Battery Charge LED (Green)

The Battery Charge LED is located above the **On/Off** button. It remains on steady when the battery is fully charged, and blinks slowly when the battery is charging.

### Power LED (Green)

The Power LED is located above the **On/Off** button. It remains on steady when the BTS Master is on, and blinks slowly when the BTS Master is off but has external power.

### Fan Inlet and Exhaust Ports

Keep the fan inlet and exhaust ports clear of obstructions at all times. This important for proper ventilation and cooling of the instrument. For port locations, refer to [Figure 2-3](#).

### Connector Panel

The top panel of connectors is described in [Section 2-3 “Test Panel Connectors”](#) on [page 2-3](#). Recommendations for use and care of the connectors are described in [Section 2-4 “Connector Care”](#) on [page 2-6](#).

## Front Panel Keys

The term hard key refers to each of the buttons on the instrument face and not to the touch button images on the display screen (the submenu touch keys, the main menu touch keys, and icons that are provided for touch screen navigation). The front panel keys perform as follows:

### Menu Key

Press this key to display shortcut icons for the installed instrument modes and also for any additional shortcuts that have been added by a user of the instrument. Refer to “[Menu Key](#)” on [page 2-11](#) for additional information.

### Enter Key

Press this key to finalize data input.

### Arrow Keys

The four arrow keys are used to scroll up, down, left, or right. Depending upon instrument mode and measurement selection, 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. In some measurements, the **Left/Right** arrow keys change values by different increments than the **Up/Down** arrow keys or the rotary knob. The arrow keys also can be used to move markers.

### Rotary Knob

Turn the rotary knob to change numerical values, to scroll through selectable items within a list, and to move markers. Values or items may be within a dialog box or an edit window.

### Shift Key

Press the **Shift** key and then press a number key to open the menu that is printed above the number. Press **Shift** then **0** (zero) for “[Touch Screen Calibration](#)”, which is described [on page 2-14](#). Press three keys, **Shift**, then **Decimal**, then **+/-**, to save a JPEG image of the current display screen. The filename will be based on the current date and time. The file is saved to the root directory of the internal memory.

When the **Shift** key is active, its icon is displayed at the top-right corner of the measurement display area between the battery charge indicator and the submenu label ([Figure 2-4](#)).



**Figure 2-4.** Shift Key Icon

### Esc Key

Press this key to cancel any setting that is currently being made.

### Number Keypad

Press these keys to directly input numbers, including a decimal point. A secondary function of the number keys opens menus.

### Decimal Key

Press this key when entering decimal values.

### +/- Key

Press this key to change the sign of numbers that are entered with the number keys. Press three keys, **Shift**, then **Decimal**, then **+/-**, to save a JPEG image of the current display screen.

## 2-6 Touch Screen

The touch screen and keypad are used for data entry. The sweep window and surrounding screen areas provide measurement information.

### Graphical User Interface (GUI)

The measurement display, or sweep window, provides measurement trace data. Above the grid and trace data, additional measurement data is displayed, and the analyzer mode is shown in the top-right corner. The lower area of the grid may be reduced in size to display an optional data window, such as a table of measurement data or marker data. To the left of the grid and trace data is the instrument settings summary, below are the five main menu touch keys, and to the right are the submenu touch keys.

The two sets of touch buttons are available in all analyzer Modes. The five main menu touch keys and the bottom of the screen and (up to) eight submenu touch keys on the right side of the display provide control of measurement settings. In addition, you can touch other areas of the display screen to perform tasks that are also available from the menu keys.

For example:

- In Spectrum Analyzer mode, if you touch the RBW setting on the left side of the display (Instrument Settings Summary), then the bandwidth menu (BW) is displayed.
- If you place a marker on the screen, then you can touch the measurement trace or drag the marker to relocate. (Not available in all measurement modes.)
- If you touch the file type list box in one of the file management dialog boxes, then you can open the Filetype drop-down list to select a file type.
- If you touch the upper-right corner of the display screen in Spectrum Analyzer mode (near where the instrument displays “Spectrum Analyzer” on the screen), then the active measurement menu is displayed. If there is no active measurement, then the measurement menu is displayed (this is a shortcut, rather than pressing the **Shift** and **Measure (4)** keys).

### Main Menu Touch Screen Keys

The five main menu touch keys vary in function depending upon the selected mode of instrument operation.

These five main menu keys are arranged horizontally along the lower edge of the touch screen. The main menu key functions change to match specific instrument Mode settings. The main menu keys generate function-specific submenus. The various measurement modes are selected by pressing the **Shift** key and then the **Mode (9)** key. Descriptions of the various measurement modes can be found in the applicable Measurement Guides that are listed in [Appendix A, “Related Documents”](#). For more details about the Mode settings, refer to section “Mode Selector Menu” on page 2-16.

Available measurement modes are based on model and options purchased. Refer to [Table 1-1 on page 1-2](#) for additional information.

### Submenu Touch Screen Keys

The submenu touch keys are located in the active function block (submenu key labels) along the right edge of the display. The submenu labels change as instrument measurement and parameter settings change. The current submenu title is shown at the top of the submenu key block. An example of the keys is shown in [Figure 2-3](#).

Additional details are described in [Section 2-10 “Display Overview”](#) on page 2-18.

### Menu Key

Press the **Menu** key to display a grid of shortcut icons for installed measurement modes and user-selected menus and setup files.

[Figure 2-5](#) shows the **Menu** key screen with shortcut icons for the installed measurement modes. Touch one of the icons in the top rows to change modes. These icons appear when the associated applications or options are installed and enabled. They cannot be moved or deleted. The display of the Menu screen will vary depending on the Spectrum Master model, firmware version, and installed options.



**Figure 2-5.** Menu Screen, Icons for Installed Measurements

#### Note

The display of the Menu screen varies depending on the installed options.  
Only the **Esc** key and the onscreen icons are functional in the menu screen.

Figure 2-6 shows the **Menu** key screen with shortcut icons for the installed measurement modes and four rows of user-defined shortcuts to menus and setup files.

Press and hold down any key for a few seconds to add a shortcut to this screen. For example, to create a shortcut for setup files (.stp), open the recall menu and hold down on the file name for several seconds. Then select the location for the shortcut.



Figure 2-6. Menu Screen, Shortcuts Added

User-defined shortcuts are saved until deleted. To delete or move a shortcut button, press the **Menu** key, then press and hold the shortcut for approximately 3 seconds. The Customize Button dialog box opens to allow a button to be deleted or moved. Press **Esc** to exit the Menu shortcut display.

**Note** The Factory Default reset will delete all user created shortcut icons from the Menu screen. Refer to the “Reset Menu” on page 5-9 for additional information.

Help for the Menu shortcut screen is available by pressing the question mark icon in the lower-right corner of the display.

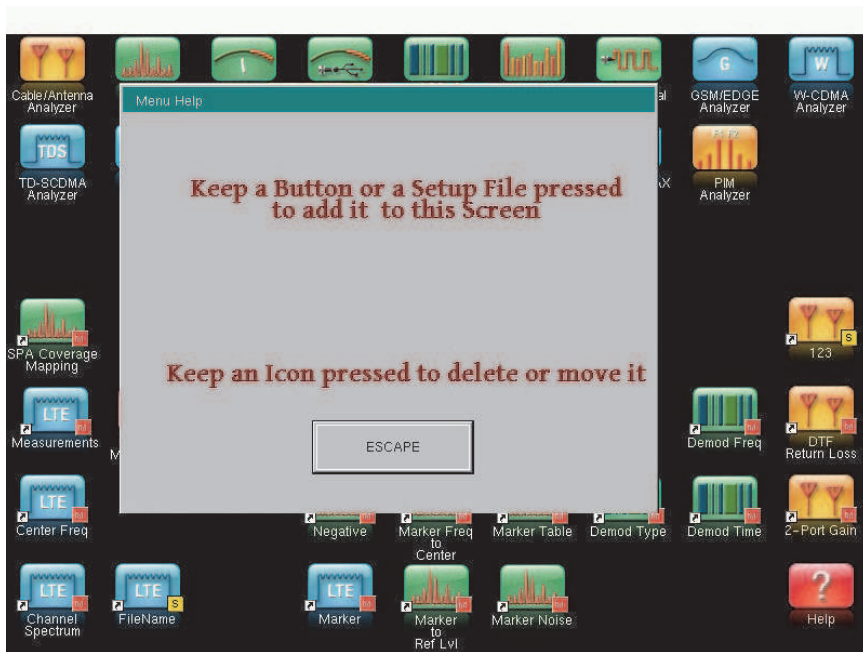


Figure 2-7. Menu Shortcut Help

## 2-7 Touch Screen Calibration

The Calibrate Touch Screen submenu key is in the “System Menu” on page 5-4. When pressed, the touch screen calibration message box is displayed with instructions for calibration. Calibration optimizes the response of touch input. You touch targets in sequence as they are displayed on the touch screen. This requires less than one minute.

Calibration is recommended if your touch inputs do not correspond to the appropriate locations on the screen. After the information box is displayed, press **Enter** to begin calibration, or press **Esc** to cancel.

You can also press **1** to use arrow navigation.

### Calibrate Touch Screen Shortcut

You can access touch screen calibration by pressing **Shift** then **0** (zero). This displays the touch screen calibration message box. Press **Enter** to begin calibration, or press **Esc** to cancel. This shortcut can be used if your touch inputs do not correspond to the appropriate locations on the screen to such an extent that you cannot access the Calibrate Touch Screen submenu key.

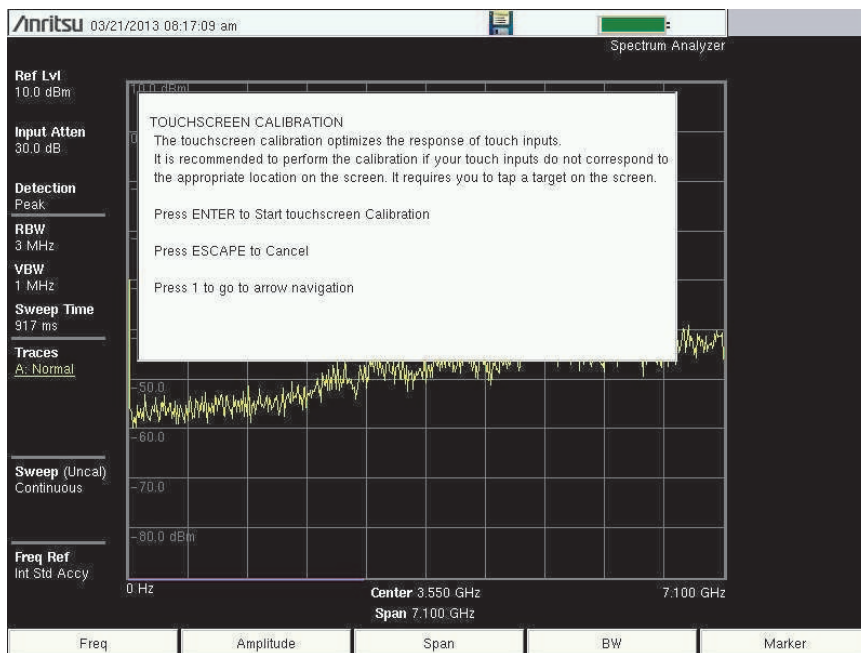


Figure 2-8. Touchscreen Calibration Help

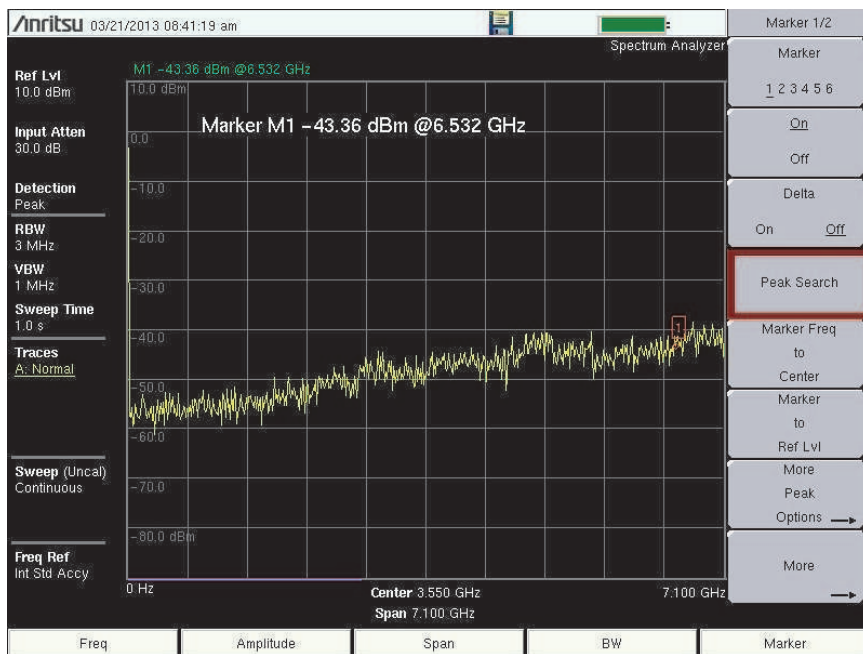


## Disable Touch Screen to Use Arrow Navigation

If the touch screen is not functioning, you can use Arrow Navigation to simulate pressing the touch screen main menu keys and submenu keys. From the touch screen calibration message box, press **1** to use arrow navigation. This displays the arrow navigation message box. Press **1** again to enter the arrow navigation mode, or press **Esc** to cancel.

In arrow navigation mode, a red selection box surrounds a key (see [Figure 2-9](#)). Use the **Arrow** keys above the number keypad to move the red selection box. Then press the **Menu** key to activate the selected touch screen key. Note that only the main menu keys and submenu keys can be activated using Arrow Navigation. This feature does not move the red selection box into other areas of the touch screen.

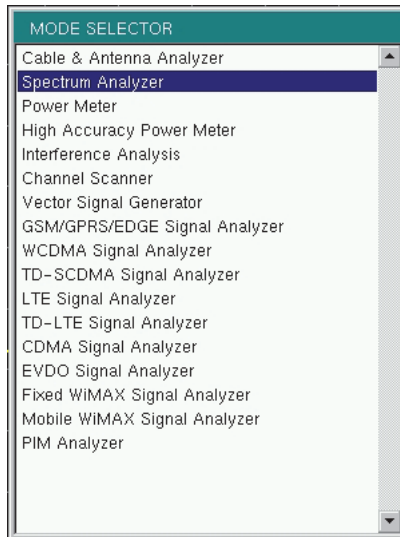
To return to normal touch entry mode, reboot the instrument (turn power Off and then On). If your touch screen has been damaged, then refer to [Section 1-2 “Contacting Anritsu”](#) on page 1-1.



**Figure 2-9.** Arrow Navigation Example

## 2-8 Mode Selector Menu

To access the functions under the Mode menu, press the **Shift** key, then the **Mode (9)** key. Use the directional arrow keys, rotary knob, or touch screen to highlight the selection, and press the **Enter** key to select. The list of modes that appears in this menu will vary depending upon the options installed in the instrument. This is an alternate method of selecting an instrument mode (see [Figure 2-5 on page 2-11](#) for a description of the Menu Key screen). [Figure 2-10](#) is an example of the Mode menu. Your instrument may not show the same list.



**Figure 2-10.** Mode Selector Menu

## 2-9 Secondary Function Menus

Pressing the **Shift** key and then a number key selects the menu function that is printed above the number key (Figure 2-11).



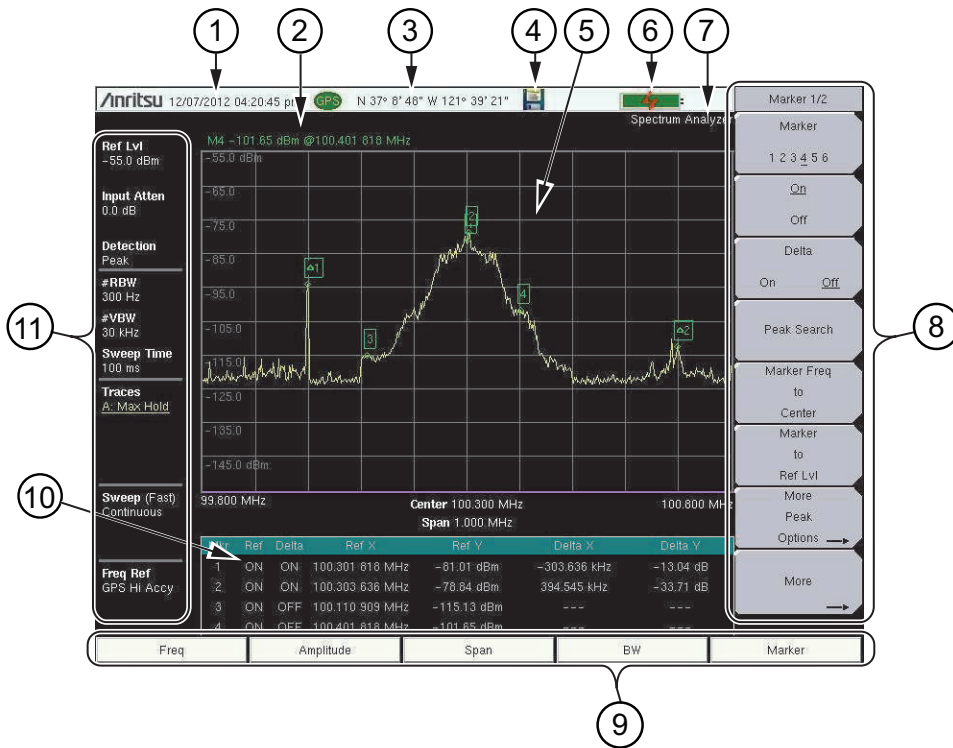
**Figure 2-11.** Keypad and Secondary Function Menus

Not all Secondary Function Menus are active in various operation modes. If any one of these ten menus is available in a specific instrument mode of operation, then it can be called from the number keypad. It may also be available from a main menu key or a submenu key. The Secondary Function Menus are: Touch (0), Preset (1), Calibrate (2), Sweep (3), Measure (4), Trace (5), Limit (6), File (7), System (8), and Mode (9).

**Note** Shift plus Touch (0) is for “Calibrate Touch Screen Shortcut” on page 2-14.

## 2-10 Display Overview

A typical measurement display is shown in Figure 2-12.



1	Real Time Clock
2	Data Summary, Active Marker Values
3	Current Location Data, Latitude and Longitude Using GPS
4	Shortcut to the Save Submenu
5	Measurement Display or Measurement Grid or Sweep Window
6	Battery Charge Indicator
7	Instrument Mode (shortcut to Current Measurement Submenu)
8	SubMenu Keys or Active Function Block
9	Main Menu Keys
10	Optional Data Window (also location of Marker Table)
11	Instrument Settings Summary (shortcuts to Menus and Submenus)

Figure 2-12. Spectrum Analyzer Display Example

**Note** The images shown in this manual may differ from images displayed on the actual instrument.

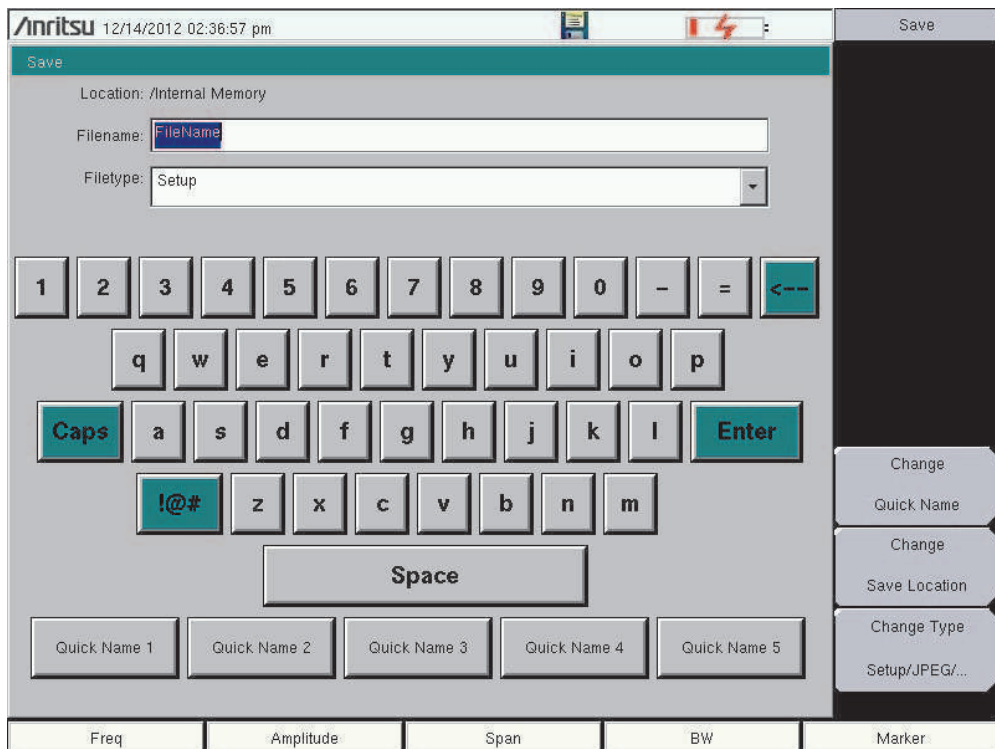
## 2-11 Data Entry

### Numeric Values

Numeric values are changed using the rotary knob, arrow keys, or the keypad. Pressing one of the main menu keys displays a list of submenus on the right side of the touch screen. When the value on a submenu key is displayed in red it is ready for changing. When using the rotary knob or arrow keys, the changing value is shown on the submenu and in the sweep window. When using the keypad, the new value is shown in the sweep window, and the submenu changes to Units. Selecting a unit for the new value completes the entry.

