## User Guide

# Cell Master

## MT8212E and MT8213E

## MT8212E
## 2 MHz to 4 GHz Cable and Antenna Analyzer
## 100 kHz to 4 GHz Spectrum Analyzer
## 10 MHz to 4 GHz Power Meter

## MT8213E
## 2 MHz to 6 GHz Cable and Antenna Analyzer
## 100 kHz to 6 GHz Spectrum Analyzer
## 10 MHz to 6 GHz Power Meter

Appendix A provides a list of supplemental documentation for the Cell Master features and options. The documentation set is available as PDF files on the documentation disc and the Anritsu website.

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

Part Number: 10580-00250
Revision: K
Published: December 2014

# WARRANTY

The Anritsu products listed on the title page are warranted against defects in materials and workmanship for three years from the date of shipment.

Anritsu's obligation covers repairing or replacing products which prove to be defective during the warranty period. Buyers shall prepay transportation charges for equipment returned to Anritsu for warranty repairs. Obligation is limited to the original purchaser. Anritsu is not liable for consequential damages.

# LIMITATION OF WARRANTY

The foregoing warranty does not apply to Anritsu connectors that have failed due to normal wear. Also, the warranty does not apply to defects resulting from improper or inadequate maintenance, unauthorized modification or misuse, or operation outside of the environmental specifications of the product. No other warranty is expressed or implied, and the remedies provided herein are the Buyer's sole and exclusive remedies.

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# TRADEMARK ACKNOWLEDGMENTS



# NOTICE



# UPDATES

Updates, if any, can be downloaded from the Anritsu Website at:
http://www.anritsu.com

For the latest service and sales contact information in your area, please visit:
http://www.anritsu.com/contact.asp

# DECLARATION OF CONFORMITY

**Manufacturer's Name:** ANRITSU COMPANY

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

declares that the product specified below:

**Product Name:** Cell Master

**Model Number:** MT8212E, MT8213E

conforms to the requirement of:

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

## Electromagnetic Compatibility: EN61326:2006

Emissions: EN55011: 2007 Group 1 Class A

| | | |
|---|---|---|
| Immunity: | EN 61000-4-2:1995 +A1:1998 +A2:2001 | 4kV CD, 8kV AD |
| | EN 61000-4-3:2006 +A1:2008 | 3V/m |
| | EN 61000-4-4:2004 | 0.5kV SL, 1kV PL |
| | EN 61000-4-5:2006 | 0.5kV L-L, 1kV L-E |
| | EN 61000-4-6: 2007 | 3V |
| | EN 61000-4-11: 2004 | 100% @ 20msec |

## Electrical Safety Requirement:

Product Safety: EN 61010-1:2001

Eric McLean, Corporate Quality Director

Morgan Hill, CA

23 DEC 2009
Date

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

## CE Conformity Marking

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

## C-tick Conformity Marking

Anritsu affixes the C-tick marking onto its conforming products in accordance with the electromagnetic compliance regulations of Australia and New Zealand in order to indicate that these products conform to the EMC regulations of Australia and New Zealand.

N274

## Notes On Export Management

This product and its manuals may require an Export License or approval by the government of the product country of origin for re-export from your country.

Before you export this product or any of its manuals, please contact Anritsu Company to confirm whether or not these items are export-controlled.

When disposing of export-controlled items, the products and manuals need to be broken or shredded to such a degree that they cannot be unlawfully used for military purposes.

## Mercury Notification

This product uses an LCD backlight lamp that may contain mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities for disposal or recycling information.

## Perchlorate Notification

This product uses a small Lithium battery that may contain perchlorate installed internally on the circuit board. Disposal may be regulated due to environmental considerations. Please contact your local authorities for disposal or recycling information.

# European Parliament and Council Directive 2002/96/EC

Equipment marked with the Crossed-out Wheelie Bin symbol complies with the European Parliament and Council Directive 2002/96/EC (the "WEEE Directive") in the European Union.

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

# Chinese RoHS Compliance Statement

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

| 部件名称 | 有毒有害物质或元素 | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 [Cr (VI)] | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 印刷线路板 (PCA) | × | ○ | × | × | ○ | ○ |
| 机壳、支架 (Chassis) | × | ○ | × | × | ○ | ○ |
| LCD | × | × | × | × | ○ | ○ |
| 其他（电缆、风扇、连接器等） (Appended goods) | × | ○ | × | × | ○ | ○ |

○：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。
×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

环保使用期限

这个标记是根据 2006/2/28 公布的「电子信息产品污染控制管理办法」以及 SJ/T 11364-2006「电子信息产品污染控制标识要求」的规定，适用于在中国销售的电子信息产品的环保使用期限。仅限于在遵守该产品的安全规范及使用注意事项的基础上，从生产日起算的该年限内，不会因产品所含有害物质的泄漏或突发性变异，而对环境污染，人身及财产产生深刻地影响。
注）电池的环保使用期限是 5 年。生产日期标于产品序号的前四码
（如 S/N 0728XXXX 为07 年第 28 周生产）。

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

**Warning**

**WARNING**

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

**Caution**

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

# Safety Symbols Used on Equipment and in Manuals

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

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

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

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

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

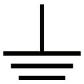
These indicate that the marked part should be recycled.

**Warning**

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

**Warning**

or



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

**Warning**


This equipment 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 equipment 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 data sheet.

# Table of Contents

## Chapter 4—File Management



## Chapter 5—System Operations



## Chapter 6—GPS (Option 31)

# Chapter 1 — General Information

## 1-1 Introduction

This chapter provides information about frequency range, available options, additional documents, general overview, preventive maintenance, and annual verification requirements for the Anritsu Handheld MT821xE Cell Master models. Throughout this manual, the term Cell Master will refer to both the MT8212E and MT8213E.

## 1-2 Chapter Overview

# 1-3 Contacting Anritsu

To contact Anritsu, please visit:

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

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

Updated product information can be found on the Anritsu website:

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 MT8212E:

http://www.anritsu.com/en-us/products-solutions/products/MT8212E.aspx

# 1-4 Available Models

Table 1-1 lists the Cell Master models and frequency range described in this User Guide.

**Table 1-1.** Cell Master Model

| Model | Frequency Range |
|---|---|
| MT8212E | Cable & Antenna Analyzer, 2 MHz to 4 GHz<br>Spectrum Analyzer, 100 kHz to 4 GHz<br>Power Meter, 10 MHz to 4 GHz |
| MT8213E | Cable & Antenna Analyzer, 2 MHz to 6 GHz<br>Spectrum Analyzer, 100 kHz to 6 GHz<br>Power Meter, 10 MHz to 6 GHz |

# 1-5 Available Options

Available options for the Cell Master are shown in Table 1-2.

**Table 1-2.** Available Options (Sheet 1 of 3)

| MT8212E | MT8213E | Description |
|---|---|---|
| MT8212E-0021 | MT8213E-0021 | 2-Port Transmission Measurement |
| MT8212E-0010 | MT8213E-0010 | Bias-Tee |
| | | |
| MT8212E-0031 | MT8213E-0031 | GPS Receiver (Requires Antenna P/N 2000-1528-R) |
| MT8212E-0019 | MT8213E-0019 | High-Accuracy Power Meter (Requires External Power Sensor) |
| | | |
| MT8212E-0025 | MT8213E-0025 | Interference Analyzer[1] |
| MT8212E-0027 | MT8213E-0027 | Channel Scanner |

**Table 1-2.** Available Options (Sheet 2 of 3)

| MT8212E | MT8213E | Description |
|---|---|---|
| MT8212E-0431 | MT8213E-0431 | Coverage Mapping[1] |
| MT8212E-0444 | MT8213E-0444 | EMF Measurement (Requires Anritsu Isotropic Antenna) |
| MT8212E-0090 | MT8213E-0090 | Gated Sweep |
| MT8212E-0028 | MT8213E-0028 | C/W Signal Generator (Requires CW Signal Generator Kit, P/N 69793) |
| MT8212E-0040 | MT8213E-0040 | GSM/GPRS/EDGE RF Signal Analyzer |
| MT8212E-0041 | MT8213E-0041 | GSM/GPRS/EDGE Demodulated Signal Analyzer |
| MT8212E-0044 | MT8213E-0044 | W-CDMA/HSDPA RF Signal Analyzer |
| MT8212E-0045 | MT8213E-0045 | W-CDMA Demodulated Signal Analyzer |
| MT8212E-0065 | MT8213E-0065 | W-CDMA/HSDPA Demodulated Signal Analyzer |
| MT8212E-0035 | MT8213E-0035 | W-CDMA/HSDPA Over-the-Air Signal Analyzer[1] |
| MT8212E-0060 | MT8213E-0060 | TD-SCDMA/HSDPA RF Signal Analyzer |
| MT8212E-0061 | MT8213E-0061 | TD-SCDMA/HSDPA Demodulated Signal Analyzer |
| MT8212E-0038 | MT8213E-0038 | TD-SCDMA/HSDPA Over-the-Air Signal Analyzer |
| MT8212E-0541 | MT8213E-0541 | LTE/LTE-A RF Measurements |
| MT8212E-0542 | MT8213E-0542 | LTE/LTE-A Modulation Measurements |
| MT8212E-0546 | MT8213E-0546 | LTE/LTE-A Over-the-Air Measurements (Requires Options 0031 and 0542 for full functionality) |
| MT8212E-0551 | MT8213E-0551 | TD-LTE/LTE-A RF Measurements |
| MT8212E-0552 | MT8213E-0552 | TD-LTE/LTE-A Modulation Measurements |
| MT8212E-0556 | MT8213E-0556 | TD-LTE/LTE-A Over-the-Air Measurements (Requires 0031 and 0552 for full functionality) |
| MT8212E-0042 | MT8213E-0042 | cdmaOne/CDMA2000 1X RF Signal Analyzer |
| MT8212E-0043 | MT8213E-0043 | cdmaOne/CDMA2000 1X Demodulated Signal Analyzer |
| MT8212E-0033 | MT8213E-0033 | cdmaOne/CDMA2000 1X Over-the-Air Signal Analyzer[1] |

**Table 1-2.** Available Options (Sheet 3 of 3)

| MT8212E | MT8213E | Description |
|---|---|---|
| MT8212E-0062 | MT8213E-0062 | CDMA2000 1xEV-DO RF Signal Analyzer |
| MT8212E-0063 | MT8213E-0063 | CDMA2000 1xEV-DO Demodulated Signal Analyzer |
| MT8212E-0034 | MT8213E-0034 | CDMA2000 1xEV-DO Over-the-Air Signal Analyzer[1] |
| MT8212E-0046 | MT8213E-0046 | IEEE 802.16 Fixed WiMAX RF Signal Analyzer |
| MT8212E-0047 | MT8213E-0047 | IEEE 802.16 Fixed WiMAX Demodulated Signal Analyzer |
| MT8212E-0066 | MT8213E-0066 | IEEE 802.16 Mobile WiMAX RF Signal Analyzer |
| MT8212E-0067 | MT8213E-0067 | IEEE 802.16 Mobile WiMAX Demodulated Signal Analyzer |
| MT8212E-0037 | MT8213E-0037 | IEEE 802.16 Mobile WiMAX Over-the-Air Signal Analyzer |
| | | |
| MT8212E-0030 | MT8213E-0030 | ISDB-T Digital Video Measurements |
| MT8212E-0032 | MT8213E-0032 | ISDB-T SFN Measurements |
| MT8212E-0079 | MT8213E-0079 | ISDB-T BER Measurements[2][3] |
| | | |
| MT8212E-0064 | MT8213E-0064 | DVB-T/H Digital Video Measurements |
| MT8212E-0078 | MT8213E-0078 | DVB-T/H SFN Measurements |
| MT8212E-0057 | MT8213E-0057 | DVB-T/H BER Measurements[4][3] |
| | | |
| MT8212E-0051 | MT8213E-0051 | T1 Analyzer[3] |
| MT8212E-0052 | MT8213E-0052 | E1 Analyzer[3] |
| MT8212E-0053 | MT8213E-0053 | T3/T1 Analyzer[3] |
| | | |
| MT8212E-0098 | MT8213E-0098 | Standard Calibration (ANSI Z540-1-1994) |
| MT8212E-0099 | MT8213E-0099 | Premium Calibration<br>(ANSI Z540-1-1994 plus test data) |

1.Requires GPS Receiver Option 0031.

2.Requires Option 0030

3.Mutually exclusive options: These options are mutually exclusive because they require hardware that occupies the same space. The options are the BER options (Option 0057 and Option 79), Option 0051, Option 0052, and Option 0053. The BER options, 57 and 79, can be installed together because they use the same hardware.

4.Requires Option 0064

## 1-6 Standard Accessories

The Anritsu Cell Master includes a one year warranty which includes: battery, firmware, software, and Certificate of Calibration and Conformance.

The Cell Master Technical Data Sheet (P/N 11410-00485) contains a list and description of standard accessories. The data sheet is provided with the instrument and is also available on the Anritsu website: http://us.anritsu.com.

## 1-7 Optional Accessories

The Cell Master Technical Data Sheet (P/N 11410-00485) also contains a list and description of available optional accessories. The data sheet is provided with the instrument and is also available on the Anritsu website: http://us.anritsu.com.

## 1-8 Additional Documents

This user guide is specific to the Cell Master and includes a general description about the instrument. For information about Cable & Antenna Measurement, Spectrum Analysis, Interference Analysis, 2-port Transmission Measurements, Power Meter, 3GPP Signal Analysis, 3GPP2 Signal Analysis, WiMAX Signal Analysis, Backhaul Analyzer, and PIM Analyzer, refer to the individual Measurement Guides listed in Appendix A, “Measurement Guides”.

## 1-9 General Description

The Cell Master MT821xE is a handheld multi-function Base Station Analyzer designed to make Cable and Antenna Analysis, Spectrum Analysis and Power Meter measurements in the field. In addition, the Cell Master can be equipped with 2-port Transmission Measurement capability, Interference Analyzer, Channel Scanner, Coverage Mapping, CW Signal Generator, GSM/EDGE Analyzer, W-CDMA/HSDPA Analyzer, TD-SCDMA Analyzer, CDMA Analyzer, EVDO Analyzer, Fixed and Mobile WiMAX Analyzer, PIM Analyzer, T1/T3, E1 Analyzer, LTE Analyzer, and TD-LTE Analyzer, thus eliminating the need to carry multiple instruments to the field.

The cable & antenna analyzer includes Return Loss, Cable Loss, VSWR, Distance-to-fault -Return Loss, Distance-to-Fault SWR, 1-port phase and smith chart measurements. The 2-port transmission measurement option includes two power levels and access to a built-in 32V bias tee.

The bright 8.4" TFT color display provides easy viewing in a variety of lighting conditions. The Cell Master MT821xE is equipped with a Li-Ion battery delivering more than three hours of battery life. The combination of a touch screen and keypad enables users to navigate menus with the touch screen and enter numbers with the keypad.

A GPS receiver can be added to Cell Master MT821xE.

### Trace Storage

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of up to 1000 measurement setups and up to 1000 traces using Master Software Tools (MST). External storage can be used for bulk measurement storage. Measurements and setups can be stored in a USB flash drive or transferred to a PC by using the included USB cable.

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

## 1-10 Cell Master Specifications

Refer to the Cell Master Technical Data Sheet (P/N 11410-00485) for general specifications, detailed measurement specifications for all available measurement modes, ordering information, power sensors, and available accessories. The data sheet is included with the instrument and also available on the Anritsu website: http://us.anritsu.com.

## 1-11 Preventive Maintenance

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

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

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of the N(f) connectors and the pins of the N(m) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are undamaged, gauge the connectors to confirm that the dimensions are correct.

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

## 1-12 Calibration Requirements

Anritsu recommends annual calibration and performance verification by local Anritsu service centers. The Cable and Antenna Analyzer mode requires calibration standards for OPEN, SHORT, and LOAD (OSL) or InstaCal module, which are sold separately.

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|---|---|
| **Note** | Anritsu recommends allowing the instrument to warm up to typical operation temperature (~15 minutes) before calibrating. |

## 1-13 Annual Verification

Anritsu recommends an annual calibration and performance verification of the Cell Master and the OSL calibration components and InstaCal module by local Anritsu service centers.

The Cell Master is self-calibrating and there are no field-adjustable components. The OSL calibration components are crucial to the integrity of the calibration. As a result, they must be verified periodically to ensure performance conformity. This is especially important if the OSL calibration components have been accidentally dropped or over-torqued.

Contact information for Anritsu Service Centers is available at:

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

## 1-14 ESD Caution

The Cell Master, like other high performance instruments, is susceptible to electrostatic discharge ( ESD) damage. Coaxial cables and antennas often build up a static charge, which (if allowed to discharge by connecting directly to the Cell Master without discharging the static charge) may damage the Cell Master input circuitry. Cell Master 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 Cell Master, it is recommended that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the Cell Master. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the Cell Master. It is important to remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

## 1-15 Battery Replacement

The battery can be replaced without the use of tools. The battery compartment is located on the lower left side of the instrument (when you are facing the measurement display). Slide the battery door down, towards the bottom of the instrument, to remove it. Remove the battery pack from the instrument by grabbing the battery lanyard and pulling out. Replacement is the opposite of removal. The battery key side (slot below the contacts) should be facing the front on the unit and slide in first.

| | |
|---|---|
| **Note** | When inserting the battery the battery label should face the back of the instrument and the guide slot on the battery should be below the contacts. If the battery door does not latch closed, the battery may be inserted incorrectly. |


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

The battery that is supplied with the Cell Master may need charging before use. The battery can be charged while it is installed in the Cell Master by using either the AC-DC Adapter or the Automotive Cigarette Lighter Adapter. The battery can also be charged outside the Cell Master with the optional Dual Battery Charger. Refer to "Battery Symbols" on page 2-13 for a description of battery symbols.

| | |
|---|---|
| **Note** | Use only Anritsu Company approved batteries, adapters, and chargers with this instrument. |

| | |
|---|---|
| **Caution** | When using the Automotive Cigarette Lighter Adapter, always verify that the supply is rated for a minimum of 60 Watts @ 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. |

# 1-16 Soft Carrying Case

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

To install the 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 Cell Master.
2. Place the soft carrying case face down on a stable surface, with the front panel fully closed and laying flat.

| Note | The soft case has two zippers near the back. The zipper closer to the front of the case opens to install and remove the instrument. The zipper closer to the back of the case opens an adjustable support panel that can be used to provide support for improved stability and air flow while the instrument is in the case. This support panel also contains the storage pouch. |
|---|---|

3. Open the zippered back of the case.
4. Insert the instrument face down into the case, take 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 Cell Master.


**Figure 1-2.** Instrument Inserted into the Soft Carrying Case

5. Close the back panel and secure with the zipper to secure the Cell Master.

The soft carrying case includes a detachable shoulder strap, which can be connected to the D-rings of the case.

| | |
|---|---|
| **Caution** | The soft case has panel openings for the fan inlet and exhaust ports. Do not block the air flow through the panels when the unit is operating. |

## 1-17 Tilt Bail Stand

A Tilt Bail is attached to the back of the Cell Master for desktop operation. The tilt bail provides two settings of backward tilt for improved stability. 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 until it attaches to the Cell Master.

| | |
|---|---|
| **Note** | Do not use the tilt bail while the instrument is in the soft case. The soft case has an adjustable support panel in the back zipper. |


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

# 1-18 Secure Environment Workplace

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

## Cell Master Memory Types

The instrument contains non-volatile disk-on-a-chip memory, EEPROM, and volatile DRAM memory. 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 (not included with the instrument)

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 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

Set the Cell Master to save files to the 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 with the rotary knob, **Up/Down** arrow keys, or the touchscreen.
5. Press the Set Location submenu key.

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

| | |
|---|---|
| **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. |

# Chapter 2 — Instrument Overview

## 2-1 Introduction

This chapter provides a brief overview of the Anritsu Cell Master. The intent of this chapter is to acquaint the user with the instrument. For detailed measurement information, refer to a specific measurement guide listed in Appendix A, "Measurement Guides".

## 2-2 Chapter Overview



## 2-3 Turning On the Cell Master

The Anritsu Cell Master is capable of approximately three hours of continuous operation from a fully charged, field-replaceable battery (see Section 1-15 "Battery Replacement" on page 1-7). The Cell Master 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-DC Adapter or the Automotive Cigarette Lighter Adapter. Both items are included with the Cell Master.

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

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

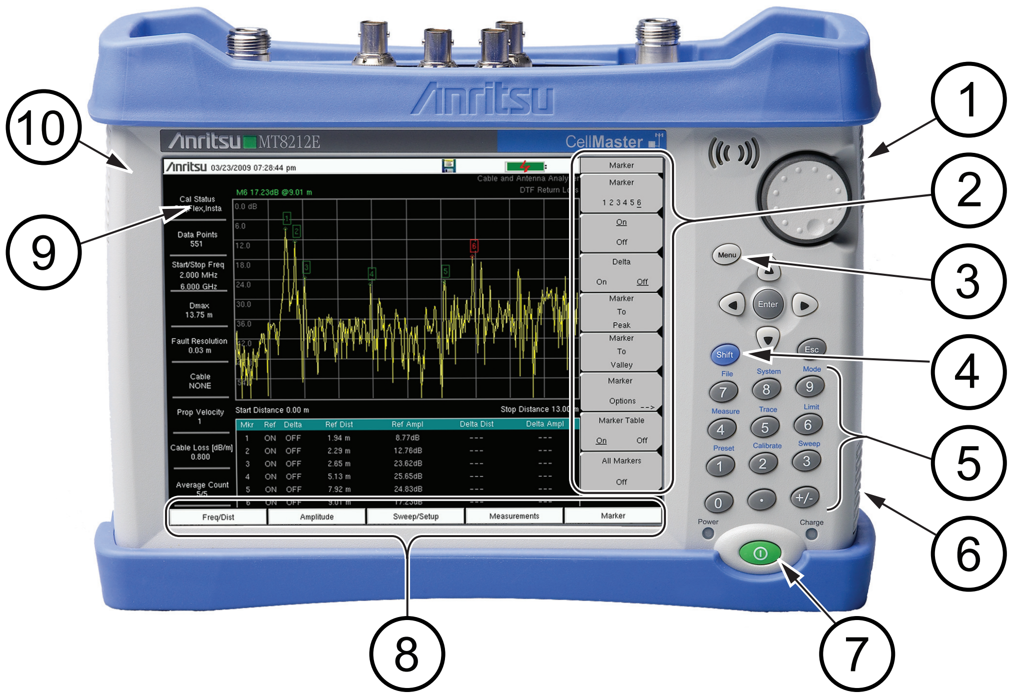



**Figure 2-1.** Cell Master Overview

| | |
|---|---|
| 1. | Fan Inlet Port |
| 2. | Touch Screen Submenu Keys |
| 3. | Menu Key |
| 4. | Shift Key |
| 5. | Numeric Keypad and Shift Menu Keys (1 to 9, printed in blue above each key) |
| 6. | Fan Inlet Port |
| 7. | On/Off Button |
| 8. | Touch Screen Main Menu Keys |
| 9. | Calibration Status and Type |
| 10. | Fan Exhaust Port |

The Cell Master takes approximately sixty seconds to complete power warm-up and to load the application software. At the completion of this process, the instrument is ready for use.

## 2-4 Front Panel Overview

The Cell Master menu-driven interface is easy to use and requires little training. The Cell Master uses a touch screen and keypad for data input. The five bottom menu keys and eight submenu keys on the right side are touch screen keys. The menu and submenu keys will vary depending upon the selected mode of operation, see "Mode Selector Menu" on page 2-16.

Numeric keys 1 through 9 are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself and the alternate function is printed in blue above each of the keys. Use the blue **Shift** key to access the functions printed on the panel. The **Escape** key, used for aborting data entry, is the oval button located above numeric key 9. The rotary knob, the four arrow keys, and the keypad can be used to change the value of an active parameter.

The Menu key provides graphical icons of all the installed measurement modes and user defined short-cuts (see "Menu Key" on page 2-3). The locations of the keys are shown in Figure 2-1.

| | |
|---|---|
| **Note** | Keep the fan inlet and exhaust ports clear of obstructions at all times for proper ventilation and cooling of the instrument. |

## Front Panel Keys

### Menu Key

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

Figure 2-2 shows the **Menu** key screen with shortcut icons for the installed measurement modes. Touch one of the icons in the top two rows to change modes. These icons are preinstalled and cannot be moved or deleted.


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

| **Note** | The display of the Menu screen will vary depending on Cell Master model and installed options. |
|---|---|

Figure 2-3 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 submenu key or main menu key for a few seconds to add a shortcut to this screen. After a few seconds the Menu screen is automatically displayed and shows the available locations for the shortcut. Select an open (unused) location to store the new shortcut.

To add shortcut 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 2-3.** Menu Key Screen

User-defined shortcuts will stay in memory 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 will open 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 5-6 for additional information. |
|---|---|

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

### Esc Key

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

### Enter Key

Press this key to finalize data input or select a highlighted item from a list.

### Arrow Keys

The four arrow keys (around the **Enter** key) are used to scroll up, down, left, or right. The arrow keys can often be used to change a value or to change a selection from a list. This function is similar to the function of the rotary knob. The arrow keys are also used to move markers.

### Shift Key

Pressing the **Shift** key and then a number key executes the function that is indicated in blue text above the number key. When the **Shift** key is active, its icon is displayed at the top-right of the measurement display area by the battery charge indicator.


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

### Number Keypad

The Number keypad has two functions: The primary function is number entry. The secondary function of the number keypad is to list various menus. See "Keypad Menu Keys (1 to 9)" on page 2-6.

### Rotary Knob

Turning the rotary knob changes numerical values, scrolls through selectable items from a list, and moves markers. Values or items may be within a dialog box or an edit window.

## Touch Screen Keys

### Main Menu Touch Screen Keys

These five main menu keys are horizontally arranged 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 listed in Appendix A, "Measurement Guides".

| | |
|---|---|
| **Note** | Available measurement modes are based on model and options purchased. Refer to Table 1-1 and Table 1-2 for additional information. |

### Submenu Touch Screen Keys

These submenu keys are arranged along the right-hand edge of the touch screen. The submenu labels change as instrument measurement settings change. The current submenu title is shown at the top of the submenu key block.

## Keypad Menu Keys (1 to 9)

Pressing the **Shift** key and then a number key selects the menu function that is printed in blue characters above the number key. See Figure 2-1 on page 2-2.

Not all Secondary Function Menus are active in various measurement modes. If any one of these 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 Preset Menu (1) and System Menu (8) are described in Chapter 5, "System Operations ". The Sweep Menu (3), Measure Menu (4), Trace Menu (5), and Limit Menu (6) vary depending on measurement mode, see the Measurement Guides listed in Appendix A for information. The File Menu (7) is described in Chapter 4, "File Management". The Mode Menu (9) is described in "Mode Selector Menu" on page 2-16.

## LED Indicators

### Power LED

The Power LED is located to the left of the **On/Off** key. The LED is solid green when the unit is on and slowly blinks when the unit is off but has external power.

### Charge LED

The Charge LED is located to the right of the **On/Off** key. The LED slowly blinks when the battery is charging and is solid green when the battery is fully charged.

# 2-5 Display Overview

Figure 2-5 and Figure 2-6 illustrate some of the key information areas of the Cell Master in Cable & Antenna mode and Spectrum Analyzer mode. For detailed information on either mode, refer to the Measurement Guides listed in Appendix A, "Measurement Guides".

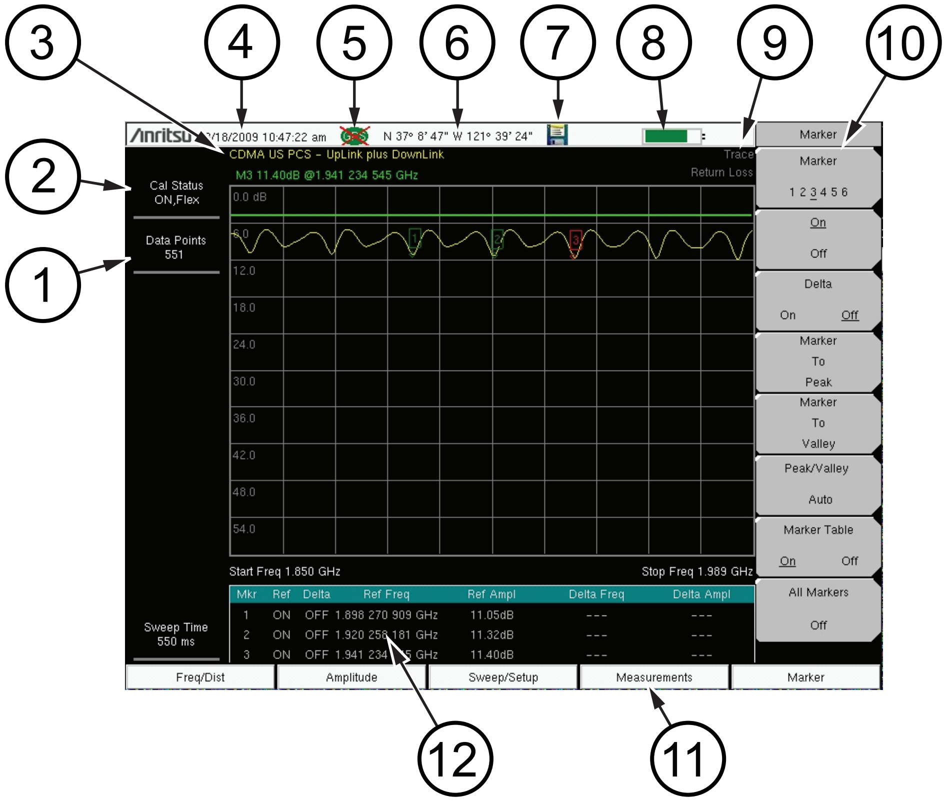



**Figure 2-5.** Cable & Antenna Analyzer Return Loss Measurement Display

| | |
|---|---|
| 1. | Measurement Settings Summary |
| 2. | Calibration Status, Type |
| 3. | Frequency Standard |
| 4. | Date and Time |
| 5. | GPS Icon |
| 6. | GPS Location |
| 7. | Save Icon |
| 8. | Battery Charge Indicator |
| 9. | Trace Measurement Title |
| 10. | Submenu Touch Screen Keys |
| 11. | Main Menu Touch Screen Keys |
| 12. | Marker Table |

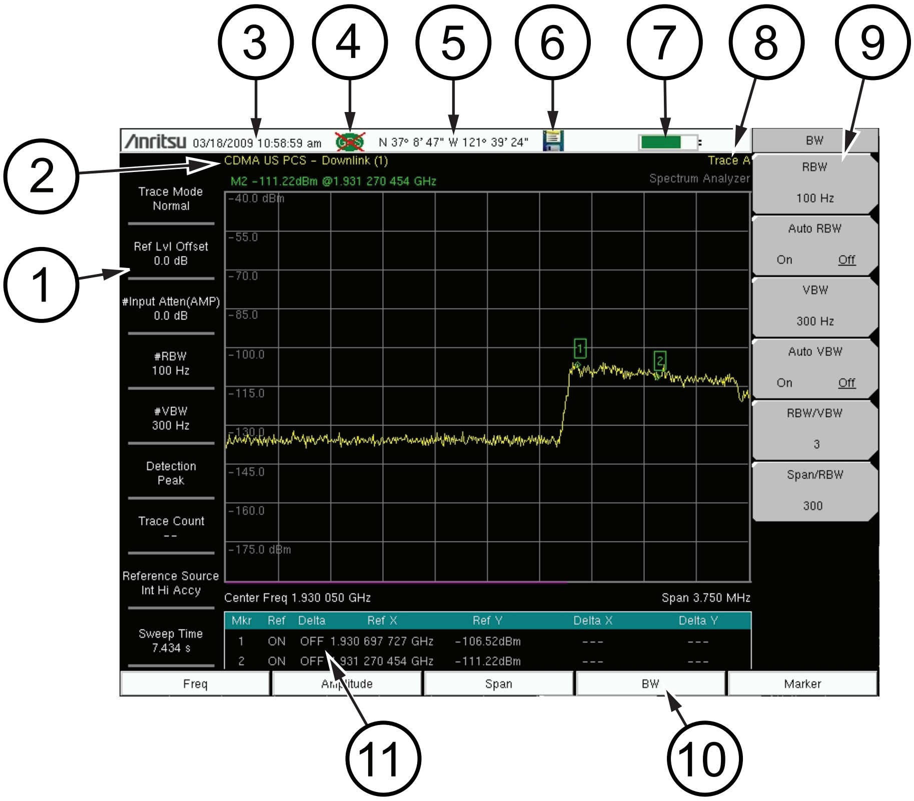



**Figure 2-6.** Spectrum Analyzer Display

| | |
|---|---|
| 1. | Measurement Settings Summary (Touch Screen Shortcuts) |
| 2. | Frequency Standard |
| 3. | Date and Time |
| 4. | GPS Icon |
| 5. | GPS Location |
| 6. | Save Icon |
| 7. | Battery Charge Indicator |
| 8. | Trace Measurement Title |
| 9. | Submenu Touch Screen Keys |
| 10. | Main Menu Touch Screen Keys |
| 11. | Marker Table |

| | |
|---|---|
| **Note** | Many of the measurement settings are used as touch screen shortcuts. Use the touch screen to select a measurement setting to edit. |

## 2-6 Test Panel Connector Overview

Test panel connectors for the Cell Master are shown in Figure 2-7.

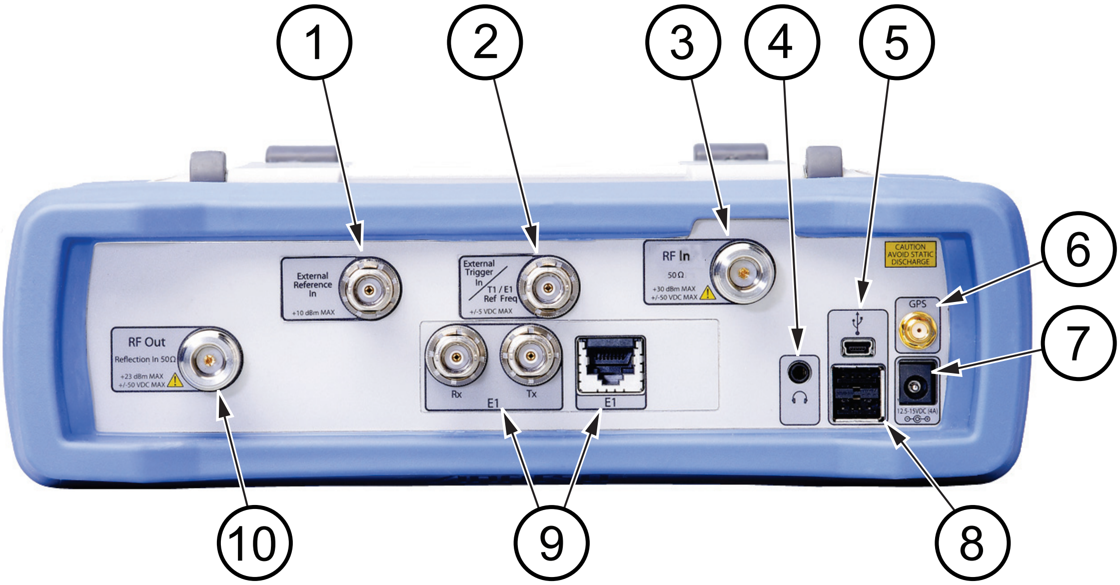



**Figure 2-7.** Test Panel Connectors

| | |
|---|---|
| 1. | External Reference |
| 2. | External Trigger, T1 E1 Ref. Freq. |
| 3. | RF In (Type N) |
| 4. | Headset jack |
| 5. | USB Mini-B |
| 6. | GPS (Type SMA) |
| 7. | External Power |
| 8. | USB Type A |
| 9. | Option 52: Rx, Tx, E1 Connectors<br>Option 51 or Option 53: RJ45 is replaced with Bantam Connectors |
| 10. | RF Out (Type N) |

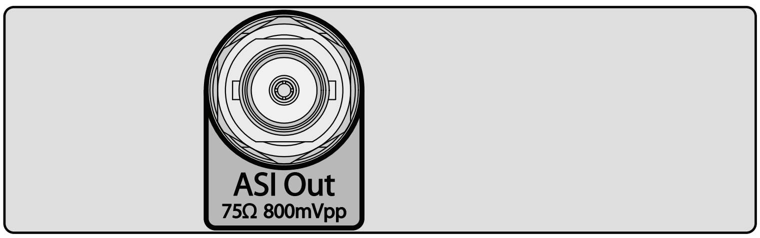



**Figure 2-8.** DVB ASI Out BNC Connector for BER Measurements (Option 57 and Option 79)

### External Power

The external power connector is used to power the unit and for battery charging. Input is 12 VDC to 15 VDC at up to 5.0 A. The green flashing Power LED near the power switch indicates that the instrument has external power.

| | |
|---|---|
| **Warning** | When using the AC-DC 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. |

### USB Interface – Type A

The Cell Master has two Type A USB connectors that accept USB Flash Memory devices for storing measurements, setups data, and screen images.

### USB Interface – Mini-B

The USB 2.0 Mini-B connector can be used to connect the Cell Master directly to a PC. The first time the Cell Master is connected to a PC, the normal USB device detection by the computer operating system will take place.

| | |
|---|---|
| **Note** | For proper detection, the applicable Anritsu Software Tool should be installed on the PC prior to connecting the Cell Master to the USB port. |

### Headset Jack

The headset jack provides audio output from the built-in AM/FM/SSB demodulator for testing and troubleshooting wireless communication systems. The jack accepts a 2.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones.

### Ext Trigger In

A TTL signal that is applied to the External Trigger 50 Ω female BNC input connector causes a single sweep to occur. In the Spectrum Analyzer mode, it is used in zero span, and triggering occurs on the rising edge of the signal. 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.

### RF In

50 Ω Type-N female connector. Maximum input and damage level are provided in the Technical Data Sheet (refer to Appendix A).

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).

### RF Out (Reflection In)

RF output, 50 Ω Type-N female connector, for reflection measurements. Maximum ouput and damage level are provided in the Technical Data Sheet (refer to Appendix A).

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).

### GPS Antenna Connector

The GPS antenna connection on the Cell Master is type SMA-female. GPS function is described in Chapter 6, "GPS (Option 31) ".

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).

### Rx, Tx, E1 Connectors

These ports are used in T1/T3/E1 operations described in the Backhaul Measurement Guide (PN: 10580-00238) available on the documentation disc. Refer to Appendix A, "Measurement Guides" for additional information.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the T3 BNC connectors. Do not overtighten the connectors.

### Digital Signal Output (DVB ASI Out) BNC Connector

The digital signal output, BNC female connector is unique to the Bit Error Rate (BER) options (Option 57 and Option 79) and is present only when one or both of these options are installed. The Digital Television Signal Analyzer options operations are described in the Digital Television Signal Analyzer Measurement Guide (refer to Appendix A).

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

The DVB-ASI function produces MPEG-TS data output during a BER measurement. This output can be connected to MPEG-TS analysis equipment to monitor video errors or can be connected via an appropriate ASI to USB demultiplexing and decoding accessories for channel identification and monitoring purposes.

# 2-7 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.

## 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. A slight resistance can usually be felt as the center conductors mate.

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

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

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

   Do not over torque the connector.

## Disconnecting Procedure

1. If a wrench is needed, then use an open-end wrench to keep the connector body from turning while loosening with a second wrench.
2. Complete the disconnection by hand, turning only the connector nut.
3. Pull the connectors straight apart without twisting or bending.

# 2-8 Symbols and Indicators

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

## Calibration Symbols

The current calibration status and type is displayed in the upper-left of the screen when in Cable & Antenna Analyzer mode. See Figure 2-5 on page 2-7. The five status messages are described next.

### Cal Status: ON, Flex

The Cell Master has been calibrated with discrete Open, Short, and Load components. This is a FlexCal calibration indicating it is possible to change the frequency range after calibration.

### Cal Status: ON, Standard

The Cell Master has been calibrated with discrete Open, Short, and Load components. This is a Standard calibration indicating it is not possible to change the frequency range after calibration without performing another calibration.

### Cal Status: ON, Flex, Insta

The Cell Master has been calibrated with the InstaCal module. This is a FlexCal calibration indicating it is possible to change the frequency range after calibration.

### Cal Status: ON, Standard, Insta

The Cell Master has been calibrated with the InstaCal module. The Cell Master has been calibrated with discrete Open, Short, and Load components. This is a Standard calibration indicating it is not possible to change the frequency range after calibration without performing another calibration.

### Cal Status Off:

The Cell Master has not been calibrated.

For calibration procedures refer to the Cable & Antenna Measurement Guide (PN: 10580-00241) listed in Appendix A.

## Battery Symbols

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 2-9.** 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)

Detailed battery information is also available in the Status dialog box (**System** > Status).

When either the AC-DC Adapter or the Automotive Cigarette Lighter Adapter is connected, the battery automatically receives a charge, and the battery symbol with the lightning bolt is displayed (Figure 2-10).

**Figure 2-10.** Battery Charging Icon

The green Charge LED 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. |

When operating from external power without a battery installed, the battery symbol is replaced by a red plug body (Figure 2-11).

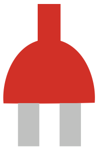


**Figure 2-11.** Battery Not Installed

## Additional Symbols

### Single Sweep

Single Sweep is selected. Press Continuous in the **Sweep** menu to resume continuous sweeping.

### Floppy Icon 

Shortcut to the Save submenu. Touch the icon to open the touch screen keyboard for saving measurements, setups, or screen displays.

# 2-9 Data Entry

## Numeric Values

Numeric values are changed using the rotary knob, arrow keys, or the keypad. Pressing one of the main menu keys will display 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 red on the graticule. When using the keypad, the new value is shown in red on the graticule and the submenu changes to Units. Selecting a unit for the new value completes the entry.

## 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, the rotary knob, or the touch screen. 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 using Master Software Tools (MST) or Anritsu Line Sweep Tools (LST).

## Text Entry

When entering text, as when saving a measurement, the touch screen keyboard is displayed (Figure 2-12). Characters are entered directly with the touch screen keyboard. The keypad can be used for numeric entry. The left and right arrow keys will scroll the cursor through the filename. See "Save Menu" on page 4-9 for additional information.

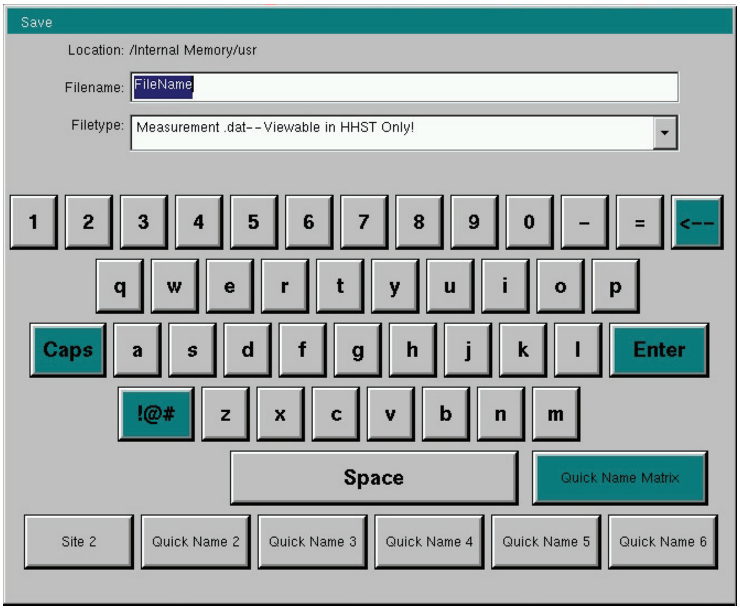



**Figure 2-12.** Touch Screen Keyboard

# 2-10 Mode Selector Menu

To access the functions under the Mode menu, select the **Shift** key, then the **Mode** (9) key. Use the directional arrow keys, the rotary knob, or the touch screen to highlight the selection, and press the **Enter** key to select. The list of modes that appear in this menu will vary depending upon the options that are installed and activated in the instrument. Figure 2-13 is an example of the Mode menu. Your instrument may not show the same list. The current mode is displayed below the battery symbol.

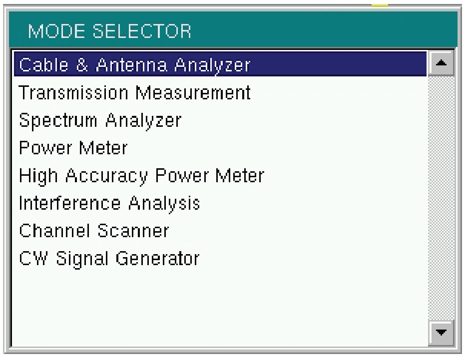



**Figure 2-13.** Mode Selector Menu

| | |
|---|---|
| **Note** | The display of the Mode Selector will vary depending on the installed options. |

The **Menu** key is another option to quickly change measurement modes. Press the **Menu** key then select one of the Measurement icons in the top two rows (Figure 2-2 on page 2-3).

# Chapter 3 — Quick Start Guide

## 3-1 Introduction

This chapter provides a brief overview of basic measurement setups. For detailed measurement information, refer to a specific measurement guide listed in Appendix A, "Measurement Guides". This chapter provides quick start measurement information for the following measurement modes:

- Section 3-3 "Cable & Antenna Analyzer" on page 3-2
- Section 3-4 "Spectrum Analyzer" on page 3-8

## 3-2 Measurement Mode Selection

Press the **Menu** key and use the touch screen to select the appropriate measurement icon.


**Figure 3-1.** Menu Screen with Icons for Installed Measurement Modes

| **Note** | The display of the Menu screen will vary depending on installed options. |
|---|---|

# 3-3 Cable & Antenna Analyzer

Set the instrument to Cable & Antenna Analyzer mode as described in the previous section.

## Select the Measurement Type

Press the **Measurement** main menu key and select the appropriate measurement.

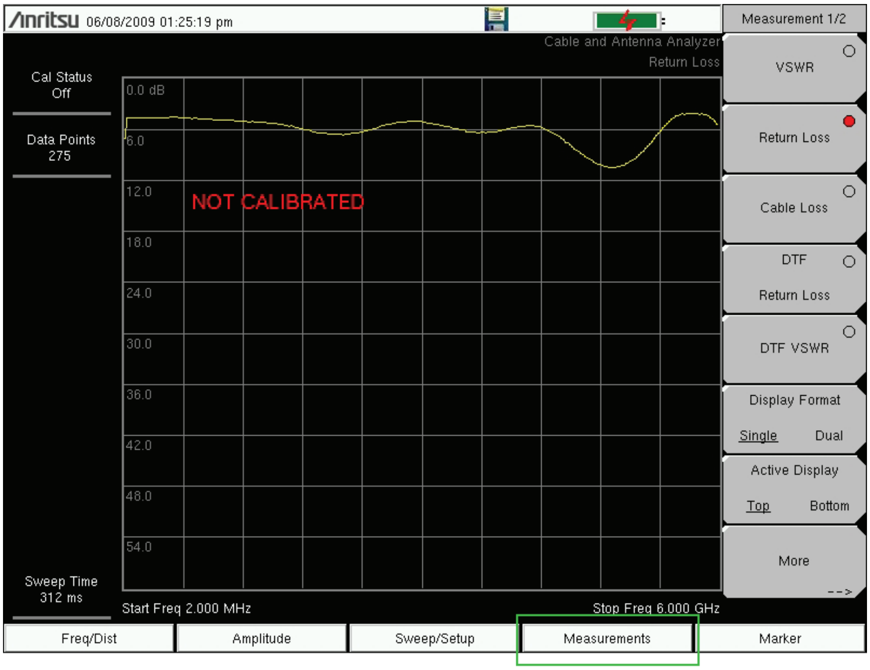



**Figure 3-2.** Measurement Menu

## Set the Frequency

1. Press the **Freq/Dist** main menu key.
2. Press the Start Freq submenu key and use the keypad, rotary knob, or the arrow keys to enter the start frequency.
3. Press the Stop Freq submenu key and use the keypad, rotary knob, or the arrow keys to enter the stop frequency.

## Set the Amplitude

1. Press the **Amplitude** main menu key.
2. Press the **Top** submenu key and use the keypad, rotary knob, or the arrow keys to edit the top scale value. Press **Enter** to set.

3. Press the Bottom submenu key and use the keypad, rotary knob, or the arrow keys to edit the bottom scale value. Press **Enter** to set.

| **Note** | For Amplitude in Smith Chart measurements, refer to “Smith Chart” in the Cable & Antenna Measurement Guide listed in Appendix A. |
|---|---|

## Turn on Markers

1. Press the **Marker** main menu key.
2. Press the Marker 1 2 3 4 5 6 submenu key and select the marker number 1 button using the touch screen. The underlined number on the Marker submenu key indicates the active marker.
3. Use the arrow keys, the keypad, or the rotary knob to move the marker. The current value for the selected marker is shown above the upper-left corner of the graph. It is also possible to drag the marker using the touch screen.
4. Delta Markers are available for each of the six reference markers. For the selected marker, Toggle the Delta On/Off submenu key to turn on the Delta marker.

### Peak/Valley Auto Markers

When making Return Loss and VSWR measurements, the Peak/Valley Auto feature can be used to automatically turn on Marker 1 to peak, Marker 2 to valley, and display M1 and M2 in the Marker Table. This feature is not available for DTF measurements.

1. Press the **Marker** main menu key.
2. Press the Peak/Valley Auto key.

## Single Limit Line

1. Press **Shift** and then **Limit** (6) to enter the Limit menu.
2. Press the Limit On/Off key to turn on the Limit.
3. Press Single Limit and then use the numeric keypad, the arrow keys, or the rotary knob to change the limit value and then press **Enter**.

| | |
|---|---|
| **Note** | Refer to the Cable & Antenna Measurement Guide listed in Appendix A for creating multi-segment limit lines. |

4. Press the Limit Alarm key to turn on or off the Limit Alarm.

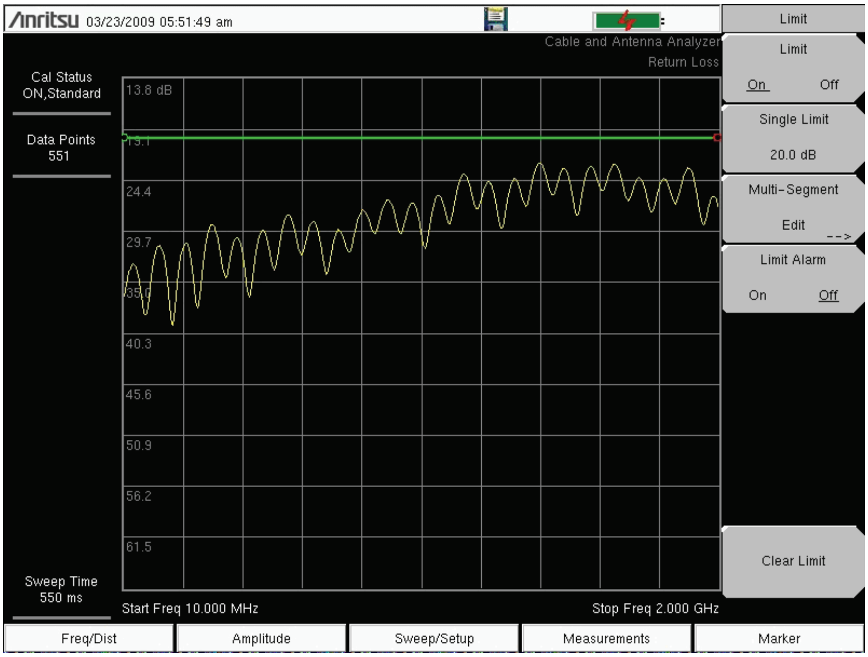



**Figure 3-3.** Single Limit Lines

## DTF Setup

1. Press the **Measurements** main menu key and select DTF Return Loss or DTF VSWR.
2. Press the **Freq/Dist** main menu key.
3. Press the Units submenu key and select m to display distance in meters or ft to display distance in feet.
4. Press DTF Aid and use the touch screen, or arrow keys to navigate through all the DTF parameters.
    a. Set Start Distance and Stop Distance. Stop Distance needs to be smaller than Dmax.
    b. Enter the Start and Stop frequencies.
    c. Press Cable, select the appropriate cable from the cable list and press **Enter**.
    d. Press Continue.

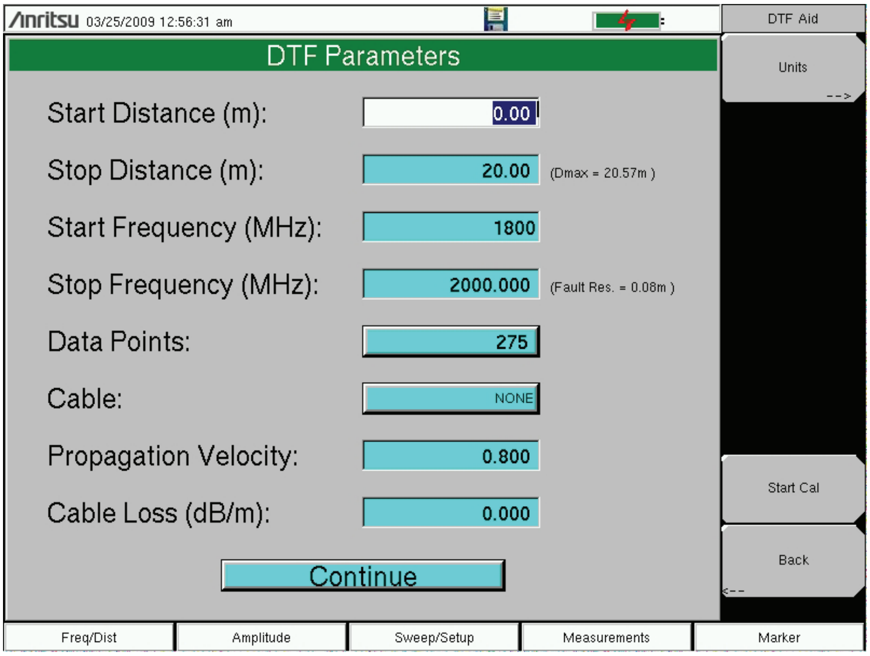



**Figure 3-4.** DTF Aid

5. Press **Shift** then **Calibrate** (2) to calibrate the instrument. Refer to "Calibrate with OSL Calibration" on page 3-6 for additional information.
6. Press the **Marker** main menu key and set the appropriate markers.
7. Press **Shift** and **Limit** (6) to enter and set the appropriate limit lines.
8. Press **Shift** and **File** (7) to save the measurement. See the User Guide for details.

## Calibrate with OSL Calibration

| | |
|---|---|
| **Note** | Refer to the Cable & Antenna Measurement Guide listed in Appendix A for calibration details. |

1. Press the **Freq/Dist** main menu key and enter the appropriate frequency range
2. Press **Shift** then **Calibrate** (2) key.
3. Select Standard or FlexCal.
4. Press Start Cal and follow instructions on screen.
5. Connect Open to RF Out and press the **Enter** key.
6. Connect Short to RF Out and press the **Enter** key.
7. Connect Load to RF Out and press the **Enter** key.
8. Verify that the calibration has been properly performed by checking that the Cal Status message is now displaying “ON, Standard” or “ON, FlexCal”.

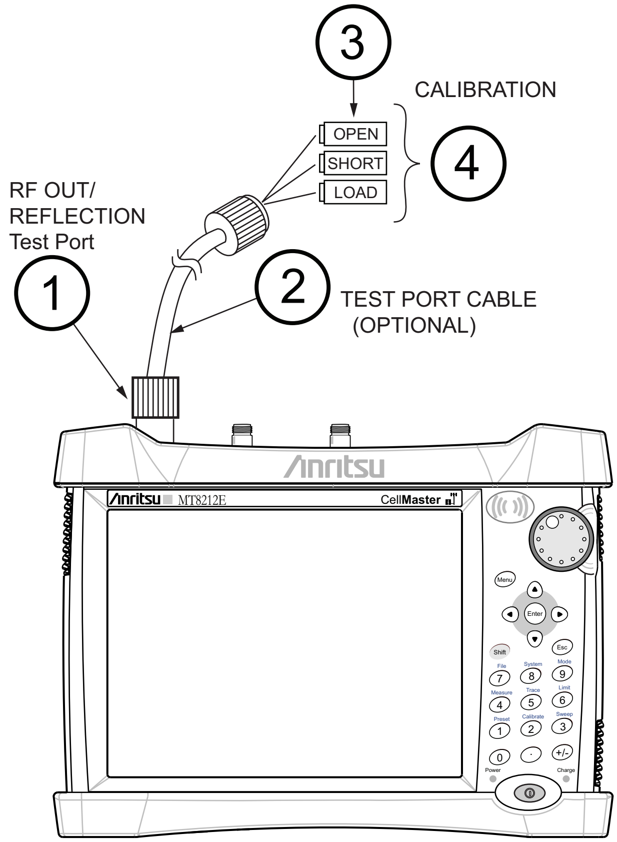



**Figure 3-5.** Calibration Setup with OSL Cal

| | |
|---|---|
| 1. | RF Out / Reflection Test Port |
| 2. | Test Port Cable (Optional) |
| 3. | Calibration Components (Open, Short, Load) |
| 4. | Calibration Test Connection |

# 3-4 Spectrum Analyzer

Set the instrument to Spectrum Analyzer mode as described in Section 3-2 “Measurement Mode Selection” on page 3-1.

## Set Start and Stop Frequencies

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

## Enter the Center Frequency

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

The center frequency and span is shown at the bottom of the screen.

## Select a Signal Standard

1. Press the **Freq** main menu key.
2. Press the Signal Standard submenu key. The Signal Standards dialog box opens.
3. Highlight a signal standard and press **Enter** to select.
4. Press the Channel submenu key to change the channel value in the Channel Editor.

The signal standard is shown in yellow at the top of the screen.

## Set the Measurement Frequency Bandwidth

1. Press the **BW** main menu key to display the BW menu.
    - Press the RBW and/or the VBW submenu key to manually change the values.
    - Set RBW and VBW automatically by pressing the Auto RBW submenu key or the Auto VBW submenu key.
2. Press the RBW/VBW submenu key to change the resolution bandwidth and video bandwidth ratio.
3. Press the Span/RBW submenu key to change the span width to resolution bandwidth ratio.

## Set the Amplitude

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

### Set Amplitude Reference Level and Scale

1. Press the Reference Level submenu key and use the arrow keys, rotary knob, 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 arrow keys, rotary knob, or the keypad to enter the desired scale. Press **Enter** to set the scale value.

### Set Amplitude Range and Scale

1. Press the Auto Atten submenu key to set an optimal reference level based on the measured signal.
2. Press the Scale submenu key.
3. Enter the desired scale units by using the keypad, the arrow keys, or the rotary knob. Press **Enter** to set. The y-axis scale is automatically renumbered.

## Power Offset Set Up for Compensating External Loss

To obtain accurate results, compensate for any external attenuation by using power offset. In power offset mode, the compensation factor is in dB. (External attenuation can be created by using an external cable or an external high power attenuator.)

Press the RL Offset submenu key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. When using the rotary knob, the value changes in increments of 0.1 dB. Using the **Left/Right** arrow keys changes the value in 10% increments of the value shown on the Scale submenu key. When using the **Up/Down** arrow keys, the value changes in the increment shown on the Scale submenu key. When using the keypad, enter the new value then press **Enter** or the dB submenu key to set the value. The power offset is displayed in the instrument settings summary column on the left side of the measurement display.

## Set the Span

1. Press the **Span** main menu key or 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.

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

## Single Limit Line

Press the **Limit** menu key to display the Limit menu.

1. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
2. Activate the selected limit line by pressing the On Off submenu key so that On is underlined.
3. Press the Limit Move submenu key to display the Limit Move menu. Press the first Move Limit submenu key and use the arrows keys, rotary knob, or keypad to change the dBm level of the limit line.
4. Press the Back submenu key to return to the Limit menu.
5. If necessary, press the Set Default Limit submenu key to redraw the limit line in view.

## Create a Limit Envelope

1. Press **Shift** then **Limit** (6) to open the Limit menu.
2. Select Limit Envelope.
3. Press the Create Envelope key.

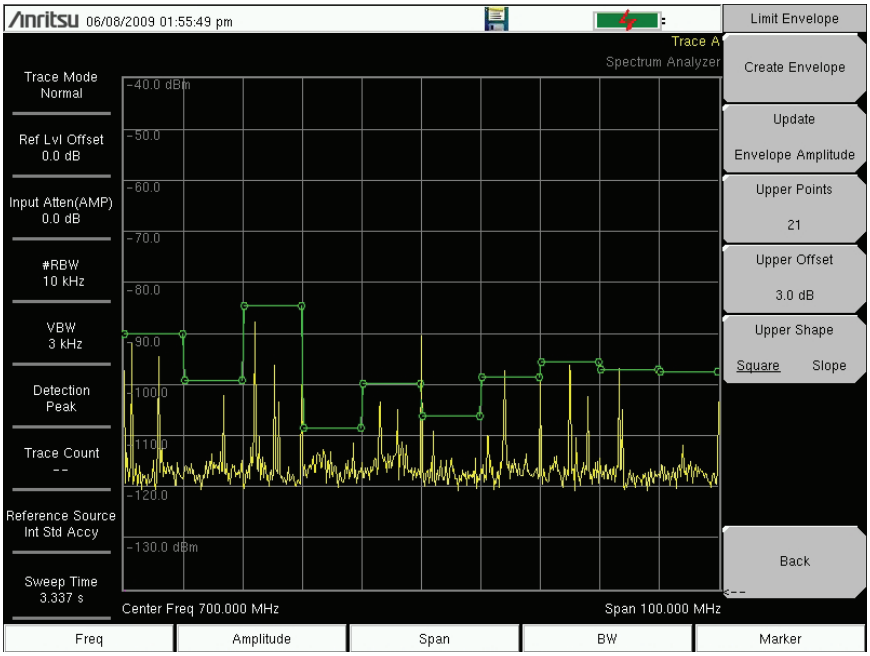



**Figure 3-6.** Limit Envelope

## Setting Up Markers

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

### Selecting, Activating, and Placing a Marker

1. Press the Marker 1 2 3 4 5 6 submenu key and then select the desired marker using the touch screen marker buttons. The selected marker is underlined on the Marker submenu key.
2. Press the On Off submenu key so that On is underlined. The selected marker is displayed in red and ready to be moved.
3. Use the rotary knob to place the marker on the desired frequency.
4. Repeat steps 1 through 3 to activate and move additional markers.

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

1. Press the Marker 1 2 3 4 5 6 submenu key and select the desired delta marker. The selected marker is underlined.
2. Press the Delta On Off submenu key so that On is underlined. The selected marker is displayed in red and ready to be moved.
3. Use the rotary knob to place the delta marker on the desired frequency.
4. Repeat steps 1 through 3 to activate and move additional markers.

### Viewing Marker Data in a Table Format

1. Press the More submenu key.

2. Press the Marker Table On Off submenu key so that On is underlined. All marker and delta marker data are displayed in a table under the measurement graph.

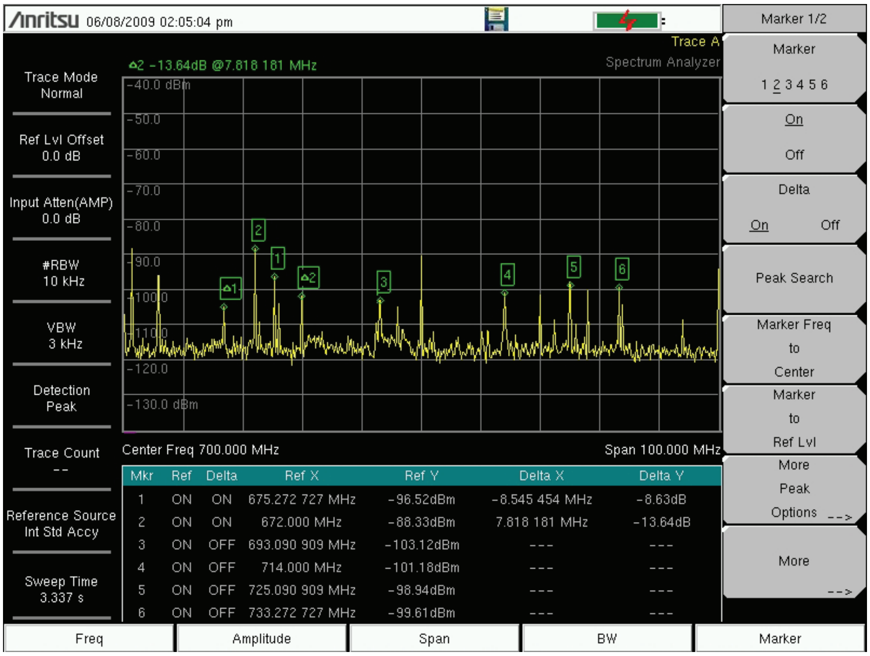



**Figure 3-7.** Marker Table

## Select a Smart Measurement Type

In Spectrum Analyzer mode, press **Shift** then **Measure** (4) and select a smart measurement using the submenu keys.

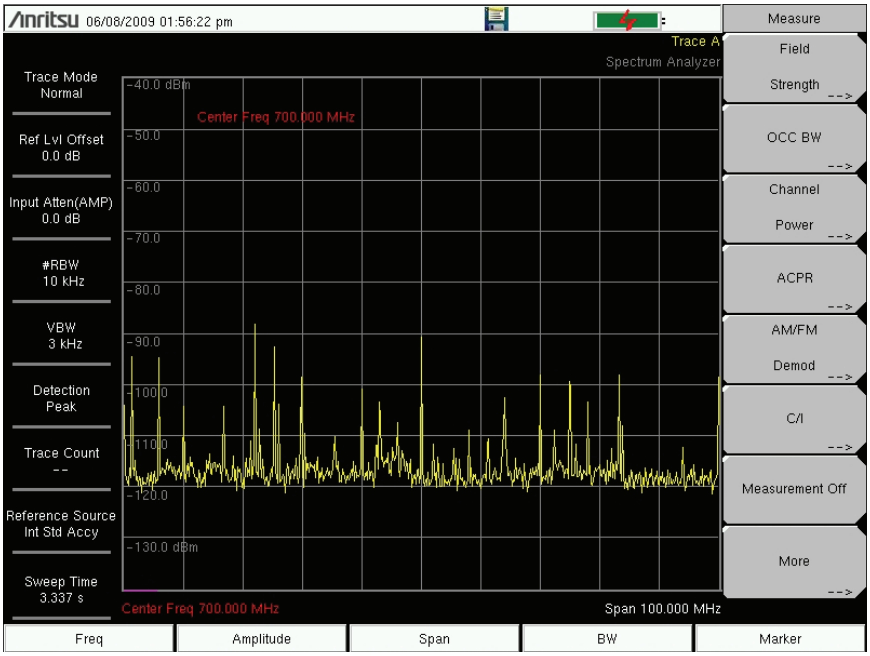



**Figure 3-8.** Spectrum Analyzer Measure Menu

## Group Edit

The Group Edit feature allows markers and limit lines to be copied from one trace to all of the traces in a folder. In addition, the title and subtitle can be quickly renamed for all of the traces in a folder. For example, to add a cell site number on the title.

To change the title to be the cell site number for all traces in a folder:

1. Select Tools | Group Edit.
2. Set the application type to VNA.
3. Select the location of the folder.
4. Enter the cell site number and check Plot Title.
5. Click Apply to rename all of the plot titles in the selected folder.

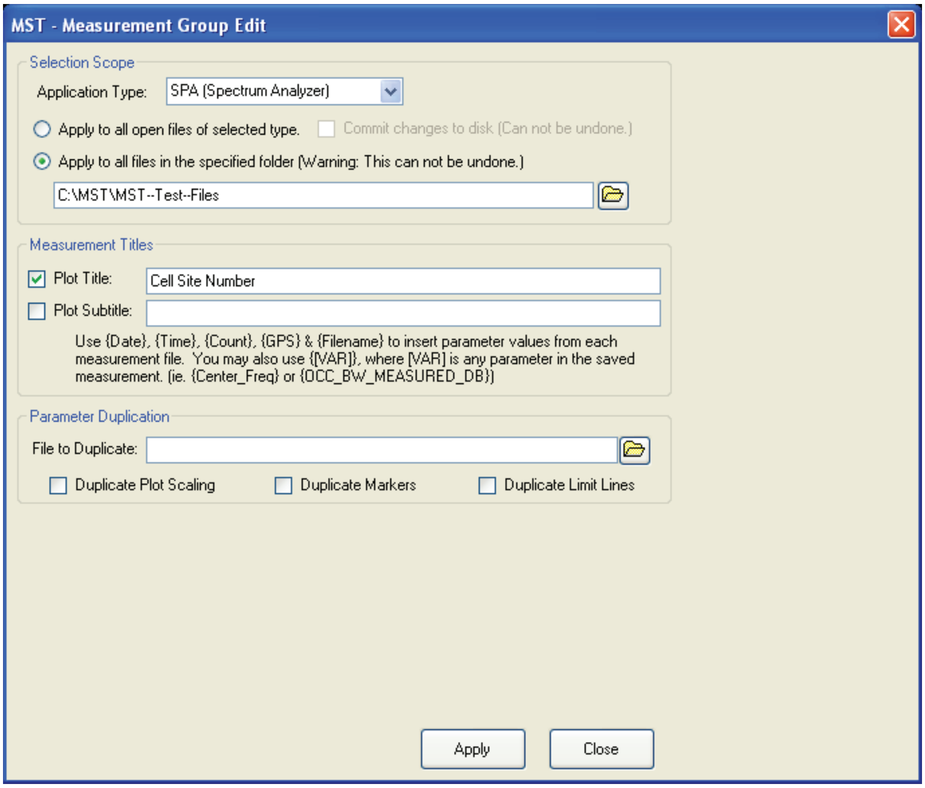



**Figure 3-9.** MST Measurement Group Edit Dialog

## Print All to PDF

If Adobe Acrobat is installed on the computer with MST, traces can be converted to PDF using Print All and selecting Print to PDF. This creates a compact and portable PDF report of all of the traces in a folder with just one click.

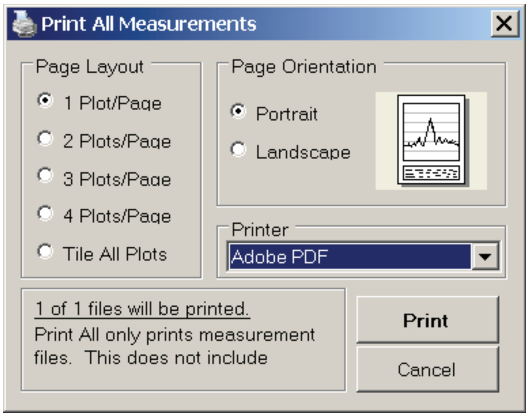



**Figure 3-10.** MST Print All Measurements Dialog

# 3-5 Saving Measurements

Measurement files can be stored in the following formats:

.VNA or .DAT for Cable and Antenna analyzer measurements

.SPA for Spectrum Analyzer measurements

Saving files in .VNA or .SPA is recommended as it enables users to edit, view, and analyze traces with Master Software Tools (MST).

| | |
|---|---|
| **Note** | Anritsu recommends saving files to the internal memory and then transferring the files to an external USB memory device if needed. Refer to Chapter 4, "Copying Files" for more details.<br><br>The .DAT file format is recommended only for users who need to work with this format or prefer using Handheld Software Tools (HHST). Traces saved as .DAT can be viewed, edited, and analyzed with Handheld Software Tools. If the DUAL measurement display is turned on, files will be saved as Filename_1 and Filename_2.<br><br>.DAT is supported only for Return Loss, VSWR, Cable Loss, DTF RL, DTF VSWR and only supports 137, 275, 551 data points. 1102 and 2204 data points are not supported in the .DAT file format. Use the .VNA file format if these resolutions are required.<br><br>.DAT files cannot be recalled to the instrument for viewing. If this is required, use the .VNA file format. |

**Procedure for saving files:**

1. Press **Shift** then File (#7).
2. Press Save Measurement.
3. Press Change Save Location and set the current location to be the USB flash drive or internal memory, and then press Set Location.
4. Press Change Type (Setup/JPG/…) and select Measurement .VNA or Measurement .DAT or Measurement (when in Spectrum Analyzer mode).
5. Enter the file name using the keyboard and press Enter.

Refer to Chapter 4, "File Management" for more details about working with files.

# Chapter 4 — File Management

## 4-1 Introduction

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

## 4-2 Managing Files

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

| | |
|---|---|
| **Note** | When navigating through the **File** menu, pressing the **Esc** key will return to the previous menu. |

### Save Files

#### Set the Save Location

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

#### Save Measurement As

The Save Measurement As key is used to quickly save measurements with a specific file name. The Cell Master saves the measurement with the latest file name that was used to save a measurement and with a number that is automatically incremented and appended to the end of the file name. For instance, if the last measurement was saved with the name System Return Loss, Save Measurement As saves the next measurement as System Return Loss_#1, System Return Loss_#2 etc. The file name used can be changed using the Save dialog box (Figure 4-1).

#### Save a Measurement

Press the Save Measurement key and enter the name for the measurement file. The measurement file type defaults to DAT format, but measurements also can be saved in VNA format (you must select VNA before saving). Note that both DAT and VNA file types support full data point resolution (up to 2204), but older Anritsu PC software programs may support up to only 551 points. While files may appear with less points, full point resolution is available from these files in Line Sweep Tools. Measurements may be saved as other file types, such as JPEG. You may save Setup files (STP), but note that Setup files DO NOT contain measurement data.

#### Save a Setup

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

### Create a Menu Shortcut for a Setup file

Press the Recall submenu key to display saved setup files. Locate the setup file to shortcut and then press and hold on the file name for a few seconds. Select a location in the shortcut grid to save the setup file.

### 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. See "Save Menu" on page 4-9 and "Save Location Menu" on page 4-10 for details.

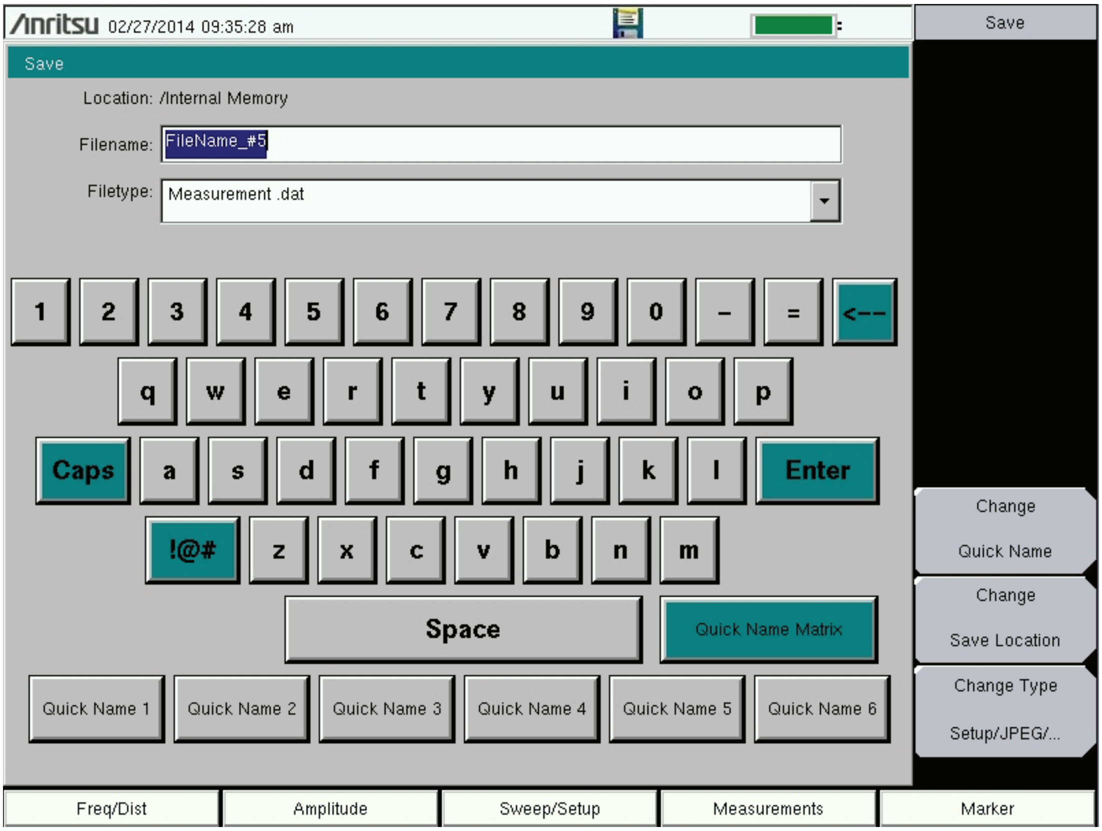



**Figure 4-1.** Save Dialog Box

## 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.

## Quick Name Matrix

The Quick Name Matrix button displays in the Cable and Antenna Analyzer measurement mode. The Quick Name Matrix button allows contractors and field personnel to save time entering files names when they are making measurements. Using the touchscreen, press the Quick Name Matrix key shown in Figure 4-1 to open the Quick Name Matrix shown in Figure 4-2.

Often carriers require file names to be reported in special conventions including site number, sector information, color coding, measurement type, termination device, and frequency information. Setup the buttons in this matrix to quickly enter the required file name.

1. Press and hold any Matrix key in the first column to edit the label. Use this column to enter the first set of variables required in the file naming convention.
2. Continue with additional columns as necessary.

After the keys have been labeled they can be used to quickly create filenames with the required file naming conventions. Select the type of file and press Enter to save the file.

The Keyboard key returns to the Save Dialog Box (Figure 4-1).

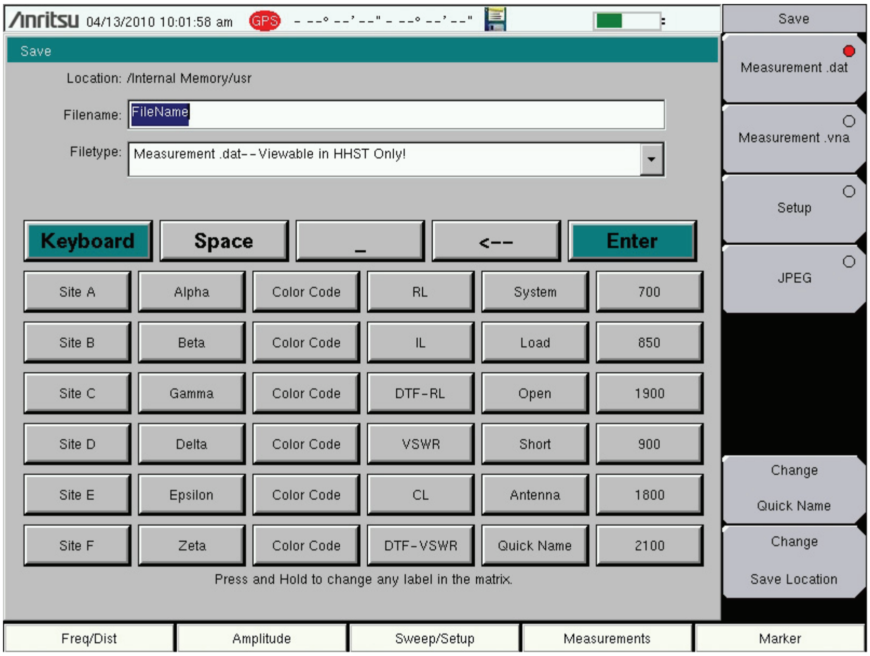



**Figure 4-2.** Quick Name Matrix

## Recall Files

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

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

### 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 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 press **Enter**.

## Recall Dialog Box

The Recall dialog box (Figure 4-3) will open previously saved measurements and setups. See the "Recall Menu" on page 4-12 for additional information.

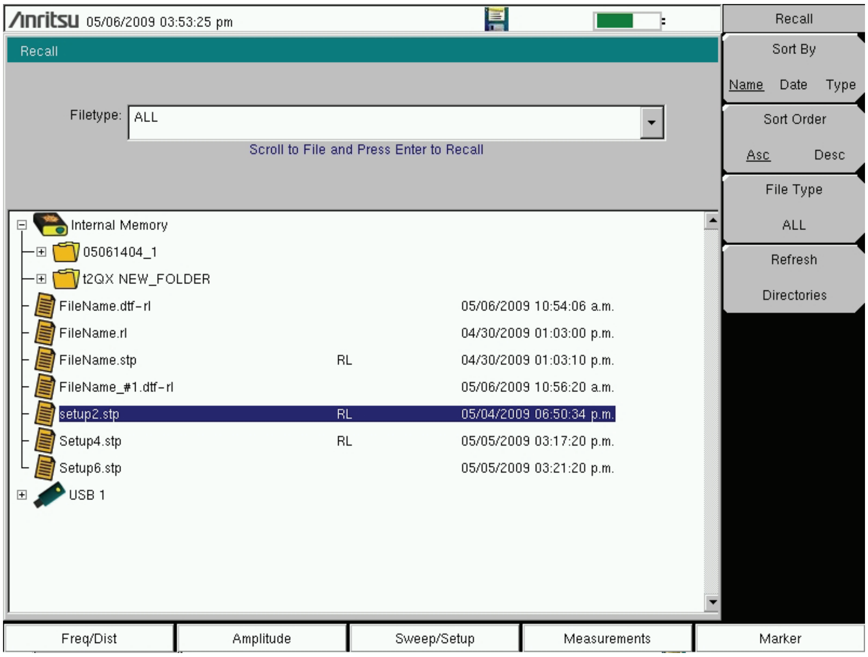



**Figure 4-3.** Recall Dialog Box

## Copying Files

The steps below detail copying a file from internal memory to an external flash drive. Select the files to copy in the top window and the location for the files to be copied to in the bottom window (Figure 4-4). Refer to the "Copy Menu" on page 4-13 for additional information.

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

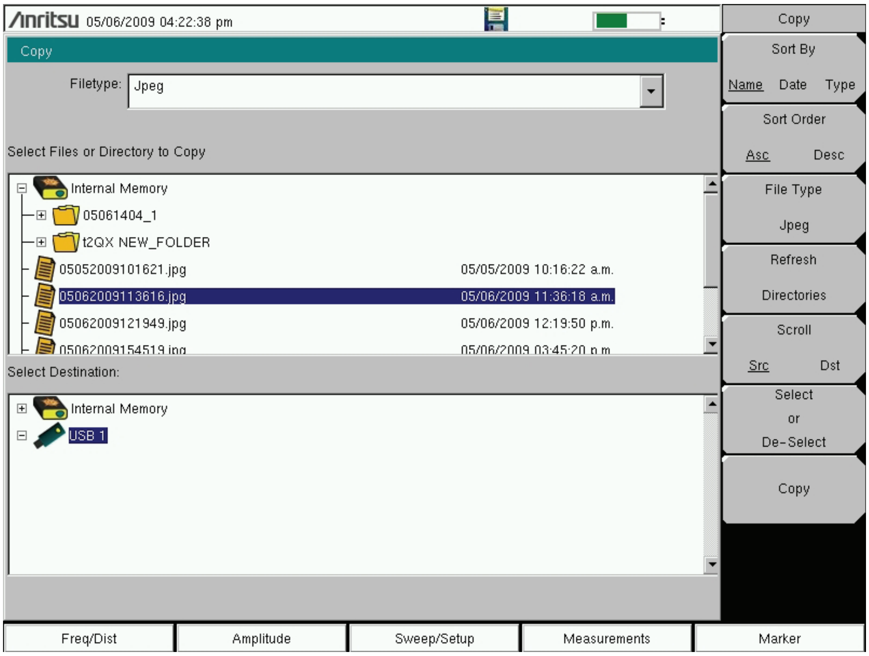



**Figure 4-4.** Copy Dialog Box

## Deleting Files

### Delete a Selected File or Files

Press the Delete submenu key. Highlight the file to be deleted with the touchscreen or the **Up/Down** arrow keys. Press the Select or De-Select key. The file will be outlined in blue when selected. Press the Delete key and **Enter** to delete the selected file.

## Delete Dialog Box

Press the Delete submenu key to open the Delete dialog box (Figure 4-5). The submenus allow sorting by file type, name and saved date. See the “Delete Menu” on page 4-14 for additional information.

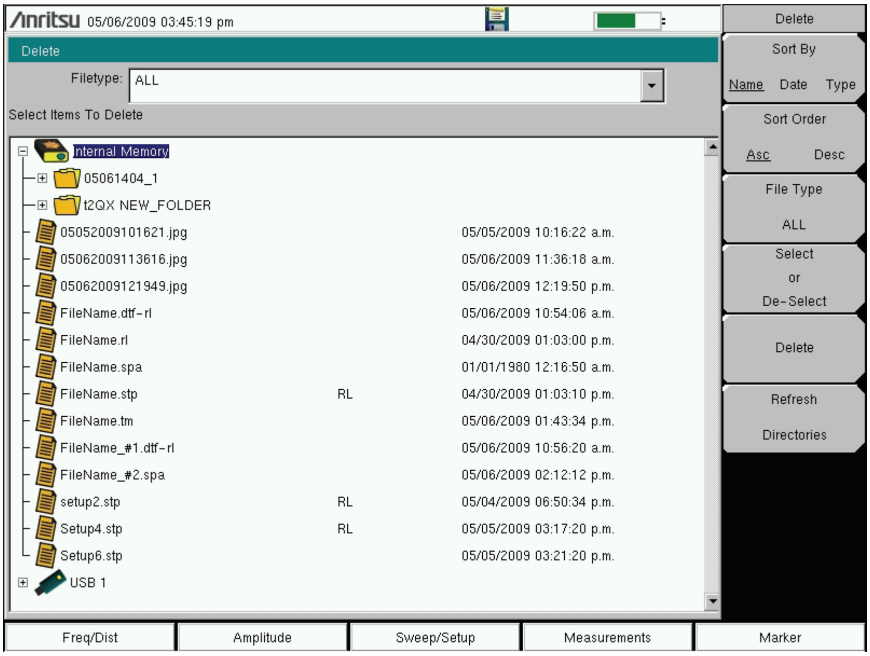



**Figure 4-5.** Delete Dialog Box

# 4-3 File Menu Overview

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

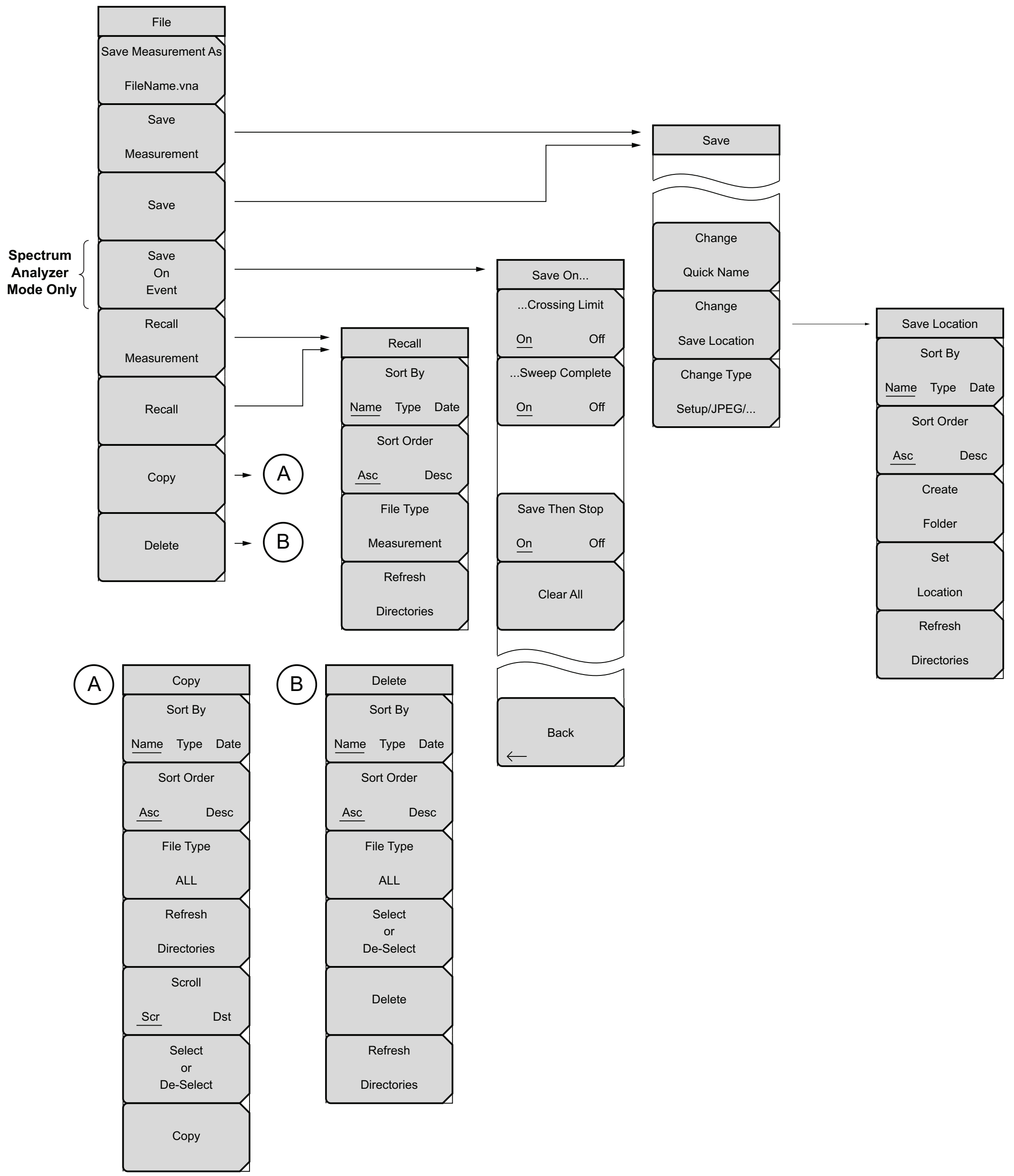
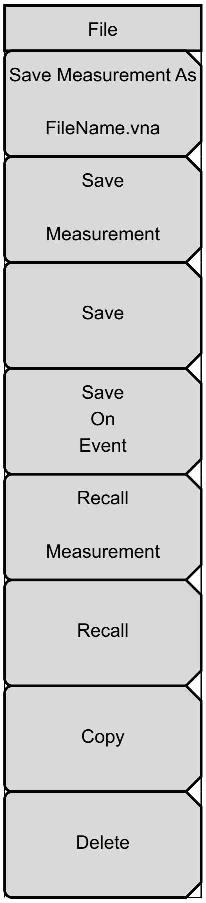



**Figure 4-6.** File Menu

# 4-4 File Menu

Key Sequence: **File**




**Save Measurement As:** 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, type in a new file with the touch screen keyboard and press **Enter**. After a few seconds the screen with return to File menu. Press the Save Measurement As key again and the new file name will be used. Measurement files names have a .rl extension.

**Save Measurement:** Press this submenu key to display the "Save Dialog Box" on page 4-2 with the touch screen keyboard. Measurements can be saved to internal memory or to a USB flash drive. The saved measurement can be named by using touch screen keyboard. By default, measurements are saved in a directory named /user to internal memory. The save destination is set with the "Save Location Menu" on page 4-10.

**Save:** Press this submenu key to display the "Save Dialog Box" on page 4-2 with the touch screen keyboard. Measurements can be saved to internal memory or to a USB flash drive. The saved setup, measurement, or JPEG file can be named by using touch screen keyboard. By default, measurements are saved in a directory named /user to internal memory. The save destination can be changed by pressing the Change Save Location submenu key and then using the "Save Location Menu" on page 4-10.

**Save on Event** (Spectrum Analyzer mode only)**:** Press this submenu key to display the "Save On... Menu" on page 4-11.

**Recall Measurement:** Press this submenu key to display the "Recall Menu" on page 4-12. This menu is for recalling measurements from internal memory or a USB flash drive.

**Recall:** Press this submenu key to display the "Recall Menu" on page 4-12. This menu is for recalling measurement or setup data from internal memory or a USB flash drive.

**Copy:** Press this submenu key to display the "Copy Menu" on page 4-13. This submenu is for copying files or folders from internal memory or a USB flash drive.

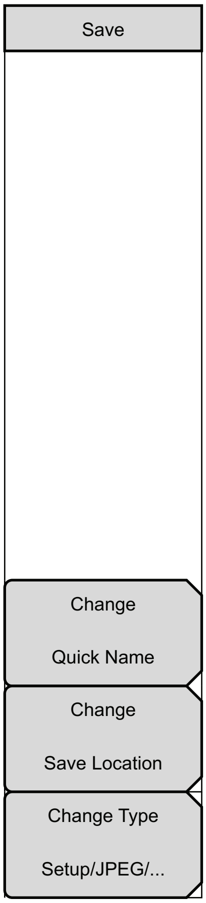
**Delete:** Press this submenu key to display the "Delete Menu" on page 4-14 and a selection box that shows the setup and measurement names, the type and the date and time that the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file that is to be deleted and press the Delete submenu key, then **Enter**. Press the **Esc** key to cancel the operation. Note that deleted files cannot be recovered.

**Figure 4-7.** File Menu

## Save Menu

Key Sequence: **File** > Save Measurement

Key Sequence: **File** > Save




**Change Quick Name:** Press this submenu key to change the Quick Names at the bottom of the touch screen keyboard (Figure 4-1). Select the Quick Name to edit and press **Enter**. Type the new Quick Name and press **Enter** again. The new Quick Name will display on the button below the keyboard.

**Change Save Location:** Press this submenu key to open the "Save Location Menu".

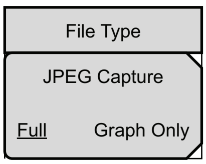
**Change Type**
**Setup/JPEG/...** Press this submenu key to change the file type. The Select File Type list box and the File Type menu are displayed.

**Figure 4-8.** Save Menu

## File Type Menu

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

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

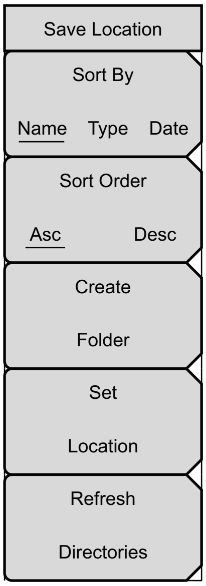



**JPEG Capture**
**Full Graph Only:** Press this submenu key to toggle the file type to Full or to Graph Only.

**Figure 4-9.** File Type Menu

## Save Location Menu

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




This menu and dialog box is used to create folders and select where the Cell Master will save the current file. Select folders or drives with the **Up/Down** keys, the rotary knob or the touch screen.

Note: Only folders (not files) are visible in the Save Location dialog box. To view files, use the "Recall Menu" on page 4-12.

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

**Sort Order:** Displays the folder names in ascending or descending order .

**Create Folder:** This key will create a new folder in the highlighted location or folder. The create directory dialog box will display for naming the folder.

**Set Location:** This key will set the current location for saving files and return to the "Save Menu" on page 4-9.

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

**Figure 4-10.** Save Location Menu

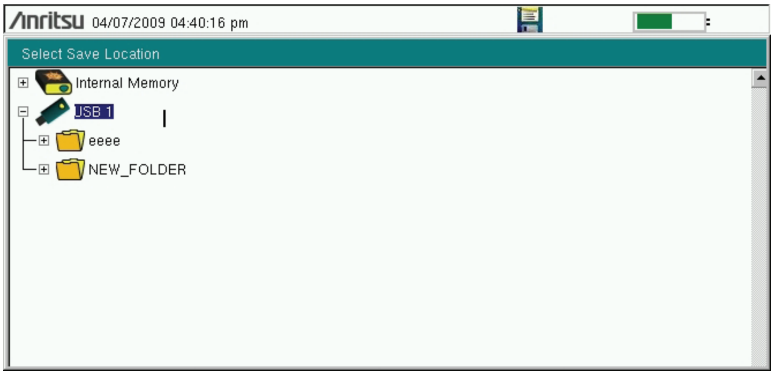
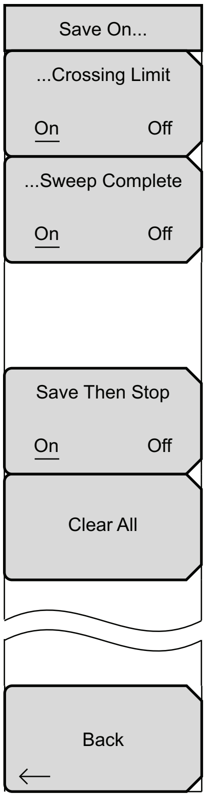



**Figure 4-11.** Select Save Location Dialog Box

## Save On... Menu

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




In Spectrum Analyzer mode, this menu is used to auto save measurements to internal memory after:

**...Crossing Limit: Toggling this submenu key to On will save the measurement to internal memory when the measurement has crossed a defined limit line created with the Limit menu.**

**...Sweep Complete: Toggling this submenu key to On will save the measurement to internal memory after the current sweep is complete. If Save Then Stop is toggled Off, a measurement will be saved after every sweep.**

**Save Then Stop:** Set this key to On to stop the sweep after a measurement is saved. With this key Off and Sweep Complete On a measurement is saved after every sweep.

**Clear All:** Pressing this key will turn Off the three save on event keys:

Crossing Limit

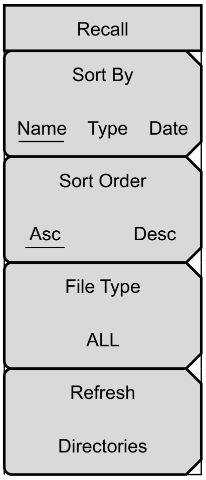
Sweep Complete

Save Then Stop

**Figure 4-12.** Save On Menu

## Recall Menu

Key Sequence: **File** > Recall




This menu and dialog box is used to create folders and select where the Cell Master will save the current file. Select folders or drives with the **Up/Down** keys, the rotary knob or the touch screen.

**Sort By: 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.**

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

**File Type:** Press this submenu key to select what type of file is viewed. The options are the ALL, Measurement, or Setup. The file type can be changed with the **Up/Down** keys, the rotary knob, or the touch screen. Press **Enter** to make the selection.

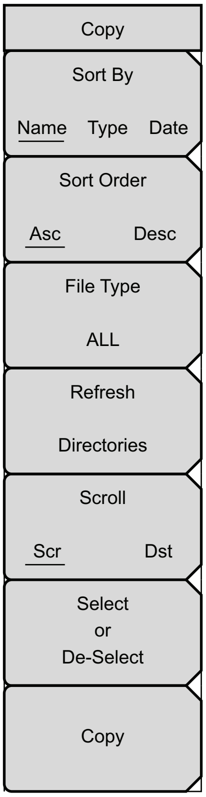
> **Setup:** Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.
>
> **Measurement:** Measurement files contain all of the information in the setup files and the measurement data.
>
> **Limit Lines (.lim):** The Limit line file contains limit line data details.
>
> **ALL:** Displays all file types.

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

**Figure 4-13.** Recall Menu

## Copy Menu

Key Sequence: **File** > Copy




This menu and dialog box is used to copy folders and files. Select folders or files with the **Up/Down** keys, the rotary knob or the touch screen. Figure 4-4 on page 4-5 shows the Copy dialog box with two Jpeg images and one folder (including the folder's contents) selected and ready to be copied to the USB flash drive. Highlight a folder and press **Enter** to view the contents.

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

**File Type:** Press this submenu key to select what type of file to view for copying. The options are: ALL, Measurement, Setup, or Jpeg. The file type can be changed with the **Up/Down** keys, the rotary knob, or the touch screen. Press **Enter** to make the selection.

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

**Scroll Files To Copy:** This key toggles with the Scroll Destination Folder key. It has the same function as touching the top (Select Files or Directory to Copy) window in Figure 4-4. When the circle is red you can use the **Up/Down** keys or the rotary knob to scroll through the files.

**Scroll Scr Dst:** Press this submenu key to use the scroll function in the Source Folder (Scr - top panel) or Destination Folder (Dst - bottom panel). See Figure 4-4.

Note: Previously saved files are not visible in this window.

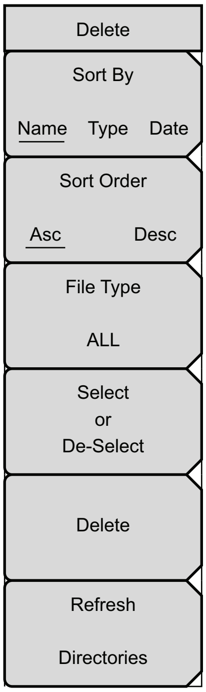
**Select or De-Select:** Use this key to select or deselect the file(s) or folder(s) to be copied. When selected, a file or folder will be outlined in blue, see Figure 4-4.

**Copy:** Copies the files or folders selected in the top window to the destination selected in the bottom window. A dialog box will display showing when the copying is complete. If a file with the same name exists in the destination folder a warning box will display to allow file overwrite or to cancel.

**Figure 4-14.** Copy Menu

## Delete Menu

Key Sequence: **File** > Delete




This menu and dialog box is used to delete folders and files. Select folders or files with the **Up/Down** keys, the rotary knob or the touch screen.

**Sort By: 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.**

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

**File Type:** Press this submenu key to select 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 **Up/Down** keys, the rotary knob, or the touch screen. Press **Enter** to make the selection.

**Select or De-Select:** 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.

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

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

**Figure 4-15.** Delete Menu

# Chapter 5 — System Operations

## 5-1 Introduction

This chapter will review the Cell Master system operations.


- "System Menu Overview" on page 5-2
- "System Menu" on page 5-3
- "Preset Menu" on page 5-7
- "Self Test" on page 5-7
- "Updating the Cell Master Firmware" on page 5-8


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

# 5-2 System Menu Overview

To access the functions under the System menu, select the **Shift** key, then the **System** (8) key.

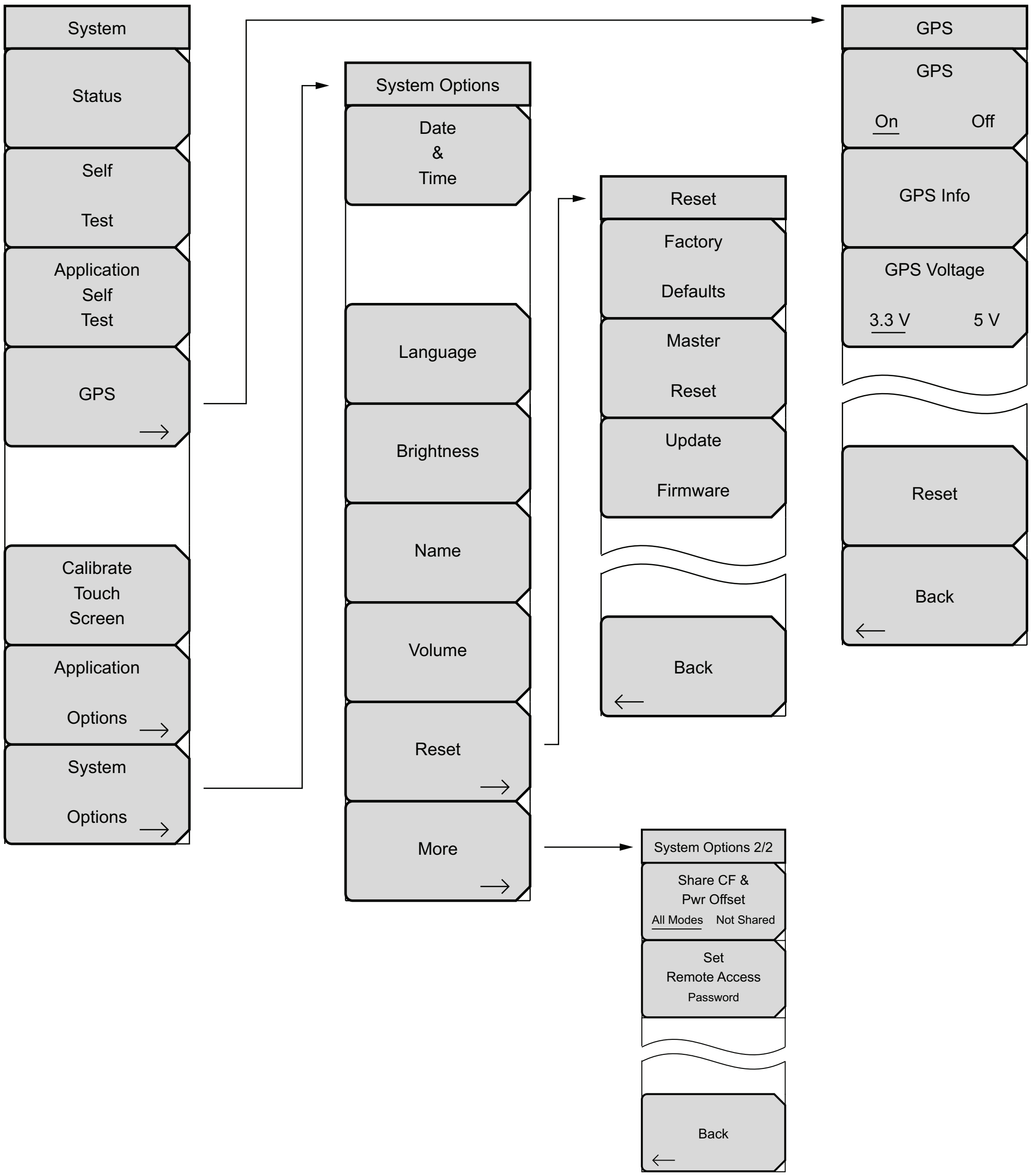
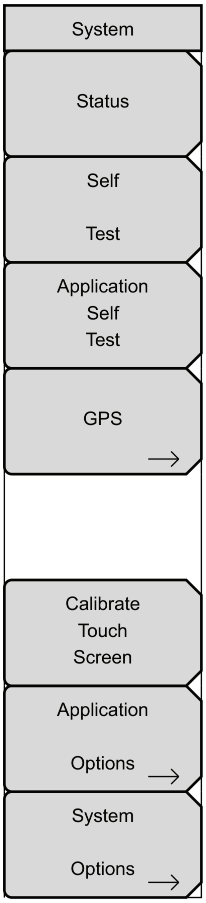



**Figure 5-1.** System Menu Group

# 5-3 System Menu

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




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

**Self Test:** This key initiates a series of diagnostic tests that check the components of the instrument. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

**Application Self Test:** This key initiates a series of diagnostic tests related to the performance of the instrument for specific applications. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

**GPS :** Opens the "GPS Menu" on page 6-4.

**Calibrate Touch Screen:** Start the touch screen calibration. Run the calibration procedure when instrument is not responding to your screen taps as expected.

**Application Options:** This submenu key presents a menu to select application options. This will vary depending upon the measurement mode.

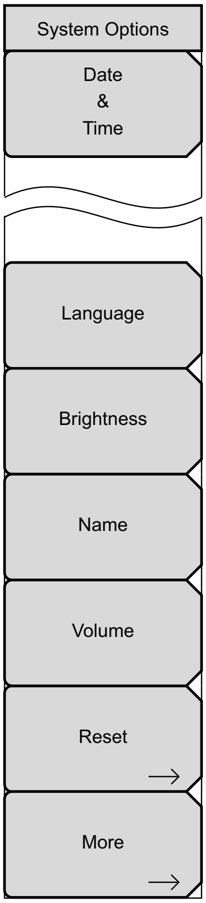
**System Options:** This key opens the "System Options Menu" on page 5-4.

**Figure 5-2.** System Menu

| | |
|---|---|
| **Note** | **Calibrate Touch Screen Shortcut**<br>Press **Shift** then **0** to open the Calibrate Touch Screen display. Press **Enter** to start the calibration or **Esc** to cancel. |

## System Options Menu

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




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

**Language:** This submenu key brings up a selection box allowing selection from a list of built-in languages for the Cell Master displays. The languages currently available are English, French, German, Spanish, Japanese, Chinese, Korean, and Italian. In addition, up to two custom languages may be loaded into the instrument if they have been defined using the Master Software Tools. If a mode does not have language translations available, English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changing the setting.

**Brightness:** Press this submenu key to adjust the brightness of the display. This adjustment allows you to optimize viewing under a wide variety of lighting conditions. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to select a brightness level from 1 to 9, where 9 is the brightest. Press **Enter** to accept the change.

**Name:** Opens a dialog box to name the instrument. The unit can be named using the keypad to select numbers and the touch screen keys to select letter groups. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. The Back Space key will remove the last character entered. Press **Enter** to save the name.

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

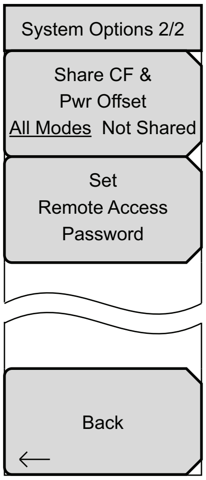
**Reset:** Press this submenu key to open the "Reset Menu" on page 5-6.

**More:** Press this submenu key to open the "System Options 2/2 Menu" on page 5-5.

**Figure 5-3.** System Options Menu

## System Options 2/2 Menu

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




**Share CF & Pwr Offset**

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

**Set Remote Access Password:** Press this submenu key to open the Password text box (Figure 5-5) and Text Entry menu. Type in the desired password. Upper case and lower case letters and the symbols – _ + . are the allowed password characters. Press **Enter** to save or **Esc** to cancel.

**Back:** Press this submenu key to return to the "System Options Menu" on page 5-4.

**Figure 5-4.** System Options Menu 2/2)

### Remote Access Password

| **Warning** | Do not use SCPI commands with this feature. |
|---|---|

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

The password is first set into the instrument, then used in MST. When prompted in MST, enter the password into the password text box. The password text box shown in Figure 5-5 may differ from the text box that is displayed on your instrument.

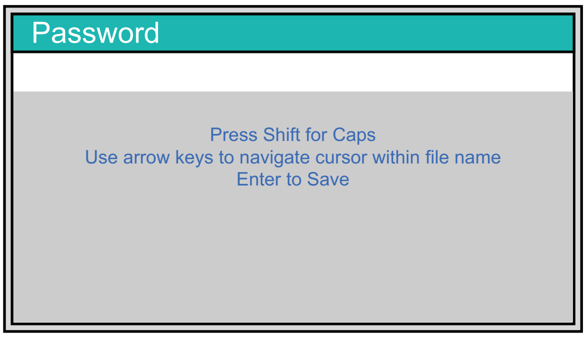
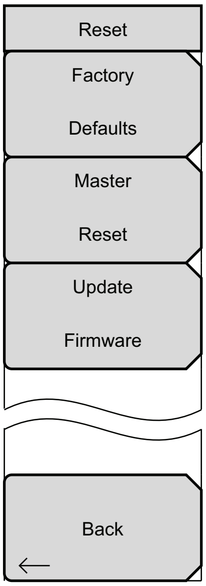



**Figure 5-5.** Remote Access Password Text Box

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).

## Reset Menu

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




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

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

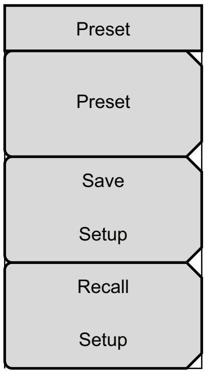
**Update Firmware:** Press this submenu key to update the instrument operating system with a USB memory device. Press **Enter** and follow the onscreen instructions to update the firmware or press **Esc** to return to normal operation without updating. Refer to "Updating the Cell Master Firmware" on page 5-8 for additional information on firmware update options.

**Back:** Press this submenu key to return to the "System Options Menu" on page 5-4.

**Figure 5-6.** Reset Menu

## 5-4 Preset Menu

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




**Preset:** This key resets the instrument to the default starting conditions.

**Save Setup:** Opens the Save dialog box (Figure 4-1) to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved.

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

Note: Set the File type as Setup. See “Save Menu” on page 4-9 for details.

**Recall Setup:** This key allows the selection and recall of a previously stored instrument setup using the “Recall Menu” on page 4-12. Use the rotary knob, the **Up/Down** arrow keys, or the touchscreen to highlight the saved setup, and press **Enter**. All current instrument settings are replaced by the stored setup information.

**Figure 5-7.** Preset Menu

## 5-5 Self Test

At power on, the Cell 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. The Application Self Test runs a series of tests that are related to the current operating mode of the instrument.

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

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

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

# 5-6 Updating the Cell Master Firmware

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

http://www.anritsu.com/

Search for the product model number. The firmware updates are on the product page under the Library tab in the "Drivers, Software Downloads" section.

| | |
|---|---|
| **Note** | The "Release History" link provides a summary of the firmware changes. |

1. Click on the "Firware Update for the Cell Master MT821xE" link.
2. Click the "Download" button and then "Run". After the download is complete, press "Run" again and follow the onscreen instructions. Press "Help (?)" for additional information.
3. After the firmware update is saved on the USB memory stick, eject the memory stick from the computer.
4. Turn the Cell Master off and insert the USB memory stick into the Cell Master.
5. Connect the AC adapter and turn the Cell Master On.
6. The instrument should update automatically. Follow the instrument prompts.
7. If the automatic update did not start, complete the following steps:
    a. On the instrument press the **Shift** key and then the **System** (8) key.
    b. Press the following key sequence: System Options > Reset > Update Firmware. The Load Firmware menu opens.
    c. Press the **Load Firmware** main menu key (located at the bottom-left corner of the instrument screen).
    d. Press the Update Application Firmware submenu key.
    e. From the choices presented, select the desired "Save" mode.
    f. Press the **Enter** key to begin the firmware update.
    g. Press the **Enter** key one more time to confirm that you want to upgrade the instrument firmware.
8. After the update is compete, the Cell Master will restart.

| | |
|---|---|
| **Note** | Do not turn off the instrument during the firmware update to avoid potential permanent damage to the instrument. |

# Chapter 6 — GPS (Option 31)

## 6-1 Introduction

The Cell Master is available with a built-in GPS receiver feature (Option 31) that can provide latitude, longitude, altitude, and UTC timing information. This option also enhances frequency reference oscillator accuracy in the spectrum analyzer mode. Within three minutes of satellite acquisition, the reference oscillator will have an accuracy of better than 25 ppb (parts per billion). No accuracy specifications apply if no GPS satellites are acquired.

In order to acquire data from the GPS satellites, the user must have line-of-sight to the satellites or the antenna must be placed outside without any obstructions. An Anritsu GPS antenna is required.

| **Note** | The Cell Master Technical Data Sheet provides a list of the options and measurements that require GPS (Option 31). |
|---|---|

## 6-2 Chapter Overview


- Section 6-3 “Activating the GPS Feature” on page 6-1
- Section 6-4 “Saving and Recalling Traces with GPS Information” on page 6-3
- Section 6-5 “GPS Menu” on page 6-4


## 6-3 Activating the GPS Feature

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

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


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

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


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

5. Press the GPS Info submenu key to view information about:

- Tracked Satellites
- Latitude and Longitude
- Altitude
- UTC
- Fix Available
- Almanac complete
- Antenna and Receiver Status
- GPS Antenna Voltage and Current

See Section 6-5 “GPS Menu” on page 6-4 for details about the GPS Info dialog box.

6. Press the Reset submenu key to reset the GPS.

7. The GREEN GPS icon with a RED CROSS through it, as shown below, appears when GPS satellite tracking is lost (after actively tracking 3 or more satellites). The GPS longitude and latitude are saved in the instrument memory until the Cell Master is turned off or until GPS is turned off by using the GPS On/Off key.


**Figure 6-3.** GPS Icon, Tracking Lost

# 6-4 Saving and Recalling Traces with GPS Information

## Saving Traces with GPS Information

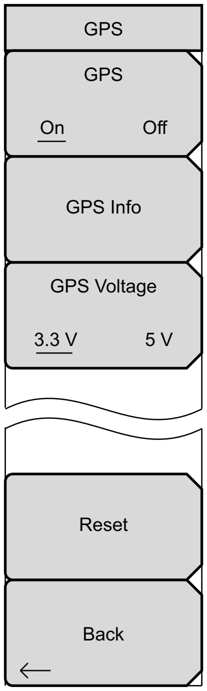
The GPS coordinates of a location can be saved along with a measurement trace. Refer to the "Save Menu" on page 4-9 for more information. The current GPS coordinates will be saved with the measurement traces whenever GPS is on and actively tracking satellites.

## Recalling GPS Information

If the GPS coordinates were saved with a measurement, then when the measurement is recalled, the coordinates that were saved are recalled as well. Refer to the "Recall Menu" on page 4-12 for more information about recalling a saved trace.

# 6-5 GPS Menu

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




**GPS:** Press this submenu key to turn GPS on or off.

**GPS Info:** Press this submenu key to display the current GPS information.

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

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

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

**UTC:** Universal Coordinated Time.

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

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

**Antenna Status:**
OK: Antenna is connected properly and antenna is working properly

Short/Open: A short or open exists between the antenna and the connection. If this message is displayed, then remove and replace the GPS antenna. If the message persists, then try another Anritsu GPS antenna. If the message persists, then contact your nearest Anritsu Service Center.

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

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

**GPS Voltage:** Press this submenu key to set the source voltage to be either 3.3 V or 5 V depending on the GPS receiver being used. GPS antenna voltage is set to 3.3 V by default in order to prevent accidental damage to lower-voltage GPS antennas.

**Reset:** The Reset key sets the tracked number of satellites to 0 and erases any almanac data, along with saved coordinates. The process of searching for and reacquiring satellites will begin again.

**Back:** Press this submenu key to return to the "System Menu" on page 5-3.

**Figure 6-4.** GPS Menu

# Chapter 7 — Bias Tee (Option 10)

## 7-1 Overview

Option 10 provides a bias tee that is installed inside the instrument. The bias arm is connected to a 12 VDC-to-32 VDC power source that can be turned on as needed to place the voltage on the center conductor of the instrument's RF In port. This supply of bias implies it is mostly useful when conducting two-port transmission measurements. This voltage can be used to provide power to block down-converters in satellite receivers and can also be used to power some tower-mounted amplifiers.

The bias can be turned on only when the instrument is in transmission measurement or spectrum analyzer mode.

When bias is turned on, the bias voltage and current are displayed in the lower left corner of the display. The 12 VDC-to-32 VDC power supply is designed to continuously deliver a maximum of 6 Watts.

The bias tee menu can be accessed from the applications options menu and in transmission measurement, it can also be accessed from the **Measure** main menu.

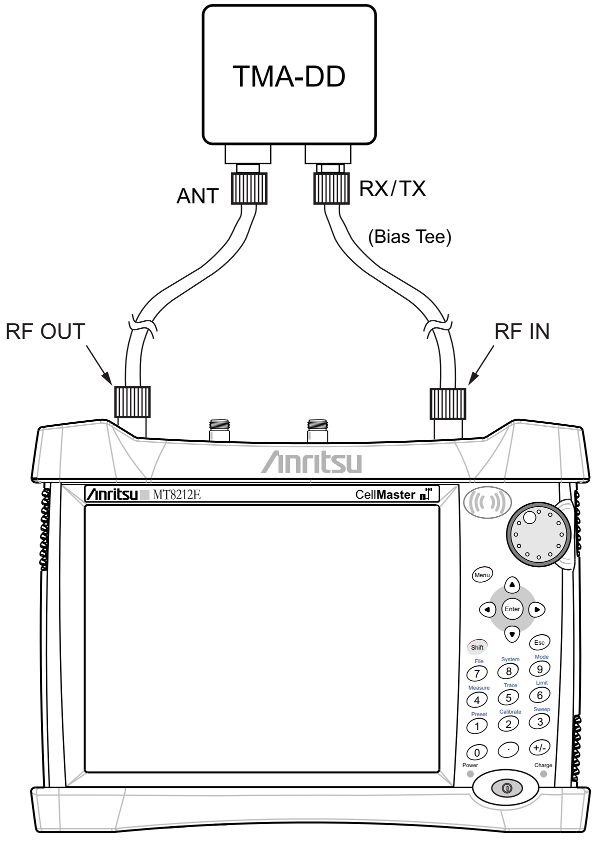



**Figure 7-1.** Variable Bias Tee

# Chapter 8 — Anritsu Tool Box

## 8-1 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

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

## 8-2 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 8-1 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.

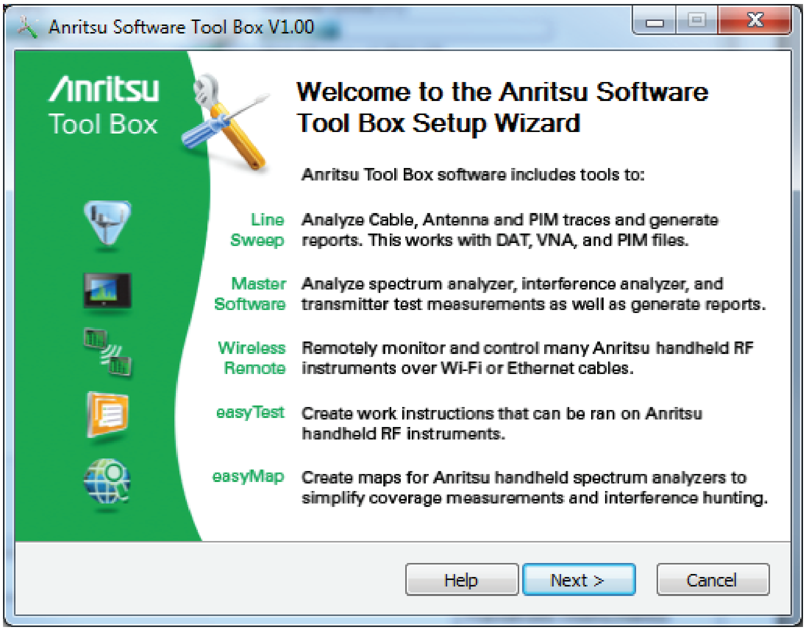



**Figure 8-1.** Anritsu Tool Box Setup Wizard

If the installer does not autostart, open the DVD in Windows Explorer and double-click the executable setup file. See Figure 8-2.

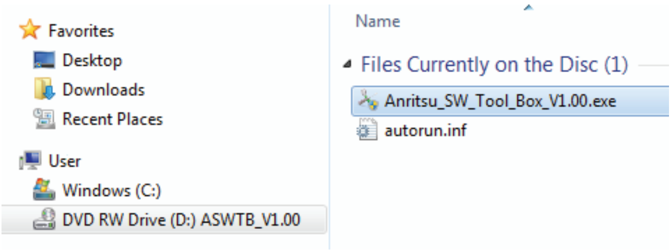



**Figure 8-2.** Tool Box Installer on the Anritsu Software DVD

# 8-3 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 8-3.


**Figure 8-3.** Anritsu Tool Box Screen

# 8-4 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. 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.

## Line Sweep Tools (LST)

Line Sweep Tools is post-capture trace processing software designed for users who need to analyze and generate reports on large numbers of cable, antenna, and PIM traces. Software features include:

- Measurement plot data capture and transfer from the instrument to a PC
- Marker and limit line presets
- Return Loss, Distance-to-Fault, PIM analysis
- LMR Master and VNA Master Field Mode compatibility
- Plot overlay for comparison of up to ten traces of the same measurement type
- Plot area zooming
- A naming grid for renaming files, titles, and subtitles
- Automated report generation
- Output to printer or to PDF or HTML format
- Export of plot data to text, image, or VNA files

## 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 intructions 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.

# Appendix A — Measurement Guides

## A-1 Introduction

This appendix provides a list of supplemental documentation for Cell Master features and options. These measurement guides are available as PDF files on the documentation disc and the Anritsu website.

**Table A-1.** Analyzers and Analyzer Options (Sheet 1 of 3)

| Cell Master Feature (Required Option) | Related Document (Part Number) |
|---|---|
| Cable and Antenna Analyzer | Cable and Antenna Analyzer Measurement Guide (10580-00241) |
| Spectrum Analyzer<br>Interference Analyzer (0025)<br>Channel Scanner (0027)<br>C/W Signal Generator (0028)<br>Gated Sweep (0090)<br>Coverage Mapping (0431)<br>EMF Measurements (0444) | Spectrum Analyzer Measurement Guide (10580-00231) for *Firmware V1.11 and BEFORE*<br>Spectrum Analyzer Measurement Guide (10580-00244) for *Firmware AFTER V1.11* |
| Bias-Tee (0010)<br>2-Port Transmission Measurement (0021) | 2-Port Transmission Measurement Guide (10580-00242) |
| W-CDMA/HSDPA Over-the-Air Signal Analyzer (0035)<br>TD-SCDMA/HSDPA Over-the-Air Signal Analyzer (0038)<br>GSM/GPRS/EDGE RF Signal Analyzer (0040)<br>GSM/GPRS/EDGE Demodulated Signal Analyzer (0041)<br>W-CDMA/HSDPA RF Signal Analyzer (0044)<br>W-CDMA Demodulated Signal Analyzer (0045)<br>TD-SCDMA/HSDPA RF Signal Analyzer (0060)<br>TD-SCDMA/HSDPA Demodulated Signal Analyzer (0061)<br>W-CDMA/HSDPA Demodulated Signal Analyzer (0065)<br>LTE/LTE-A RF Measurements (0541)<br>LTE/LTE-A Modulation Measurement (0542)<br>LTE/LTE-A Over-the-Air Measurements (0546)<br>LTE and TD-LTE Coverage Mapping (included)<br>TD-LTE/LTE-A RF Measurements (0551)<br>TD-LTE/LTE-A Modulation Measurement (0552)<br>TD-LTE/LTE-A Over-the-Air Measurements (0556) | 3GPP Signal Analyzer Measurement Guide (10580-00234) |

**Table A-1.** Analyzers and Analyzer Options (Sheet 2 of 3)

| Cell Master Feature (Required Option) | Related Document (Part Number) |
|---|---|
| cdmaOne/CDMA2000 1X Over-the-Air Signal Analyzer (0033)<br>CDMA2000 1xEV-DO Over-the-Air Signal Analyzer (0034)<br>cdmaOne/CDMA2000 1X RF Signal Analyzer (0042)<br>cdmaOne/CDMA2000 1X Demodulated Signal Analyzer (0043)<br>CDMA2000 1xEV-DO RF Signal Analyzer (0062)<br>CDMA2000 1xEV-DO Demodulated Signal Analyzer (0063) | 3GPP2 Signal Analyzer Measurement Guide (10580-00235) |
| ISDB-T Measurements (0030)<br>ISDB-T SFN Field Measurements (0032)<br>ISDB-T BER Measurements (0079)<br>DVB-T/H Measurements (0064)<br>DVB-T/H SFN Measurements (0078)<br>DVB-T/H BER Measurements (0057) | Digital Video Broadcast Signal Analyzer Measurement Guide (10580-00237) |
| High-Accuracy Power Meter (0019)<br>Power Meter (0029) | Power Meter Measurement Guide (10580-00240) |
| IEEE 802.16 Mobile WiMAX Over-the-Air Signal Analyzer (0037)<br>IEEE 802.16 Fixed WiMAX RF Signal Analyzer (0046)<br>IEEE 802.16 Fixed WiMAX Demodulated Signal Analyzer (0047)<br>IEEE 802.16 Mobile WiMAX RF Signal Analyzer (0066)<br>IEEE 802.16 Mobile WiMAX Demodulated Signal Analyzer (0067) | WiMAX Signal Analyzer Measurement Guide (10580-00236) |
| T1 Analyzer (0051)<br>E1 Analyzer (0052)<br>T3/T1 Analyzer (0053) | Backhaul Analyzer Measurement Guide (10580-00238) |
| PIM Analyzer (Standard Feature) | PIM Master User Guide<br>(10580-00280) |
| ODTF-1 Optical Distance-to-Fault Module | ODTF-1 Optical Distance-to-Fault User Guide (10580-00215) |
| Performance Specifications | Cell Master Technical Data Sheet<br>(11410-00485) |
| SCPI Programming Manual | Cell Master Programming Manual<br>(10580-00256) |

**Table A-1.** Analyzers and Analyzer Options (Sheet 3 of 3)

| Cell Master Feature (Required Option) | Related Document (Part Number) |
|---|---|
| Documentation | Handheld Instruments Documentation Disc (10920-00060) |

# Index

10580-00250 K

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**Measurement Guide**

# 3GPP Signal Analyzer or Anritsu RF and Microwave Handheld Instruments

## BTS Master™, Cell Master™, Spectrum Master™, LMR Master™

| | RF | Demod | OTA |
|---|---|---|---|
| GSM/GPRS/EDGE | Option 40 | Option 41 | N/A |
| W-CDMA/HSPA+ | Option 44 | Option 65 | Option 35 |
| TD-SCDMA/HSPA+ | Option 60 | Option 61 | Option 38 |
| LTE/LTE-A | Option 541 | Option 542 | Option 546 |
| TD-LTE/LTE-A | Option 551 | Option 552 | Option 556 |

**For some models, RF, Demod, and OTA are combined as a single option.**

| | |
|---|---|
| GSM/GPRS/EDGE | Option 880 |
| W-CDMA/HSPA+ | Option 881 |
| TD-SCDMA/HSPA+ | Option 882 |
| LTE/LTE-A (FDD and TDD) | Option 883 |

| | |
|---|---|
| **Note** | Not all instrument models offer every option or every measurement within a given option. Please refer to the Technical Data Sheet of your instrument for available options and measurements within the options. |

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490 Jarvis Drive
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http://www.anritsu.com

Part Number: 10580-00234
Revision: T
Published: November 2015

## TRADEMARK ACKNOWLEDGMENTS



## NOTICE



## UPDATES

Updates, if any, can be downloaded from the Anritsu Website at:
http://www.anritsu.com

For the latest service and sales contact information in your area, please visit:
http://www.anritsu.com/contact.asp

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.

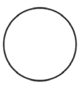
**Caution**

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

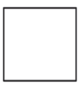
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all 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.

**Warning**

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

**Warning**

or

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

**Warning**


This equipment 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.

# Table of Contents

## Chapter 3—W-CDMA/HSPA+ Signal Analyzer

## Chapter 5— LTE Signal Analyzer

# Chapter 1 — General Information

## 1-1 Introduction

This Measurement Guide documents 3GPP signal analysis for the following Anritsu instruments:

- BTS Master
- Cell Master
- Spectrum Master
- LMR Master

| | |
|---|---|
| **Note** | Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options. |

## 1-2 3GPP Signal Analysis Overview

### GSM/GPRS/EDGE

GSM/GPRS/EDGE signal analysis is described in Chapter 2, "GSM/GPRS/EDGE Signal Analyzer".

- Option 40: GSM/EDGE RF Measurements
- Option 41: GSM/EDGE Demodulation
- Option 880: GSM/GPRS/EDGE Measurements (requires Option 9)

### W-CDMA/HSPA+

W-CDMA/HSPA+ signal analysis is described in Chapter 3, "W-CDMA/HSPA+ Signal Analyzer".

- Option 44: W-CDMA/HSPA+ RF Measurements
- Option 45: W-CDMA Demodulation
- Option 65: W-CDMA/HSPA+ Demodulation
- Option 35: W-CDMA/HSPA+ Over-the-Air (OTA) Measurements
- Option 881: W-CDMA/HSPA+ Measurements (requires Option 9)

### TD-SCDMA/HSPA+

TD-SCDMA/HSPA+ signal analysis is described in Chapter 4, "TD-SCDMA/HSPA+ Signal Analyzer".

- Option 60: TD-SCDMA/HSPA+ RF Measurements
- Option 61: TD-SCDMA/HSPA+ Demodulation
- Option 38: TD-SCDMA/HSPA+ OTA Measurements
- Option 882: TD-SCDMA/HSPA+ Measurements (requires Option 9)

### LTE

LTE signal analysis is described in Chapter 5, "LTE Signal Analyzer".

- Option 541: LTE/LTE-A RF Measurements
- Option 542: LTE/LTE-A Modulation Measurements
- Option 546: LTE/LTE-A OTA Measurements (requires Options 31 and 542 for full functionality)
- Option 883: LTE/LTE-A FDD/TDD Measurements

### TD-LTE

TD-LTE signal analysis is described in Chapter 6, "TD-LTE Signal Analyzer".

- Option 551: TD-LTE/LTE-A RF Measurements
- Option 552: TD-LTE/LTE-A Modulation Measurements
- Option 556: TD-LTE/LTE-A OTA Measurements (requires Options 31 and 552 for full functionality)
- Option 883: LTE/LTE-A FDD/TDD Measurements

LTE and TD-LTE coverage mapping is described in Chapter 7, "LTE and TD-LTE Coverage Mapping".

EMF measurements in the LTE and TD-LTE Signal Analyzer modes are described in Chapter 8, "EMF (Option 444)".

## 1-3 Selecting a Measurement Mode

Select a measurement mode by pressing **Shift** and then the **Mode** (9) button to open the Mode Selector dialog box. Highlight the desired measurement mode using the **Up** or **Down** arrow keys and press **Enter**.

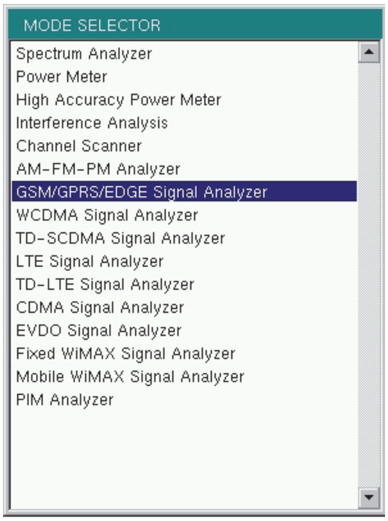



**Figure 1-1.** Mode Selector Dialog Box

| | |
|---|---|
| **Note** | Screen captured images are provided as examples. The image and measurement details shown on your instrument may differ from the examples in this measurement guide.<br>The actual menus on your instrument may also differ based on instrument model, firmware version, and installed options. |

Some Anritsu handheld instruments also have a **Menu** button which displays icons of installed measurement modes and allows measurement mode selection using the touch screen.

Refer to the instrument User Guide for additional information.


**Figure 1-2.** Mode Selector Dialog Box

## 1-4 Contacting Anritsu

To contact Anritsu, please visit:

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

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

Updated product information can be found on the Anritsu website:

http://www.anritsu.com/

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

# Chapter 2 — GSM/GPRS/EDGE Signal Analyzer

## 2-1 Introduction

The Global Systems for Mobile (GSM) communication is a globally accepted standard for digital cellular communication. GSM uses a combination of Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). Within each band are approximately one hundred available carrier frequencies on 200 kHz spacing (FDMA), and each carrier is broken up into time-slots so as to support eight separate conversations (TDMA). Each channel has an uplink and a downlink. GSM uses the Gaussian Minimum Shift Keying (GMSK) modulation method.

GPRS/EDGE is an extension of GSM technology and is applicable to data services. GSM uses Gaussian Minimum Shift Keying (GMSK) modulation and EGDE uses 8PSK Phase Shift Keying modulation.

The GSM/GPRS/EDGE frequency ranges are: 380–400 MHz, 410–430 MHz, 450–468 MHz, 478–496 MHz, 698–746 MHz, 747–792 MHz, 806–866 MHz, 824–894 MHz, 890–960 MHz, 880–960 MHz, 876–960 MHz, 870–921 MHz, and 1710–1990 MHz.

The instrument features two GSM/GPRS/EDGE measurement modes: RF Measurements and Demodulator. The instrument can be directly connected to any GSM/GPRS/EDGE base station for accurate measurements. When a physical connection is not available or required, the instrument can receive and demodulate GSM/GPRS/EDGE signals over the air.

GSM/GPRS/EDGE RF measurements provide views of spectrum, power versus time (frame), power versus time (slot) with mask and summary screens.

The spectrum view displays channel spectrum and multi-channel spectrum. The channel spectrum screen includes channel power, burst power, average burst power, frequency error, modulation type, and Base Station Identity Code (BSIC). The multi-channel spectrum displays as many as ten channels and, using the cursor to select a channel, can display the measurements for just the selected channel.

GSM/GPRS/EDGE Demodulator demodulates GSM/GPRS/EDGE signals and displays the results of detailed measurements to analyze transmitter modulation performance. Results are shown for phase error (rms), phase error peak, EVM (rms), EVM (peak), origin offset, C/I, modulation type and magnitude error (rms) and a vector diagram of the signal.

This chapter describes the menus in GSM/GPRS/EDGE Signal Analyzer mode.

| | |
|---|---|
| **Note** | Screen capture images are provided as examples. The image and measurement details shown on your instrument may differ from the examples in this measurement guide. |

## 2-2 Measurement Setup

Please refer to the instrument User Guide for detailed information on how to select the GSM/GPRS/EDGE Signal Analyzer mode, set up the frequency range, amplitude, limit lines, markers, and file management.

## 2-3 GSM/GPRS/EDGE RF Measurements

GSM RF measurements consists of Spectrum, Power versus Time (frame), Power versus Time (slot), Summary and Demodulator. To make GSM/GPRS/EDGE measurements connect the unit to the base station following the instructions.

| | |
|---|---|
| **Caution** | The maximum input power without damage is +30 dBm on the RF In port. To prevent damage, always use a coupler or high power attenuator. |

1. Press the **Setup** main menu key.
2. Press the GSM/EDGE submenu key and highlight Auto to select the GSM or EDGE signal.

| | |
|---|---|
| **Note** | Highlight GSM or EDGE to set the instrument to measure only a GSM or EDGE signal. |

3. The instrument has automatic external reference frequency detection or, if equipped, activate GPS to get GPS High Accuracy frequency error measurements. Refer to the User Guide for GPS setup information.

## 2-4 Measurement Display

Press the **Measurements** main menu key to select measurement display options.

To display Spectrum, press the Spectrum submenu key. Press the Channel Spectrum submenu key for a single channel (Figure 2-1), or the Multi-Channel Spectrum submenu key to display the multi-channel spectrum (Figure 2-2).

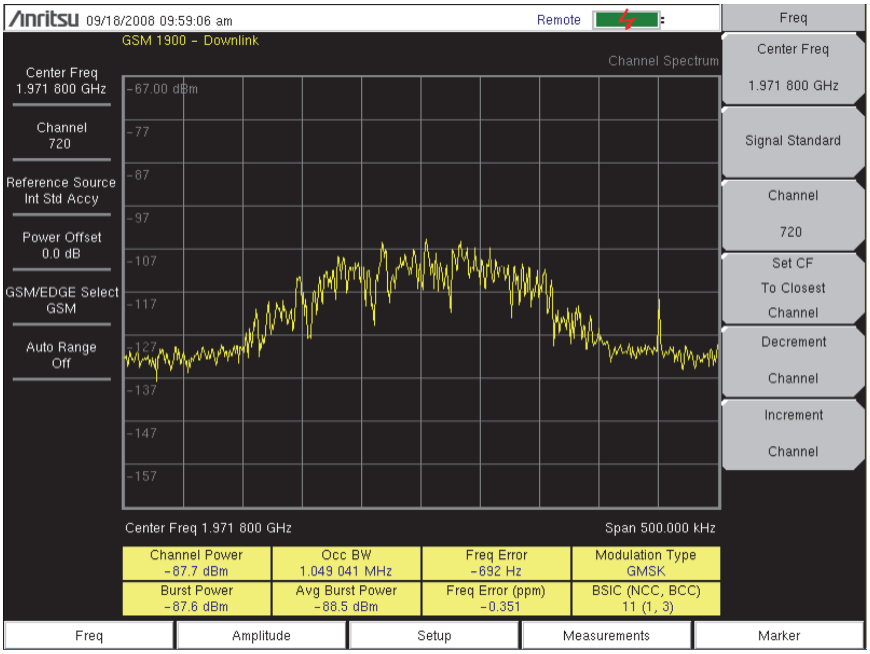



**Figure 2-1.** GSM Single Channel Measurement

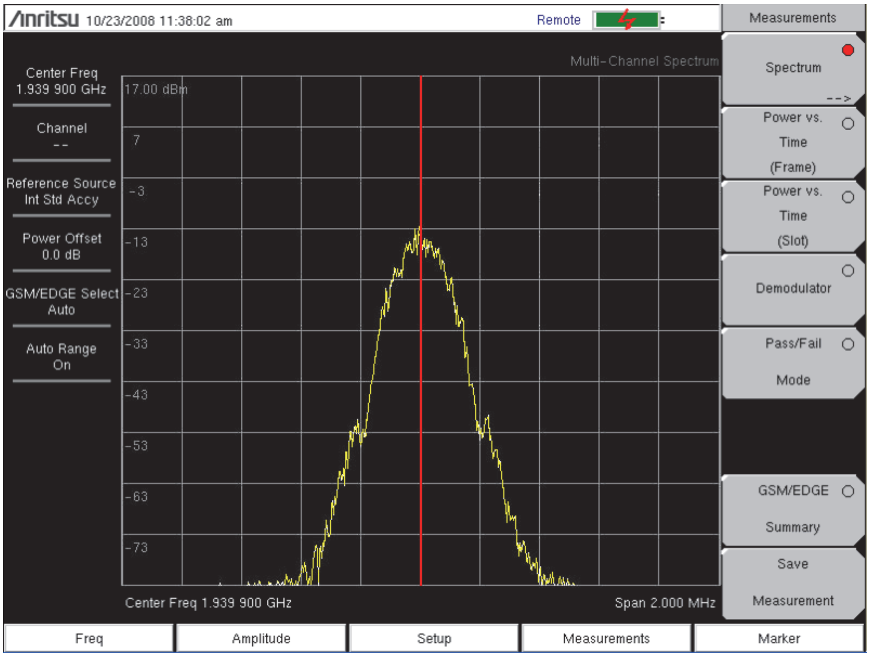



**Figure 2-2.** GSM Multi-Channel Measurement

To display Power versus Time (Frame) press the Power versus Time (Frame) submenu key to activate the Power versus Time (Frame) measurement (Figure 2-3).

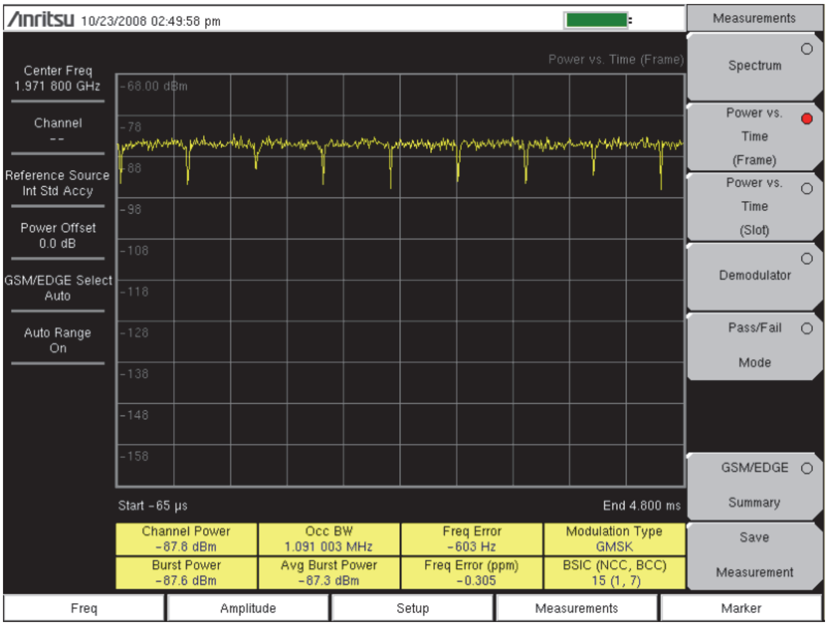



**Figure 2-3.** GSM Power vs. Time (Frame) Measurement

To display Power versus Time (Slot) press the Power versus Time (Slot) submenu key to activate the Power versus Time (Slot) measurement (Figure 2-4). The mask is according to the 3GPP TS 05.05 specification. The first slot information is displayed.

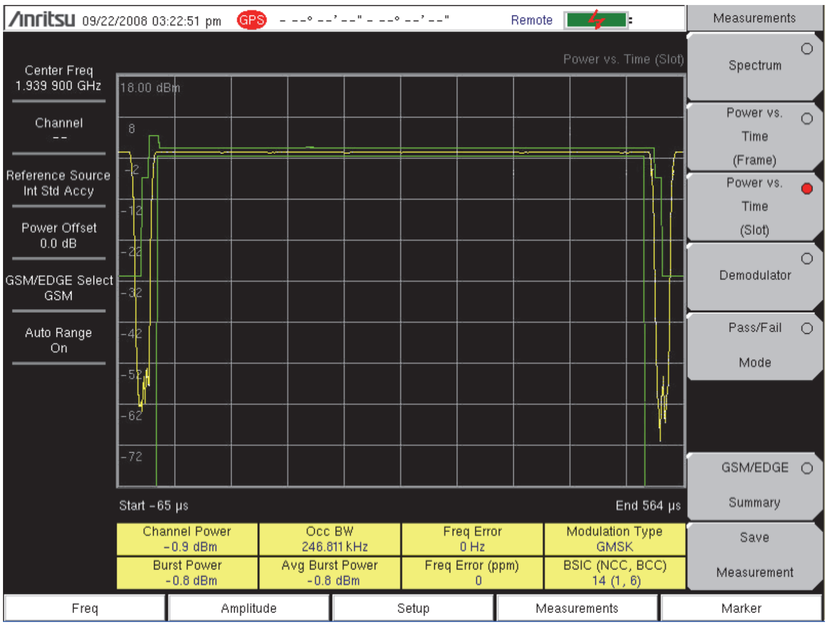



**Figure 2-4.** GSM Power vs. Time (Slot) Measurement

# 2-5 Demodulator

This measurement demodulates the GSM/GPRS/EDGE signal and displays the vector with Phase Error, EVM, Origin Offset, C/I, Modulation Type and Magnitude Error (as applicable). See Figure 2-5 and Figure 2-6. To demodulate the GSM/EDGE signal:

1. Set the frequency as described in the User Guide.
2. Press the **Setup** main menu key.
3. Press the GSM/EDGE submenu key and highlight Auto to automatically select the GSM or EDGE signal.

| | |
|---|---|
| **Note** | Highlight GSM or EDGE to set the instrument to measure only a GSM or EDGE signal. |

4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS to get GPS High Accuracy frequency error measurements. Refer to the User Guide for GPS setup information.
5. Press the **Measurements** main menu key.
6. Press the Demodulator submenu key.

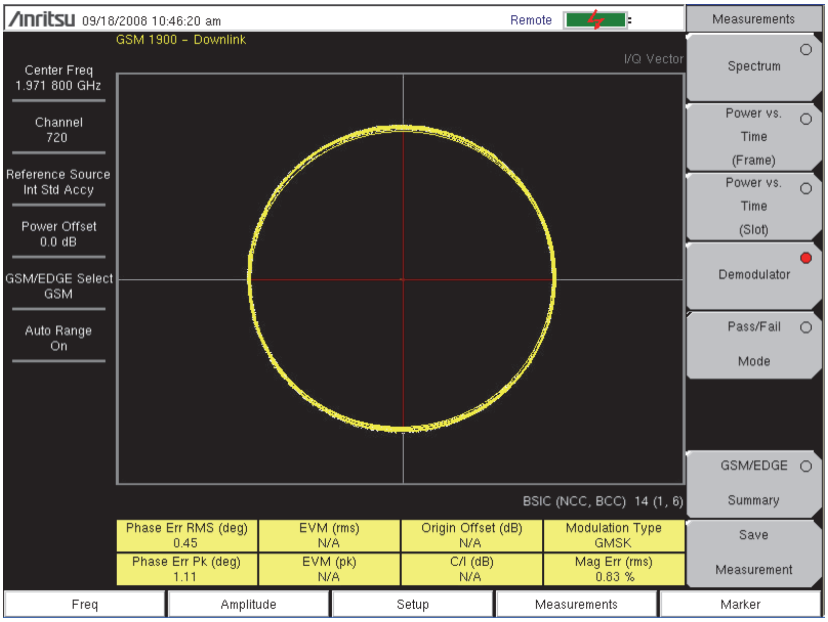



**Figure 2-5.** GSM Demodulator Measurement

| | |
|---|---|
| **Note** | Using multi-channel spectrum, channel cursor, select the channel and press the Demodulator submenu key and the unit will demodulate the selected channel. |

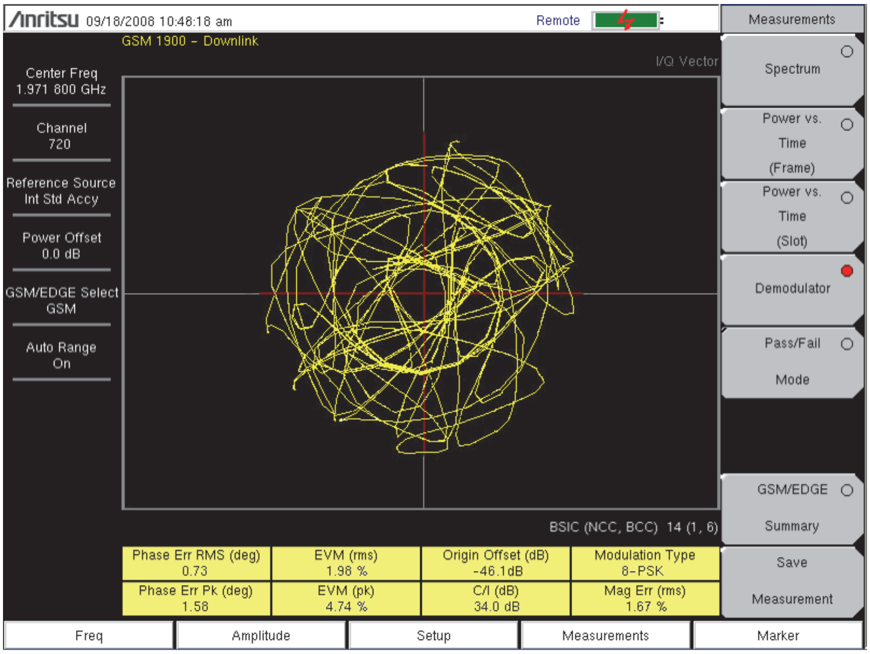



**Figure 2-6.** EDGE Demodulator Measurement

To display the GSM/EDGE Summary screen (Figure 2-7), press the GSM/EDGE Summary soft key.

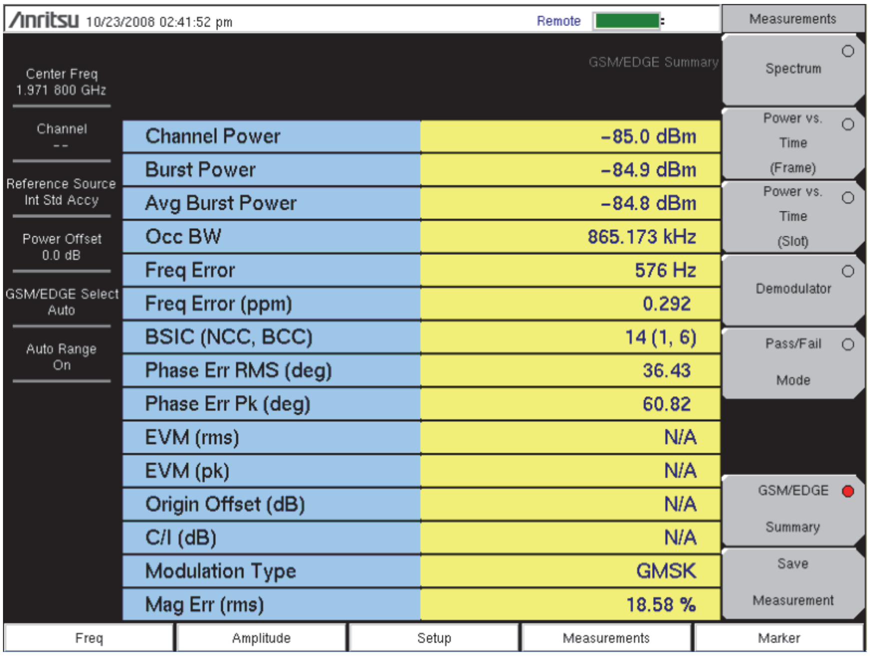



**Figure 2-7.** GSM/EDGE Summary

# 2-6 GSM/GPRS/EDGE Mode Pass/Fail

The unit can store test sets for testing base station performance and can recall these test sets for quick, easy measurements. These test sets are for reference only and can be edited using Master Software Tools. When a test set is selected, the unit displays the test results in a tabular format with PASS or FAIL indications that include min/max thresholds (Figure 2-8).

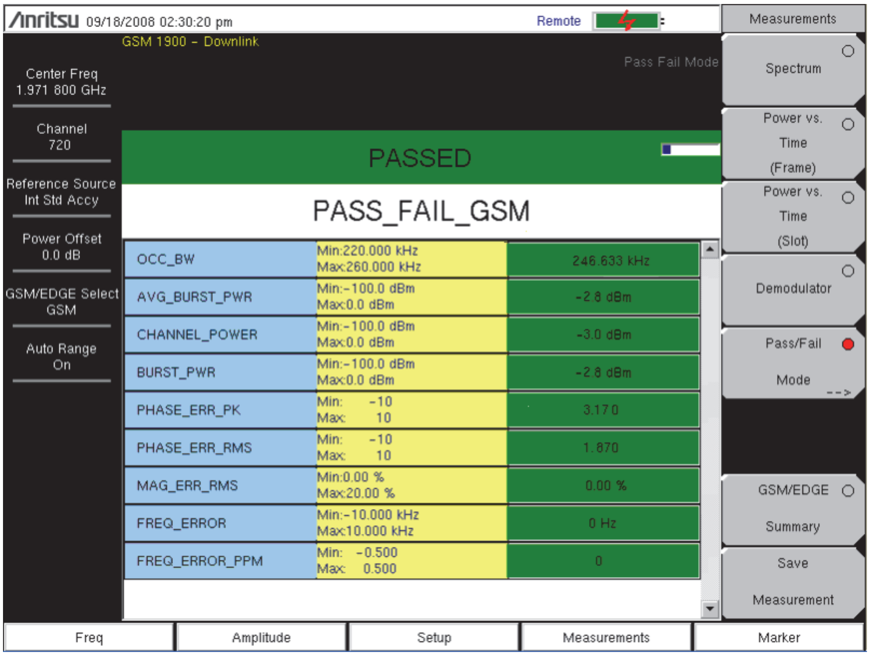



**Figure 2-8.** Pass/Fail Mode

Using Master Software Tools, a custom test set can also be created and downloaded to the instrument. All measurement parameters can be selected for pass/fail testing.

## Pass/Fail Mode Procedure

1. Set the frequency as described in the User Guide.
2. Press the **Measurements** main menu key.
3. Press the Pass/Fail Mode submenu key to activate Pass/Fail Mode.
4. Press the Pass/Fail Mode submenu key to display the Pass/Fail Mode menu and then press the Select Pass/Fail Test submenu key to display the available test sets.
5. Use the rotary knob or **Up/Down** arrow keys to select the applicable test set and to activate the measurement.

Refer to the Master Software Tools documentation for information on creating a custom pass/fail test set.

## 2-7 Measurement Results

**Average Burst Power**

The average burst power over 10 measured burst power values. This average is restarted when a new frequency is selected.

**Channel Power**

Channel power measures the average power in a GSM/EDGE frame in the frequency specified. Out of specification power indicates system faults. Channel power is expressed in dBm.

**Freq Error**

The difference between the received frequency and the specified frequency is the frequency error. This number is only as accurate as the frequency reference used, and is typically only useful with a good external frequency reference or GPS. Frequency error is displayed in both Hz and ppm.

**Occ BW**

The occupied bandwidth is calculated as the bandwidth containing 99% of the transmitted power.

**Burst Power**

Burst power is the average power over the useful part of the first active burst GSM/EDGE slot. A GSM/EDGE signal has eight time slots in a frame.

**BSIC (NCC, BCC)**

This is the Base Station Identity Code broadcasted on GSM systems. The code consists of a Network Color Code (NCC) and a Base Station Color Code (BCC).

**Phase Err RMS (deg)**

The RMS phase error measured in degrees between the received signal and an ideal reconstructed reference signal of the first active slot.

**Phase Err Pk (deg)**

The peak phase error measured in degrees between the received signal and an ideal reconstructed reference signal of the first active slot.

**EVM (rms)**

The RMS (%) of all the error vectors between the ideal reconstructed reference symbol points and the received symbol points divided by the RMS value of the signal present in the first active slot. This measurement is performed for 8PSK modulated signals (EDGE) only.

**EVM (pk)**

The peak (%) of all the error vectors between the ideal reconstructed reference symbol points and the received symbol points divided by the RMS value of the signal present in the first active slot. This measurement is performed for 8PSK modulated signals (EDGE) only.

**Origin Offset (dB)**

Origin Offset is the carrier leakage component of the measured signal in dB and this measurement is applicable to EDGE signal only.

### Carrier to Interference Ratio – C/I (dB)

Carrier to Interference Ratio is the ratio of the desired carrier power to the undesired signal power (interferer) in dB. This value is an estimate that is derived from the measured RMS EVM value. This measurement is applicable to an EDGE signal only.

### Modulation Type

The modulation type can be GMSK (for GSM signals) or 8PSK (for EDGE signals).

### Mag Err (rms)

The RMS of the magnitude error between the received signal and an ideal reconstructed reference signal of the first active slot in %.

# 2-8 GSM/GPRS/EDGE Menus

Figure 2-9 show the map of GSM/GPRS/EDGE menus. The following sections describe GSM/GPRS/EDGE main menus and associated submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.

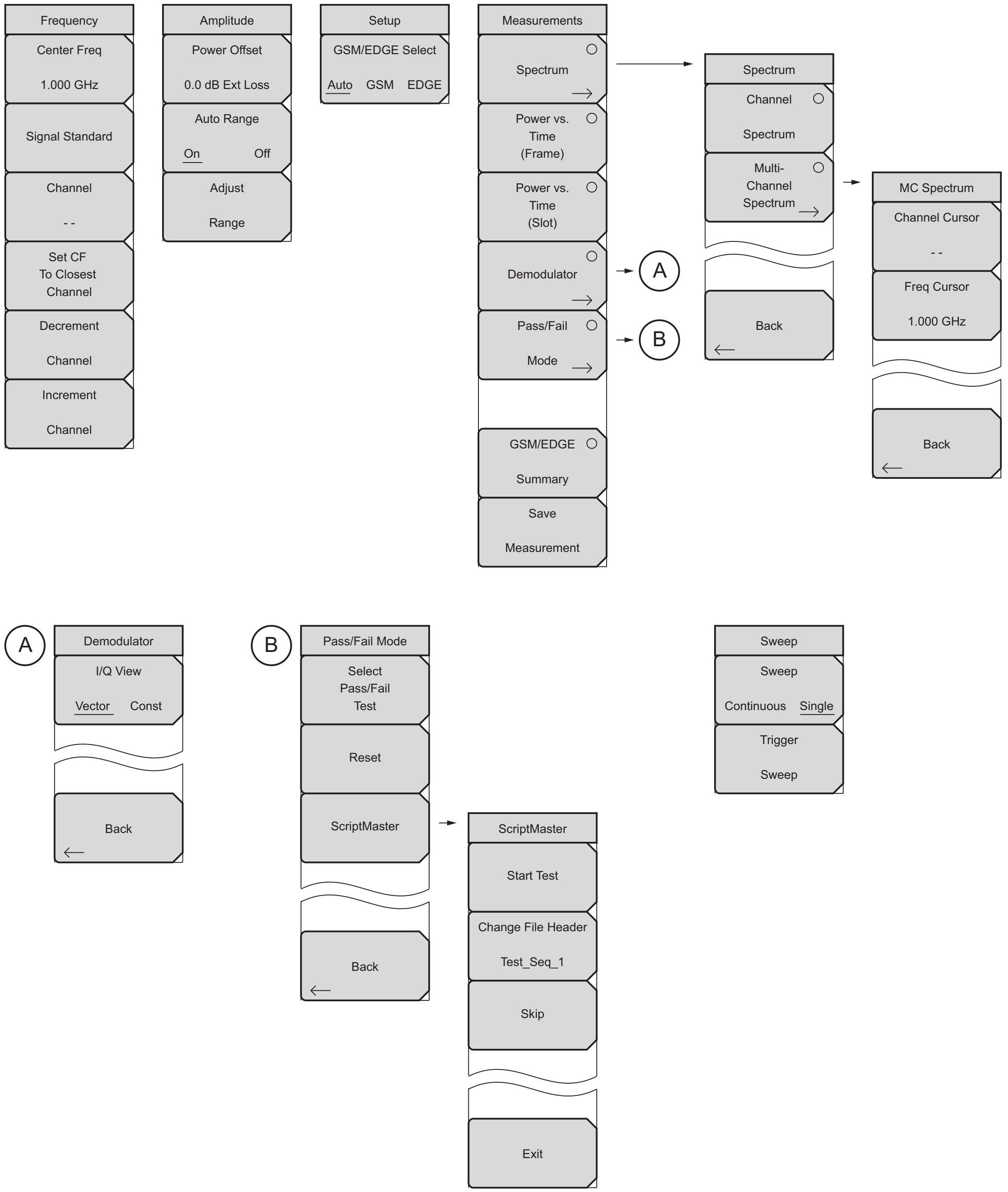
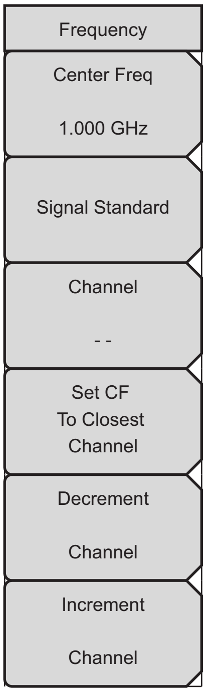



**Figure 2-9.** GSM/GPRS/EDGE Menu Layout

# 2-9 Freq (Frequency) Menu

Key Sequence: **Freq**




**Center Freq:** Press the **Freq** key followed by the Center Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the Enter key has the same effect as pressing the MHz submenu key.

**Signal Standard:** Use the **Up/Down** arrow keys or the rotary knob to highlight a signal standard and press **Enter** to select. When a signal standard is selected, the center frequency and span for the first channel of the selected standard is automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered. Appendix A contains a table of the signal standards that are in the instrument firmware.

**Channel:** Use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard. The center of the channel is automatically tuned to the center frequency of the selected GSM/EDGE channel.

**Set CF To Closest Channel:** Changes the center frequency to the closest channel.

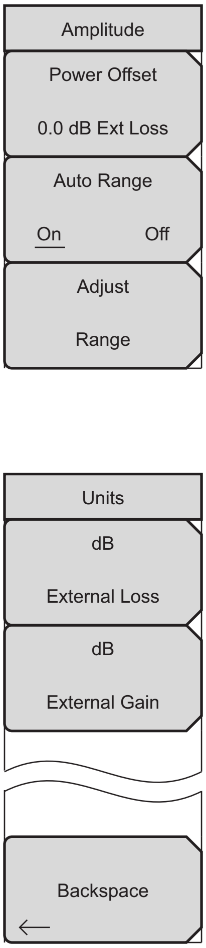
**Decrement Channel:** Decreases the channel number one channel.

**Increment Channel:** Increases the channel number one channel.

**Figure 2-10.** GSM/GPRS/EDGE Freq Menu

# 2-10 Amplitude Menu

Key Sequence: **Amplitude**




**Power Offset:** Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

By default, the instrument will automatically change attenuation, preamplifier and digital gain settings to make the best GSM measurements.

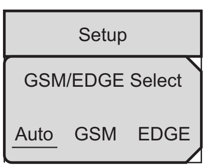
**Auto Range:** Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

**Adjust Range:** Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

**Figure 2-11.** GSM/GPRS/EDGE Amplitude Menu

# 2-11 Setup Menu

Key Sequence: **Setup**

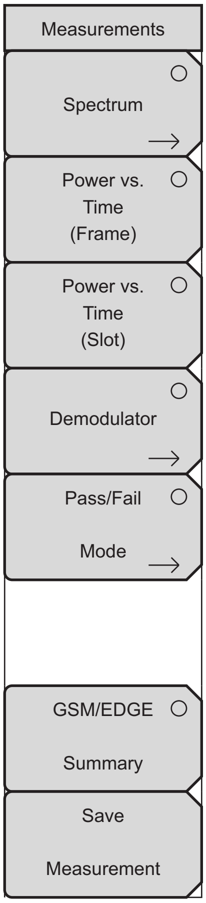



**GSM/EDGE Select:** Toggles between Auto, GSM and EDGE. Auto allows the instrument to search for a GSM or EDGE signal automatically. Selecting GSM or EDGE sets the instrument to measure only a GSM or EDGE signal.

**Figure 2-12.** GSM/GPRS/EDGE Setup Menu

# 2-12 Measurements Menu

Key Sequence: **Measurements**




**Spectrum:** Opens the “Spectrum Menu” on page 2-14.

**Power versus Time (Frame):** Displays approximately eight and a half slots of the GSM/EDGE signal frame starting from the first active slot found. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Modulation Type, Burst Power, Avg Burst Power, and BSIC.

**Power versus Time (Slot):** Displays the first active slot of the GSM/EDGE signal capture. The mask is as specified in 3GPP TS 05.05. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Modulation Type, Burst Power, Avg Burst Power, and BSIC.