### Text Entry

When entering text (as when saving a measurement), the touch screen keyboard is displayed ([Figure 2-13](#)). Characters are entered directly with the touch screen keyboard. The keypad can be used for numeric entry. The left and right arrow keys scroll the cursor through the text. Refer to [“Save Menu” on page 4-9](#) for additional information.



**Figure 2-13.** Touch Screen Keyboard for Saving a Measurement

## Parameter Setting

Pop-up list boxes or edit 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 **Enter** key. At any time before finalizing the input, press the escape (**Esc**) key to abort the change and retain the previously existing setting.

Some parameters (such as for antennas or couplers) can be added to list boxes by creating them and importing them through the use of Master Software Tools.

## 2-12 Symbols and Indicators

The following symbols and indicators convey the instrument status or condition on the display.

### Battery Symbol:

The battery symbol above the display indicates the charge remaining in the battery. The colored section inside the symbol changes size and color with the charge level.



**Figure 2-14.** Battery Status

**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 0% to 10% charged

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

When the battery is charging, the symbol changes to that shown in [Figure 2-15](#):



**Figure 2-15.** Battery Charging Status

The Battery Charge LED (refer to [Figure 2-3 on page 2-7](#)) flashes when the battery is charging, and remains on steady when the battery is fully charged.

**Caution** Use only Anritsu-approved batteries, adapters, and chargers with this instrument.

The battery symbol is replaced by a red plug body to indicate that the instrument is running from external power and is not charging the battery (or to indicate that the battery is not present). When the external AC adaptor is connected, the battery automatically receives a charge, and the battery symbol with the lightning bolt is displayed (Figure 2-15). When the battery is not installed, the red plug body is displayed, as shown in Figure 2-16. If the battery is installed but has lost communications with the instrument, then the battery charge indicator will not be shown.



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**Figure 2-16.** Battery Not Installed or Not Charging

### Storage Icon



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**Figure 2-17.** Storage Icon

This shortcut to the “[Save Menu](#)” on page 4-9 is an image of a 3.5 inch floppy disk drive (FDD). It is equivalent to pressing **Shift** and **File (7)**, then **Save**.

The icon is located between GPS data and the battery symbol at the top of the display screen. Touch the icon to display the Save menu and the touch screen keyboard used for saving measurements, setups, limit lines, or screen display JPEG files (see [Figure 4-1](#), “[Save Dialog Box](#)” on page 4-3).





# Chapter 3 — Quick Start

## 3-1 Introduction

This chapter is intended to assist you in your first use of the MT8220T BTS Master. The purpose of this chapter is to provide a starting point for basic measurement setups. This chapter describes general instrument setup, including: instrument mode, frequency, bandwidth, amplitude, span, limit lines, and markers. After measurements are taken, refer to [“Managing Files” on page 4-1](#) for a description of saving, recalling, and deleting measurement files. For more detailed information about specific measurements, refer to the measurement descriptions in the measurement guides for the specific instrument mode and analyzer technology (such as Cable & Antenna, Spectrum Analyzer, WiMAX, or 3GPP). Refer to [Appendix A, “Related Documents”](#), for a list of these measurement guides and their Anritsu part numbers.

An example of a measurement available with Option 25, Interference Analyzer is shown in [Figure 3-1](#). The spectrogram displays power at frequency for a specified time period. Refer to the Spectrum Analyzer Measurement Guide for additional information.

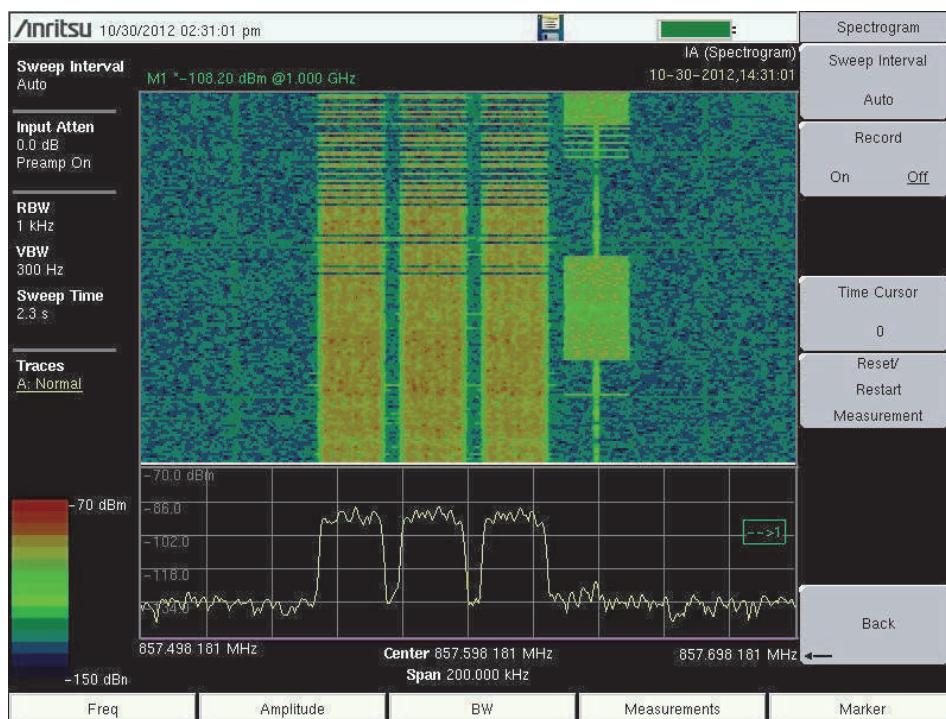


Figure 3-1. Spectrogram Example

## 3-2 Measurement Setup

### Connect the Input Source

Connect the input signal or antenna to the RF In connector on the top of the instrument. For connector descriptions, refer to [Figure 2-2 on page 2-3](#).

### Editing and Entering Values

- Parameter values that are ready for editing are displayed in red on the submenu key. After changing the value, press **Enter** or the appropriate unit terminator key to set the new value.
- Some submenu keys have toggled parameter values (On / Off, Low / High, On/Large/Off). On these submenu keys, the current value is underlined. Press the submenu key to toggle the value.
- Use the **Arrow** keys, numeric keypad, or rotary knob to change submenu key values, to select list box options, or to enter filenames.

### Selecting the Analyzer Mode

The instrument Analyzer Modes are also referred to as Measurement Modes or Applications. To switch to a different mode:

1. Press the **Menu** button on the instrument front panel.
2. Press the desired screen icon. Refer to “[Menu Key](#)” on page 2-11.

Alternatively, you can:

1. Press **Shift** followed by the **Mode (9)** key on the numeric keypad to display the Mode Selector list of installed applications (refer to “[Mode Selector Menu](#)” on page 2-16).
2. Use the directional **Arrow** keys or the rotary knob to highlight the desired mode. The left and right **Arrow** keys skip to the top and bottom of the list, respectively.
3. Press **Enter**.

To exit without changing the selection, press **Esc**.

## 3-3 Set the Measurement Frequency

### Using Start and Stop Frequencies

The submenu keys and the frequency settings are displayed on the left and right edges of the graph in the seep window.

1. Press the **Freq** main menu key.
2. Press the Start Freq submenu key.
3. Enter the desired start frequency. When entering a frequency by using the keypad, the submenu key labels change to frequency units: GHz, MHz, kHz, and Hz. Press the appropriate unit key. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.
4. Press the Stop Freq submenu key.
5. Enter the desired stop frequency.

### Entering Center Frequency

1. Press the **Freq** main menu key.
2. Press the Center Freq submenu key. This key is usually selected automatically.
3. Enter the desired center frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency by using the keypad, the submenu key labels change to frequency units: GHz, MHz, kHz, and Hz. Press the appropriate unit key. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.

### Selecting Signal Standard

1. Press the **Freq** main menu key.
2. Press the Signal Standard submenu key. The Signal Standards dialog opens. You can enter channel numbers instead of frequencies.
3. Highlight a signal standard and press **Enter** or the rotary knob to select.
4. Press the Channel submenu key to change the channel value in the Channel Editor.

<b>Note</b> The signal standards list can be updated via Master Software Tools.
---

### Setting Measurement Frequency Bandwidth

#### Spectrum Analyzer and Interference Analysis Mode

1. Press the **BW** main menu key to display the BW menu.
  - Press the RBW or the VBW submenu key (or both) to manually change values.
  - Set RBW and VBW automatically by pressing the Auto RBW submenu key or the Auto VBW submenu key.
2. Press the VBW/Average Type submenu key to toggle between Linear averaging (arithmetic mean) and Logarithmic averaging (geometric mean).

3. Press the RBW/VBW submenu key to change the ratio of resolution bandwidth to video bandwidth.
4. Press the Span/RBW submenu key to change the ratio of span width to resolution bandwidth.

## 3-4 Set the Amplitude

Press the **Amplitude** main menu key to display the Amplitude menu.

### Setting Amplitude Reference Level and Scale

#### Spectrum Analyzer and Interference Analysis Modes

To change the current measurement units, press the **Units** submenu key and select the required units from the submenu keys that are presented. Press the **Back** submenu key to return to the Amplitude menu.

1. Press the **Reference Level** submenu key and use the **Up/Down** arrow keys or the keypad to change the reference level. Press **Enter** to set the reference level value.
2. Press the **Scale** submenu key and use the **Up/Down** arrow keys or the keypad to enter the desired scale. Press **Enter** to set the scale value.

**Note** The Scale parameter cannot be changed when linear units are selected (Watts or Volts).  
Press the Amplitude submenu key and select Auto Atten coupling of the attenuator setting and the reference level to help ensure that harmonics and spurs are not introduced into the measurements. Attenuator Functions are described in the Spectrum Analyzer Measurement Guide.

### Setting Amplitude Range and Scale

This setting applies to most demodulator modes of instrument operation. The Spectrum Analyzer mode and Cable & Antenna modes has no equivalent to Auto Range. For other analyzer modes, consult the individual measurement guides in [Appendix A](#).

1. Press the **Adjust Range** submenu key to set an optimal reference level based on the measured signal.

To have the instrument continually set the optimal reference level, press the **Auto Range** submenu key so that On is selected.

2. Press the **Scale** submenu key.
3. Enter the desired scale units by using the keypad, the **Arrow** keys, or the rotary knob. Press the **Enter** key to set. The y-axis scale is automatically renumbered.

## Reference Level Offset for External Loss or External Gain

To obtain accurate measurements, compensate for any external attenuation or gain by using the **RL Offset** submenu. The compensation factor is in dB. External attenuation can be created by using an external cable or an external high power attenuator, external gain is typically from an amplifier.

To adjust the reference level for either gain or loss, press the **RL Offset** submenu key and enter a positive dB value and then press the appropriate submenu key (**dB External Gain** or **dB External Loss**). The new **RL Offset** value will be displayed on the instrument and reference level is adjusted.

## 3-5 Set the Span

### Spectrum Analyzer, Interference Analysis, and Power Meter Modes

1. Press the **Span** main menu key or press the **Freq** main menu key followed by the **Span** submenu key.
2. To select full span, press the **Full Span** submenu key. Selecting full span overrides any previously set **Start** and **Stop** frequencies.
3. For a single frequency measurement, press the **Zero Span** submenu key.

<b>Note</b>	To quickly move the span value up or down, press the <b>Span Up 1-2-5</b> or <b>Span Down 1-2-5</b> submenu keys. These keys facilitate a zoom-in, zoom-out feature in a 1-2-5 sequence.
-------------	--

## 3-6 Setting Up Limit Lines

Press the **Shift** key then the **Limit (6)** key on the numeric keypad to display the Limit menu.

### Simple Limit Line

#### Spectrum Analyzer and Interference Analysis Modes

1. Press the **Shift** key and then the **Limit (6)** key.
2. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
3. Activate the selected limit line by pressing the On Off submenu key so that On is underlined.
4. Press the Limit Move submenu key to display the Limit Move menu. Press the Move Limit submenu key to adjust the limit line.
5. Press the Back submenu key to return to the Limit menu.
6. If necessary, press the Set Default Limit submenu key to redraw the limit line in view.

### Limit Line Envelope

#### Spectrum Analyzer and Interference Analysis Modes

1. Press the **Shift** key and then the **Limit (6)** key.
2. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
3. Press the Limit Envelope submenu key to display the Limit Envelope menu.
4. Press the Create Envelope submenu key to create an envelope around the measurement.
5. Press Upper Points or Lower Points submenu key to change the number of segments in the envelope.
6. Press the Upper Shape or Lower Shape submenu key to toggle between square and sloped limit envelope.
7. Adjust the Upper or Lower Offset to move the limit line closer to (a smaller value) or further away from the trace.

### Complex Limit Lines

#### Spectrum Analyzer and Interference Analysis Modes

When building some complex limit lines, you can create either the right or left half of the limit line and then build the remainder by pressing the **Limit Advanced** submenu key and then pressing the **Limit Mirror** submenu key. The complete set of Limit menus is described in the Spectrum Analyzer Measurement Guide (refer to [Appendix A](#)).

## 3-7 Setting Up Markers

Press the **Marker** main menu key to display the Marker menu. See [Figure 3-2](#). Touch a marker number or the Marker button to activate that marker. After a marker is active, other submenu keys can be used to place the marker. Refer to the Measurement Guides in [Appendix A](#) for more details.

1. Press the **Marker** submenu key. Press the desired marker number. The selected marker number is displayed in the sweep window and is also underlined on the Marker submenu key.
2. Press the **On Off** submenu key (if necessary) so that **On** is underlined. The selected marker is displayed in red, ready to be moved.
3. Use the rotary knob, an **Arrow** key, or the touch screen to place the marker on the desired frequency.

Note that when a marker is active, you can drag your finger across the sweep window horizontally (at any level) to move the marker. Also, when a marker is active and the Marker menu is displayed, you can type a frequency to place the active marker at a point of interest.

4. Press the **Peak Search** submenu key to move the active marker to the highest signal amplitude that is currently displayed on screen. For additional marker movements, press the **More Peak Options** submenu key. Refer to the Spectrum Analyzer Measurement Guide for more details.
5. Repeat [Step 1](#) and [Step 2](#) to activate and move multiple markers.

### Selecting, Activating, and Placing a Delta Marker:

When a delta marker is On, its position data is relative to its reference marker. For example, Delta Marker 3 displays x-axis and y-axis data relative to Marker 3. This reference relationship differs when using the “[Marker 1 Reference](#)” submenu key as described on [page 3-8](#).

1. Press the **Marker** submenu key and then select a marker in the list box.
2. Press the **Delta On Off** submenu key so that **On** is underlined. The selected marker is displayed in red, ready to be moved.
3. Use the rotary knob, **Arrow** keys, touch screen, or the numeric keypad to place the delta marker on the desired offset frequency from the associated reference marker.
4. Repeat [Step 1](#) and [Step 2](#) to activate and move multiple delta markers.

## Viewing Marker Data in a Table Format

1. Press the More submenu key.
2. Press the Marker Table submenu key so that On is underlined. All marker data and delta marker data are displayed in a table under the measurement graph. If Marker Table is set to Large, then the table has room for only the x-axis and y-axis data for one marker, which is the active marker. Select another marker to view its values in the large table.

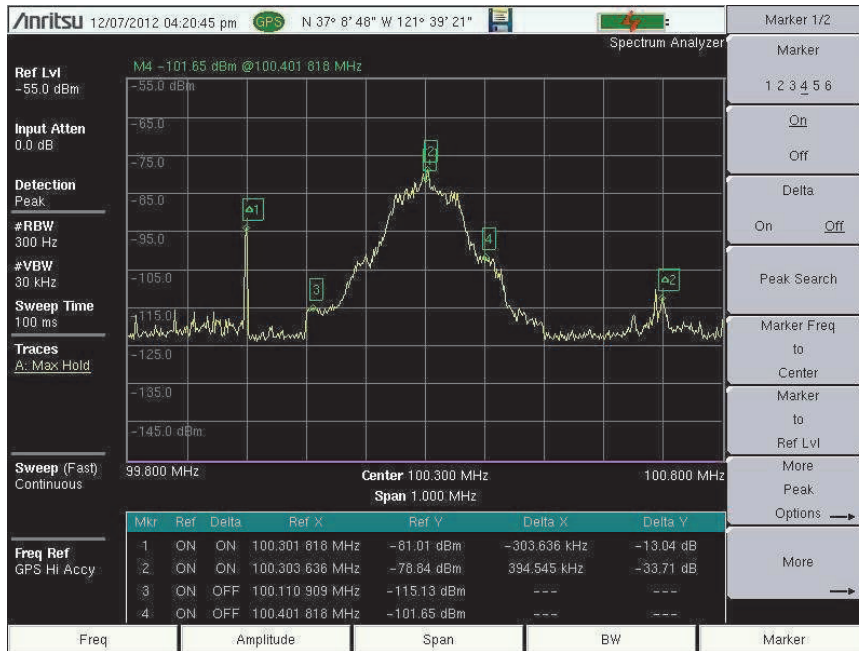


Figure 3-2. Markers with Table

### Marker Table Set to Large

To change the marker that is displayed in the large marker table, make another marker active by selecting it in the Marker Selection box.

If you want to make a delta marker active without changing its location, first select its reference marker. The Delta submenu key will have **On** underlined, indicating that the delta marker is in use. Press the Delta key once. The delta marker will remain On, its position will not change, it will become the active marker, and its x-axis and y-axis data will then be displayed in the large Marker Table.

### Marker 1 Reference

The Marker 1 Reference submenu key is in the Marker (2/2) menu. When turned On, this feature sets reference Marker 1 to On, and turns On all six delta markers in positions relative to Marker 1. These six positions are spaced evenly across the current measurement span.

This feature is useful for examining measurement events such as spurs, harmonics, and phase noise.



## 3-8 Selecting a Measurement Type

1. Change the measurement mode (if required). Press **Shift** then **Mode (9)**. Use the directional arrow keys, rotary knob, or touch screen to highlight the selection, and press the **Enter** key to select.
2. Select the measurement type. Press **Shift** then **Measure (4)**. Select the appropriate measurement type with the submenu key.

## 3-9 Saving Measurements

1. Press **Shift** then **File (7)**.
2. Press the Save Measurement submenu key.
3. Press the Change Save Location submenu key and set the current location to be the USB flash drive or internal memory. Then press **Set Location**.
4. Press Change Type (Setup/JPEG/...) and select Measurement.
5. Enter the file name using the letter key and press **Enter**.

Refer to [Chapter 4, “File Management”](#) for additional information. The Save on Event submenu key is described in the [“File Menu” on page 4-8](#).