**Demodulator:** Opens the “Demodulator Menu” on page 2-15. Displays the IQ vector of the GSM/EDGE signal. The screen also displays Phase Err RMS, Phase Err Pk, EVM (rms), EVM (pk), Origin Offset (dBc), C/I (dB), Modulation Type and Magnitude Error (rms).

Note: GSM uses GMSK modulation and EDGE uses 8PSK modulation. EVM (rms), EVM(pk), Orgin Offset, C/I are not measured for GSM signals (shows N/A on the display).

**Pass/Fail Mode:** Opens the “Pass/Fail Mode Menu” on page 2-16. Displays the Pass/Fail measurements in a table format with clear pass or fail indicators that include min/max thresholds and actual measured results.

**GSM/EDGE Summary:** Displays the measurement results in a table format.

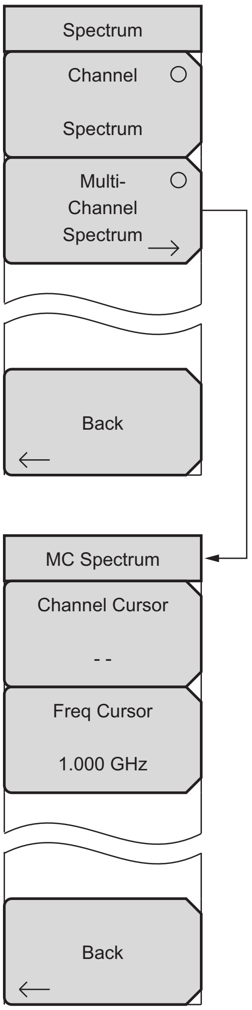
**Save Measurement:** Opens a dialog window to name and save the current measurement. Refer to the User Guide that came with the instrument for the saving functions.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Trace-1, Trace-2, and so forth) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or press the submenu key for each letter. GSM measurements are saved with a .gsm file extension, and GSM/EDGE measurements are saved with an .edg extension.

**Figure 2-13.** GSM/GPRS/EDGE Measurements Menu

## Spectrum Menu

Key Sequence: **Measurements** > Spectrum




**Channel Spectrum:** Displays the spectrum of the selected channel. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Burst and Average Burst Power, and the Base Station Identity Code (BSIC).

**Multi-Channel Spectrum:** Displays the spectrum of ten GSM/EDGE channels. Opens the MC Spectrum Menu shown below:

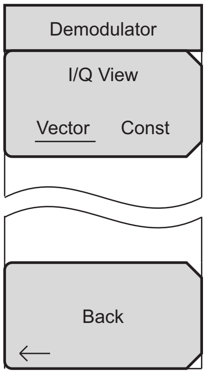
> **Channel Cursor:** Select Channel Cursor to place the cursor at a specific channel location. Use the rotary knob or the **Up/Down** arrow keys to select the channel. Press the **Enter** key to select.
>
> **Freq Cursor:** Select Freq Cursor to place the cursor at a specific frequency. Use the rotary knob or the **Up/Down** arrow keys to select the frequency. Press the **Enter** key to select.
>
> **Back:** Returns to the Spectrum Menu.

**Back:** Returns to the "Measurements Menu".

**Figure 2-14.** Spectrum Menu

## Demodulator Menu

Key Sequence: **Measurements** > Demodulator



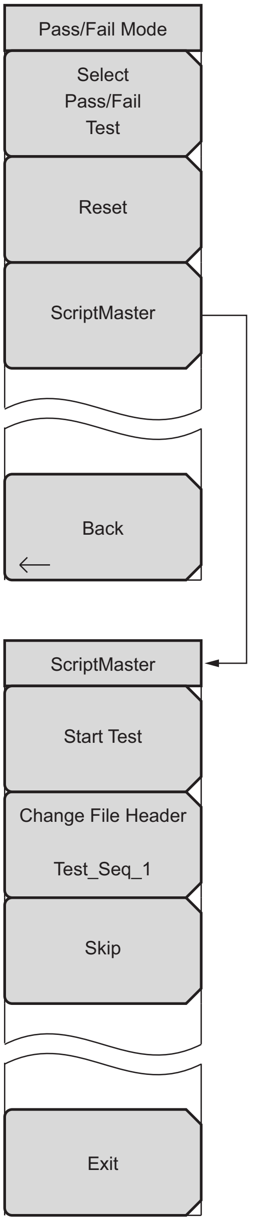

**I/Q View:** Allows selection between Vector or Const.

**Back:** Returns to the "Measurements Menu".

**Figure 2-15.** GSM/GPRS/EDGE Freq Menu

## Pass/Fail Mode Menu

Key Sequence: **Measurements** > Pass/Fail Mode




**Select Pass/Fail Test:** Display the available test sets in the Select Pass/Fail Test window.

**Reset:** Resets the Pass/Fail Mode test.

**ScriptMaster:** Opens the Select File by Scrolling window and also lists Recall and Back submenu keys. Recall a Script file, created in Master Software Tools, from the window. The ScripMaster instructions are loaded into the instrument and the ScriptMaster menu is listed.

> **Start Test:** Begins running the instructions listed in ScriptMaster.
>
> **Change File Header:** Opens the Pass Fail Test File Header entry window and lists the Text Entry menu to name the saved file after the ScriptMaster measurement process is complete.
>
> **Skip:** Skips over a ScripMaster instruction.
>
> **Exit:** Ends the ScriptMaster measurement process. Returns the instrument to the previous measurement setup.

**Back:** Returns to the “Measurements Menu”.

**Figure 2-16.** GSM/GPRS/EDGE Pass/Fail Menu

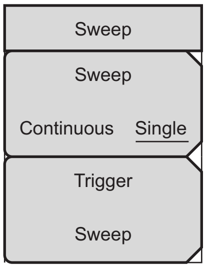
# 2-13 Marker Menu

Key Sequence: **Marker**

This menu is available only in Multi-Channel Spectrum view and opens the MC Spectrum submenu. See the "Spectrum Menu" on page 2-14 for details.

# 2-14 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key




**Sweep Single/Continuous:** This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

**Trigger Sweep:** Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

**Figure 2-17.** GSM/GPRS/EDGE Sweep Menu

# 2-15 Measure Menu

This menu opens the "Measurements Menu" on page 2-13.

# 2-16 Trace Menu

This menu is not available in GMS/GPRS/EDGE measurement mode.

# 2-17 Limit Menu

This menu is not available in GMS/GPRS/EDGE measurement mode.

# 2-18 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the instrument User Guide.

# Chapter 3 — W-CDMA/HSPA+ Signal Analyzer

## 3-1 Introduction

The WCDMA/HSPA+ signal analyzer supports the following measurement modes:

- RF Measurements
- Demodulator
- Over-The-Air (OTA) Measurements

Connect the instrument to any Node B/BTS for accurate RF and demodulator measurements.

| | |
|---|---|
| **Note** | The W-CDMA/HSPA+ Demodulator option demodulates both W-CDMA and HSPA+ signals. Refer to the instrument Technical Data Sheet for option availability. |

The instrument can measure node B transmitter performance over the air or directly. To measure a W-CDMA signal over the air, connect the appropriate frequency band antenna to the RF In connector. To connect the node B equipment directly, connect the power amplifier of the node B equipment to the RF In connector of the unit using a coupler or attenuator.

| | |
|---|---|
| **Note** | The maximum input damage level of the RF In port is +30 dBm. To prevent damage, always use a coupler or high power attenuator. |

# 3-2 W-CDMA/HSPA+ Measurements

| | |
|---|---|
| **Note** | Use an applicable band pass filter to eliminate out of band signals that can cause mixer saturation. |

### Carrier Frequency

Carrier Frequency is the selected transmitter operating center frequency entered by the user or calculated from the signal standard and channel number entered by the user.

### Carrier Feedthrough

Carrier Feedthrough measures the amount of unmodulated signal that is leaking through the transmitter and is displayed in the Code Domain Power display. The W-CDMA 3GPP specification does not specify carrier feedthrough measurement.

### CDP

Code Domain Power displays how much of the channel power is in each Orthogonal Variable Spreading Factor (OVSF code). Power is normalized to the channel power, so if a code reads –10 dB, it means that the code is 1/10th of the channel power. Colors are applied according to Table 3-1.

**Table 3-1.** Channel Power Colors

| Parameter | Description | Color | Vlewable on Display |
|---|---|---|---|
| CPICH | Common Pilot Channel | Red | All CDP views |
| P-CCPCH | Primary Common Control Physical Channel | Magenta | All CDP views |
| S-CCPCH | Secondary Common Control Physical Channel | Cyan | All CDP views |
| PICH | Paging Indicator Channel | Green | All CDP views |
| P-SCH | Primary Sync Channel | Navy Blue | Control Channels |
| S-SCH | Secondary Sync Channel | Blue | Control Channels |
| Traffic | W-CDMA Traffic | Yellow | All CDP views |
| Noise | Noise | Grey | All CDP views |
| HS-PDSCH | High Speed Physical Downlink Shared Channel | Orange | HSPA+ Screen and CDP Screen when the W-CDMA/HSPA+ option is installed |

| | |
|---|---|
| **Note** | In W-CDMA specification, the P-SCH and S-SCH are not assigned spreading codes and therefore do not appear in the code domain power display. They have special non-orthogonal scrambling codes and are on 10% of the time. |

### Channel Power

Channel power is the total power transmitted in the 5 MHz W-CDMA channel specified. Channel Power measures the node B/base station transmitting power across the entire 5 MHz W-CDMA (BTS) channel. Channel power is displayed in dBm and Watts.

For Over the Air (OTA) measurements, the channel power will vary as the signal path from the node B transmitter to the instrument varies.

### Scrambling Code

In the W-CDMA specification, the scrambling code can be from 0 to 511. If the scrambling code is known, its value can be entered and the test set can decode and display the code domain power of the signal. If the scrambling code is unknown, the instrument can be set to auto scrambling so that the test set can lock onto the strongest code to decode and display the code domain power of the signal.

### Spreading Factor (OVSF)

According to the 3GPP standard the spreading factor can be from 4 to 512, and the instrument can be set to a maximum spreading factor of 256 or 512.

### Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This is tied to the external frequency reference accuracy and is typically useful only with a good external frequency reference.

### Codogram

When Codogram is selected the screen displays the changes in code power levels over time.

### Noise Floor

The average power of inactive codes in the code domain, as displayed in the CDP measurement display.

### Threshold

The Active Channel Threshold Level can be set to indicate which code channels are considered active. Any code channels exceeding this power level are considered active traffic channels and any code channels below this power level are considered inactive (or noise). A horizontal red line on the screen represents the threshold level. This level can be set automatically based on the received signal, or the user can manually enter a value in the Threshold setup menu.

### Occupied Bandwidth

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the transmitted spectrum around the selected center frequency.

### EVM (Error Vector Magnitude)

The Error Vector Magnitude is the ratio in percent of the difference between the measured waveform and the reference waveform. EVM metrics are used to measure the modulation quality of a transmitter. The 3GPP standard requires that the EVM not exceed 17.5%.

```
EVM = (reference–measured) / reference x 100
```

### Symbol EVM (EVM)

Symbol EVM is defined as the EVM for a single code channel.

### Peak to Average Power

Peak to Average power is the ratio of the peak power and the RMS power of the signal calculated over one frame interval and is displayed in dB.

### Peak CD Error (Peak Code Domain Error)

PCDE takes the noise and projects the maximum impact it will have on all OVSF codes. PCDE is the maximum value for the code domain error for all codes (both active and inactive).

In the 3GPP standard, in order to address the possibility of uneven error power distribution in W-CDMA, the EVM measurement has been supplemented with PCDE. The 3GPP standard requires that the PCDE not exceed –33 dB at a spreading factor of 256.

### Ec

Ec is a measurement of energy. Ec is determined by multiplying CPICH by the chip time.

### Ec/Io

The pilot power compared to the total channel power. Ec/Io is displayed in text-only displays and in OTA measurement displays.

### Pilot Dominance

The strength of the strongest pilot compared to the next strongest pilot in the same channel. This should be >10 dB in order to make good measurements.

### OTA Total Power

The total channel power is also called (Io) and displayed in dBm.

### CPICH Power

CPICH power is the power of the Common Pilot Channel power displayed in dBm.

### P-CCPCH Power

P-CCPCH power is the Primary Common Control Physical Channel power displayed in dBm.

### S-CCPCH Power

S-CCPCH power is the Secondary Common Control Physical Channel power displayed in dBm.

### P-SCH Power

P-SCH power is the Primary Sync Channel power displayed in dBm.

### S-SCH Power

S-SCH power is the Secondary Sync Channel Power displayed in dBm.

### PICH

PICH is the Paging Indicator Channel Power.

### HSPA+ Power versus Time Display

Select the code and set the time to display how the code is varying over time. In CDP view, HSPA+ signals are displayed in orange.

### Constellation

In the HSPA+ view, the symbol constellation for the selected code is displayed (16QAM or QPSK).

# 3-3 General Measurement Setups

Please refer to the User Guide for information on selecting the W-CDMA/HSPA+ Signal Analyzer mode, setting up frequency, amplitude, power offset for compensating external loss, limit lines, markers, and file management.

## Scrambling Code Setup

The scrambling code can be set up automatically or manually.

In Auto mode, the unit automatically locks on to the strongest scrambling code in the signal. In Manual mode, the desired code is manually entered and the unit looks only for that specific scrambling code.

To set up auto scrambling:

1. Press the **Setup** main menu key.
2. Press the Scrambling Code submenu key to select Auto.

To manually set up a Scrambling Code:

1. Press the **Setup** main menu key.
2. Press the Scrambling Code submenu key to select Manual and use the keypad, the arrow keys, or the rotary knob to enter the desired Scrambling Code, as shown on the left side of the screen. Press the **Enter** key to set the scrambling code.

## Maximum Spreading Factor Setup

In a W-CDMA system, the number of chips per data symbol is called the Spreading Factor. The lower the spreading factor the higher the data rate. According to the 3GPP standard, the spreading factor can vary from 4 to 512 and the maximum spreading factor is either 256 or 512. The instrument can be set to 256 or 512 maximum spreading factors. To set up the maximum spreading factor:

1. Press the **Setup** main menu key.
2. Press the Max Spreading Factor submenu key to select either 256 or 512.

## S-CCPCH Spreading Factor, S-CCPCH Code and PICH Code Setup

In the 3GPP specification, two optional control channels are provided for S-CCPCH and PICH. These codes can have different spreading codes and spreading factors. The S-CCPCH spreading factor and S-CCPCH and PICH codes can be manually entered.

| | |
|---|---|
| **Note** | For the most accurate results, manually enter the S-CCPCH spreading factor and the S-CCPCH and PICH codes before taking the measurement. |

1. Press the **Setup** main menu key.
2. Press the S-CCPCH Spread submenu key and manually enter the desired spreading factor. The default value is 256.
3. Press the S-CCPCH Code submenu key and manually enter the desired spreading code. The default value is 3.
4. Press the PICH Code submenu key and manually enter the desired spreading code. The default PICH code is 16.

## Threshold Setup

The threshold level is an advanced setting that can be set to indicate which codes are considered active. In the Code Domain Power screen, the threshold level is indicated by a horizontal dotted red line. Any code channels exceeding this power level are considered active traffic channels and any code channels below this power level are considered inactive or noise. To set the threshold level:

1. Press the **Setup** main menu key, then press More.
2. Press the Threshold submenu key and select Auto or Manual.
3. To set the threshold level manually, press the Manual Threshold submenu key and use the rotary knob, arrow keys, or the numeric keypad to change the value. When entering a threshold using the keypad, the screen menu will show the Units key. Press the dB submenu key or the **Enter** key to set the entered threshold.

## Filtered versus Unfiltered Power

The ACLR measurement uses the filtered channel power to determine the ACLR values and it is listed as filtered on the display. In all other screens the unfiltered channel power is displayed as channel power.

# 3-4 W-CDMA/HSPA+ RF Measurements

The W-CDMA/HSPA+ RF Measurements consist of three measurements:

- Spectrum
- Adjacent Channel Leakage Ratio (ACLR)
- Spectral Emission Mask

To make W-CDMA RF measurements, connect the RF in connector to the node B equipment.

| | |
|---|---|
| **Note** | Screen captured images are provided as examples. The image and measurement details shown on your instrument may differ from the examples in this Measurement Guide. |

## Band Spectrum Setup

Displays the selected band spectrum. The cursor can be moved to select the desired channel using the directional arrow keys or the rotary knob. The Channel Number can also be directly entered using the numerical keypad.

| | |
|---|---|
| **Note** | Selecting Channel Spectrum after selecting a channel using the cursor will display the measurements for the selected signal. |

## Band Spectrum Procedure

1. Set the measurement frequency by using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key and the RF Measurements submenu key.
3. Press the Band Spectrum submenu key to display the band spectrum (Figure 3-1).

4. Move the cursor, using the directional arrow keys or the rotary knob, to select the desired channel. The Channel Number can also be directly entered using the numerical keypad.

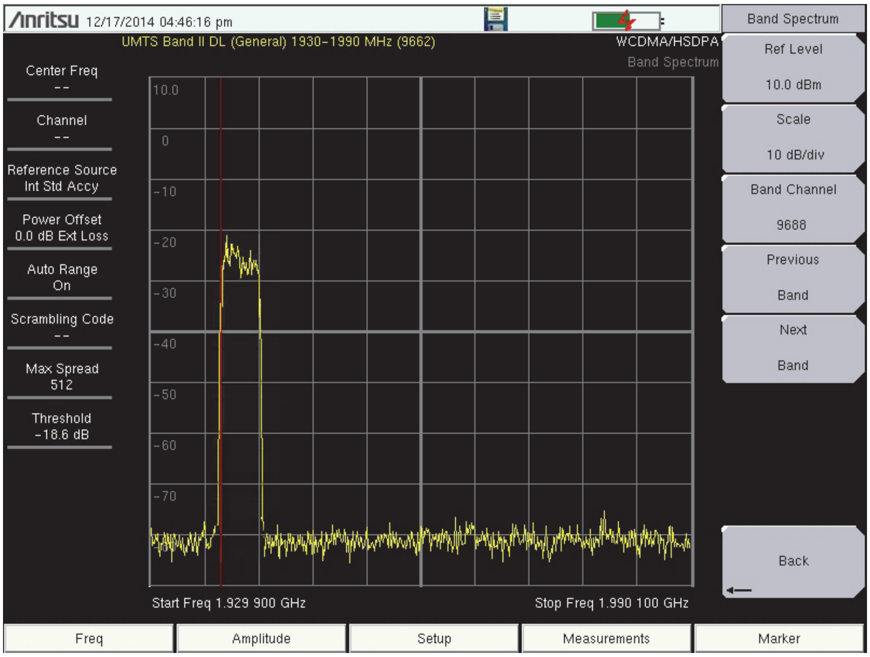



**Figure 3-1.** Band Spectrum

## Channel Spectrum Setup

The channel spectrum screen displays the selected channel signal and the following measurements: channel power in dBm and Watts, occupied bandwidth, and peak to average power. When Channel Spectrum is selected, the unit automatically displays the measurements for the selected signal.

## Channel Spectrum Procedure

1. Press the **Setup** main menu key.
2. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
3. Press the **Measurements** main menu key.
4. Press the RF Measurements submenu key.
5. Press the Channel Spectrum submenu key to activate the spectrum measurement (Figure 3-2).

| | |
|---|---|
| **Note** | Using the Band Spectrum cursor, select the desired channel and the unit will automatically display the measurements for the selected channel when the Channel Spectrum key is selected. |

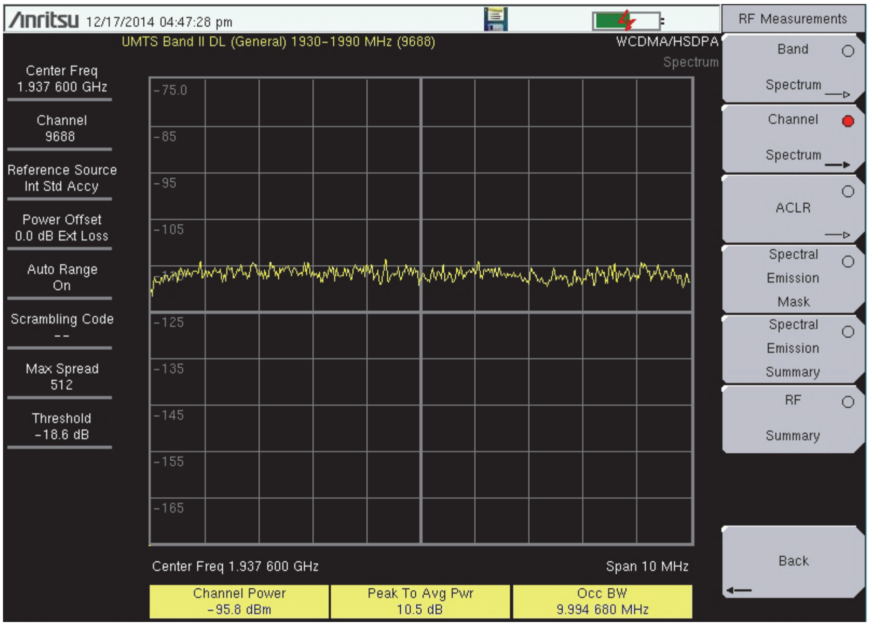



**Figure 3-2.** Channel Spectrum

## ACLR Measurement Setup

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The 3GPP standard specifies one main channel and two adjacent channels. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph.

The channel spacing is –10 MHz, –5 MHz, +5 MHz and +10 MHz and the channels are color coded. The 3GPP standard requires the adjacent channel power leakage ratio to be better than 45 dB at 5 MHz offset and 50 dB at 10 MHz offset.

ACLR measurements can be made for multi-channel systems by measuring the main channels and the adjacent channels, from one to four channels. The ACLR screen can display up to 12 channels total.

In the ACLR measurement mode the filtered channel power is used to determine ACLR values and is listed as filtered on the display.

The following procedure is for one main channel two adjacent channels.

## ACLR Measurement Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key.

3. Press the RF Measurements submenu key.

| | |
|---|---|
| **Note** | The ACLR measurement uses the filtered channel power to determine the ACLR values and it is listed as filtered on the display. In all other screens the unfiltered channel power is displayed as channel power. |

4. Press the ACLR submenu key to activate the ACLR measurement.

| | |
|---|---|
| **Note** | Using the Band Spectrum cursor, select the required channel and press the ACLR submenu key. The measurement will be displayed. |

5. Press the ACLR submenu key again and select one main channel and two adjacent channels (Figure 3-3).

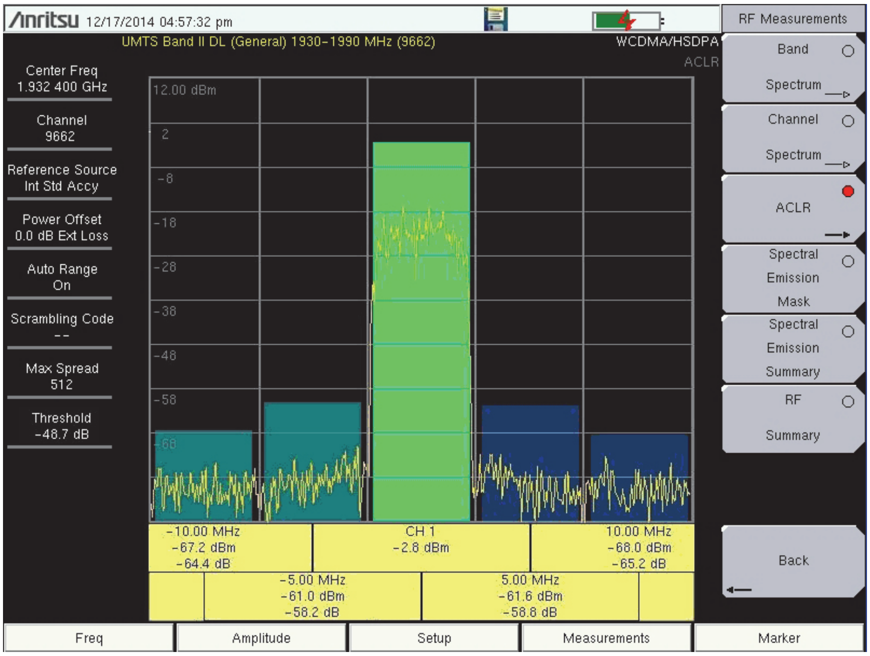



**Figure 3-3.** ACLR Measurement

## ACLR Multi-channel ACLR Procedure

1. Press the **Measurements** main menu key.
2. Press the RF Measurements submenu key.
3. Press the ACLR submenu key to activate the ACLR measurement.
4. Press the ACLR submenu key again to open the ACLR menu.
5. Press Select # of Main Channels to open the Num of Main Channels list box. Highlight the desired number of channels and press **Enter**. In Figure 3-4, four channels were selected.

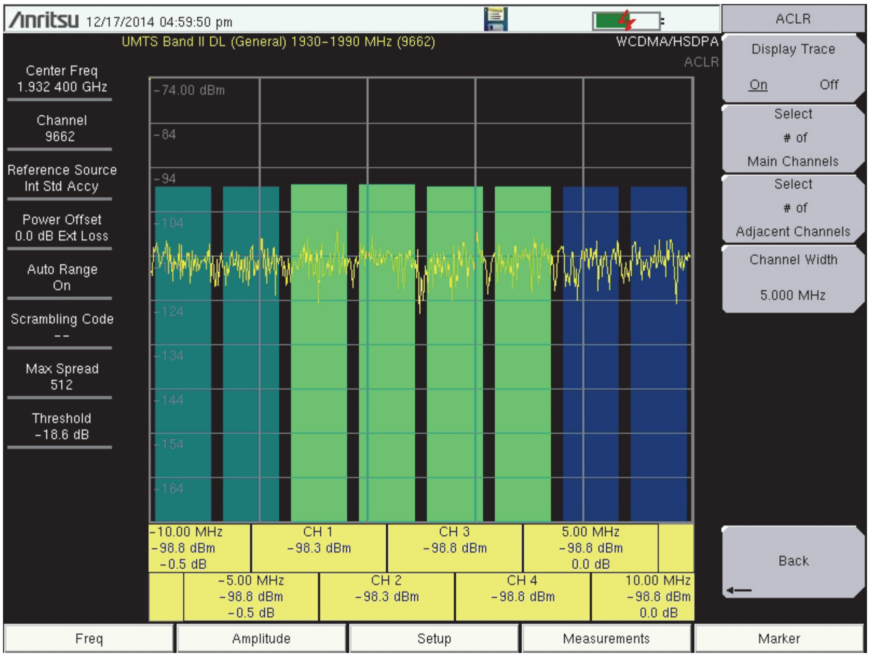



**Figure 3-4.** ACLR Multi-channel Measurement

## Spectral Emission Mask Setup

The Spectral Emission Mask displays the selected signal and the mask as defined in the 3GPP specification. The mask varies depending upon the input signal. The instrument also indicates if the signal is within the specified limits by displaying PASSED or FAILED. The emission mask is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

The 3GPP specification specifies four masks depending upon the base station output power:

- $P \geq 43$ dBm
- $39 \leq P < 43$ dBm
- $31 \leq P < 39$ dBm
- $P < 31$ dBm

## Spectral Emission Mask Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. Press the Spectral Emission Mask submenu key to activate the Spectral Emission Mask measurement (Figure 3-5).

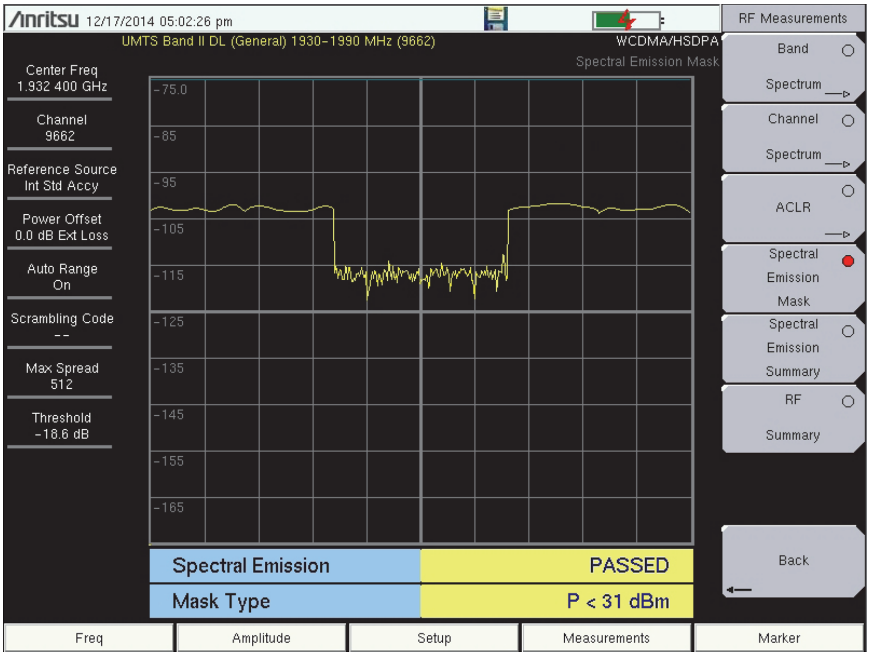



**Figure 3-5.** Spectral Emission Mask Measurement

5. Press the Spectral Emission Summary submenu key to display the Spectral Emission Summary table (Figure 3-6).

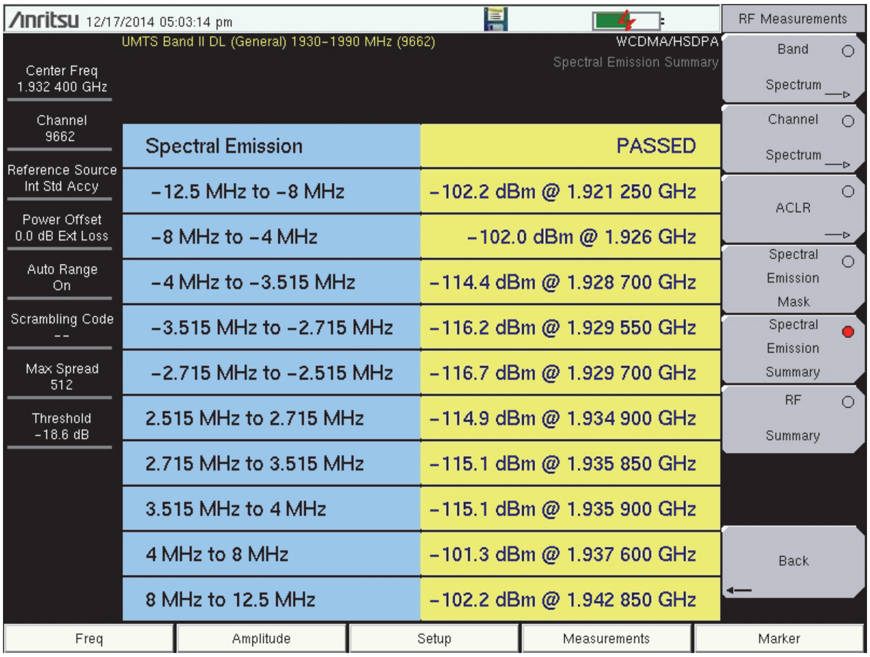



**Figure 3-6.** Spectral Emission Mask Summary

## RF Summary

The RF Summary displays the critical transmitter performance measurements in the table format, without demodulating the W-CDMA/HSPA+ signal. The parameters displayed in the RF summary table are Channel Power in dBm and Watts, Carrier Frequency, Frequency Error, Spectral emission Pass/Fail criteria, Occupied Bandwidth, Peak to Average Power, ACLR at –10 MHz, –5 MHz, 5 MHz and 10 MHz channels.

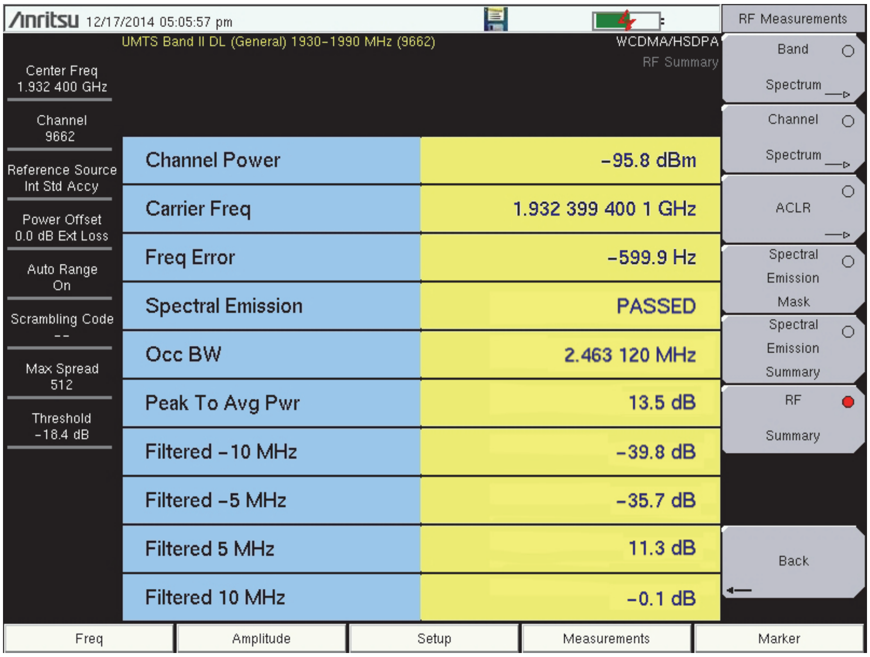



**Figure 3-7.** RF Summary

# 3-5 Demodulator

In the demodulator mode, the RF In is connected to the node B equipment and the unit will demodulate the W-CDMA signal. The W-CDMA/HSPA+ demodulator has Code Domain Power (CDP), HSPDA, Codogram and Modulation Summary screens.

| | |
|---|---|
| **Note** | The W-CDMA/HSPA+ Demodulator option demodulates both W-CDMA and HSPA+ signals. The W-CDMA Demodulator only demodulates W-CDMA signals. |

## Zoom Function

In CDP and Codogram measurements, the Zoom function can be activated to zoom in on selected OVSF codes. The Zoom function can be set to start from a particular OVSF code.

| | |
|---|---|
| **Note** | Press CDP or Codogram twice to activate the zoom function. The arrow in the lower right corner of the submenu key indicates a sub menu is available. |

## Code Domain Power (CDP) Setup

The Code Domain Power (CDP) display includes spreading factor (OVSF codes) 256 or 512 with zoom in on codes. The instrument can zoom to 32, 64 and 128 codes and the user can input the zoom code to start the zoom in from the entered OVSF codes. The demodulator also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH power in the table format. For W-CDMA/HSPA+ Demodulator, the HSPA+ codes are also displayed.

## Code Domain Power (CDP) Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
5. Connect the external reference to the RF In BNC connector and wait for the unit to recognize the external reference and lock up to it. Refer to the User Guide for additional information.
6. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
7. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
8. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
9. Press the Threshold submenu key to manually set the Threshold level which determines which codes are active. The default value is –30 dB.
10. Press the **Measurements** main menu key.
11. Press the **Demodulator** submenu key to activate the demodulator menu.
12. Press the CDP submenu key to activate the CDP measurement.
13. Press the CDP submenu key again to activate the zoom function.
14. Press the Zoom submenu key to select the appropriate zoom level. The Zoom key toggles between 32, 64, and 128.
15. Press the Zoom Start submenu key to manually enter the zoom start code.
16. Press the Back submenu key to go back to the CDP measurement.

| | |
|---|---|
| **Note** | The blue color block on the CDP screen represents the selected zoom codes and the same codes are displayed in the zoom screen. |

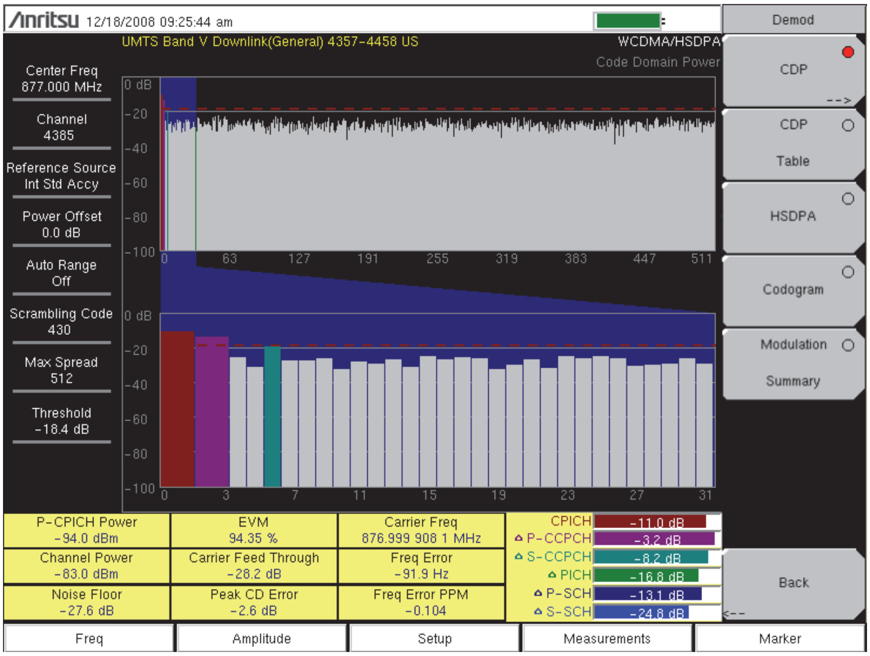



**Figure 3-8.** CDP Measurement Summary

### Activating Markers

1. Press the **Marker** main menu key to display the Marker menu.
2. Press the Marker submenu key to select the appropriate marker (1 through 6). The underlined marker number is the currently selected marker.
3. Press the On/Off submenu key to activate the selected marker.
4. Press the Marker Table submenu key to display the Marker table. The marker table is displayed on the screen below the CDP measurements table.

| | |
|---|---|
| **Note** | Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the W-CDMA/HSPA+ measurements. |

## HSPA+ Setup

HSPA+ displays the spreading factor (OVSF codes) 256 or 512 codes and high speed downlink physical shared channel codes HS-PDSCH. The right or left active codes can be selected using the cursor. The selected code power versus time and constellation are displayed. The demodulator also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH power in the table format.

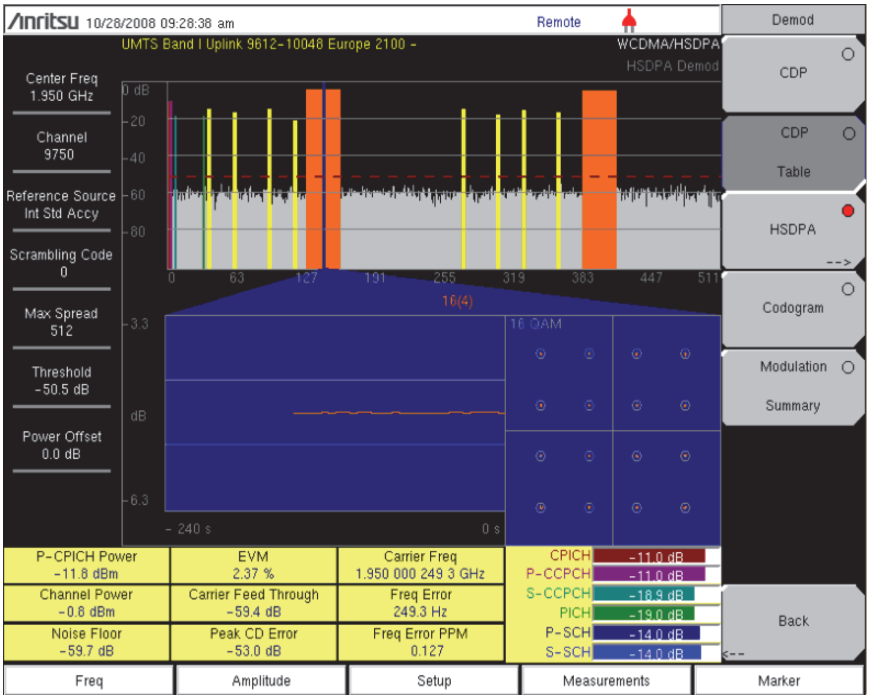



**Figure 3-9.** HSPA+ Measurement Summary

| | |
|---|---|
| **Note** | This screen is available with the W-CDMA/HSPA+ demod option only. |

## HSPA+ Procedure

1. Press the Demodulator submenu key to list the Demod menu.
2. Press the HSPA+ submenu key to activate the HSPA+ measurement. The red dot on the submenu key indicates HSPA+ is selected.
3. Press the HSPA+ submenu key again to display the HSPA+ measurement signal parameters.
4. Press the Total Time submenu key to set the time or the Single Sweep Time submenu key to set the time for the power versus time display. The maximum time is 72 hours.
5. Use the cursor to select the desired code. The code parameters are displayed on the screen.

6. Press the IQ Persistence submenu key and use the keypad or rotary knob to set the IQ Persistence to 2. The instrument will display the constellation diagram after the first sample, and then update the constellation diagram after the second sample. IQ Persistence can be set as high as 48. When the maximum is reached, the first sample is replaced.

| | |
|---|---|
| **Note** | The W-CDMA modulation type is QPSK, and the HSPA+ modulation is 16QAM or QPSK. |

Activating Markers

1. Press the **Marker** main menu key to display the Marker menu.
2. Press the Marker submenu key to select the appropriate marker (1 through 6). The underlined marker number is the currently selected marker.
3. Press the On/Off submenu key to activate the selected marker.
4. Press the Marker Table submenu key to display the Marker table. The marker table is displayed on the screen below the measurements table.

| | |
|---|---|
| **Note** | Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the W-CDMA/HSPA+ measurements. |

## Codogram Setup

Codogram displays the code power levels over time. Two graphs are displayed on the screen, the top one displays all the selected OVSF codes and the bottom one displays the selected OVSF zoom codes.

## Codogram Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
5. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
6. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
7. Press the Threshold submenu key to manually set the Threshold level which determines which codes are active. The default value is –30dB.
8. Press the **Measurements** main menu key.
9. Press the Demodulator submenu key to list the Demod menu.

10. Press the Codogram submenu key to activate the Codogram measurement.
11. Press the Codogram submenu key again to list the Codogram menu and set the zoom and test time parameters for the measurement.
12. Press the Zoom submenu key to select the appropriate zoom level. The Zoom key toggles between 32, 64, and 128.
13. Press the Zoom Start submenu key to manually enter the zoom start code.
14. Press the Total Time or Single Sweep Time submenu key to set the required time.
15. Press the Back submenu key to go back to the Codogram measurement.

| **Note** | The blue color block on the Codogram screen represents the selected zoom codes and the same codes are displayed in the zoom screen. Save the data before making any measurements, otherwise the data will be lost. |
|---|---|

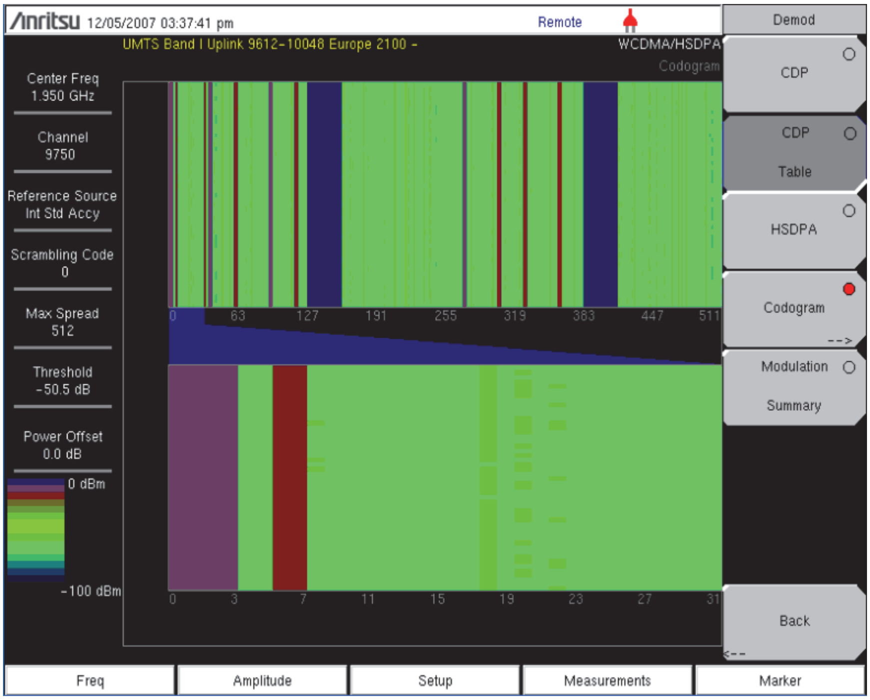



**Figure 3-10.** Codogram Measurement

# 3-6 Over-the-Air Measurements

## OTA Setup

In Over-the-Air (OTA) mode, the instrument is not connected to the node B equipment. The OTA screen displays the six strongest scrambling codes as bar graphs. Displayed underneath the bar graphs are the related scrambling code number, CPICH, Ec/Io, Ec, and pilot dominance in the table format.

In Over-the-Air measurement, the Scrambling Code can be set to Auto to automatically measure and display the six strongest scrambling codes, or Manual, to look for the set scrambling codes.

The OTA measurement screen can be locked by pressing the Code Lock On/Off submenu key. The Display Unit submenu key can be used to display the OTA bar graph by selecting CPICH or Ec/Io. The default display is CPICH. The Sort By submenu key can display the scrambling codes sorted by Power or Code.

| | |
|---|---|
| **Note** | Press Reset to activate the OTA measurement in a different location for accurate results. |

## OTA Procedure

1. Connect the appropriate antenna to the RF In connector to make OTA measurements.
2. Set the measurement frequency using one of the methods listed in the User Guide
3. Press the **Measurements** main menu key.
4. Press the OTA submenu key to display the Over-The-Air submenu.
5. Press the Scrambling Code submenu key and select Auto to automatically detect the six scrambling codes (Figure 3-11).
6. To only look for specific scrambling codes, press the Scrambling Code submenu key to highlight Manual, then use the Manual Code submenu key to select the specific code and the On/Off submenu key to turn the selected code on or off. The Code Lock submenu key locks the code, so that the code will not change with each update.

Refer to “Over-The-Air Menu” on page 3-38 for a description of OTA measurement submenus.

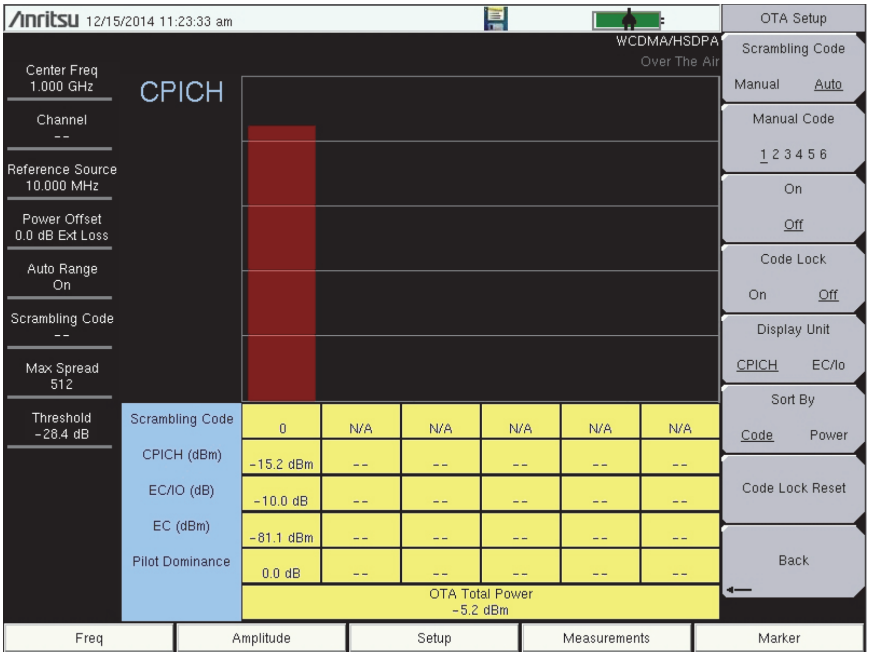



**Figure 3-11.** OTA Measurement Summary

## W-CDMA Summary Setup

W-CDMA summary (Figure 3-12) displays the critical W-CDMA measurements from RF and demodulation measurements.

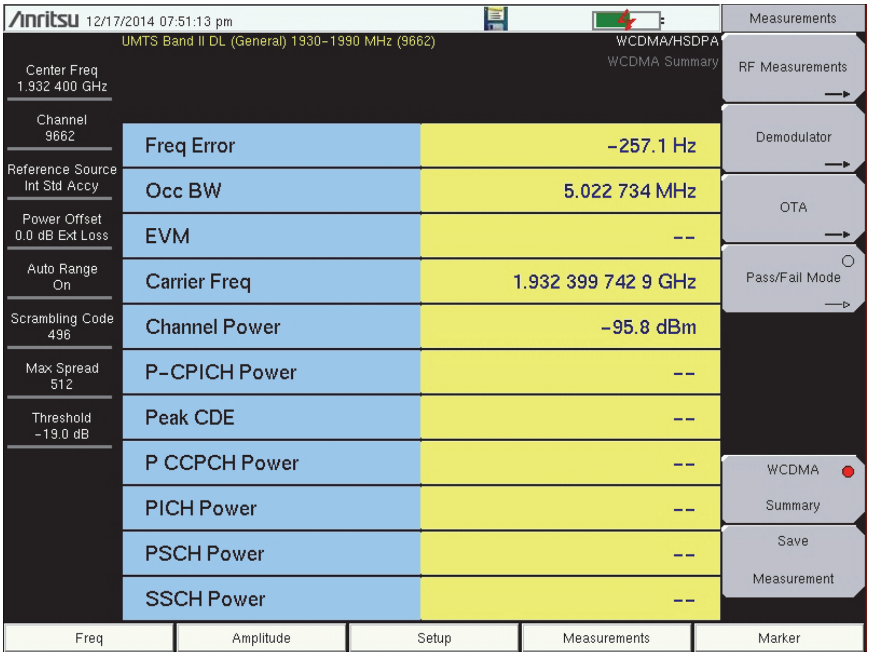



**Figure 3-12.** W-CDMA Measurement Summary

## W-CDMA Summary Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
5. Connect the external reference to the RF In BNC connector and wait for the unit to recognize the external reference and lock to it.
6. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
7. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
8. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
9. Press the **Threshold** submenu key to manually set the Threshold level to determine which codes are active. The default value is –30dB.

10. Press the **Measurements** main menu key.
11. Press the W-CDMA Summary submenu key.

# 3-7 Pass/Fail Mode Setup

The instrument stores the five test models specified in the 3GPP specification (TS 125.141) for testing base station performance and recalls these models for quick easy measurements. After selection of a test model, the instrument displays test results in tabular format with clear PASS or FAIL indications that include min/max threshold.

Using Master Software Tools, a custom test list can be created and downloaded into the instrument. All critical parameters can be selected for pass/fail testing, including each individual code power level, the spreading factor and symbol EVM.

## Pass/Fail Mode Procedure

1. Connect the appropriate antenna to the RF In connector to make OTA measurements.
2. Press the **Measurements** main menu key.
3. Press the Pass/Fail Mode submenu key to display the pass/fail mode menu.
4. Press the Select Pass/Fail Test submenu key and select the applicable Test Model to activate the measurement (Figure 3-13).

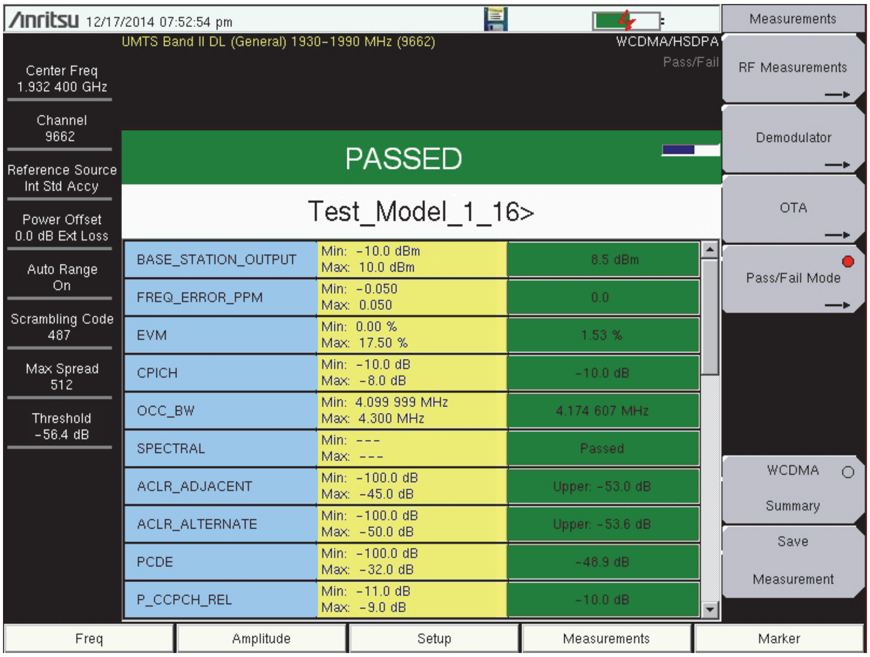



**Figure 3-13.** Pass/Fail Mode

# 3-8 W-CDMA/HSPA+ Menus

Figure 3-14 show the map of the W-CDMA/HSPA+ menus. The following sections describe W-CDMA/HSPA+ main menus and associated submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.

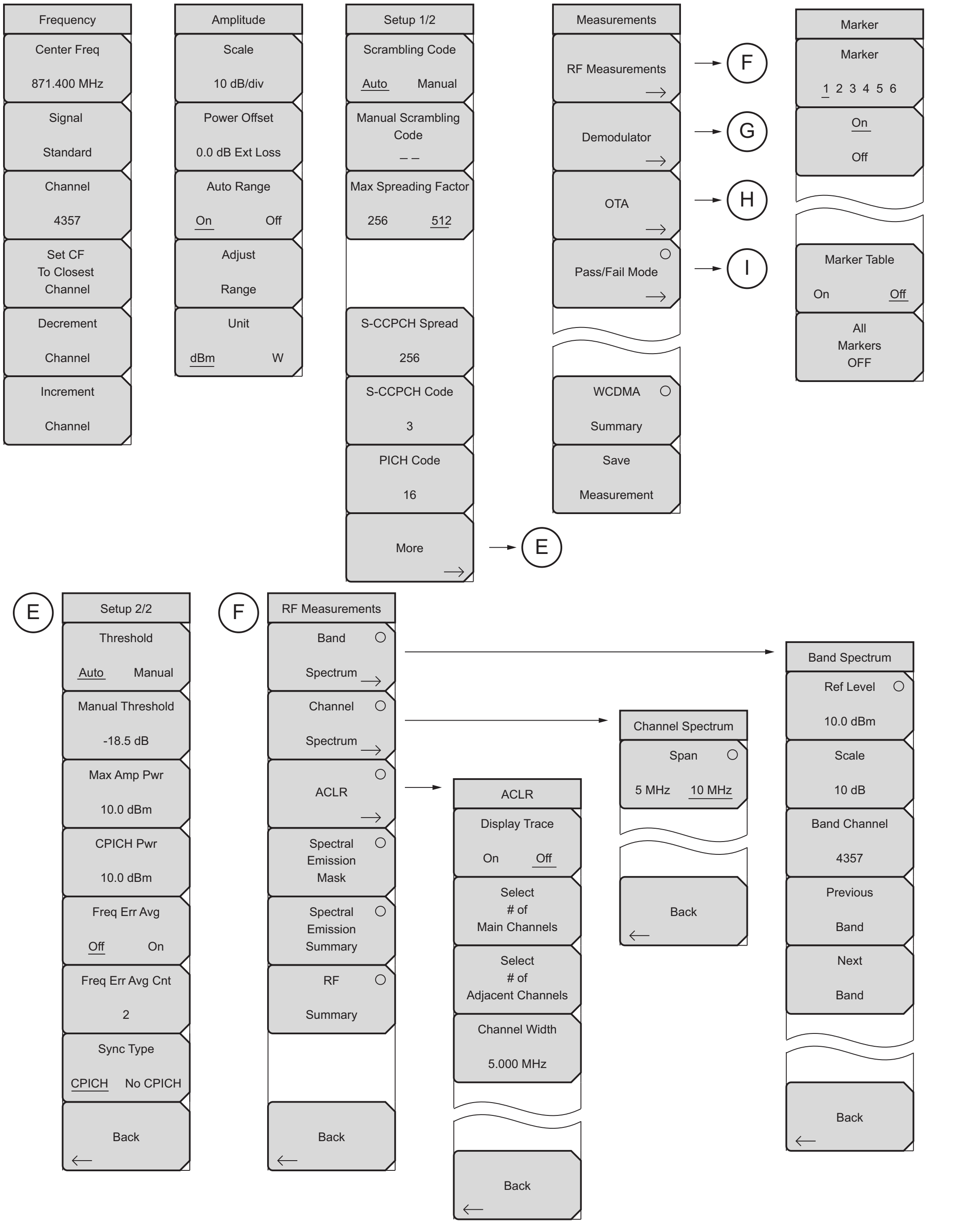



**Figure 3-14.** W-CDMA/HSPA+ Menu Layout (1 of 2)

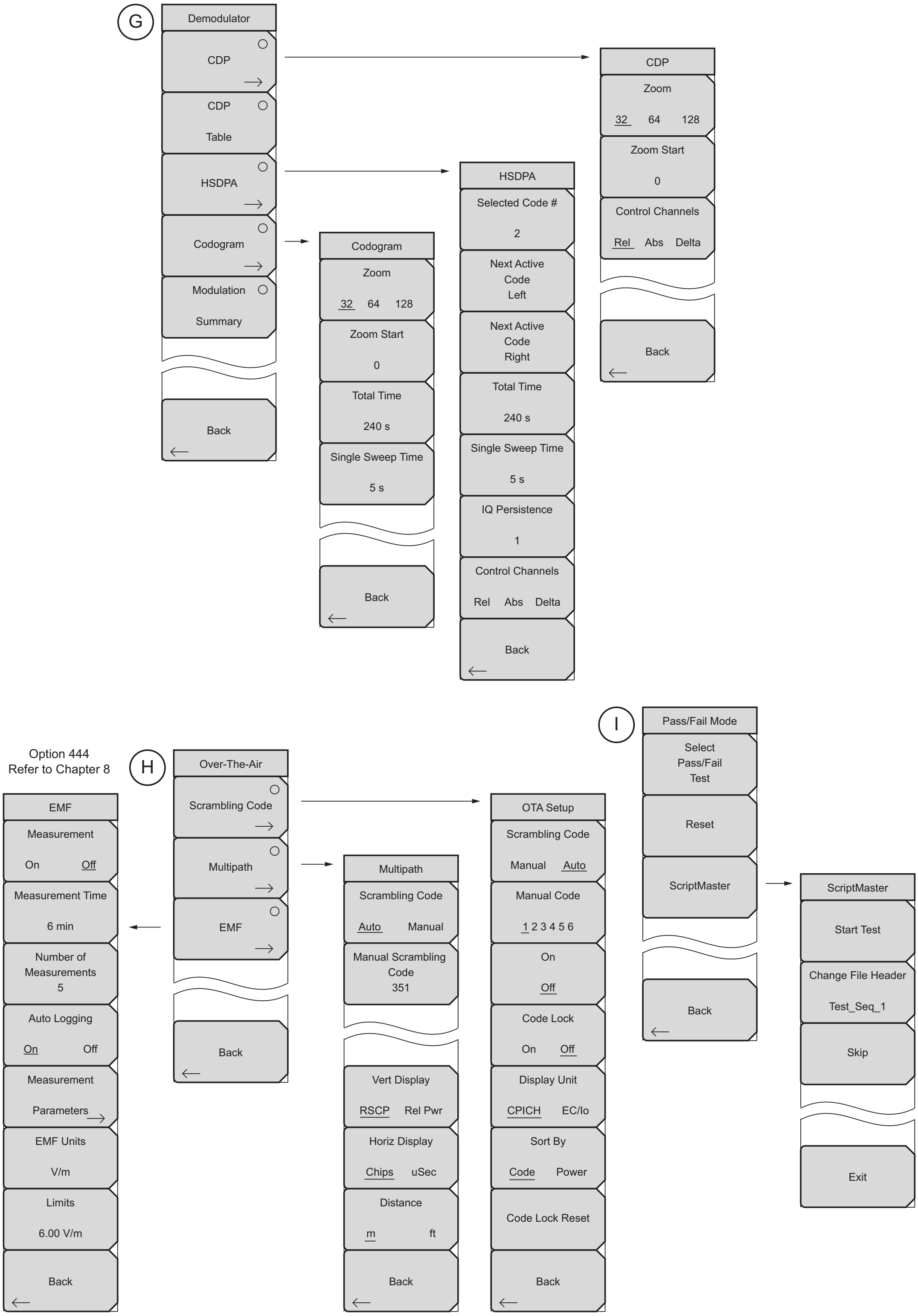
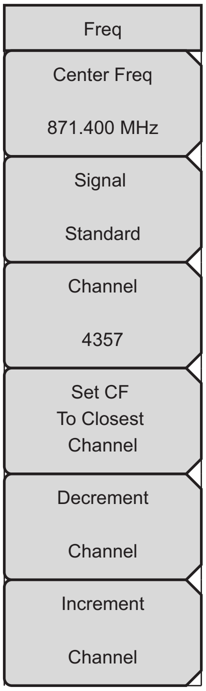



**Figure 3-15.** W-CDMA/HSPA+ Menu Layout (2 of 2)

# 3-9 Freq (Frequency) Menu

Key Sequence: **Freq**




**Center Freq:** Press the **Freq** key followed by the Center Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the Enter key has the same effect as pressing the MHz submenu key.

**Signal Standard:** Use the **Up/Down** arrow keys or the rotary knob to highlight a signal standard and press Enter to select. When a signal standard is selected, the center frequency and span for the first channel of the selected standard is automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered. Appendix A contains a table of the signal standards that are in the instrument firmware.

**Channel:** Use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard. The center of the channel is automatically tuned to the center frequency of the selected W-CDMA channel.

**Set CF To Closest Channel:** Changes the center frequency to the closest channel.

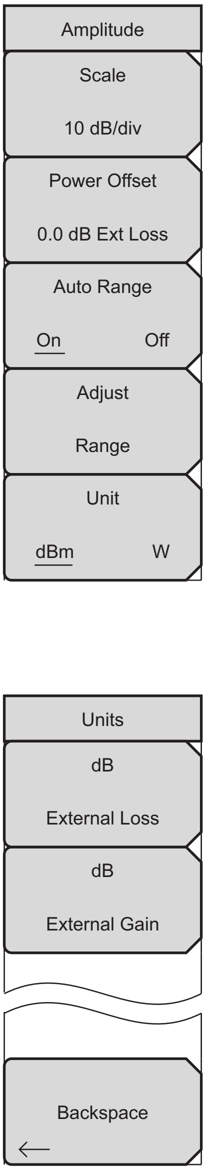
**Decrement Channel:** Decreases the channel number by one.

**Increment Channel:** Increases the channel number by one.

**Figure 3-16.** W-CDMA/HSPA+ Freq Menu

# 3-10 Amplitude Menu

Key Sequence: **Amplitude**




**Scale:** The scale can be set in 1 dB steps from 1 dB per division to 15 dB per division. The value can be changed using the numeric keypad, rotary knob, or the arrow keys. When using the keypad, the submenu changes to Units, in which case, press the dB/div key to accept the entered scale value.

**Power Offset:** Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

**Auto Range:** Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

**Adjust Range:** Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

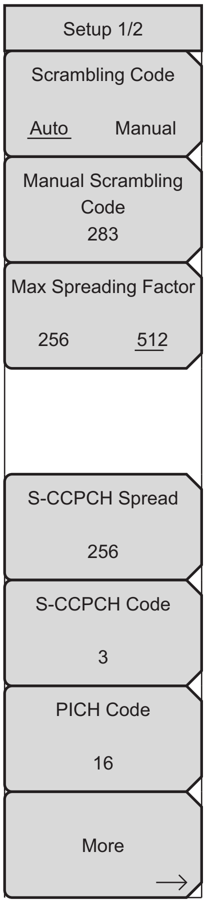
**Unit:** Changes the unit of measure for the Y-axis between dBm and W.

**Figure 3-17.** W-CDMA/HSPA+ Amplitude Menu

# 3-11 Setup Menu

## Setup 1/2 Menu

Key Sequence: **Setup**




**Scrambling Code:** Press the **Scrambling Code** submenu key to toggle between Auto and Manual Scrambling Code.

**Manual Scrambling Code:** Press the **Manual Scrambling Code** submenu key to manually enter the scrambling code using the arrow keys, rotary knob, or numeric keypad.

**Max Spreading Factor:** Press the **Max Spreading Factor** submenu key to toggle between 256 codes and 512 codes.

**S-CCPCH Spread:** Press the **S-CCPCH Spread** submenu key to enable the S-CCPCH spreading factor and enter the desired code. The default value is 256.

**S-CCPCH Code:** Press the **S-CCPCH Code** submenu key to enable and enter the S-CCPCH code. The default value is 3.

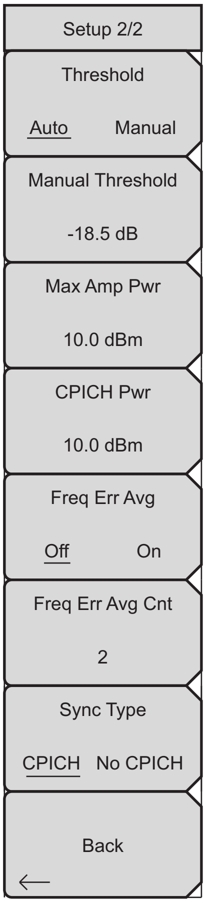
**PICH Code:** Press the **PICH Code** submenu key to activate Paging Indicator Channel and enter the desired code. The default value is 16.

**More:** Lists the “Setup 2/2 Menu” on page 3-29 to continue measurement setup.

**Figure 3-18.** W-CDMA/HSPA+ Setup Menu (1/2)

## Setup 2/2 Menu

Key Sequence: **Setup** > More




**Threshold:** Sets the measurement threshold to be set either automatically by the instrument or manually by the user.

**Manual Threshold:** Change the measurement threshold manually by entering a desired value and pressing **Enter**.

**Max Amp Pwr:** Sets the maximum transmit power of the base station.

**CPICH Pwr:** Sets the power of the CPICH.

**Freq Err Avg:** Turns on averaging for the frequency error measurement.

**Freq Err Avg Cnt:** Sets the number of measurements to use in the frequency error averaging calculations. The number can be set from 2 to 15.

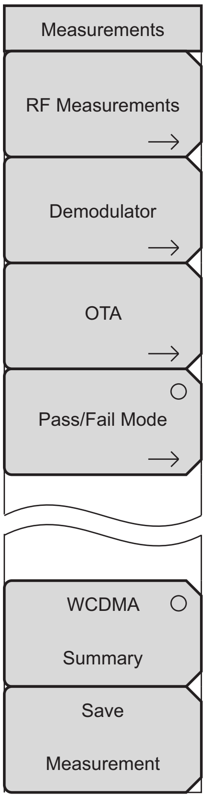
**Sync Type:** Selects between CPICH or No CPICH for synchronization.

**Back:** Returns to the “Setup 1/2 Menu” on page 3-28.

**Figure 3-19.** W-CDMA/HSPA+ Setup Menu (2/2)

# 3-12 Measurements Menu

Key Sequence: **Measurements**




**RF Measurement:** Opens the “RF Measurement Menu” on page 3-31.

**Demodulator:** Opens the “Demodulator Menu” on page 3-34. In this mode, the received W-CDMA signal is demodulated. The demodulator has five displays, CDP, CDP Table, HSPA+, Codogram and Modulation Summary.

**OTA:** Opens the “Over-The-Air Menu” on page 3-38. Press it once to display the W-CDMA/HSPA+ Over-the-Air Measurements and list the Over-the-Air menu.

**Pass/Fail Mode:** Opens the “Pass/Fail Mode Menu” on page 3-41. The instrument saves the five test model conditions specified in the 3GPP specification to test the base station. After the selected test model, the unit displays whether the base station passed or failed the test. Using Master Software Tools, a custom test list can be created and downloaded into the unit. All critical measurements can be selected for pass fail testing including each individual code power, spreading factor and symbol EVM. The results are displayed in table format with clear identification of pass/fail results including min/max thresholds and measured results.

**W-CDMA Summary:** Displays the critical W-CDMA measurements in a table format.

**Save Measurement:** Opens a dialog window to name and save the current measurement. Refer to the User Guide for additional information on saving a measurement.

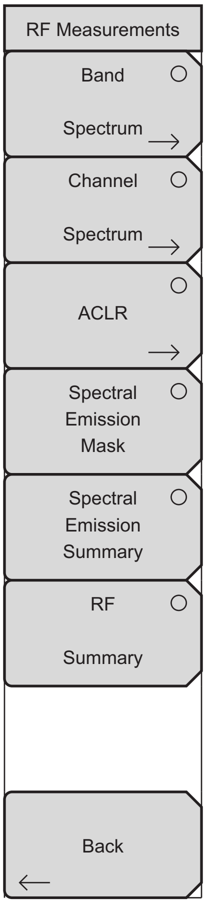
W-CDMA/HSPA+ measurements are saved with a WCD extension.
GSM/EDGE measurements are saved with an EDG extension.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Trace-1, Trace-2, and so forth) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob, or press the submenu key for each letter.

**Figure 3-20.** W-CDMA/HSPA+ Measurements Menu

## RF Measurement Menu

Key Sequence: **Measurements** > RF Measurements




**Band Spectrum:** Opens the “Band Spectrum Menu” on page 3-32.

**Channel Spectrum:** Opens the “Channel Spectrum Menu” on page 3-32. Press once to select the Channel Spectrum display. The screen also displays Channel Power in dBm and watts, Peak to Average power and Occupied Bandwidth. Press it again to open the Channel Spectrum menu.

**ACLR:** Opens the “ACLR Menu” on page 3-33. Press once to select the Adjacent Channel Leakage Ratio (ACLR) display. The user can set the main channels and adjacent channels from 1 channel to 4 channels. This screen can display up to 12 channels total.

**Spectral Emission Mask:** Displays the received signal and the mask based on received signal strength.

**Spectral Emission Summary:** Displays the spectral emission mask in table format and whether the received signal passed in each frequency range.

**RF Summary:** Displays the RF measurements in table form.

**Back:** Returns to the “Measurements Menu” on page 3-30.

**Figure 3-21.** W-CDMA/HSPA+ RF Measurement Menu

## Band Spectrum Menu

Key Sequence: **Measurements** > RF Measurements > Band Spectrum


**Ref Level:** Sets the required reference level.

**Scale:** Changes the scale.

**Band Channel:** Use the cursor to select the required channel to analyze the selected channel signal.

**Previous Band:** Selects the previous band.

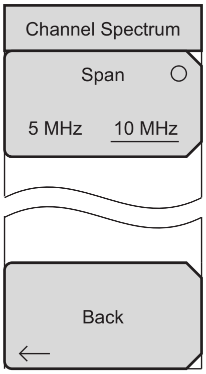
**Next Band:** Selects the next band.

**Back:** Returns to the "RF Measurement Menu" on page 3-31.

**Figure 3-22.** W-CDMA/HSPA+ Band Spectrum Menu

## Channel Spectrum Menu

Key Sequence: **Measurements** > RF Measurements > Channel Spectrum



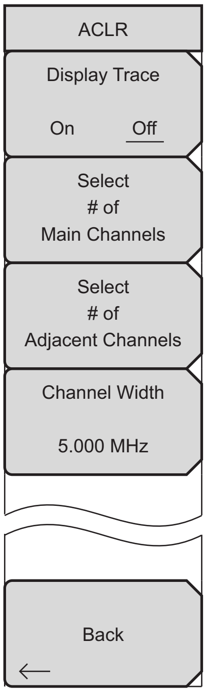

**Span:** Select either a 5 MHz or 10 MHz span.

**Back:** Returns to the "RF Measurement Menu" on page 3-31.

**Figure 3-23.** W-CDMA/HSPA+ Channel Spectrum Menu

## ACLR Menu

Key Sequence: **Measurements** > RF Measurements > ACLR




**Display Trace:** Select On to display the trace.

**Select # of Main Channels:** Set the main channels from 1 channel to 4 channels.

**Select # of Adjacent Channels:** Set the adjacent channels from 1 channel to 4 channels.

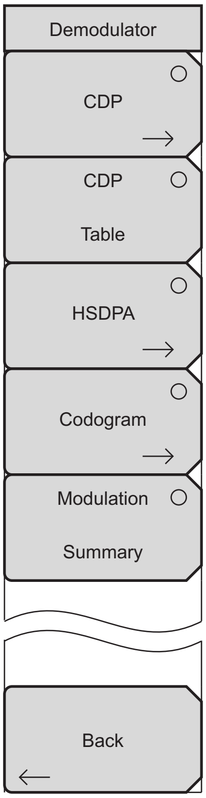
**Channel Width:** Set the bandwidth for the channels for the number of adjacent channels selected.

**Back:** Returns to the "RF Measurement Menu" on page 3-31.

**Figure 3-24.** W-CDMA/HSPA+ ACLR Menu

## Demodulator Menu

Key Sequence: **Measurements** > Demodulator




**CDP:** Open the "CDP Menu" on page 3-35. When Code Domain Power (CDP) is selected the screen displays all the selected OVSF codes and selected OVSF zoom codes in the graphical format. The display also displays P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error. The screen also displays control channel view with CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in the table format. If the marker is set on the code, the marker will display the code number, power and Symbol EVM.

Note: For the W-CDMA/HSPA+ demodulator option, the CDP screen displays HSPA+ and W-CDMA signals. P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error are also displayed. The screen displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in the table format. If the marker is set on the code, the marker will display the code number, power and Symbol EVM.

**CDP Table:** Displays the following Code Domain Power (CDP) parameters in table format: Code, Status, EVM, Mod Type, Power (dB), and Power (dBm).

**HSPA+:** Open the "HSDPA Menu" on page 3-36. When HSPA+ is selected, the screen displays all the selected OVSF including high speed data channel codes and selected OVSF with high speed codes in the graphical format. The selected code Power versus time and Constellation diagram will be displayed. The screen also displays control channel view with P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error. The screen also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in table format.

Note: This screen is available with the W-CDMA/HSPA+ demod option only.

**Codogram:** Open the "Codogram Menu" on page 3-37. When Codogram is selected the screen displays the changes in code power levels over time. Two graphs are displayed on the screen, the top one displays all the selected OVSF codes and the bottom one displays the selected OVSF zoom codes.

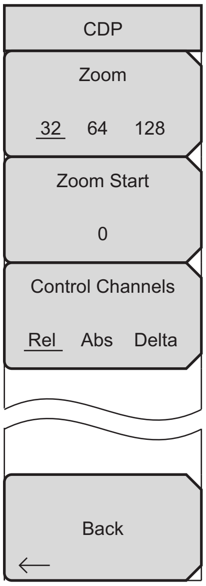
**Modulation Summary:** Displays the demodulation parameters in the table format.

**Back:** Returns to the "Measurements Menu" on page 3-30.

**Figure 3-25.** W-CDMA/HSPA+ Demodulator Menu

## CDP Menu

Key Sequence: **Measurements** > Demodulator > CDP




**Zoom:** Select a zoom function of 32, 64, or 128 codes.

**Zoom Start:** Enter the required zoom start code. For example, to start at code 2, enter 2.

**Control Channels:** Select a control channel mode between Rel, Abs, and Delta.

**Back:** Returns to the “Demodulator Menu” on page 3-34.

**Figure 3-26.** W-CDMA/HSPA+ CDP Menu

## HSDPA Menu

Key Sequence: **Measurements** > Demodulator > HSDPA


**Selected Code:** Press this submenu key to select the active code, using the arrow keys, rotary knob, or numeric keypad. The range is 0 to 255 or 0 to 511 depending on the Max Spreading Factor set under the Setup main menu. Refer to "Setup 1/2 Menu" on page 3-28.

**Next Active Code Left:** Select the next active code to the left of the selected code.

**Next Active Code Right:** Select the next active code to the right of the selected code.

**Total Time:** Set the time for the power versus time screen. The maximum total time is 72 hours.

**Single Sweep Time:** Set the single sweep time. The instrument automatically calculates the total time.

**IQ Persistence:** Set the number of samples before displaying the screen (maximum 48).

**Control Channels:** Select a control channel mode between Rel, Abs, and Delta.

**Back:** Returns to the "Demodulator Menu" on page 3-34.

**Figure 3-27.** HSPA+ Menu

## Codogram Menu

Key Sequence: **Measurements** > Demodulator > Codogram


**Zoom:** Select a zoom function of 32, 64, or 128 codes.

**Zoom Start:** Enter the required zoom start code. For example, to start at code 2, enter 2.

**Total Time:** Use the keypad, arrow keys, or the rotary knob to enter the total time to display the changes in code power levels. The maximum total time for Codogram is 72 hours.

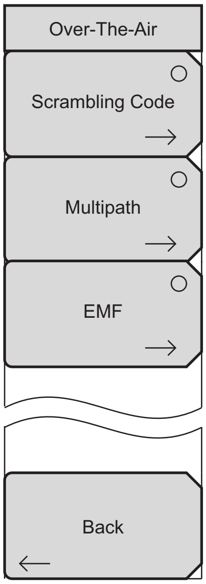
**Single Sweep Time:** Single sweep time is related to total time. Use the keypad, arrow keys, or the rotary knob to set the single sweep time.

**Back:** Returns to the "Demodulator Menu" on page 3-34.

**Figure 3-28.** W-CDMA/HSPA+ Codogram Menu

## Over-The-Air Menu

Key Sequence: **Measurements** > OTA




**Scrambling Code:** Opens the "OTA Setup Menu" on page 3-39.

**Multipath:** Opens the "Multipath Menu" on page 3-40.

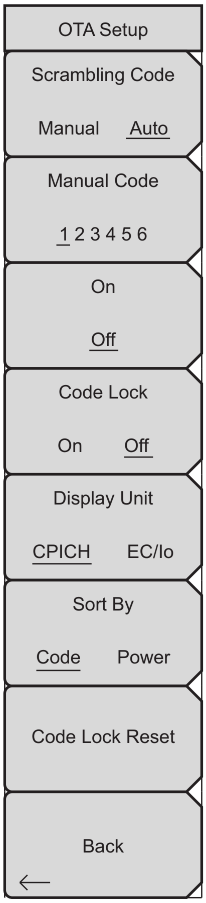
**EMF** (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this key opens the "W-CDMA EMF Menu" on page 8-10.

**Back:** Returns to the "Measurements Menu" on page 3-30.

**Figure 3-29.** W-CDMA/HSPA+ Over-The-Air Menu

## OTA Setup Menu

Key Sequence: **Measurements** > OTA > Scrambling Code




**Scrambling Code:** Set the scrambling codes to manual or auto.

**Manual Code:** Select the scrambling code manually.

**On/Off:** Switch On/Off the manually selected scrambling code.

**Code Lock:** Lock the measured codes.

**Display Unit:** Display the codes by CPICH or Ec/Io.

**Sort By:** Sort the measured codes by code numbers or power.

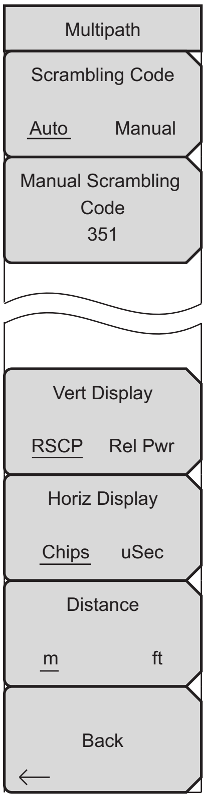
**Code Lock Reset:** Reset the measurement screen.

**Back:** Returns to the "Over-The-Air Menu" on page 3-38.

**Figure 3-30.** W-CDMA/HSPA+ Over-The-Air (OTA) Setup Menu

## Multipath Menu

Key Sequence: **Measurements** > OTA > Multipath




**Scrambling Code:** Set the scrambling codes to manual or auto.

**Manual Scrambling Code:** Sets the manual scrambling code.

**Vert Display:** Switch vertical display between RSCP and Rel Pwr.

**Horiz Display:** Switch between Chips and uSec for the horizontal display.

**Distance:** Switch between meters and feet.

**Back:** Returns to the "Over-The-Air Menu" on page 3-38.

**Figure 3-31.** W-CDMA/HSPA+ Multipath Menu

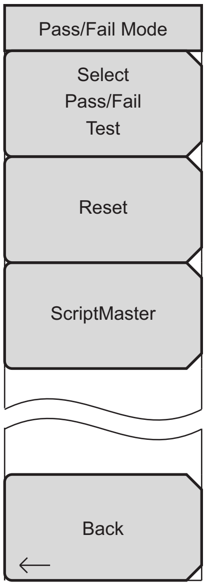
## EMF Menu

Key Sequence: **Measurements** > OTA > EMF

Refer to "W-CDMA EMF Menu" on page 8-10.

## Pass/Fail Mode Menu

Key Sequence: **Measurements** > Pass/Fail Mode




**Select Pass/Fail Test:** Select the parameters file from the list.

**Reset:** Restart the measurement.

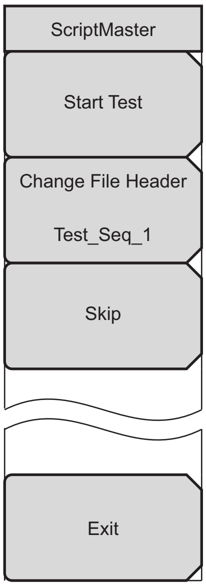
**ScriptMaster:** Opens the “ScriptMaster Menu” on page 3-41.

**Back:** Returns to the “Measurements Menu” on page 3-30.

**Figure 3-32.** W-CDMA/HSPA+ Pass/Fail Mode Menu

## ScriptMaster Menu

Key Sequence: **Measurements** > Pass/Fail Menu > ScriptMaster




Opens the Select File by Scrolling window and also lists Recall and Back submenu keys. Recall a Script file, created in Master Software Tools, from the window. The ScripMaster instructions are loaded into the instrument and the ScriptMaster menu is listed.

**Start Test:** Begins the running the instructions listed in ScriptMaster.

**Change File Header:** Opens the Pass Fail Test File Header entry window and lists the Text Entry menu to name the saved file after the ScriptMaster measurement process is complete.

**Skip:** Skips over a ScripMaster instruction.

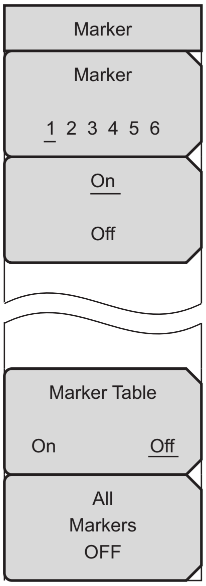
**Exit:** Ends the ScriptMaster measurement process. Returns the instrument to the previous measurement setup.

**Figure 3-33.** W-CDMA/HSPA+ ScriptMaster Menu

# 3-13 Marker Menu

Key Sequence: **Marker**

Press the **Marker** main menu key to open the Marker menu. The instrument is equipped with six markers. Any or all markers can be employed simultaneously.




**Marker:** Selects the active marker (1 to 6). The underlined marker number is the active marker. Each press of the submenu key moves the underline to the next marker number. Pressing **Shift** causes reverses the direction of marker selection. Press the **Shift** button again to change back to the original direction.

**On/Off:** Turns the selected marker underlined in the Marker submenu key On or Off.

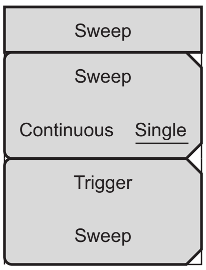
**Marker Table On/Off:** Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered for them.

**All Markers Off:** Turns off all markers.

**Figure 3-34.** W-CDMA/HSPA+ Marker Menu

# 3-14 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key




**Sweep Single/Continuous:** This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

**Trigger Sweep:** Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

**Figure 3-35.** W-CDMA/HSPA+ Sweep Menu

## 3-15 Measure Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

## 3-16 Trace Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

## 3-17 Limit Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

## 3-18 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the instrument User Guide.

# Chapter 4 — TD-SCDMA/HSPA+ Signal Analyzer

## 4-1 Introduction

The TD-SCDMA/HSPA+ Signal Analyzer offers three options:

- RF Measurements
- Demodulator
- Over-The-Air (OTA) Measurements

Three display types are provided for RF Measurements: Channel Spectrum display, Power versus Time display, or the RF Summary table.

Demodulator measurements can be viewed in either the CDP Data display or the Modulation Summary table.

The Over-the-Air Code Scan measurement displays the power of all 32 sync codes in sequential order. The Tau Scan measurement displays the codes based on Tau values.

## 4-2 General Measurement Setups

Refer to the instrument User Guide for information on how to select the TD-SCDMA/HSPA+ Signal Analyzer mode, set up frequency and amplitude, and perform file management.

## 4-3 TD-SCDMA/HSPA+ RF Measurements

The following parameters are measured in the RF Measurement mode.

**Channel Power**

Channel power measures the average time domain power within the 1.6 MHz channel bandwidth and is expressed in dBm.

**Channel Power (RRC)**

Channel Power (RRC) is similar to Channel Power but is measured after being filtered by using the Root Raised Cosine (RRC) filter. It is usually smaller than channel power.

**Slot x Pwr**

X denotes slots 0 through 6. This is the power in each of the 7 slots, excluding the gap.

**Occ BW**

Occupied bandwidth is the calculated bandwidth containing 99% of the total integrated power occupied in the span. Span is 5 MHz when Number of Carrier is set to 1. For all other values, span is set to 1.6 MHz.

**DwPTS Pwr**

The power in the Downlink Pilot slot, excluding the gap.

**UpPTS Pwr**

The power in the Uplink Pilot Slot, excluding the gap.

**DL-UL Delta Power**

The average difference between the active DL slots and the active UL slots, including pilot slots. UL and DL slots are selected according to the Uplink Switch Point setting. Without UL data slot and without UpPTS, the DL-UL Delta Power value is not applicable.

**On/Off Ratio**

The ratio of the power between the on and off portions of the Downlink slots.

**Slot PAR**

The peak to average power in the selected (or auto detected) slot. The highest 0.1% power of the slot is used as the peak.

**Left Channel Power**

The channel power of the 1.6 MHz channel left of the main channel. This is useful in the multi-carrier environments.

**Right Channel Power**

The channel power of the 1.6 MHz channel right of the main channel. This is useful in the multi-carrier environments.

**Left Channel Occ BW**

This is the occupied bandwidth of the channel left of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

**Right Channel Occ BW**

This is the occupied bandwidth of the channel right of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

## Measurement Setup

Refer to the User Guide for general instrument setup instructions, and continue with the following setups for the specific RF measurements.

## Channel Spectrum

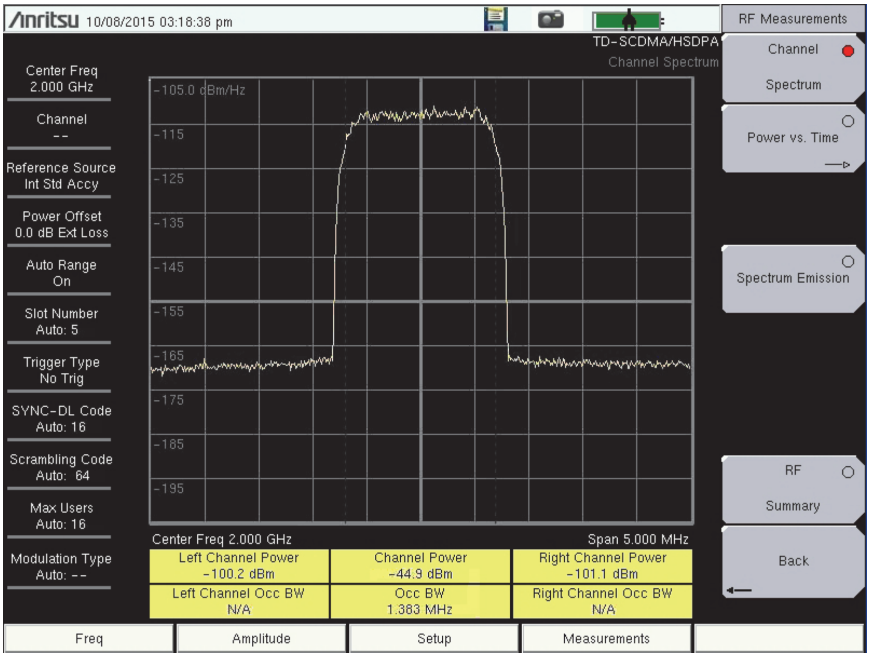



**Figure 4-1.** TD-SCDMA/HSPA+ Channel Spectrum

1. Press the **Setup** main menu key.
2. Press the More submenu key.
   a. Press the Number of Carriers submenu key so that the desired number is underlined.
   b. Press the Spreading Factor submenu key so that the desired Spreading Factor is underlined: Auto, 16, or 1.
   c. To set the Modulation Type, press the Modulation Type submenu key. The Modulation Type selection window opens. Select the desired setting: Auto, QPSK, 8PSK, 16QAM, or 64QAM.
   d. If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, select Off. If the presence of the DwPTS is unknown, select Auto.
   e. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum value is 5 sec.
   f. Press the Back submenu key to return to the Setup menu
3. Press the **Measurements** main menu key.
4. Press the RF Measurements submenu key.
5. Press the Channel Spectrum submenu key to activate this RF measurement view (see Figure 4-1).
6. Press the Back submenu key again to return to the Measurements menu.

## Power versus Time

The Power versus Time view shows the time domain view.

1. Press the **Setup** main menu key.
    a. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
    b. Press the Trigger submenu key. The Trigger menu opens.
    1. Press the Trigger Type submenu key to select No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
    2. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
    3. Press the Back submenu key to return to the Setup menu.
    c. Press the More submenu key to continue with setups under the Advanced Settings menu.
    d. Press the Number of Carriers submenu key so that the desired number is underlined.
    e. Press the Spreading Factor submenu key to so that the desired Spreading Factor is underlined: Auto, 16, or 1.
    f. To set the Modulation Type, press the Modulation Type submenu key. The Modulation Type selection window opens. Select the desired setting: Auto, QPSK, 8PSK, 16QAM, or 64QAM.
    g. If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, select Off. If the presence of the DwPTS is unknown, select Auto.
    h. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum value is 5 sec.
    i. Press the Back submenu key to return to the Setup menu.
    j. Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. Press the Power vs. Time submenu key to activate this RF measurement view. Press this key again to set up the Power vs. Time measurement.
    a. Press the View submenu key to toggle the measurement view to Sub-Frame (see Figure 4-2) or Slot (see Figure 4-3).
    b. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
    c. Press the Back submenu key to return to the RF Measurements menu.
    d. Press the Back submenu key again to return to the Measurements menu.

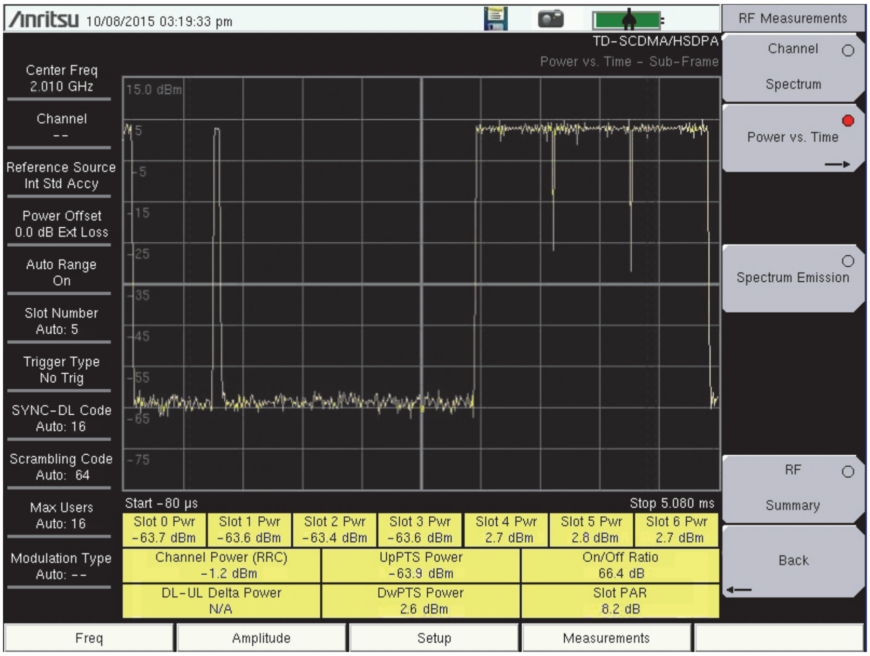



**Figure 4-2.** TD-SCDMA/HSPA+ Power vs. Time: Sub-Frame Measurement

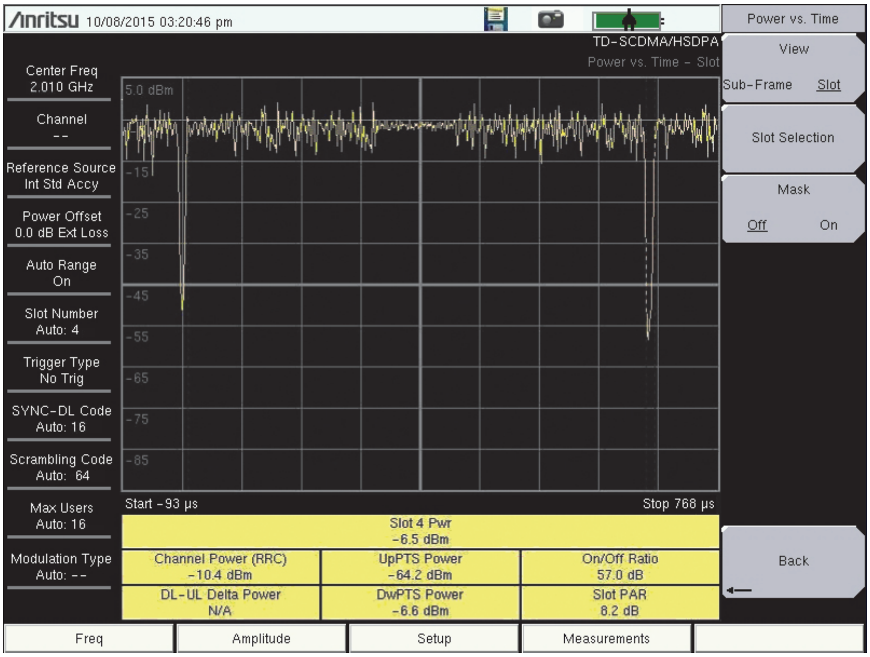



**Figure 4-3.** TD-SCDMA/HSPA+ Power vs. Time: Slot Measurement

## RF Summary

The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the TD-SCDMA/HSPA+ signal. The parameters that are displayed in the RF summary table are Channel Power (dBm), Channel Power (RRC) (dBm), Occupied Bandwidth (Hz), DwPTS Power (dBm), UpPTS Power (dBm), On/Off Ratio (dB), Slot PAR (dB), Left Channel Power (dBm), Right Channel Power (dBm), Left Channel Occupied Bandwidth, and Right Channel Occupied Bandwidth.

1. Press the **Setup** main menu key.
   a. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   b. Press the Trigger submenu key. The Trigger menu opens.
   1. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
   2. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
   3. Press the Back submenu key to return to the Setup menu.
   c. Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
   d. Press the More submenu key to continue with setups under the Advanced Settings menu.
   e. Press the Number of Carriers submenu key so that the desired number is underlined.
   f. Press the Back submenu key to return to the Setup menu.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. In the RF Measurements menu, press the RF Summary submenu key to view the primary RF measurements in a table.

# 4-4 TD-SCDMA/HSPA+ Demodulator


**Figure 4-4.** TD-SCDMA/HSPA+ Demodulator, CDP Data

The following parameters are measured in the Demodulator option.

### Slot Power

The power measured in the selected slot, excluding the gap. If Slot Selection is set to Auto, then the instrument searches for an active downlink slot and uses the detected slot number for measuring slot power.

### DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

### Noise Floor

Noise floor is the average of inactive codes powers (dB) from the code domain power (CDP).

### Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

### Tau

Tau is the timing delay of the frame starting point in reference to the occurrence of a trigger. When no trigger is used, Tau values are relative to the most dominant SYNC-DL code.

**Scrambling Codes**

The display format is Scrambling Code # (relative power in dB). A measure of the relative powers of the four scrambling codes (relative to Slot Power) that correspond to the detected SYNC-DL code. Only those scrambling codes with high relative power are displayed. Typically, only one scrambling code is displayed unless significant interference occurs from neighboring codes.

**EVM**

The Error Vector Magnitude (EVM) is the ratio (in percent) of the difference between the reference waveform and the measured waveform. EVM metrics are used to measure the modulation quality of a transmitter. The EVM value displayed by the instrument is the root mean square EVM of the measured downlink slot data.

**Peak EVM**

The peak of the measured EVM.

**Peak CDE**

The peak of the Code Domain Error (CDE) is the remnant power in the code domain after the useful signal is extracted.

## Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode and continue with the following setups for the specific Demodulator measurements.

1. Press the **Setup** main menu key.
   - **a.** Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   - **b.** Press the Trigger submenu key. The Trigger menu opens.
     1. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
     2. Press the Ext Trigger Polarity submenu key to toggle either Rising or Falling trigger edge.
     3. Press the Back submenu key to return to the Setup menu.
   - **c.** Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
   - **d.** Press the SYNC-DL Code submenu key. The SYNC-DL Code menu and selection window open. Use the rotary knob or press the touch screen to highlight Auto or the desired code (0 to 31), then press **Enter**.
   - **e.** Press the Scrambling Midamble Code submenu key to open the Scrambling Code selection window and menu. Use the rotary knob or press the touch screen to highlight Auto or the desired code (0 to 127), then press the **Enter** key.
   - **f.** Press the Max Users submenu key to open the Maximum Users selection window and menu. Use the rotary knob or press the touch screen to highlight Auto or the desired value (2 to 16), then press **Enter**.

g. Press the Meas Speed submenu key to toggle through the measuring speeds: Fast, Norm, and Slow.

h. Press More to continue with setups in the Advanced Settings menu. Refer to "Advanced Settings Menu" on page 4-20 for a description of available parameters.

i. Press the Back submenu key to return to the Setup menu.

### CDP Data

1. Press the **Measurements** main menu key.
2. Press the Demodulator submenu key.
3. Press the CDP Data submenu key once to select the CDP Data measurement and press again to open the CDP Data menu.
4. In the CDP Data menu, press the CDP Units submenu key to toggle Relative or Absolute.
5. Press the Back submenu key to return to Demodulator menu.
6. Press the Back submenu key again to return to the Measurements menu.

### Modulation Summary

The Modulation Summary displays the critical Modulation transmitter performance measurements in a table format by demodulating the TD-SCDMA/HSPA+ signal that is displayed in the Modulation Summary table: Slot Power, EVM, Peak EVM, Freq Error, Freq Error PPM, Tau, Noise Floor, Carrier Feed Through, and Peak CDE.

1. Press the **Measurements** main menu key.
2. Press the Demodulator submenu key.
3. Press the Modulation Summary submenu key to display the modulation summary table.
4. Press the Back submenu key to return to the Measurements menu.

## CDP and CDE

Code Domain Power (CDP) and Code Domain Error (CDE) are displayed with color coding as described in Table 4-1:

**Table 4-1.** Color Legend for CDP and CDE

| Display Color | Code Type |
|---|---|
| Orange | Active Codes |
| Gray | Idle Codes |
| Light Blue | Code Domain Errors |

# 4-5 TD-SCDMA/HSPA+ Over-the-Air Measurements

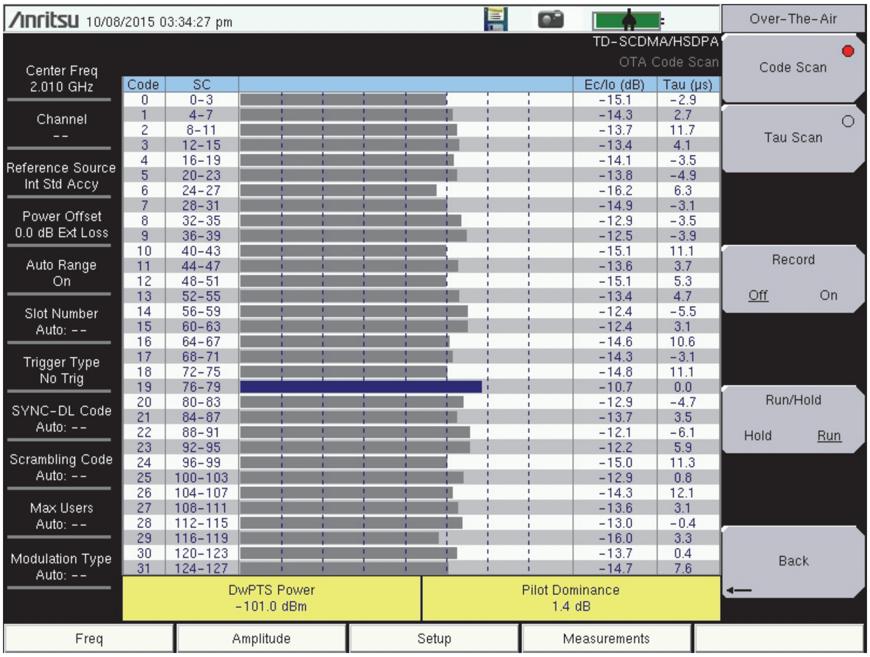



**Figure 4-5.** TD-SCDMA/HSPA+ OTA Code Scan

### Code Scan

Scans and displays the power of all 32 SYNC-DL codes in sequential order, including Ec/Io (dB) and Tau (μs). DwPTS Power and Pilot Dominance values are displayed below the table of codes (see Figure 4-5). The Scrambling Codes (SC) corresponding to each SYNC-DL code are also displayed next to each code for easy reference.

### Tau Scan

Displays the code power versus Tau in a bar graph format. The horizontal axis (Tau) has dynamic scale. The six strongest SYNC-DL codes are displayed below the bar graph with their Tau (us) and Ec/Io (dB) values. DwPTS Power and Pilot Dominance values are displayed below the table of the six strongest codes (see Figure 4-6).

### DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

### Pilot Dominance

Pilot dominance is a measure of the strength of the strongest code compared to the next strongest code in the same channel.

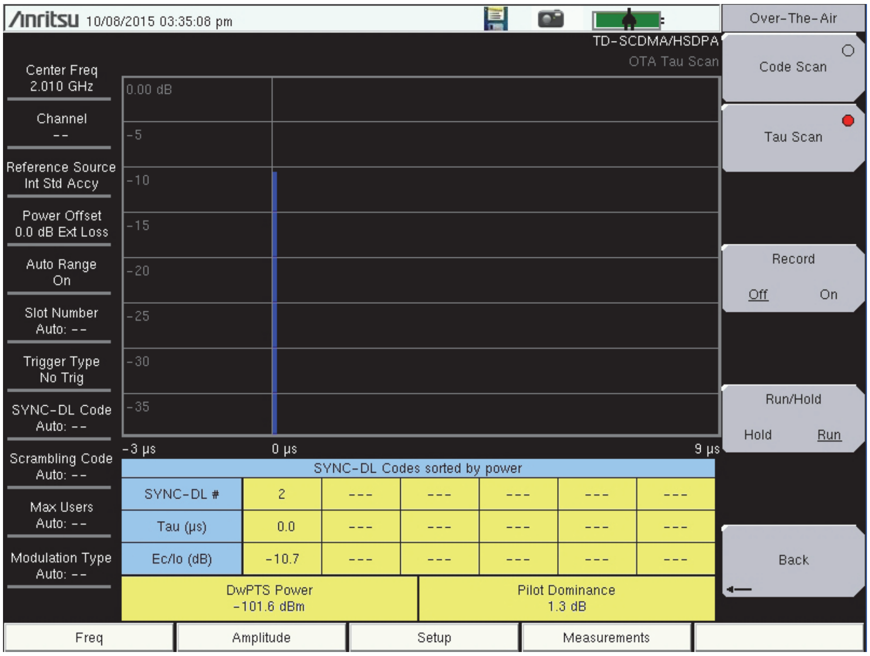



**Figure 4-6.** TD-SCDMA/HSPA+ OTA Tau Scan

## Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode.

1. Press the **Setup** main menu key. Press the Trigger submenu key. The Trigger menu opens.
   a. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
   b. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
   c. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum offset value is 5 sec.
   d. Press the Back submenu key to return to the Setup menu.
2. Continue with the following setups for the specific OTA measurements.

### Code Scan

1. Press the **Measurements** main menu key.
2. Press the OTA submenu key. The Over-the-Air menu is displayed.
3. Press the Code Scan submenu key to activate this measurement view.

### Tau Scan

1. Press the **Measurements** main menu key.
2. Press the OTA submenu key.
3. Press the Tau Scan submenu key to activate this measurement view.

# 4-6 TD-SCDMA/HSPA+ Pass/Fail Measurements

The following is an example of a Pass/Fail measurement.

## Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode.

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail submenu key to activate the test.
3. Press the Pass/Fail submenu key again to display the Pass/Fail menu.
4. Press the Select Pass/Fail Test submenu key. Use the arrow keys or the rotary knob to highlight the desired test mode, then press the Select Test submenu key or the **Enter** key.
5. Press the Reset submenu key to begin a new pass/fail test measurement (see Figure 4-7).
6. Press the Back submenu key to return to the Measurements menu.

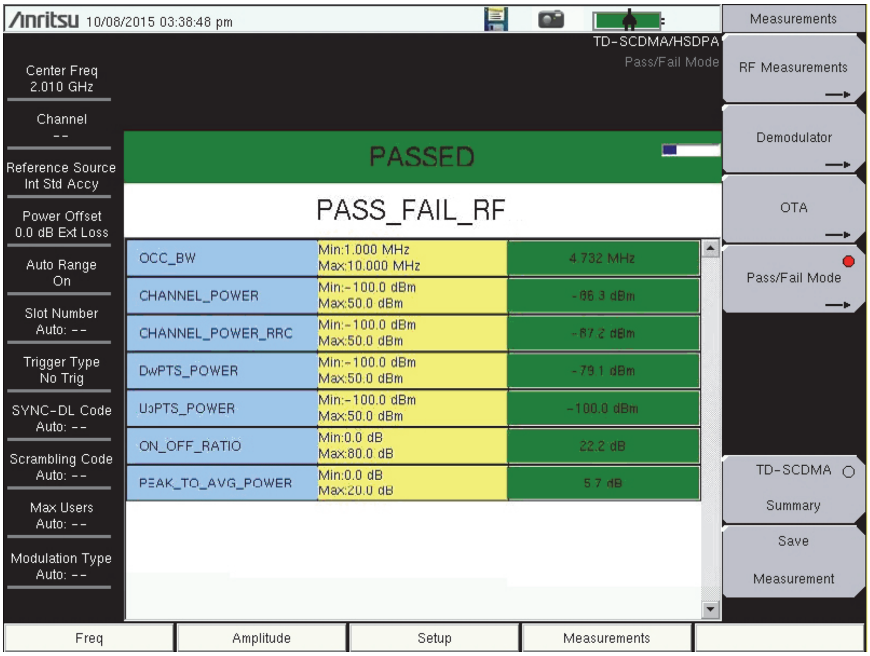



**Figure 4-7.** TD-SCDMA/HSPA+ Pass/Fail Measurements

# 4-7 TD-SCDMA/HSPA+ Menus

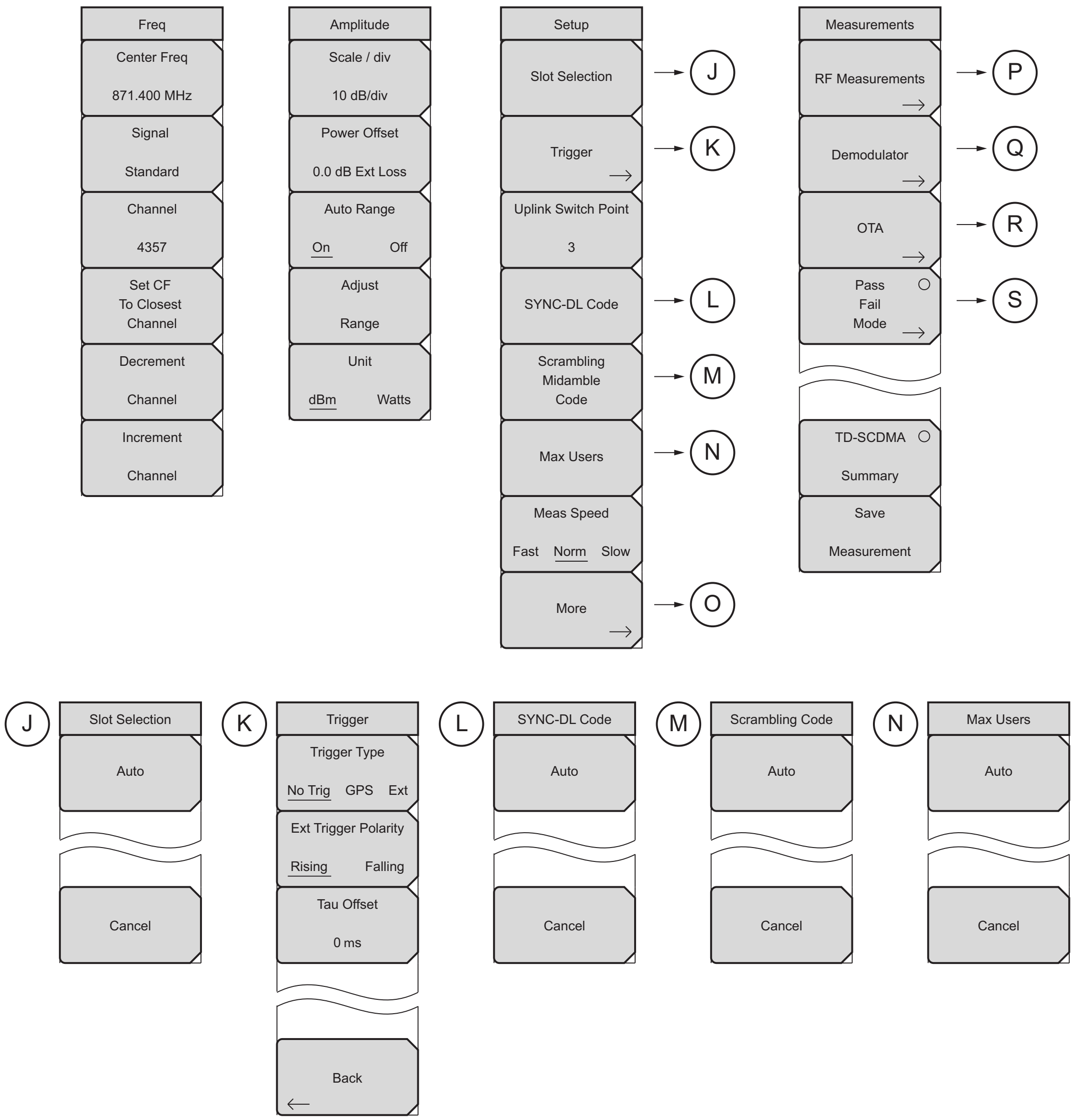



**Figure 4-8.** TD-SCDMA/HSPA+ Menu Layout (1 of 2)

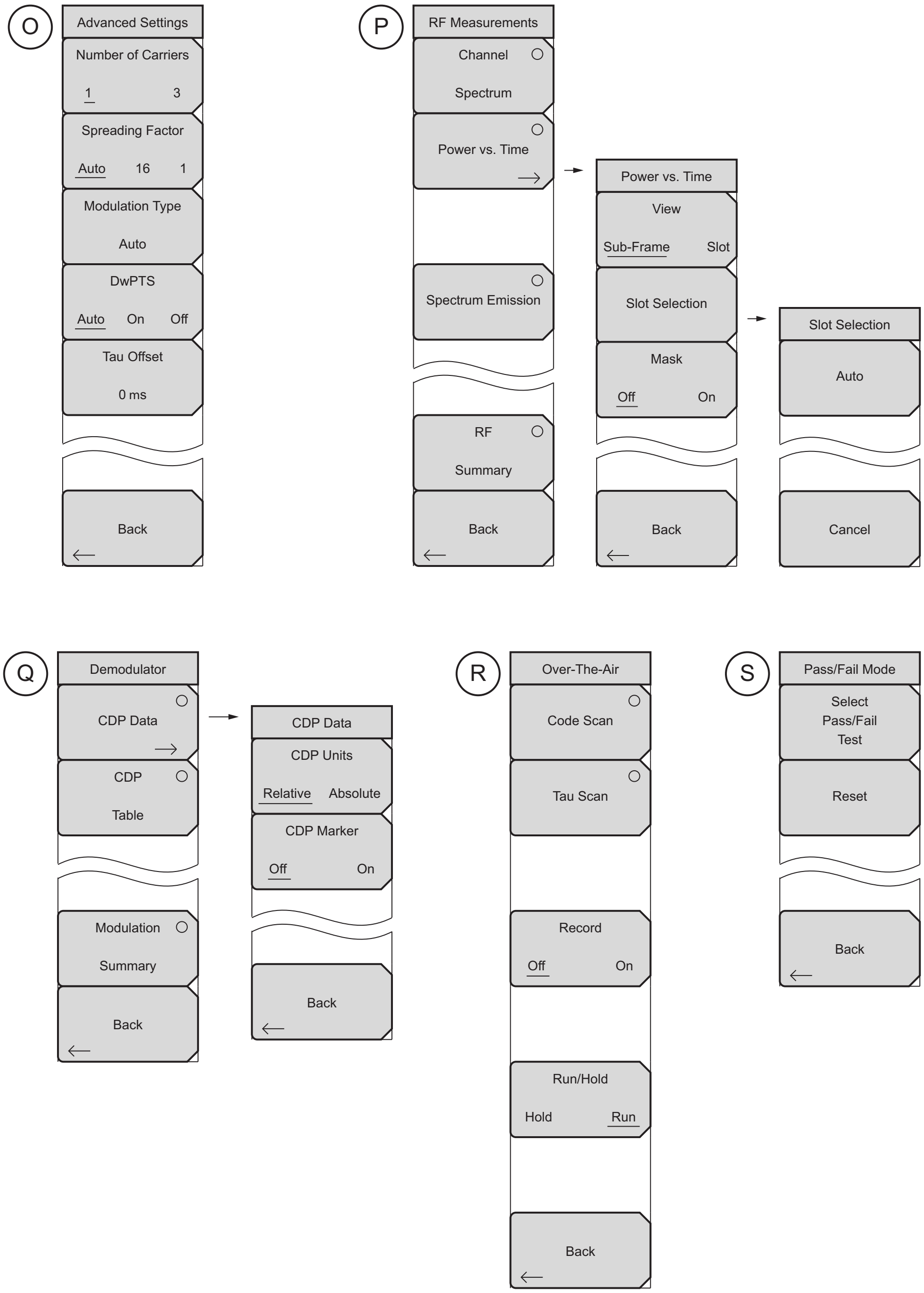
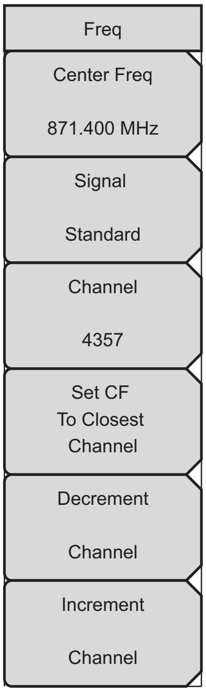



**Figure 4-9.** TD-SCDMA/HSPA+ Menu Layout (2 of 2)

# 4-8 Freq (Frequency) Menu

Key Sequence: **Freq**




**Center Freq:** Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency (2.7 GHz is the maximum value that can be entered) by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

**Signal Standard:** Opens the Signal Standards list box in order to select signal standard.

**Channel:** Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

**Set CF to Closet Channel:** Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

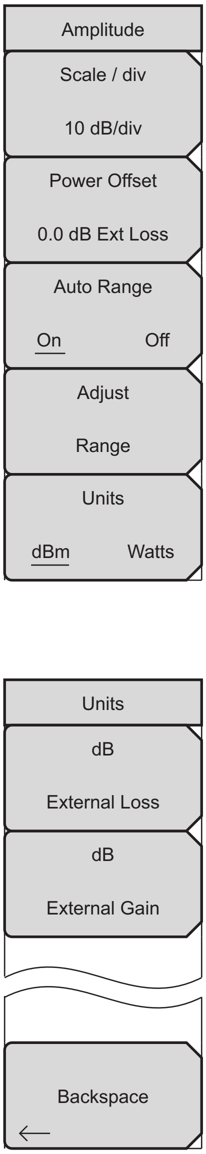
**Decrement Channel:** Decrements the channel by one channel.

**Increment Channel:** Increments the channel by one channel.

**Figure 4-10.** TD-SCDMA/HSPA+ Freq Menu

# 4-9 Amplitude Menu

Key Sequence: **Amplitude**




**Scale/div:** Press this submenu key to change the scale of the y-axis in the measurement display. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div. The value can be changed using the numeric keypad, rotary knob, or the arrow keys. This setting applies to the Channel Spectrum, Power vs. Time, and Spectrum Emission views only.

**Power Offset:** Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

**Auto Range:** Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

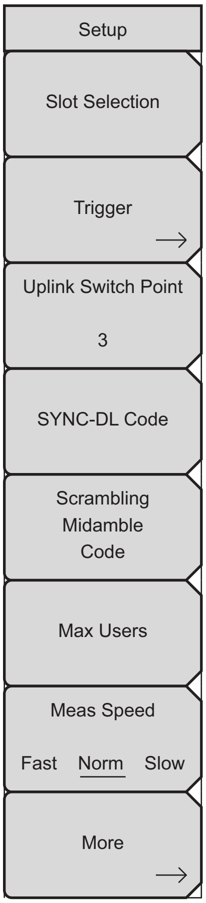
**Adjust Range:** Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

**Units:** Press this submenu key to view the power measurements in dBm or watts.

**Figure 4-11.** TD-SCDMA/HSPA+ Amplitude Menu

# 4-10 Setup Menu

Key Sequence: **Setup**




**Slot Selection**: Press this submenu key to display the "Slot Selection Menu" on page 4-18 and open the Slot Selection window. Use the rotary knob or press the touch screen to highlight the desired slot (0 to 6), then press **Enter**. If Auto is selected, the active slot is automatically detected.

**Trigger:** Opens the "Trigger Menu" on page 4-18. Press this submenu key to list the Trigger menu, to set up the trigger parameters, and to set up the Tau Offset.

**Uplink Switch Point:** Press this submenu key to set an uplink switch point. This is the slot number of the last uplink timeslot. Slots from the next timeslot to the end of the sub-frame are considered downlink. Use the rotary knob or the arrow keys to change the value, which ranges from 0 through 6, where 0 is no uplink. The default value is 3.

**SYNC-DL Code:** Press this submenu key to display the "SYNC-DL Code Menu" on page 4-19 and open the SYNC-DL Code selection window. Use the rotary knob or press the touch screen to highlight the desired code (0 through 31), then press **Enter**. If Auto is selected, the active SYNC-DL code is applied.

**Scrambling Midamble Code:** Press this submenu key to display the "Scrambling Code Menu" on page 4-19 and open the Scrambling/Midamble Code selection window. Use the rotary knob or press the touch screen to highlight the desired code (0 through 127), then press **Enter**. If Auto is selected, the active Scrambling/Midamble code is applied.

**Max Users:** Press this submenu key to display the "Max Users Menu" on page 4-19 and open the Maximum Users selection window. Use the rotary knob or press the touch screen to highlight the desired number of users (2 through 16), then press **Enter**. If Auto is selected, the maximum number of users is listed.

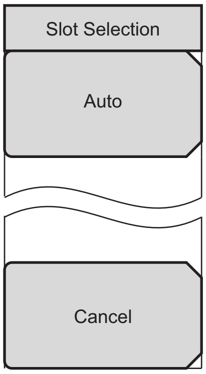
**Meas Speed:** Press this submenu key to select the desired scan speed: Fast, Normal, or Slow. The active state is underlined on the face of the submenu key.

**More:** Opens the "Advanced Settings Menu" on page 4-20.

**Figure 4-12.** TD-SCDMA/HSPA+ Setup Menu

## Slot Selection Menu

Key Sequence: **Setup** > Slot Selection



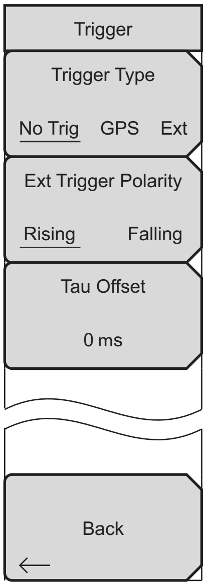

**Auto:** Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

**Cancel:** Disregards any entry and returns to “Setup Menu” on page 4-17.

**Figure 4-13.** TD-SCDMA/HSPA+ Slot Selection Menu

## Trigger Menu

Key Sequence: **Setup** > Trigger




**Trigger Type:** Select a trigger type by pressing this submenu key to toggle among No Trig, GPS, or Ext. The active state is underlined on the face of the submenu key.

**Ext Trigger Polarity:** Press this submenu key to toggle either Rising or Falling polarity of external trigger.

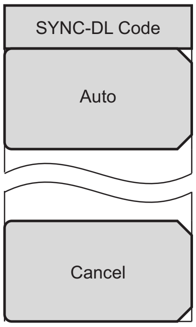
**Tau Offset:** Press this submenu key to add an offset (5 sec is the maximum offset that can be entered) to the current Tau value.

**Back:** Press this submenu key to return to “Setup Menu” on page 4-17.

**Figure 4-14.** TD-SCDMA/HSPA+ Trigger Menu

## SYNC-DL Code Menu

Key Sequence: **Setup** > SYNC-DL Code



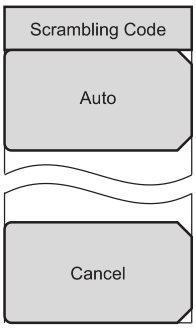

**Auto:** Automatically seeks the active SYNC-DL code. Auto in the SYNC-DL Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

**Cancel:** Disregards any entry and returns to “Setup Menu” on page 4-17.

**Figure 4-15.** TD-SCDMA/HSPA+ Trigger Menu

## Scrambling Code Menu

Key Sequence: **Setup** > Scrambling Midamble Code



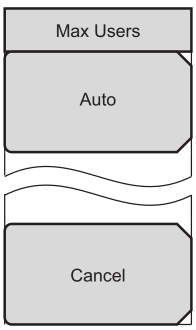

**Auto:** Automatically looks for the Scrambling/Midamble code. Auto in the Scrambling/Midamble Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

**Cancel:** Disregards any entry and returns to “Setup Menu” on page 4-17.

**Figure 4-16.** TD-SCDMA/HSPA+ Scrambling Midamble Code Menu

## Max Users Menu

Key Sequence: **Setup** > Max Users



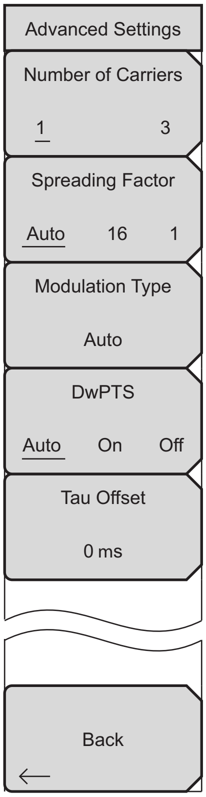

**Auto:** Automatically looks for the maximum number of users. Auto in the Maximum Users selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

**Cancel:** Disregards any entry and returns to “Setup Menu” on page 4-17.

**Figure 4-17.** TD-SCDMA/HSPA+ Max Users Menu

## Advanced Settings Menu

Key Sequence: **Setup** > More




**Number of Carriers:** Press this submenu key to select the number of carriers present in the signal. The setting toggles between 1 and 3.

**Spreading Factor:** Select the desired spreading factor, Auto, 16 or 1.

**Modulation Type:** Press this submenu key to display the Demodulation Types menu and open the Modulation Type selection window (see Figure 4-19). Use the rotary knob or press the touch screen to highlight the desired type, then press **Enter**. Select Auto if you are unsure.

**DwPTS:** If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, then select Off. If the presence of the DwPTS is unknown, select Auto.

**Tau Offset:** Press this submenu key to add an offset to the current Tau value. Use the rotary knob or the arrow keys to change the value. You can also enter a value using the numeric keypad, in which case you need to press the appropriate Units key (µs, ms, or s). 5 sec is the maximum offset that may be entered.

**Back:** Press this submenu key to return to "Setup Menu" on page 4-17.

**Figure 4-18.** TD-SCDMA/HSPA+ Advanced Settings Menu

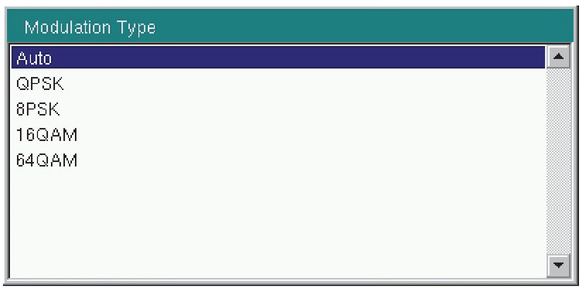
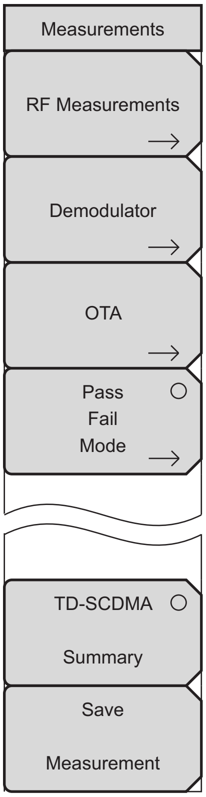



**Figure 4-19.** Modulation Type Window

# 4-11 Measurements Menu

Key Sequence: **Measurements**




**RF Measurements:** Press this submenu key to display the "RF Measurements Menu" on page 4-22.

**Demodulator:** Press this submenu key to display the "Demodulator Menu" on page 4-24 and to set up demodulator testing.

**OTA:** Press this submenu key to display the "Over-The-Air Menu" on page 4-25.

**Pass Fail Mode:** Press this submenu key to activate the Pass/Fail test. Press this submenu key again to display the "Pass Fail Mode Menu" on page 4-26 and set up pass/fail testing.

**TD-SCDMA Summary:** Press this submenu key to display a table of the TD-SCDMA measurements. The following measurement values are displayed in the table:

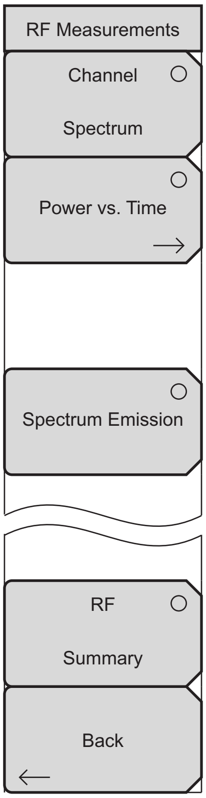
Channel Power
Occ BW
Slot Power
DwPTS Power
UpPTS Power
On/Off Ratio
Freq Error
Freq Error PPM
EVM
Peak CDE
Tau

**Save Measurement:** Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument's User Guide for information on file management functions.

**Figure 4-20.** TD-SCDMA/HSPA+ Measurements Menu

## RF Measurements Menu

Key Sequence: **Measurements** > RF Measurements




**Channel Spectrum:** Displays the spectrum of the input signal. The span is automatically set to 5 MHz. Beneath the graph, values for the following measurements are displayed: Left Channel Power, Channel Power, Right Channel Power, Left Channel Occ BW, Occ BW, and Right Channel Occ BW. Channel Power is displayed in dBm or watts depending on unit selection.

**Power vs. Time:** Opens the "Power vs. Time Menu" on page 4-23.

**Spectrum Emission:** Changes the display for Spectrum Emission measurement.

**RF Summary:** Press this submenu key to display the following RF measurements in table format:

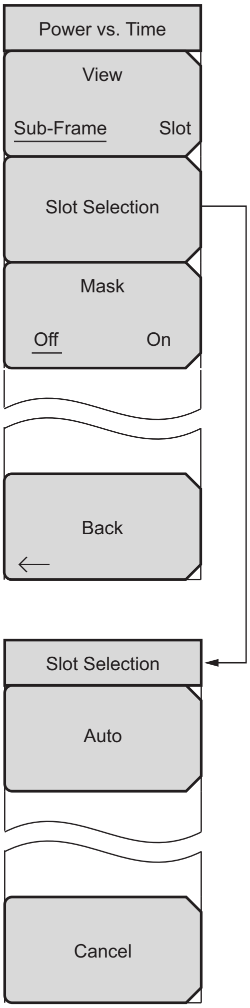
Channel Power
Channel Power (RRC)
Occ BW
DwPTS Pwr
UpPTS Pwr
On/Off Ratio
Slot PAR
Left Channel Power
Right Channel Power
Left Channel Occ BW
Right Channel Occ BW

**Back:** Press this submenu key to return to "Measurements Menu" on page 4-21.

**Figure 4-21.** TD-SCDMA/HSPA+ RF Measurement Menu

## Power vs. Time Menu

Key Sequence: **Measurements** > RF Measurements > Power vs. Time




**View:** Press this submenu key to display the Power vs. Time graph in either the Sub-Frame view or the Slot view.

**Slot Selection:** Press this submenu key to display the Slot Selection menu and open the Slot Selection window. Use the rotary knob or press the touch screen to highlight the desired slot (0 to 6), then press **Enter**. If Auto is selected, the active slot will be detected automatically.

> **Auto:** Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto submenu key have the same function.
>
> **Cancel:** Cancels any new setting you have highlighted without pressing **Enter**. If the Slot Selection currently in effect is highlighted, returns to the Power vs. Time menu.

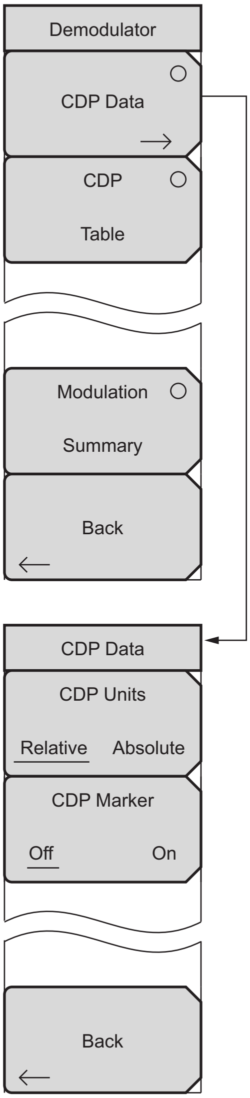
**Mask:** Press this submenu key to turn the mask On and Off.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 4-21.

**Figure 4-22.** TD-SCDMA/HSPA+ Power vs. Time Menu

## Demodulator Menu

Key Sequence: **Measurements** > Demodulator




**CDP Data:** Press this submenu key once to activate this test. Press this submenu key again to display the CDP Data menu and further set up the measurement.

> **CDP Units:** Select either Relative units (dB) or Absolute units (dBm).
>
> **CDP Marker:** Press this submenu key to toggle the CDP markers On or Off.
>
> **Back:** Returns to the Demodulator menu.

**CDP Table:** Press this submenu key to display a table of the CDP Code, Mod Type, Power (dB), and Power (dBm).

**Modulation Summary:** Press this submenu key to view the performance of the transmitter demodulated TD-SCDMA/HSPA+ signal in table format. The following parameters are displayed in the table:

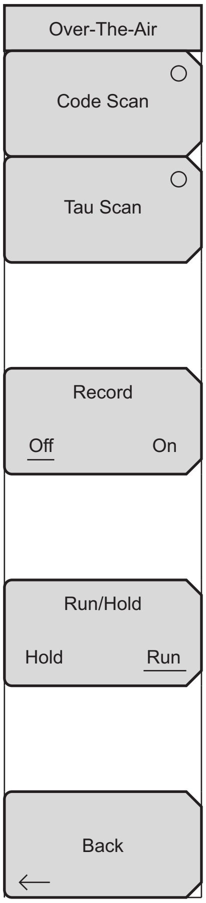
- Slot Power (dBm)
- EVM
- Peak EVM
- Freq Error
- Freq Error PPM
- Tau
- Noise Floor
- Carrier Feed Through
- Peak CDE

**Back:** Press this submenu key to return to the “Measurements Menu” on page 4-21.

**Figure 4-23.** TD-SCDMA/HSPA+ Demodulator Menu

## Over-The-Air Menu

Key Sequence: **Measurements** > OTA




**Code Scan:** Press this submenu key to display the 32 sync codes in table format. Displayed below the table are DwPTS Power (in dBm) and Pilot Dominance (in dB).

**Tau Scan:** Press this submenu key to display the code power versus Tau in bar graph format. Code numbers are displayed at the top of each bar. A table below the bar graph shows the 6 strongest codes (identified by number) and the Tau (in μs) and the Ec/Io (in dB).

**Record Off/On:** Pressing this submenu key so that On is underlined (selected) sets the instrument to automatically record all OTA measurements that are taken while in the Run mode. Before recording occurs, the name of a log file is flashed on the screen. This is the file in which all recorded data is stored. Selecting Off stops all recording and closes the log file. When pressed again, recording begins in a new file. If Record is turned On when the measurement is a non-OTA measurement (such as Spectrum), then no action is performed.

**Run/Hold:** Press this submenu key to set either Run mode or Hold mode. Hold mode prevents the instrument from taking any new measurements and freezes the current measurement. Run mode allows the instrument to continually take measurements.

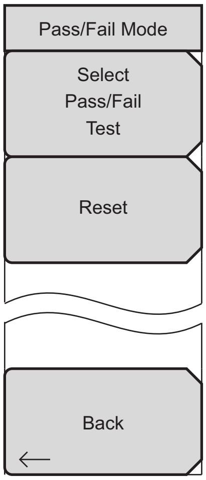
When Record is already toggled On, pressing the Run/Hold submenu key toggles the taking of measurements on and off to continue appending new measurements within the same log file, rather than creating a new log file.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 4-21.

**Figure 4-24.** TD-SCDMA/HSPA+ Over the Air Menu

## Pass Fail Mode Menu

Key Sequence: **Measurements** > Pass Fail Mode




**Select Pass/Fail Test:** Press this submenu key to open the Select Pass/Fail Test selection window. Use the rotary knob or the arrow keys, or press the touch screen to highlight the desired test (PASS_FAIL_RF, PASS_FAIL_DEMOD, or PASS_FAIL_ALL), then press the Select Test submenu key. Press **Esc** to return to the Pass/Fail Mode menu without initiating a test.

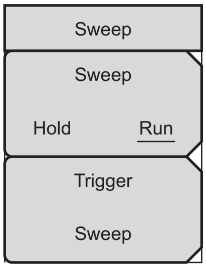
**Reset:** Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 4-21.

**Figure 4-25.** TD-SCDMA/HSPA+ Pass Fail Mode Menu

# 4-12 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key




**Sweep Hold/Run:** Press this submenu key to toggle between Run mode and Hold mode. Hold mode prevents the instrument from taking any new measurements and freezes the current measurement. Run mode allows the instrument to continually take measurements.

**Trigger Sweep:** Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

**Figure 4-26.** TD-SCDMA/HSPA+ Sweep Menu

# 4-13 Measure Menu

Displays the "Measurements Menu" on page 4-21.

# 4-14 Trace Menu

This menu is not available in TD-SCDMA/HSPA+ measurement mode.

# 4-15 Limit Menu

This menu is not available in TD-SCDMA/HSPA+ measurement mode.

# 4-16 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the User Guide.

# Chapter 5 — LTE Signal Analyzer

## 5-1 Introduction

The Long Term Evolution (LTE) Signal Analyzer offers three measurement options:

- RF Measurements

  The following display types are provided for RF measurements: Channel Spectrum display, ACLR display, Spectral Emission Mask display, and the RF Summary table.

- Modulation Measurements

  Modulation measurements can be viewed in Power vs Resource Block, Constellation display, Control Channel Power display, or the Modulation Summary table.

- Over-The-Air (OTA) Measurements

  Over-the-Air measurements include Scanner, Tx Test, Coverage Mapping, and Carrier Aggregation. EMF measurements are available with Option 444.

## 5-2 General Measurement Setups

Please refer to the User Guide for selecting the LTE Signal Analyzer mode, setting up frequency, amplitude, and file management. In addition, perform the following LTE specific setup procedures.

1. Press the **Setup** main menu key.
2. Press the BW submenu key to open the Select Bandwidth list. Select the desired Bandwidth with the arrow keys or rotary knob and press **Enter**.
3. Press the EVM Mode submenu key to select either Auto or PBCH Only. Selecting Auto measures Physical Downlink Shared Channel (PDSCH) if data is available, otherwise it measures Physical Broadcast Channel (PBCH), a control channel that carries a broadcast message. Selecting PBCH Only forces a PBCH measurement.

| | |
|---|---|
| **Note** | The Modulation Constellation will show a QPSK constellation when PBCH is being measured. PBCH Only mode is useful when making measurements over the air under conditions where the transmitted data uses MIMO.<br>The instrument also automatically selects PBCH only when OTA measurements are selected.<br>PBCH only is also necessary when connecting directly to the transmitter and MIMO is used, when measuring live traffic and assuming that precoding is used in that eNodeB. |

4. Press Sync then the Sync Type submenu key to select between the Normal (SS) or RS for synchronization. RS should be selected *ONLY* when there is no sync signal. This happens only when directly connected to a base station that is configured such that one of the antenna ports does not have a sync signal. When RS is selected, the Cell ID submenu key becomes active. Enter the Cell ID of the base station. The Cell ID field is automatically populated with the last measured Cell ID for user convenience.

| | |
|---|---|
| **Note** | Sync Type RS is only supported when BW is set to 10 MHz. |

5. Press Back to return to the **Setup** main menu.

## Antenna Status

The Antenna Status indicator can show when antennas are detected and which one is currently being measured. Antenna Status is displayed for any EVM measurement shown: Constellation, Control Channel Power, Modulation Summary and LTE Summary. The antennas icons are displayed at the lower-left corner of the display screen (Figure 5-1).

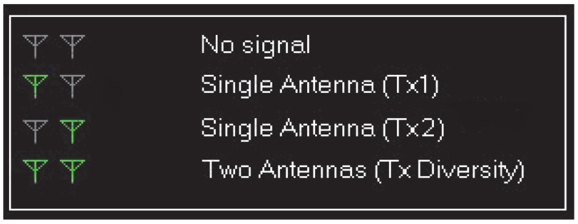



**Figure 5-1.** Antenna Status

# 5-3 LTE RF Measurements

The following parameters are measured in the RF Measurement mode.

## Channel Spectrum

Channel Spectrum displays the spectrum of the input signal across one channel. The Channel Power and Occupied BW are computed and displayed below the graph.

### Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

### Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

## ACLR

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph. For example, when BW is set to 10 MHz, the channel spacing is –20 MHz, –10 MHz, +10 MHz and +20 MHz and the channels are color coded.

## Spectral Emission Mask

The Spectral Emission Mask (SEM) measurement supports the testing for "Operating Band Unwanted Emissions" described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

## RF Summary

The RF Summary is a display of the occupied bandwidth, power of the main channel, upper adjacent channels, and lower adjacent channels in a table format. The RF Summary also shows the SEM status: PASS or FAIL. Refer to individual RF measurement descriptions for additional details on each measurement.

## RF Measurement Setups

### Channel Spectrum

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Channel Spectrum submenu key to activate this RF measurement view (Figure 5-2).
4. Press the Channel Spectrum submenu key again to select the Channel Spectrum menu, where you can adjust the span.

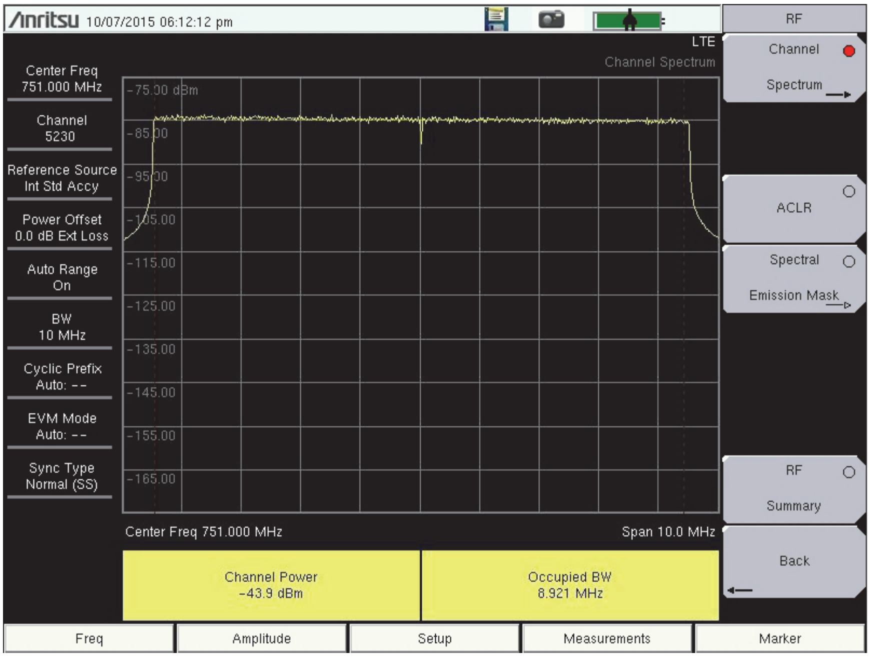



**Figure 5-2.** Channel Spectrum

5. Press the Back submenu key to return to the RF menu.

## ACLR

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the ACLR submenu key to activate ACLR display and measurement (Figure 5-3).

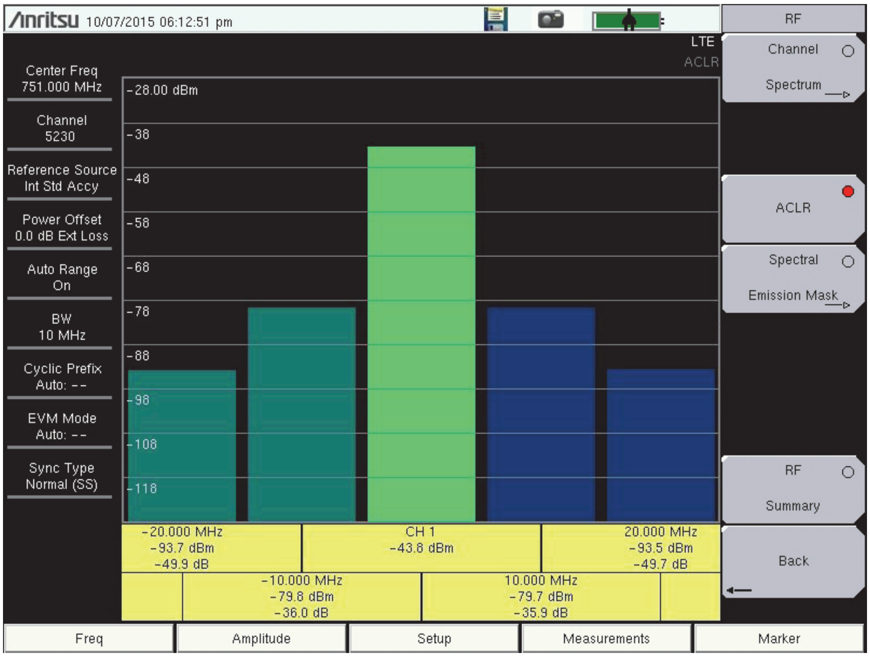



**Figure 5-3.** Adjacent Channel Leakage Ratio

4. Press the Back submenu key to return to the Measurements menu.

### Spectral Emission Mask

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Spectral Emission Mask submenu key to activate the Spectral Emission measurement and display (Figure 5-4).
4. Press the Spectral Emission Mask submenu key again to list the Spectral Emission menu and set up its parameters. Refer to Figure 5-24, "LTE RF Menu" on page 5-32 for additional information.
5. To view the measurement data in a table format, press the Summary Table submenu key so On is underlined.

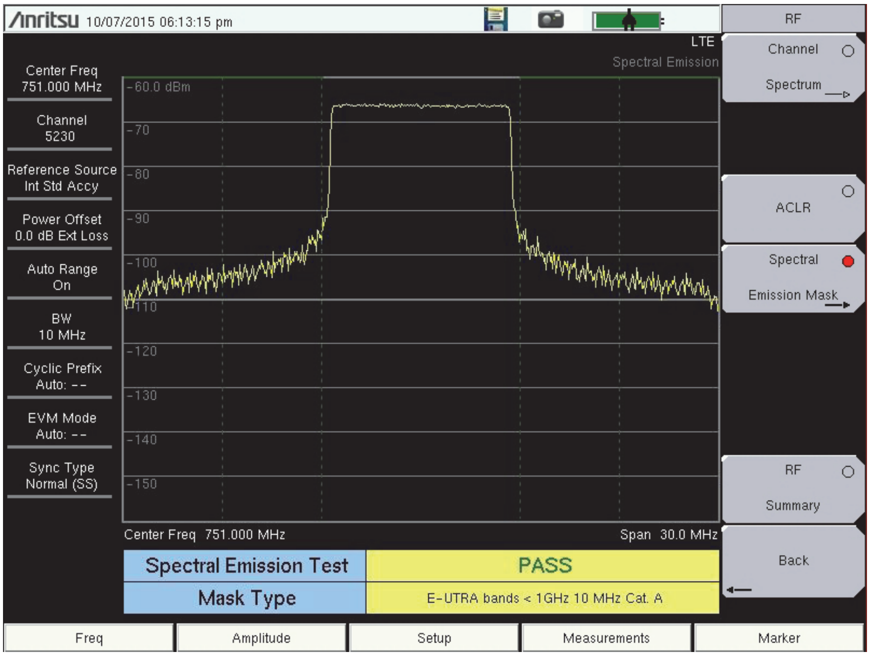



**Figure 5-4.** Spectral Emission Mask

6. Press the Back submenu key to return to the RF menu.

## RF Summary

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the RF Summary submenu key to activate and display the RF measurements in table format (Figure 5-5).

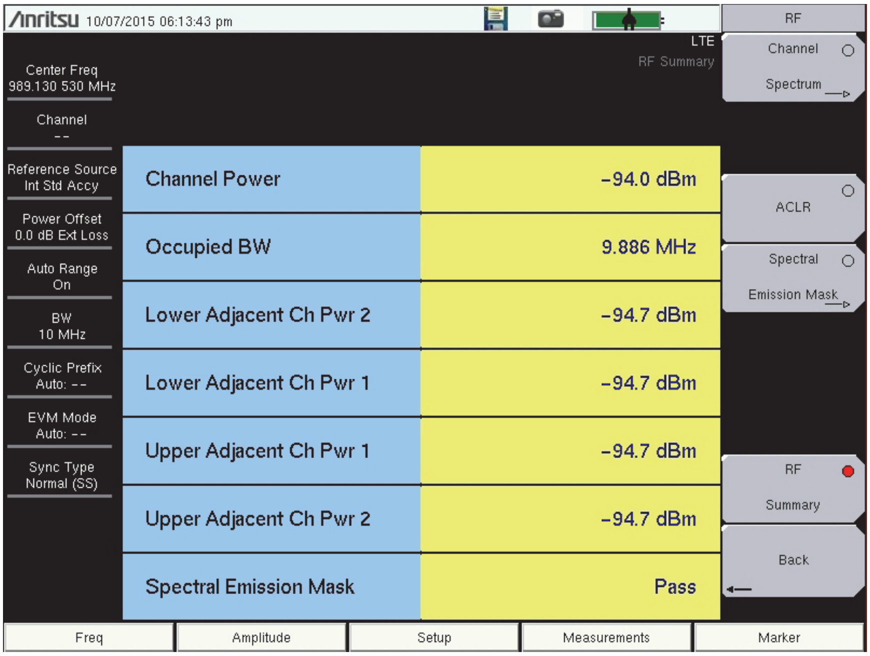



**Figure 5-5.** RF Summary

4. Press the Back submenu key to return to the Measurements menu.

# 5-4 LTE Modulation Measurements

The following parameters are measured in the Modulation Measurement mode.

## Power vs Resource Block (RB)

This measurement displays the Power vs. RB grid with the RB Color Map, the measurement table and measurement progress bar.

**Two Dimensional Power vs RB Grid**

Shows the PDSCH power of each RB using color. The y-axis is frequency (sub-carriers) and the x-axis is time (sub-frame). There are ten columns for the ten sub-frames. The number of subcarriers varies depending on the bandwidth chosen and hence the number of RBs on the y-axis. Each cell in the grid corresponds to a particular RB in a particular sub-frame. As the measurement progresses, each sub-frame is measured and the cells in the grid are colored according to the PDSCH power in the RB.

**Resource Block Color Map**

The color mapping of the RB power level is determined by the RB Color Map Max Value and RB Color Map Range submenus. Setting these values can be done by entering them manually or by pressing Autoscale Color Map.

| | |
|---|---|
| **Note** | The Power Offset is applied to the measured value before matching to a color map. |

**Measurements Table**

**Active RBs**
The number of active Resource Blocks. A RB is determined to be active if the measured PDSCH power is above a certain threshold that indicates that the RB is being used for carrying data.

**Utilization**
The percentage of RBs that carry data. It is the number of Active RBs divided by the total number of RBs, expressed as a %.

**Channel Power**
Channel power is the average total power within the bandwidth and is expressed in dBm.

**OSTP**
OSTP is the measurement of the OFDM symbol transmit power.

**EVM**
The RMS (%) of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. Individual frame EVM(RMS) is displayed for the modulation types QPSK, 16-QAM, and 64-QAM.

**Cell ID**
Cell identifying information sent by the transmitter in the sync signal.

**Measurement Progress Bar**

This progress bar indicates the sub-frame that is currently being measured.

#### Markers

Markers are available for use in the Power vs Resource Block measurement. The markers will outline the selected RB. Above the two dimensional grid, the specific RB subcarrier/sub-frame coordinates will be displayed along with its power level.

## Constellation

This measurement displays the constellation of the demodulated symbols over the first sub-frame and a results table of the following measurements.

#### Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

#### EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value. Reset occurs when setup parameters are changed or by toggling the EVM Max Hold button.

#### Freq Error

The difference between the measured carrier frequency and the specified carrier frequency is the frequency error. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

#### Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

#### Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

#### EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM value since Reset and the second number is the current measured value.

#### Freq Error (ppm)

Freq Error displayed in parts per million (ppm).

#### Cell ID

Cell identifying information sent by the transmitter in the sync signal.

## Control Channel Power

This measurement shows the power levels of key physical layer Control Channels and also includes the numerical results table described in the "Constellation" section above. EVM per control channel is also available, as well as a table view showing the power in both per-resource-element and total power formats.

### Ref Signal (RS) Power

Reference Signal power displayed in dBm. The reference signal is used for downlink channel estimation.

### P-SS Power

Primary Sync Signal power displayed in dBm or Watts. The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.

### S-SS Power

Secondary Sync Signal power displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.

### PBCH Power

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

### PCFICH Power

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDCCH and PDSCH channels.

### PHICH Power

Physical Hybrid Automatic Repeat Request Indicator Channel. Transmits the channel coded HARQ indicator codeword used for error correction.

### PDCCH Power

Physical Downlink Control Channel.

### Ng

Ng is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in a LTE sub-frame (this number is constant for all sub-frames).

## Tx Time Alignment

Measures the delay between the signals from two antennas at the antenna ports.

## Modulation Summary

Modulation Summary displays the Ref Signal (RS) Power, Sync Signal (SS) Power, EVM (rms), Freq Error (Hz and ppm), Cell ID and PBCH Power in a table format. Refer to individual modulation measurement descriptions for additional detail on each measurement.

## Modulation Measurement Setups

### Power vs Resource Block

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Power vs Resource Block submenu key to activate the Power vs Resource Block measurement view.

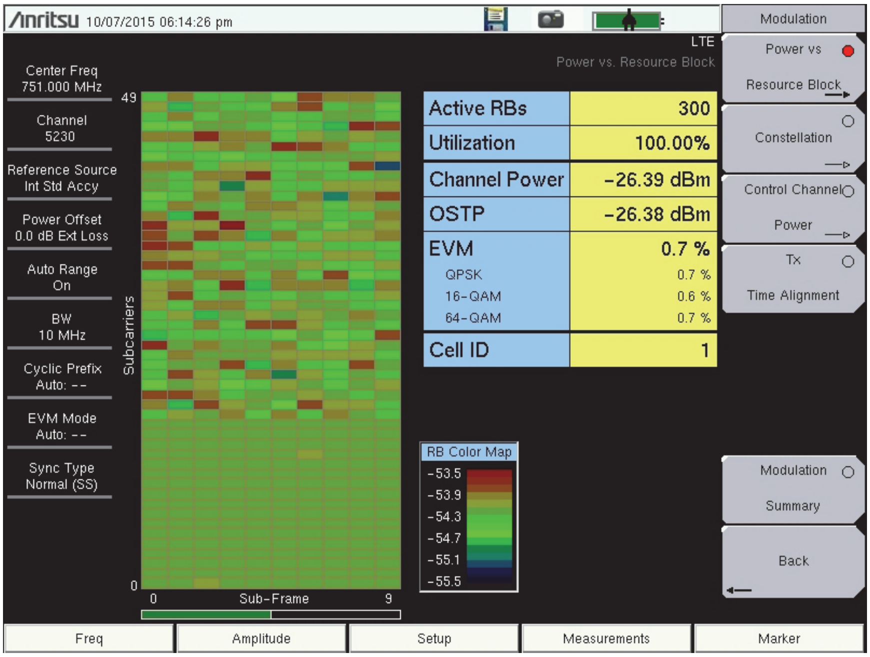



**Figure 5-6.** Power versus Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to list the Power versus RB menu for setting up the RB Color Map maximum value and range. Press a submenu key to change the desired parameter. Or, press the Autoscale Color Map submenu key to automatically set the Max and Range values.
5. Press the Back submenu key to return to the Modulation menu.

### Markers

1. While in the Power vs Resource Block measurement, press the **Marker** main menu key. The RB Marker submenu opens. The Marker State button default value is On, so the markers highlight a row of sub-frames and a column of sub-carriers.
2. To immediately find the strongest resource block press the Peak Search button.
3. To choose a specific resource block, press the Marker RB # submenu key and move it to the desired RB # using the arrow buttons, knob or enter a RB number and press **Enter**.
4. To choose a specific sub-frame, press the Marker Sub-frame submenu key and move it to the desired Sub-frame using the arrow buttons, knob, or enter the sub-frame number and press **Enter**.

## Constellation

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Constellation submenu key to activate the Constellation measurement view (Figure 5-7). Press the Constellation submenu key again to list the Constellation menu and set up the reference points and data legend.
    a. Press the Reference Points submenu key to turn the reference points (small white circles) On or Off.
    b. Press the Data Legend submenu key to turn the data legend On or Off.
4. Press the Back submenu key to return to the Modulation menu.

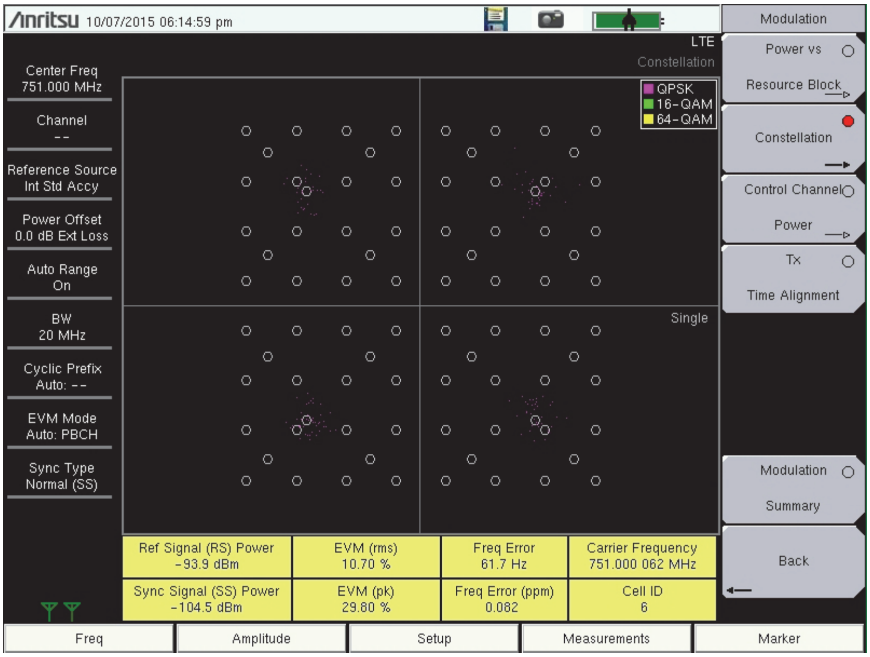



**Figure 5-7.** Constellation Measurement View

### Control Channel Power

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Control Channel Power submenu key to activate the Control Channel Power display (Figure 5-8). Press the key again to view or change the Display Mode and Control Channel EVM settings.

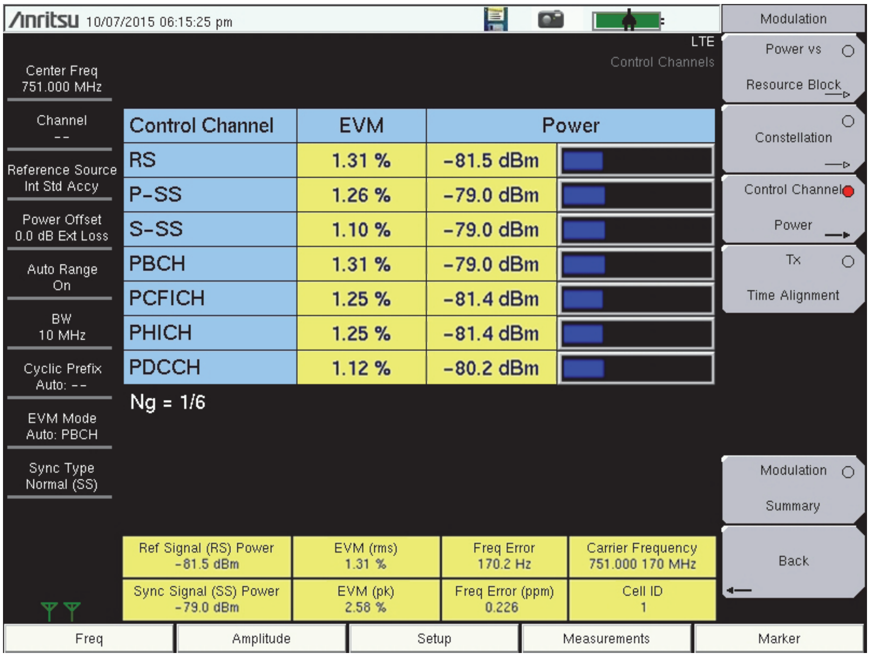



**Figure 5-8.** Control Channel Power

4. Press the Back submenu key to return to the Modulation menu.

### Tx Time Alignment

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Tx Time Alignment submenu key to set the modulation measurement to Tx Time Alignment view (Figure 5-9).

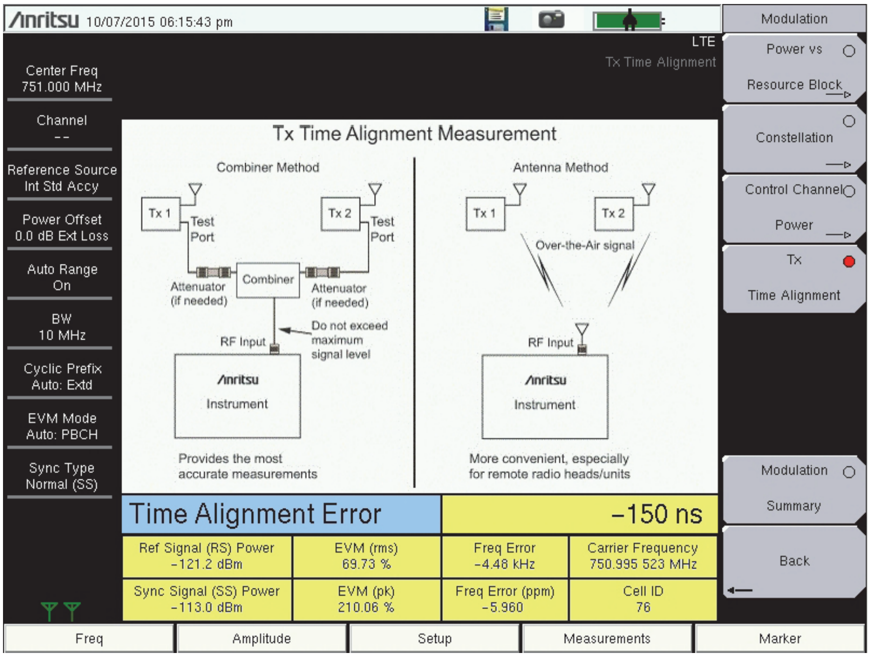



**Figure 5-9.** Tx Time Alignment

4. Press the Back submenu key to return to the Measurements menu.

### Modulation Summary

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Modulation Summary submenu key to activate and display the modulation measurements in table format (Figure 5-10).

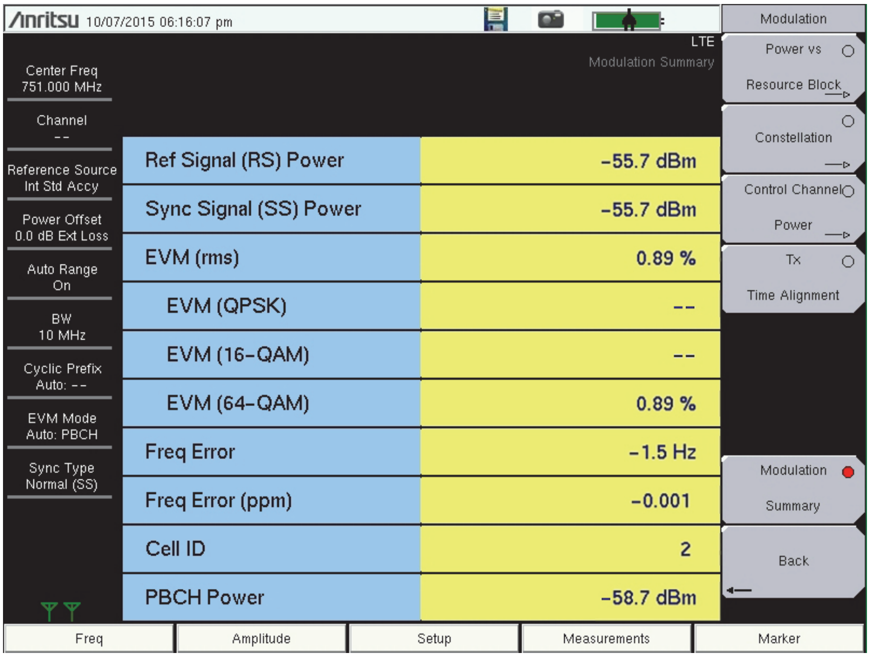



**Figure 5-10.** Modulation Summary

4. Press the Back submenu key to return to the Measurements menu.

# 5-5 LTE Over-the-Air (OTA) Measurements

Scanner, Tx Test, Antenna Status and Mapping are measurements taken over the air. EMF measurements are available only with Option 444.

Antenna Status and the PBCH Modulation Results table are displayed when the Show Mod Results are set On for Scanner and Tx Test measurements. The PBCH Modulation Results table is the same numeric results table displayed in LTE Modulation Constellation and Control Channel Power measurements.

## Antenna Status

The Antenna Status indicator shows the number of antennas detected and which one is currently being measured. In OTA Measurements, the Antenna Status is displayed when Show Mod Results is On for Scanner and Tx Test.

## Scanner

The Scanner measurement scans for the presence of up to 6 cell IDs and the following measurement values.

**Cell ID, Sector ID, Group ID**

Identifying information sent by the transmitter in the sync signal.

**S-SS Power**

Secondary Sync Signal power is displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. S-SS Power contains information needed for cell search.

**RSRP**

Reference Signal Received Power provides the UE with essential information about the strength of cells from which path loss can be calculated and used for determining optimum power settings for operating networks. RSRP is used in both idle and connected states. RSRP is used as a parameter in multi-cell scenarios.

**RSRQ**

Reference Signal Receive Quality provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRP is the ratio between RSRP and RSSI measured in dB.

**SINR**

Signal-to-Interference-plus-Noise Ratio is measured in dB.