## 3-10 Anritsu PC Software Tools

Anritsu Master Software Tools and Line Sweep Tools are Microsoft Windows compatible programs for transferring and editing saved measurements, markers, and limit lines to a PC. Refer to [Chapter 7, “Anritsu Tool Box”](#) for an overview of the software.



# Chapter 4 — File Management

## 4-1 Introduction

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

## 4-2 Managing Files

Press the **Shift** key then the **File (7)** key on the numeric keypad to display the **File** menu. The following steps describe file management.

<b>Note</b>	When navigating through the <b>File</b> menu, pressing the <b>Esc</b> key returns the menu display to the previous menu.
-------------	--

### File Types

In the Save, Recall, Copy, and Delete menus, a submenu key is used to select the type of files to be managed. The **Change Type Setup/JPEG/...** and **File Type ALL** submenu keys open the Select File Type list box, which displays all of the file types that can be selected in the current instrument mode.

The Select File Type list box may contain some of the following entries:

- ALL (displays all file types)
- Setup, \*.stp  
(Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.)
- Measurement, \*.vna, \*.spa, \*.pm, \*.ia, \*.cs, \*.edg, \*.wcd, \*.tds, \*.lte, \*.tdlte, \*.cdma, \*.evdo, \*.wmx, \*.wmxe, \*.pim  
(Measurement files contain all of the information in the setup files and the measurement data.)
- JPEG, \*.jpg
- Limit Lines, \*.lim  
(The Limit line file contains limit line data details.)
- Mapping Tab Delimited, \*.mtd
- KML 2D, \*.kml
- KML 3D, \*.kml

You can also use the touch screen to open the drop down list for the Filetype entry box, as shown in [Figure 4-1 on page 4-3](#), [Figure 4-2 on page 4-4](#), [Figure 4-3 on page 4-5](#), and [Figure 4-4 on page 4-6](#).

**Setup:** Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.

**Measurement:** Measurement files contain all of the information in the setup files and the measurement data.

**Limit Lines (.lim):** The Limit line file contains limit line data details.

**ALL:** Displays all file types.

## Saving Files

The submenu keys that are available for file management may vary with instrument options and analyzer modes.

### Set the Save Location

Press the **Save** submenu key then the **Change Save Location** key and select the location to save files (refer to [“Save Location Menu” on page 4-10](#)). 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** submenu key to store the save location.

### Save a Measurement As

The **Save Measurement As** submenu key is used to quickly save measurements with a specific file name. The BTS 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 ACPR, pressing **Save Measurement As** saves the next measurement as ACPR\_#1, ACPR\_#2, and so forth. The file name that is used can be changed by using the **Save** dialog box ([Figure 4-1](#)).

### Save a Measurement

Press the **Save Measurement** submenu key and enter the name for the measurement file. The file type defaults to measurement, and the appropriate extension is added based on the current measurement mode. For more information about file types, refer to [“File Types” on page 4-1](#).

### 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** submenu key or the touchscreen, and then press **Enter** to save.

<b>Note</b>	A setup also can be saved and recalled from the Preset menu.
-------------	--

### Create a Menu Shortcut for a Setup file

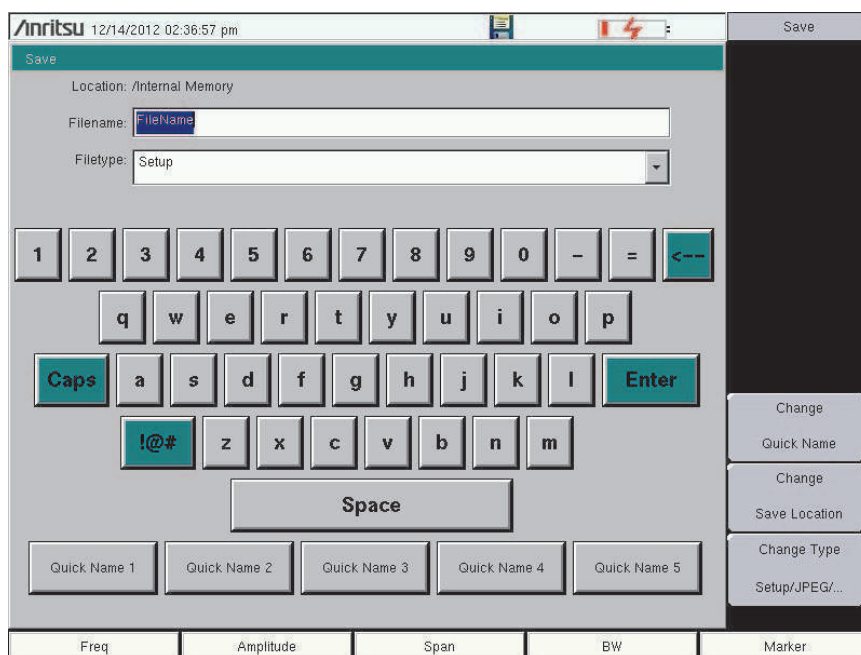
Press the **Recall** submenu key to display saved setup files. Locate the setup file to be the shortcut and then press and hold on the file name (on the touchscreen) for a few seconds. Select a location in the shortcut grid to save the setup file. The shortcut grid is for the touchscreen shortcut buttons that are displayed by pressing the **Menu** key.

### 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 4-1](#)) is used to store files on the internal memory or an external flash drive. The file type, file name, and save location are set at this display. Refer to “[Save Menu](#)” on page 4-9 and “[Save Location Menu](#)” on page 4-10 for details.



**Figure 4-1.** Save Dialog Box

### Quick Name Keys

Quick Name keys below the keyboard in [Figure 4-1](#) allow users to enter quick names for frequently used file measurement names. To edit the keys, press the **Shift** key, then the **File (7)** key. Press **Save** then the **Change Quick Name** key, select one of the Quick Names for editing, press **Enter** and enter the new name for the key. Press **Enter** again and the new name will be displayed on the key.

## Recalling Files

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

You can sort files in the recall menu by name, date, or type. You can also choose to view only measurement files or only setup files by pressing **File Type** on the Recall dialog box and by selecting the file type that you want to view. For more information about file types, refer to “[File Types](#)” on page 4-1.

### Recall a Measurement

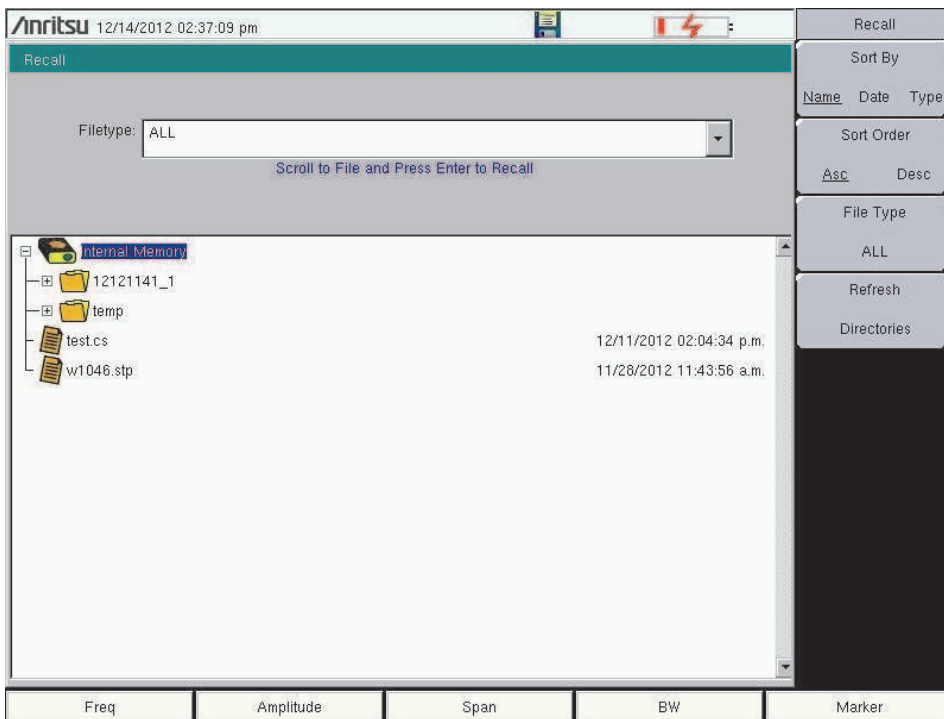
From the **File** menu, press the Recall Measurement submenu key, select the measurement with the touchscreen, rotary knob, or the **Up/Down** arrow keys, and then press **Enter**.

### Recall a Setup

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

## Recall Dialog Box

The Recall dialog box ([Figure 4-2](#)) allows you to open previously saved measurements and setups. Refer to the “[Recall Menu](#)” on page 4-12 for additional information.

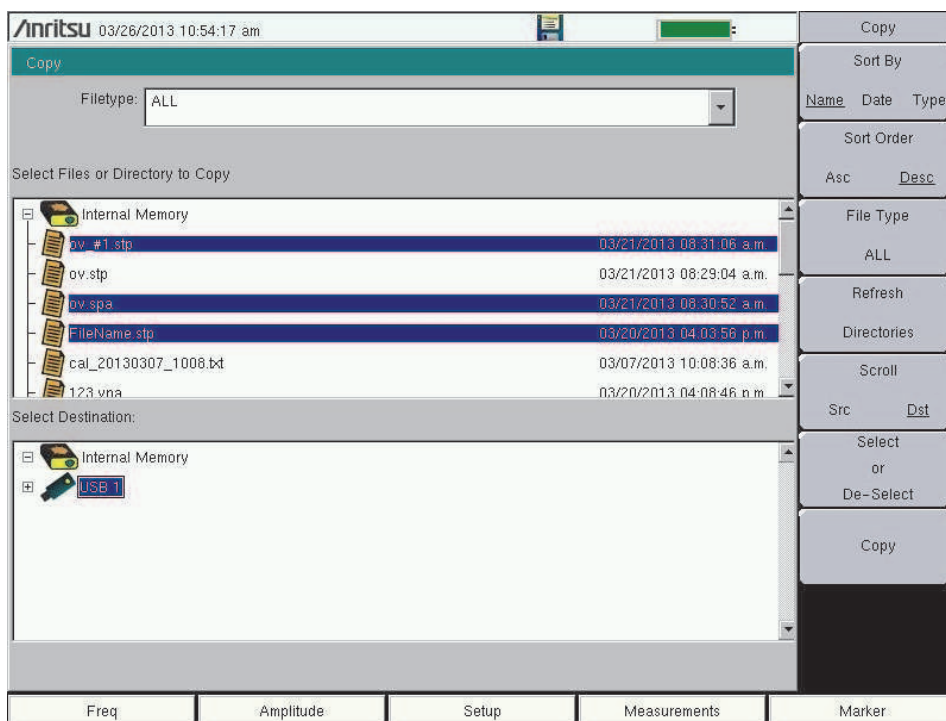


**Figure 4-2.** Recall Dialog Box

## Copying Files

The steps below describe copying a file from internal memory to an external USB flash drive. Select the files to be copied in the top window and select the destination for the files in the bottom window (Figure 4-3). Refer to the “Copy Menu” on page 4-14 for additional information.

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



**Figure 4-3.** Copy Dialog Box

**Note** Use the **Left/Right** arrow keys to Collapse/Expand folders.

## Deleting Files

### Delete a Selected File or Files

Press the **Delete** submenu key. Highlight the file to be deleted with the touchscreen or with the **Up/Down** arrow keys. Press the **Select** or **De-Select** key to include desired files. A selected file will be outlined in blue. Press the **Delete** key and then press **Enter** to delete the selected file (or group of files).

### Delete Dialog Box

Press the **Delete** submenu key to open the **Delete** dialog box (Figure 4-4). The submenus allow sorting files by type, name, and saved date. Refer to the “[Delete Menu](#)” on page 4-16 for additional information.

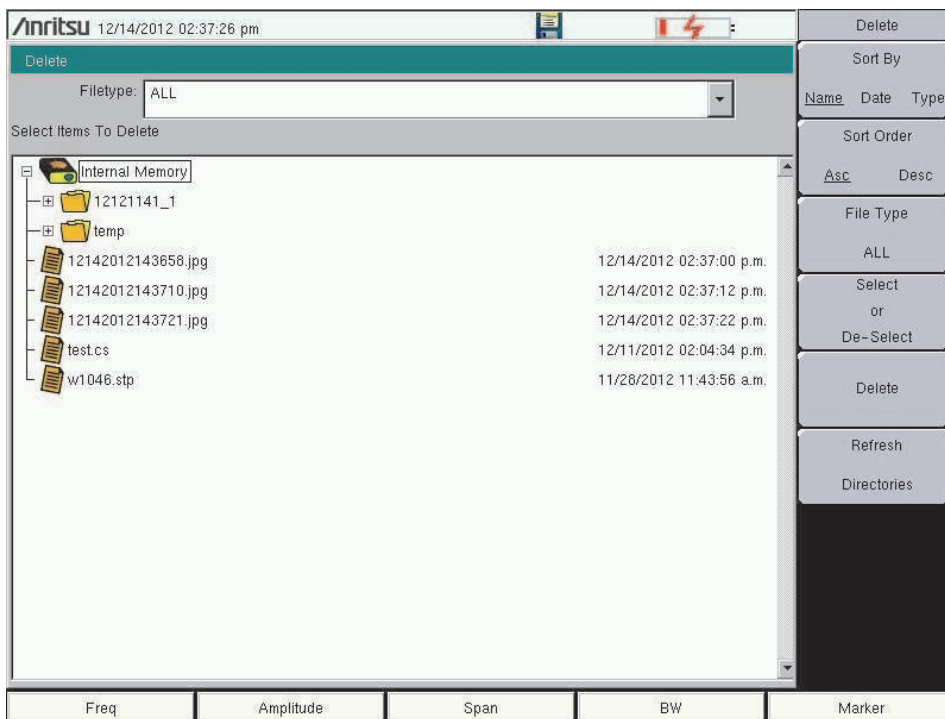


Figure 4-4. Delete Dialog Box



### 4-3 File Menu Overview

Open the File menu by pressing the **Shift** key, then the **File (7)** key. Menu maps typically display all possible submenu keys, although some keys are displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

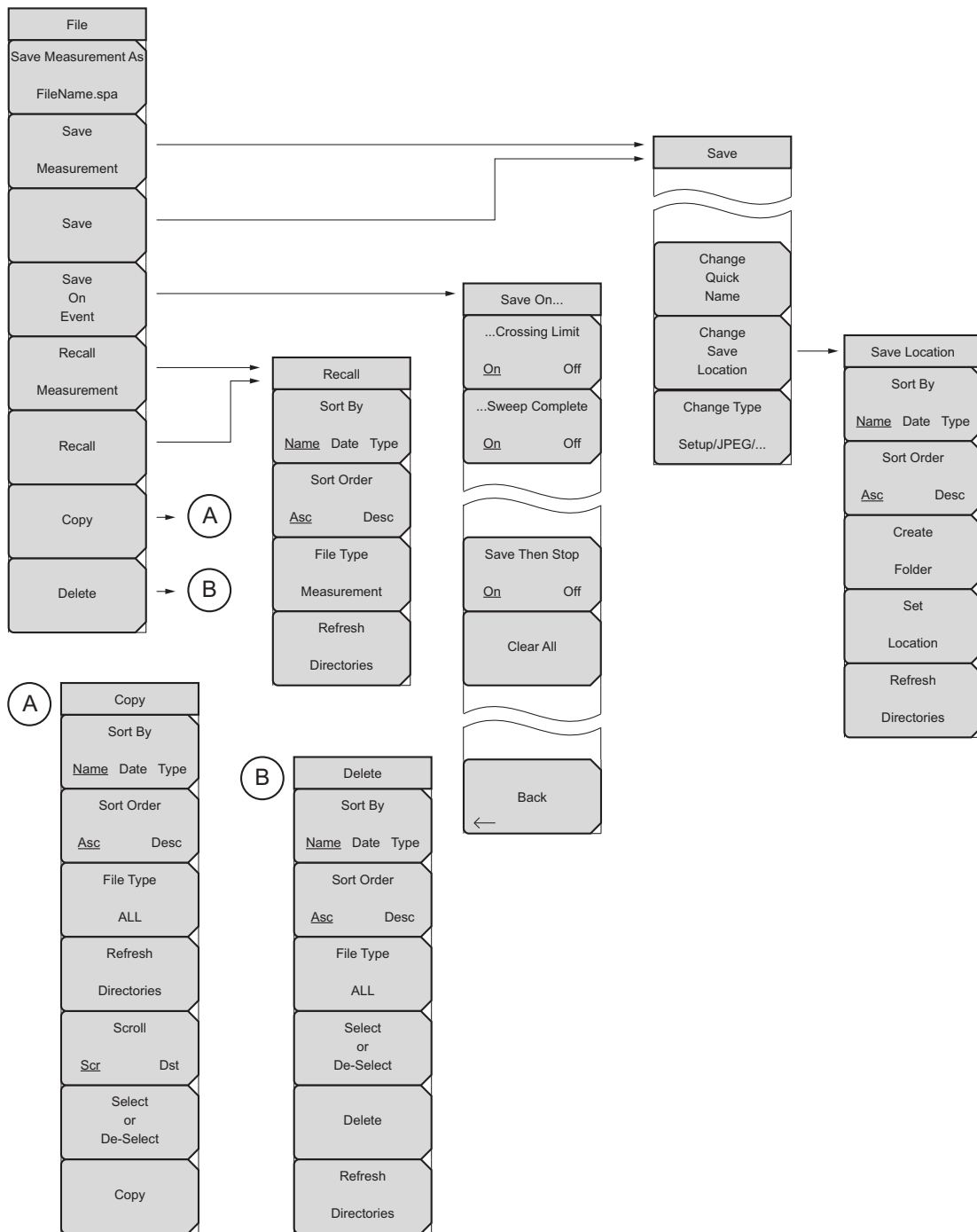


Figure 4-5. File Menu Overview

## 4-4 File Menu

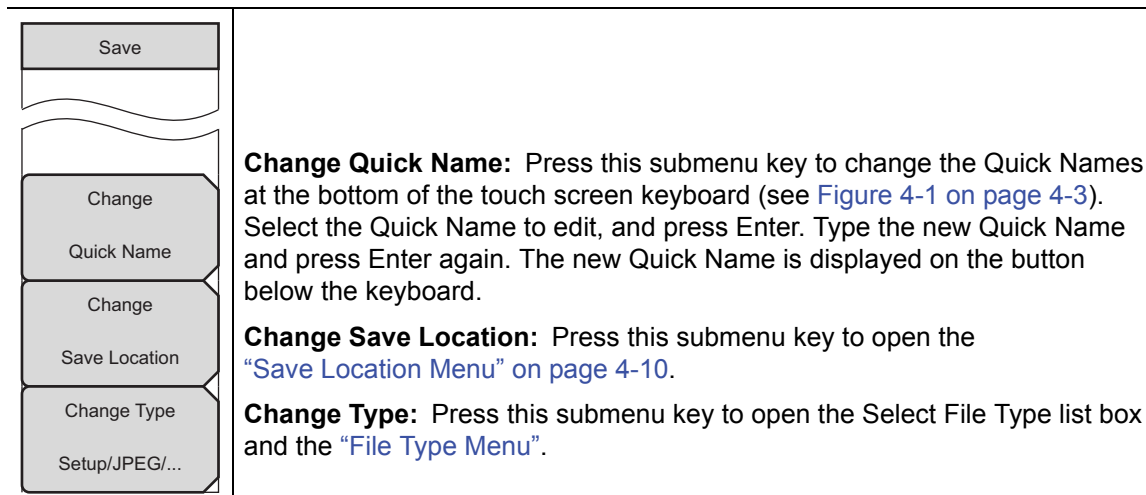
Key Sequence: **Shift > File (7)**

File	<p><b>Save Measurement As:</b> This key will save the current setup with a user defined file name. The default file name is changed using the Save submenu. To change the default file name, press the Save Measurement submenu key to open the Save dialog box. Enter the new measurement filename with the letter keys. Refer to <a href="#">“Save Menu” on page 4-9</a>. Press <b>Enter</b> to save the name and return to the File menu. The Save Measurement As submenu key displays the new entered name appended with <code>_#1</code>. After a few seconds the screen will return to the File menu. Press the Save Measurement As key again, and the new file name will be used. Each press of this submenu key saves the current measurement with the same base filename while incrementing the final number. Measurement file names have an extension based on the measurement type.</p> <p><b>Save Measurement:</b> Press this submenu key to display the <a href="#">“Save Menu” on page 4-9</a> and Save dialog box. Measurements can be saved to internal memory or to a USB flash drive. The saved measurement can be named using the text entry keys. By default, measurements are saved to internal memory. The save destination is set with the <a href="#">“Save Location Menu” on page 4-10</a>.</p> <p><b>Save:</b> Press this submenu key to display the <a href="#">“Save Menu” on page 4-9</a>. Measurements can be saved to internal memory or to a USB flash drive. The saved setup, measurement or JPEG file can be named by using the text entry keys. By default, measurements are saved to internal memory. The save destination is set with the <a href="#">“Save Location Menu” on page 4-10</a>.</p> <p><b>Save on Event (Not available in all modes of operation):</b> Press this submenu key to display the <a href="#">“Save On Event Menu” on page 4-11</a>.</p> <p><b>Recall Measurement:</b> Press this submenu key to display the <a href="#">“Recall Menu” on page 4-12</a>. This menu is for recalling measurements from internal memory or a USB flash drive.</p> <p><b>Recall:</b> Press this submenu key to display the <a href="#">“Recall Menu” on page 4-12</a>. This menu is for recalling measurement or setup data from internal memory or a USB flash drive.</p> <p><b>Copy:</b> Press this submenu key to display the <a href="#">“Copy Menu” on page 4-14</a>. This submenu is for copying files or folders from internal memory or a USB flash drive.</p> <p><b>Delete:</b> Press this submenu key to display the <a href="#">“Delete Menu” on page 4-16</a> and a selection box that shows the setup and measurement names, the type and the date and time that the information was saved. Use the rotary knob or the <b>Up/Down</b> arrow keys to highlight the file that is to be deleted and press the Delete submenu key, then <b>Enter</b>. Press the <b>Esc</b> key to cancel the operation. Note that deleted files can not be recovered.</p>
Save Measurement As	
FileName.spa	
Save	
Measurement	
Save	
Save On Event	
Recall	
Measurement	
Recall	
Copy	
Delete	