**Dominance**

Dominance is the ratio of the power for the largest signal to the sum of all other signals found, measured in dB.

## Tx Test

Tx Test measurements are optimized for remote radio heads and MIMO systems. The first table in Tx Test replicates the Scanner table measurements, except the measurement scans the presence of up to 3 cell IDs. The second table shows the RS power across all detected antennas (transmitters) for the strongest Cell ID. This is displayed as average power and delta power for the detected transmitters, along with a small bar graph that shows the relative RS powers for each Tx. The PBCH Modulation Results table can also be turned on.

## Mapping (Coverage Mapping)

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ) and SINR. It is the same measurement as in Scanner which scans for the presence of up to 6 cell IDs but only displays the presence of up to 3 cell IDs. For full details regarding Coverage Mapping set up and testing, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

## Carrier Aggregation

This measurement displays a table of up to five Component Carriers (CC) used in Carrier Aggregation and their measured signal components.

**Frequency**

This is the set center frequency.

**Bandwidth (BW)**

This is the set bandwidth of the Component Carrier.

**Cyclic Prefix (CP)**

The length of Cyclic Prefix can be specified as either Normal or Extended.

**MIMO**

The MIMO status indicators show which transmitters are active in a MIMO configuration. Active transmitters display as a green dot, inactive as grey. They correspond to the antenna icons shown at the bottom left of the screen for each Component Carrier scanned.

**Reference Signal (RS) Power**

Reference Signal power is displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

**RS Delta Power**

RS Delta Power shows the maximum relative power difference in dB between the RS powers of the MIMO signals and can be used to check correct MIMO configuration.

**Sync Signal (SS) Power**

Sync signal power is displayed in dBm or Watts.

**EVM (rms)**

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**EVM (pk)**

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**Freq Error**

This is the difference between the measured carrier frequency and the specified carrier frequency. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

**Freq Error (ppm)**

This is the frequency error displayed in parts per million.

**TAE**

Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

**Cell ID**

Cell identifying information sent by the transmitter in the sync signal.

## EMF (Option 444 only)

EMF measurements are available in Over-the-Air LTE Signal Analyzer mode only when Option 444 is installed. The option requires an isotropic antenna, at a frequency range that is within specification of the instrument used. Refer to the isotropic antenna and spectrum analyzer Technical Data Sheets.

Chapter 8, "EMF (Option 444)" provides connection instructions for the antenna and detailed descriptions of the EMF Measurement menu and submenus.

## Measurement Setup

### Scanner

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Scanner submenu key to activate the OTA Scanner display (Figure 5-11 on page 5-19). Press the Scanner key again to display the OTA Scanner menu.
   a. Press the Sort By... submenu key to list the Sort By menu and select the parameter the OTA Scanner will use for sorting (Cell ID, Group ID, Sector ID, S-SS Power, RSRP, RSRQ or SINR) and press **Enter**.
   b. Press the Show Mod Results submenu key to display or hide the Modulation Results of the strongest signal.

| | |
|---|---|
| **Note** | When Show Mod Results is on, the scanner measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the LTE demod option to toggle this submenu to On. |

c. Use the Auto Save submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file.

4. Press Back to return to the Over-the-Air menu.

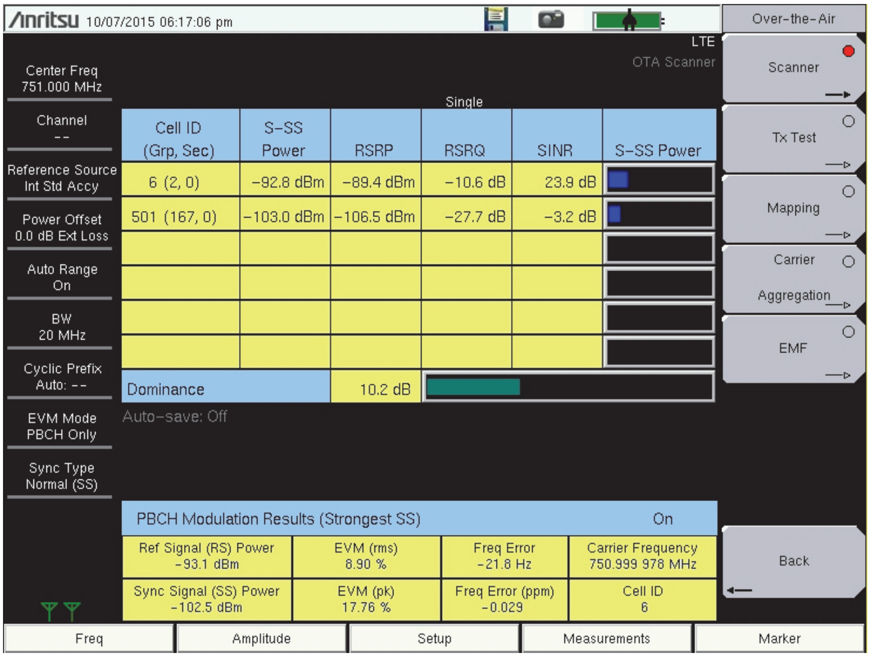



**Figure 5-11.** Over-the-Air Scanner Measurements

## Tx Test

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Tx Test submenu key to activate the OTA Tx Test display (Figure 5-12 on page 5-20). Press the Tx Test key again to display the OTA Tx Test menu.
4. Press the Show Mod Results key to display or hide the PBCH Modulation Results (Strongest SS) table.
5. Press **Back** to return to the Over-the-Air menu.

| | |
|---|---|
| **Note** | When Show Mod Results is on, the Tx Test measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the LTE demod option to toggle this submenu to On. |

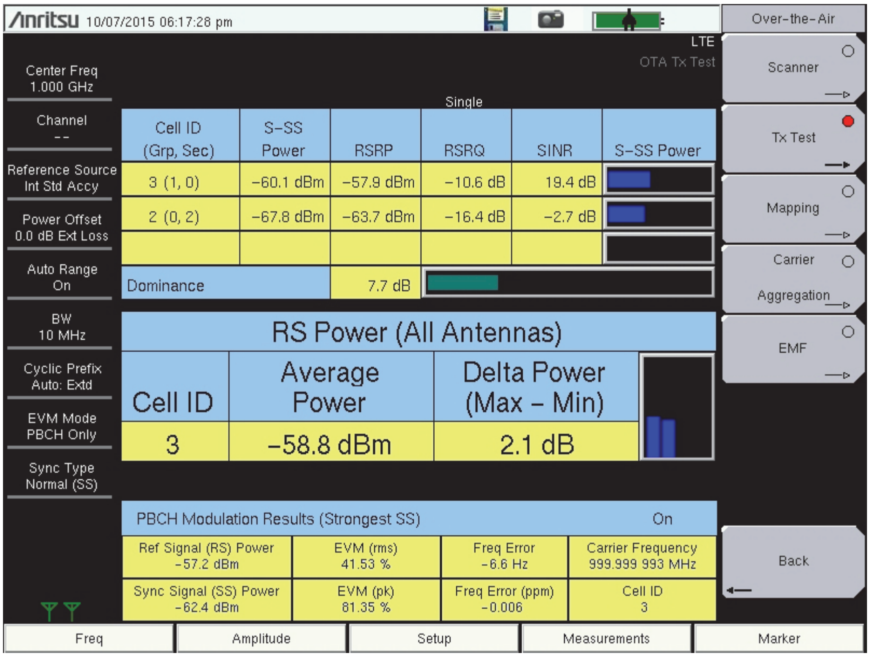



**Figure 5-12.** Over-the-Air Tx Test Measurement

### Mapping

Refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

### Carrier Aggregation

Refer to "Carrier Aggregation Menu" on page 5-41.

### EMF

Refer to "LTE/TD-LTE EMF Menu" on page 8-2.

# 5-6 Pass/Fail Tests

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail Test submenu key to activate the Pass/Fail display in table format (Figure 5-13). Press the Pass/Fail Test submenu key again to select a Pass/Fail test.
   a. Press the Select Pass/Fail Test submenu key to open the Select Pass Fail Test window. Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test. Refer to the instrument User Guide and the Master Software Tools (MST) User Guide for creating new Pass/Fail tests.
   b. Press the Reset submenu key to erase a previous measurement/s and restart the Pass/Fail test.

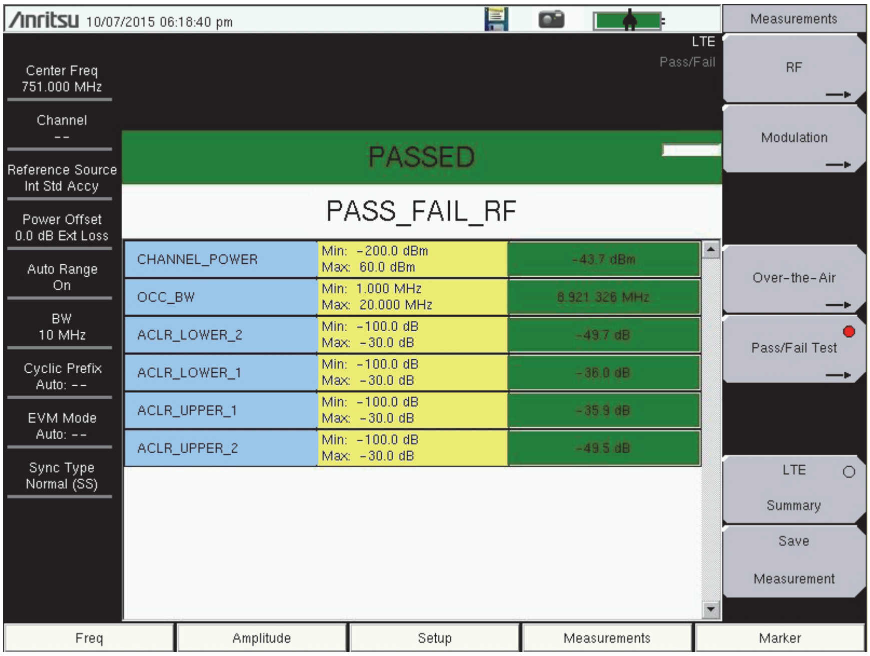



**Figure 5-13.** Past/Fail Test

3. Press the Back submenu key to return to the Measurements menu.

# 5-7 LTE Summary

The following parameters are displayed in the LTE Summary measurement.

**Freq Error**

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

**Occupied BW**

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

**Carrier Frequency**

Carrier Frequency is the measured transmitter operating center frequency.

**Channel Power**

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

**Ref Signal (RS) Power**

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

**Sync Signal (SS) Power**

Sync signal power displayed in dBm or Watts.

**EVM (rms)**

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**PBCH Power**

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

**PCFICH Power**

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDSCH (Physical Downlink Shared Channel).

**Spectral Emission Mask**

Displays a Pass/Fail status for the signal measured against the selected mask.

## Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the LTE Summary submenu key to activate and display the LTE measurements in table format.

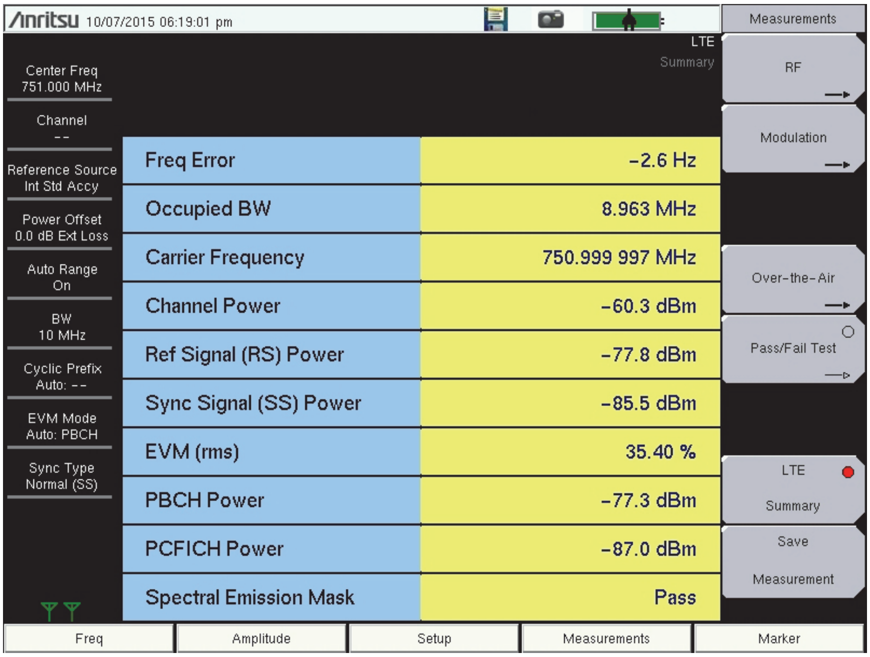



**Figure 5-14.** LTE Summary

# 5-8 LTE Menus

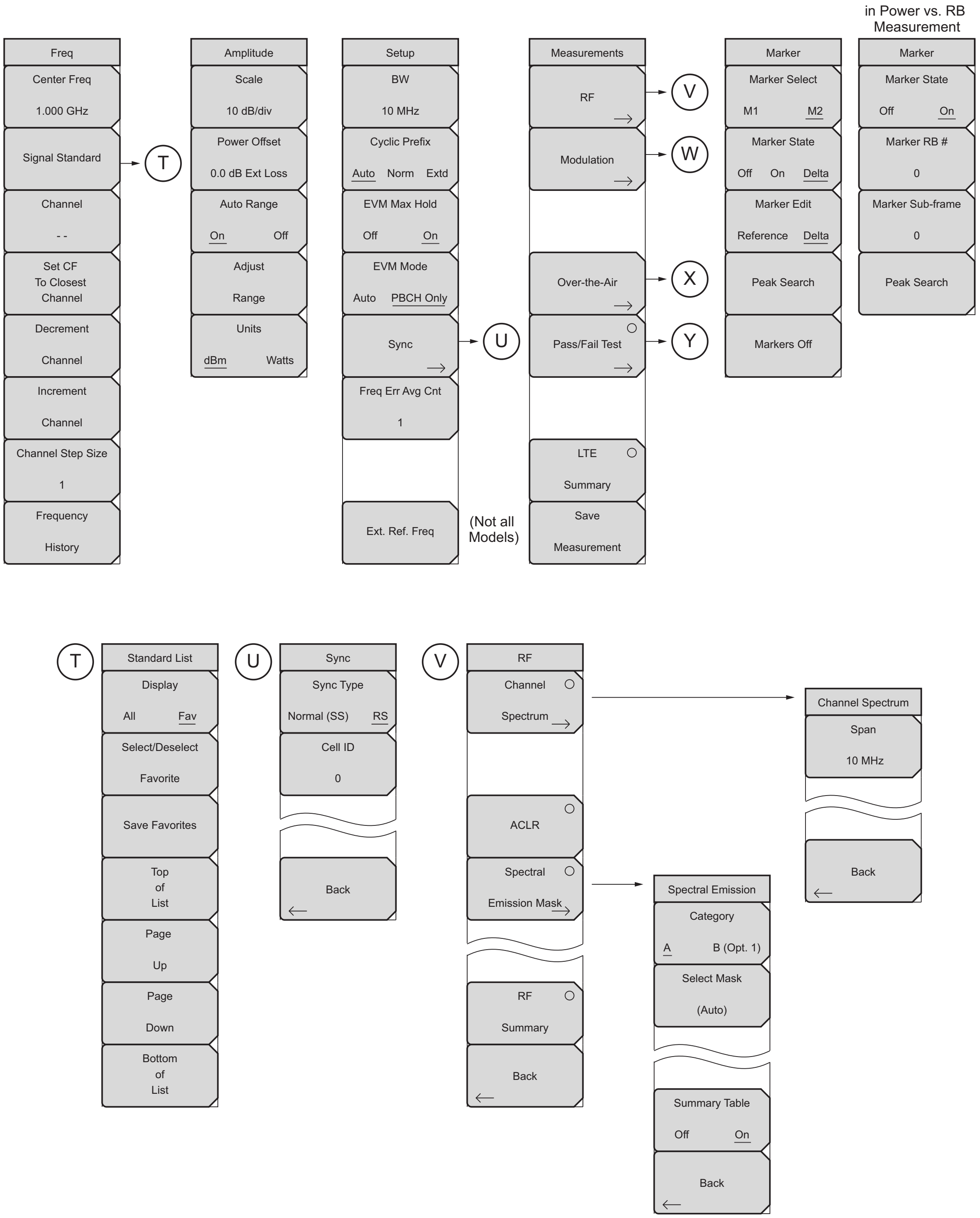



**Figure 5-15.** LTE Menu Layout (1 of 3)

## LTE Menus (continued)

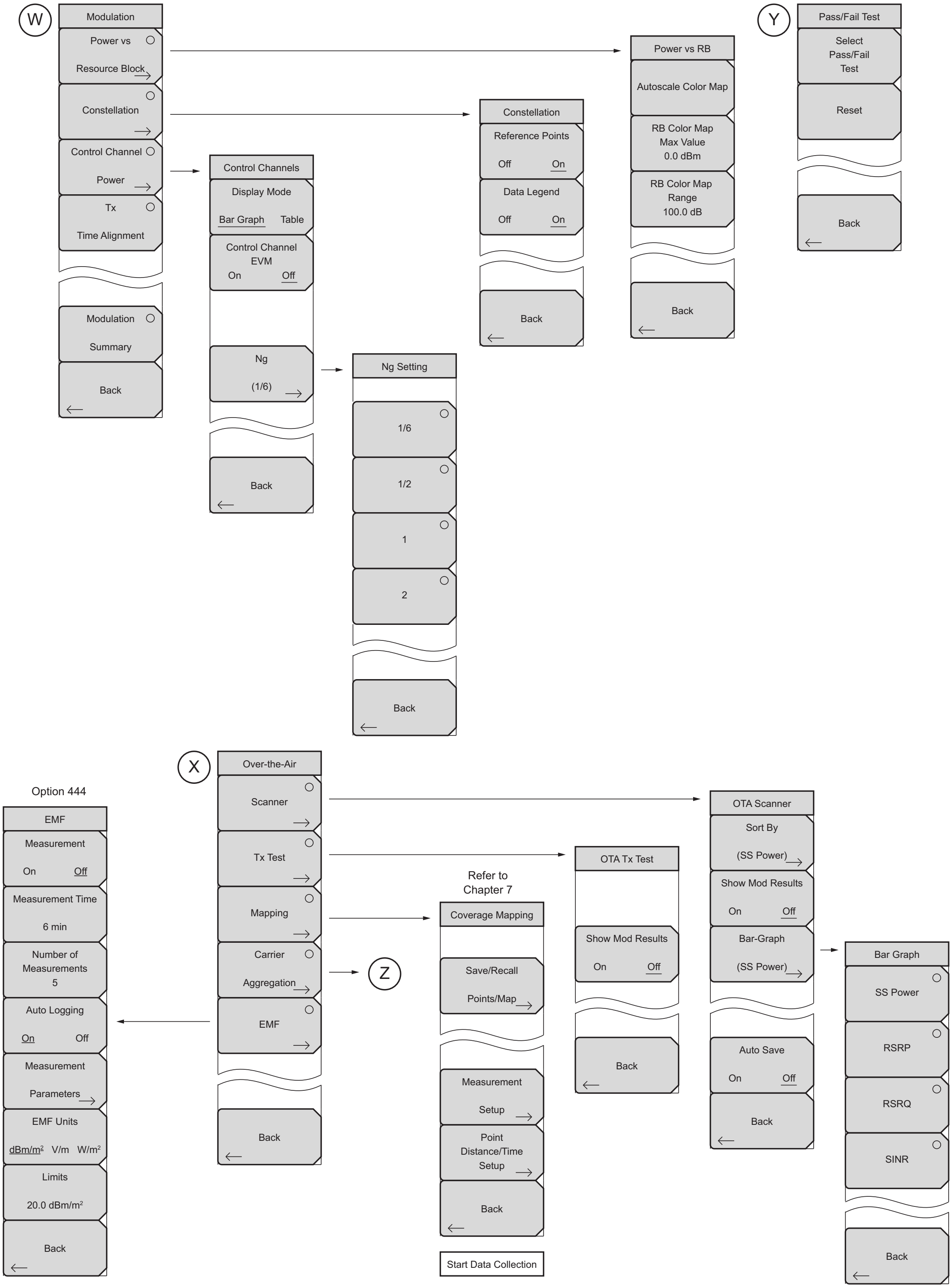



**Figure 5-16.** LTE Menu Layout (2 of 3)

## LTE Menus (continued)

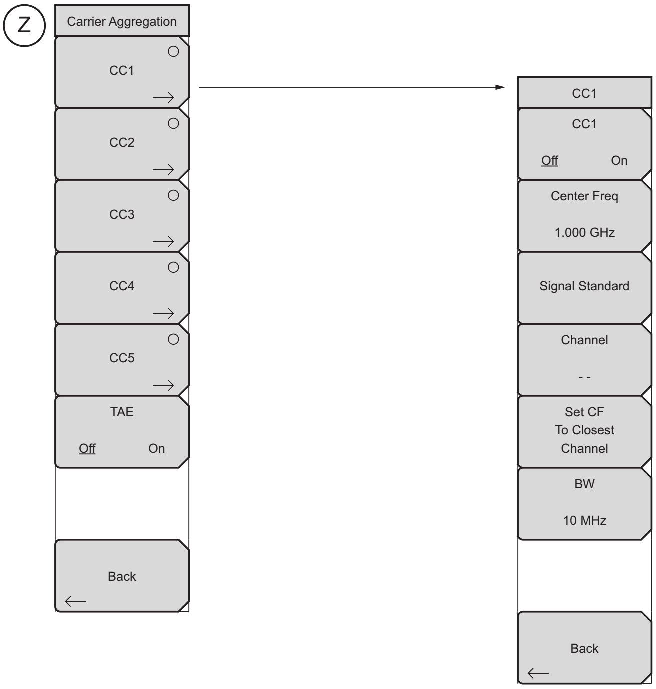
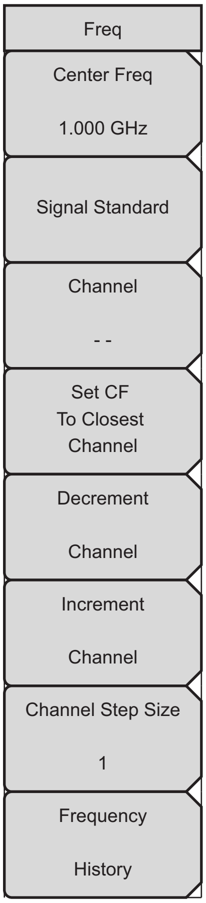



**Figure 5-17.** LTE Menu Layout (3 of 3)

# 5-9 Freq (Frequency) Menu

Key Sequence: **Freq**




**Center Freq:** Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

**Signal Standard:** Opens the "Standard List Menu" on page 5-28.

**Channel:** Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

**Set CF to Closest Channel:** Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

**Decrement Channel:** Decrements the channel by one channel.

**Increment Channel:** Increments the channel by one channel.

**Channel Step Size:** Use this submenu key to specify the step size used for incrementing or decrementing the channel number. Change the step value by using the arrow keys or rotary knob. Press the **Enter** key to set the value.

**Frequency History:** Opens a list box that displays the last five selected frequencies. When a frequency is entered using the Center Frequency submenu key or the Signal Standard/Channel submenu keys, the list will be updated.

**Figure 5-18.** LTE Freq Menu

## Standard List Menu

Key Sequence: **Freq** > Signal Standard


**Display:** Toggles between displaying all available signal standards and the signal standards marked as favorites (* in the Fav column).

**Select/Deselect Favorite:** Press this submenu key to select or deselect a signal standards as a favorite.

**Save Favorites:** Press this submenu key to have the instrument save to memory the signal standards were selected as favorites. Next time the signal standard list is displayed, these signal standard will be marked as favorites (* in the Fav column).

**Top of List:** Press this submenu key to display the first signal standard in the list.

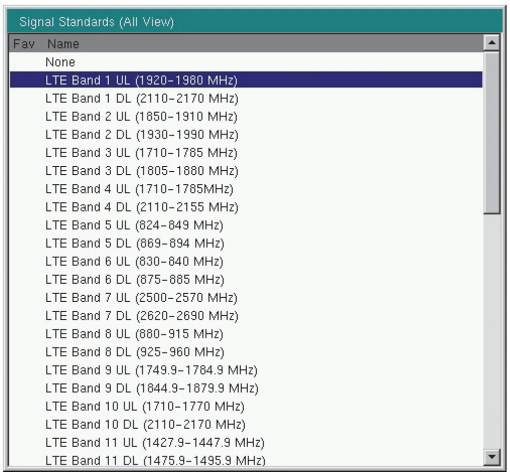
**Page Up:** Press this submenu key to scroll up one page in the signal standard list.

**Page Down:** Press this submenu key to scroll down one page in the signal standard list.

**Bottom of List:** Press this submenu key to display the last signal standard in the list.

Press **Esc** to close the Signal Standards list and return to the Frequency menu.

**Figure 5-19.** LTE Signal Standards



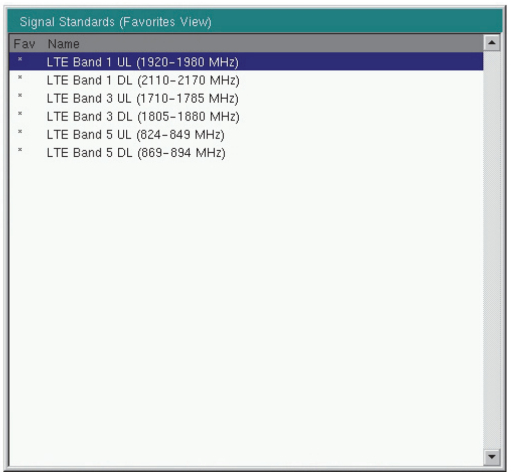
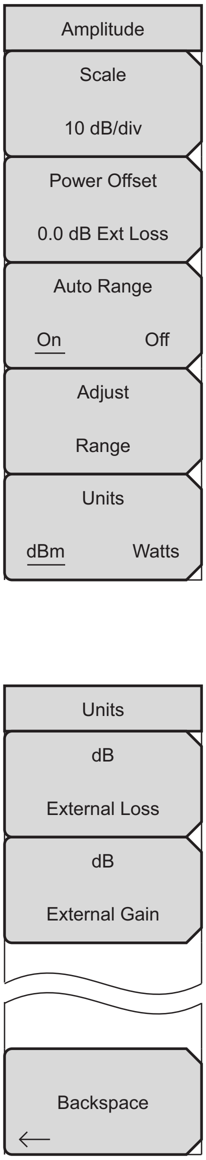




**Figure 5-20.** LTE Signal Standard List, All and Favorites

# 5-10 Amplitude Menu

Key Sequence: **Amplitude**




**Scale:** Press this submenu key to change the scale of the y-axis in the RF measurement displays. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div.

**Power Offset:** Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

**Auto Range:** Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

**Adjust Range:** Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

**Units:** Press this submenu key to set the units for all measurements and summary tables in either dBm or Watts.

**Figure 5-21.** LTE Amplitude Menu

# 5-11 Setup Menu

Key Sequence: **Setup**

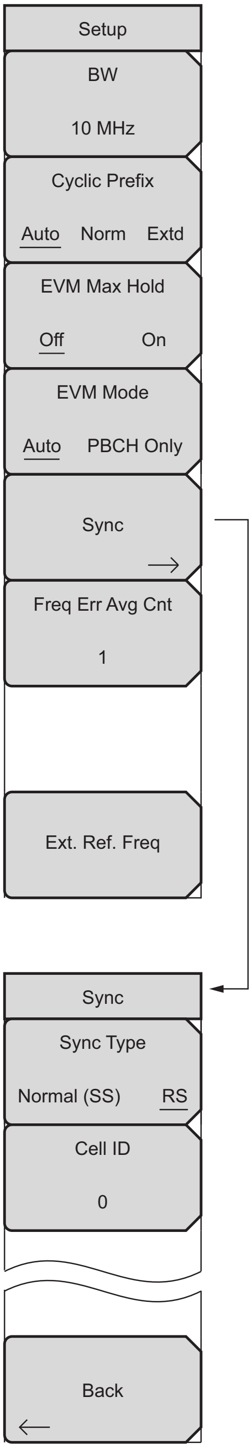



**Figure 5-22.** LTE Setup Menu

**BW:** Opens the Select Bandwidth list. Choose from the following bandwidths:

1.4 MHz
3 MHz
5 MHz
10 MHz
15 MHz
20 MHz

**Cyclic Prefix:** Press this key to set the instrument to measure signal with a Normal or Extended Cyclic Prefix, or to allow the instrument to detect the Cyclic Prefix automatically.

**EVM Max Hold:** Turn the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.

**EVM Mode:** Press to select either Auto or PBCH Only. Selecting Auto measures PDSCH if data is available, otherwise, it measures PBCH. Selecting PBCH Only forces a PBCH measurement and the constellation measurement will only show QPSK. The instrument will automatically choose PBCH Only mode when the OTA Scanner is used.

**Sync:** Opens the Sync submenu.

**Sync Type:** Press to choose between the Normal (SS) or RS Sync Type. Only choose RS when there is no sync signal present in the transmitter under test. If RS is chosen and a sync signal is present, no modulation measurements will be available.

**Cell ID:** Identifying information sent by the transmitter in the sync signal. If Normal (SS) is selected as the Sync Type, the Cell ID is extracted automatically from the Sync Signal. The Cell ID must be entered manually when RS Sync Type is selected. For user convenience, the Cell ID is automatically populated from the last measured signal with an SS.

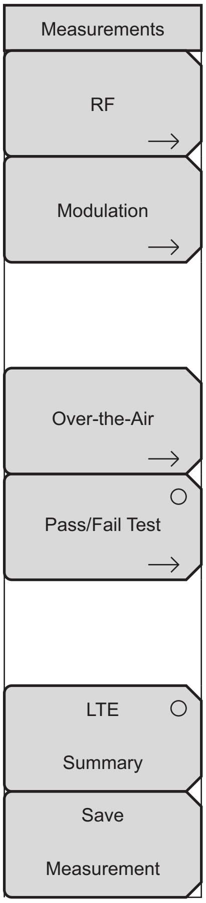
**Back:** Returns to the Setup menu.

**Freq Err Avg Cnt:** When the count is greater than one, the frequency error value is averaged over past measurements. If the count is one, then no averaging occurs.

**Ext. Ref. Freq (Only Some Models):** Press to set the external reference frequency. The External Reference Frequency list opens. Highlight the desired frequency and press **Enter**.

# 5-12 Measurements Menu

Key Sequence: **Measurements**




**RF:** Press this submenu key to display the “RF Menu” on page 5-32.

**Modulation:** Press this submenu key to display the “Modulation Menu” on page 5-33.

**Over-the-Air:** Press this submenu key to display the “Over-the-Air Menu” on page 5-37.

**Pass/Fail Test:** Press this submenu key to activate the Pass/Fail test. Press key again to display the “Pass/Fail Test Menu” on page 5-43 and set up pass/fail testing.

**LTE Summary:** Press this submenu key to display a table of the LTE measurements. The following measurement values are displayed in the table:

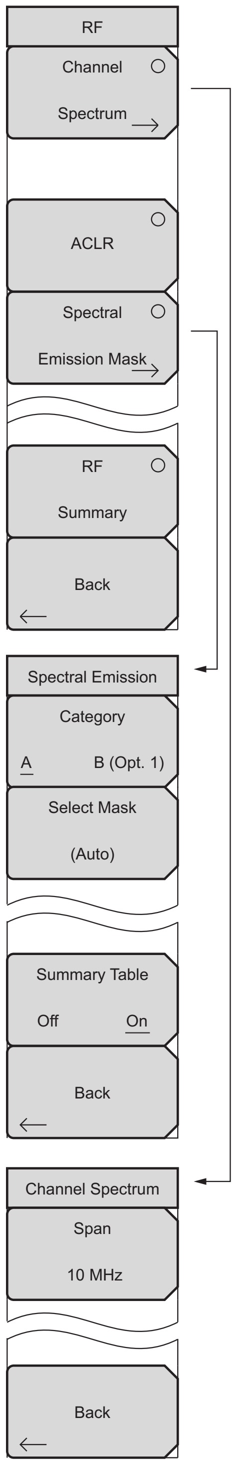
- Freq Error
- Occupied BW
- Carrier Frequency
- Channel Power
- Ref Signal (RS) Power
- Sync Signal (SS) Power
- EVM (rms)
- PBCH Power
- PCFICH Power
- Spectral Emission Mask

**Save Measurement:** Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument’s User Guide for information on file management functions.

**Figure 5-23.** LTE Measurements Menu

## RF Menu

Key Sequence: **Measurements** > RF




**Channel Spectrum:** Displays the spectrum of the input signal. Beneath the graph, values for the following measurements are displayed: Channel Power and Occupied BW. Channel Power is displayed in dBm or Watts (based on the Units submenu setting in the **Amplitude** menu) and Occupied BW is displayed in MHz. Press this button again to list the Channel Spectrum menu to set the Span.

> **Span:** Opens the Span list file to select a span of Auto, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz, or 30 MHz.
>
> **Back:** Returns to the RF Menu.

**ACLR:** Displays a bar graph of the main channel power and two adjacent channels on either side. The table underneath the chart lists the frequency, power, and power relative to the main channel (in dB).

**Spectral Emission Mask:** The Spectral Emission Mask measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region. Press this button again to list the Spectral Emission submenu.

> **Category A B (Opt. 1):** Select the desired category based on the information above.
>
> **Select Mask (Auto):** Displays a list of standard and custom masks for use in SEM measurements. Select “Auto Select” if the desired mask is unknown.
>
> **Summary Table:** Displays the Spectral Emission measurement data in table form.
>
> **Back:** Returns to the RF Menu.

**RF Summary:** Press this submenu key to display the following RF measurements in table format:

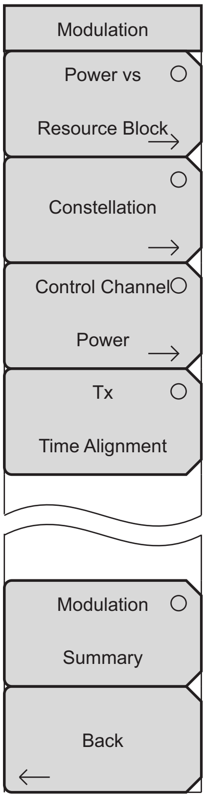
> Channel Power
> Occupied BW
> Lower Adjacent CH Pwr 2
> Lower Adjacent CH Pwr 1
> Upper Adjacent CH Pwr 1
> Upper Adjacent CH Pwr 2
> Spectral Emission Mask

**Back:** Press this submenu key to return to “Measurements Menu” on page 5-31.

**Figure 5-24.** LTE RF Menu

## Modulation Menu

Key Sequence: **Measurements** > Modulation




**Power vs Resource Block:** Press once to display the Power vs. Resource Block measurement window. Press again to open the “Power vs. Resource Block Menu” on page 5-34 for setting up the Resource Block Color Map parameters.

**Constellation:** Press this submenu key to set the modulation measurement to Constellation view. This view displays the constellation of the modulated data symbols over subframe 0. Press the key again to open the “Constellation Menu” on page 5-35.

**Control Channel Power:** Press the Control Channel Power submenu key to set the display as bar graph or table.

**Tx Time Alignment:** Press to set the modulation measurement to Tx Time Alignment view. Refer to “Tx Time Alignment” on page 5-14.

**Modulation Summary:** Press this submenu key to display a summary table of all of the modulation-related numerical measurement results:

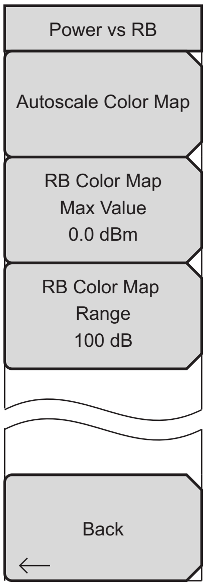
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

**Back:** Press this submenu key to return to the “Measurements Menu” on page 5-31.

**Figure 5-25.** LTE Modulation Menu

## Power vs. Resource Block Menu

Key Sequence: **Measurements** > Modulation > Power vs. Resource Block




**Autoscale Color Map:** Adjusts the RB Max Value and Range automatically on the color map.

**RB Color Map Max Value:** Press to adjust the RB Color Map Max Value manually.

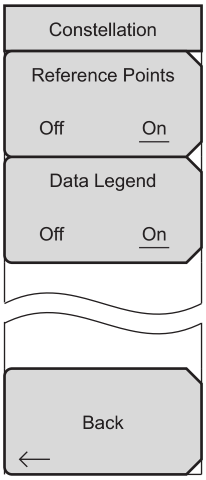
**RB Color Map Range:** Press to adjust the RB Color Range manually.

**Back:** Press this submenu key to return to the "Modulation Menu" on page 5-33.

**Figure 5-26.** LTE Power vs. Resource Block Menu

## Constellation Menu

Key Sequence: **Measurements** > Modulation > Constellation




**Reference Points:** Press this submenu key to display reference points (small white circles) for the various constellations. On is the default state.

**Data Legend:** Turns the legend box in the top right corner of the constellation graph On and Off. On is the default state.

**Back:** Press this submenu key to return to the "Modulation Menu" on page 5-33.

The constellations are color coded as follows:

QPSK is shown in purple
16-QAM is shown in green
64-QAM is shown in yellow

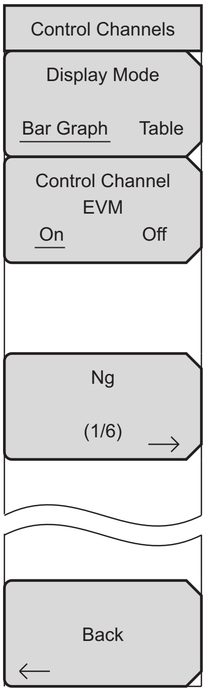
Values for the following measurements are shown beneath the graph:

Ref. Signal (RS) Power
EVM (rms)
Freq Error
Carrier Frequency
Sync Signal (SS) Power
EVM (pk)
Freq Error (ppm)
Cell ID

**Figure 5-27.** LTE Constellation Menu

## Control Channel Power Menu

Key Sequence: **Measurements** > Modulation > Control Channel Power




**Display Mode:** Select Bar Graph or Table as the desired view.

**Control Channel EVM On Off:** When On, the EVM column is included to display the EVM of each control channel. The EVM column is included for either Bar Graph or Table displays.

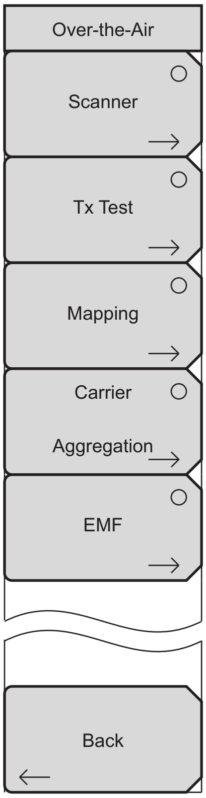
**Ng (1/6):** Determines the number of PHICH groups in a LTE sub-frame.

**Back:** Press this submenu key to return to the "Modulation Menu" on page 5-33.

**Figure 5-28.** LTE Control Channel Menu

## Over-the-Air Menu

Key Sequence: **Measurements** > Over-the-Air




**Scanner:** Press this submenu key to display the Scanner table, which shows several power measurements for multiple base stations at the same frequency. Measurements include Sync Signal (S-SS) Power, RSRP, RSRQ, and SINR. Press the key again to display the "OTA Scanner Menu" on page 5-38 to set up Sort By and Show Mod Results.

**Tx Test:** Opens the OTA Tx Test mode. Press it again to open the "Over-the-Air Tx Test Menu" on page 5-39 and the Show Mod Results submenu key.

**Mapping:** Sets the display for coverage mapping. Press it again to set the coverage mapping parameters – Save/Recall Points/Map, Measurement Setup and Point Distance/Time Setup.

For full details, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

**Carrier Aggregation:** Press this submenu key to display the Carrier Aggregation Component Carrier frequencies and measured parameters. In the Carrier Aggregation Menu, select the desired Component Carrier to set up for measurement. Refer to "Carrier Aggregation Menu" on page 5-41.

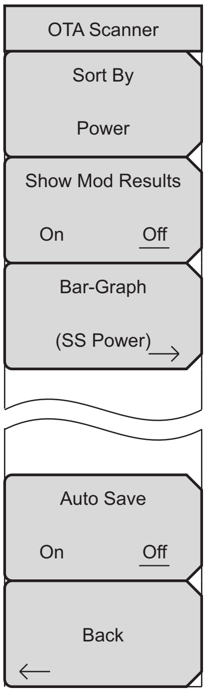
**EMF** (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this button opens the "LTE/TD-LTE EMF Menu" on page 8-2.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 5-31.

**Figure 5-29.** LTE Over-the-Air Menu

## OTA Scanner Menu

Key Sequence: **Measurements** > Over-the-Air > Scanner > Scanner




**Sort By:** Opens the Sort By list dialog. Choose one of the following parameters to sort the Scanner table rows.

Cell ID
Group ID
Sector ID
S-SS Power
RSRP
RSRQ
SINR

**Show Mod Results (Demod option required on some instruments):** Displays in table format the following measurements and information.

Ref. Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM (pk)
Freq Error
Freq Error (ppm)
Carrier Frequency
Cell ID

**Bar-Graph:** Opens the Bar Graph menu to select the parameter to be displayed in the last Bar-Graph column: SS Power, RSRP, RSRQ or SINR. Press **Back** to return to the OTA Scanner menu.

**Auto Save:** Use this submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file. When a file is full, a new file is automatically created.

Files are automatically saved to the instrument's Current Location selection in the subdirectory /Internal Memory/user. Refer to the File Management chapter in your instrument User Guide for instructions on setting the Current Location for saving files.

File names are automatically created:

Yyyymmddhhnnss.lte

*example:* 2009081122332244.lte

y - year, 2009, m - month, 08, d - day, 11, h - hour, 22, n - minutes, 33
s - seconds, 44

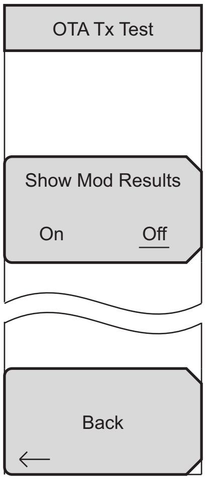
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

**Back:** Press this submenu key to return to "Over-the-Air Menu" on page 5-37.

**Figure 5-30.** LTE OTA Scanner Menu

## Over-the-Air Tx Test Menu

Key Sequence: **Measurements** > Over-the-Air > Tx Test



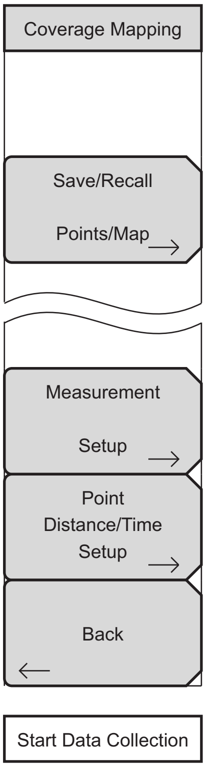

**Show Mod Results:** When set to Off, the PBCH Results table and Antenna Status indicators are not displayed. When set to On, the Antenna Status and PBCH Modulation Results table are displayed.

**Back:** Press this submenu key to return to "Over-the-Air Menu" on page 5-37.

**Figure 5-31.** LTE Over-the-Air Tx Test Menu

## Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping




**Save/Recall Map Points:** Opens the "Mapping Save/Recall Menu" on page 7-13.

**Measurement Setups:** Opens the "Measurement Setup Menu" on page 7-14.

**Point Distance/Time Setup:** Opens the "Point Distance/Time Setup Menu" on page 7-15.

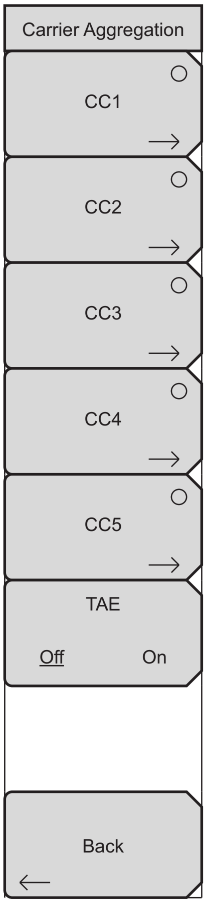
**Back:** Returns to the "Over-the-Air Menu" on page 5-37.

**Start/Stop Data Collection:** Press this main menu key to start coverage mapping data collection based on Measurement Setup settings and Point Distance/Time Setup settings. A running count of collected data points is displayed at the bottom of the screen. Press again to stop data collection.

**Figure 5-32.** Coverage Mapping Menu

## Carrier Aggregation Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation




**CC1 through CC5:** Select the desired Component Carrier to set up for measurement. See Figure 5-34.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

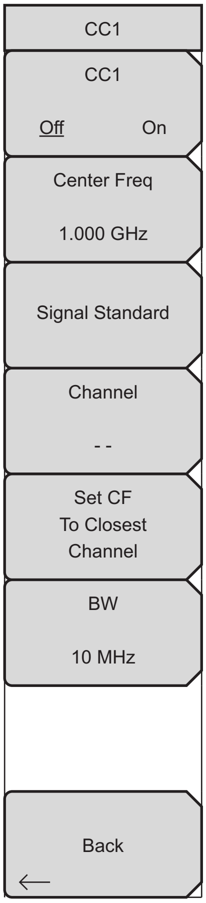
**TAE:** Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

**Back:** Returns to the “Over-the-Air Menu” on page 5-37.

**Figure 5-33.** Carrier Aggregation Menu

## Component Carrier Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation > CC1




**CC1 Off On:** Turns On the Component Carrier.

**Center Freq:** Press this submenu key to set the receiver center frequency. Enter the frequency using the keypad, arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels change to Units: GHz, MHz, kHz, and Hz. In this case, enter the desired value, then press the desired unit submenu key or press **Enter** to select MHz as the frequency unit.

**Signal Standard:** Opens the “Standard List Menu” on page 5-28.

**Channel:** Opens the Channel Editor dialog where you can select a channel number within the range of the selected signal standard.

**Set CF to Closest Channel:** Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

**BW:** Displays the Select Bandwidth list, from which you can choose:

1.4 MHz
3 MHz
5 MHz
10 MHz
15 MHz
20 MHz

**Back:** Returns to the previous menu.

**Figure 5-34.** Component Carrier Menu

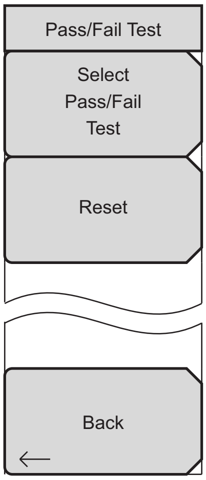
## EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF

Refer to “LTE/TD-LTE EMF Menu” on page 8-2.

## Pass/Fail Test Menu

Key Sequence: **Measurements** > Pass/Fail Test > Select Pass/Fail Test




**Select Pass/Fail Test:** Press this submenu key to open the Select Pass/Fail Test list box and select a test type. Choose from:

PASS_FAIL_RF
PASS_FAIL_MOD
PASS_FAIL_CONTROL
PASS_FAIL_ALL

Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test or press **Esc** to cancel your choice.

Note: The current list of pass/fail tests is a default list. Master Software Tools (MST) includes features to create additional pass/fail tests.

**Reset:** Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

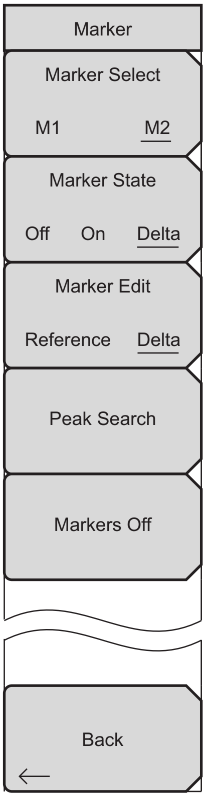
**Back:** Press this submenu key to return to "Measurements Menu" on page 5-31.

**Figure 5-35.** LTE Pass Fail Mode Menu

# 5-13 Marker Menu

Key Sequence: **Marker**

Available for Channel Spectrum measurements. When making Power vs Resource Block measurements, refer to “Power vs Resource Block Marker Menu” on page 5-45.




**Marker Select:** Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

**Marker State:** Sets the state of the selected marker underlined in the Marker Select submenu.

**Marker Edit:** Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

**Peak Search:** Moves the selected marker to the trace peak.

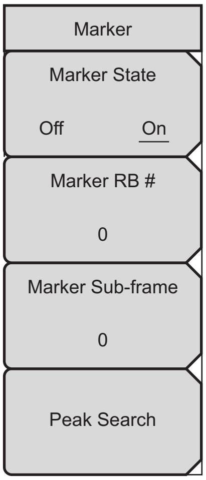
**Markers Off:** Turns off all markers.

**Back:** Press this submenu key to return to “Measurements Menu” on page 5-31.

**Figure 5-36.** LTE Marker Menu

### Power vs Resource Block Marker Menu

Key Sequence: **Marker** (When Power vs. Resource Block measurement is selected).




**Marker Select:** Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

**Marker State:** Sets the state of the selected marker underlined in the Marker Select submenu.

**Marker Edit:** Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

**Peak Search:** Moves the selected marker to the trace peak.

**Markers Off:** Turns off all markers.

**Back:** Press this submenu key to return to "Measurements Menu" on page 5-31.

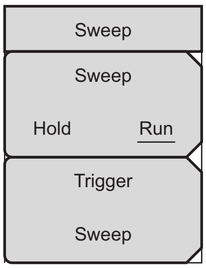
**Figure 5-37.** LTE Resource Block Marker Menu

## 5-14 Calibrate Menu

This menu is not available in LTE measurement mode.

## 5-15 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key




**Sweep Single/Continuous:** This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

**Trigger Sweep:** Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

**Figure 5-38.** LTE Sweep Menu

## 5-16 Measure Menu

Displays the "Measurements Menu" on page 5-31.

## 5-17 Trace Menu

This menu is not available in LTE measurement mode.

## 5-18 Limit Menu

This menu is not available in LTE measurement mode.

## 5-19 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the instrument User Guide.

# Chapter 6 — TD-LTE Signal Analyzer

## 6-1 Introduction

The Time-Division Long Term Evolution (TD-LTE) Signal Analyzer offers three measurement options:

- RF Measurements

  The following display types are provided for RF measurements: Channel Spectrum display, Power vs. Time, ACLR display, Spectral Emission Mask display, and the RF Summary table.

- Modulation Measurements

  Modulation measurements can be viewed in Power vs Resource Block, Constellation display, Control Channel Power display, or the Modulation Summary table.

- Over-The-Air (OTA) Measurements

  Over-the-Air measurements include Scanner, Tx Test, Coverage Mapping, and Carrier Aggregation. EMF measurements are available with Option 444.

## 6-2 General Measurement Setups

Please refer to the User Guide for selecting the TD-LTE Signal Analyzer mode, setting up frequency, amplitude, and file management. In addition, perform the following TD-LTE specific setup procedures.

1. Press the **Setup** main menu key.
2. Press the BW submenu key to open the Select Bandwidth list. Select the desired Bandwidth with the arrow keys or rotary knob and press **Enter**.
3. Press the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.
4. Press the EVM Mode submenu key to select either Auto or PBCH Only. Selecting Auto measures Physical Downlink Shared Channel (PDSCH) if data is available, otherwise it measures Physical Broadcast Channel (PBCH), a control channel that carries a broadcast message. Selecting PBCH Only forces a PBCH measurement.

| | |
|---|---|
| **Note** | The Constellation will show a QPSK constellation when PBCH is being measured. PBCH Only mode is especially useful when making measurements over the air under conditions where the transmitted data uses MIMO. |

5. Press the Trigger submenu key. The Trigger menu opens to set Trigger Source and Trigger Polarity. For Trigger Source, select No Trig or Ext. Then select the trigger edge by setting Trigger Polarity to Rising or Falling. Press the Back submenu key to return to the Setup menu.
6. *(Not applicable for all models)* Press the Ext. Ref. Freq submenu key to configure the instrument using an external reference frequency. The External Reference Frequency list opens. Highlight the desired frequency and press **Enter**.

## Antenna Status

The Antenna Status indicator can show when antennas are detected and which one is currently being measured. Antenna Status is displayed for any EVM measurement shown: Constellation, Control Channel Power, Modulation Summary and LTE Summary. The antennas icons are displayed at the lower-left corner of the display screen (Figure 6-1).

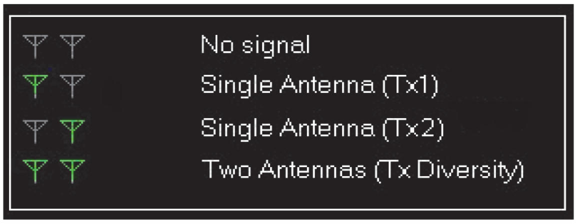



**Figure 6-1.** Antenna Status

# 6-3 TD-LTE RF Measurements

The following parameters are measured in the RF Measurement mode.

## Channel Spectrum

Channel Spectrum displays the spectrum of the input signal across one channel. The Channel Power and Occupied BW are computed and displayed below the graph.

### Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

### Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

## Power vs. Time

Power vs Time displays the power of the received signal in the time domain. A submenu allows the user to toggle between viewing 1 full Frame and 1 Sub-Frame and specify a Sub-Frame number when viewing just the Sub-Frame.

### Sub-Frame Power

Power of each sub-frame in dBm or Watts.

### Total Frame Power

Average power of the 10 sub-frames in dBm or Watts.

### DwPTS Power

The power of the Downlink Pilot Time Slot in Sub-Frame 1 in dBm or Watts.

### Transmit Off Power

The mean power measured over a 70 µs window in the transmitter OFF period.

**Cell ID**

Identifying information sent by the transmitter in the sync signal.

**Timing Error**

The error in time between the external trigger input signal and the start of the frame. The Timing Error is only displayed if Triggering is set up to use an external trigger signal to act as a timing reference.

## ACLR

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph. For example, when BW is set to 10 MHz, the channel spacing is –20 MHz, –10 MHz, +10 MHz and +20 MHz and the channels are color coded.

## Spectral Emission Mask

The Spectral Emission Mask (SEM) measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

## RF Summary

The RF Summary is a display of the occupied bandwidth, power of the main channel, upper adjacent channels, and lower adjacent channels in a table format. The RF Summary also shows the SEM status: PASS or FAIL. Refer to individual RF measurement descriptions for additional details on each measurement.

## RF Measurement Setups

### Channel Spectrum

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Channel Spectrum submenu key to activate this RF measurement view (Figure 6-2).
4. Press the Channel Spectrum submenu key again to select the Channel Spectrum menu, where you can adjust the span.

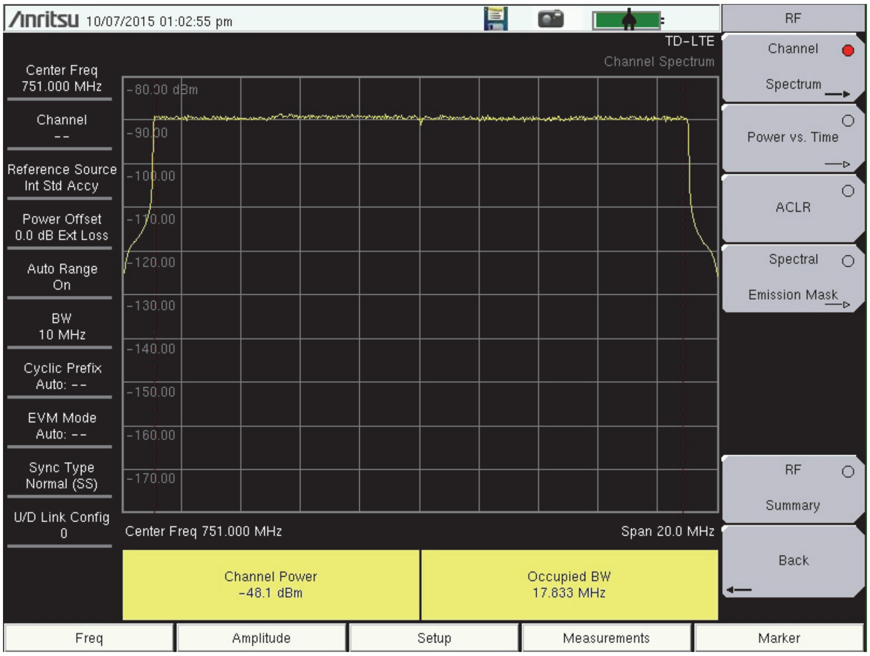



**Figure 6-2.** Channel Spectrum

5. Press the Back submenu key to return to the RF menu.

### Power vs. Time

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Power vs. Time submenu key to select measurement.
4. Press the Power vs. Time submenu key again to set the View and Sub-Frame Number parameters.

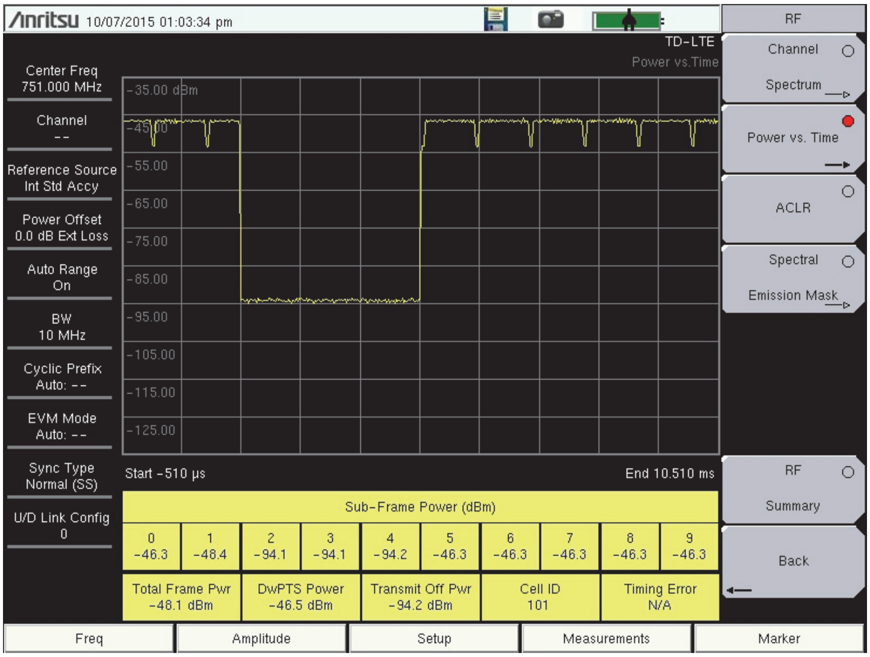



**Figure 6-3.** Power vs. Time

5. Press the Back submenu key to return to the RF menu.

## ACLR

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the ACLR submenu key to activate ACLR display and measurement (Figure 6-4).

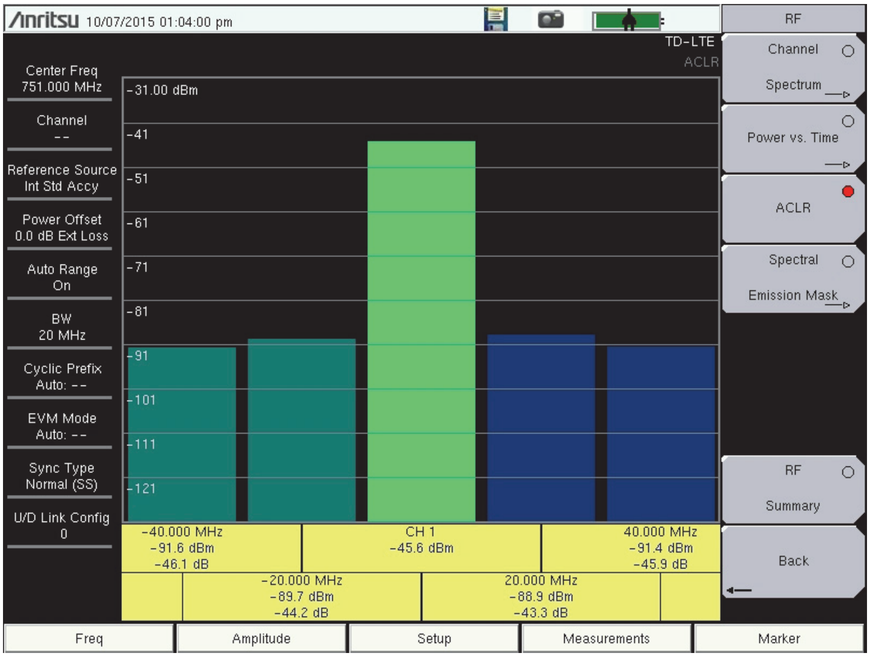



**Figure 6-4.** Adjacent Channel Leakage Ratio

4. Press the Back submenu key to return to the Measurements menu.

## Spectral Emission Mask

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Spectral Emission Mask submenu key to activate the Spectral Emission measurement and display (Figure 6-5).
4. Press the Spectral Emission Mask submenu key again to list the Spectral Emission menu and set up its parameters.
5. To view the measurement data in a table format, press the Summary Table submenu key so On is underlined.

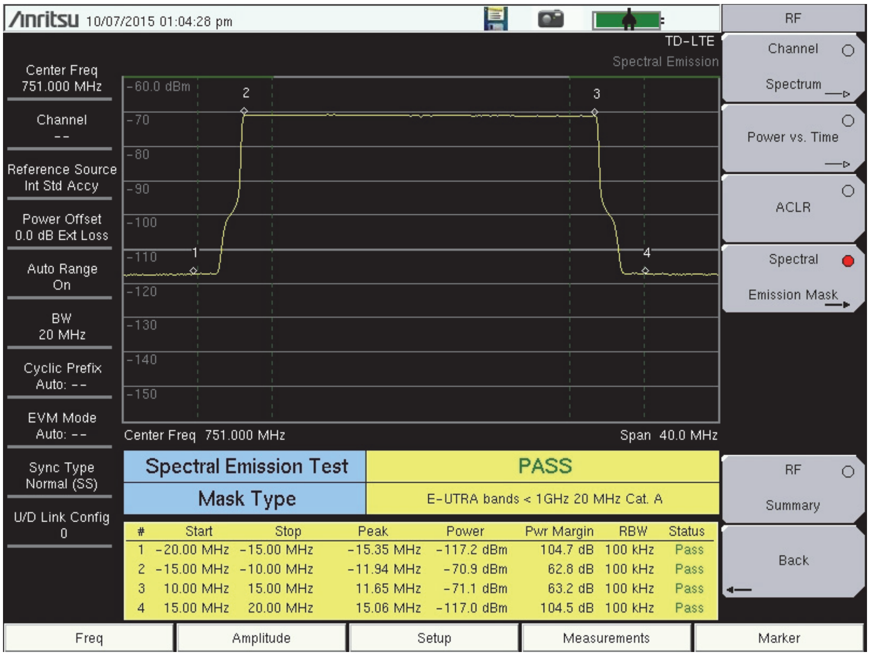



**Figure 6-5.** Spectral Emission Mask

6. Press the Back submenu key to return to the RF menu.

### RF Summary

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the RF Summary submenu key to activate and display the RF measurements in table format (Figure 6-6).

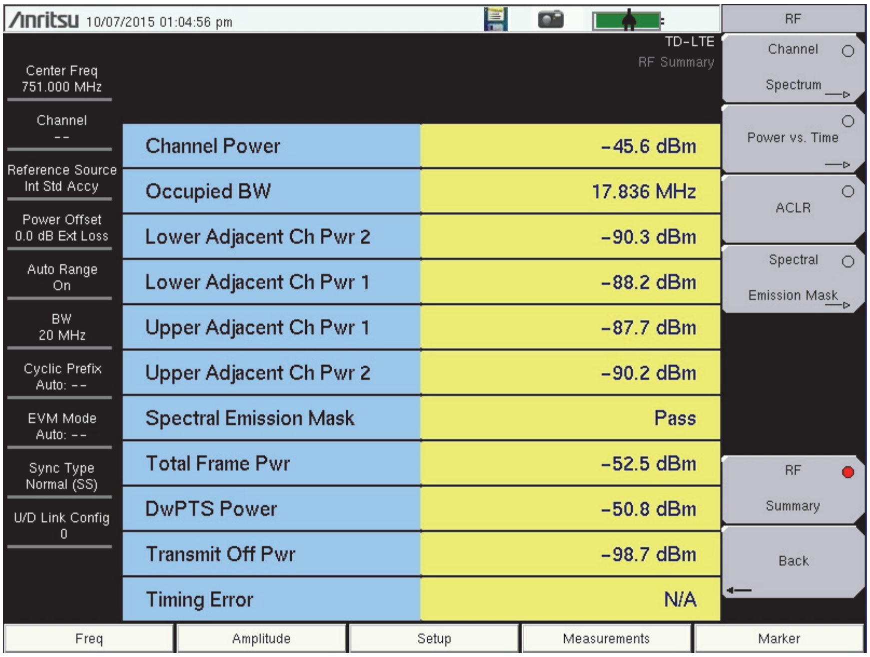



**Figure 6-6.** RF Summary

4. Press the Back submenu key to return to the Measurements menu.

# 6-4 TD-LTE Modulation Measurements

The following parameters are measured in the Modulation Measurement mode.

## Power vs Resource Block (RB)

This measurement display contains the Power vs RB grid, a RB Color Map, the measurements table and measurement progress bar.

### Two Dimensional Power vs RB Grid

This view shows the PDSCH power of each RB using color. The y-axis is frequency (sub-carriers) and the x-axis is time (sub-frames). The number of subcarriers varies depending on the bandwidth chosen and hence the number of RBs on the y-axis. Each cell bin the grid corresponds to a particular RB in a particular sub-frame. For TD-LTE, the number of Active Resource Blocks and Utilization is only displayed for sub-frame 0.

### Resource Block Color Map

The color mapping of the RB power level is determined by the RB Color Map Max Value and RB Color Map Range submenus. Setting these values can be done by entering them manually or by pressing Autoscale Color Map.

| **Note** | The Power Offset is applied to the measured value before matching to a color map. |
|---|---|

### Measurements Table

#### Active RBs

The number of active Resource Blocks in sub-frame 0. An RB is determined to be active if the measured PDSCH power is above a certain threshold that indicates that the RB is being used for carrying data.

#### Utilization

The percentage of Resource Blocks that carry data. It is the number of Active Resource Blocks in sub-frame 0 divided by the total number of Resource Blocks in sub-frame 0, expressed as a %.

#### Channel Power

Channel power is the average total power within the bandwidth and is expressed in dBm.

#### OSTP

OSTP is the measurement of the OFDM symbol transmit power.

#### EVM

The RMS (%) of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. Individual frame EVM(RMS) is displayed for the modulation types QPSK, 16-QAM, and 64-QAM.

#### Cell ID

Cell identifying information sent by the transmitter in the sync signal.

### Measurement Progress Bar

This progress bar indicates the sub-frame that is currently being measured.

### Markers

Markers are available for use in the Power vs Resource Block measurement. The markers will outline the selected RB. Above the two dimensional grid, the specific RB subcarrier/sub-frame coordinates will be displayed along with its power level.

## Constellation

This measurement displays the constellation of the demodulated symbols over the first sub-frame.

### Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

### EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value. Reset occurs when setup parameters are changed or by toggling the EVM Max Hold button.

### Freq Error

The difference between the measured carrier frequency and the specified carrier frequency is the frequency error. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

### Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

### Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

### EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value.

### Freq Error (ppm)

Freq Error displayed in parts per million (ppm).

### Cell ID

Cell identifying information sent by the transmitter in the sync signal.

## Control Channel Power

This measurement shows the power levels of key physical layer Control Channels and also includes the measurement results described in the "Constellation" section. EVM per control channel is also available, as well as a table view showing the power in both per-resource-element and total power formats.

**Ref Signal (RS) Power**

Reference Signal power displayed in dBm. The reference signal is used for downlink channel estimation.

**P-SS Power**

Primary Sync Signal power displayed in dBm or Watts. The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.

**S-SS Power**

Secondary Sync Signal power displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.

**PBCH Power**

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

**PCFICH Power**

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDCCH and PDSCH channels.

**PHICH Power**

Physical Hybrid Automatic Repeat Request Indicator Channel. Transmits the channel coded HARQ indicator codeword used for error correction.

**PDCCH Power**

Physical Downlink Control Channel.

**Ng**

Ng is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in a TD-LTE sub-frame (this number is constant for all sub-frames).

## Tx Time Alignment

Measures the delay between the signals from two antennas at the antenna ports.

## Modulation Summary

Modulation Summary displays the Ref Signal (RS) Power, Sync Signal (SS) Power, EVM (rms), Freq Error (Hz and ppm), Cell ID and PBCH Power in a table format. Refer to individual Modulation measurement descriptions for additional detail on each measurement.

## Modulation Measurement Setups

### Power vs Resource Block

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Power vs Resource Block submenu key to activate the Power vs Resource Block measurement view.

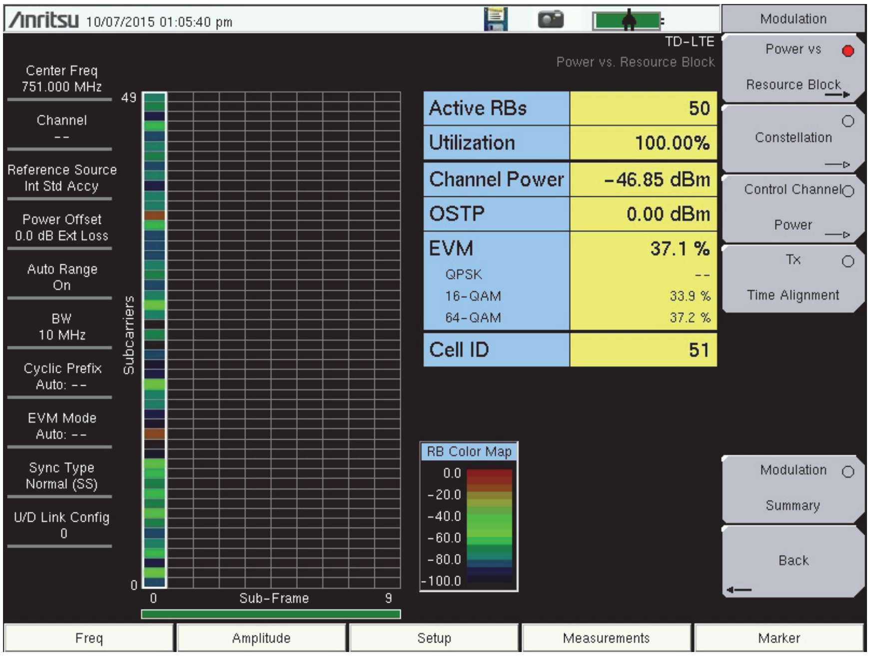



**Figure 6-7.** Power vs Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to list the Power vs RB Menu and set up the RB Color Map max value and range. Press the submenu key to change the desired parameter, or, press the Autoscale Color Map submenu key to automatically set the Max and Range values.
5. Press the Back submenu key to return to the Modulation menu.

### Markers

1. While in the Power vs Resource Block measurement, press the **Marker** main menu key. The RB Marker submenu opens. The Marker State button default value is On, so the markers highlight a row of sub-frames and a column of sub-carriers.
2. To immediately find the strongest subcarrier within the sub-frame, press the Peak Search button.
3. To choose a specific RB #, press the Marker RB # submenu key and move it to the desired RB# using the arrow buttons, knob or enter the RB number and press **Enter**.
4. To choose a specific sub-frame, press the Marker Sub-frame submenu key and move it to the desired Sub-frame using the arrow buttons, knob or enter the sub-frame number and press **Enter**.

### Constellation

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Constellation submenu key to activate the Constellation measurement view (Figure 6-8). Press the Constellation submenu key again to list the Constellation menu and set up the reference points and data legend.
   a. Press the Reference Points submenu key to turn the reference points (small white circles) On or Off.
   b. Press the Data Legend submenu key to turn the data legend On or Off.

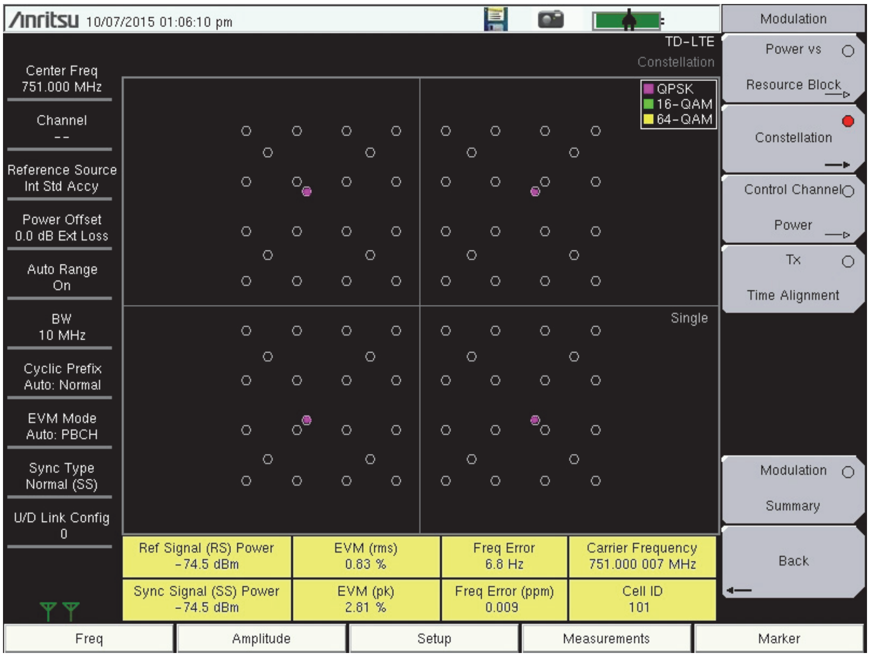



**Figure 6-8.** Constellation Measurement View

4. Press the Back submenu key to return to the Modulation menu.

## Control Channel Power

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Control Channel Power submenu key to activate the Control Channel Power display in table format (Figure 6-9). Press the key again to view or change the Display Mode and Control Channel EVM settings.

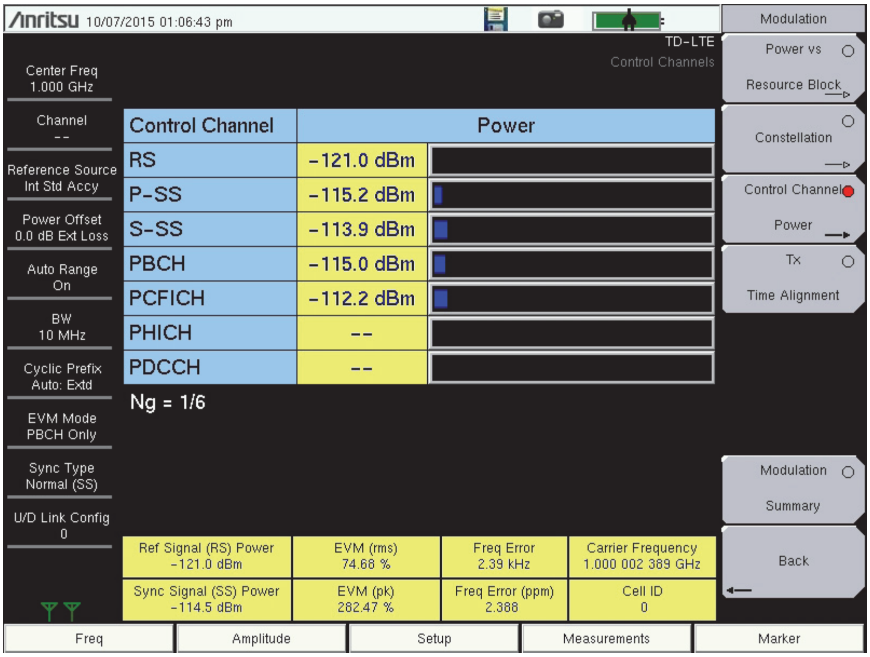



**Figure 6-9.** Control Channel Power

4. Press the Back submenu key to return to the Modulation menu.

### Tx Time Alignment

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Tx Time Alignment submenu key to set the modulation measurement to Tx Time Alignment view (Figure 6-10).

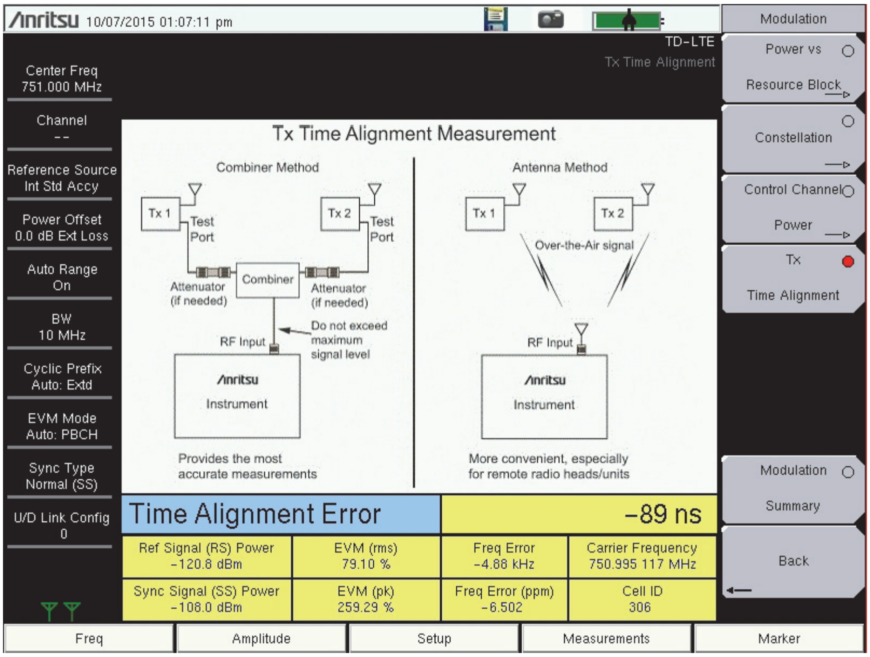



**Figure 6-10.** Tx Time Alignment

4. Press the Back submenu key to return to the Measurements menu.

### Modulation Summary

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Modulation Summary submenu key to activate and display the modulation measurements in table format (Figure 6-11).

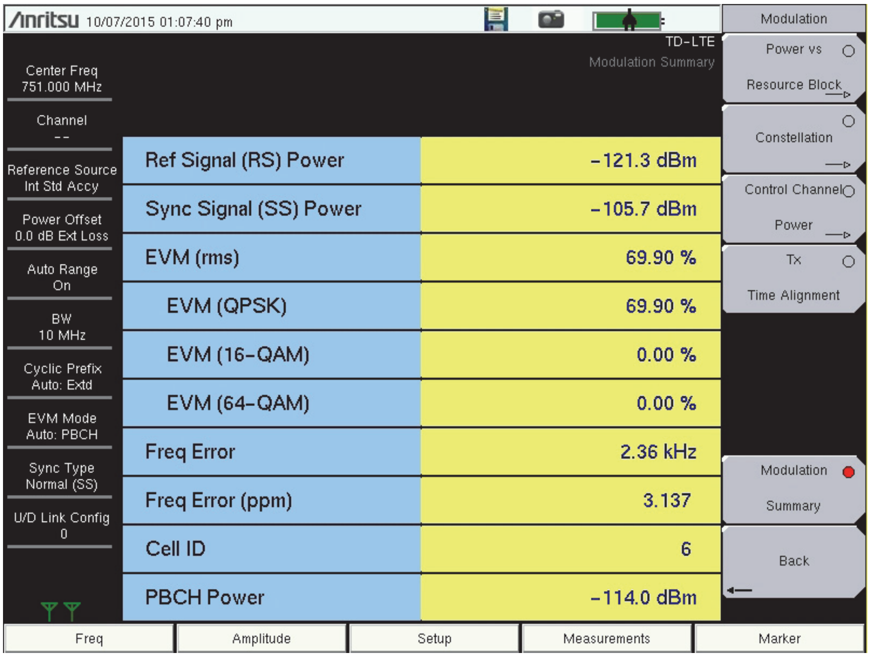



**Figure 6-11.** Modulation Summary

4. Press the Back submenu key to return to the Measurements menu.

# 6-5 TD-LTE Over-the-Air (OTA) Measurements

Scanner, Tx Test, Antenna Status and Mapping are measurements taken over the air. EMF measurements are available only with Option 444.

Antenna Status and the PBCH Modulation Results table are displayed when the Show Mod Results are set On for Scanner and Tx Test measurements. The PBCH Modulation Results table is the same numeric results table displayed in LTE Modulation Constellation and Control Channel Power measurements.

## Antenna Status

The Antenna Status indicator shows the number of antennas detected and which one is currently being measured. In OTA Measurements, the Antenna Status is displayed when Show Mod Results is On for Scanner and Tx Test.

## Scanner

The Scanner measurement scans for the presence of up to 6 cell IDs and the following measurements.

**Cell ID, Sector ID, Group ID**

Identifying information sent by the transmitter in the sync signal.

**S-SS Power**

Secondary Sync Signal power is displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. S-SS Power contains information needed for cell search.

**RSRP**

Reference Signal Received Power. Provides the UE with essential information about the strength of cells from which path loss can be calculated and used for determining optimum power settings for operating networks. RSRP is used in both idle and connected states. RSRP is used as a parameter in multi-cell scenarios.

**RSRQ**

Reference Signal Receive Quality. Provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRP is the ratio between RSRP and RSSI measured in dB.

**SINR**

Signal-to-Inference Noise Ratio in dB.

**Dominance**

Dominance is the ratio of the power for the largest signal to the sum of all other signals found, in dB.

## Tx Test

Tx Test measurements are optimized for remote radio heads and MIMO systems. The first table in Tx Test replicates the Scanner table measurements, except the measurement scans the presence of up to 3 cell IDs. The second table shows the RS power across all detected antennas (transmitters) for the strongest Cell ID. This is displayed as average power and delta power for the detected transmitters, along with a small bar graph that shows the relative RS powers for each Tx. The PBCH Modulation Results table can also be turned on.

## Mapping (Coverage Mapping)

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ) and SINR. It is the same measurement as in Scanner which scans for the presence of up to 6 cell IDs but only displays the presence of up to 3 cell IDs. For full details regarding Coverage Mapping set up and testing, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

## Carrier Aggregation

This measurement displays a table of up to five Component Carriers (CC) used in Carrier Aggregation and their measured signal components.