**Figure 4-6.** File Menu

## Save Menu

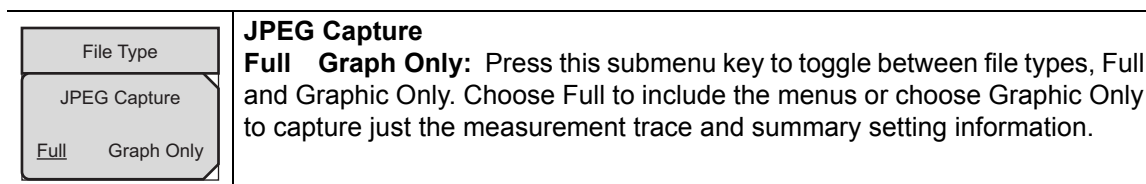
Key Sequence: **Shift > File (7) > Save**



**Figure 4-7.** Save Menu

## File Type Menu

Key Sequence: **Shift > File (7) > Save > Change Type**



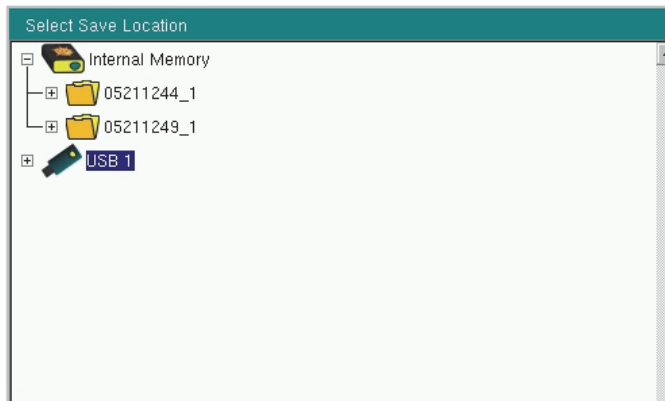
**Figure 4-8.** File Type Menu

### Save Location Menu

Key Sequence: **Shift > File (7) > Save > Change Save Location**

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Save Location</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Sort By</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Name   Date   Type</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Sort Order</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Asc   Desc</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Create</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Folder</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Set</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Location</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Refresh</div> <div style="border: 1px solid black; padding: 5px;">Directories</div>	<p>This menu and dialog box are used to create folders and to select the location where the BTS Master will save the current file. Select folders or drives with the <b>Up/Down</b> keys or the rotary knob.</p> <p><b>Note:</b> Only folders (not files) are visible in the Save Location dialog box. To view files, use the <a href="#">“Recall Menu” on page 4-12.</a></p> <p><b>Sort By</b>  <b>Name   Date   Type:</b> Press this submenu key to sort the folders by Name, Type, or Date.</p> <p><b>Sort Order</b>  <b>Asc   Desc:</b> Display the folder names in ascending or descending order.</p> <p><b>Create Folder:</b> Press this submenu key to create a new folder in the highlighted location or folder. The create directory dialog box will display for naming the folder.</p> <p><b>Set Location:</b> Press this submenu key to set the current location for saving files and to return to the <a href="#">“Save Menu” on page 4-9.</a></p> <p><b>Refresh Directories:</b> Press this key to update the display.</p>
---	---


**Figure 4-9.** Save Location Menu



**Figure 4-10.** Select Save Location Dialog Box

## Save On Event Menu

Key Sequence: **Shift** > **File (7)** > Save On Event

Save On...	This menu is not available in all modes of operation. The menu is used to auto save measurements to internal memory after one of the following events:
...Crossing Limit <input type="checkbox"/> On <input type="checkbox"/> Off	<b>...Crossing Limit</b> <b>On Off:</b> Toggle this submenu key to On in order to save the measurement to internal memory when the measurement has crossed a defined limit line, created with the <b>Limit</b> menu.
...Sweep Complete <input type="checkbox"/> On <input type="checkbox"/> Off	<b>...Sweep Complete</b> <b>On Off:</b> Toggle this submenu key to On in order to save the measurement to internal memory after the current sweep is complete. If <b>Save Then Stop</b> is toggled Off, then a measurement is saved after every sweep.
Save Then Stop <input type="checkbox"/> On <input type="checkbox"/> Off	<b>Save Then Stop</b> <b>On Off:</b> Set this key to On to stop the sweep after a measurement is saved. With this key Off and <b>Sweep Complete</b> On, a measurement is saved after every sweep.
Clear All	<b>Clear All:</b> Press this key to turn Off the three save on event keys:
	<b>Crossing Limit</b> <b>Sweep Complete</b> <b>Save Then Stop</b>
Back 	<b>Back:</b> Press this key to turn return to the <a href="#">“File Menu” on page 4-8</a> .

**Figure 4-11.** Save On Event Menu

## Recall Menu

This menu and the dialog box shown in [Figure 4-13 on page 4-13](#) are used to navigate folders and select files to recall to the BTS Master. Select folders or files with the **Up/Down** keys, the rotary knob, or the touch screen.

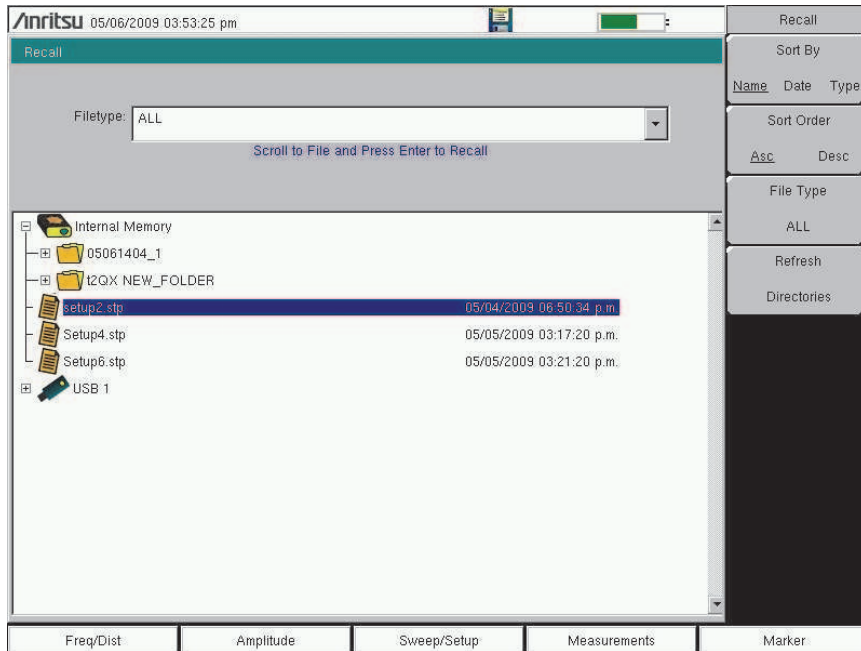
Key Sequence: **Shift > File (7) > Recall**

Recall	<p><b>Sort By:</b> Press this submenu key to sort file and folders by the file name, by the type of file, or by the date that the file or folder was saved.</p> <p><b>Sort Order:</b> Displays the folder or file in ascending or descending order based on the selection in the Sort By key.</p> <p><b>File Type:</b> Press this submenu key to open the Select File Type list box and select the type of file to be viewed. The file type can be changed with the <b>Up/Down</b> arrow keys or the rotary knob. Press <b>Enter</b> to make the selection. Some examples of file types are:</p> <p><b>Setup:</b> Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.</p> <p><b>Measurement:</b> Measurement files contain all of the information in the setup files and the measurement data.</p> <p><b>Limit Lines:</b> The Limit line file contains limit line data details.</p> <p><b>ALL:</b> Displays all file types.</p> <p>For more information about file types, refer to <a href="#">“File Types” on page 4-1</a>.</p> <p><b>Refresh Directories:</b> Press this key to update the display.</p>
Sort By	
Name Date Type	
Sort Order	
Asc Desc	
File Type	
ALL	
Refresh	
Directories	

**Figure 4-12.** Recall Menu

## Recall Dialog Box

Select folders or files with the **Up/Down** keys, the rotary knob, or the touch screen.



**Figure 4-13.** Recall Dialog Box

## Copy Menu

This menu and dialog box are used to copy folders and files. Select folders or files with the **Up/Down** keys or the rotary knob. [Figure 4-15 on page 4-15](#) shows the Copy dialog box with two JPEG images selected and ready to be copied to the USB flash drive. Highlight a folder and then press either **Enter** or the **Right** arrow key to view the contents.

Key Sequence: **Shift > File (7) > Copy**

Copy	<b>Sort By</b> <b>Name Date Type:</b> Press this submenu key to sort file and folder lists by name, by type of file, or by the date that the file was saved.
Sort By Name Date Type	<b>Sort Order</b> <b>Asc Desc:</b> Press this submenu key to display the folders or files in ascending ( <b>Asc</b> ) or descending ( <b>Desc</b> ) order based on the selection in the <b>Sort By</b> key.
Sort Order Asc Desc	<b>File Type:</b> Press this submenu key to select the type of files to view for copying. The file type can be changed with the <b>Up/Down</b> keys or the rotary knob, or by using the touch screen. Press <b>Enter</b> to make the selection. For more information about file types, refer to <a href="#">“File Types” on page 4-1</a> .
File Type ALL	<b>Refresh Directories:</b> Press this key to update the display.
Refresh Directories	<b>Scroll</b> <b>Src Dst:</b> Press this submenu key to use the scroll function in either the Source Window ( <b>Scr</b> - top pane) or the Destination Window ( <b>Dst</b> - bottom pane). See <a href="#">Figure 4-15</a> .
Scroll Scr Dst	<b>Select or De-Select:</b> Use this key to select or deselect the files or folders to be copied. When selected, a file or folder is highlighted in blue (see <a href="#">Figure 4-15</a> ).
Select or De-Select	<b>Copy:</b> Press this submenu key to copy the files or folders that are selected in the top pane to the destination that is selected in the bottom pane. A dialog box is displayed when the copy function 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 to allow cancel.
Copy	

**Figure 4-14.** Copy Menu



### Copy Dialog Box

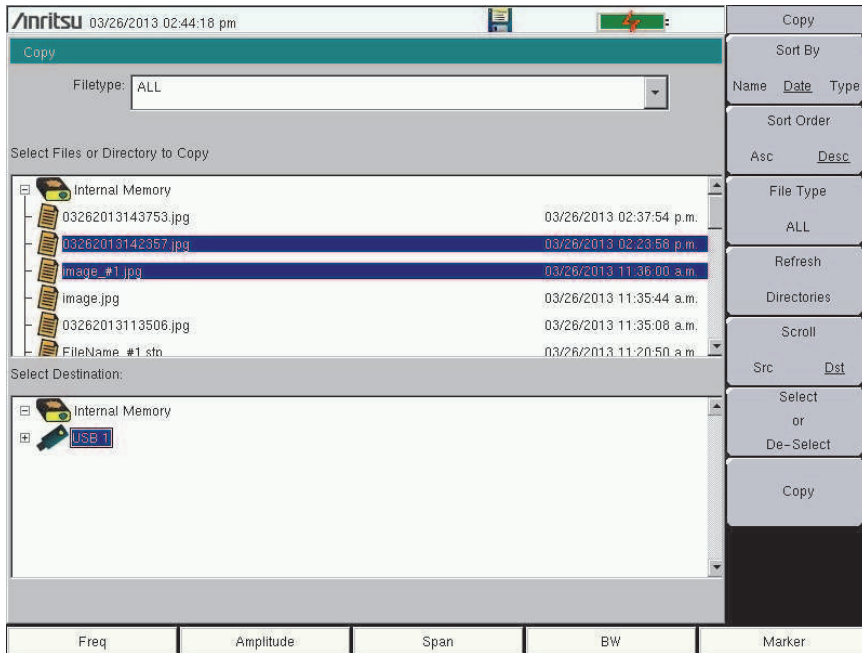


Figure 4-15. Copy Dialog Box

### Delete Menu

Key Sequence: **Shift > File (7) > Delete**

Delete	<p>This menu and dialog box are used to delete folders and files. Select folders or files with the <b>Up/Down</b> keys or the rotary knob.</p> <p><b>Sort By:</b> Press this 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.</p> <p><b>Sort Order:</b> Displays the folder or file in ascending or descending order based on the selection in the Sort By key.</p> <p><b>File Type:</b> Press this submenu key to select what type of file view for deleting. The options are the ALL, Measurement, Setup, Limit Lines, or JPEG. The file type can be changed with the <b>Up/Down</b> keys or the rotary knob. Press <b>Enter</b> to make the selection.</p> <p>For more information about file types, refer to <a href="#">“File Types” on page 4-1</a>.</p> <p><b>Select or De-Select:</b> Use this key to select or deselect the file(s) or folder(s) to be deleted. When selected, a file or folder will be outlined in blue.</p> <p><b>Delete:</b> Press this key to open the Delete dialog box. Press <b>Enter</b> to delete the selected item or <b>Esc</b> to Cancel.</p> <p><b>Refresh Directories:</b> Press this key to update the display.</p>
Sort By	
Name Date Type	
Sort Order	
Asc Desc	
File Type	
ALL	
Select or De-Select	
Delete	
Refresh	
Directories	

Figure 4-16. Delete Menu

### Delete Dialog Box

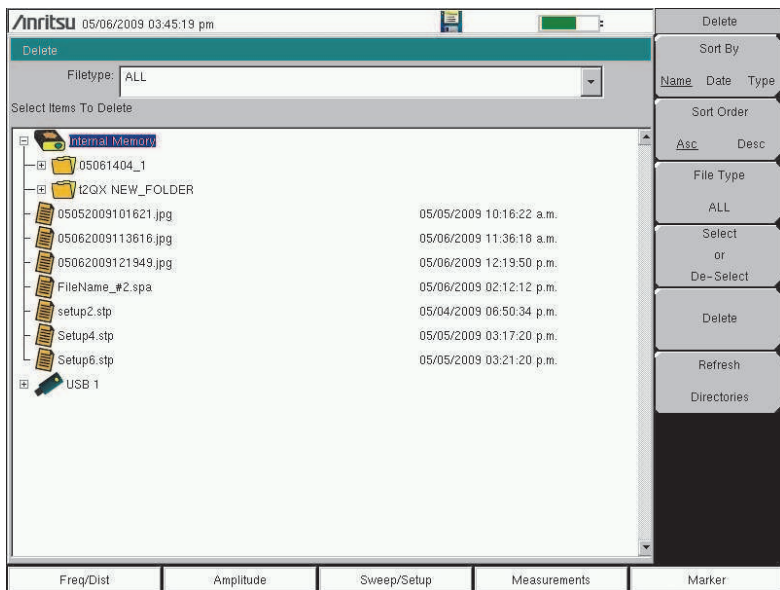


Figure 4-17. Delete Dialog Box

# Chapter 5 — System Operation

## 5-1 Introduction

This chapter reviews the BTS Master system operations.

Other menus including Sweep, Measure, Trace, and Limit are described in the Measurement Guides that are listed in [Appendix A](#).

## 5-2 System Menu Overview

To access the functions under the System menu, press the **Shift** key, then the **System (8)** key. [Figure 5-1](#) and [Figure 5-2](#) show the menu group that is accessible from the System menu. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to the menu descriptions on the following pages).

Note that the menus that are indicated by numbered circles are shown in [Figure 5-2](#).

### System Menu Map 1

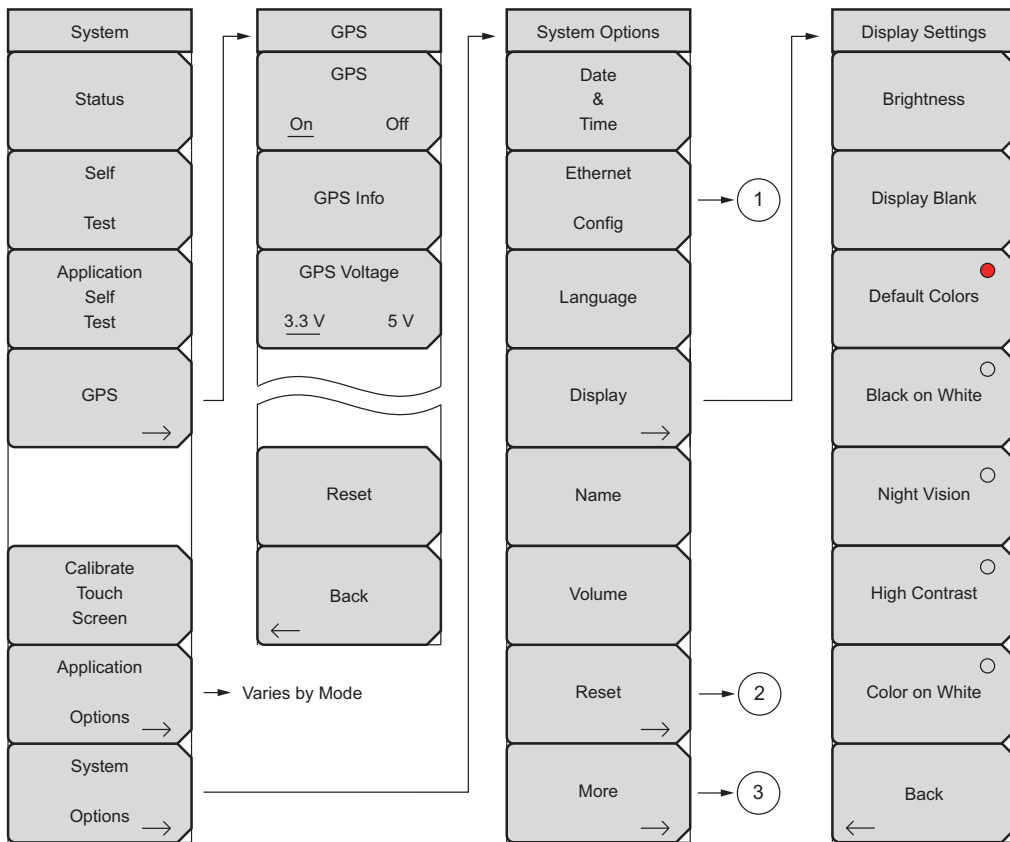


Figure 5-1. System Menu Map (1 of 2)

### System Menu Map 2

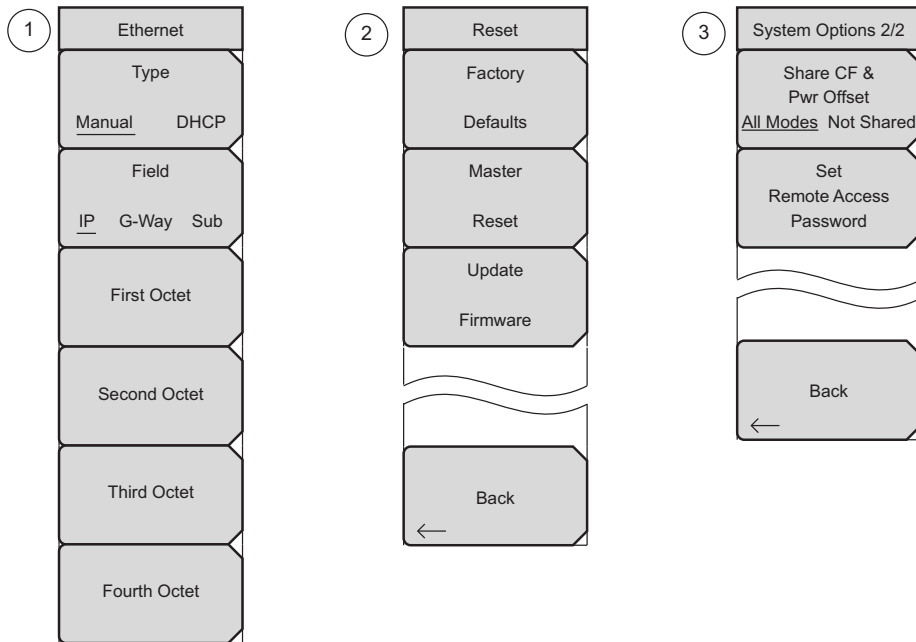


Figure 5-2. System Menu Map (2 of 2)

## 5-3 System Menu

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

	<p><b>Status:</b> 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 <b>Esc</b> or <b>Enter</b> to return to normal operation.</p> <p><b>Self Test:</b> Press this submenu key to run a series of tests that are related to the performance of the motherboard hardware. Press the <b>Esc</b> key to abort, or press the <b>Enter</b> 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.</p> <p>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 (refer to “<a href="#">Anritsu Service Centers</a>” on page 1-6) and report the test results. Press <b>Esc</b> or <b>Enter</b> to return to normal operation.</p> <p><b>Application Self Test:</b> 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 mode. Press the <b>Esc</b> key to abort, or press the <b>Enter</b> 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 (refer to “<a href="#">Anritsu Service Centers</a>” on page 1-6).</p> <p>Some of the hardware that is tested may also be used in multiple operating modes. One or more additional submenu keys may be displayed to allow running additional application self tests. For example, in an instrument model with the Tracking Generator option, when the test results are displayed, a <b>TG Self Test</b> submenu key is provided for an additional test.</p> <p><b>GPS:</b> Press this submenu key to open the GPS Menu. Refer to <a href="#">Chapter 6, “GPS”</a> for additional information.</p> <p><b>Calibrate Touch Screen:</b> Press this submenu key to begin touch screen calibration.</p> <p><b>Application Options:</b> Submenu keys are specific to each measurement mode. Please refer to a specific Measurement Guide, as listed in <a href="#">Appendix A</a>.</p> <p><b>System Options:</b> Press this submenu key to open the “<a href="#">System Options Menu</a>” on page 5-5.</p>
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Figure 5-3. System Menu

### Touch Screen Calibration

Touch screen calibration details and related features are described in “[Touch Screen Calibration](#)” on page 2-14.

## System Options Menu

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

System Options	
Date & Time	<b>Date &amp; Time:</b> Press this submenu key to display a dialog box for setting the current date and time. Use the submenu keys or the <b>Left/Right</b> arrow keys to select the field to be modified. Use the keypad, the <b>Up/Down</b> arrow keys, or the rotary knob to select the date and time. Press <b>Enter</b> to accept the changes, or press the <b>Esc</b> key to return to normal operation without changing anything.
Ethernet Config	<b>Ethernet Config:</b> 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 <a href="#">Appendix C, “LAN and DHCP”</a> .
Language	<b>Language:</b> Press this submenu key to open a list box and select a built-in language for the BTS 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 BTS Master. One 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 <b>Enter</b> to accept the change, or press the <b>Esc</b> key to return to normal operation without changes.
Display →	In addition, any existing language (except English) may be edited for a better local translation.  <b>Caution:</b> A reset will overwrite any custom settings within the BTS Master and will require that you reload the custom language files via Master Software Tools.
Name	<b>Display:</b> The Display submenu key opens the “ <a href="#">Display Settings Menu</a> ” on <a href="#">page 5-8</a> allowing brightness control and the selection of different display attributes.
Volume	<b>Name:</b> Press this submenu key to open a dialog box to name the instrument. The BTS Master can be named by using the text entry controls as described in section “ <a href="#">Text Entry</a> ” on <a href="#">page 2-19</a> . Press <b>Enter</b> to save the name.
Reset →	<b>Volume:</b> Press this submenu key to set the speaker volume. The current volume setting is displayed on the screen. Use the keypad, the <b>Up/Down</b> arrow keys, or the rotary knob to change the volume, and press the <b>Enter</b> key to accept the change.
More →	<b>Reset:</b> Press this submenu key to open the “ <a href="#">Reset Menu</a> ” on <a href="#">page 5-9</a> .
	<b>More:</b> Press this submenu key to open the “ <a href="#">System Options 2/2 Menu</a> ” on <a href="#">page 5-6</a> .

**Figure 5-4.** System Options Menu

## System Options 2/2 Menu

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

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">System Options 2/2</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Share CF &amp; Pwr Offset All Modes Not Shared</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Set Remote Access Password</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Back ←</div>	<p><b>Share CF &amp; Pwr Offset</b>  <b>All Modes Not Shared:</b> 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.</p> <p><b>Set Remote Access Password:</b> Press this submenu key to open the Password text box (<a href="#">Figure 5-6</a>) and Text Entry menu. Type in the desired password. Upper case and lower case letters and the symbols - _ + . are the allowed password characters. Press <b>Enter</b> to save or <b>Esc</b> to cancel.</p> <p><b>Back:</b> Press this submenu key to return to the “<a href="#">System Options Menu</a>” on page 5-5.</p>
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**Figure 5-5.** System Options Menu 2/2)

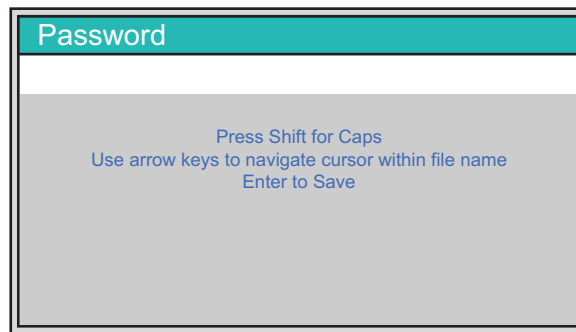


## Remote Access Password

**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 remote 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 5-6](#) may differ from the text box that is displayed on your instrument.









**Figure 5-6.** 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).

## Display Settings Menu

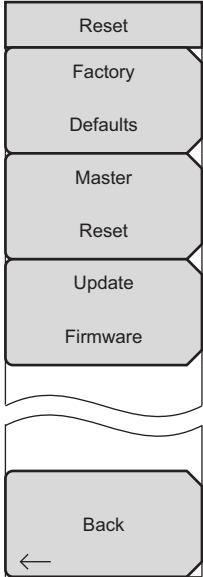
Key Sequence: **Shift** > **System (8)** > System Options > Display

Display Settings	
Brightness	<b>Brightness:</b> The brightness of the display can be adjusted to optimize viewing under a wide variety of lighting conditions. Use the <b>Up/Down</b> arrow keys (increment changes of 25), the <b>Left/Right</b> arrow keys (0 or 100), or the rotary knob (increment changes of 1) to select a brightness level from 0 to 100, with 100 being the brightest. Press <b>Enter</b> to accept the change. All of the visible display options are affected by the Brightness setting.
Display Blank	<b>Display Blank:</b> Opens a note box. Press <b>Enter</b> to turn off the display, or press <b>Esc</b> to abort. When the display is off, turn on the display with three rapid key presses of any key except the power key (or turn instrument power Off and On).
Default Colors 	<b>Default Colors:</b> Sets the display colors to their factory default condition and is used for normal viewing. The measurement grid is black (or a shade of gray), and the background is black.
Black on White 	<b>Black on White:</b> Sets the display colors to black (data) and white (background). This setting is used for printing and viewing in broad daylight conditions.
Night Vision 	<b>Night Vision:</b> Sets the display to a red-tinted color (data) with a black background. Optimized for night-time viewing.
High Contrast 	<b>High Contrast:</b> Increases the black and white contrast of the default display. This setting is used for challenging viewing conditions.
Color on White 	<b>Color on White:</b> Sets the display background to white, the grid to gray, and leaves sweep data in color. This setting is used for printing and viewing in broad daylight conditions.
Back 	<b>Back:</b> Press this submenu key to return to the “ <a href="#">System Options Menu</a> ” on page 5-5.

**Figure 5-7.** Display Settings Menu

## Reset Menu

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

 <p>The screenshot shows a vertical list of menu items: 'Reset', 'Factory Defaults', 'Master Reset', 'Update Firmware', and 'Back'. A left-pointing arrow is visible at the bottom of the 'Back' option.</p>	<p><b>Factory Defaults:</b> Press this submenu key to restore the BTS Master to its factory default parameter values and Mode settings, including Ethernet, language, and brightness settings. Press the <b>Enter</b> key to initiate the reset. The BTS Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press <b>Esc</b> rather than pressing <b>Enter</b>.</p> <p><b>Note:</b> This same reset sequence can be initiated when turning the BTS Master on by pressing and holding the <b>Esc</b> key until the Anritsu splash screen is displayed.</p> <p><b>Master Reset:</b> Press this submenu key to restore the factory setting to all system parameters, including Ethernet, language, and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored. Press the <b>Enter</b> key to initiate the reset. The BTS Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press <b>Esc</b> rather than pressing <b>Enter</b>.</p> <p><b>Note:</b> This same reset sequence can be initiated when turning the BTS Master on by pressing and holding the <b>System (8)</b> key until the Anritsu splash screen is displayed.</p> <p><b>Update Firmware:</b> Press this submenu key to update the instrument operating system using an external USB drive. Press <b>Enter</b> to begin the update, or press <b>Esc</b> to return to normal operation without updating. Refer to “<a href="#">Update Firmware</a>” on page 5-11 for additional information.</p> <p><b>Back:</b> Press this submenu key to return to the “<a href="#">System Options Menu</a>” on page 5-5.</p>
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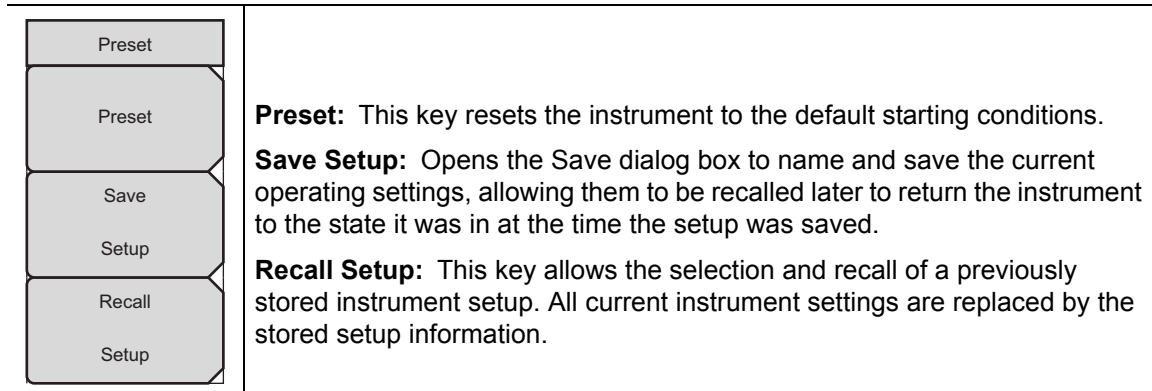
**Figure 5-8.** Reset Menu

### Caution

A Factory Defaults reset or Master Reset will require that you reload any custom language files via Master Software Tools.

## 5-4 Preset Menu

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



**Figure 5-9.** Preset Menu

## 5-5 Self Test

At power on, the BTS Master runs through a series of quick checks to ensure that the system is functioning properly. The System Self Test runs a series of tests that are related to the instrument hardware. The Application Self Test runs a series of tests that are related to the instrument hardware that is used in the current operating mode of the instrument.

If the BTS Master is within the specified operating range with a charged battery, and if the self test fails, then contact your Anritsu Service Center.

To initiate 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** submenu key. The Self Test results are displayed.

Press the **Esc** key to continue.

Also refer to **Self Test** and **Application Self Test** in [Section 5-3 “System Menu” on page 5-4](#).

## 5-6 Update Firmware

To update the firmware in your BTS Master, download the firmware upgrade file from the Anritsu Web site, transfer the file to a USB memory stick, and load the firmware update into your BTS Master.

Handheld Firmware Update Methods are described on the Anritsu Web site:

<http://www.anritsu.com/en-US/Products-Solutions/Instructional/Handheld-Firmware-Methods.aspx>

### USB Loader Method

This method uses a USB Memory Stick to transfer the files from your PC to the instrument. Firmware downloads are available from the product family links or from the instrument product page (under the Library tab). Download the file and follow the embedded instructions.

#### What You Need

1. Personal computer with Internet access.
2. A properly formatted USB memory stick.

**Note**

Anritsu recommends reformatting your USB memory stick before using it for firmware upgrade.

3. Your BTS Master, powered with an adapter.

### Firmware Download Methods

You can find the update file on the BTS Master product page, or you can navigate directly to the “Firmware Updates Get the latest firmware for your instrument” page.

#### Product Page Method

1. Navigate to the Anritsu Internet page:  
<http://www.anritsu.com>
2. Use the Search field to enter the model name or model number. Select the BTS Master MT8220T product page link from the search results.



**Figure 5-10.** Anritsu Web Page Search Field

3. From the instrument product page, navigate to the **Library** tab and select “Firmware Update for the BTS Master MT8220T” from the Drivers, Software Downloads list.

4. On the Firmware Update for the BTS Master MT8220T page, click the **Download** button, and save the executable file to your PC, following on-screen instructions.
5. When download is complete, execute the file to run the software wizard, which provides on-screen instructions for loading the firmware upgrade onto your USB memory stick.  
A **View Firmware Upgrade Instructions** button is available to display a list of upload instructions on your PC for reference.
6. Move the USB memory stick to your instrument.

### Firmware Updates Page Method

1. Navigate to the following URL:  
<http://www.anritsu.com/en-US/Products-Solutions/Instructional/Handheld-Firmware-Spas.aspx>
2. Continue at [Step 4](#) above to download the file. Then follow the procedure in “[USB Firmware Update](#)”.

### USB Firmware Update

With the memory stick inserted, follow the 8-step process:

1. Press **Shift 8**.
2. Press the System Options submenu key.
3. Press the Reset submenu key.
4. Press the Update Firmware submenu key.
5. Press the **Load Firmware** main menu key.
6. Press the Update Application Firmware submenu key.
7. Use the rotary knob to select **Save And Restore User Data** from the Firmware Update list box.
8. Press **Enter**.

Your BTS Master will automatically restart when the firmware upgrade is complete. Then the internal firmware update requires several minutes.

Subsequent upgrades are faster because the BTS Master will recognize new upgrade firmware on the USB memory stick and load it automatically. This upgrade function does not begin until the instrument is turned On with the USB memory stick in place.

# Chapter 6 — GPS

## 6-1 Introduction

The BTS Master MT8220T includes a built-in GPS receiver that can provide latitude, longitude, altitude, and UTC timing information. When GPS is actively locked to satellites, this information is displayed on the instrument and included with all saved measurements. GPS also enhances frequency reference oscillator accuracy.

## 6-2 Setting Up GPS

In order to acquire data from the GPS satellites, you must have line-of-sight to the satellites, or the antenna must be placed outside without any obstructions. A passive GPS antenna (Anritsu part number 2000-1733-R) is included with the MT8220T.

### Activating the GPS Feature

1. Attach the GPS antenna to the GPS Antenna connector on the top of the instrument.
2. Press the **Shift** key then the **System (8)** key on the numeric keypad to display the System menu.
3. Press the GPS submenu key to display the GPS menu.
4. Activate GPS by pressing the GPS, On/Off submenu key so that **On** is underlined. When GPS is first turned On, the GPS icon is displayed in red to indicate that less than 3 satellites are currently being tracked.



---

**Figure 6-1.** GPS Icon, Red

5. Press the GPS Info submenu key to open the GPS Info window, which displays:
  - Tracked Satellites
  - Latitude
  - Longitude
  - Altitude
  - UTC timing information
  - Fix available
  - Almanac Complete
  - Antenna Status
  - Receiver Status
  - GPS Antenna current and voltage
6. When the GPS receiver is tracking at least 3 satellites, the GPS icon changes to green.



**Figure 6-2.** GPS Icon, Green

**Note**

As long as 3 minutes may be required for the Ref Freq status to change to GPS High Accuracy in the Status menu, which is displayed on the left side of the measurement display.

To reset the GPS, press the Reset submenu key. The green GPS icon with a red cross appears when GPS satellite tracking is lost (see to [Figure 6-3](#)). This occurs after being active (tracking three or more satellites).



**Figure 6-3.** GPS Icon, Green with Red Cross

After GPS location Fix is attained, the internal reference oscillator begins to correct its frequency to match the GPS standard. After the internal frequency is adjusted to match the GPS standard, the status is indicated by “GPS High Accuracy” showing in the Status menu, which is displayed on the left side of the measurement display. When the GPS feature is not enabled, the reference source displays either “Internal Standard Accuracy” or a user-selected external reference frequency in the Status menu.

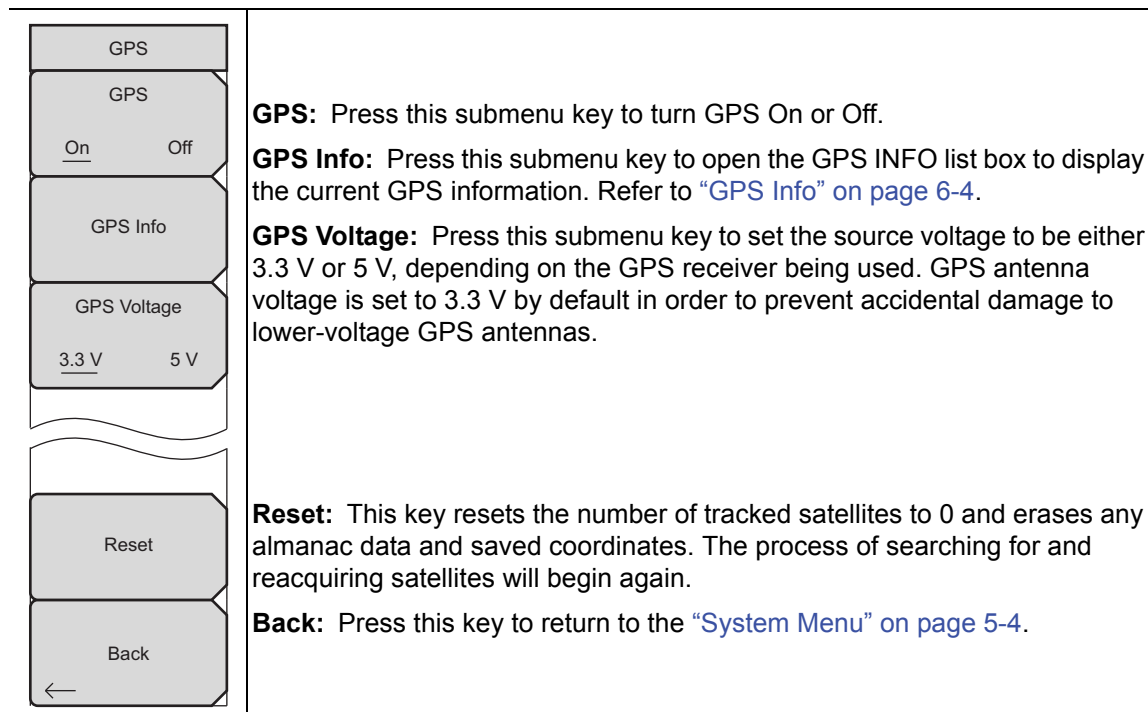
Within three minutes of satellite acquisition, the reference oscillator will have an accuracy of better than 25 ppb (parts per billion). The OCXO internal standard accuracy is  $\pm 0.3$  PPM. The correction factor applied to the internal OCXO allows the instrument to maintain GPS frequency accuracy for three days at better than 50 ppb, even when the instrument is obstructed from receiving signals from the GPS satellites.