**Frequency**

This is the set center frequency.

**Bandwidth (BW)**

This is the set bandwidth of the Component Carrier.

**Cyclic Prefix (CP)**

The length of Cyclic Prefix can be specified as either Normal or Extended.

**MIMO**

The MIMO status indicators show which transmitters are active in a MIMO configuration. Active transmitters display as a green dot, inactive as grey. They correspond to the antenna icons shown at the bottom left of the screen for each Component Carrier scanned.

**Reference Signal (RS) Power**

Reference Signal power is displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

**RS Delta Power**

RS Delta Power shows the maximum relative power difference in dB between the RS powers of the MIMO signals and can be used to check correct MIMO configuration.

**Sync Signal (SS) Power**

Sync signal power is displayed in dBm or Watts.

**EVM (rms)**

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**EVM (pk)**

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**Freq Error**

This is the difference between the measured carrier frequency and the specified carrier frequency. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

**Freq Error (ppm)**

This is the frequency error displayed in parts per million.

**TAE**

Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

**Cell ID**

Cell identifying information sent by the transmitter in the sync signal.

## EMF (Option 444 only)

EMF measurements are available in Over-the-Air TD-LTE Signal Analyzer mode only when Option 444 is installed. The option requires an isotropic antenna, at a frequency range that is within specification of the instrument used. Refer to the isotropic antenna and spectrum analyzer Technical Data Sheets.

Chapter 8, "EMF (Option 444)" provides connection instructions for the antenna and detailed descriptions of the EMF Measurement menu and submenus.

## Measurement Setup

### Scanner

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Scanner submenu key to activate the OTA Scanner display (Figure 6-12 on page 6-20). Press the Scanner key again to display the OTA Scanner menu.
   a. Press the Sort By... submenu key to list the Sort By menu and select the parameter the OTA Scanner will use for sorting (Power, Cell ID, or Sector ID). Press Back to return to the OTA Scanner menu.
   b. Press the Show Mod Results submenu key to display or hide the Modulation Results of the strongest signal.

| | |
|---|---|
| **Note** | When Show Mod Results is on, the overall scanner measurement speed is slower due to the additional time required to demodulate the strongest signal.<br>Some instruments require the TD-LTE demod option to toggle this submenu to On. |

c. Use the Auto Save submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file.

4. Press the Back submenu key to return to the Over-the-Air menu.

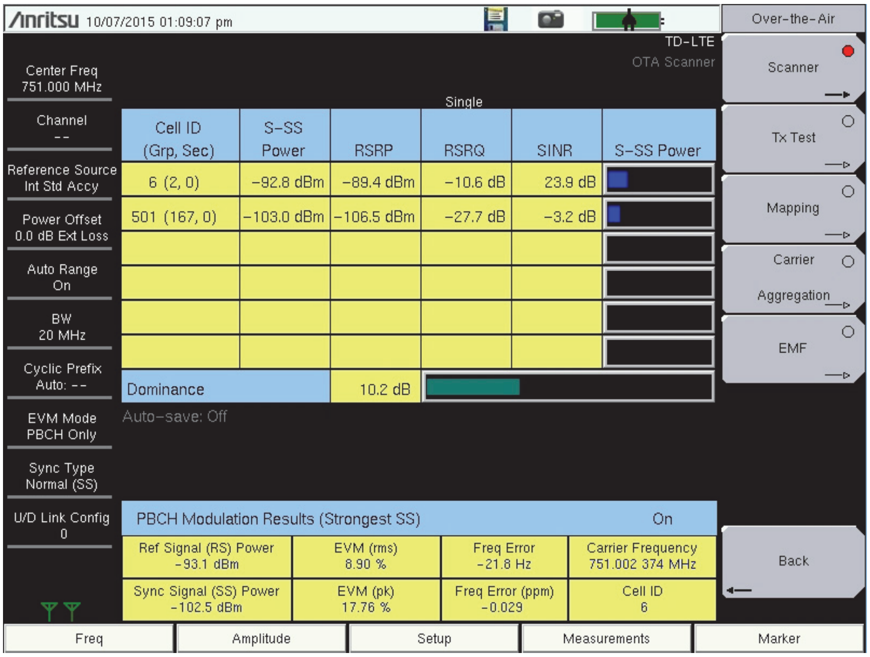



**Figure 6-12.** Over-the-Air Measurements

### Tx Test

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Tx Test submenu key to activate the OTA Tx Test display (Figure 6-13 on page 6-21). Press the Tx Test key again to display the OTA Tx Test menu.
4. Press the Show Mod Results key to display or hide the PBCH Modulation Results (Strongest SS) table.
5. Press **Back** to return to the Over-the-Air menu.

| | |
|---|---|
| **Note** | When Show Mod Results is on, the Tx Test measurement speed is slower due to the additional time required to demodulate the strongest signal.<br>Some instruments require the TD-LTE demod option to toggle this submenu to On. |

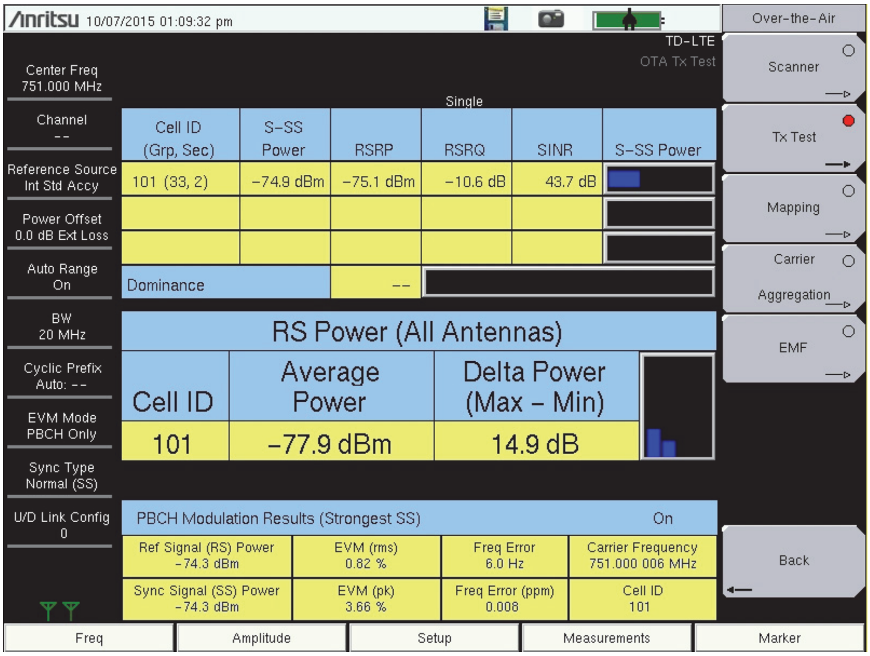



**Figure 6-13.** Over-the-Air Tx Test Measurement

### Mapping

Refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

### Carrier Aggregation

Refer to "Carrier Aggregation Menu" on page 6-45.

### EMF

Refer to "LTE/TD-LTE EMF Menu" on page 8-2.

# 6-6 Pass/Fail Tests

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail Test submenu key to activate the Pass/Fail display in table format (Figure 6-14). Press the Pass/Fail Test submenu key again to select a Pass/Fail test.
   a. Press the Select Pass/Fail Test submenu key to open the Select Pass Fail Test window. Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test. Refer to the instrument User Guide and the Master Software Tools (MST) User Guide for creating new Pass/Fail tests.
   b. Press the Reset submenu key to erase a previous measurement/s and restart the Pass/Fail test.

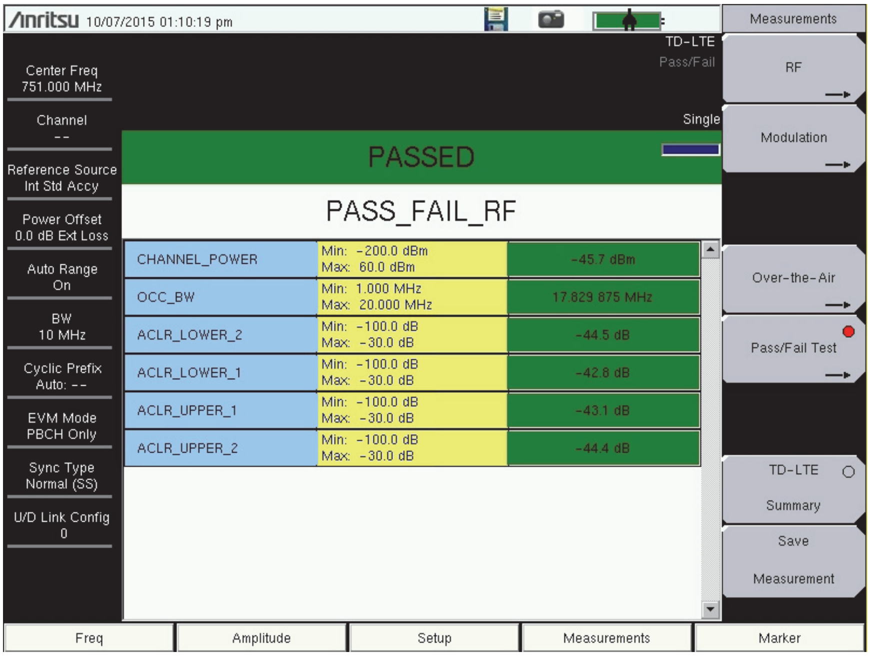



**Figure 6-14.** Past/Fail Test

3. Press the Back submenu key to return to the Measurements menu.

# 6-7 TD-LTE Summary

The following parameters are displayed in the TD-LTE summary measurement.

**Freq Error**

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

**Occupied BW**

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

**Carrier Frequency**

Carrier Frequency is the measured transmitter operating center frequency.

**Channel Power**

Channel power measures the average power within the selected bandwidth and is expressed in dBm.

**Ref Signal (RS) Power**

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

**Sync Signal (SS) Power**

Sync signal power displayed in dBm or Watts.

**EVM (rms)**

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

**PBCH Power**

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

**PCFICH Power**

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDSCH (Physical Downlink Shared Channel).

**Spectral Emission Mask**

Displays a Pass/Fail status for the signal measured against the selected mask.

## Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the TD-LTE Summary submenu key to activate and display the TD-LTE measurements in table format.

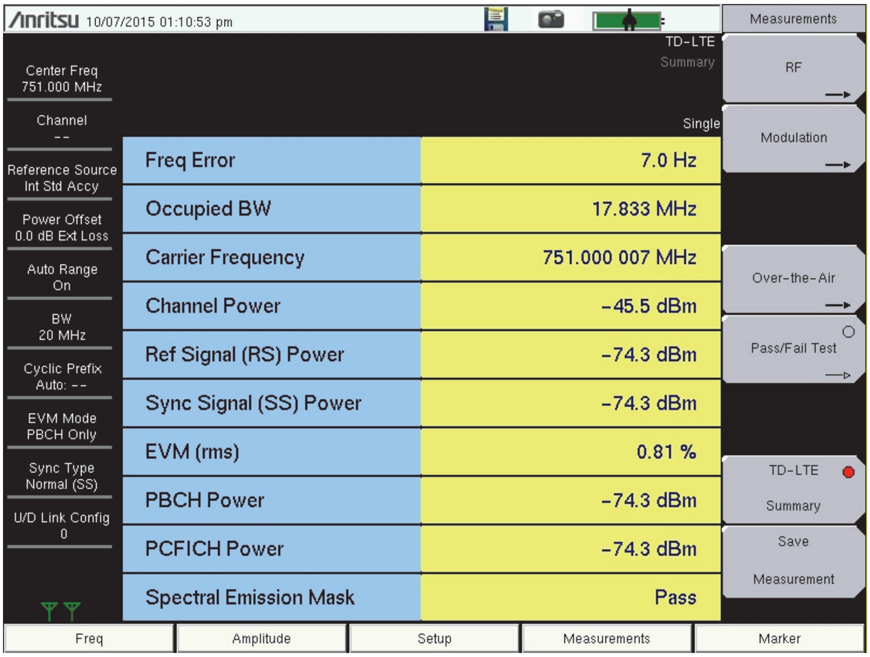



**Figure 6-15.** TD-LTE Summary

# 6-8 TD-LTE Menus

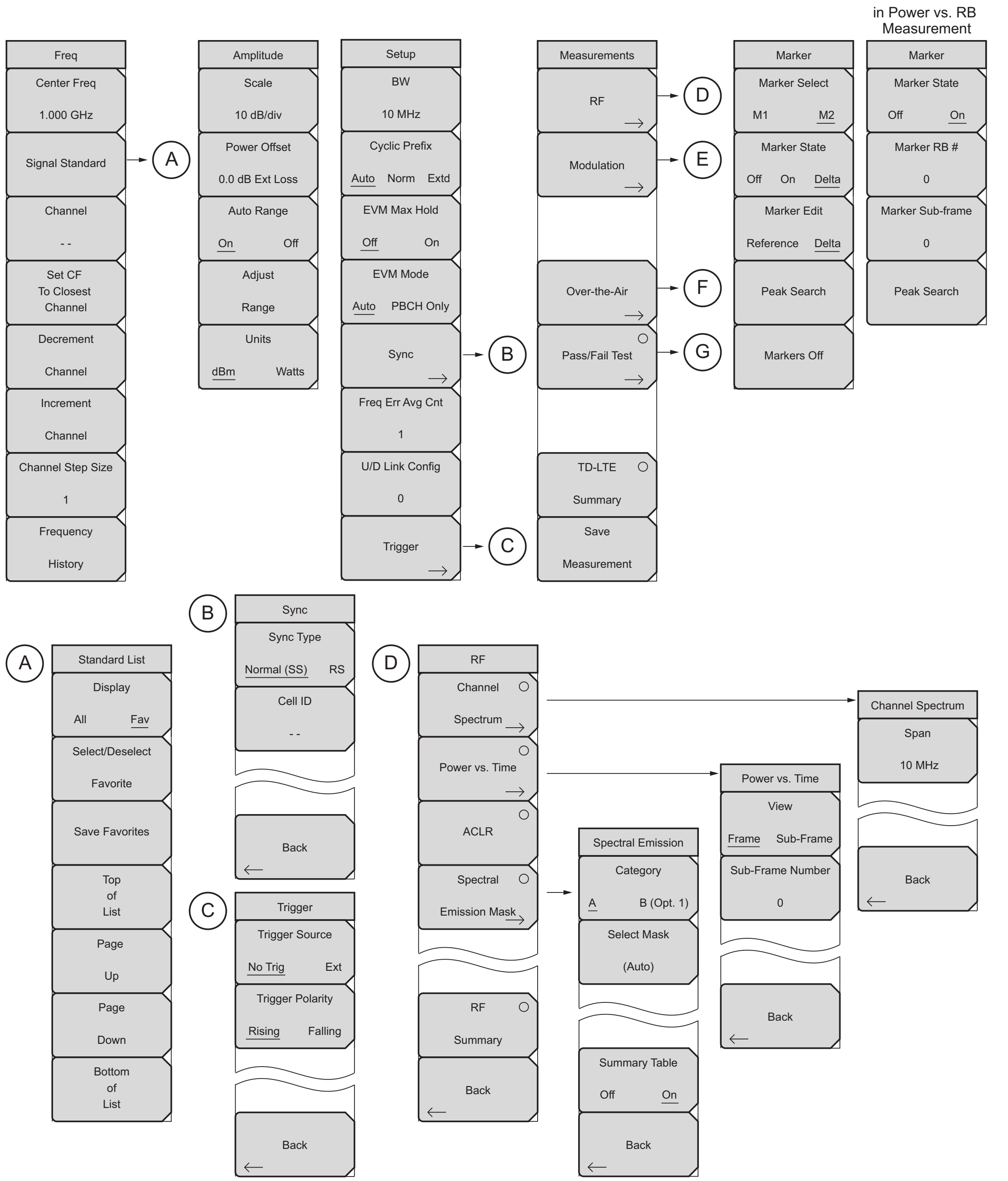



**Figure 6-16.** TD-LTE Menu Layout (1 of 3)

# TD-LTE Menus (continued)

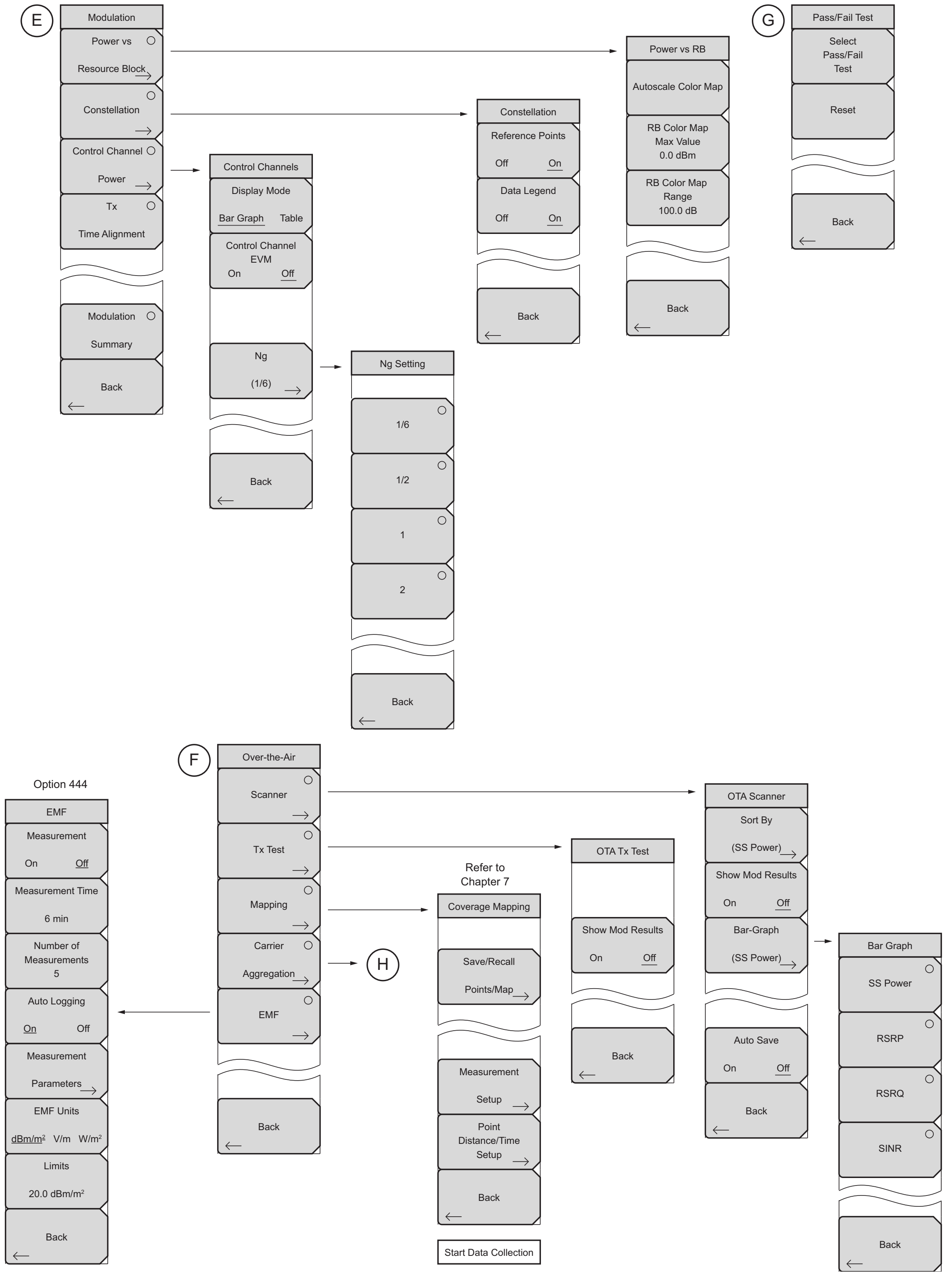



**Figure 6-17.** TD-LTE Menu Layout (2 of 3)

## TD-LTE Menus (continued)

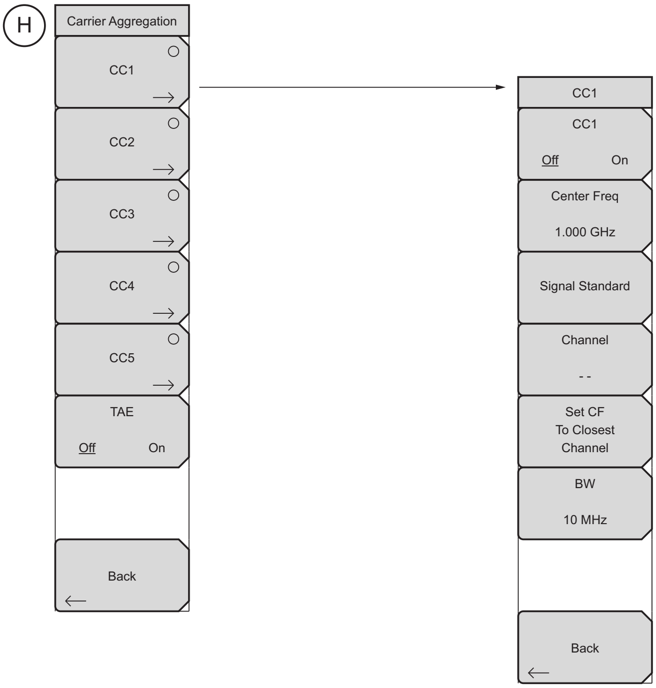
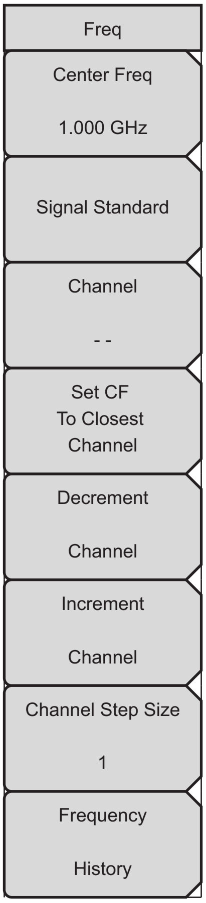



**Figure 6-18.** TD-LTE Menu Layout (3 of 3)

# 6-9 Freq (Frequency) Menu

Key Sequence: **Freq**




**Center Freq:** Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

**Signal Standard:** Opens the Signal Standards list box in order to select signal standard.

**Channel:** Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

**Set CF to Closest Channel:** Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

**Decrement Channel:** Decrements the channel by one channel.

**Increment Channel:** Increments the channel by one channel.

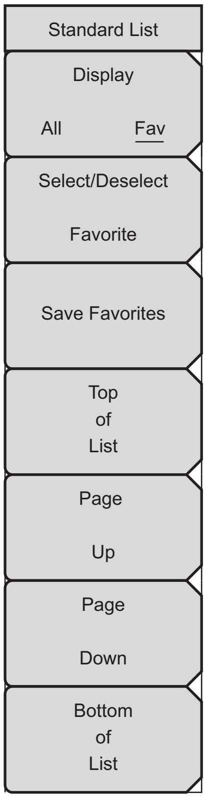
**Channel Step Size:** Use this submenu key to specify the step size used for incrementing or decrementing the channel number. Change the step value by using the arrow keys or rotary knob. Press the **Enter** key to set the value.

**Frequency History:** Opens a list box that displays the last five selected frequencies. When a frequency is entered using the Center Frequency submenu key or the Signal Standard/Channel submenu keys, the list will be updated.

**Figure 6-19.** TD-LTE Freq Menu

## Standard List Menu

Key Sequence: **Freq** > Signal Standard




**Display:** Toggles between displaying all available signal standards and the signal standards marked as favorites (* in the Fav column).

**Select/Deselect Favorite:** Press this submenu key to select or deselect a signal standards as a favorite.

**Save Favorites:** Press this submenu key to have the instrument save to memory the signal standards were selected as favorites. Next time the signal standard list is displayed, these signal standard will be marked as favorites (* in the Fav column).

**Top of List:** Press this submenu key to display the first signal standard in the list.

**Page Up:** Press this submenu key to scroll up one page in the signal standard list.

**Page Down:** Press this submenu key to scroll down one page in the signal standard list.

**Bottom of List:** Press this submenu key to display the last signal standard in the list.

Press **Esc** to close the Signal Standards list and return to the Frequency menu.

**Figure 6-20.** TD-LTE Signal Standards

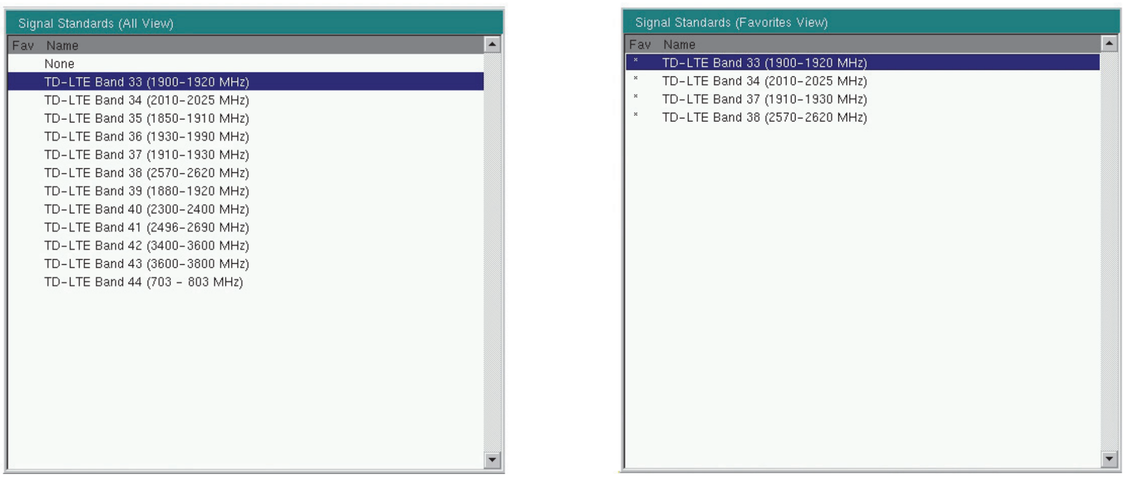
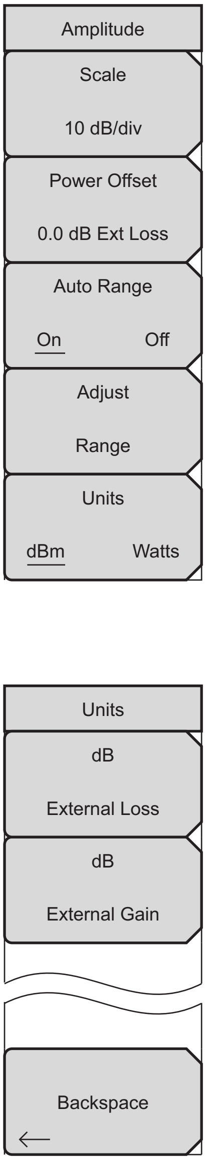



**Figure 6-21.** TD-LTE Signal Standard List, All and Favorites

# 6-10 Amplitude Menu

Key Sequence: **Amplitude**




**Scale:** Press this submenu key to change the scale of the y-axis in the RF measurement displays. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div.

**Power Offset:** Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

**Auto Range:** Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

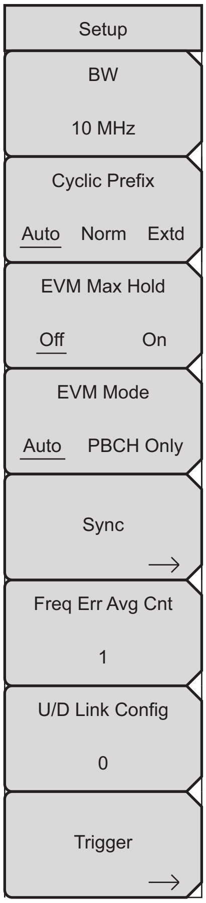
**Adjust Range:** Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

**Units:** Press this submenu key to set the units for all measurements and summary tables in either dBm or Watts.

**Figure 6-22.** TD-LTE Amplitude Menu

# 6-11 Setup Menu

Key Sequence: **Setup**




**BW:** Opens the Select Bandwidth list. Choose from the following bandwidths: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, or 20 MHz.

**Cyclic Prefix:** Press this submenu key to set the instrument to measure signal with a Normal or Extended Cyclic Prefix, or to allow the instrument to detect the Cyclic Prefix automatically.

**EVM Max Hold:** Turn the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.

**EVM Mode:** Press this key to select either Auto or PBCH Only. Selecting Auto measures PDSCH if data is available, otherwise, it measures PBCH. Selecting PBCH Only forces a PBCH measurement and the constellation measurement will only show QPSK. The instrument will automatically choose PBCH Only mode when the OTA Scanner is used.

**Sync:** Press this key to open the “Sync Menu” on page 6-32.

**Freq Err Avg Cnt:** When the count is greater than one, the frequency error value is averaged over past measurements. If the count is one, then no averaging occurs.

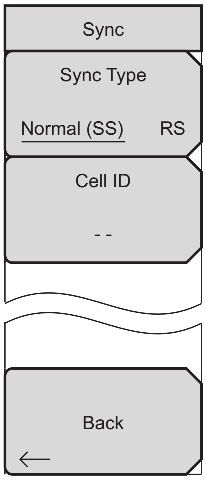
**U/D Link Config:** Press this key to set the Uplink/Downlink configuration, also known as the Frame Format. Use the keypad, arrow keys, or the rotary knob to set the value between 0 and 6 inclusive. This selection determines which subframes are uplink subframes and which are downlink subframes, and where the transitions between uplink and downlink subframes occur.

**Trigger:** Press this key to open the “Trigger Menu” on page 6-32.

**Figure 6-23.** TD-LTE Setup Menu

## Sync Menu

Key Sequence: **Setup** > Sync




**Sync Type:** Press to choose between the Normal (SS) or RS Sync Type. Only choose RS when there is no sync signal present in the transmitter under test. If RS is chosen and a sync signal is present, no modulation measurements will be available.

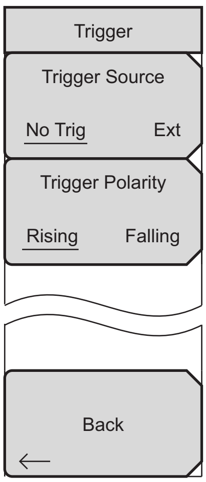
**Cell ID:** Identifying information sent by the transmitter in the sync signal. If Normal (SS) is selected as the Sync Type, the Cell ID is extracted automatically from the Sync Signal. The Cell ID must be entered manually when RS Sync Type is selected. For user convenience, the Cell ID is automatically populated from the last measured signal with an SS.

**Back:** Press this submenu key to return to the "Setup Menu" on page 6-31.

**Figure 6-24.** TD-LTE Sync Menu

## Trigger Menu

Key Sequence: **Setup** > Trigger




**Trigger Source:** Press this key to choose between No Trig or External (Ext). When Ext is chosen, the instrument uses an external trigger input to determine frame start timing for data acquisition. The internal algorithms will search for a frame sync and use the delta between the external timing reference and internal sync to compute a 'Timing Error' measurement.

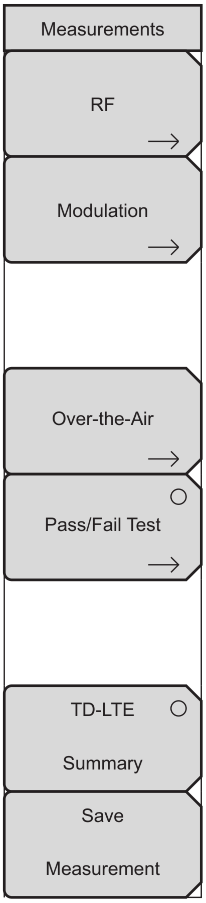
**Trigger Polarity:** Select the desired edge of the external trigger source to use for reference.

**Back:** Press this submenu key to return to the "Setup Menu" on page 6-31.

**Figure 6-25.** TD-LTE Sync Menu

# 6-12 Measurements Menu

Key Sequence: **Measurements**




**RF:** Press this submenu key to display the “RF Menu” on page 6-34.

**Modulation:** Press this submenu key to display the “Modulation Menu” on page 6-37.

**Over-the-Air:** Press this submenu key to display the “Over-the-Air Menu” on page 6-41.

**Pass/Fail Test:** Press this submenu key to activate the Pass/Fail test. Press the key again to display the “Pass/Fail Test Menu” on page 6-47 and set up pass/fail testing.

**TD-LTE Summary:** Press this submenu key to display a table of the TD-LTE measurements. The following measurement values are displayed in the table:

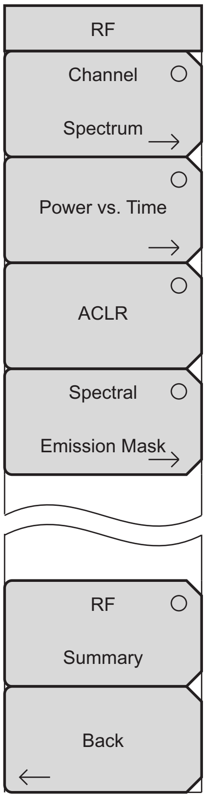
Freq Error
Occupied BW
Carrier Frequency
Channel Power
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
PBCH Power
PCFICH Power
Spectral Emission Mask

**Save Measurement:** Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument’s User Guide for information on file management functions.

**Figure 6-26.** TD-LTE Measurements Menu

## RF Menu

Key Sequence: **Measurements** > RF




**Channel Spectrum:** Opens the "Channel Spectrum Menu" on page 6-35. Displays the spectrum of the input signal. Beneath the graph, values for the following measurements are displayed: Channel Power and Occupied BW. Channel Power is displayed in dBm or Watts (based on the Units submenu setting in the **Amplitude** menu) and Occupied BW is displayed in MHz. Press this button again to list the Channel Spectrum menu to set the Span.

**Power vs. Time:** Opens the "Power vs. Time Menu" on page 6-35. Displays the Power vs. Time graph showing the signal in the time domain.

**ACLR:** Displays a bar graph of the main channel power and two adjacent channels on either side. The table underneath the chart lists the frequency, power, and power relative to the main channel (in dB).

**Spectral Emission Mask:** Opens the "Spectral Emission Menu" on page 6-36. The Spectral Emission Mask measurement supports the testing for "Operating Band Unwanted Emissions" described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region. Press this button again to list the Spectral Emission submenu.

**RF Summary:** Press this submenu key to display the following RF measurements in table format:

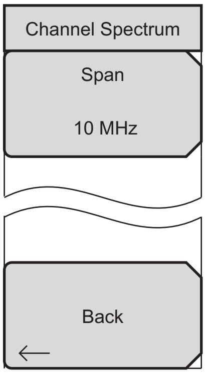
Channel Power
Occupied BW
Lower Adjacent CH Pwr 2
Lower Adjacent CH Pwr 1
Upper Adjacent CH Pwr 1
Upper Adjacent CH Pwr 2
Spectral Emission Mask
Total Frame Pwr
DwPTS Power
Transmit Off Pwr
Timing Error

**Back:** Press this submenu key to return to the "Measurements Menu" on page 6-33.

**Figure 6-27.** TD-LTE RF Menu

## Channel Spectrum Menu

Key Sequence: **Measurements** > RF > Channel Spectrum



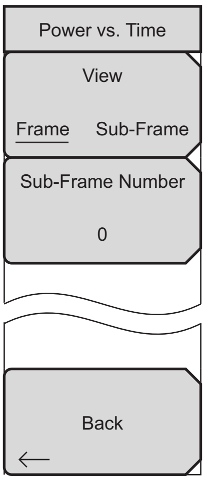

**Span:** Opens the Span list to select a span of Auto, 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz, or 30 MHz.

**Back:** Returns to the "RF Menu" on page 6-34.

**Figure 6-28.** TD-LTE Channel Spectrum Menu

## Power vs. Time Menu

Key Sequence: **Measurements** > RF > Power vs. Time




**View:** Press to select either Frame or Sub-Frame

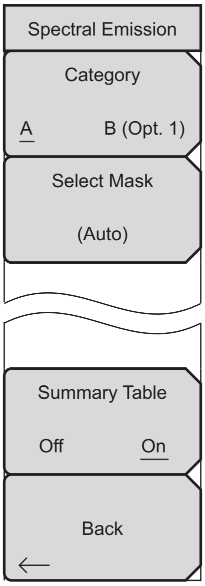
**Sub-Frame Number:** If Sub-Frame is selected, press to enter the desired sub-frame to view.

**Back:** Returns to the "RF Menu" on page 6-34.

**Figure 6-29.** TD-LTE Power vs. Time Menu

## Spectral Emission Menu

Key Sequence: **Measurements** > RF > Spectral Emission




**Category A B (Opt. 1):** Select the desired category based on the information on page 6-34.

**Select Mask (Auto):** Displays a list of standard and custom masks for use in SEM measurements. Select “Auto Select” if the desired mask is unknown.

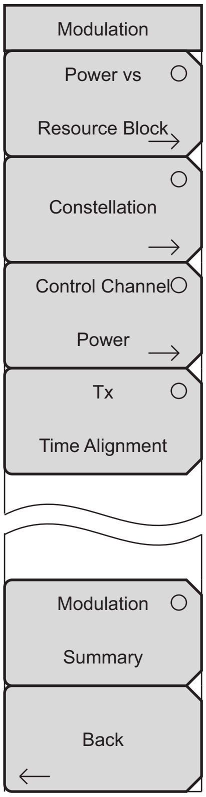
**Summary Table:** Displays the Spectral Emission measurement data in table form.

**Back:** Returns to the “RF Menu” on page 6-34.

**Figure 6-30.** TD-LTE Spectral Emission Menu

## Modulation Menu

Key Sequence: **Measurements** > Modulation




**Power vs Resource Block:** Press once to display the Power vs. Resource Block measurement window. Press again to open the "Power vs. Resource Block Menu" on page 6-38 for setting up the Resource Block Color Map parameters.

**Constellation:** Press this submenu key to set the modulation measurement to Constellation view. This view displays the constellation of the modulated data symbols over subframe 0. Press the key again to open the "Constellation Menu" on page 6-39.

**Control Channel Power:** Press the Control Channel Power submenu key to set the display as bar graph or table. Refer to the "Control Channel Power Menu" on page 6-40.

**Tx Time Alignment:** Press to set the modulation measurement to Tx Time Alignment view. Refer to "Tx Time Alignment" on page 6-15.

**Modulation Summary:** Press this submenu key to display a summary table of all of the modulation-related numerical measurement results:

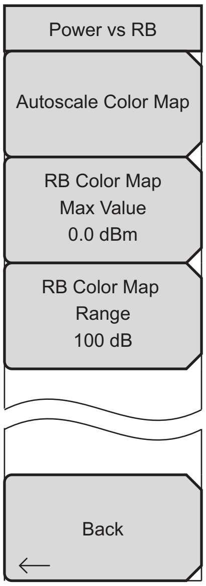
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

**Back:** Press this submenu key to return to "Measurements Menu" on page 6-33.

**Figure 6-31.** TD-LTE Modulation Menu

## Power vs. Resource Block Menu

Key Sequence: **Measurements** > Modulation > Power vs. Resource Block




**Autoscale Color Map:** Adjusts the RB Max Value and Range automatically on the color map.

**RB Color Map Max Value:** Press to adjust the RB Color Map Max Value manually.

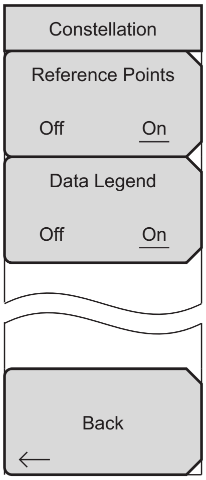
**RB Color Map Range:** Press to adjust the RB Color Range manually.

**Back:** Press this submenu key to return to the “Modulation Menu” on page 6-37.

**Figure 6-32.** TD-LTE Power vs. Resource Block Menu

## Constellation Menu

Key Sequence: **Measurements** > Modulation > Constellation




**Reference Points:** Press this submenu key to display reference points (small white circles) for the various constellations. On is the default state.

**Data Legend:** Turns the legend box in the top right corner of the constellation graph On and Off. On is the default state.

**Back:** Press this submenu key to return to the "Modulation Menu" on page 6-37.

The constellations are color coded as follows:

QPSK is shown in purple
16-QAM is shown in green
64-QAM is shown in yellow

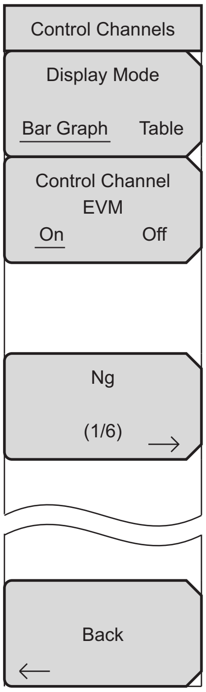
Values for the following measurements are shown beneath the graph:

Ref. Signal (RS) Power
EVM (rms)
Freq Error
Carrier Frequency
Sync Signal (SS) Power
EVM (pk)
Freq Error (ppm)
Cell ID

**Figure 6-33.** TD-LTE Constellation Menu

## Control Channel Power Menu

Key Sequence: **Measurements** > Modulation > Control Channel Power




**Display Mode:** Select Bar Graph or Table as the desired view.

**Control Channel EVM On Off:** When On, the EVM column is included to display the EVM of each control channel. The EVM column is included for either Bar Graph or Table displays.

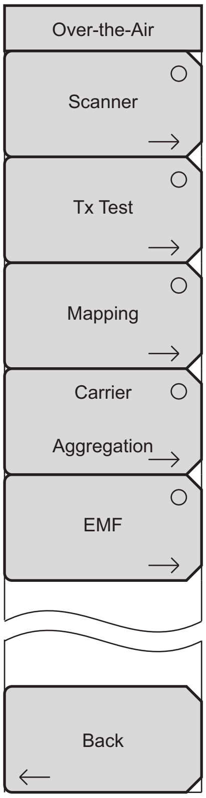
**Ng (1/6):** Determines the number of PHICH groups in a LTE sub-frame.

**Back:** Press this submenu key to return to the "Modulation Menu" on page 6-37.

**Figure 6-34.** TD-LTE Control Channel Menu

## Over-the-Air Menu

Key Sequence: **Measurements** > Over-the-Air




**Scanner:** Press this submenu key to display the Scanner table, which shows several power measurements for multiple base stations at the same frequency. Measurements include Sync Signal (S-SS) Power, RSRP, RSRQ, and SINR. Press the key again to display the "OTA Scanner Menu" on page 6-42 to set up Sort By and Show Mod Results.

**Tx Test:** Opens the OTA Tx Test mode. Press it again to open the "Over-the-Air Tx Test Menu" on page 6-43 and the Show Mod Results submenu key.

**Mapping:** Sets the display for coverage mapping. Press it again to set the coverage mapping parameters – Save/Recall Points/Map, Measurement Setup and Point Distance/Time Setup.

For full details, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

**Carrier Aggregation:** Press this submenu key to display the Carrier Aggregation Component Carrier frequencies and measured parameters. In the Carrier Aggregation Menu, select the desired Component Carrier to set up for measurement. Refer to "Carrier Aggregation Menu" on page 6-45.

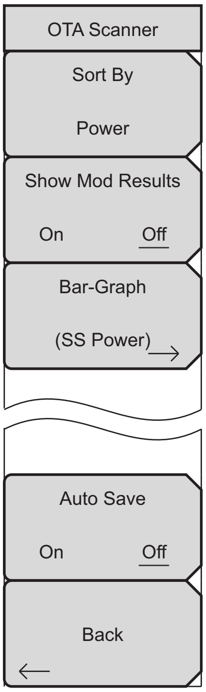
**EMF** (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this button opens the "LTE/TD-LTE EMF Menu" on page 8-2.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 6-33.

**Figure 6-35.** TD-LTE Over-the-Air Menu

## OTA Scanner Menu

Key Sequence: **Measurements** > Over-the-Air > Scanner > Scanner




**Sort By:** Opens the Sort By list dialog. Choose one of the following parameters to sort the Scanner table rows.

Cell ID
Group ID
Sector ID
S-SS Power
RSRP
RSRQ
SINR

**Show Mod Results (Demod option required on some instruments):** Displays in table format the following measurements and information.

Ref. Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM (pk)
Freq Error
Freq Error (ppm)
Carrier Frequency
Cell ID

**Bar-Graph:** Opens the Bar Graph menu to select the parameter to be displayed in the last (rightmost) column of the bar graph: SS Power, RSRP, RSRQ or SINR. Press **Back** to return to the OTA Scanner menu.

**Auto Save:** Use this submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file. When a file is full, a new file is automatically created.

Files are automatically saved to the instrument's Current Location selection in the subdirectory /Internal Memory/user. Refer to the File Management chapter in your instrument User Guide for instructions on setting the Current Location for saving files.

File names are automatically created:

Yyyymmddhhnnss.tdlte

*example:* 2009081122332244.tdlte

y - year, 2009, m - month, 08, d - day, 11, h - hour, 22, n - minutes, 33
s - seconds, 44

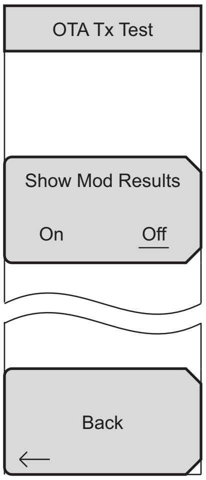
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

**Back:** Press this submenu key to return to the "Over-the-Air Menu" on page 6-41.

**Figure 6-36.** TD-LTE OTA Scanner Menu

## Over-the-Air Tx Test Menu

Key Sequence: **Measurements** > Over-the-Air > Tx Test



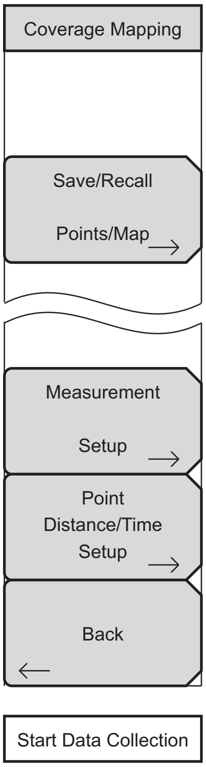

**Show Mod Results:** When set to Off, the PBCH Results table and Antenna Status indicators are not displayed. When set to On, the Antenna Status and PBCH Modulation Results table are displayed.

**Back:** Press this submenu key to return to the "Over-the-Air Menu" on page 6-41.

**Figure 6-37.** TD-LTE Over-the-Air Tx Test Menu

## Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping




**Save/Recall Map Points:** Opens the “Mapping Save/Recall Menu” on page 7-13.

**Measurement Setups:** Opens the “Measurement Setup Menu” on page 7-14.

**Point Distance/Time Setup:** Opens the “Point Distance/Time Setup Menu” on page 7-15.

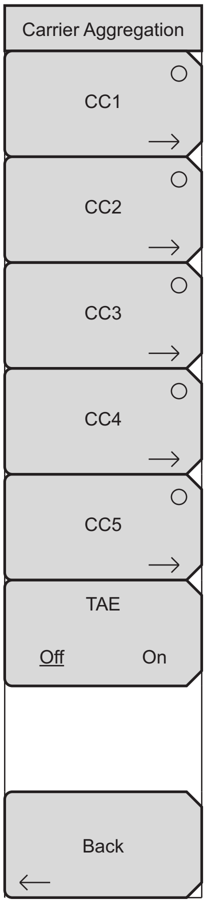
**Back:** Returns to the “Over-the-Air Menu” on page 6-41.

**Start/Stop Data Collection:** Press this main menu key to start coverage mapping data collection based on Measurement Setup settings and Point Distance/Time Setup settings. A running count of collected data points is displayed at the bottom of the screen. Press again to stop data collection.

**Figure 6-38.** Coverage Mapping Menu

## Carrier Aggregation Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation




**CC1 through CC5:** Select the desired Component Carrier to set up for measurement. See Figure 6-40.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

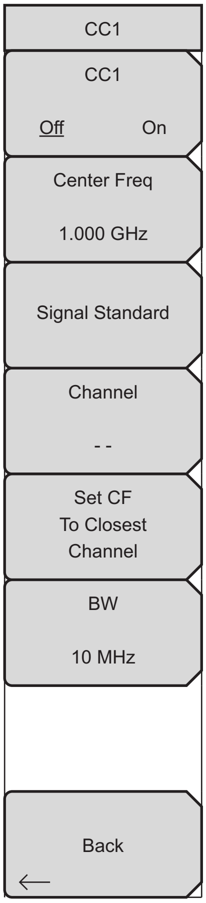
**TAE:** Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

**Back:** Returns to the "Over-the-Air Menu" on page 6-41.

**Figure 6-39.** Carrier Aggregation Menu

## Component Carrier Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation > CC1




**CC1 Off On:** Turns On the Component Carrier.

**Center Freq:** Press this submenu key to set the receiver center frequency. Enter the frequency using the keypad, arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels change to Units: GHz, MHz, kHz, and Hz. In this case, enter the desired value, then press the desired unit submenu key or press **Enter** to select MHz as the frequency unit.

**Signal Standard:** Opens the “Standard List Menu” on page 6-29.

**Channel:** Opens the Channel Editor dialog where you can select a channel number within the range of the selected signal standard.

**Set CF to Closest Channel:** Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

**BW:** Displays the Select Bandwidth list, from which you can choose:

1.4 MHz
3 MHz
5 MHz
10 MHz
15 MHz
20 MHz

**Back:** Returns to the previous menu.

**Figure 6-40.** Component Carrier Menu

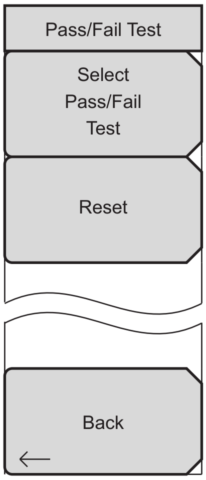
## EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF

Refer to “LTE/TD-LTE EMF Menu” on page 8-2.

## Pass/Fail Test Menu

Key Sequence: **Measurements** > Pass/Fail Test > Select Pass/Fail Test




**Select Pass/Fail Test:** Press this submenu key to open the Select Pass/Fail Test list box and select a test type. Choose from:

PASS_FAIL_RF
PASS_FAIL_MOD
PASS_FAIL_CONTROL
PASS_FAIL_ALL

Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test or press **Esc** to cancel your choice.

Note: The current list of pass/fail tests is a default list. Master Software Tools (MST) includes features to create additional pass/fail tests.

**Reset:** Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

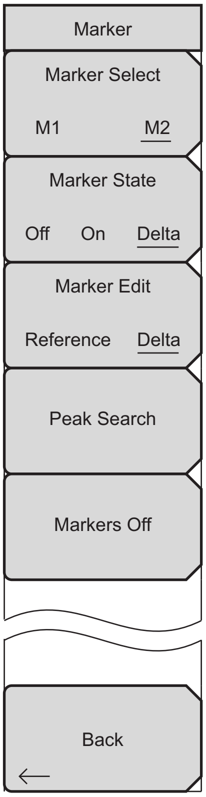
**Back:** Press this submenu key to return to the "Measurements Menu" on page 6-33.

**Figure 6-41.** TD-LTE Pass Fail Mode Menu

# 6-13 Marker Menu

Key Sequence: **Marker**

Available for Channel Spectrum and Power vs. Time measurements.




**Marker Select:** Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

**Marker State:** Sets the state of the selected marker underlined in the Marker Select submenu.

**Marker Edit:** Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

**Peak Search:** Moves the selected marker to the trace peak.

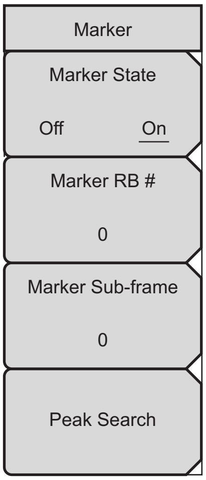
**Markers Off:** Turns off all markers.

**Back:** Press this submenu key to return to the "Measurements Menu" on page 6-33.

**Figure 6-42.** TD-LTE Marker Menu

### Power vs Resource Block Marker Menu

Key Sequence: **Marker** (When Power vs. Resource Block measurement is selected).




**Marker Select:** Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

**Marker State:** Sets the state of the selected marker underlined in the Marker Select submenu.

**Marker Edit:** Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

**Peak Search:** Moves the selected marker to the trace peak.

**Markers Off:** Turns off all markers.

**Back:** Press this submenu key to return to "Measurements Menu" on page 6-33.

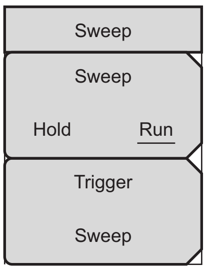
**Figure 6-43.** TD-LTE Resource Block Marker Menu

## 6-14 Calibrate Menu

This menu is not available in TD-LTE measurement mode.

## 6-15 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key




**Sweep Single/Continuous:** This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

**Trigger Sweep:** Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

**Figure 6-44.** TD-LTE Sweep Menu

## 6-16 Measure Menu

Displays the "Measurements Menu" on page 6-33.

## 6-17 Trace Menu

This menu is not available in TD-LTE measurement mode.

## 6-18 Limit Menu

This menu is not available in TD-LTE measurement mode.

## 6-19 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the User Guide.

# Chapter 7 — LTE and TD-LTE Coverage Mapping

| | |
|---|---|
| **Note** | Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options. |

## 7-1 Introduction

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ), and SINR. The Anritsu easyMap Tools program creates special maps compatible with Anritsu handheld spectrum analyzers. The software creates files with or without GPS information. The files compatible with coverage mapping will have a .map extension. easyMap Tools is available from the Anritsu website (www.anritsu.com).

This chapter presents brief examples and menu overview of Coverage Mapping, Coverage Mapping setup, measurement parameters setup, and points distance/time setup.

## 7-2 General Measurement Setups

Refer to the Measurement Setups section in this Measurement Guide for the specific measurement mode used in setting up frequency, amplitude, and GPS.

## 7-3 Coverage Mapping

The instrument logs data automatically based on either time or distance interval. If there is no map available when making the measurements, it is still possible to save all the data to a KML file and then later combine the data file with a map.

Coverage Mapping is possible both outdoors (GPS signal required) and indoors (no GPS signal). For more accurate position data for indoor measurements, use a stylus such as the Anritsu 2000-1691-R.

- **Outdoor Mapping:** The instrument logs data automatically based on either time or distance interval. If there is no map available when making the measurements, it is still possible to save all the data to a KML file and then combine the data with a map. You may also recall a map after taking the data without having to save and recall it.

| | |
|---|---|
| **Note** | Outdoor coverage mapping requires Option 31 or an Anritsu analyzer having the GPS receiver as a standard accessory component. |

- **Indoor Mapping:** Using a start-walk-stop approach, the instrument provides in-building coverage mapping by overlaying data directly onto the downloaded map (which may be a drawing of a building). Data is captured when you tap the touchscreen. The instrument places points linearly between taps if Time interval is used for capturing data and there is more than one measurement. When the Repeat Type is Distance, new measurements are placed at the next tap point.

### Outdoor Coverage

With a valid GPS signal, the instrument identifies the current location on the displayed GeoEmbedded map with a plus sign. Previously saved locations display as colored squares. Using GPS, latitude, longitude, and altitude data is automatically saved for each location.

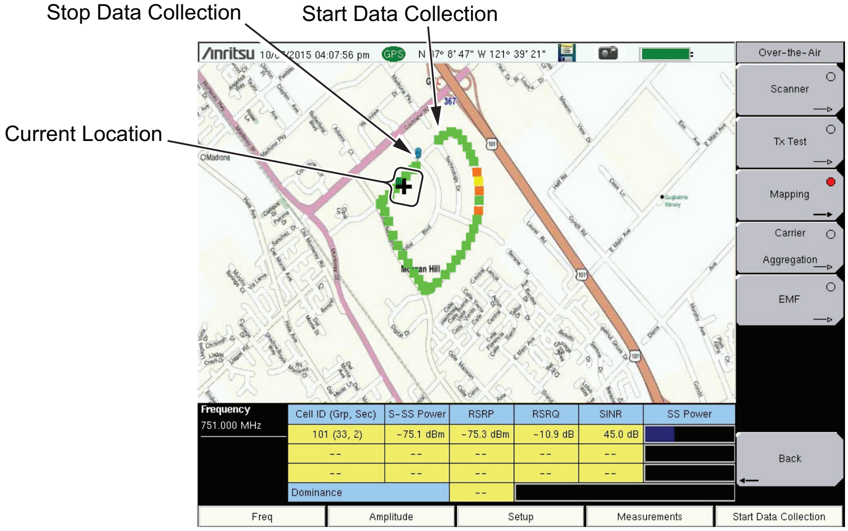



**Figure 7-1.** Outdoor Coverage Mapping (GPS On)

### Indoor Coverage

With GPS turned off and a non-GeoEmbedded map file, the user indicates the current position (+) with the touchscreen. On instruments that do not have a touchscreen, use the arrow keys. Previously saved locations are displayed as colored squares.

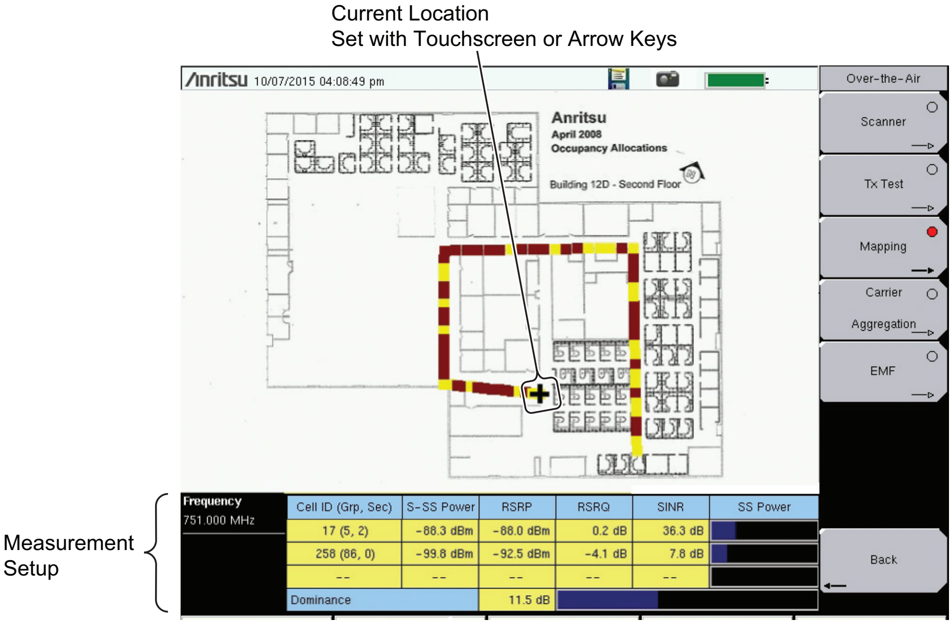



**Figure 7-2.** Indoor Coverage Mapping (GPS Off)

Coverage Mapping is a four-step process:

- Create an indoor or outdoor map using “Anritsu easyMap Tools”.
- Load the map and configure the “Instrument Settings” on page 7-4.
- Connect an antenna to the instrument and go to “Measurement Setup” on page 7-6.
- “Save the Coverage Mapping Information” on page 7-7.

## Anritsu easyMap Tools

Anritsu easyMap Tools allows you to capture maps of any location and create Anritsu Map Files. These maps are viewed on the Anritsu instrument during coverage mapping. There are two Anritsu Map File formats:

- legacy .map map files
- .azm map files, which are displayed in full zoom-out view (pan-and-zoom is currently not supported in Coverage Mapping)

Download easyMap Tools from the Anritsu website (www.anritsu.com). Additional information about easyMap Tools is available in the software Help.

### Outdoor Map

Type an address in easyMap Tools and capture the map with GPS data.

### Indoor Map

In easyMap Tools, open a bitmapped image (JPEG, GIF, TIFF, or PNG) of the floor plan for indoor mapping. You can also use a downloaded map and make it an indoor map. This method works well if you can get a good aerial view of a building.

The image size should be close to 666 pixels x 420 pixels (~1.6:1 ratio).

| | |
|---|---|
| **Note** | A USB flash drive is required to transfer maps to the instrument. |

## Instrument Settings

### Setup

1. Create the appropriate map with Anritsu easyMap Tools. Refer to "Anritsu easyMap Tools" on page 7-3 and the software Help. Outdoor mapping requires a GeoEmbedded map or the default grid.
2. Open up Coverage Mapping by pressing the **Measurements** main menu button followed by the Over-the-Air submenu key and then pressing the Mapping submenu key.

   *Continue with Step 3 for outdoor coverage mapping only. GPS must be off for indoor mapping.*
3. Turn on GPS.
   a. Press **Shift** then **System** (8).
   b. Press the GPS submenu key.
   c. Connect a GPS antenna to the SMA connector.
   d. Turn on GPS. On should be underlined in the GPS submenu key.
   e. Press the GPS Voltage submenu key to select the appropriate voltage for the antenna being used. Refer to the instrument Technical Data Sheet for voltage specifications of supported GPS antennas.
   f. Press GPS info and verify that the information from four or more satellites is captured. Press **Esc** to close the info box.

   It may take several minutes for the GPS receiver to track at least four satellites. When it does, the GPS icon at the top of the screen turns green. Refer to your instrument User Guide for additional information on GPS.

### Recall a Map

The instrument allows you to recall a .map file or .azm file created with easyMap Tools. With a valid GPS signal, the current location will be displayed on an outdoor map or an arrow will show the direction of the current location if it is outside the map coverage area. With an indoor map, position the plus sign at the current location by using the touchscreen or by using the arrow keys and then pressing **Enter**.

Connect the USB flash drive that has the map file or files created in "Anritsu easyMap Tools" on page 7-3 to the instrument.

1. Press the Mapping submenu key in the Over-the-Air submenu.
2. Press the Save/Recall Points/Map submenu key.
3. Press Recall a Map and select the appropriate map from the USB flash drive.
4. Use the arrow keys to scroll down to the desired map and press **Enter** to select.

   *Step 5 and Step 6 apply to outdoor coverage mapping only.*
5. The new map file will be displayed and the current location (if within the GPS boundaries of the displayed map) is shown as a plus sign with outdoor mapping.
6. If the current location is outside the map boundaries, an arrow indicates the direction of the current location in relation to the displayed map.

If you do not see the USB drive in the Recall menu:

1. Press the Refresh Directories submenu key.
2. If the drive is still not visible, exit the menu, then remove and reconnect the USB drive.
3. Press Recall a Map again.
4. If the drive is still not visible, reformat the USB flash drive in FAT32 format, then copy the map files to the reformatted drive.

### Recall the Default Grid

The instrument can make coverage mapping measurements even when an Anritsu easyMap Tools file of the current indoor or outdoor location is not available. In such cases, use the default grid map, save the KML points, and recall them at a later time with a map. You may also recall a map after taking the data without having to save and recall it. Alternatively, you can save the KML points and view them in Google Earth or Google Maps, or you can save the points in mtd (mapping tab delimited) format, and use another tool for analysis, such as Microsoft Excel. Refer to "Mapping Save/Recall Menu" on page 7-13 for additional information on recalling saved maps and .kml data.

| Note | When using the default grid, the coverage area for outdoor mapping is fixed at 10 x 10 miles. For indoor coverage mapping, the grid size is the indoor map file dimensions (666 pixels by 420 pixels). If GPS is on and locked, the center point of the default grid is the current location. |
|---|---|

1. Select the Mapping submenu key.
2. Press the Save/Recall Points/Map submenu key.
3. Press the Recall Default Grid submenu key.

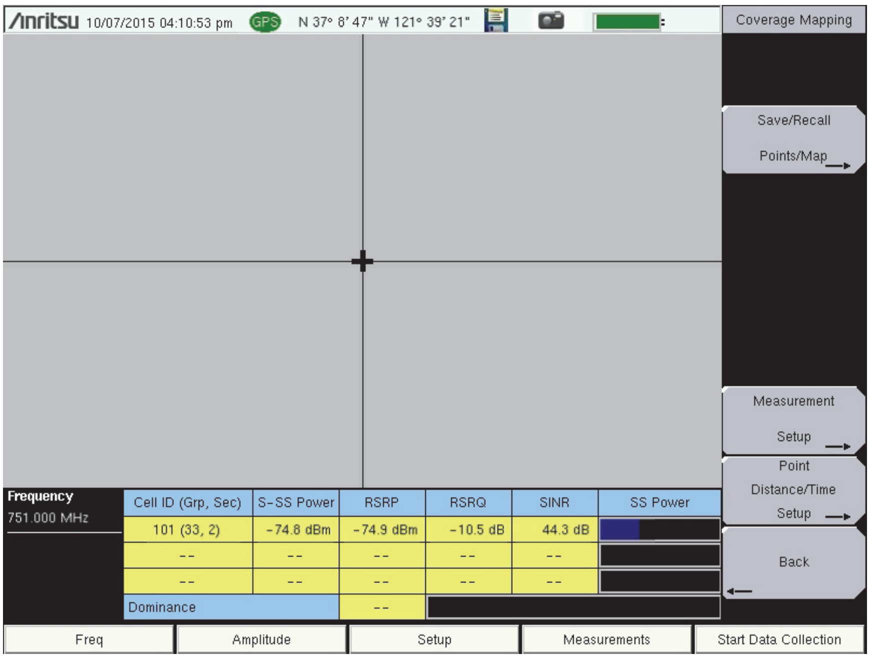



**Figure 7-3.** LTE Coverage Mapping with the Default Grid

## Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Mapping submenu key to activate the Coverage Mapping display. Press the Mapping key again to display the Coverage Mapping menu.
4. Press the Measurement Setup submenu key to open the Measurement Setup menu to select which measurement is mapped and to set the threshold values for S-SS, RSRP, RSRQ and SINR.
5. Press the Measurement submenu key to open the Mapping Parameter menu.
   a. Select the signal parameter to be mapped and displayed in bar graph form by selecting one of the parameter buttons and then pressing Back. All four measurements are saved for each data point, independent of which one is chosen for mapping on the instrument screen. For example, if RSRP is selected for mapping, the resulting .kml file will also include S-SS, RSRQ and SINR values.
   b. Set the thresholds for S-SS, RSRP, RSRQ or SINR by pressing the respective Thresholds button. After pressing a threshold button, set the threshold levels for Excellent, Very Good, Good, Fair and Poor. Then press the Back button.
6. Set up the interval type and interval parameters. Press the Point Distance/Time Setup submenu button to open the Points Distance/Time menu. If Time is selected for Repeat Type, then set the time period by pressing the Repeat Time submenu key. If Distance is selected for Repeat Type, then set the Repeat Distance and Distance Units. If necessary, delete any previously stored points by pressing the Delete ALL Points button.

| | |
|---|---|
| **Note** | All files will be stored in the default save location. To change the default location, Press **Shift** then **File** (7) to enter File menu. Press Save then Change Save Location. Create a new folder or change the current location on the USB flash drive or in the instrument's storage memory. Press Set Location to make this the new default location for saving files. |

7. Press Back to return to the Over-the-Air menu.

## Measurement Mapping

After completing the setups for Coverage Mapping and measurements, you are ready to make measurements.

1. Press the **Start Data Collection** main menu key. Data will be collected at the time or distance interval based on the setting in "Point Distance/Time Setup Menu" on page 7-15. The color of the squares indicates the power level based on the chosen measurement and its threshold level setup.
2. Press the **Stop Data Collection** main menu key to end the measurement process. Save the collected data as a .kml file, a tab-delimited text file (.mtd) or a .jpg file. Refer to "Save the Coverage Mapping Information" on page 7-7.

## Save the Coverage Mapping Information

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key, then Mapping.
3. Coverage Mapping has three save options. Refer to "Save KML Points", "Save Tab Delimited Points" or "Save JPG".

All files will be stored in the default save location. To change the default location:

1. Press **Shift**, then **File (7)** to access the File menu.
2. Press Save.
3. Press Change Save Location.
4. Select an existing folder or press the Create Folder submenu key to create a new folder in the instrument's internal memory or on a USB drive.
5. Press Set Location to make the selected folder the new default location for saving files.

### Save KML Points

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save KML Points. In the Save dialog, change the file name as appropriate, then press **Enter**. The following information is saved for the points currently displayed on the screen:

- Location and time based on GPS information
- Cell, Group and Sector ID
- Center Frequency
- Measured signals: S-SS, RSRP, RSRQ and SINR

The `.kml` file can be recalled and viewed on the instrument. Refer to "Mapping Save/Recall Menu" on page 7-13 for information on recalling a map.

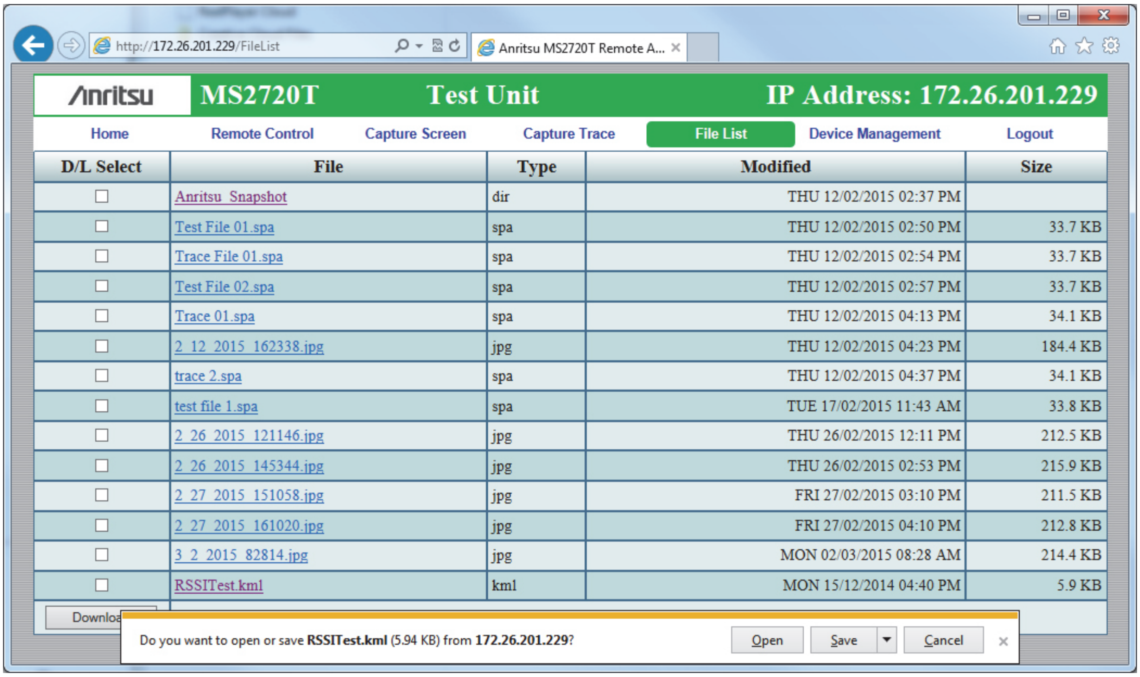
The `.kml` file can also be opened and viewed using Google Earth and a network connection.

| Note | **Installing Google Earth**<br>If you don't have Google Earth installed on your computer:<br>1. Go to www.google.com/earth.<br>2. Click Download Google Earth and follow the on-screen instructions.<br>3. After installation and Google Earth is opened, user instructions and several types of help are available from the Help pull-down menu. |
|---|---|

1. Connect your computer or mobile device to the instrument via the Web Remote Control server. To do this, enter the instrument IP address in your Web browser address bar.

   You can look up your instrument IP address by pressing **Shift**, then **System (8)**, followed by Status. If your instrument has not been set up with an IP address, press System Options, then Ethernet Config to access the Ethernet Editor dialog.

2. Click the File List tab and look for the `.kml` file you want to view in Google Earth. See Figure 7-4.
3. Click the map file name in the File column. Alternatively, you can select the checkbox next to the .kml file name, then click the Download button.
4. Click Open or Save in the pop-up dialog.




| D/L Select | File | Type | Modified | Size |
|---|---|---|---|---|
| ☐ | Anritsu_Snapshot | dir | THU 12/02/2015 02:37 PM | |
| ☐ | Test File 01.spa | spa | THU 12/02/2015 02:50 PM | 33.7 KB |
| ☐ | Trace File 01.spa | spa | THU 12/02/2015 02:54 PM | 33.7 KB |
| ☐ | Test File 02.spa | spa | THU 12/02/2015 02:57 PM | 33.7 KB |
| ☐ | Trace 01.spa | spa | THU 12/02/2015 04:13 PM | 34.1 KB |
| ☐ | 2_12_2015_162338.jpg | jpg | THU 12/02/2015 04:23 PM | 184.4 KB |
| ☐ | trace 2.spa | spa | THU 12/02/2015 04:37 PM | 34.1 KB |
| ☐ | test file 1.spa | spa | TUE 17/02/2015 11:43 AM | 33.8 KB |
| ☐ | 2_26_2015_121146.jpg | jpg | THU 26/02/2015 12:11 PM | 212.5 KB |
| ☐ | 2_26_2015_145344.jpg | jpg | THU 26/02/2015 02:53 PM | 215.9 KB |
| ☐ | 2_27_2015_151058.jpg | jpg | FRI 27/02/2015 03:10 PM | 211.5 KB |
| ☐ | 2_27_2015_161020.jpg | jpg | FRI 27/02/2015 04:10 PM | 212.8 KB |
| ☐ | 3_2_2015_82814.jpg | jpg | MON 02/03/2015 08:28 AM | 214.4 KB |
| ☐ | RSSITest.kml | kml | MON 15/12/2014 04:40 PM | 5.9 KB |

**Figure 7-4.** Web Remote Control Window - File List Tab

Opening the .kml file automatically launches Google Earth if the application is not currently open. Figure 7-5 illustrates a sample coverage mapping .kml file viewed in Google Earth. You can also view the file with Google Maps, provided you have the appropriate plug-in for your browser.

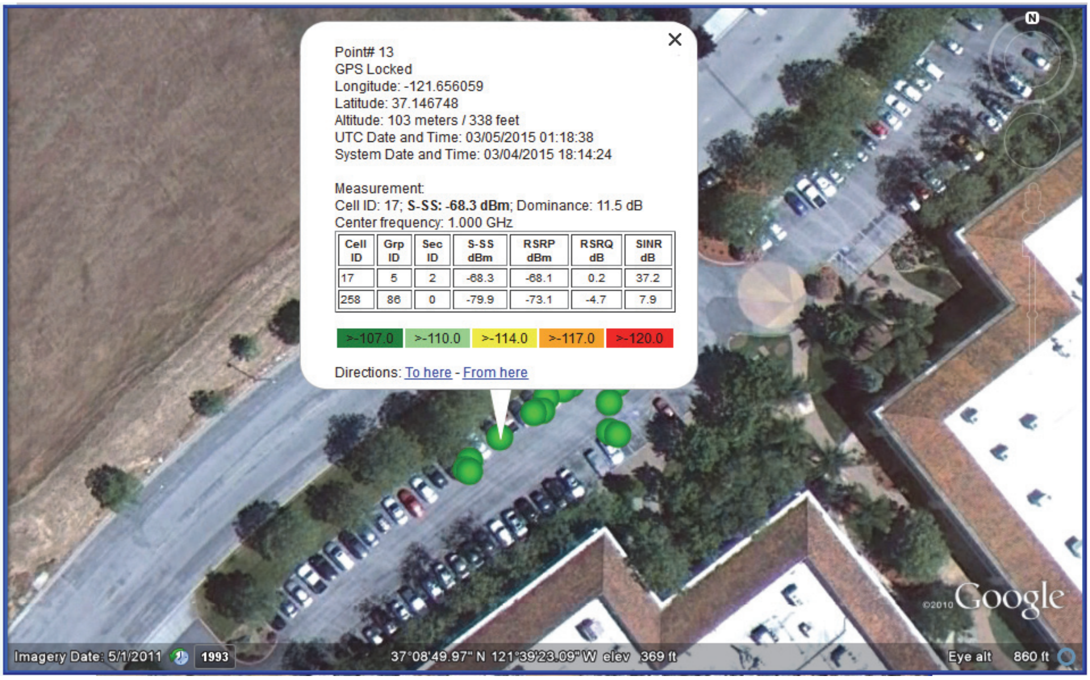



**Figure 7-5.** Sample Coverage Mapping KML File in Google Earth

### Save Tab Delimited Points

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save Tab Delimited Points. In the Save dialog, change the file name as appropriate, then press **Enter**. A tab delimited text file (.mtd) of the coverage mapping data currently displayed on the screen will be saved to the default location.

### Save JPG

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save JPG. In the Save dialog, change the file name as appropriate, then press **Enter**. A .jpg file of the current screen is saved to the default location.

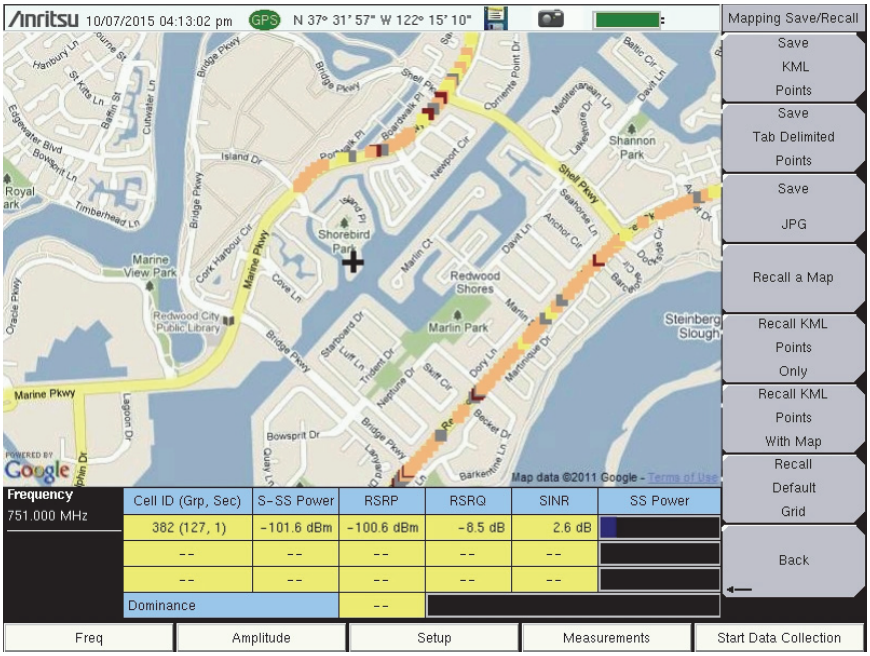



**Figure 7-6.** Coverage Mapping Measurement Saved as a .jpg File

# 7-4 Coverage Mapping Menus

Figure 7-7 shows the map of the LTE and TD-LTE Over-the-Air Coverage Mapping and associated submenus. Section 7-5 describes the details of Coverage Mapping menus and associated submenus.

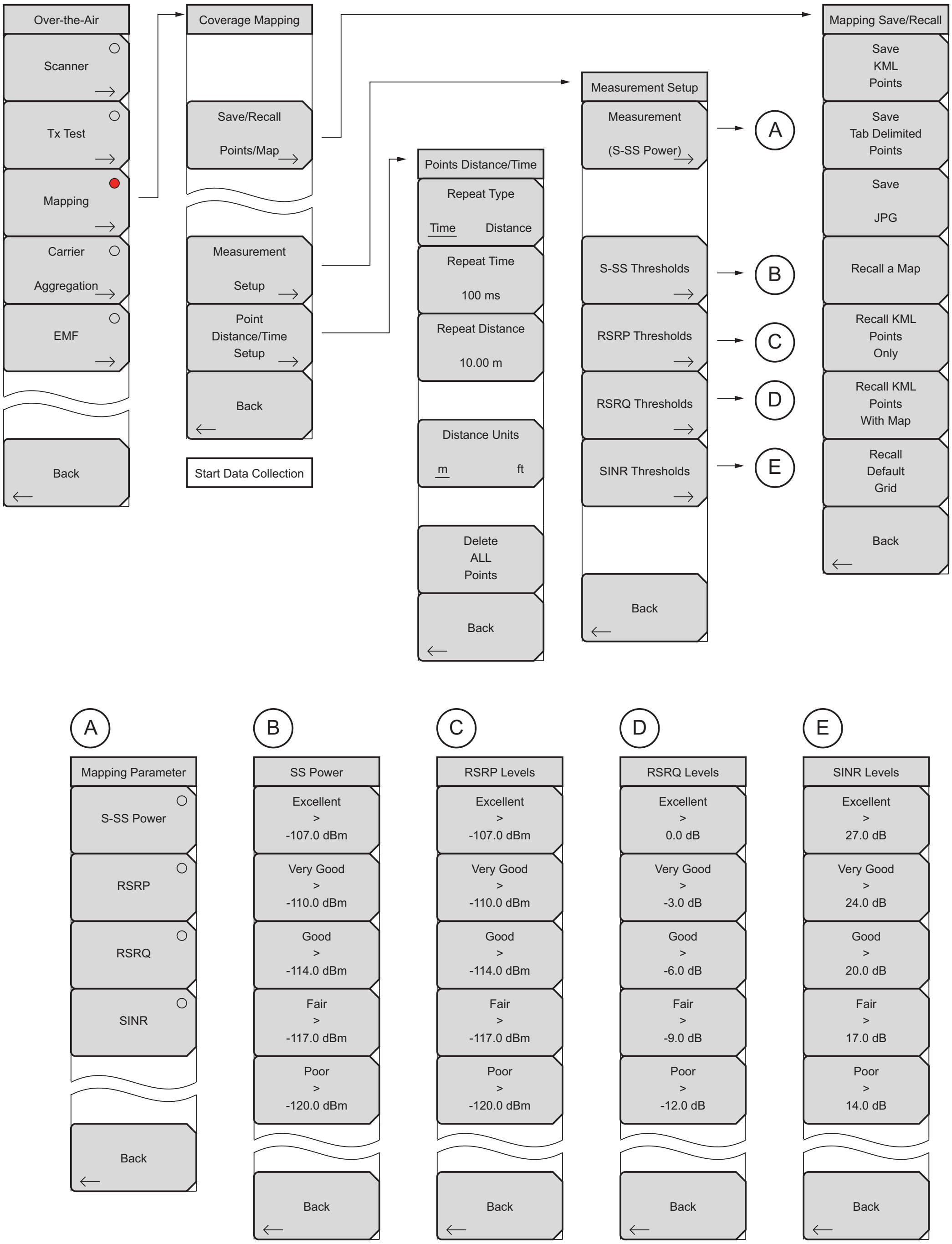
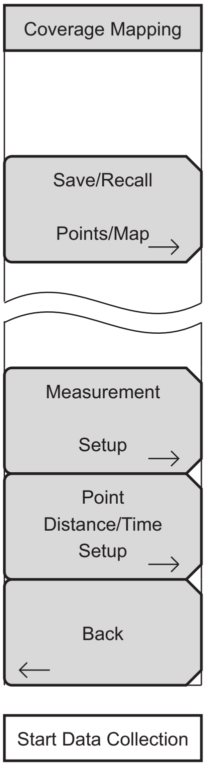



**Figure 7-7.** Coverage Mapping Menu

# 7-5 Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping




**Save/Recall Map Points:** Opens the "Mapping Save/Recall Menu" on page 7-13.

**Measurement Setups:** Opens the "Measurement Setup Menu" on page 7-14.

**Point Distance/Time Setup:** Opens the "Point Distance/Time Setup Menu" on page 7-15.

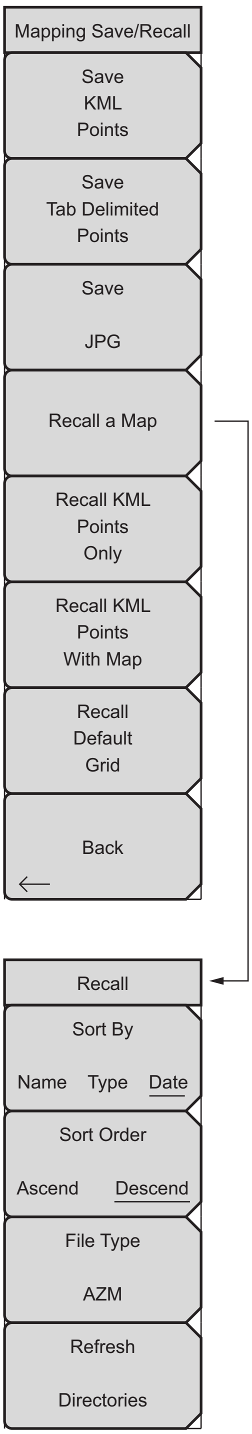
**Back:** Returns to the "Over-the-Air Menu" on page 5-37 (LTE) or "Over-the-Air Menu" on page 6-41 (TD-LTE).