In order to acquire data from the GPS satellites, you must have line-of-sight to the satellites, or the antenna must be placed outside with no obstructions.



## 6-3 GPS Menu

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



**Figure 6-4.** GPS Menu

## GPS Info

**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 GPS information.

**Latitude and Longitude:** Shows location in degrees, minutes, and seconds.

**Altitude:** Shows altitude information in meters.

**Fix Available:** The cold start search sets are established to ensure that at least three satellites are acquired within the first couple of minutes. When the three satellites are found, the receiver computes an initial fix (typically in less than two minutes). **Fix Available: No** 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 and Short/Open

- **OK:** Antenna is connected properly and is working properly.
- **Short/Open:** A short or open exists between the antenna and the connection. If this message is displayed, then remove and reconnect the GPS antenna. If the message persists, then try another Anritsu GPS antenna. If the message persists, then contact your nearest Anritsu Service Center (refer to “[Anritsu Service Centers](#)” on page 1-6).

**Receiver Status:** Current status of the receiver.

**GPS Antenna Voltage and Current:** Shows voltage and current.

# Chapter 7 — Anritsu Tool Box

## 7-1 Introduction

The Anritsu Tool Box is a suite of applications that provide an interface between Anritsu handheld RF instruments and a PC. The instrument connects to the computer via a USB, Ethernet, or serial port. Depending on the application selected, available functions range from the capture, transfer, and reporting of measurement data for trace analysis, to map preparation, creation and delivery of work instructions, and remote instrument monitoring and control.

The Tool Box may be installed from the Anritsu software DVD or you can download individual applications from the Anritsu website at [www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx](http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx)

This chapter gives an overview of the software installation DVD and the main features of each application in the Anritsu Tool Box.

## 7-2 Software Installation DVD

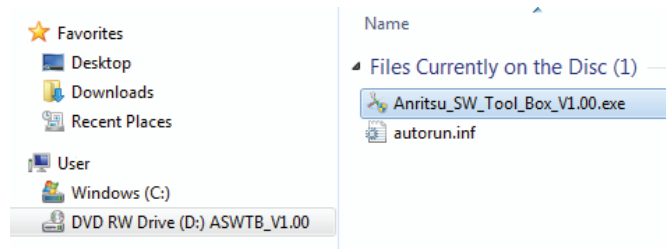
Place the software disc in the DVD drive on your PC and follow the on-screen instructions. The Setup Wizard welcome screen illustrated in [Figure 7-1](#) may change with the software version.

You will be asked to select which applications you wish to install. Not all instrument models are supported by every software tool. Visit the web page referenced in the *Introduction* section above and follow the links for more information on a specific tool.



**Figure 7-1.** Anritsu Tool Box Setup Wizard

If the installer does not autostart, open the DVD in Windows Explorer and double-click the executable setup file. See [Figure 7-2](#).



**Figure 7-2.** Tool Box Installer on the Anritsu Software DVD

## 7-3 Anritsu Software Tool Box

The Anritsu Tool Box serves as a central location from which you can open a previously saved measurement, visit the Anritsu website, or launch an application. To open the Tool Box, either double-click the desktop shortcut or select the Tool Box from the Windows Start menu, under All Programs and the Anritsu folder. On the Tool Box screen, hover the mouse pointer over any of the application icons to view a short description of the application. See [Figure 7-3](#).



**Figure 7-3.** Anritsu Tool Box Screen

## 7-4 Software Tools

The Anritsu Tool Box provides links to the software tools installed on your PC. Alternatively, you can launch an application using its desktop shortcut or through the Windows Start menu.

The following sections list the top features and functions of the tools contained in the Anritsu Tool Box that are compatible with the Spectrum Master MS2720T. For a detailed description of these features and how to perform specific tasks, refer to each application's Help system. The program Help also lists the instrument models, measurement modes, trace types, and file types that are compatible with that application.

### Master Software Tools (MST)

Master Software Tools is designed for users of Anritsu handheld spectrum analyzers, interference analysis tools, transmission testers, and backhaul testers. Supported functions include the following:

- Transfer of captured measurement data to and from a PC for storage and analysis
- RF Spectrum Analyzer traces
- RF Interference analysis
- Spectrum monitoring
- Transmitter signal quality tests
- T1, T3, and E1 backhaul tests
- Trace overlay features for comparing multiple Spectrum Analyzer measurements
- Limit lines and markers
- Script Master for the creation of automated test procedures
- Export of measurement data as text, graphic, or Comma Separated Value format (CSV) files
- Reports created in HTML format for use in other applications

### easyTest Tools

easyTest Tools is used to create work instruction files that consist of a command sequence and instructions to help less experienced personnel with operating the instrument in the field.

- A drag-and-drop tool facilitates the creation of a test sequence from a library of commands.
- Instructions can be a mix of textual prompts and graphic images.
- Sample procedure files (.ett) are included with easyTest Tools.
- Command sequences are delivered electronically and loaded on the instrument, where they are recalled with a press of a button.
- Recall Setup places the instrument in the proper mode for the measurement by retrieving saved parameters such as measurement type, frequency and amplitude settings, markers and limit lines.
- The current measurement setup or the screen display can be saved manually or automatically.

## easyMap Tools

easyMap Tools is the new name for Anritsu Map Master. The application allows users to find and prepare geo-referenced maps and to build floor plans suitable for Anritsu Handheld Spectrum Analyzers with Interference Analysis or Coverage Mapping capabilities (Option 25 or Option 431, respectively).

Software functions include:

- Creation of geo-referenced maps with pan and zoom capability
- Conversion of maps and floor plans to a form suitable for use on Anritsu Handheld Spectrum Analyzers and Interference Analyzers
- Introduction of GPS information into previously non-geo-referenced maps

## Wireless Remote Tools

Wireless Remote Tools enables the user to remotely monitor and control the instrument over a wireless LAN connection.

- The wireless connection is typically established using a USB-powered Wi-Fi router attached to the instrument and a matching Wi-Fi link on the PC end.
- Remote monitoring and control of the instrument enhance operator safety and efficiency when conditions make it unsafe or impractical to be close to the instrument.

# Chapter 8 — Web Remote Control

## 8-1 Introduction

Web Remote Control capabilities are embedded in the BTS Master, providing full instrument control through an HTML-5 compatible browser. The ability to remotely monitor and control the instrument from the ground or desk enhances operator safety and efficiency when conditions make it unsafe or impractical to be close to the instrument.

A remote connection terminates when the user logs out or closes the browser. Passwords can be used to manage multiple-user access to the same instrument.

To prevent multi-user conflicts, only one connection is permitted at a time. A second user who tries to take control of the instrument will be denied on his or her first access attempt. If a second attempt is made after one minute has passed, the first user session is terminated and another session started for the new user. This prevents an idle user from blocking access to the instrument.

While only one user can have control of the instrument, multiple users can view the same instrument using a desktop sharing application.

## 8-2 Setup

You can connect one or more instruments, through direct connection, a LAN, or portable router, to any device with an HTML-5 browser. Current versions of Google Chrome and Mozilla Firefox are supported. The device may be a laptop, a desktop computer, or a mobile device, including a wide range of tablets and smart phones running Android or iOS operating systems. Note that you cannot download files to an iOS device, for lack of a user-accessible file system in this environment.

Physical connection is established from the instrument's Ethernet port directly to the computer, or to a LAN or a portable Wi-Fi router such as the ZyXEL MWR102 Portable Router.

### LAN Connection

1. Connect the Ethernet port of the BTS Master to your LAN.
2. Press **Shift** followed by **System (8)**.
3. Press the **Status** submenu key to display the Status window and take note of the instrument IP address.

Press **Esc** to close the Status window.

4. If no IP address has been assigned, refer to [Appendix C, "LAN and DHCP"](#) for information on setting an IP address for the instrument. If connecting to another network, we recommend that you request a static IP address from your network administrator to avoid duplicate addresses.

Alternatively, you can set the instrument for dynamic IP addressing using DHCP. In a long distance network, however, it may be difficult or impossible to determine what the current dynamic address is, after the instrument is in the field.

5. Set instrument parameters as appropriate, such as measurement mode, frequency range, amplitude. You may skip this step and set up the instrument remotely at a later time, after Ethernet connection has been established.
6. Launch a Web browser on your PC, laptop, or mobile device.
7. Enter the instrument IP address in the browser search bar and click the Search arrow.

Depending on user login status and whether a password is required, either the Web Remote Control login page or the Home page will display. See [Figure 8-2 on page 8-4](#) and [Figure 8-3 on page 8-5](#).

## Connection to a Wi-Fi Portable Router

Instead of connecting the instrument directly to a LAN, you can connect it to a Wi-Fi router. This section documents connection to the ZyXEL MWR102 Portable Router as an example.

1. Take note of the router's SSID and pre-programmed password, which are found on a sticker affixed to the router.
2. Using the Ethernet cable included with the router, connect one end to the black LAN port and the other end to the test instrument's Ethernet port.
3. Insert the Mini-B (small) end of the provided USB cable into the router and the Type-A (larger) end of the cable into one of the USB ports of your test instrument.
4. Optionally, secure the router to the instrument body using a strip of Velcro or other hook-and-loop fastener. You may also place the router in the instrument carrying case, if it fits.
5. Use your computer's Wi-Fi Network Connection utility to find the router. With the ZyXEL MWR102 Portable Router, the SSID name will be ZyXEL followed by an alphanumeric string unique to your particular router.
6. Connect to this SSID. When prompted, enter the router password noted in [Step 1](#).
7. Set the IP address manually on the BTS Master. Refer to "[Ethernet Menu](#)" on [page C-4](#) and see [Figure 8-1](#).
8. Enter the instrument IP address in the browser search bar and click the Search arrow.

Depending on user login status and whether a password is required, either the Web Remote Control login page or the Home page will display. See [Figure 8-2 on page 8-4](#) and [Figure 8-3 on page 8-5](#).



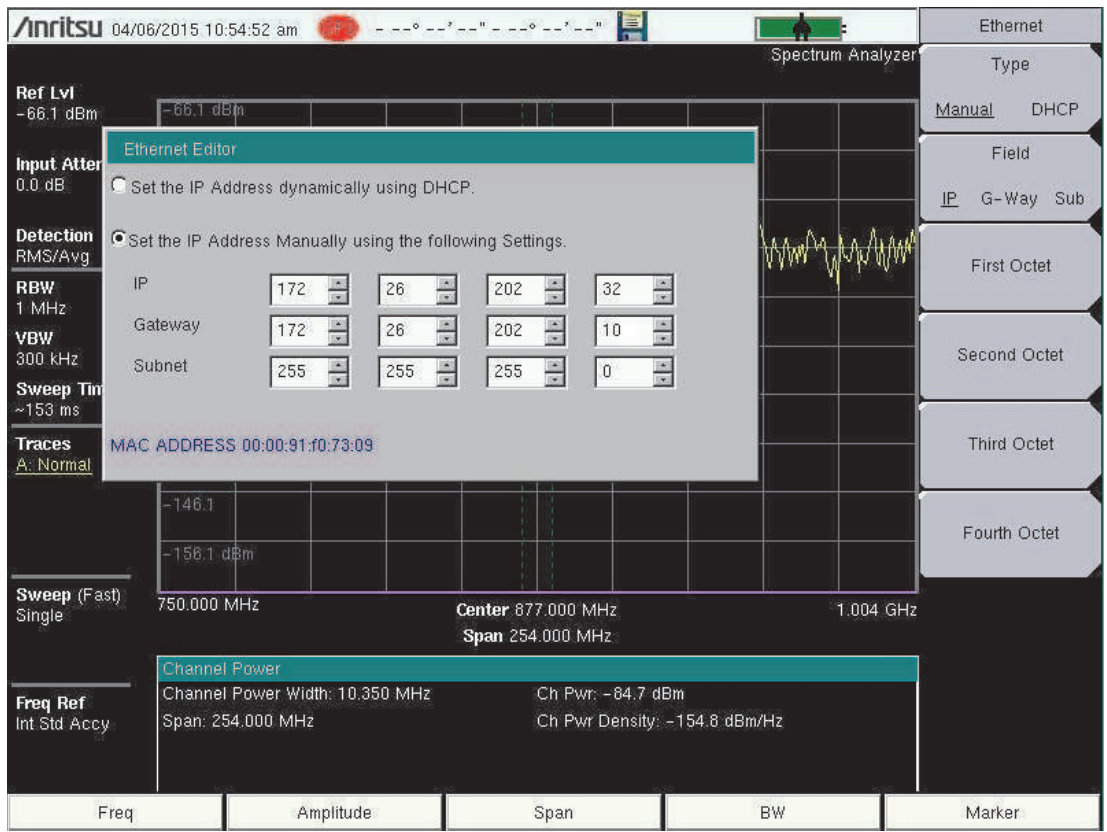
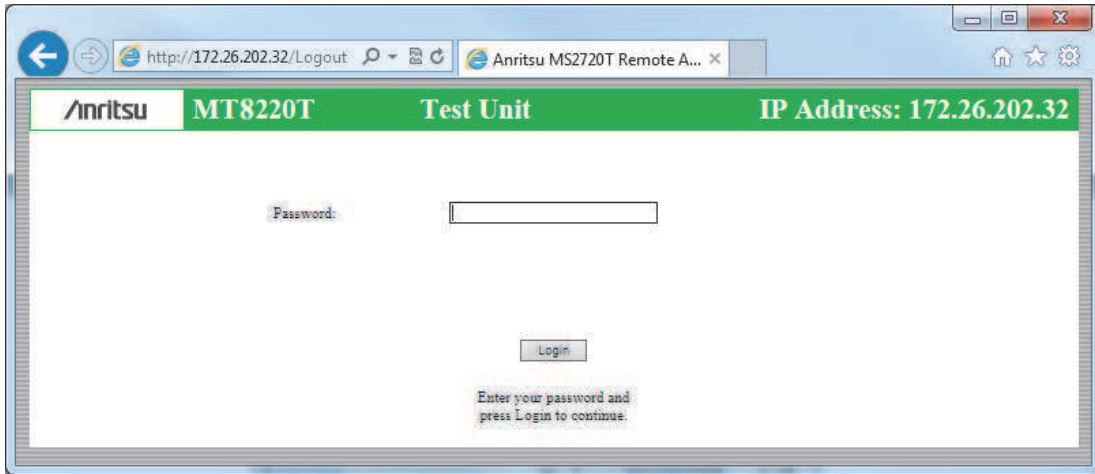


Figure 8-1. Setting IP Address Manually

## 8-3 Web Remote Control Interface

After you have entered the instrument IP address in a Web browser's address bar, the Web Remote Control login page opens if this is the first time you are connecting to the instrument, or if a password is required and you previously logged out. Enter the instrument password or leave the field blank if no password has been set, then click Login. See [Figure 8-2](#).



**Figure 8-2.** Login Page

Only one user at a time can connect to the instrument. If you attempt to connect after another user, a message is displayed on the login page, indicating the instrument is currently being used by another client. If you try again after one minute, the current user's session will be terminated and you will then have control of the instrument.

### Notes

- There may be a period of a few minutes from the time a user logs out until the instrument is released. During this time, connection attempts by other users will fail.
- Closing the Web Remote Control browser window without logging out also releases the instrument after a period of a few minutes.
- If you have previously connected to this instrument, the login page is skipped and the Web Remote Control Home page opens, provided no other user is currently connected to the same instrument.

Upon successful connection, the Web Remote Control Home page displays on your PC or mobile device, as illustrated in [Figure 8-3 on page 8-5](#). Information displayed on the Home page is the same as the System Status window on the instrument.

At the top of the browser window, a green title bar shows the instrument model number and IP address. If the instrument has been assigned a name, this name is displayed in the center of the title bar. The menu bar consists of tabs for commands and links.

The screenshot displays the Anritsu MT8220T Web Remote Control Home Page. The browser window title is "Anritsu MT8220T Remote" and the address bar shows "172.26.202.118/HOME". The page header includes the Anritsu logo, the instrument model "MT8220T", the name "Test Unit", and the IP address "IP Address: 172.26.202.118". The navigation menu consists of "Home", "Remote Control", "Capture Screen", "Capture Trace", "File List", "Device Management", and "Logout".

The main content area is titled "System Information" and contains two tables:

Versions	
Package	V1.12
OS	V3.69
Base	V5.09
ATA Boot	V3.25
Keypad	V2.3.4

Operating Status	
Temperature	53.0 C / 127.4 F
Battery Charge	100 %
Battery Current	15 mA
Battery Voltage	11.7 V
Serial Number	1540091

Below the System Information section is the "Installed Components" section, which contains two tables:

Applications	
Vector Network Analyzer	V5.66
Spectrum Analyzer	V6.47
Channel Scanner	V6.47
Interference Analyzer	V6.47
WCDMA/HSDPA Signal Analyzer	V3.08
CDMA Signal Analyzer	V3.04
GSM/GPRS/EDGE Signal Analyzer	V3.04
EVDO Signal Analyzer	V3.04
High Accuracy Power Meter	V3.12
Fixed WiMAX Signal Analyzer	V3.09
Mobile WiMAX Signal Analyzer	V3.09
TD-SCDMA Signal Analyzer	V3.04
LTE Signal Analyzer	V3.13
TD-LTE Signal Analyzer	V3.08

Options	
19	High Accuracy Power Meter
25	Interference Analyzer
27	Channel Scanner
90	Gated Sweep
431	Coverage Mapping
880	GSM/GPRS/EDGE
881	WCDMA/HSPA+
882	TDSCDMA/HSPA+
883	LTE (FDD/TDD)
884	CDMA2000 1X/EVDO
885	WIMAX (FIXED/MOBILE)

Figure 8-3. Web Remote Control Home Page

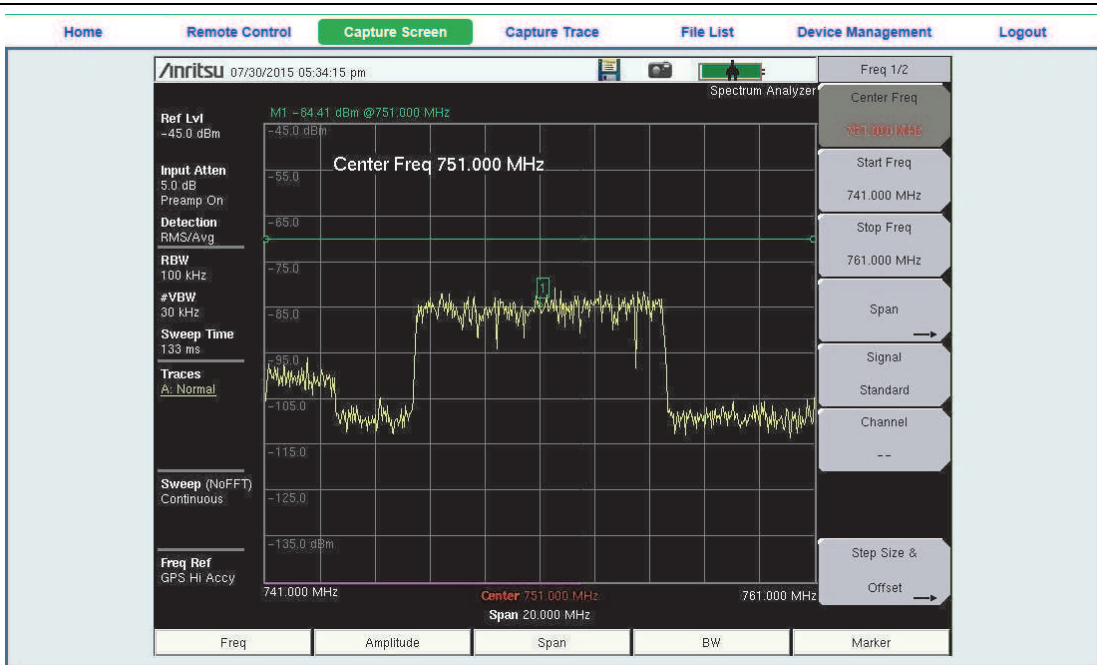
## Menu Bar

### Remote Control

Opens “Remote Control” on page 8-7.