**Start/Stop Data Collection:** Press this main menu key to start collection of coverage mapping data based on the settings of Measurement Setup and Point Distance/Time Setup. A running count of collected data points is displayed at the bottom of the map. Press this key again to stop data collection.

**Figure 7-8.** Coverage Mapping Menu

## Mapping Save/Recall Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Save/Recall Points/Map




**Save KML Points:** Press this button to save the KML points. FileName.kml will be stored in the default save location. From the File menu, press Save, then Change Save Location to change default location. Refer to "Save the Coverage Mapping Information" on page 7-7.

**Save Tab Delimited Points:** Press this button to save the points in a tab delimited text file. FileName.mtd will be stored in the default location.

**Save JPG:** Press the Save JPG key to save a .jpg file of the current screen.

**Recall a Map:** Opens the Recall submenu (shown at the bottom left of this page) for selecting a map to display on the screen. The default map type is .azm. Press the File Type submenu key to select a different map type to recall.

**Recall KML Points Only:** Opens the Recall submenu for selecting a .kml file. Displays the saved locations overlaid on the current map or the default grid.

**Recall KML Points With Map:** Opens the Recall submenu for selecting a .kml file. The map that was used when the points were saved will be recalled if it is available.

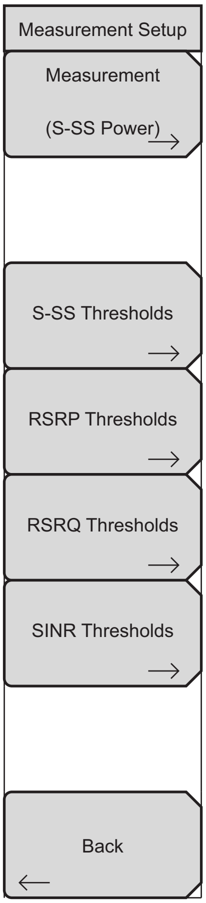
**Recall Default Grid:** If you do not have a GPS embedded map but are out in the field making measurements, the Recall Default Grid submenu allows you to save points and the corresponding GPS coordinates (or screen coordinates for indoor maps) to view at a later time. You can also load the map after acquiring points, or switch maps at any time without losing data.

**Back:** Returns to the "Coverage Mapping Menu" on page 7-12.

**Figure 7-9.** Mapping Save/Recall Menu

## Measurement Setup Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Measurement Setup




**Measurement:** Press and select which measurement to map on the screen: S-SS Power, RSRP, RSRQ or SINR. All measurements are stored as part of the saved file:

**S-SS Thresholds:** Opens the SS Power menu for setting threshold levels.

> **SS-Power:** Set the SS Power threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

**RSRP Thresholds:** Opens the RSRP Levels menu for setting threshold levels.

> **RSRP Levels:** Set the RSRP threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

**RSRQ Thresholds:** Opens the RSRQ Levels menu for setting threshold levels.

> **RSRQ Levels:** Set the RSRQ threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

**SINR Thresholds:** Opens the SINR Levels menu for setting threshold levels.

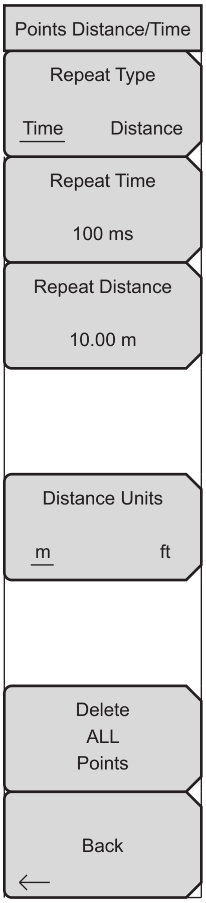
> **SINR Levels:** Set the SINR threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

**Back:** Returns to the "Coverage Mapping Menu" on page 7-12.

**Figure 7-10.** Measurement Setup Menu

## Point Distance/Time Setup Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Point Distance/Time Setup




**Repeat Type:** Toggles between using a Time or Distance interval for capturing data. Refer to "Measurement Setup" on page 7-6. You may have to move the instrument around for data collection, and you may need to tap the touchscreen if indoors.

**Repeat Time:** When the Repeat Type is Time and GPS is turned On for outdoor coverage mapping, use this submenu key to set the time interval between measurements. For indoor mapping (GPS is Off), the instrument interpolates position measurements in a straight line between each pair of screen-tap locations.

**Repeat Distance:** When the Repeat Type is Distance and GPS is turned On for outdoor mapping, use this submenu key to set the distance interval between measurements. For indoor mapping (GPS is Off), the instrument places all new measurements at the next screen-tap location.

**Distance Units:** Toggles the unit of measure between meters and feet.

**Delete ALL Points:** Deletes any and all map points.

**Back:** Returns to the "Coverage Mapping Menu" on page 7-12.

**Figure 7-11.** Point Distance/Time Setup Menu

# Chapter 8 — EMF (Option 444)

| | |
|---|---|
| **Note** | Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options. |

## 8-1 Introduction

Option 444 adds the EMF Measurement menu to the Over-the-Air LTE and TD-LTE measurement modes. It must be used in conjunction with the Anritsu isotropic antenna, at a frequency range that is within specification of the instrument and antenna used. Refer to the isotropic antenna and signal analyzer technical data sheets.

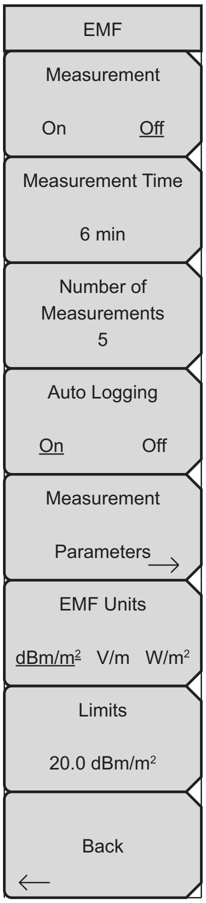
## 8-2 Connecting the Antenna

1. Connect the antenna RF connector to the **Analyzer/RF In** port on the instrument. See Figure 8-1. The antenna connector must be *finger* tight.
2. Connect the antenna USB connector to one of the USB Type A ports on the instrument.


**Figure 8-1.** Connecting the Anritsu Isotropic Antenna

# 8-3 LTE/TD-LTE EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF




**Measurement On/Off:** Starts the EMF Measurement and removes access to all other menu buttons. The measurement turns On only if the Center Frequency is set within the valid range and the Anritsu Isotropic Antenna is connected.

Note that the Measurement Time and other related parameters must be set before starting the measurement. This button is useful for stopping or restarting measurements when settings need to be changed. When the measurement is in progress, access to other menus and key presses are blocked.

**Measurement Time:** Sets the duration of each EMF measurement from one minute up to 30 minutes. The default is 6 min. The instrument captures over-the-air data for the X axis when a valid sync signal is found and a valid Cell ID exists, then moves to the Y and Z axes. There is no axis dwell time parameter. You will get as many isotropic results for the set of three axes as can be obtained within the specified Measurement Time.

When no valid sync signal is found for the current axis, data captured for this axis will be excluded from the measurement results and the instrument moves to the next axis. Refer to "Measurement Results (LTE/TD-LTE)" on page 8-7.

**Number of Measurements:** Sets the number of EMF measurements to complete from 1 up to 10,000. The EMF test is fully executed when the specified number of measurements have completed.

**Auto Logging On/Off:** Auto Logging is On by default. This must be selected prior to starting the measurements for the results to be logged. The average, max, and min values of each isotropic set of three axes, the isotropic trace data, and the computed total average, max, and min values are saved in a tab delimited text file in internal memory.

The location of this log file is a new folder named with the current time stamp followed by _1, and created in "/Internal Memory/EMF/". The folder can hold 100 files. Each file holds five measurements. The 101st file and the files created thereafter are stored in a new folder with the same time stamp as the first, followed by _2 (then _3, and so on). Each file has its own time stamp.

**Measurement Parameters:** Opens the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

**EMF Units:** dBm/m$^2$, V/m, and W/m$^2$ are the currently supported units. V/m is the default unit.

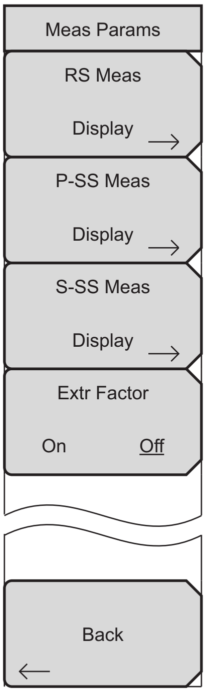
**Limits:** A single number can be entered. The Field Strength (Avg) value is the running average for the current Measurement Time and should stay below this limit (default 6 V/m) for the test to pass. When the Extrapolation Factor is On (refer to "Meas Params Menu (LTE/TD-LTE)" on page 8-3), the Field Strength (Avg) is extrapolated and the computed value should stay below the limit for the test to pass.

**Back:** Returns to the previous menu.

**Figure 8-2.** LTE/TD-LTE EMF Menu

## Meas Params Menu (LTE/TD-LTE)

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters




**RS Meas Display:** Opens the "RS Display Menu" on page 8-4.

**P-SS Meas Display:** Opens the "P-SS Display Menu" on page 8-5.

**S-SS Meas Display:** Opens the "S-SS Display Menu" on page 8-6.

**Extr Factor On/Off:** Toggles On/Off the Extrapolation Factor. The extrapolation factor, if turned On, displays the extrapolated field strength number for the selected capture bandwidth.

**Back:** Returns to the "LTE/TD-LTE EMF Menu" on page 8-2.

**Figure 8-3.** LTE/TD-LTE Meas Params Menu

## RS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > RS Meas Display


The displayed **Reference Signal** parameters below can be changed at the start or at the end of the measurement cycle. All of the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

**RS Act:** Selects the display of Actual Value (current isotropic number).

**RS Total Min:** Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

**RS Total Max:** Selects the display of Total Max, which is the maximum value for the entire measurement period.

**RS Avg/Meas:** Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

**RS Total Avg:** Selects the display of Total Avg, which is the running average for the entire measurement period.

**Back:** Returns to the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

**Figure 8-4.** RS Display Menu

## P-SS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > P-SS Meas Display


The displayed **Primary Synchronization Signal** parameters below can be changed at the start or at the end of the measurement cycle. All of the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

**P-SS Act:** Selects the display of Actual Value (current isotropic number).

**P-SS Total Min:** Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

**P-SS Total Max:** Selects the display of Total Max, which is the maximum value for the entire measurement period.

**P-SS Avg/Meas:** Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

**P-SS Total Avg:** Selects the display of Total Avg, which is the running average for the entire measurement period.

**Back:** Returns to the “Meas Params Menu (LTE/TD-LTE)” on page 8-3.

**Figure 8-5.** P-SS Display Menu

## S-SS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > S-SS Meas Display


The displayed **Secondary Synchronization Signal** parameters below can be changed at the start or at the end of the measurement cycle. All the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

**S-SS Act:** Selects the display of Actual Value (current isotropic number).

**S-SS Total Min:** Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

**S-SS Total Max:** Selects the display of Total Max, which is the maximum value for the entire measurement period.

**S-SS Avg/Meas:** Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

**S-SS Total Avg:** Selects the display of Total Avg, which is the running average for the entire measurement period.

**Back:** Returns to the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

**Figure 8-6.** S-SS Display Menu

## Measurement Results (LTE/TD-LTE)

The measurement starts by setting the antenna's X axis and capturing over-the-air data. If a sync signal is found and a valid Cell ID exists, then the following parameters are detected and stored: the channel power in 1.4 MHz bandwidth, the Cell ID, RS, P-SS, and S-SS (all per Resource Element). This is repeated for Y and Z axes. If any one of the axes has a valid Cell ID, the isotropic result (for example, $(RS^2{}_X + RS^2{}_Y + RS^2{}_Z)^{0.5}$) for each of the above parameters is displayed as the Actual result.

The Measurement Parameters submenu (refer to page 8-3) lets you choose which computed result is displayed in the measurements table, in each of the RS, P-SS, and S-SS columns. See Figure 8-7. The choices of display parameters are: Actual, Total Min, Total Max, Avg/Meas (the default), and Total Avg.

Total Min, Total Max, and Total Avg are the min, max, and average values computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements). Avg/Meas is the running average of the isotropic results computed from all measurements completed thus far within the specified Measurement Time.

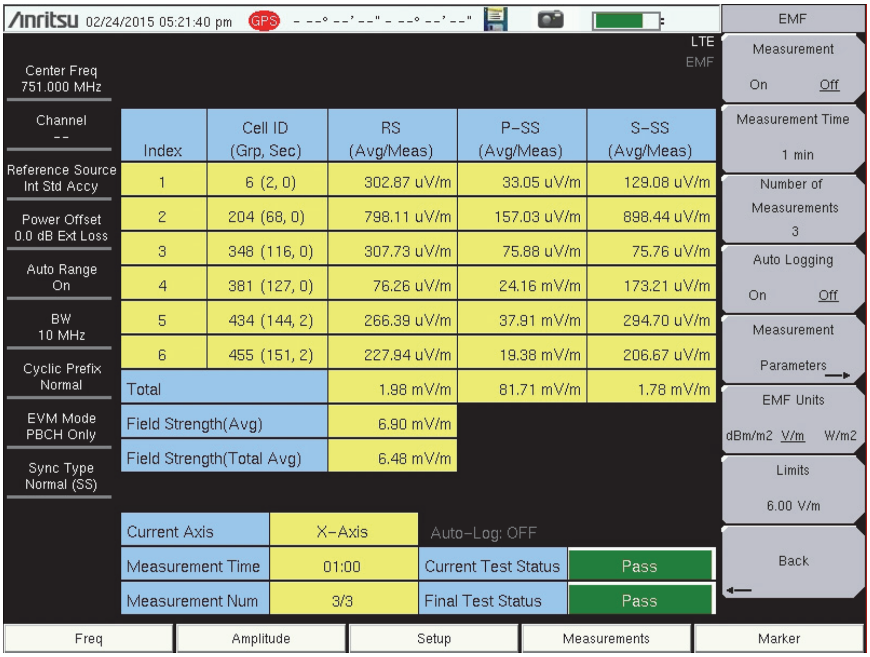



**Figure 8-7.** LTE EMF Measurement Results

There is no axis dwell time parameter. If a sync signal is not found within a specific time, data for the current axis is excluded and the instrument switches to the next axis. The Field Strength number is still computed and compared with the specified limit to determine the Pass or Fail status at the end of the measurement period (Measurement Time × Number of Measurements).

Field Strength (Avg) is the running average for the current Measurement Time. Field Strength (Total Avg) is the running average for all measurements completed thus far within the measurement period.

When the extrapolation factor is turned Off, the Field Strength number is the measured Channel Power in a 1.4 MHz bandwidth. Changing the bandwidth (BW) setting in the Setup menu does not change this number.

If the extrapolation factor is On, the Field Strength ($E_{max}$) is computed as follows:

$$E_{max} = E_{cp} \times N_{cp}$$

where $E_{cp}$ is the RMS value of the channel power recorded in each axis and $N_{cp}$ is the number of subcarriers divided by 72. The number of subcarriers can be provided by the network operator or can be calculated from Table 8-1. The selected channel bandwidth (BW key in the instrument Setup main menu) determines the number of subcarriers. The default BW is 1.4 MHz.

**Table 8-1.** Field Strength Numbers

| Channel Bandwidth (MHz) | Subcarriers |
|---|---|
| 1.4 | 72 |
| 3 | 180 |
| 5 | 300 |
| 10 | 600 |
| 15 | 900 |
| 20 | 1200 |

Assuming that all subcarriers in the BW setup are at the same power level, the Field Strength value for other BW setups can be extrapolated based on the Channel Power in 1.4 MHz BW. The Field Strength cell labels in the table are updated with an *Ex*, such as Field Strength (Ex Avg), to indicate the extrapolation factor has been applied. See Figure 8-8 on page 8-9.

The displayed values are measurement results from the BW setup made prior to starting the measurement. Changing the BW setup, hence the extrapolation factor, after the measurement is complete has no effect on the currently displayed values.

If a valid Cell ID is obtained even once during the entire measurement period, an entry will be made in the table. "--" indicates an invalid result. A maximum of six cell IDs can be detected. The Total row sums the isotropic numbers for the selected display parameter across Cell IDs.

## Pass/Fail

The limit check is done at the end of each Measurement Time. If the Field Strength (Avg), with or without extrapolation, exceeds the set limit, the Current and the Final Test Status are marked as Fail in red. If the Field Strength (Avg) does not exceed the limit, the Current Test Status is marked as Pass in green. In the example in Figure 8-8, the extrapolated Field Strength (Ex Avg) is 22.22 mV/m.

If all of the measurements pass, the Final Test Status is updated to Pass in green.

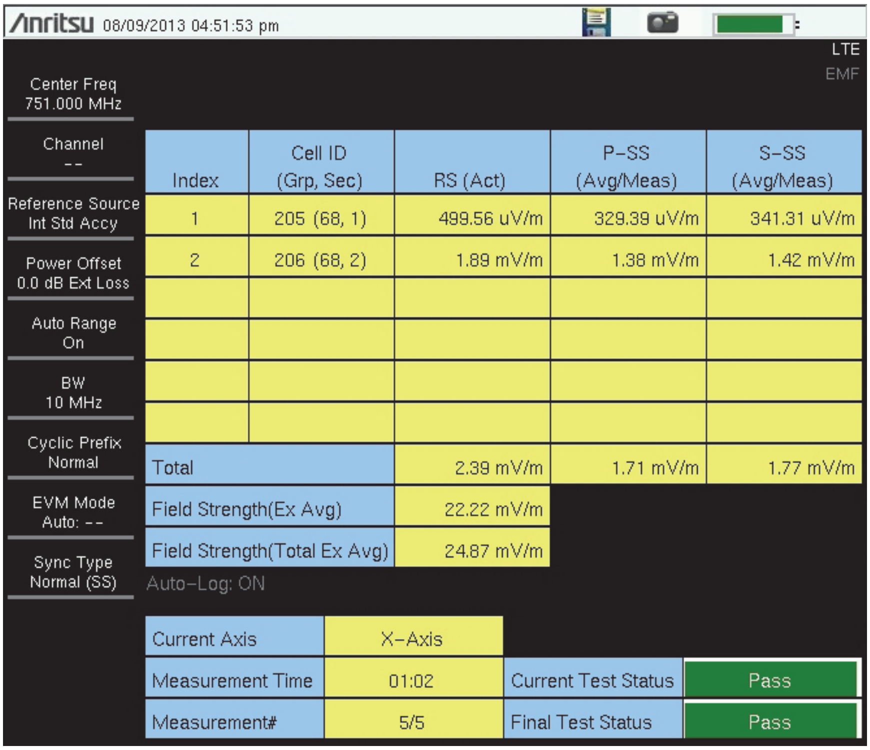
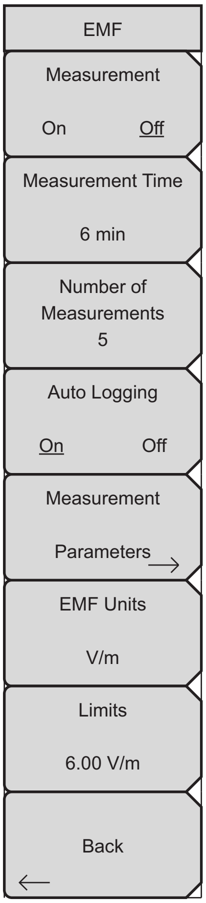



**Figure 8-8.** LTE/TD-LTE EMF Measurement Display

# 8-4 W-CDMA EMF Menu

Key Sequence: **Measurements** > OTA > EMF




**Measurement On/Off:** Starts the EMF Measurement and removes access to all other menu buttons. The measurement turns On only if the Center Frequency is set within the valid range and the Anritsu Isotropic Antenna is connected.

Note that the Measurement Time and other related parameters must be set before starting the measurement. This button is useful for stopping or restarting measurements when settings need to be changed. When the measurement is in progress, access to other menus and key presses are blocked.

**Measurement Time:** Sets the duration of each EMF measurement from one minute up to 30 minutes. The default is 6 min. The instrument captures over-the-air data for the X axis when a sync signal is found and there is a valid scrambling code, then moves to the Y and Z axes. There is no axis dwell time parameter. You will get as many isotropic results for the set of three axes as can be obtained within the specified Measurement Time.

When no valid sync signal is found for the current axis, data captured for this axis will be excluded from the measurement results and the instrument moves to the next axis. Refer to “Measurement Results (W-CDMA)” on page 8-14.

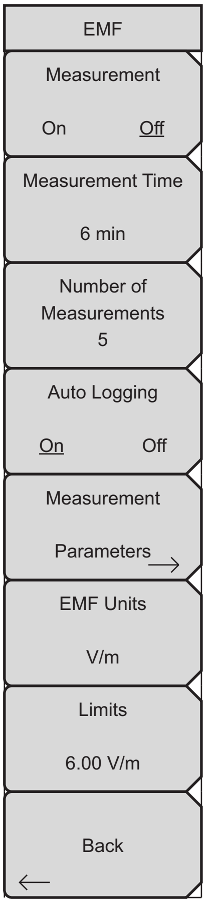
**Number of Measurements:** Sets the number of EMF measurements to complete from 1 up to 10,000. The EMF test is fully executed when the specified number of measurements have completed.

**Auto Logging On/Off:** Auto Logging is On by default. This must be selected prior to starting the measurements for the results to be logged. The PCPICH (Primary Common Pilot Channel) and Field Strength actual and average values of the current measurement are stored. The maximum, minimum, and total average values stored are not per measurement, but for all the values captured until that point.

The location of the saved log file is a new folder named with the current time stamp followed by _1, and created in “/Internal Memory/EMF/”. The folder can hold 100 files. Each file holds five measurements. The 101$^{st}$ file and the files created thereafter are stored in a new folder with the same time stamp as the first, followed by _2 (then _3, and so on). Each file has its own time stamp.

**Measurement Parameters:** Opens the “Meas Params Menu (W-CDMA)” on page 8-12.

**Figure 8-9.** W-CDMA EMF Menu (1 of 2)




**EMF Units:** The unit choices are dBm/m$^2$, V/m, W/m$^2$, % of Limit (V/m), and % of Limit (W/m$^2$). V/m is the default unit.

% of Limit (V/m) and % of Limit (W/m$^2$) display the measured numbers as a percentage of the selected limit. The submenu key shows the currently selected EMF unit. If the selected base unit is in V/m or % of Limit ( V/m), the averaging over the selected period is done in Volt units; if any of the other units are selected, the measurements are performed in power (Watt) units. If you change the EMF units at the end of the measurement, the values displayed are converted from the base units used during the measurement.

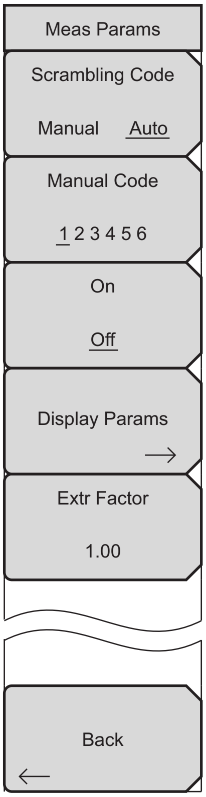
**Limits:** A single number can be entered. The Field Strength (Avg) value should stay below this limit (default 6 V/m) for the test to pass.

**Back:** Returns to the previous menu.

**Figure 8-10.** W-CDMA EMF Menu (2 of 2)

## Meas Params Menu (W-CDMA)

Key Sequence: **Measurements** > OTA > EMF > Measurement Parameters




**Scrambling Code:** Press this key to toggle between Auto or Manual scrambling code. Auto scrambling code determines the scrambling code automatically.

The choice of Auto or Manual scrambling codes and the code lock/reset options function in the same manner as Scrambling Code in W-CDMA OTA measurement mode. Refer to "OTA Setup Menu" on page 3-39.

**Manual Code:** Press this submenu key to select a scrambling code index, 1 through 6. The key is active only in Manual mode, which is selected using the Scrambling Code submenu key.

Refer to "General Measurement Setups" on page 3-5 for details on manually setting up the scrambling code and related parameters.

**On Off:** Switches On/Off the manual codes.

**Display Params:** Opens the "Display Menu" on page 8-13. Enter this submenu to select the parameter you want displayed in the rightmost column of the measurement results table.

**Extr Factor:** The extrapolation factor, when turned On (> 1), displays the extrapolated P-CPICH numbers. The field strength values are not extrapolated.

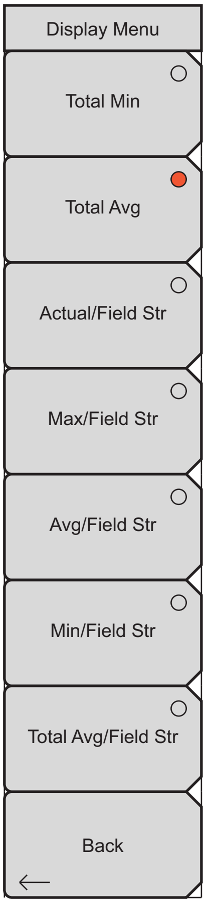
This parameter can be set between 1 and 100 (the network operator can provide this number). It can be used to provide a safety margin in case of an increase in transmit power from an LTE station. The fine tuning may be based on operator input (system setup/power ratio) and/or per regulatory requirements (margins). Refer to "Measurement Results (W-CDMA)" on page 8-14.

**Back:** Returns to the "W-CDMA EMF Menu" on page 8-10.

**Figure 8-11.** W-CDMA Meas Params Menu

## Display Menu

Key Sequence: **Measurements** > OTA > EMF > Measurement Parameters > Display Params




Press one of the keys in this submenu to select which parameter is displayed in the rightmost column of the measurement results table. The default selection is Total Avg. See Figure 8-13 on page 8-14.

The parameter to be displayed can be changed at the start or at the end of the measurement cycle. All the parameters are always computed and stored. Once the measurement is complete, any parameter can be viewed in the desired units and with the desired extrapolation factor.

**Total Min** is the minimum value computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements).

**Total Avg** is the average value computed from all measurements completed thus far within the measurement period.

The remaining choices are coverage measurements computed as a ratio of common pilot signal to the channel power (5 MHz bandwidth):

**Actual/Field Str**

**Max/Field Str**

**Avg/Field Str**

**Min/Field Str**

**Total Avg/Field Str**

**Back:** Returns to the "Meas Params Menu (W-CDMA)" on page 8-12.

**Figure 8-12.** W-CDMA Display Menu

## Measurement Results (W-CDMA)

The measurement starts by setting the antenna's X axis and capturing over-the-air data. If a sync signal is found and there is a valid scrambling code, the PCPICH and Channel Power in 5 MHz bandwidth are stored. This is repeated for Y and Z axes. If any one of the axes has a valid scrambling code, the isotropic result (for example, $(PCPICH^2{}_X + PCPICH^2{}_Y + PCPICH^2{}_Z)^{0.5}$) for each of the above parameters is displayed as the Actual result.

The PCPICH Actual, Total Max, and Avg/Meas parameters are displayed as fixed columns in the measurement results table. See Figure 8-13. Total Max is the max value computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements). Avg/Meas is the running average of the isotropic results computed from all measurements completed thus far within the specified Measurement Time.

Using the Display Params submenu, you can select the computed result to display in the rightmost table column. Refer to "Display Menu" on page 8-13.

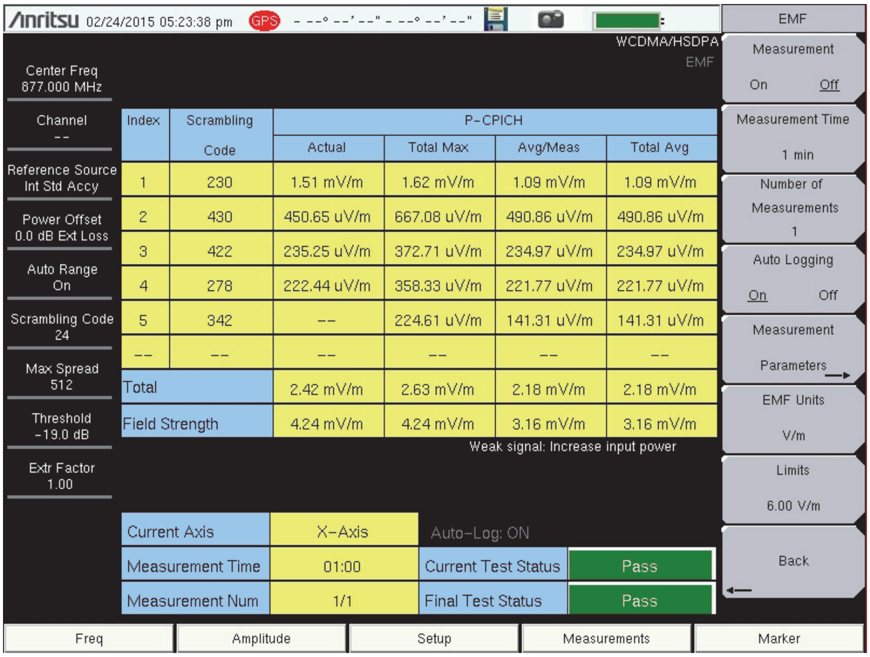



**Figure 8-13.** W-CDMA EMF Measurement Results

There is no axis dwell time parameter. If a sync signal is not found within a specific time, data for the current axis is excluded and the instrument switches to the next axis.

The Field Strength number is the measured Channel Power in a 5 MHz bandwidth.

If the extrapolation factor is turned On, the $E_{max}$ value is the extrapolated PCPICH for Total Max, Total Min, Total Avg, or Avg/Meas, and is computed as follows:

$$E_{max} = E_{pcpich} \times \sqrt{k}$$

where $E_{pcpich}$ is the root sum square (rss) value of the common pilot signal recorded in each axis and k is the extrapolation factor provided by the network operator. For example:

$$E_{max\ (pcpich\ total\ max)} = E_{pcpich\ total\ max} \times \sqrt{k}$$

| Note | The extrapolation factor k is the ratio of the maximum total output power at the base station to the power of PCPICH at the base station. If there is a power boosting factor (BF), k = (max total output power ÷ P(PCPICH)) ÷ BF.<br>Changing the extrapolation factor immediately updates the displayed values, except for Field Strength. Refer to “Meas Params Menu (W-CDMA)” on page 8-12. |
|---|---|

If a valid scrambling code  is obtained even once during the entire measurement period, an entry is made in the table. A maximum of 6 scrambling codes can be detected. The Total row sums the isotropic numbers for the selected display parameter across scrambling codes.

If no valid scrambling code is detected for any of the three axes, the isotropic numbers are excluded from all measurement results (Total Max, Total Min, Total Avg, Avg/Meas). In this case, the display will show “--” .

## Pass/Fail

The limit check is performed at the end of each Measurement Time. If the Field Strength (Avg/Meas) exceeds the set limit, the Current and Final Test Status are marked as Fail in red. If the Field Strength (Avg/Meas) does not exceed the limit, the Current Test Status is marked as Pass in green. In the example in Figure 8-14, the Field Strength (Avg Meas) is 5.05 mV/m.

If all of the measurements pass, the Final Test Status is updated to Pass in green.


| Index | Scrambling Code | P-CPICH Actual | Total Max | Avg/Meas | Total Avg |
|---|---|---|---|---|---|
| 1 | 230 | 562.31 uV/m | 861.59 uV/m | 569.61 uV/m | 577.44 uV/m |
| 2 | 278 | 130.19 uV/m | 342.23 uV/m | 220.52 uV/m | 221.48 uV/m |
| 3 | 342 | 378.07 uV/m | 491.76 uV/m | 359.78 uV/m | 371.11 uV/m |
| 4 | 414 | -- | 156.74 uV/m | 156.74 uV/m | 156.74 uV/m |
| 5 | 422 | 259.55 uV/m | 326.38 uV/m | 232.60 uV/m | 241.86 uV/m |
| 6 | 430 | 1.33 mV/m | 1.50 mV/m | 1.30 mV/m | 1.34 mV/m |
| Total | | 2.66 mV/m | 3.06 mV/m | 2.84 mV/m | 2.91 mV/m |
| Field Strength | | 4.70 mV/m | 5.80 mV/m | 5.05 mV/m | 4.62 mV/m |

**Figure 8-14.** W-CDMA EMF Measurement Display

# Appendix A — Error Messages

## A-1 Introduction

This Appendix provides a list of 3GPP error messages. Self Test and General Operation error messages are in the User Guide.

## A-2 3GPP Messages

### Warning Messages

1. External Reference not found. Internal reference Locked successfully

   This message is displayed when the instrument has detected an external reference but couldn't lock to the reference. It automatically switches to the Internal Reference. This could happen if the external reference frequency does not match the specified external reference frequency in the Setup menu.

2. External Reference Locked Successfully

### Notifications

1. RF Over Power
2. ADC over range
   a. If Auto Range is On - ADC over range: Decrease input power.
   b. If Auto Range is Off - ADC over range: Adjust range or decrease input power.
3. Level Under
   a. If Auto Range is On - No signal detected: Increase input power.
   b. If Auto Range is Off: Adjust range or increase input power.
4. Out of band saturation

   When the software detects that there is too much power outside the current frequency range, this message is displayed. This usually means that the instrument is currently tuned to a frequency with a very low amplitude signal or no signal and there is a strong signal at another frequency outside the current IF bandwidth.

5. Poor Range
   a. If Auto Range is On - Weak signal: Increase input power.
   b. If Auto Range is Off: Adjust range or increase input power.
6. Lock Failure xx

   When there is a lock failure detected from any of the internal LOs, this message is displayed. The xx is usually an error code in hex that can be interpreted by a service center to obtain more information on which LO had the failure.

7. Attempting to lock to Internal ref.
8. Attempting to lock to External ref.

# A-3 LTE Messages

1. Sync signal not found

   When the firmware does not find a synchronization signal (P-SS and S-SS), this message is displayed. Measurement results are cleared ('--' is seen in the result area for all modulation and Scanner results. Channel Power will continue to be displayed).

2. Demodulation Error

   When a wrong cell ID is entered after setting Sync Type to RS, this message is displayed. All Measurement results are cleared.

# A-4 TD-LTE Messages

1. Sync signal not found

   When the firmware does not find a synchronization signal (P-SS and S-SS), this message is displayed. Measurement results are cleared ('--' is seen in the result area for all modulation and Scanner results. Channel Power will continue to be displayed).

2. No Trigger found

   When Trigger is set to 'External' and no external trigger is found, this message is displayed. Results that depend on the trigger are cleared ('--' is seen in the result area)

# Index

## N



## O



## P



## R



## S

10580-00234 T

Anritsu utilizes recycled paper and environmentally conscious inks and toner.

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490 Jarvis Drive
Morgan Hill, CA 95037-2809
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http://www.anritsu.com

Measurement Guide

# Cable and Antenna Analyzer for Anritsu RF and Microwave Handheld Instruments

## Site Master™
## Cell Master™
## PIM Master™ MW82119B

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

Part Number: 10580-00241
Revision: B
Published: October 2014

## TRADEMARK ACKNOWLEDGMENTS



## NOTICE



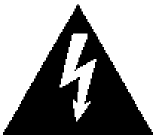
## UPDATES

Updates, if any, can be downloaded from the Documents area of the Anritsu web site at:
http://www.us.anritsu.com

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

**Warning**

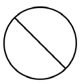

This indicates a hazardous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

**Caution**

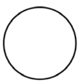
This indicates a hazardous procedure that could result in loss related to equipment malfunction if proper precautions are not taken.

## Safety Symbols Used on Equipment and in Manuals

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

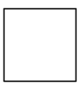


This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



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

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



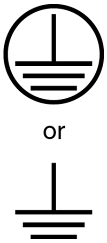
This indicates a note. The contents are described in the box.


These indicate that the marked part should be recycled.

**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**



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

**Warning**


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

**Caution**

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

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

# Table of Contents

# Chapter 1 — General Information

## 1-1 Introduction

The Site Master, Cell Master, and PIM Master (MW82119B with Option 331) offer a wide range of cable and antenna measurements: Return Loss, VSWR, Cable Loss, Distance-To-Fault RL, Distance-To-Fault VSWR, 1-Port Phase, and Smith Chart. This chapter provides setup and measurement procedures for each measurement. It also includes a line sweep fundamentals overview section.

## 1-2 Contacting Anritsu

To contact Anritsu, please visit:

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

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

Updated product information can be found on the Anritsu web site:

http://www.anritsu.com/

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

## 1-3 General Measurement Setups

The User Guide for your instrument provides a general overview of file management, system settings, and GPS. Chapter 2 of this guide provides specific setup, measurement, and menu information for cable and antenna measurements.

## 1-4 Selecting the Cable and Antenna Mode

The current measurement mode is displayed on screen below the battery symbol. To change to Cable & Antenna Analyzer measurement mode.

- Press the **Menu** key and select the Cable-Antenna Analyzer icon using the touch screen.

  or

1. Press the **Shift** key followed by pressing the **Mode** (**9**) key on the numeric keypad to open the Mode Selector list box.
2. Use the directional arrow keys, touchscreen, or the rotary knob to highlight the mode, and press the **Enter** key to select.

Refer to your User Guide for additional information.

# Chapter 2 — Cable and Antenna Analyzer

## 2-1 Overview

This chapter shows how to setup the instrument and perform basic line sweep measurements.

| | |
|---|---|
| **Note** | Confirm that the instrument is in Cable and Antenna Analyzer mode. Refer to "Selecting the Cable and Antenna Mode" on page 1-2. |

## 2-2 Cable and Antenna Measurement Setup

This section covers the following measurement setups functions:


- "Select Measurement Type" on page 2-1
- "Calibration" on page 2-1
- "Frequency" on page 2-2
- "Amplitude" on page 2-3
- "Sweep/Setup" on page 2-3
- "Display Setup" on page 2-6
- "Limit Lines" on page 2-7


### Select Measurement Type

Press the **Measurement** main menu key and select the appropriate measurement. The setup instructions below apply to all cable and antenna measurements. For specific instructions on how to setup Distance-To-Fault, refer to "Distance-To-Fault (DTF)" on page 2-18.

### Calibration

For accurate results, the instrument must be calibrated before making any measurements.

The instrument must be re-calibrated whenever the temperature exceeds the calibration temperature range or when the test port extension cable is removed or replaced. Unless the calibration type is Flexcal, the instrument must also be re-calibrated every time the setup frequency changes. See Chapter 3, "Calibration" for details on how to perform a calibration.

## Frequency

(for VSWR, Return Loss, Cable Loss, Smith Chart, 1-Port Phase measurements)

### Setting up the Measurement Frequency using Start and Stop Frequencies

1. Press the **Freq/Dist** main menu key.
2. Press the Start Freq submenu key and use the keypad to enter the start frequency. When entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key to complete the entry.
3. Press Stop Freq and use the keypad to enter the stop frequency. Press the appropriate unit key to complete the entry.

### Setting up the Measurement Frequency by Selecting a Signal Standard

1. Press the **Freq/Dist** main menu key.
2. Press the Signal Standard submenu key.
3. Select uplink, downlink, or uplink plus downlink.
4. Press the Select Standard key.
5. Use the rotary knob or the **Up/Down** arrow keys and scroll to the appropriate signal standard and press **Enter** to select.

| | |
|---|---|
| **Note** | The Signal Standard menu can be customized. If a particular standard is missing, Master Software Tools (MST) can be used to edit the signal standard list. Please see the MST manual for more details. |

## Frequency/Distance

(Distance-To-Fault Return Loss, Distance-To-Fault VSWR)

1. Press the **Freq/Dist** main menu key.
2. Press the Start Dist submenu key and use the keypad to enter the start distance.When entering a distance using the keypad, the key label changes to m or ft. Press the unit key or **Enter** to complete the entry.
3. Press Stop Dist and use the keypad to enter the stop distance. Press the unit key or **Enter** to complete the entry.
4. To set the frequency, press DTF Aid. For more details about DTF Aid, refer to "DTF Setup" on page 2-19.

Refer to "Freq Menu" on page 2-27 for additional information.

## Amplitude

(For Amplitude in Smith Chart measurements, see “Smith Chart” on page 2-23)

### Setting the Amplitude using Top and Bottom Keys

1. Press the **Amplitude** main menu key.
2. Press the Top submenu key and use the keypad, rotary knob, or the **Up/Down** arrow key to edit the top scale value. Press **Enter** to set.
3. Press the Bottom key and use the keypad, rotary knob, or the **Up/Down** arrow key to edit the bottom scale value. Press **Enter** to set.

### Setting the Amplitude using Autoscale

The instrument will automatically set the top and bottom scales to the minimum and maximum values of the measurement with some margin on the y-axis of the display.

1. Press the **Amplitude** main menu key
2. Press the Autoscale submenu key

### Setting the Amplitude using Fullscale

To automatically set the scale to the default setting (0 dB to 60 dB for Return Loss and 1 to 65.535 for VSWR), press the Fullscale key. The instrument will automatically set the top and bottom scales to the default values.

1. Press the **Amplitude** main menu key.
2. Press the Fullscale submenu key.

Refer to “Amplitude Menu” on page 2-31 for additional information.

## Sweep/Setup

The sweep/setup menus include keys to set Run/Hold, Sweep Type, RF Immunity, Data Points, Average / Smoothing, and Output power.

### Run/Hold

When in the Hold mode, this key starts the instrument sweeping and provides a Single Sweep Mode trigger; when in the Run mode, it pauses the sweep.

1. Press the **Sweep/Setup** main menu key.
2. Toggle the Run/Hold key.

### Sweep Type Single and Continuous

This toggles the sweep between single sweep and continuous sweep. In single sweep mode, each sweep must be activated by the Run/Hold key.

1. Press the **Sweep/Setup** main menu key.
2. Toggle the Single/Continuous key.

### RF Immunity High / Low

The instrument defaults to RF Immunity High. This setting protects the instrument from stray signals from nearby or co-located transmitters that can affect frequency and DTF measurements. The algorithm used to improve instrument's ability to reject unwanted signals slows down the sweep speed. If the instrument is used in an environment where immunity is not as issue, the RF Immunity key can be set to Low to optimize sweep speed. Use this feature with caution, as the introduction of an interfering signal might be mistaken for a problem with the antenna or cable run. If Immunity is set to Low during a normal RL or VSWR measurement, the instrument will be more susceptible to interfering signals. Interfering signals can make the measurement look better or worse than it really is.

1. Press the **Sweep/Setup** main menu key.
2. Toggle the RF Immunity High/Low key.

### Data Points

The number of data points can be set to 137, 275, 551, 1102, and 2204 data points. This can be changed before or after calibration regardless of the display setting. The default setting is 275. This is recommended for most measurements. More data points slow down the sweep speed. More data points are helpful in DTF as this enables better coverage for the same fault resolution.

1. Press the **Sweep/Setup** main menu key.
2. Select 137, 275, 551, 1102, or 2204 data points.

Refer to "Sweep/Setup Menu" on page 2-32 for additional information about the **Sweep/Setup** main menu and submenus.

### Averaging

Averaging helps to average out the trace and minimize the effect of outliers. Trace averaging takes the running average of the number of traces indicated in the Averaging Factor. The Average Count in the status window turns on if Averaging is turned on. When the Average Count reaches the entered average count, a running average of the last set of sweeps is performed. Averaging Factor can be set between 1 and 65535.

1. Press the **Sweep/Setup** main menu key.
2. Press the Averaging/Smoothing submenu key.
3. Press Averaging Factor and enter the number of running averages using the keypad, then press the **Enter** key.
4. Press the Averaging On/Off key and toggle Averaging to On.
5. Use the Restart key to start the averaging sequence from the beginning.

### Smoothing %

Smoothing is a mathematical function that calculates a rolling average of the trace data. This provides a way to look at the general shape of a measurement while smoothing out smaller variations. The value is the amount of the display that is incorporated into the rolling average. Valid entries range from 0% (no smoothing) to 10% (maximum smoothing).

The display in Figure 2-1 illustrates how smoothing can be used to reduce ripples when making 1-port cable loss measurements. The white trace shows the trace with no smoothing and the yellow trace shows the trace with 7% smoothing.

1. Press the **Sweep/Setup** main menu key.
2. Press the Averaging/Smoothing submenu key.
3. Select the Smoothing % key and enter the level of smoothing (1% to 10%).

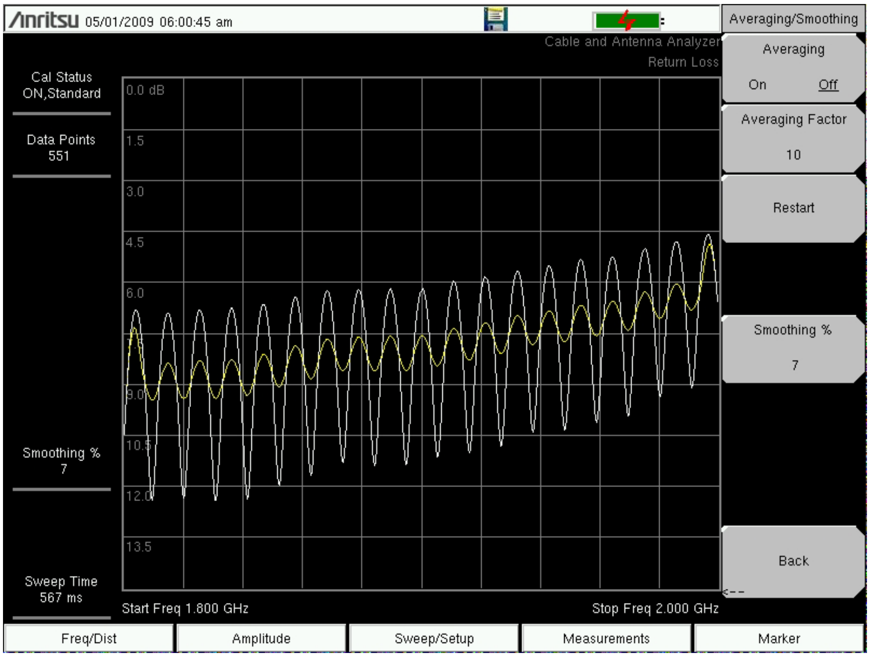



**Figure 2-1.** Smoothing Reduces Ripple

### Output Power (Low/High)

The power level defaults to High for all 1-port measurements (~ 0 dBm). It can be changed to Low (~ –35 dBm) if needed. All line sweep 1-port measurements should be performed with the output power High setting.

1. Press the **Sweep/Setup** main menu key.
2. Select the Output Power submenu key and toggle Output Power between High and Low.

Refer to “Sweep/Setup Menu” on page 2-32 for additional information.

# Display Setup

## Single and Dual Display

The instrument can display two measurements simultaneously using the Dual Display function.

Top and Bottom display can be set independently and it is possible to display all measurements either on the top or bottom. Smith Chart is not supported in dual display mode. Markers and Limit Lines can be set for each active display. Both Top and Bottom measurements are saved when saving a measurement in dual display mode. If the Marker Table is turned on in Dual Display Mode, the markers for the active display will show.

## Setting Single and Dual Display

1. Press the **Measurements** main menu key
2. Toggle the Display Format submenu key so that it is set to Dual.
3. Press the Active Display key and set it to Top. This can also be done by touching the upper display directly. The red outline indicates the active display.
4. Select the measurement for the top display.
5. Press the **Marker** main menu key and turn on the markers for the top display.
6. Open the **Limit** main menu **Shift**-6. Turn on the limit line.
7. Press **Measurement** and toggle Active Display to Bottom and repeat steps 4 to 6 to set the measurements, markers, and limit lines for the bottom display.

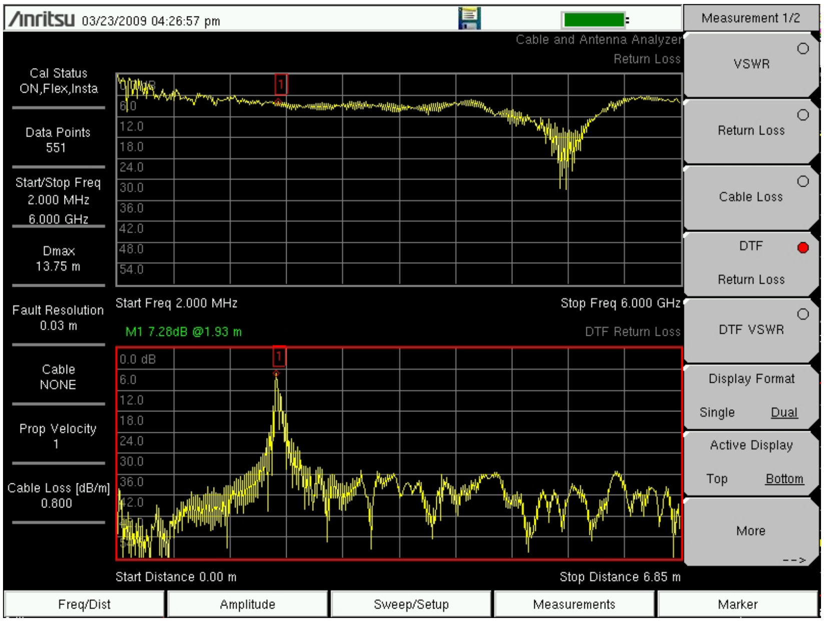



**Figure 2-2.** Dual Display with the Bottom Display Active

## Limit Lines

Pressing the **Shift** key and the **Limit** (6) key brings up the Limit menu. The cable and antenna analyzer supports both single limit and multi-segment limit lines. The multi-segment limit lines can have as many as 40 segments across the entire frequency or distance span. Limit lines can be used for visual reference , or for pass/fail criteria using the limit alarm. Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line. Limit lines are stored with setups and can be recalled at a later time.

### Single Limit Line

1. Press **Shift** and then **Limit** (6) to enter the Limit menu.
2. Press the Limit On/Off key to turn on the Limit.
3. Press Single Limit and then use the numeric keypad, **Up/Down** arrow keys, or the rotary knob followed by **Enter** to change the limit value.
4. Press the Limit Alarm key to turn on or off the Limit Alarm.

### Adjusting the Volume of Limit Alarm

1. Press **Shift** and then **System** (8)
2. Select the System Options submenu.
3. Press the Volume key.
4. Use the **Up/Down** arrow keys, rotary knob, or enter a value between 1 and 9 to adjust the volume.

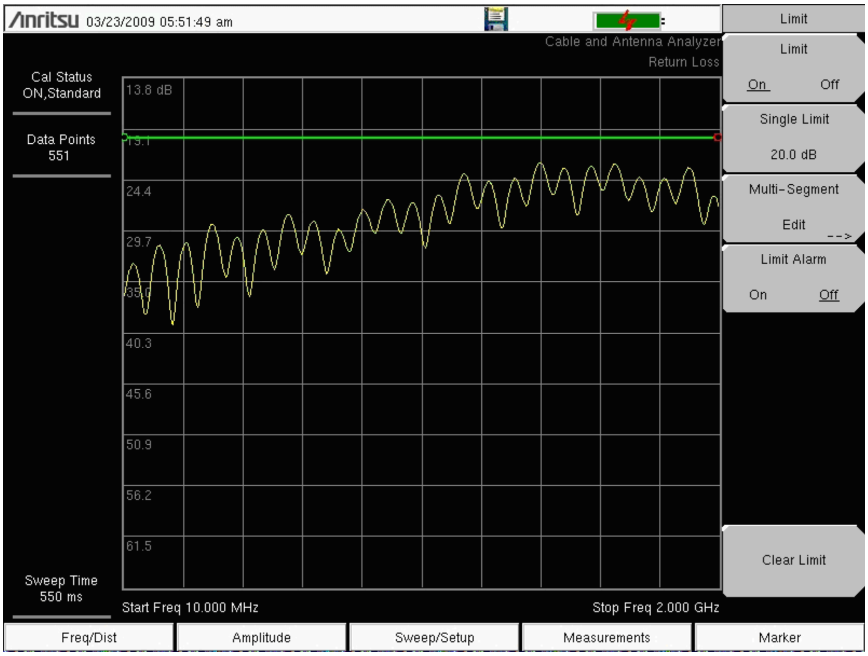



**Figure 2-3.** Single Limit Lines

### Segmented Limit Lines

The following procedure creates limit lines for a Return Loss Measurement. Limits are set to:

- 0 dB between 1800 MHz and 1830 MHz
- 13.5 dB between 1830 and 1870 MHz, and
- 0 dB between 1870 and 1900 MHz.

The frequency is set from 1800 MHz to 1900 MHz.

1. Press **Shift** and then **Limit** (6) to enter the Limit menu.
2. Press the Multi-Segment Edit key.
3. The default limit line has two points. In this example, 3 segments require 6 points. Press the Add Point key four times to add four more points.
4. Press Next Point Left until the highlighted red point is the first point to the left. Press Point Value and enter 0 dB.
5. Press Next Point Right and set the Point Value to 0 dB for the second point from the left. Press Point Freq and enter 1830 MHz.
6. Press Next Point Right and set the Point Value to 13.5 dB for the third point from the left. Press Point Freq and enter 1830 MHz.
7. Press Next Point Right and set the Point Value to 13.5 dB for the fourth point from the left. Press Point Freq and enter 1870 MHz.
8. Press Next Point Right and set the Point Value to 0 dB for the fifth point from the left. Press Point Freq and enter 1870 MHz.
9. Press Next Point Right and set the Point Value to 0 dB for the sixth point from the left. Press Point Freq and enter 1900 MHz.

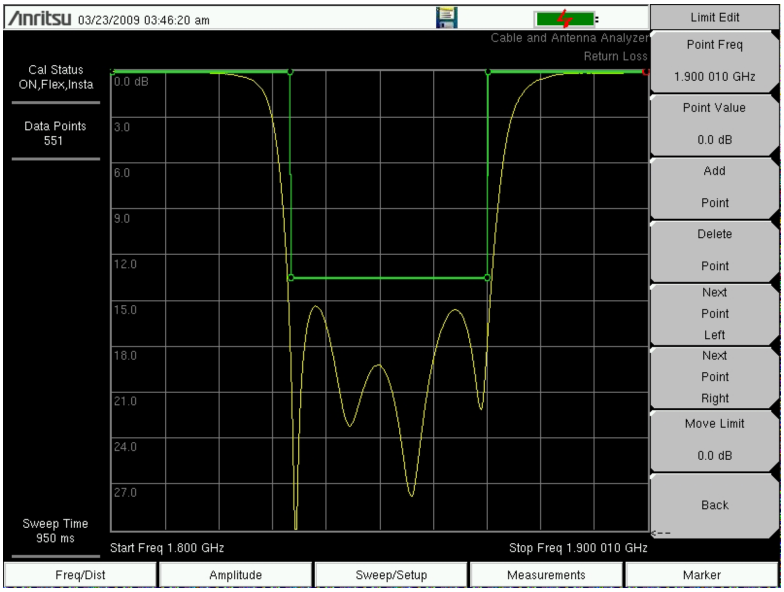



**Figure 2-4.** Segmented Limit Lines

# 2-3 Markers

Pressing the **Marker** main menu key will bring up the Marker menu. Markers can be applied to active or recalled measurements. The instrument supports six reference and six delta markers. Markers can be stored in the setups and recalled with the setup file at a later time.

### Select, Activate, and Place a Marker / Delta Marker

1. Press the **Marker** main menu key.
2. Press the Marker 1 2 3 4 5 6 key to select Marker number 1. The underlined number indicates the active marker.
3. Use the arrow keys, the keypad, or the rotary knob to move the marker. The current value for the selected marker is shown above the upper-left corner of the graph. It is also possible to drag the marker using the touch screen.
4. The Delta Markers are available for each of the six reference markers. For the selected marker, Toggle Delta On/Off to turn on the Delta marker.

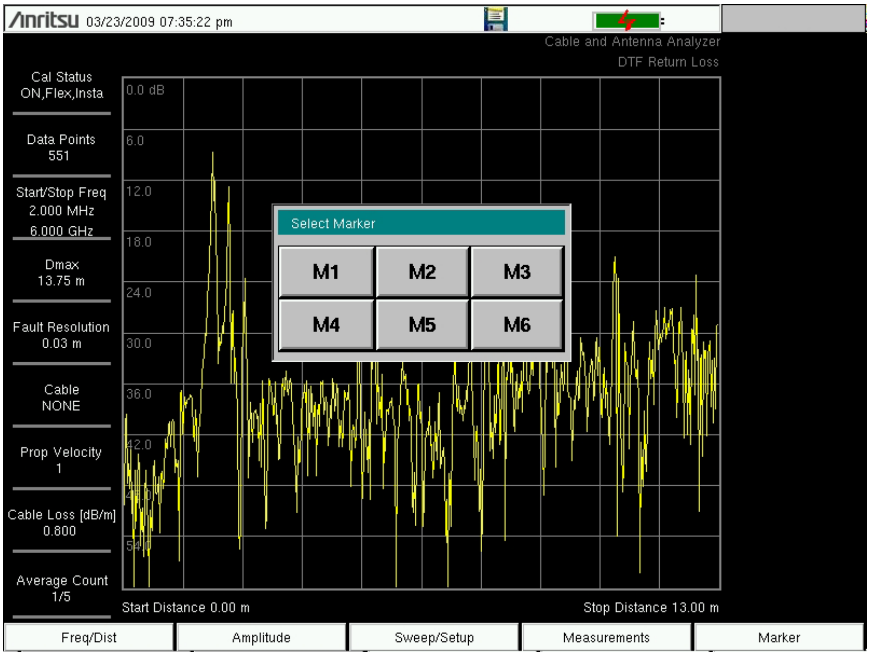



**Figure 2-5.** Selecting Markers

### Marker To Peak and Marker To Valley

All the cable and antenna measurements include Marker To Peak and Marker To Valley selections that sets the peak and valley markers automatically.

1. Press the Marker main menu key and select a marker.
2. Toggle the On/Off key to activate the marker.
3. Press Marker To Peak to set the marker to the peak of the measurement.
4. Press Marker To Valley to set the marker to valley of the measurement.

### Peak/Valley Auto

When making Return Loss and VSWR measurements, the Peak / Valley Auto feature can be used to automatically turn on Marker 1 to peak, Marker 2 to valley, and display M1 & M2 in the Marker Table. This feature is not available for DTF measurements.

1. Press the **Marker** main menu key.
2. Press the Peak/Valley Auto key.

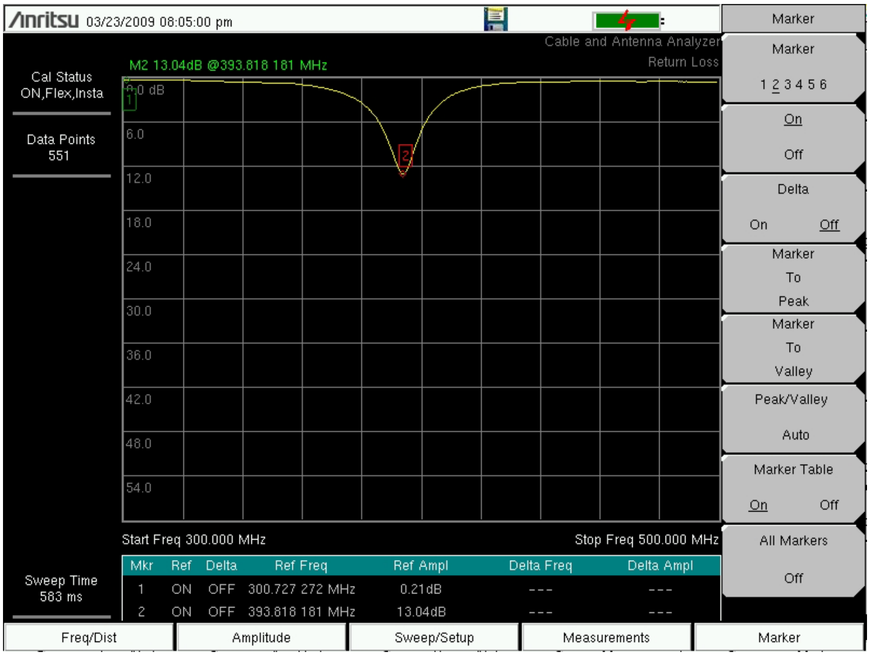



**Figure 2-6.** Using Peak/Valley Auto to Place M1 & M2 on Peak/Valley

### Marker Table

The Marker Table allows for viewing of up to six reference markers and six delta markers.

1. Press the **Marker** main menu key.
2. Press the Marker Table On/Off submenu key.

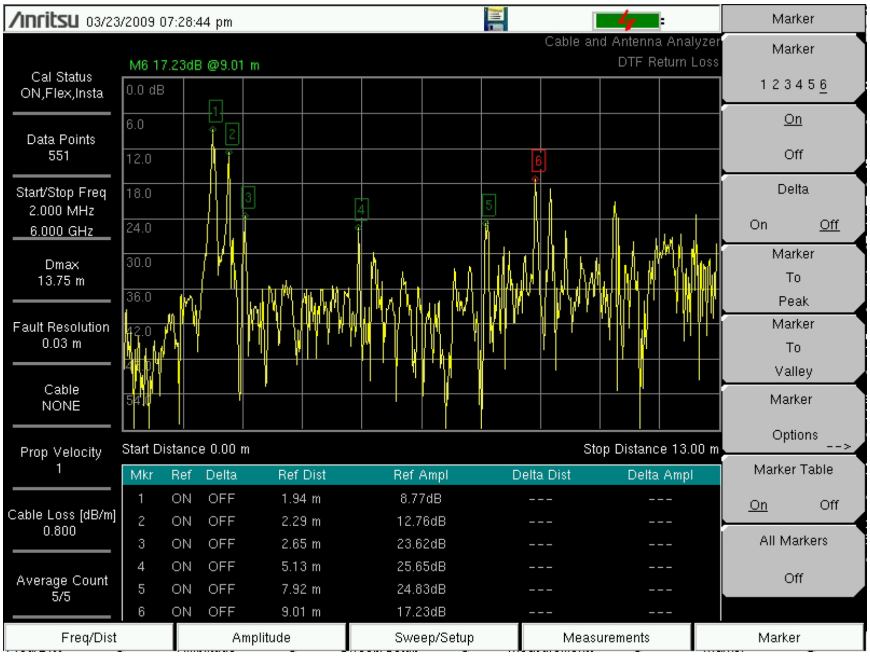



**Figure 2-7.** Marker Table Displays Six Markers

### Peak Between M1 & M2 and Valley Between M1 & M2

When Marker 5 is selected, pressing the Marker Option key will bring up two more peak options. Peak Between M1 & M2 and Valley between M1 & M2 are displayed.

1. Press the **Marker** main menu key.
2. Select Marker & 5.
3. Press Marker Options and select Peak between M1 & M2 or Valley Between M1 & M2.

### Peak Between M3 & M4 and Valley Between M3 & M4

When Marker 6 is selected, pressing the Marker Option key will bring up two more peak options. Peak Between M3 & M4 and Valley between M3 & M4 are displayed.

1. Press the **Marker** main menu key.
2. Select Marker & 6.
3. Press Marker Options and select Peak Between M3 & M4 or Valley Between M3 & M4.

Refer to "Marker Menu" on page 2-34 for additional information.

# 2-4 Trace

Pressing the **Shift** key and the **Trace** (**5**) key brings up the **Trace** main menu. The trace math menu inside the cable and antenna analyzer supports Trace Overlay features to allow viewing a two traces at the same time. This is useful when comparing a stored trace to a live trace. Trace Math operations include Trace – Memory and Trace + Memory. It is possible to copy a trace to display memory directly from the trace math menu. Traces can also be downloaded from Master Software Tools into the instrument and compared with live traces.

### Trace Overlay

The examples below illustrate how the trace overlay feature can be used to compare a trace stored in memory with a live trace.

1. Press **Shift** and **Trace** (**5**) to enter the Trace Menu
2. Press Recall Trace and locate the appropriate trace from the recall menu.
3. Press the Trace Overlay On/Off key to turn it on. The white trace is the recalled from memory trace and current trace is yellow.

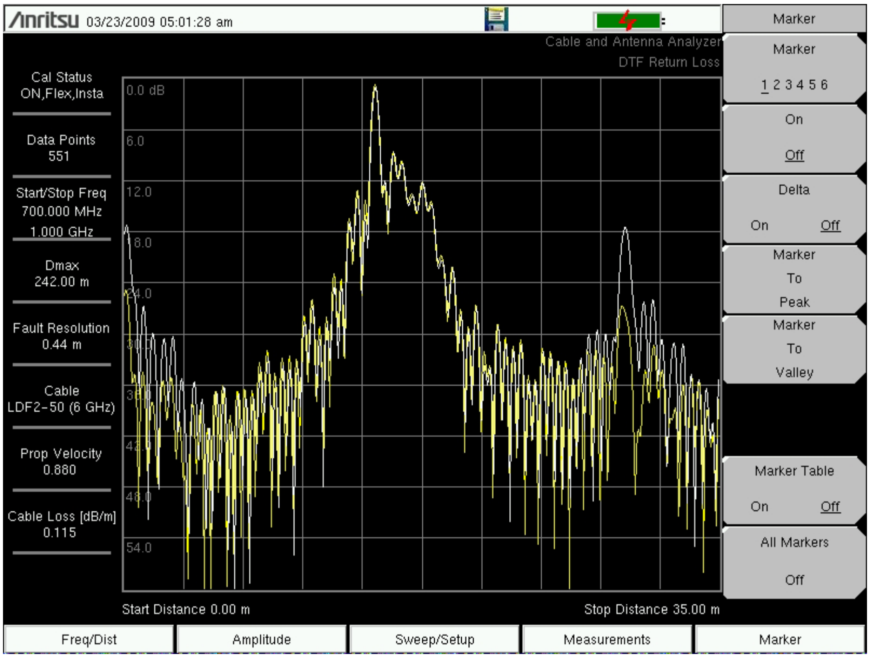



**Figure 2-8.** Trace Overlay of Two DTF Traces

### Trace Math Example

The example below illustrates how the Trace – Memory feature can be used to compare the phase of two cables.

1. Press **Shift** and **Trace** (**5**) to enter the Trace menu.
2. Connect the device under test (Cable A) and press the Copy Trace To Display Memory key.
3. Remove the first device and connect the second device under test (Cable B).
4. Press the Trace – Memory key to view the difference between Cable A and Cable B.

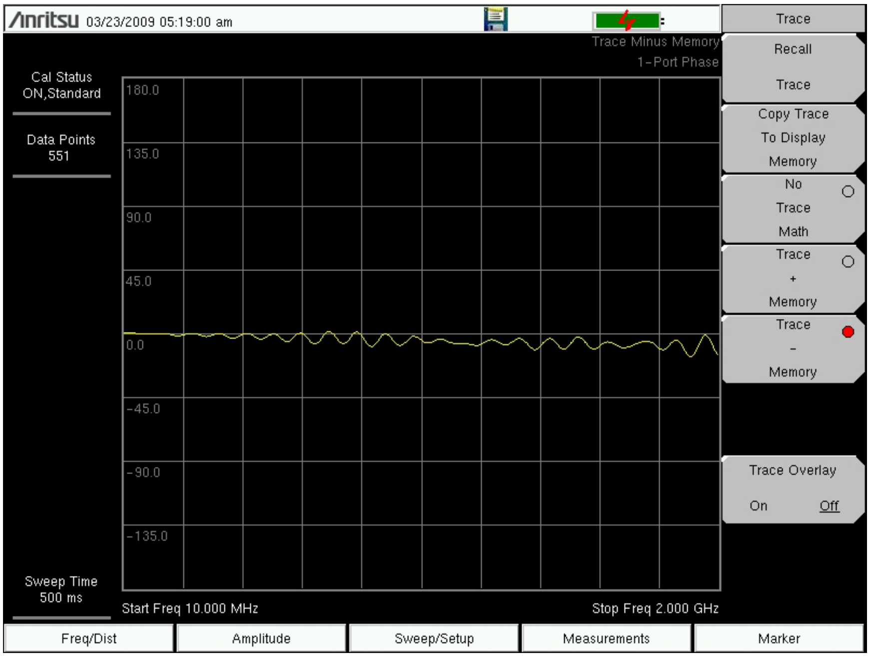



**Figure 2-9.** Trace-Memory Used to Compare the Phase of Two Cables

Refer to "Trace Menu" on page 2-35 for additional information.

# 2-5 Cable and Antenna Measurements Overview

## Line Sweep Fundamentals

In wireless communication, the transmit and receive antennas are connected to the radio through a transmission line. This transmission line is usually a coaxial cable or waveguide. This connection system is referred to as a transmission feed line system. Figure 2-10 shows an example of a typical transmission feed line system.

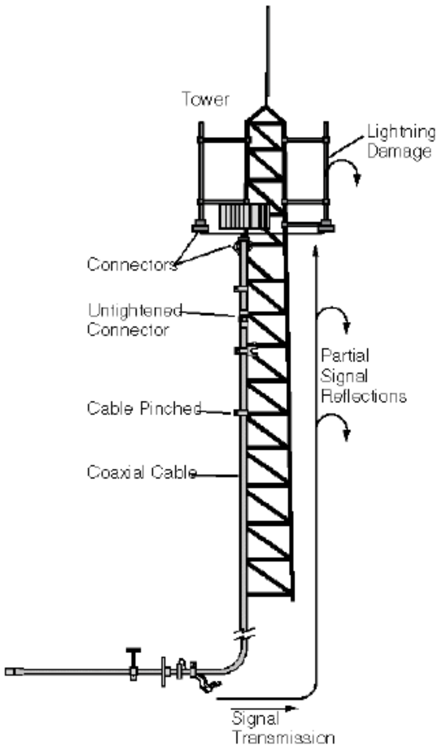



**Figure 2-10.** A Typical Transmission Feedline System

The performance of a transmission feed line system may be affected by excessive signal reflection and cable loss. Signal reflection occurs when the RF signal reflects back due to an impedance mismatch or change in impedance caused by excessive kinking or bending of the transmission line. Cable loss is caused by attenuation of the signal as it passes through the transmission line and connectors. To verify the performance of the transmission feed line system and analyze these problems, three types of line sweeps are required:

- Return Loss
- Cable Loss, and
- Distance-To-Fault.

The measurements for these sweeps are defined as

- Return Loss - System Sweep,
- DTF - Load Sweep, and
- Cable Loss Sweep.

## Line Sweep Types

### Return Loss / VSWR Measurement

Return Loss measures the reflected power of the system in decibels (dB). This measurement can also be taken in the Standing Wave Ratio (SWR) mode, which is the ratio of the transmitted power to the reflected power.

### Cable Loss Measurement

Measures the energy absorbed, or lost, by the transmission line in dB/meter or dB/ft. Different transmission lines have different losses, and the loss is frequency and distance specific. The higher the frequency or longer the distance, the greater the loss.

### Distance-To-Fault (DTF) Measurement

Reveals the precise fault location of components in the transmission line system. This test helps to identify specific problems in the system, such as connector transitions, jumpers, kinks in the cable or moisture intrusion.

## Line Sweep Measurement Types

### Return Loss – System Sweep

A measurement made when the antenna is connected at the end of the transmission line. This measurement provides an analysis of how the various components of the system are interacting and provides an aggregate return loss of the entire system.

### Distance To Fault – Load Sweep

A measurement is made with the antenna disconnected and replaced with a 50Ω precision load at the end of the transmission line. This measurement allows analysis of the various components of the transmission feed line system in the DTF mode.

### Cable Loss Sweep

A measurement made when a short is connected at the end of the transmission line. This condition allows analysis of the signal loss through the transmission line and identifies the problems in the system. High insertion loss in the feed line or jumpers can contribute to poor system performance and loss of coverage.

This whole process of measurements and testing the transmission line system is called Line Sweeping.

# 2-6 Line Sweep Measurements

This section provides typical line sweep measurements used to analyze the performance of a transmission feed line system including Return Loss, Cable Loss, and DTF.

## Return Loss Measurement

Return Loss measures the reflected power of the system in decibels (dB). This measurement can also be taken in the Standing Wave Ratio (SWR) mode, which is the ratio of the transmitted power to the reflected power.

System Return Loss measurement verifies the performance of the transmission feed line system with the antenna connected at the end of the transmission line.

**Device Under Test: Transmission Feedline with Antenna**

1. Press the **Measurements** main menu key and select Return Loss.
2. Press the **Freq/Dist** main menu key and enter the start and stop frequencies.
3. Press the **Amplitude** main menu key and enter the top and bottom values for the display.
4. Press **Shift** and **Calibrate** (**2**) to calibrate the instrument. See Chapter 3, "Calibration" for details.
5. Connect the Device Under Test.
6. Press the **Marker** main menu key and set the appropriate markers as described in "Markers" on page 2-9.
7. Press **Shift** and **Limit** (**6**) to enter and set the limits as described in "Limit Lines" on page 2-7.
8. Press **Shift** and **File** (**7**) to save the measurement. See the User Guide for details.

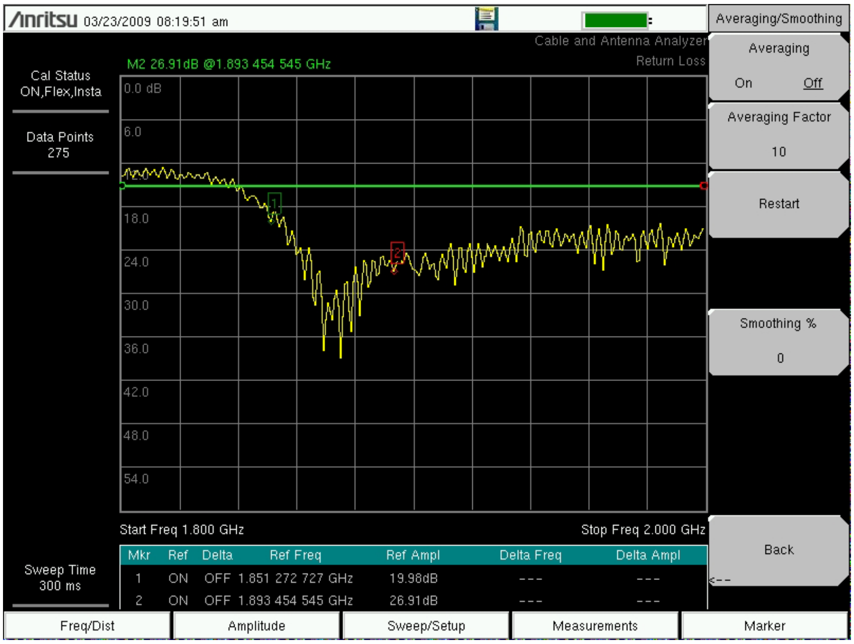



**Figure 2-11.** A Typical Return Loss Trace

## Cable Loss Measurement

The transmission feed line insertion loss test verifies the signal attenuation level of the cable system in reference to the specification. The average cable loss of the frequency range is displayed in the status display window.

### Device Under Test: Transmission Feedline with Short

1. Press the **Measurements** main menu key and select Cable Loss.
2. Press the **Freq/Dist** main menu key and enter start and stop frequencies.
3. Press the **Amplitude** main menu key and enter top and bottom values for the display.
4. Press **Shift** and **Calibrate** (**2**) to calibrate the instrument. See Chapter 3, “Calibration” for details.
5. Connect the Device Under Test.
6. Press **Shift** and **Limit** (**6**) to enter and set the limits as described in “Limit Lines” on page 2-7.
7. Press **Shift** and **File** (**7**) to save the measurement. See the User Guide for details.

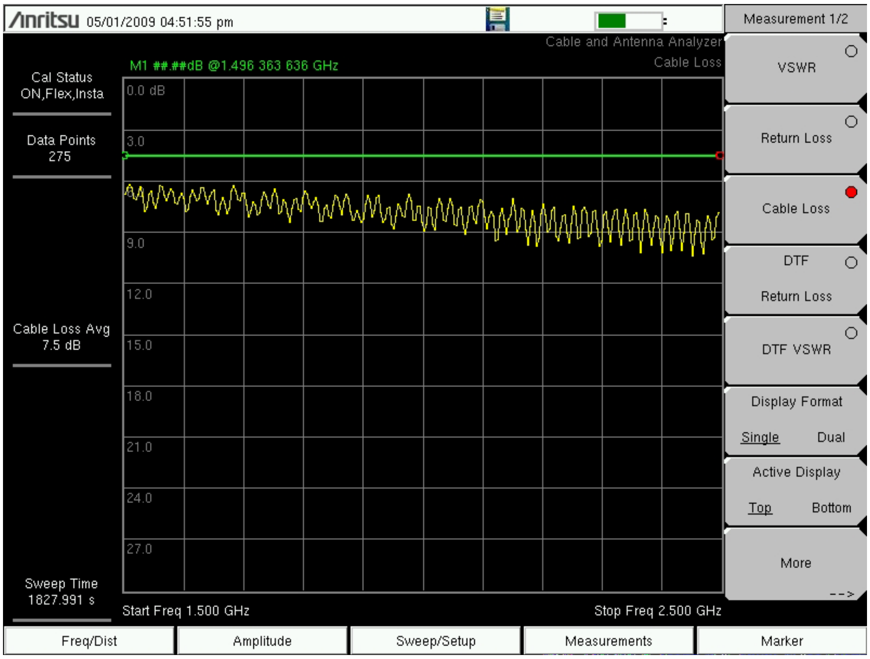



**Figure 2-12.** Cable Loss Measurement

## Distance-To-Fault (DTF)

DTF reveals the precise fault location of components in the transmission line system. This test helps to identify specific problems in the system, such as connector transitions, jumpers, kinks in the cable or moisture intrusion.

To measure the distance of a cable, DTF measurements can be made with an open or a short connected at the end of the cable. The peak indicating the end of the cable should be between 0 dB and 5 dB. An open or short should not be used when DTF is used for troubleshooting because the open/short will reflect everything and the true value of a connector might be misinterpreted and a good connector could look like a failing connector.

A 50 Ω load is the best termination for troubleshooting DTF problems because it will be 50 Ω over the entire frequency range. The antenna can also be used as a terminating device but the impedance of the antenna will change over different frequencies because the antenna is only designed to have 15 dB or better return loss in the passband of the antenna.

DTF measurement is a frequency domain measurement and the data is transformed to the time domain using mathematics. The distance information is obtained by analyzing how much the phase is changing when the system is swept in the frequency domain. Frequency selective devices such as TMAs (Tower Mounted Amplifiers), duplexers, filters, and quarter wave lightning arrestors change the phase information (distance information) if they are not swept over the correct frequencies. Care needs to be taken when setting up the frequency range whenever a TMA is present in the path.

Because of the nature of the measurement, maximum distance range and fault resolution is dependent upon the frequency range and number of data points. DTF Aid shows how the parameters are related. If the cable is longer than DMax, the only way to improve the horizontal range is to reduce the frequency span or to increase the number of data points. Similarly, the fault resolution is inversely proportional to the frequency range and the only way to improve the fault resolution is to widen the frequency span.

The instrument is equipped with a cable list (Figure 2-13) including most of the common cables used today. Once the correct cable has been selected, the instrument will update the propagation velocity and the cable attenuation values to correspond with the cable. These values can also be entered manually. Custom Cable lists can also be created with Master Software Tools and Uploaded into the instrument. Incorrect propagation velocity values affect the distance accuracy and inaccurate cable attenuation values affect the accuracy of the magnitude value.

| Cable Name | [ Prop Vel , | ( F1 , | CL1(dB/m) ) | ( F2 , | CL2(dB/m) ) | ( F3 , | CL3(dB/m) )] |
|---|---|---|---|---|---|---|---|
| NONE___________ | [ 1.000, | ( 1000 | , 0.800) | ( 1500 | , 0.800) | ( 2000 | , 0.800)] |
| FSJ1-50A (6 GHz | [ 0.840, | ( 1000 | , 0.196) | ( 2500 | , 0.322) | ( 6000 | , 0.527)] |
| FSJ2-50 (6 GHz) | [ 0.830, | ( 1000 | , 0.133) | ( 2500 | , 0.223) | ( 6000 | , 0.374)] |
| FSJ4-50B (6 GHz | [ 0.810, | ( 1000 | , 0.118) | ( 2500 | , 0.201) | ( 6000 | , 0.344)] |
| EFX2-50 (6 GHz) | [ 0.850, | ( 1000 | , 0.121) | ( 2500 | , 0.202) | ( 6000 | , 0.341)] |
| LDF1-50 (6 GHz) | [ 0.860, | ( 1000 | , 0.136) | ( 2000 | , 0.200) | ( 6000 | , 0.377)] |
| LDF2-50 (6 GHz) | [ 0.880, | ( 1000 | , 0.115) | ( 2000 | , 0.170) | ( 6000 | , 0.323)] |
| LDF4-50A (6 GHz | [ 0.880, | ( 1000 | , 0.073) | ( 2500 | , 0.121) | ( 6000 | , 0.200)] |
| HJ4-50 (6 GHz)_ | [ 0.914, | ( 1000 | , 0.092) | ( 2500 | , 0.156) | ( 6000 | , 0.257)] |
| HJ4.5-50 (6 GHz | [ 0.920, | ( 1000 | , 0.054) | ( 2500 | , 0.089) | ( 6000 | , 0.148)] |
| 310801_________ | [ 0.821, | ( 1000 | , 0.115) | ( 1000 | , 0.115) | ( 1000 | , 0.115)] |
| 311201_________ | [ 0.820, | ( 1000 | , 0.180) | ( 1000 | , 0.180) | ( 1000 | , 0.180)] |
| 311501_________ | [ 0.800, | ( 1000 | , 0.230) | ( 1000 | , 0.230) | ( 1000 | , 0.230)] |

**Figure 2-13.** Cable List

### Fault Resolution

Fault resolution is the system's ability to separate two closely spaced discontinuities. If the fault resolution is 10 feet and there are two faults 5 feet apart, the instrument will not be able to show both faults unless Fault Resolution is improved by widening the frequency span.