### Capture Screen

Captures a JPEG image of the instrument display and saves it directly to internal memory. A file name is automatically created using the current date and time stamp. Only the instrument display will be pictured on the Web page under the menu bar. See [Figure 8-4](#). In Windows, you can right-click on the screen and select Copy. With iOS, press and hold on the picture. This makes it easy to create documentation using screen captures.



**Figure 8-4.** Capture Screen Page

### Capture Trace

Opens an input dialog to enter a name for the trace to be saved. See [Figure 8-5](#). After clicking Save, a confirmation dialog opens to indicate the trace was successfully saved to the instrument.

**Figure 8-5.** Capture Trace Page

Depending on the browser and operating system used, different prompts may appear. Some operating systems like iOS may not support file saving from a browser.

### File List

Displays the list of folders and files contained in the instrument's internal memory. You can select from the list the files or folders you wish to download to your PC or mobile device. Refer to [“File List” on page 8-9](#).

### Device Management

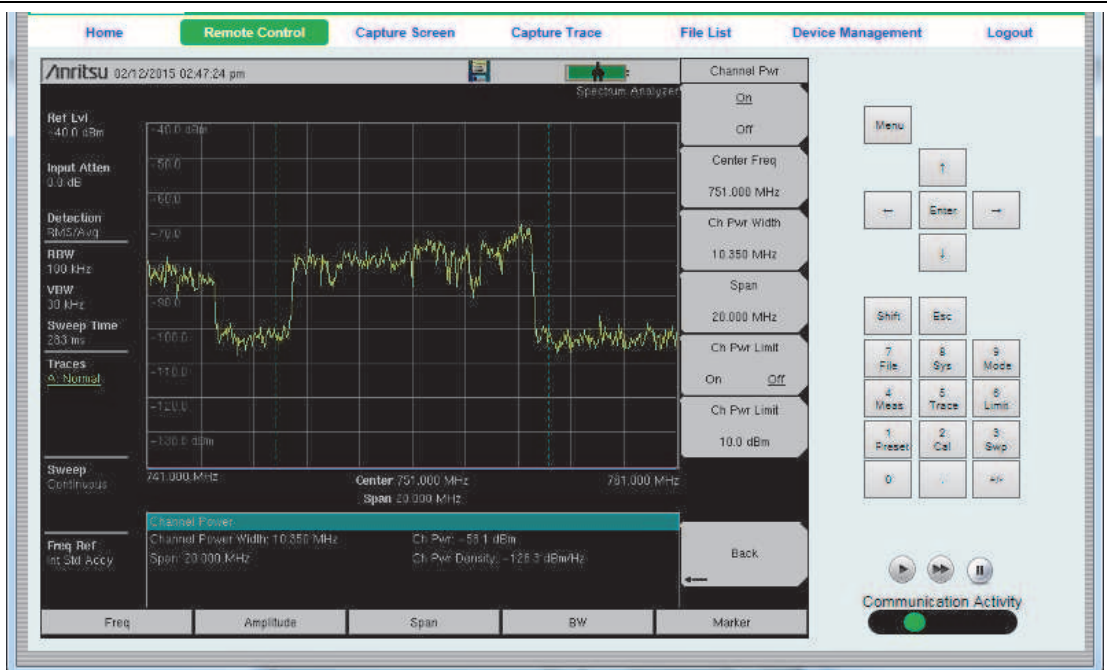
Opens the [“Device Management”](#) page, where you can set the instrument password and assign a name to the instrument.

### Logout

Exits Web Remote Control and displays the login page. To return to Web Remote Control, enter the password or leave the field blank if no password has been set, then click Login. See [Figure 8-2 on page 8-4](#).

## Remote Control

The Remote Control instrument display is a bitmap image of the instrument screen. The buttons on the right of the display reflect the layout of the buttons on the instrument and are used to access the same monitoring and control functions. See [Figure 8-6](#).



**Figure 8-6.** Remote Control Page

### Normal Mode

Normal Mode is the default mode, where the bitmap image of the instrument screen is continually refreshed in the browser window. Click the single arrow button at the bottom right of the screen or any tab on the menu bar to return to Normal Mode from either Fast or Pause Mode.

### Fast Mode

Click the double arrow button to enter Fast Mode, where the update rate can be significantly faster than Normal mode, especially over low bit-rate connections. Only the measurement data (yellow trace) is continually updated. The main menu keys and submenu keys may look different than in Normal Mode, but their functions are the same. Error messages are not shown in Fast Mode.

Fast Mode is not available with some Spectrum Analyzer measurement types, in which case the Fast Mode button is disabled. The button is not displayed when the measurement mode is something other than Spectrum Analyzer.

While in Fast mode, if a measurement type is selected that Fast mode does not support, the instrument will return to Normal mode.

### Pause Mode

Clicking the Pause button turns the Communication Activity dot in the lower right-hand corner to yellow. If the interface was in Normal Mode, this stops the instrument display from refreshing in the browser window. If the interface was in Fast Mode, the trace measurement stops updating. Click the single arrow or the double arrow button to resume remote communications with the instrument in Normal or Fast Mode, respectively. The Communication Activity dot then returns to green.

### Communication Activity

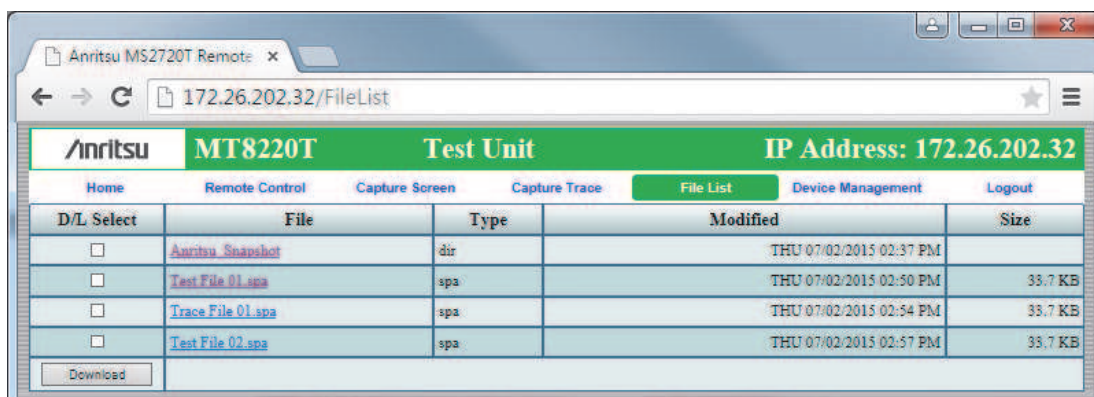
The moving dot labeled Communication Activity, when green, indicates that ongoing communication is occurring between the instrument and PC. When you click Home, Capture Screen, Capture Trace, File List, Device Management, or Logout on the menu bar, the Communication Activity dot briefly turns yellow before the selected page opens in the browser.

#### Notes

- When clicking a main menu key, submenu key, or measurement icon on the screen display, a small green dot appears at the point of the cursor to indicate that the key, button, or icon was pressed.
- A single Web-enabled device can monitor and control multiple instruments. However, multiple Web-enabled devices with different IP addresses cannot connect to the same instrument simultaneously.

## File List

Displays the list of folders (type “dir”) and files contained in the instrument's internal memory. See [Figure 8-7](#). To view the contents of a folder, click on the folder name.



**Figure 8-7.** File List Page

To download a file, click the file name. Alternatively, you can select the checkbox on the left of the file name, then click **Download**. You may also select the checkboxes of multiple files and/or folders and download them together, as a zipped folder. In this case, a pop-up dialog box shows the estimated download time. Press **OK** to continue.

**Note** Some operating systems may not support file downloads. iOS is an example.

Depending on the browser and operating system, the download function may allow you to open the file or save it, or both. In Google Chrome, for example, the downloaded file or files are automatically saved to the designated folder on your computer, such as the Downloads folder. In the banner at the bottom of the browser window, click a downloaded item to open it.

If the selected item is a single file, the file will open in the default application for the file type. For example, a JPEG file will open in the computer's default image viewer, while a measurement file will open in Master Software Tools (MST), provided the application is installed.

## Device Management

Click the **Device Management** tab on the menu bar to set or clear the instrument password, or to assign a device or unit name to the instrument. See [Figure 8-8](#).

### Password

If no password is set, access to the instrument is unrestricted and any user who knows the instrument IP address can connect to it, provided the instrument is not being used. When a password is set, the user is prompted for the password upon login.

The login page is skipped and the user is directed straight to the Web Remote Control Home page if he or she was previously connected to the instrument, then closed the browser without logging out, and no other user has logged in to the same instrument since that time.

## Instrument Name

The instrument name is displayed in the green title bar of the browser screen. It is useful in identifying the instrument when you have more than one instrument connected. The name can be assigned remotely from this Device Management page, or it can be set from the instrument's System Options menu. Note that this instrument name is not a "hostname" as used in an Ethernet router.

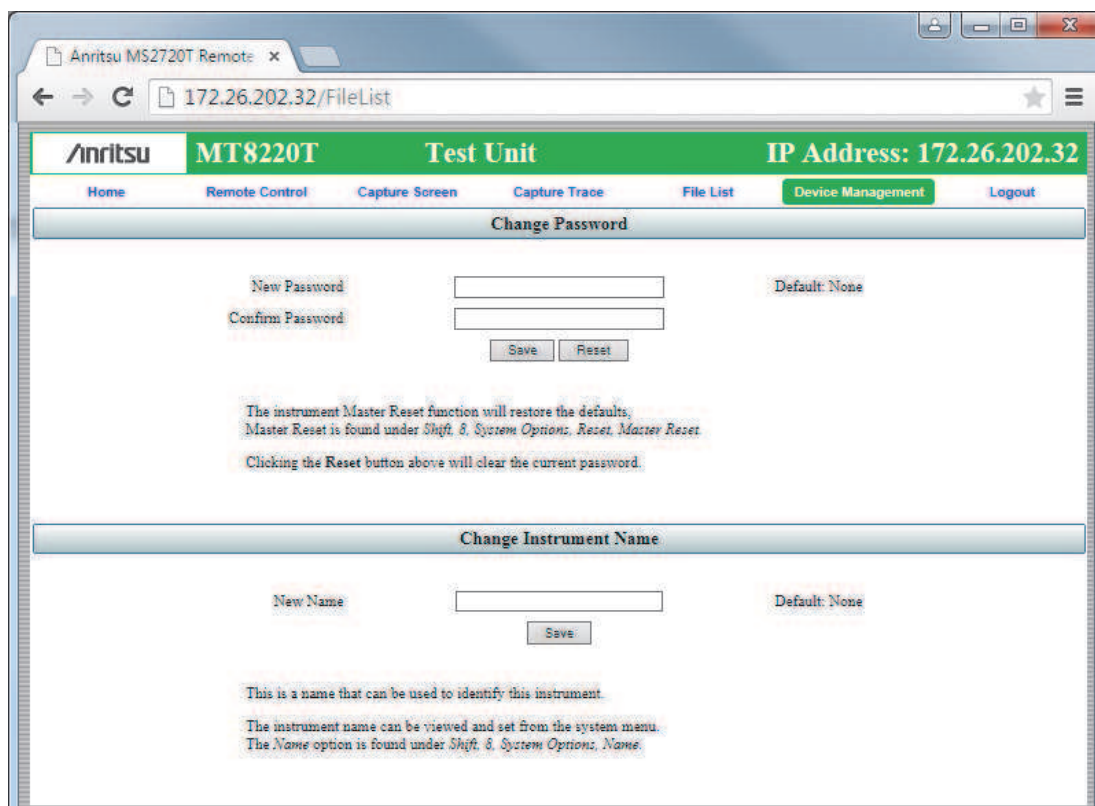


Figure 8-8. Device Management Page

## Logout

Exits Web Remote Control and displays the login page. To return to Web Remote Control, enter the password or leave the field blank if no password has been set, then click Login.



# Appendix A — Related Documents

## A-1 Introduction

This appendix provides a list of supplemental documentation for BTS Master features and options. These measurement guides are available as PDF files on the Document Disc and as free downloads from the Anritsu Web site. To determine the spectrum analyzer firmware version in your instrument, refer to submenu key description for “[Status](#)” on [page 5-4](#).

## Options

**Table A-1.** Analyzers and Analyzer Options

<b>BTS Master Feature (Required Option)</b>	<b>Related Document (Part Number)</b>
Spectrum Analyzer IQ Waveform Capture (Option 24) Interference Analyzer (Option 25) Channel Scanner (Option 27) Zero-Span IF Output (Option 89) Gated Sweep (Option 90) Coverage Mapping (Option 431)	Spectrum Analyzer Measurement Guide (10580-00349)
Cable & Antenna Analyzer	Cable and Antenna Measurement Guide (10580-00230)
Internal Power Meter High-Accuracy Power Meter (Option 19)	Power Meter Measurement Guide (10580-00240)
Vector Signal Generator (Option 23)	Signal Generators Measurement Guide (10580-00232)
CPRI RF Measurements (Option 750)	CPRI Analyzer Measurement Guide (10580-00415)
WiMAX Fixed/Mobile Measurements (Option 885)	WiMAX Signal Analyzer Measurement Guide (10580-00236)
CDMA/EV-DO Measurements (Option 884)	3GPP2 Signal Analyzer Measurement Guide (10580-00235)
GSM/GPRS/EDGE Measurements (Option 880) W-CDMA/HSPA+ Measurements (Option 881) TD-SCDMA/HSPA+ Measurements (Option 882) LTE/LTE-A FDD/TDD Measurements (Option 883)	3GPP Signal Analyzer Measurement Guide (10580-00234)

## Related Documents

**Table A-2.** Related Documents

Document Description	Part Number
Performance Specifications BTS Master Technical Data Sheet	11410-00698
Product Brochure	11410-00717
Programming Manual	10580-00367
Maintenance Manual	10580-00368
PIM Analyzer (requires PIM Master MW82xxA)	10580-00280
Handheld Instruments Document Disc	10920-00060

Additional documents are listed in the **Library** tab on each of the Anritsu product pages.

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. Example URL for MT8220T:

<http://www.anritsu.com/en-us/products-solutions/products/MT8220T.aspx>

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 — Error Messages

## B-1 Introduction

This chapter provides a list of information and error messages that could be displayed on the MT8220T BTS Master. If any error condition persists, then contact your local Anritsu Service Center (<http://www.anritsu.com/Contact.asp>).

## B-2 Self Test or Application Self Test Error Messages

### Overall Status FAILED

One or more elements of the System or Application Self Test has failed. Refer to the other pass fail tests listed below to determine which specific test failed.

### Lock Test FAILED

One or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Reset (ESC+ON), or MASTER RESET (System+ON).

**Caution:** Use of MASTER RESET (System+ON), will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

### Over Power FAILED (MT8220T-0709)

RF Power applied to the input connector is too high. Remove or reduce the input power or add additional attenuation. Sometimes out of band frequencies may be present that can cause an Over Power Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list of available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the Span to maximum in the peak detect mode of operation. If the error persists, then contact your Anritsu Service Center.

### Over Power Start FAILED

RF Power applied to the input connector is too high at turn on. See Over Power FAILED error above.

### Mixer Saturation: Increase Attenuation

Too much power applied with too little Attenuation. Increase attenuation. Sometimes even out of band frequencies may be present that would cause a Mixer Overdrive Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the SPAN to maximum in peak detect mode of operation. If the error persists, then contact your Anritsu Service Center.

## B-3 Operation Error Messages

### Fatal Error

Usually caused by a failure to communicate with one section or another. Sometimes resolved by restarting the unit or by Factory Reset (ESC+ON), resetting of the unit. Under extreme cases the use of MASTER RESET (System+ON), may resolve the issue. **Caution:** Use of MASTER RESET (System+ON), will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

### Trace not saved. Please wait for complete sweep and try again.

Attempted to save a measurement trace before the sweep had completed at least once. Wait for at least one complete sweep and try to save again.

### Measurement not valid in Zero Span

Attempt was made to make an automated measurement that requires more than ZERO SPAN to accomplish. An example would be Occupied Bandwidth measurement.

### The Freq range of the Antenna is invalid for this setup. Please select another Antenna

Choose a start and stop frequency that is within the defined frequency range for the selected antenna compensation table. See also Master Software Tools for creation and Upload of Antenna correction files.

### Minimum permitted Sweep time is 50 $\mu$ s

An attempt was made to set the minimum Sweep time to less than 50  $\mu$ s.

### Unable to add additional limit points. 41 is the maximum.

Attempted to add an additional limit line point beyond the maximum number of allowed points.

### Use Demod type USB or LSB to use Beat Frequency Osc

An attempt to use the Beat Frequency Oscillator while not in Upper or Lower Sideband Demodulation mode.

### Trace A/B/C has no data to view

Attempt to turn on or VIEW a trace that has never had data recalled into this trace location. Refer to Recall Trace section for instructions on how to recall stored measurement traces into either Trace A, B or C.

### Locking to External Ref failed; Lock attempt Failed

Switching from an internal frequency reference to the external reference has failed. Verify that the correct external reference frequency value has been selected from the list of valid external reference frequencies. Verify that the level of the external reference frequency is at least  $1 V_{p-p}$ .

**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.

**Cannot change scale in Linear mode**

Linear display mode of operation does not support a scaling change in the same manner as the Log display mode.

**Cannot turn on delta marker because Ref Marker is invalid**

Delta markers cannot be enabled unless the primary marker is within the displayed span.

**Cannot turn on delta marker because Ref Marker is a counter Marker**

Delta markers cannot be enabled unless the primary marker is NOT a counter Marker. Turn off the Counter Marker mode of marker operation to use Delta Marker.

**Current Marker is not ON**

Attempted to use a marker mode or feature for a marker that is not enabled. Turn on the appropriate marker to use this function or switch to a marker that is already enabled.

**Marker must be ON to Use the feature**

Attempted to use a marker mode or feature for a marker that is not enabled. Turn on the appropriate marker to use this function or switch to a marker that is already enabled.

**Triggering valid only in Zero Span**

External triggering can only be used while the SPAN is set to 0 (zero)

**Cannot change Modes for Recalled/Inactive Traces**

Detection modes or other elements such as RBW/VBW, averaging, and so forth, cannot be altered on a recalled trace. The trace is displayed with the same parameters in which it was saved.

**Cannot change average for Recalled/Inactive Traces**

Cannot set Delta Detection modes or other elements such as RBW/VBW, averaging, and so forth, cannot be altered on a recalled trace. The trace is displayed with the same parameters in which it was saved.

**Reference LVL Cal is OFF**

Factory Calibration is OFF. Insure that the battery level is adequate for operation or that the temperature is within acceptable limits. Reset to factory defaults with either Factory Reset (ESC+ON), or MASTER RESET (System+ON). **Caution:** Use of MASTER RESET (System+ON), will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

**IF Cal is OFF**

Factory Calibration is OFF. Insure that the battery level is adequate for operation or that the temperature is within acceptable limits. Reset to factory defaults with either Factory Reset (ESC+ON), or MASTER RESET (System+ON). **Caution:** Use of MASTER RESET (System+ON), will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

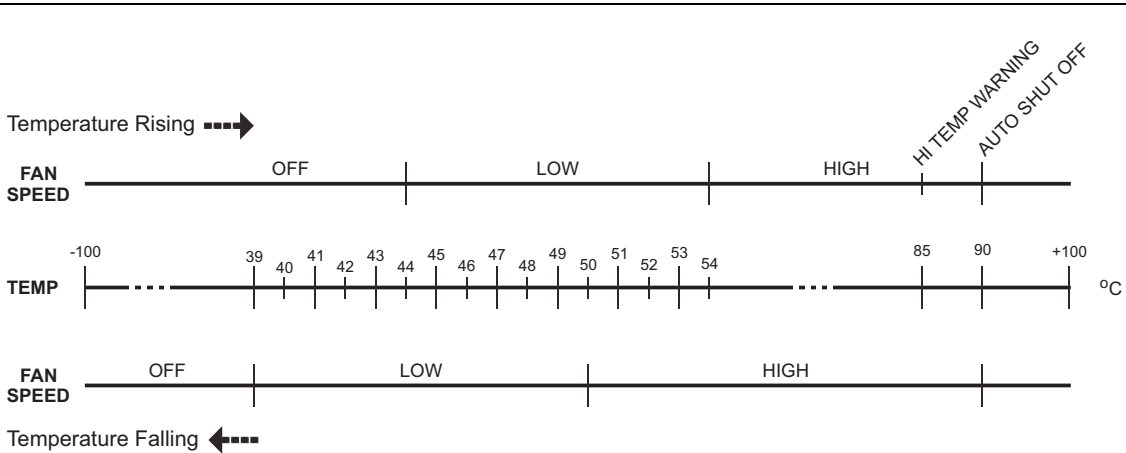
**Cannot set Delta Mkr Freq to Demod Freq**

Marker to Demod frequency is only available with a primary marker as the selected marker.

**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. 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 B-1.** Fan Speed versus 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 if the internal temperature reaches 90°C, then a countdown of 10 seconds will begin to give the user a chance to save the current setup before it will turn 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 either Factory Reset (ESC+ON). **Caution:** Use of MASTER RESET (System+ON), will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, then contact your Anritsu Service Center.

### Copy failed. Please check External USB Memory

Attempt to copy user saved data to the external USB Flash drive has failed. Do not attempt to remove or power down the unit before the copy has completed. Be sure that the USB memory device is not already full and that it is fully inserted into the USB connector.

### PLL Lock Fail

Phase Lock Loop failed to lock.

### Trace not saved. Please wait for complete sweep and try again.

Attempted to save a measurement trace before the sweep had completed at least once. Wait for at least one complete sweep and try to save again.



# Appendix C — LAN and DHCP

## C-1 Introduction

This appendix describes network connections for the MT8220T BTS Master.

## C-2 Ethernet Configuration

### LAN Connection

The RJ-45 connector is used to connect the BTS 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 MT8220T to the network and select DHCP protocol in the **Ethernet Config** menu.

Turn the BTS 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 C-1**. The image on the display panel of your BTS Master may differ from the image shown here.

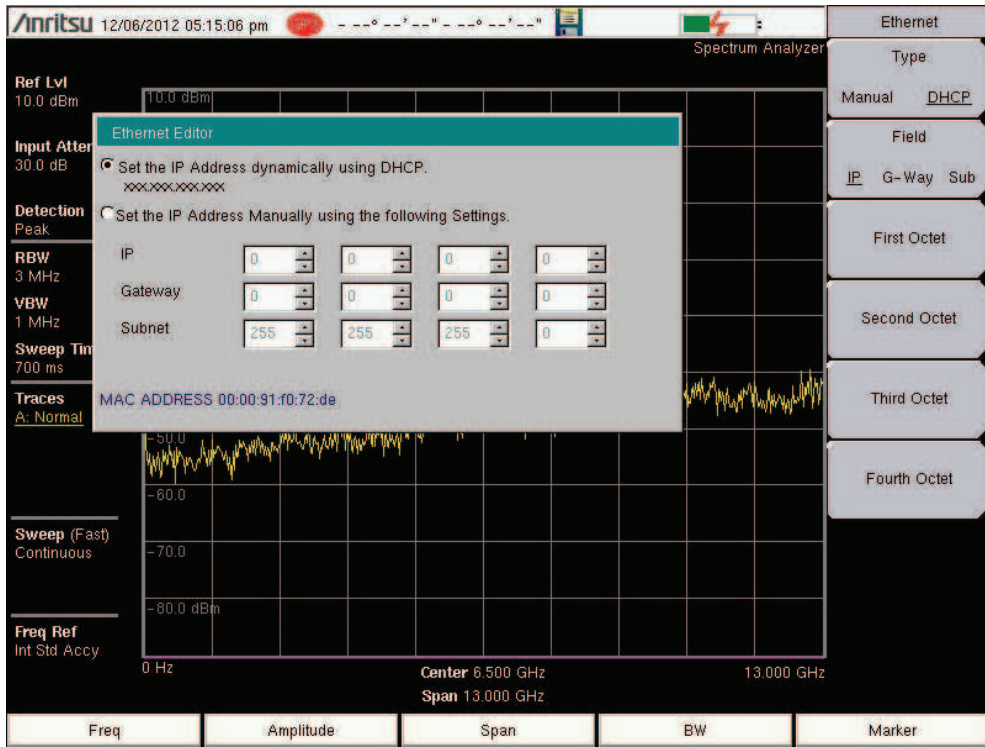


Figure C-1. IP Address Assigned Using DHCP

### 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.

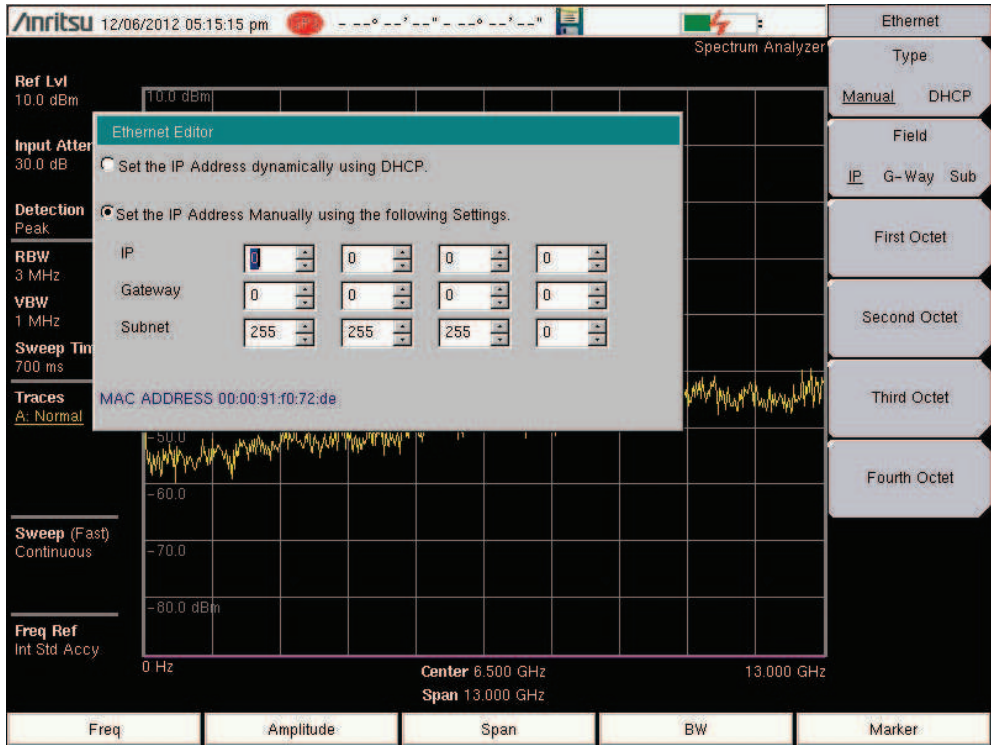


Figure C-2. Setting IP Address Manually

## Ethernet Menu

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

Ethernet	<p><b>Type</b>  <b>Manual DHCP:</b> 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 <b>Left/Right</b> arrow keys to select the field that is to be modified. Use the keypad, the <b>Up/Down</b> arrow keys, or the rotary knob to enter the input. Press <b>Enter</b> to accept the changes, or press the <b>Esc</b> key to return to normal operation without changing anything.</p>
Type Manual DHCP	
Field IP G-Way Sub	
First Octet	<p><b>Field</b>  <b>IP G-Way Sub:</b> Press this submenu key to select the desired Internet Protocol Property to be edited.</p>
Second Octet	<p><b>First Octet:</b> Moves the cursor to the left most column of the selected IP properties field.</p>
Third Octet	<p><b>Second Octet:</b> Moves the cursor to the second column from the left of the selected IP properties field.</p>
Fourth Octet	<p><b>Third Octet:</b> Moves the cursor to the third column from the left of the selected IP properties field.</p>
	<p><b>Fourth Octet:</b> Moves the cursor to the forth column from the left of the selected IP properties field.</p>

**Figure C-3.** Ethernet Menu

## C-3 DHCP

DHCP stands for Dynamic Host Configuration Protocol. It is a protocol that 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 assignment mode.

When using DHCP, no setup is required to lease and use a dynamic IP address. In a dynamic IP operation, the IP address in use may change from use to use. The DHCP server hands out IP addresses on a first come, first served 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 that requests an IP address. Normally, some amount of lag time is present on the DHCP server end, so if the device is connected again reasonably soon, then it may end up with the same 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 not conflict with other equipment on the network.

When using a static IP address on an established network, always request the 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 on the class of the address and 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 DHCP service 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
```

## C-4 ipconfig Tool

A few tools that are built into the Microsoft Windows operating system can assist in making some determinations about the network to which the PC is connected. Typing `ipconfig` at a command prompt produces a display of information about the in-use parameters of the PC and its network connection. Following is an example of the typical results expected:

<b>Note</b>	The ipconfig display does not report whether the information is from a DHCP server or from 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
```



## C-5 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) to receive a reply. Basically, the ping function sends out a request to a specific address to determine if a computing device is connected to the network at that address. If a valid connection is found, then a copy of the signal (that was sent) is returned. If a connection is not found, then the response is “request timed out”, which 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 = 0 ms, Maximum = 0 ms, Average = 0 ms
```



# Appendix D — Glossary of Terms

## D-1 Introduction

The following terms are related to this product and technology.

## D-2 Glossary of Terms

**3 dB rule :** The 3 dB rule provides a means to estimate relative power values. A 3 dB gain indicates that power increases to twice the power (a multiple of 2). A 3 dB loss indicates that power decreases to half the power (a multiple of 1/2). A system with 40 watts of input power and a 6 dB insertion loss will have only 10 watts of output power (a multiple of 1/2 for each 3 dB loss, or 1/4 of 40 watts).

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

### Adaptive Array

**Antenna :** Adaptive array antenna is a type of advanced 'smart' antenna technology that continually monitors a received signal and dynamically adapts signal patterns to optimize wireless system performance. The arrays use signal processing algorithms to adapt to user movement, to changes in the radio-frequency environment, and to multi-path and co-channel interference.

**ADC :** Analog-to-Digital Converter (ADC, A/D or A to D) is an electronic device that converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (DAC). ADC can uniquely represent all analog input values within a specified total input range by a limited number of digital output codes. Refer also to DAC.

**Analog System :** An Analog system uses an analog transmission method to send voice, video and data-using analog signals, such as electricity or sound waves, that are continuously variable rather than discrete units as in digital transmissions. Mobile analog systems include AMPS, NMT and ETACS.

### Analog

**Transmission :** Analog Transmission refers to signals propagated through the medium as continuously varying electromagnetic waves.

**Antenna :** Antenna is a device which radiates and/or receives radio signals, including RF, microwave, and RADAR.

**Antenna**

**beamwidth :** Antenna beamwidth, also known as the half-power beamwidth, is the angle of an antenna pattern or beam over which the relative power is at or above 50% of the peak power.

**Antenna Directivity :** Antenna directivity, also known as antenna gain, is the relative gain of the main beam of an antenna pattern to a reference antenna, usually an isotropic or standard dipole. Antenna Directivity is the percentage of radiated signal transmitted or received in a given direction related to beamwidth.

**Antenna Efficiency :** Antenna Efficiency is the percentage of theoretical gain actually realized from an antenna.

**Antenna Gain :** Antenna gain, also known as antenna directivity, is the relative gain of the main beam of an antenna pattern to a reference antenna, usually an isotropic or standard dipole. Antenna Gain is the effectiveness of a directional antenna expressed as the ratio of input power of the directional antenna to input power of an isotropic radiator to provide the same field strength in the desired direction. Sometimes related to a dipole antenna.

**Antenna, Isotropic :** An isotropic antenna is a theoretical point source radiating a spherical power envelope.

**Antenna, Parabolic :** A parabolic antenna is an antenna utilizing a reflector that is shaped as a paraboloid in order to both concentrate the radiated signal into a beam and to provide considerable gain. Beamwidth varies inversely and gain varies directly with the size of the antenna and with frequency.

**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.

- Average power :** Average power is the peak power averaged over time and is usually applied to pulsed systems where the carrier power is switched on and off.
- Backhaul :** In wireless technology, backhaul refers to transporting voice and data traffic from a cell site to the switch.
- 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.
- Bandwidth :** Bandwidth usually identifies the capacity of a circuit or amount of data that can be sent through a given circuit. It may be user-specified in a PVC. It is an indication of the amount of data that is passing over a medium. Also, bandwidth is the portion of the frequency spectrum required to transmit desired information. Each radio channel has a center frequency and additional frequencies above and below this carrier frequency which is used to carry the transmitted information. The range of frequencies from the lowest to the highest used is called the bandwidth.
- BBU :** Baseband Units (BBU) that are connected to remote radio heads (RRH) via CPRI protocol can be located up to 40 kilometers away from the cell tower. One BBU can run multiple cell towers.
- BER :** Bit Error Rate or Bit Error Ratio (link quality specification/testing) (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  $10^7$  bits are in error or 1 out of 10,000,000 bits are in error). Bit Error Rate is the fraction of a sequence of message bits that are in error.
- BERT :** Bit Error Rate Test/Tester (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.
- Calibration :** When making measurements, the instrument must be calibrated in order to remove residual errors due to measurement setup conditions. Anritsu recommends performing the calibration under the same conditions as the measurement: temperature, frequency, number of points, source power, and IFBW. Calibrations standards with known reflection coefficients are used to calculate the correction factors. The calibration must be conducted using the appropriate standards at the open end of any test port cables and adapters that are connected to the instrument. This ensures that the match, phase length, and loss of these cables and adapters are all accounted for. For optimal performance, high quality phase-stable cables and precision adapters must be used.
- Cell Site :** Cell Site, also called Base Station, is the local cellular tower and radio antenna (including the radios, controller, switch interconnect, etc.) that handles communication with subscribers in a particular area or cell. A cellular network is made up of many cell sites, all connected back to the switch via landline or microwave.
- 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.
- CPRI :** Common Public Radio Interface (CPRI): The Common Public Radio Interface (CPRI) standard defines the internal interface of radio base stations between the Radio Equipment Control (REC) and the Radio Equipment (RE).
- CW :** Continuous Wave (CW)

**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 logarithmic ratio of the difference between two values (a logarithm ratio is equal to 10 times). 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 -3 dB loss indicates a 50% loss in power; a +3 dB 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. Common values of dB expressed in ratios: 0 dB = 1:1, 10 dB = 10:1, 20 dB = 100:1, 30 dB = 1000:1, -30 dB = 0.001:1 [or (1/1000):1].

**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. Typical use of this term is to describe spurious signals and noise compared to a desired transmit signal.

**dBm :** dBm is an absolute measurement of power relative to 1 milliwatt. In other words, 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. Examples are: 0 dBm = 1.0 milliwatt, 10 dBm = 10 milliwatt, 30 dBm = 1000 milliwatt = 1 watt.

**DHCP :** Dynamic Host Configuration Protocol (DHCP)

**Downlink :** Downlink is the transmission path from the base station down to the mobile station.

**DSP :** Digital Signal Processing (DSP)

**DTF :** Distance-To-Fault (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. DTF measures the location and reflection size of impedance mismatches. This is typically a diagnostic measurement, not a pass/fail judgement measurement. DTF is used to identify and locate faults within an antenna system when the system is failing to meet the specified return loss or VSWR limits. DTF is also useful to verify the total length of a coaxial cable assembly.

**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 meters to 100 meters. The satellites use simple mathematical calculations to broadcast information that is translated as longitude, latitude, and altitude by Earth-based receivers.

**Impedance :** Impedance is a measure of RF component electrical resistance, measured in ohms. In most cable and antenna systems, the standard impedance is 50 ohms.



- Insertion Loss :** Insertion Loss (or Cable Loss) is a measure of the total amount of signal energy absorbed (lost) by the cable assembly. It is measured in dB. S21 (an S-Parameter) is another name for this measurement. This is often a pass/fail measurement.
- 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). Pv6 was developed in 1995, and it is standardized as RFC 2460. V6 began being deployed worldwide in the year 2000. I 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]). Ea hexadecimal group (nnnn) represents values from 0000 to FFFF, or binary values of 16 bits (0000 0000 0000 0000 to 1111 1111 1111 1111).

- IQ :** In-phase and Quadrature (IQ) or (I/Q) IQ is a method of representing digital modulation. In baseband signals can be represented by an I (In-Phase) portion and a Q (Quadrature-Phase) portion. Vectors describe the I and Q states (or equivalently the amplitude and phase) of a signal, so that all possible information about that signal can be derived from them. IQ files contain pairs of I/Q values for signals that they represent. IQ modulators are 90 degrees out of phase with each other. IQ demodulation combines two channels of information into one signal and then separates them later.
- LST :** Line Sweep tools (LST) is PC-based post-processing software that efficiently manipulates line sweep and PIM traces for reporting purposes.
- 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. F (the noise figure) is defined as the decibel value of the noise factor.  $NF = 10 \log (F)$  where log uses the base 10, or common log. This formula is valid only when the input termination is at standard noise temperature.
- OBW :** Occupied Bandwidth (OBW) 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 OBW is too large.
- OSL :** OSL or Open Short Load calibration method for coaxial line types. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSL or Offset Short 1, Offset Short 2, Load calibration method for waveguide line types.
- OSLT :** OSLT or Open Short Load Thru calibration method for coaxial line types. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSLT or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types.

- 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).
- RF : Radio Frequency (RF) is the frequency of radio sine waves. RF generally refers to wireless communications within a frequency range of 3 kHz to 300 GHz. Formally, according to the Article 2 of the Radio Law, radio frequency is below 3,000 GHz. Radio frequencies can be used for communications between a mobile telephone and an antenna mast.
- SCPI : Standard Commands for Programmable Instruments (SCPI)
- SFP : Small Form-Factor Pluggable (SFP): The SFP transceiver provides an interface to either multimode or single-mode fiber-optic cables. It contains a PCB that connects to an SFP electrical connector in a host system. The SFP is hot-pluggable and more compact than previously used devices, such as the gigabit interface converter (GBIC).
- SOLT : SOLT or Short Open Load Thru calibration method for coaxial line types with simple and redundant standards. It is not band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSLT or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types.
- SSL : SSL or Short Short Load or Offset Short 1, Offset Short 2, Load calibration method for waveguide line types uses Shorts with different offset lengths. It is a calibration (common in waveguide) with simple and redundant standards, but it is band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Offset Short 1 is 1/8 wavelength, and Offset Short 2 is 3/8 wavelength. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with OSL or Open Short Load calibration method for coaxial line types.

**SSLT :** SSLT or Short Short Line Thru or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types uses Shorts with different offset lengths. It is a calibration (common in waveguide) with simple and redundant standards, but it is band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Offset Short 1 is 1/8 wavelength, and Offset Short 2 is 3/8 wavelength. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with OSLT or Open Short Load Thru calibration method for coaxial line types.

**VSWR :** Voltage Standing Wave Ratio (VSWR). VSWR is another method to measure reflected energy caused by impedance mismatch. It is expressed as a ratio of X:1. VSWR measures the voltage peaks and valleys. A ratio of 1:1 would be a perfect match. A typical cable and antenna system would be around 1.43:1 (VSWR) or 15 dB Return Loss. The Site Master can measure either Return Loss or VSWR. Some carriers require that Return Loss is measured in VSWR. This is typically a pass/fail measurement.

**Watt :** Watt (w) is a unit of measure for power.

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