Fault Resolution (m) = $1.5 \times 10^8 \times vp / \Delta F$

### DMax

DMax is the maximum horizontal distance that can be analyzed. The Stop Distance can not exceed Dmax. If the cable is longer than Dmax, Dmax needs to be improved by increasing the number of data points or lowering the frequency span (ΔF). Note that the data points can be set to 137, 275, 551, 1102, or 2204

Dmax = (Datapoints – 1) x Fault Resolution

### DTF Setup

1. Press the **Measurements** main menu key and select DTF Return Loss or DTF VSWR.
2. Press the **Freq/Dist** main menu key.
3. Press the Units submenu key and select m to display distance in meters or ft to display distance in feet.
4. Press DTF Aid and use the touch screen, or arrow keys to navigate through all the DTF parameters.
   a. Set Start Distance and Stop Distance. Stop Distance needs to be smaller than Dmax.

| **Note** | If Stop Distance is greater than DMax, increase the number of data points. |
|---|---|

   b. Enter the Start and Stop frequencies.
   c. Press Cable and select the appropriate cable from the cable list (Figure 2-13).
   d. Press Continue.
5. Press **Shift** and **Calibrate** (**2**) to calibrate the instrument. See Chapter 3, “Calibration” for details.
6. Press the **Marker** main menu key and set the appropriate markers as described in “Markers” on page 2-9.
7. Press **Shift** and **Limit** (**6**) to enter and set the limits as described in “Limit Lines” on page 2-7.
8. Press **Shift** and **File** (**7**) to save the measurement. See the User Guide for details.

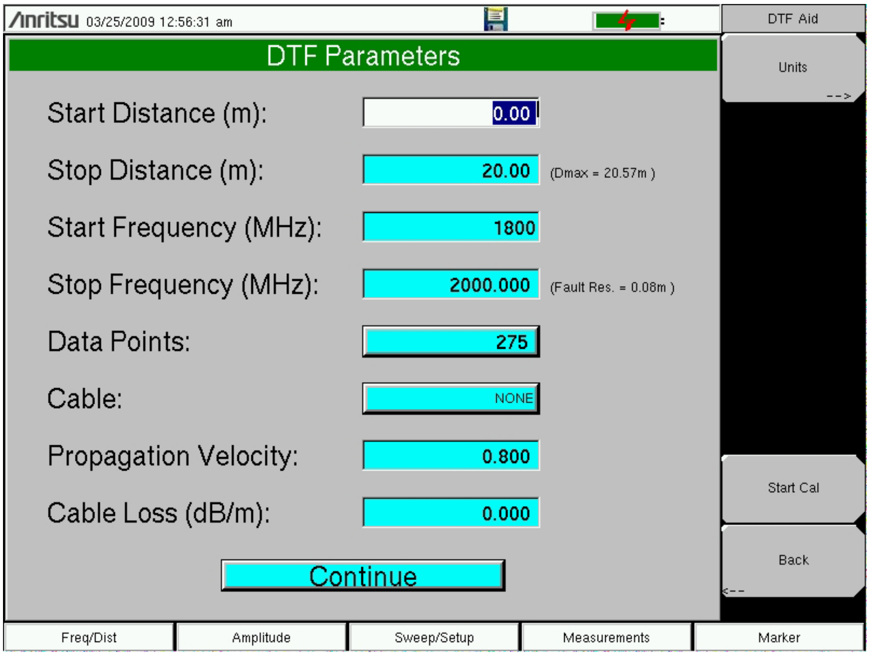



**Figure 2-14.** DTF Aid

### Example 1 – DTF Transmission Line Test

The Distance-To-Fault transmission line test verifies the performance of the transmission line assembly and its components and identifies the fault locations in the transmission line system. This test determines the return loss value of each connector pair, cable component and cable to identify the problem location. This test can be performed in the DTF-Return Loss or DTF-VSWR mode. Typically, for field applications, the DTF-Return Loss mode is used. To perform this test, disconnect the antenna and connect the load at the end of the transmission line.

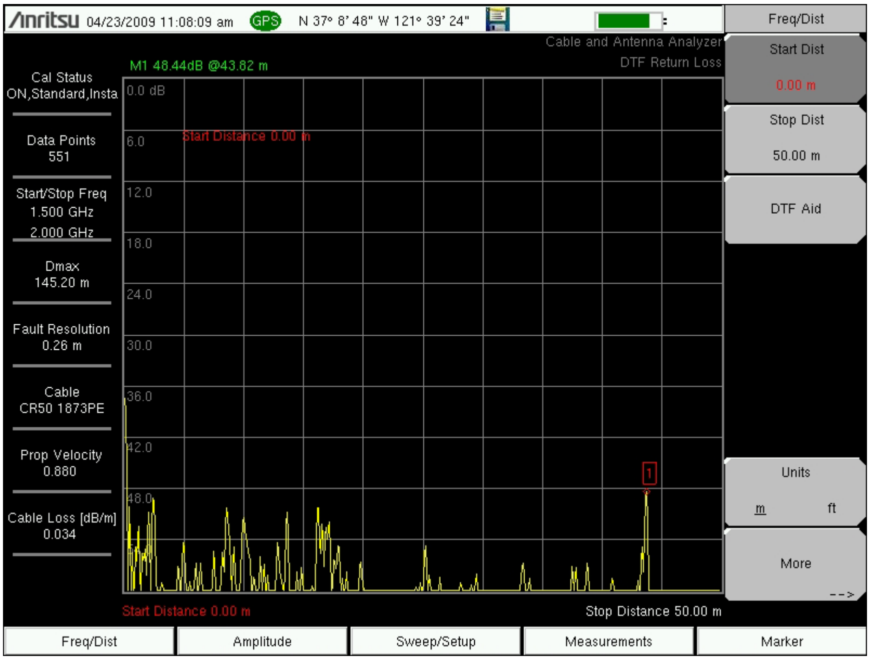



**Figure 2-15.** Typical Passing DTF Return Loss Measurement

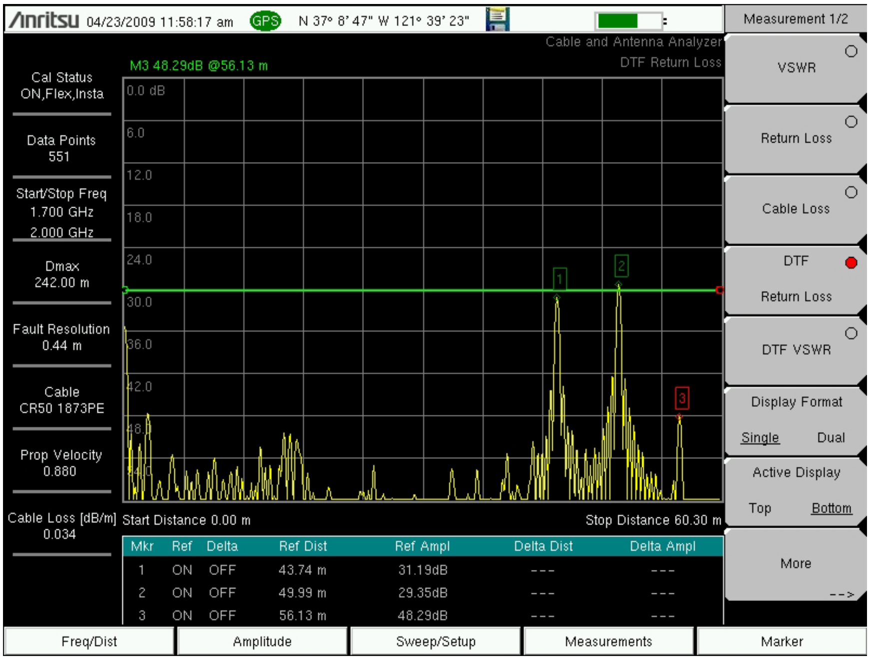



**Figure 2-16.** Typical Failing DTF Return Loss Measurement

### Example 2 – DTF with a short

To measure the distance of a cable, DTF measurements can be made with an open or a short connected at the end of the cable. The peak indicating the end of the cable should be between 0 dB and 5 dB.

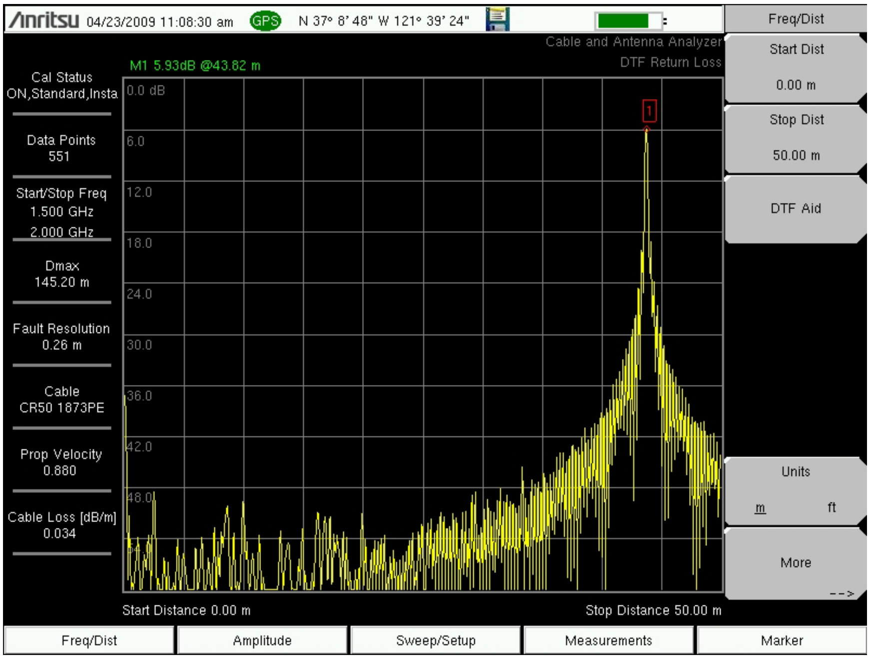



**Figure 2-17.** Typical DTF Return Loss Measurement with a Short at the End of the Cable

# 2-7 1-Port Measurements

## Phase Measurements

The instrument can display 1-port phase measurements. The following example compares the phase of two cables using a 1-port phase measurement.

1. Press the **Measurements** main menu key
2. Press the More submenu key.
3. Press the 1-Port Phase key.
4. Press the **Freq/Dist** main menu key and set the start frequency and stop frequency.
5. Press **Shift** and **Calibrate** (**2**) to calibrate the instrument. See Chapter 3, “Calibration” for details.
6. Connect device under test (Cable A) and press Copy Trace To Display Memory.
7. Remove the first device under test and connect the second device under test (Cable B).
8. Press the Trace – Memory key to view the difference between Cable A and Cable B.

## Smith Chart

The instrument can display 1-port measurements in a standard Normalized 50 ohm Smith Chart. When markers are used, the real and imaginary components of the Smith Chart value are displayed.

Anritsu Master Software Tools includes additional options and a calculator that can easily show what the return loss, VSWR, or reflection coefficient values of a specific Smith Chart value are.

It is possible to change the zoom size in the **Amplitude** menu. Expand 10 dB zooms in the Smith Chart so that the reflection coefficient is between 0 and 0.3162. Expand 20 dB expands the Smith Chart to show rho between 0 and 0.1 and Expand 30 dB expands to show rho between 0 and 0.0316.

### Smith Chart Measurement

The following example shows how a Smith Chart can be used to measure the match of an antenna.

1. Press the **Measurements** main menu key.
2. Press the More submenu key and select Smith Chart.
3. Press the **Freq/Dist** main menu key and set the start frequency and stop frequency.
4. Press **Shift** and **Calibrate** (**2**) to calibrate the instrument. See Chapter 3, “Calibration” for details.

5. Connect the antenna to the RF Out connector on the instrument.

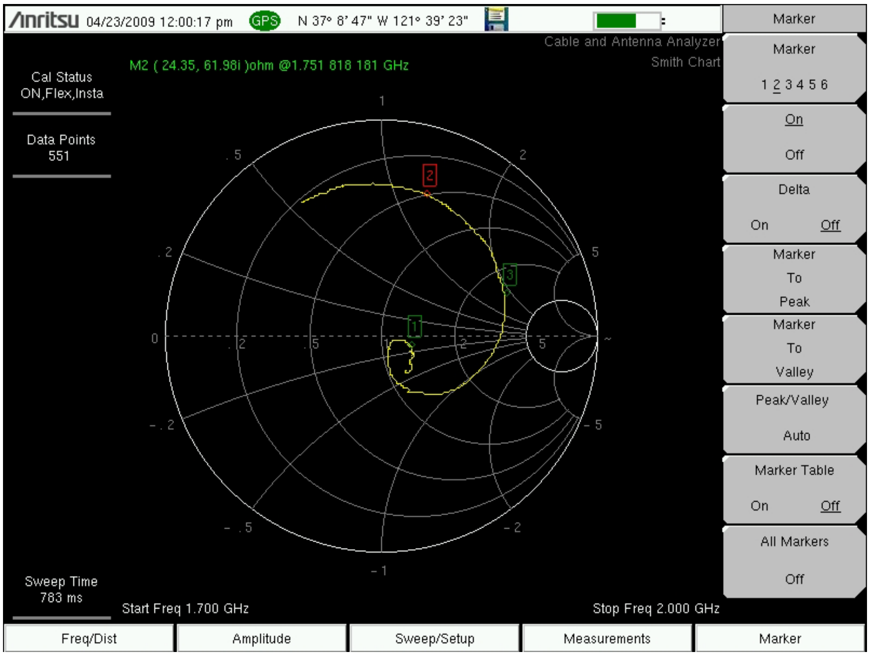



**Figure 2-18.** Typical Smith Chart display of a PCS Antenna

# 2-8 Cable and Antenna Analyzer Menus

Figure 2-19 and Figure 2-20 show the map of the Cable and Antenna Analyzer menus. The following sections describe main menus and associated submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.


**Figure 2-19.** Menu Keys (1 of 2)

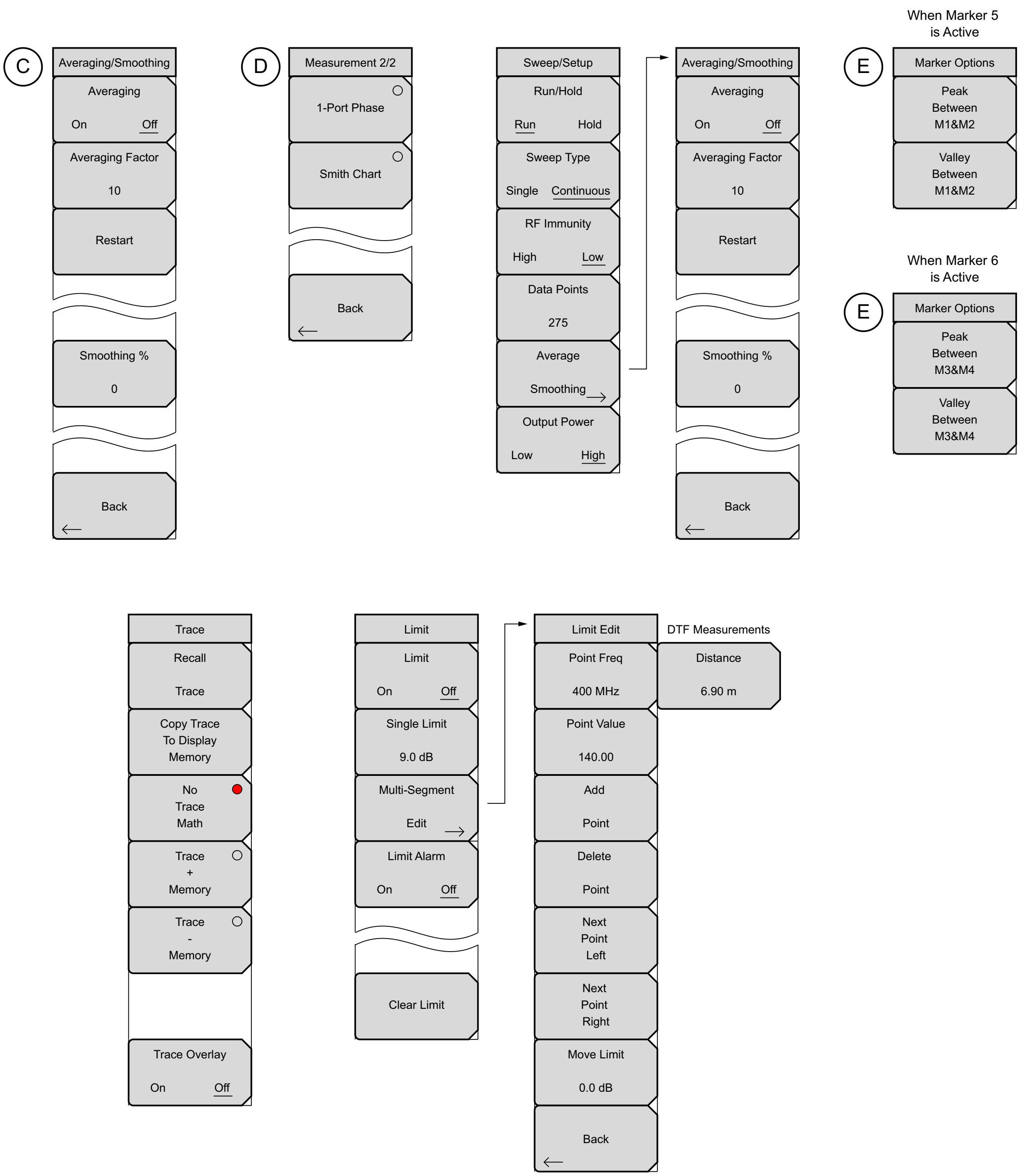


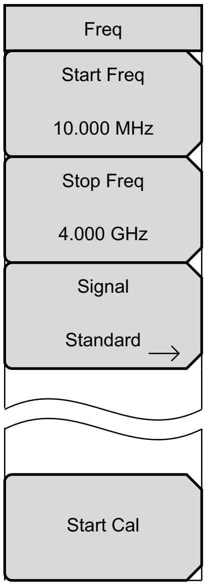

**Figure 2-20.** Main Menu Keys (2 of 2)

# 2-9 Freq Menu

The **Freq/Dist** main menu key opens the Freq menu, or the Freq/Dist menu, depending upon the type of measurement selected with the "Measurement Menu" on page 2-33.

Pressing the **Freq/Dist** main menu key after selection of DTF Return Loss or DTF VSWR on the **Measurement** main menu will open the "Freq/Dist Menu" on page 2-29.

Key Sequence: **Freq/Dist**




**Start Frequency:** Press the Start Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob.

**Stop Frequency:** Press the Stop Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob.

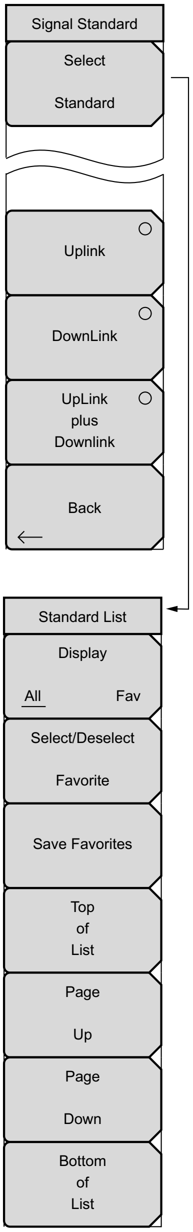
**Signal Standard:** Opens the "Signal Standard Menu" on page 2-28.

**Start Cal:** Press this submenu key and follow the instruction on screen to begin calibration. See Chapter 3 details.

**Figure 2-21.** Freq Menu

## Signal Standard Menu

Key Sequence: **Freq/Dist** > Signal Standard




**Select Standard:** Opens the Signal Standards dialog box. Select the signal standard using the arrow keys, the rotary knob, or the touch screen. When a signal standard is selected, the start and stop frequency is automatically set. Other settings, such as channel spacing and integration bandwidth, are also automatically entered.

**Display All/Fav:** Toggles between showing all signal standards based on the UpLink, Downlink, or UpLink plus DownLink selection or displaying the signal standard selected as favorites.

**Select/Deselect Favorite:** Selects the signal standard is the dialog box. Signal names selected as favorites have an "*" in the Fav column of the dialog box. Press **Enter** or Save Favorites to save.

**Save Favorites:** Saves the signal selected to the favorites list.

**Top of List:** Moves the selection to the first signal standard in the list.

**Page Up:** Moves up one page view from the current signal name.

**Display:** Moves down one page view from the current signal name.

**Bottom of List:** Moves the selection to the last signal standard in the list.

Press **Esc** to return to the Signal Standard menu.

**Uplink:** Press to display only uplink frequencies.

**Downlink:** Press to display only downlink frequencies.

**UpLink plus Downlink:** Press to display both uplink and downlink frequencies.

After pressing one of the above three keys, press Select Standard to see the results reflected in the Signal Standard dialog box.

**Back:** Returns to the "Freq Menu" on page 2-27.

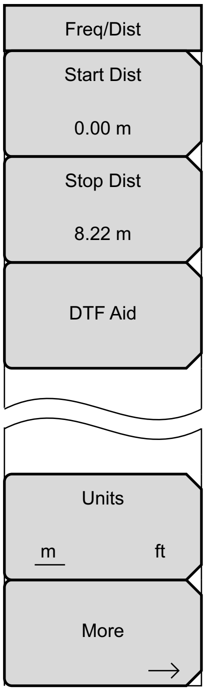
**Figure 2-22.** Signal Standard Menu

# 2-10 Freq/Dist Menu

The **Freq/Dist** main menu key opens the Freq menu, or the Freq/Dist menu, depending upon the type of measurement selected with the “Measurement Menu” on page 2-33.

Pressing the **Freq/Dist** main menu key after selection of VSWR, Return Loss, or Cable Loss on the **Measurement** main menu will open the “Freq Menu” on page 2-27.

Key Sequence: **Freq/Dist**




**Start Dist:** Press the Start Dist submenu key and enter the desired start distance using the keypad, the arrow keys, or the rotary knob.

**Stop Dist:** Press the Stop Dist submenu key and enter the desired stop distance using the keypad, the arrow keys, or the rotary knob.

**DTF Aid:** Opens the DTF Aid dialog box (Figure 2-14) for entering parameters.

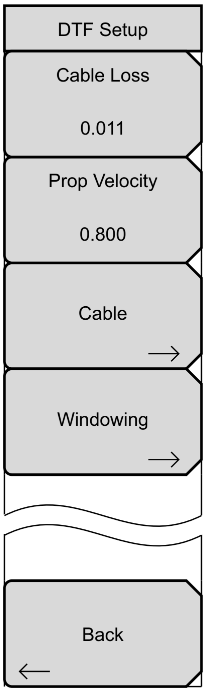
**Units:** Toggles between meters and feet.

**More:** Opens the “DTF Setup Menu” on page 2-30.

**Figure 2-23.** Freq/Dist Menu

## DTF Setup Menu

Key Sequence: **Freq/Dist** > More




**Cable Loss:** Press the Cable Loss submenu key and enter the loss in dB/ft or dB/m for the selected cable using the keypad, the arrow keys, or the rotary knob and press **Enter**.

**Prop Velocity:** Press the Prop Velocity submenu key and enter the applicable propagation velocity for the selected cable using the keypad, the arrow keys, or the rotary knob and press **Enter**.

**Cable:** The Cable submenu key opens a list of available cable specifications (see Figure 2-13). Using the arrow keys, the rotary knob, or the touch screen, select the desired cable and press **Enter**.

Note: When a cable is selected from this list, propagation velocity and cable loss are automatically set by the unit.

**Windowing:** Opens the Windowing menu. Options are:

- Rectangular
- Nominal Side Lobe
- Low Side Lobe
- Minimum Side Lobe

Refer to Appendix A for more information on windowing.

**Back:** Returns to “Freq/Dist Menu” on page 2-29.

**Figure 2-24.** DTF Setup Menu

## 2-11 Amplitude Menu

Key Sequence: **Amplitude**


**Top:** Sets the top amplitude value.

**Bottom:** Sets the bottom amplitude value.

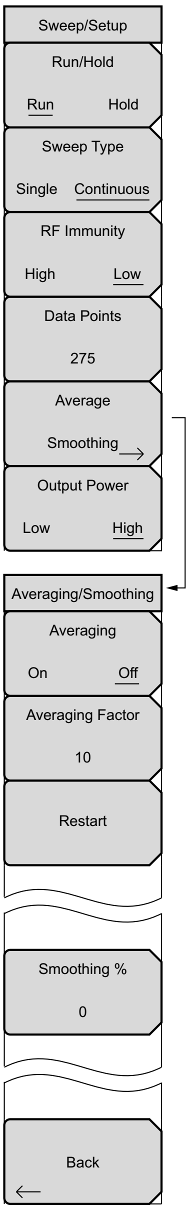
**Autoscale:** Automatically sets the top and bottom scales to the minimum and maximum values of the measurement with some margin on the y-axis of the display.

**Fullscale:** Fullscale automatically sets the scale to the default setting (0 dB to 60 dB for Return Loss and 1 dB to 65 dB for VSWR).

**Figure 2-25.** Amplitude Menu

# 2-12 Sweep/Setup Menu

Key Sequence: **Sweep/Setup**




**Run/Hold:** Toggles between Run and Hold. When in Hold mode, pressing this key starts the sweeping and provides a trigger. When in the Run mode, pressing this key pauses the sweep.

**Sweep Type:** This toggles the sweep between single sweep and continuous sweep. In single sweep mode, each sweep must be activated by the Run/Hold key.

**RF Immunity, High / Low:** The instrument defaults to RF Immunity High and is the suggested setting. See "RF Immunity High / Low" on page 2-4 for details.

**Data Points:** Opens the data points dialog box. Use the touch screen to set the number of data points: 137, 275, 551, 1102, or 2204.

**Average/Smoothing:** Opens the Average/Smoothing submenu.

**Averaging:** Toggles Averaging on or off.

**Averaging Factor:** Enter the number of running averages using the arrow keys, rotary knob, or the keypad.

**Restart:** Press the Restart key to start the averaging sequence from the beginning.

**Smoothing %:** Smoothing calculates a rolling average of the trace data. Valid entries range from 0 % (no smoothing) to 10 % (max. smoothing).

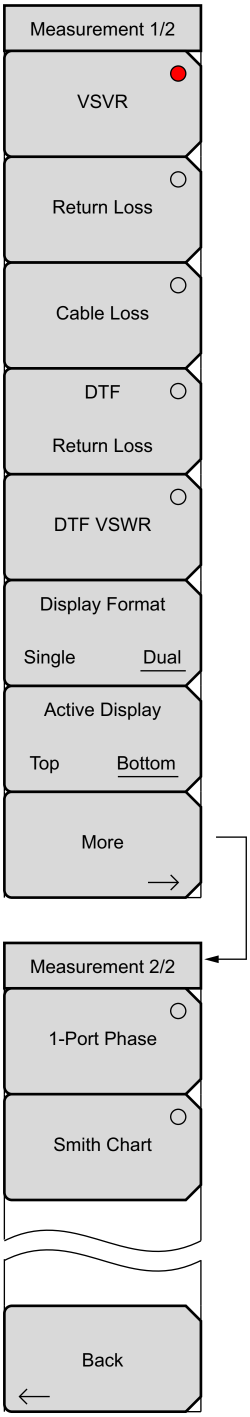
**Back:** Returns to the Sweep/Setup menu.

**Output Power:** The power level defaults to High for all 1-port measurements (approximately 0 dBm). It can be changed to Low (approximately –35 dBm) if needed.

**Figure 2-26.** Sweep/Setup Menu

# 2-13 Measurement Menu

Key Sequence: **Measurement**.




**VSWR:** Press the VSWR submenu key to view the match in VSWR.

**Return Loss:** Return Loss is used to characterize RF components and systems. The Return Loss indicates how well the system is matched by taking the ratio of the reflected signal to the incident signal, and measuring the reflected power in dB.

**Cable Loss:** The cable loss test verifies the signal attenuation level of the cable.

**DTF Return Loss:** The DTF measurement displays return loss (or VSWR) values versus distance. If the frequency measurements fail or indicate a problem in the system, then the DTF measurement can be used to identify and pinpoint the exact location of the problem. The DTF measurement shows the return loss value of all the individual components including connector pairs and cable components.

**DTF VSWR:** The DTF measurement displays return loss (or VSWR) values versus distance. If the frequency measurements fail or indicate a problem in the system, then the DTF measurement can be used to identify and pinpoint the exact location of the problem. The DTF measurement shows the return loss value of all the individual components including connector pairs and cable components.

**Display Format:** Select between having a single measurement or dual measurement display.

**Active Display:** Selects the active display, by displaying a red outline.

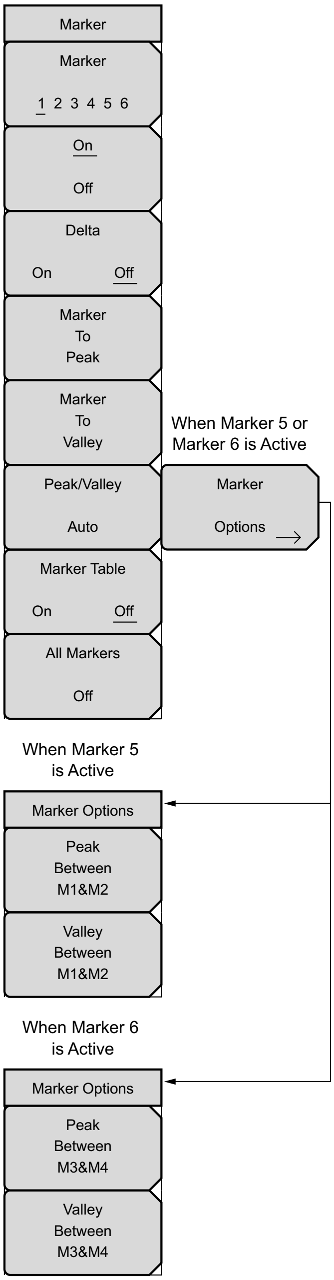
**More:** Opens an additional menu.

> **1-Port Phase:** Used for phase matching of cables.
>
> **Smith Chart:** Displays the measurement results as a Smith Chart.
>
> **Back:** Returns to the **Measurement** Menu.

**Figure 2-27.** Measurement Menu

# 2-14 Marker Menu

Key Sequence: **Marker**




**Marker:** Press the marker key the select M1 to M6 on the touch screen to choose the active marker. The underlined marker number is the active marker.

**On/Off:** Turns the selected marker underlined in the Marker key On or Off.

**Delta:** Turns on a delta marker.

**Marker to Peak:** This submenu key places the currently active marker on the highest signal amplitude currently displayed on screen.

**Marker to Valley:** This soft key places the currently active marker on the lowest signal amplitude currently displayed on screen.

**Peak/Valley Auto (Markers 1 through 4 Active):** Automatically set Marker 1 to peak and Marker 2 to valley. Note: Not available in DTF measurements.

**Marker Options (Marker 5 or 6 Active):** Displays the Marker Options submenu.

**Marker 5 Active**

> **Peak Between M1&M2:** Place Marker 5 at the peak between Marker 1 and Marker 2.
>
> **Valley Between M1&M2:** Place Marker 5 at the valley between Marker 1 and Marker 2.

**Marker 6 Active**

> **Peak Between M3&M4:** Place Marker 6 at the peak between Marker 3 and Marker 4.
>
> **Valley Between M3&M4:** Place Marker 6 at the valley between Marker 3 and Marker 4.

**Marker Table:** Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered for them.

**All Markers Off:** Turns off all markers.

**Figure 2-28.** Marker Menu

# 2-15 Sweep Menu

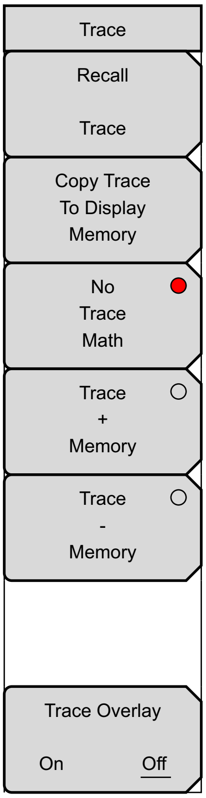
This menu open the “Sweep/Setup Menu” on page 2-32.

## 2-16 Measure Menu

This menu open the “Measurement Menu” on page 2-33.

## 2-17 Trace Menu

Key Sequence: **Shift** > **Trace** (**5**) key




**Recall Trace:** Opens the Recall dialog box to recall a previously saved measurement. See the User Guide for more information about recalling measurements. If the setup of the recalled trace is the same as the current settings, the trace is displayed in white and copied to display memory for use in Trace Math.

**Copy Trace to Memory:** Copies the current trace display to memory for use in Trace Math.

**No Trace Math:** The active trace is shown with as is with no math functions.

**Trace + Memory:** Displays the results of logarithmic adding of the active trace and the trace in memory.

**Trace – Memory:** Displays the difference between the active trace and the trace in memory.

**Trace Overlay:** Displays both the recalled trace (white) if a trace is stored in memory and the current trace (yellow).

**Figure 2-29.** Trace Menu

## 2-18 Limit Menu

Limit lines can be used for visual reference only, or for pass/fail criteria using the limit alarm. Limit alarm failures are reported whenever a signal crosses the limit line.

Each limit line can consist of a single segment, or as many as 40 segments across the entire frequency span of the instrument. These limit segments are retained regardless of the current frequency span of the instrument, allowing the configuring of specific limit envelopes at various frequencies of interest without having to re-configure them each time the frequency is changed. To clear the current limit setup configuration and return to a single limit segment starting at the current start frequency and ending at the current stop frequency, press the Clear Limit submenu key.

Key Sequence: **Shift** > **Limit** (**5**) key

**Limit On/Off:** This key toggles limit lines On or Off.

**Single Limit:** This key create a single segment limit line. The amplitude of the limit line is adjusted with the arrow keys, rotary knob, or the numeric keypad.

**Multi-Segment Edit:** The “Limit Edit Menu” on page 2-37 is displayed to allow the creation or editing of single or multi-segment limit lines. The currently active limit point is marked by a red circle on the display.

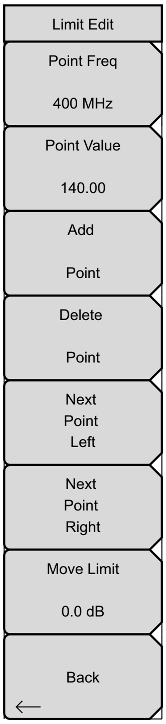
**Limit Alarm:** This submenu key selects, for the currently active limit line, if an alarm beep will occur when a data point exceeds the limit.

**Clear Limit:** This submenu key deletes all limit points for the currently active limit line.

**Figure 2-30.** Limit Menu

## Limit Edit Menu

Key Sequence: **Shift** > **Limit** (**5**) key > Limit Edit




**Point Frequency:** The frequency of each point in a limit line can be individually set. When a new point is added, it takes on a value halfway between two existing points, or the stop frequency of the current sweep if there is no point higher in frequency than the one being added. See the Add Point submenu key description for more details. Use the keypad, the **Left/Right** arrow keys, or the rotary knob to change the frequency of a point.

**Point Value:** The amplitude of each limit point can also be individually set. By default, when a new point is added, it takes on the amplitude that is on the limit line at the frequency where the point was added. Use the keypad, using the ± key as the minus sign, the **Up/Down** arrow keys or the rotary knob to move the point to the desired value. The unit of the amplitude limit is the same as the current vertical amplitude unit. See the Add Point submenu key description for more details.

**Add Point:** The precise behavior of this submenu key depends on which limit point is active at the time the key is pressed. If the active limit point is somewhere in the middle of a multi-segment limit line, a new limit point will be added that is halfway between the currently active point and the point immediately to its right. The amplitude of the point will be such that it falls on the limit line. For example, if there is a limit point at 2.0 GHz with an amplitude of –30 dBm and the next point is 3.0 GHz with an amplitude of –50 dBm, the added point will be at 2.5 GHz with an amplitude of –40 dBm. The frequency and amplitude values of the new point can be adjusted as needed with the Frequency and Amplitude submenu keys. If the last limit point is active (assuming it is not at the right edge of the display) the new limit point will be placed at the right edge of the display at the same amplitude as the point immediately to its left. Points may not be added beyond the current sweep limits of the instrument.

**Delete Point:** This submenu key deletes the currently active point. The active point becomes the one immediately to the left of the point that was deleted.

**Next Point Left:** This submenu key selects the limit point immediately to the left of the active point, making it active for editing or deletion. With each key press, the indicator of which point is active moves one limit point to the left until it reaches the left edge of the screen.

**Next Point Right:** This submenu key selects the limit point immediately to the right of the active point, making it active for editing or deletion. With each key press, the indicator of which point is active moves one limit point to the right until it reaches the right edge of the screen.

**Move Limit:** This submenu key allows an entire single or multi-segment limit line to be moved up or down by the number of dB entered using the keypad, the **Up/Down** arrow keys, or the rotary knob. The units for this amount will be the current display units as selected under the **Amplitude** menu.

**Back:** Returns to "Limit Menu" on page 2-36.

**Figure 2-31.** Limit Edit Menu

# 2-19 Other Menus

**Preset**, **File**, **Mode** and **System** are described in the User Guide. **Calibrate** is described in Chapter 3.

# Chapter 3 — Calibration

## 3-1 Introduction

This chapter provides details and procedures about the following calibration methods: InstaCal, Open-Short-Load, Standard Cal, Flexcal

## 3-2 Chapter Overview



## 3-3 Calibration Methods

For accurate results, the instrument must be calibrated before making any measurements.

The instrument must be re-calibrated whenever the temperature exceeds the calibration temperature range or when the test port extension cable is removed or replaced. Unless the calibration type is Flexcal, the instrument must also be re-calibrated every time the setup frequency changes.

The instrument can be manually calibrated with a precision OSL (Open-Short-Load) calibration tee / discrete components or with the InstaCal module. The benefit of the InstaCal module is that it is much faster, requires no connection changes, and eliminates the need to use three different terminations (open, short, load) for calibration. The trade-off is that the specified corrected directivity is 38 dB instead of 42 dB.

While InstaCal or OSL Cal tee provides two alternatives for the tools needed to perform the calibration, Standard Cal or FlexCal determines how often calibration will need to be performed. A standard calibration is an Open, Short and Load calibration for a selected frequency range, and is no longer valid if the frequency is changed. The default calibration mode is standard.

FlexCal is a broadband frequency calibration that remains valid if the frequency is changed.

Flexcal calibrates the instrument over the entire frequency range and interpolates datapoints if the frequency range is changed. This method saves time as it does not require the user to re-calibrate the system for frequency changes. The trade-off is that the accuracy is not the same as it would be with the standard calibration. It is recommended for troubleshooting purposes. Table 3-1 has a summary of calibration methods and tools.

**Table 3-1.** Summary of Calibration Methods and Tools

| Calibration Type | Calibration Tool | |
|---|---|---|
| | **OSL** | **InstaCal** |
| **Standard Cal**<br>(recalibrate every time frequency is changed) | Most Accurate Cal Method/ Need to recalibrate if frequency changes<br>This will provide the best accuracy.<br>Recommended for reporting | Fastest Calibration Method.<br>Need to recalibrate if frequency changes<br>Fast cal method.<br>Recommended for reporting |
| **FlexCal**<br>(no need to recalibrate when frequency is changed) | Most accurate cal method.<br>No need to recalibrate if frequency changes.<br>Recommended for troubleshooting. | Fastest Cal Method /<br>No need to re-calibrate if frequency changes.<br>This is the fastest and most convenient combination.<br>Recommended for troubleshooting. |

# 3-4 Calibration Verification

During the calibration process in Return Loss mode (**Measurements** > Return Loss), either with discrete calibration components or with the InstaCal module, there are typical measurement levels expected. Verifying the measurement levels displayed on the screen during calibration can save valuable time in the field.

## Trace Characteristics in Return Loss Mode

As the individual calibration components are connected to the RF out port, the following measurement levels will be displayed on the screen:

- When an OPEN is connected, a trace will be displayed between 0 dB to 10 dB.
- When a SHORT is connected, a trace will be displayed between 0 dB to 10 dB.
- When a LOAD is connected, a trace will be displayed between 0 dB to 50 dB.

# 3-5 Calibration Procedures

In Cable and Antenna Analyzer Mode, calibration is required when the "Not Calibrated" message is displayed or when the test port cable has been changed. The following sections detail how to perform OSL and InstaCal calibration.

| **Note** | If a Test Port Extension Cable is to be used, it must be connected to the Site Master before calibration. Follow the same calibration procedures with the OSL components or the InstaCal module in place at the end of the test port extension cable. |
|---|---|

## OSL Calibration Procedure (Standard and FlexCal)

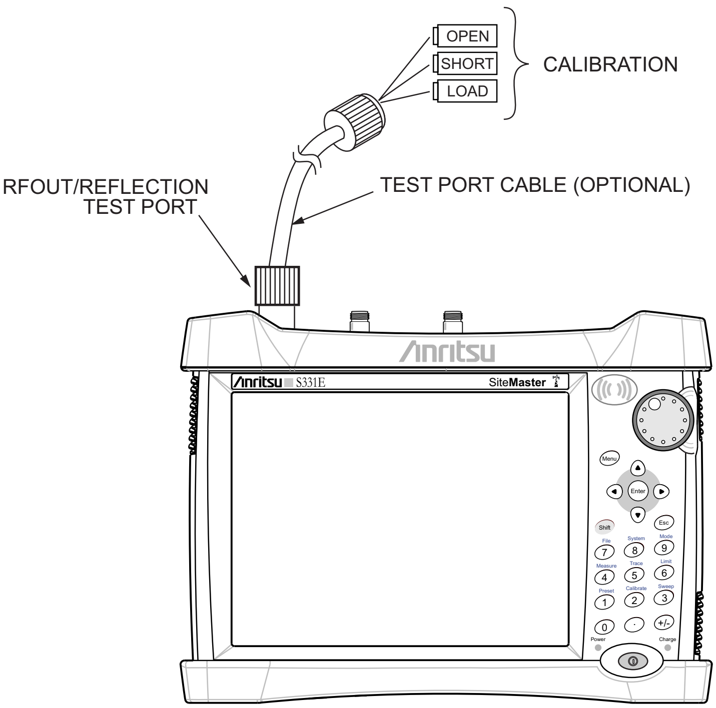



**Figure 3-1.** Calibration Setup OSL Cal

1. Press the **Freq/Dist** main menu key and enter the appropriate frequency range
2. Press **Shift** then **Cal** (2) key.
3. Select Standard or FlexCal.
4. Press Start Cal and follow instructions on screen.
5. Connect Open to RF Out and press the **Enter** key.
6. Connect Short to RF Out and press the **Enter** key.
7. Connect Load to RF Out and press the **Enter** key.
8. Verify that the calibration has been properly performed by checking that the Cal Status message is now displaying "ON, Standard" or "ON, FlexCal".

## InstaCal Module Calibration Procedures (Standard and FlexCal)

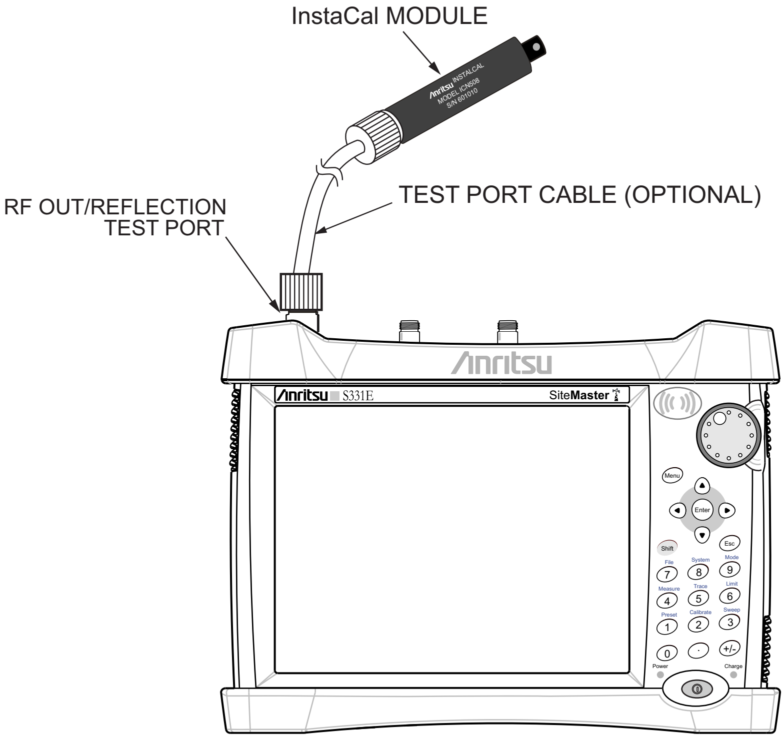



**Figure 3-2.** Calibration Setup InstaCal

1. Press the **Freq/Dist** main menu key and enter the appropriate frequency range.
2. Press **Shift** then **Cal** (2) key.
3. Select Standard or FlexCal.
4. Press Start Cal. The message "Connect OPEN or InstaCal to RF Out port" will appear on screen.
5. Connect the InstaCal module to RF Out and press the **Enter** key.
6. The instrument senses the InstaCal module and automatically calibrates the unit using the OSL procedure. An audible tone will sound when the calibration is complete.
7. Verify that the calibration has been properly performed by checking that the Cal Status message is now displaying "ON, Standard, Insta" or "ON, Flex, Insta".

| | |
|---|---|
| **Note** | The InstaCal module is not a discrete calibration component and it can not be used at the top of the tower to perform line sweep measurements. |

## 3-6 InstaCal Module Verification

Verifying the InstaCal module before any line sweeping measurements is critical to the measured data. InstaCal module verification identifies any failures in the module due to circuitry damage or failure of the control circuitry. This test does not attempt to characterize the InstaCal module, which is performed at the factory or the service center.

The performance of the InstaCal module can be verified by the Termination method which is similar to testing a bad load against a known good load.

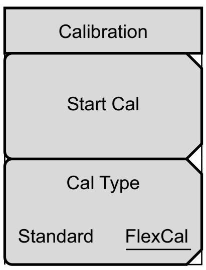
### Termination Method

The Termination method compares a precision load against the InstaCal module and provides a baseline for other field measurements. A precision load provides better than 42 dB directivity.

1. Set the instrument frequency for the device under test.
2. Press the **Measurements** main menu key and select Return Loss.
3. Connect the InstaCal module to the instrument's RF Out port and calibrate the Site Master using the InstaCal module requiring verification.
4. Remove the InstaCal module from the RF Out port and connect the precision load to the RF Out port.
5. Measure the return loss of the precision load. The level should be less than 35 dB across the calibrated frequency range.
6. Press the **Marker** main menu key and set Marker1 to Marker To Peak. The M1 value should be less than 35 dB return loss.

## 3-7 Calibrate Menu

Key Sequence: **Calibrate** .




**Start Cal:** Press this submenu key and follow the instruction on screen.

**Cal Type:** Toggles between Standard Cal and FlexCal. See Table 3-1 on page 3-2 for details.

**Figure 3-3.** Calibrate Menu

# Appendix A — Windowing

## A-1 Introduction

The theoretical requirement for inverse FFT is for the data to extend from zero frequency to infinity. Side lobes appear around a discontinuity because the spectrum is cut off at a finite frequency. Windowing reduces the side lobes by smoothing out the sharp transitions at the beginning and the end of the frequency sweep. As the side lobes are reduced, the main lobe widens, thereby reducing the resolution.

In situations where a small discontinuity may be close to a large one, side lobe reduction windowing helps to reveal the discrete discontinuities. If distance resolution is critical, then reduce the windowing for greater signal resolution.

If strong interfering frequency components are present, but are distant from the frequency of interest, then use a windowing format with higher side lobes, such as Rectangular Windowing or Nominal Side Lobe Windowing.

If strong interfering signals are present and are near the frequency of interest, then use a windowing format with lower side lobes, such as Low Side Lobe Windowing or Minimum Side Lobe Windowing.

If two or more signals are very near to each other, then spectral resolution is important. In this case, use Rectangular Windowing for the sharpest main lobe (the best resolution).

If the amplitude accuracy of a single frequency component is more important than the exact location of the component in a given frequency bin, then choose a windowing format with a wide main lobe.

When examining a single frequency, if the amplitude accuracy is more important than the exact frequency, then use Low Side Lobe Windowing or Minimum Side Lobe Windowing.

## Rectangular Windowing

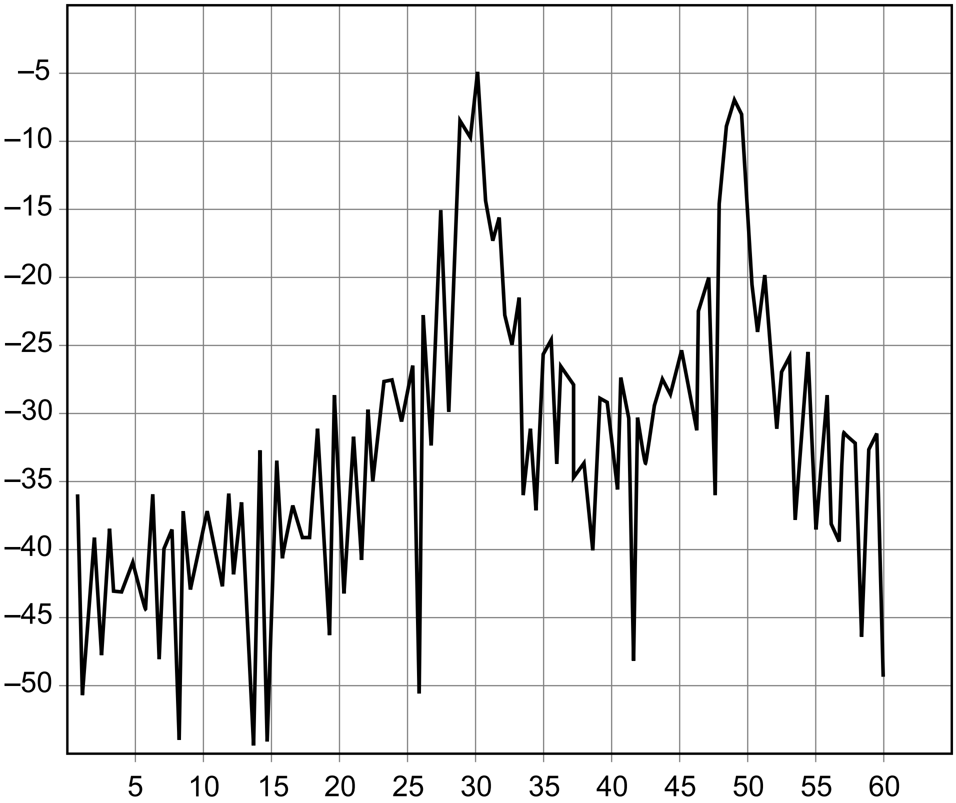



**Figure A-1.** Rectangular Windowing Example

This Distance To Fault graph has Return Loss (dB) on the vertical scale (y-axis) and distance in feet on the horizontal scale (x-axis).

This view of Rectangular Windowing shows the maximum side lobe display and the greatest waveform resolution.

## Nominal Side Lobe Windowing

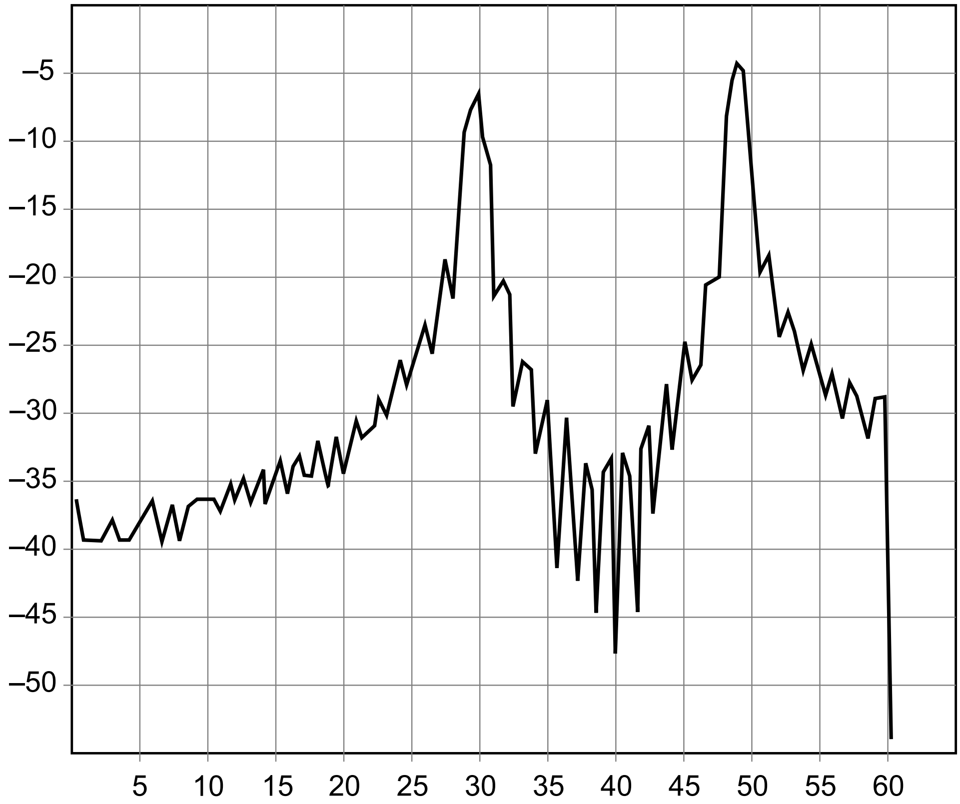



**Figure A-2.** Nominal Side Lobe Windowing Example

This Distance To Fault graph has Return Loss (dB) on the vertical scale (y-axis) and distance in feet on the horizontal scale (x-axis).

This view of Nominal Side Lobe Windowing shows less side lobe resolution than Rectangular Windowing and more side lobe resolution than Low Side Lobe Windowing. This level of windowing displays intermediate resolution.

## Low Side Lobe Windowing

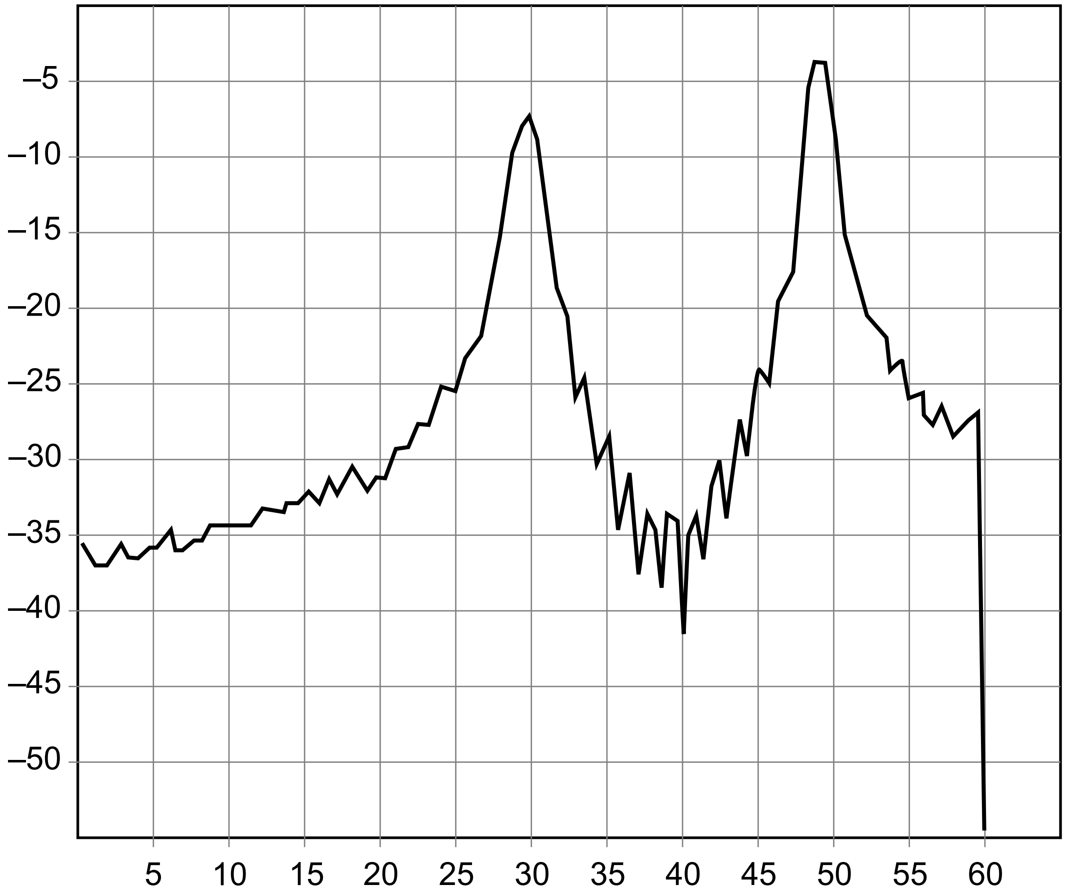



**Figure A-3.** Low Side Lobe Windowing Example

This Distance To Fault graph has Return Loss (dB) on the vertical scale (y-axis) and distance in feet on the horizontal scale (x-axis).

This view of Low Side Lobe Windowing shows less side lobe resolution than Nominal Side Lobe Windowing and more side lobe resolution than Minimum Side Lobe Windowing. This level of windowing displays intermediate resolution.

## Minimum Side Lobe Windowing

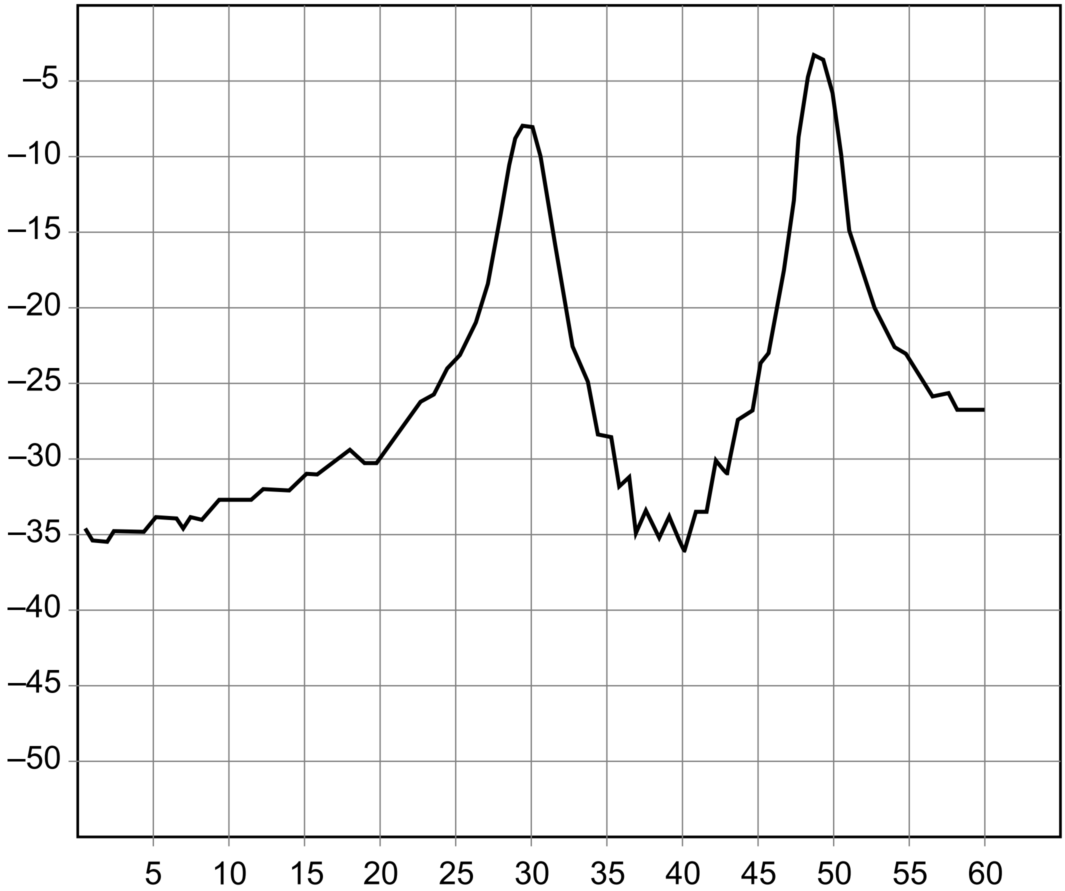



**Figure A-4.** Minimum Side Lobe Windowing Example

This Distance To Fault graph has Return Loss (dB) on the vertical scale (y-axis) and distance in feet on the horizontal scale (x-axis).

This view of Minimum Side Lobe Windowing shows less side lobe resolution than Low Side Lobe Windowing and displays the lowest side lobe and waveform resolution.

# Index

10580-00241 B



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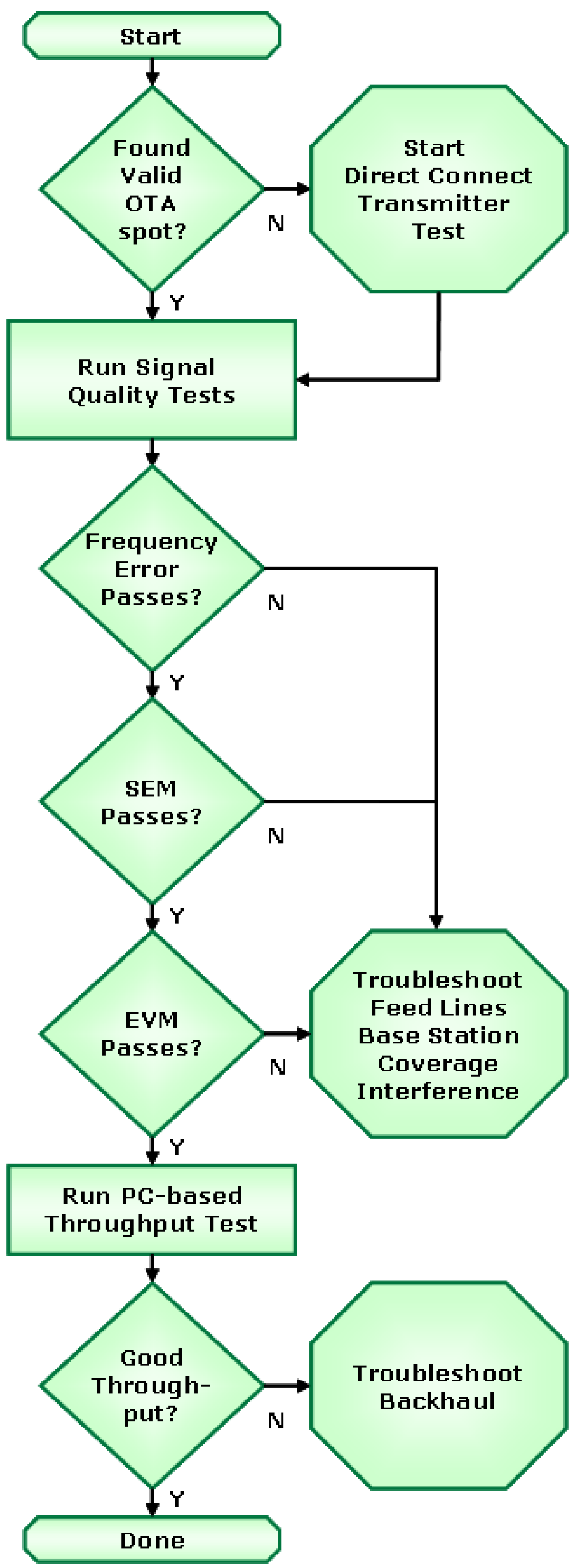
# LTE eNodeB Troubleshooting Guide – utilizing Anritsu's Handheld BTS Master™, Cell Master™ or Spectrum Master™ with Options 0541, 0542 and 0546

## Start Here

Use Over-the-Air (OTA) tests to spot-check a transmitter's coverage and signal quality. Use the Direct Connect tests to check transmitter power and EVM when the OTA test results are ambiguous.



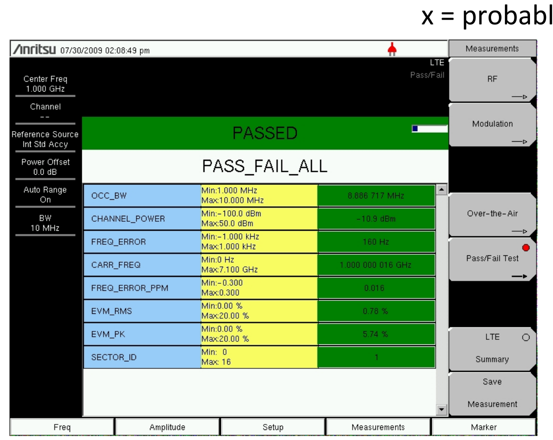

## Troubleshooting Hints

These two tables provide guidance from the first indication of a fault, a poor Key Performance Indicator (KPI), to the BTS Master, Cell Master or Spectrum Master test, and finally, to the field replaceable unit.

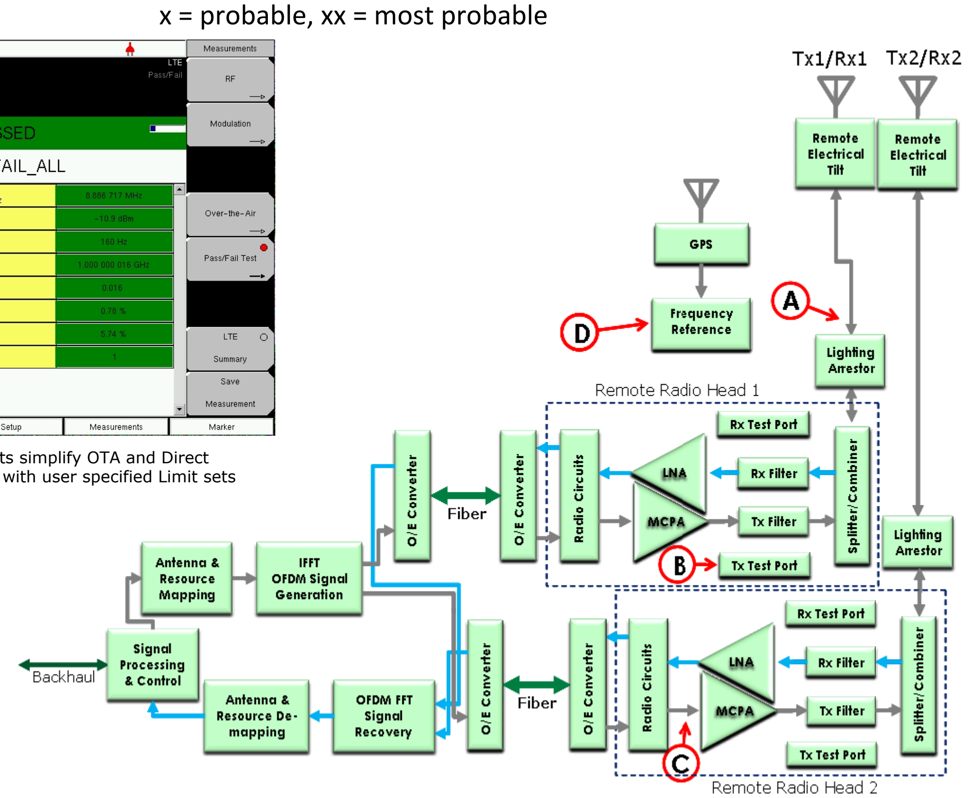
| Key Performance Indicators vs. Test | Sync Power | RS Power | Occupied BW, ACLR, & SEM | EVM (pk) | EVM (rms) | Freq Error | Rx Noise Floor | OTA EVM |
|---|---|---|---|---|---|---|---|---|
| Call/Session Blocking | | | | | | | | |
| *Power shortage* | x | x | | x | | | | |
| *Resource Block shortage* | | | x | xx | xx | | | |
| *UL Interference* | | | x | | | | xx | |
| Call/Session Drop | | | | | | | | |
| *Radio Link Timeout* | x | x | | x | x | x | x | x |
| *UL Interference* | | | x | | | | x | |
| *DL Interference* | x | x | | x | x | x | | x |

| Test vs. BTS Field Replaceable Units | Freq Ref | Signal Generation | MCPA | Filters | Antenna | Antenna Down Tilt |
|---|---|---|---|---|---|---|
| Sync Power | | x | xx | | x | |
| RS Power | | x | xx | | x | |
| Occupied BW | | x | xx | xx | | |
| Adjacent Channel Leakage Ratio (ACLR) | | x | x | xx | x | |
| Spectral Emission Mask (SEM) | | x | x | xx | x | |
| Error Vector Magnitude Peak (EVM pk) | | x | xx | | | |
| Error Vector Magnitude EVM (rms) | | x | x | x | x | |
| Frequency Error | xx | | | | | |
| OTA EVM | | x | x | x | x | x |

x = probable, xx = most probable




Pass Fail measurements simplify OTA and Direct Connect Transmitter Test with user specified Limit sets

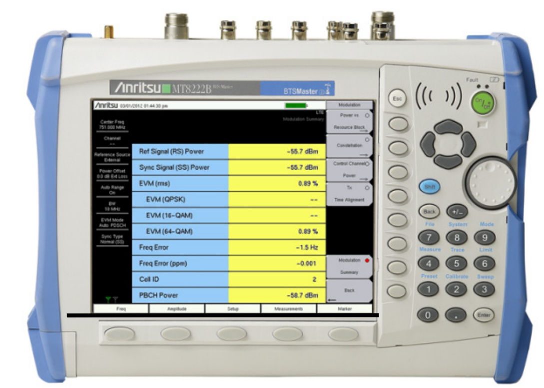



## Locating Over-the-Air Test Spots

To test an eNodeB Over-the-Air (OTA) it is necessary to find a location with good Sync Signal (SS) dominance. The SS dominance measurements are ideal for this task. OTA testing requires SS dominance readings higher than 10 dB.

To find a good OTA test site, look for a place squarely in the sector, a block or two from the tower, and away from surfaces that may reflect radio waves. A directional antenna will help to screen out unwanted signals.

In some urban areas, locating a good OTA site can be difficult. In these cases, it may be quicker to connect to the BTS for testing.



**Anritsu BTS Master™**

## Direct Connect Transmitter Tests

Transmitter tests can be run while connected to the:

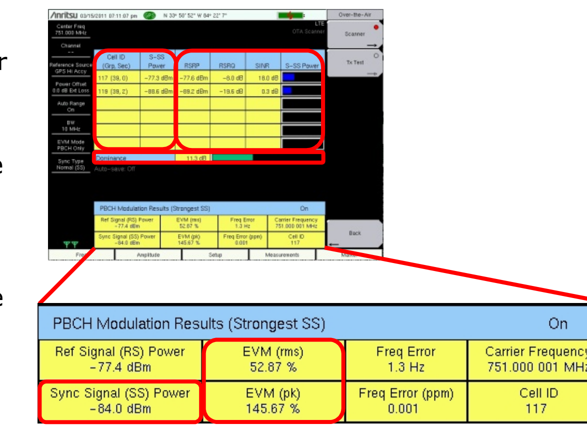
- Output of the eNodeB (Point "A").
- Test port (Point "B") which is essentially the output of the Multi-Carrier Power Amplifier (MCPA).
- Input to the MCPA (Point "C") if the signal is accessible
- Frequency reference system (Point "D") for carrier frequency errors

The goal of these measurements is to increase data rate and capacity by accurate power settings, low out-of-channel emissions, and good signal quality tests. Good signals allow the cell to generate more revenue and provide a better return on investment.

The antenna is the last link in the transmission path. If connected at point "A", it is helpful to sweep the antenna(s) at the same time, to ensure a high quality signal.

## Multiple Sector Coverage Checks

### Sync Signal Power, Dominance, Cell ID, and EVM




**Sync Signal (S-SS)** affects cell size. S-SS is also used OTA to check coverage. It should be highest near the tower, declining to a minimum level at the handoff point. More information on SS is provided elsewhere in this guide.

**Dominance**: The strength of the strongest S-SS compared to the others.

**EVM, RSRP, RSRQ, and SINR** all indicate the quality of the received signal. In this screen, EVM is measured on the PBCH signal, so as to not be affected by traffic.

**Cell, Group, and Sector ID**: Identifies the source of the OTA signals detected.

**Guidelines**:

**Dominance**: Higher than 10 dB for OTA signal quality testing.

**EVM**: Established from a known good base station at a location where the dominance figure is over 10 dB.

**Cell, Group, and Sector ID**: Should be set as defined by engineering.

**Consequences**:

**Poor Dominance**: Poor spot to test the BTS OTA. May be a result of excessive coverage, which will result in a loss of system capacity due to excessive co-channel interference.

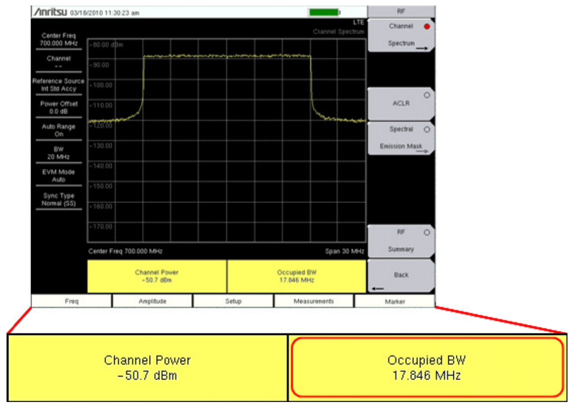
**Poor EVM**: Call drops, call blocking, low data rate, and low capacity.

**Wrong Cell, Group or Sector ID**: Dropped handoffs and island sectors.

**Common Faults**: Antenna down tilt, damaged antennas, control channel power settings, and co-channel interference.

# LTE eNodeB Troubleshooting Guide – utilizing Anritsu's Handheld BTS Master™, Cell Master™ or Spectrum Master™ with Options 0541, 0542 and 0546

## Channel Spectrum
### Occupied Bandwidth




The transmitter's signal should be centered in the display, which indicates that the proper RF channel has been chosen. This display is also useful when looking for gross RF problems.

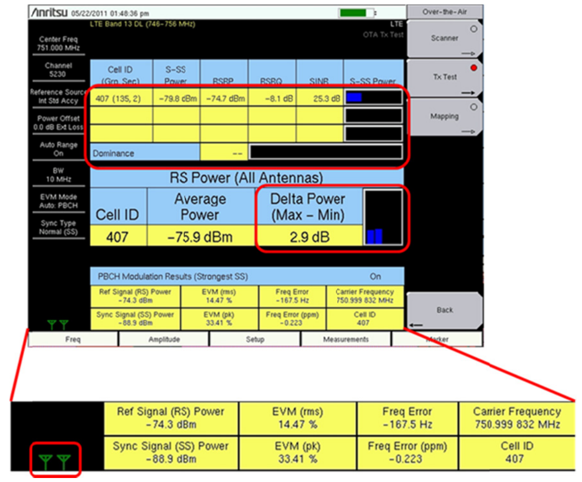
**Occupied Bandwidth** measures the width of the frequency spectrum occupied by the transmitter's signal. The Occupied Bandwidth contains 99% of the signal's power.

**Guideline**: The defined LTE Occupied Bandwidths are 1.4, 3.0, 5.0, 10, 15, and 20 MHz.

**Consequences**: Excessive Occupied BW results in interference with neighboring carriers, dropped calls, and low capacity.

**Common Faults**: The Tx filters, MCPA, Signal Processing, and antennas may contribute to Occupied Bandwidth faults.

## Tx Test
### MIMO Verification



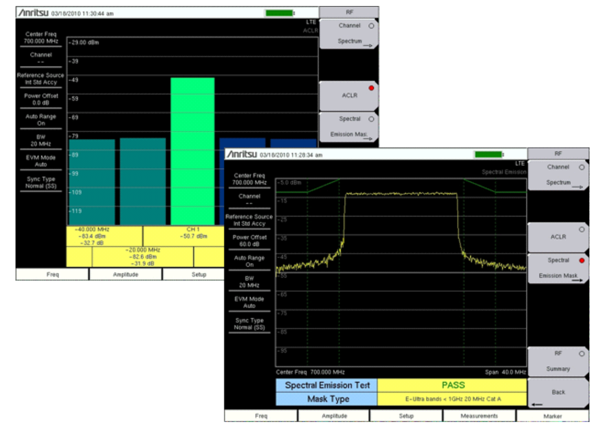

**Tx Test** measurement can be used OTA to verify low co-channel interference, MIMO operation, EVM and frequency error. It is particularly useful for Remote Radio Head (RRH) installations where it's difficult to get direct access to the transmitters. However, it can also be used directly connected to verify each MIMO transmitter. The MIMO indicator verifies which transmitter is connected.

**Guideline**: OTA as a quality indicator: one cell ID detected (use directional antenna) or >20 dB dominance, RS Delta power < 3 dB, EVM < 10%. Frequency Error < 10 Hz (GPS). Measure at installation, track changes.

**Consequences**: Poor or no MIMO operation will result in poor throughput, low sector capacity, dropped and blocked calls. Low dominance means high co-channel interference with similar consequences.

**Common Faults**: disconnected or inter-sector cross connected MIMO transmitters, faulty MCPA, poor antenna installation.

## Out-of-Channel Emissions
### Adjacent Channel Leakage Ratio (ACLR)
### Spectral Emission Mask (SEM)



ACLR and SEM are used to measure how much of the transmitted signal leaks into adjacent channels.

**ACLR** measures how much of the carrier gets into neighboring RF channels and checks the closest (adjacent) and second closest (alternate) RF channels on LTE signals.

**Guidelines**: -45 dBc for the adjacent channels, -45 dBc for the alternate channels.

**Consequences**: The eNodeB will create interference for neighboring carriers. This is also an indication of low signal quality and low capacity, which can lead to blocked calls.

**Common Faults**: Check Tx filter, MCPA and channel cards. Also, the antenna system can generate intermodulation due to corrosion.

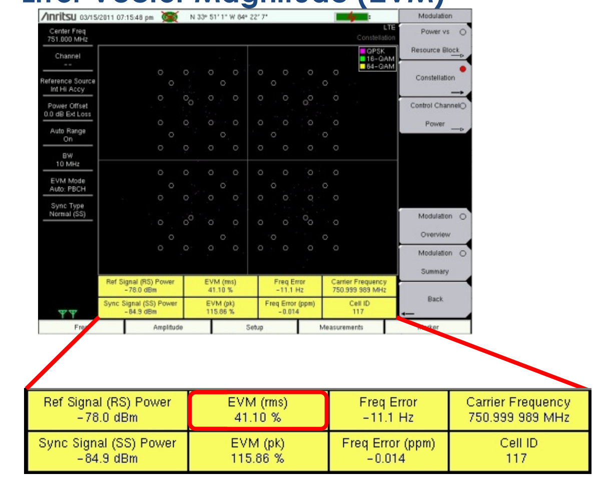
**SEM** checks closer to the signal than ACLR does. It also is sensitive to absolute power levels. Regulators in many countries require regular measurements of spectral emissions.

**Guideline**: Below the mask. Power levels matter; use correct external attenuation value.

**Consequences**: Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.

**Common Faults**: Check amplifier output filtering first. Also look for intermodulation distortion or spectral re-growth.

## Signal Quality Tests
### Error Vector Magnitude (EVM)




**EVM** is the ratio of errors, or distortions, in the actual signal, compared to a perfect signal. EVM, in this screen, measures the PBCH, if there is no data traffic, and the PDSCH if there is traffic.

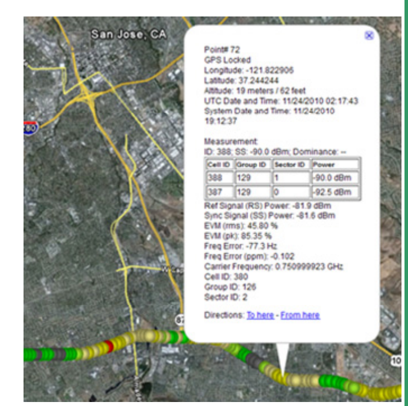
EVM is the most important signal quality measurement and is reported by modulation type also in the Modulation Summary screen.

**Guideline**: 17.5% for QPSK modulation, 12.5% for 16 QAM modulation, and 8% for 64 QAM modulation when done hooked up to the eNodeB.

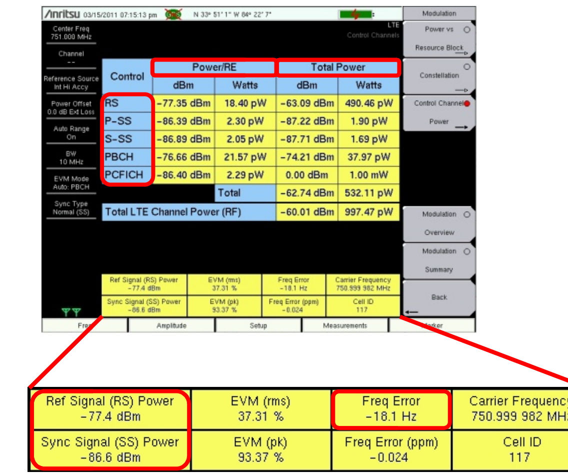
**Consequences**: Poor EVM leads to dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls. This is the single most important signal quality measurement.

**Common Faults**: EVM faults can be caused by distortion in the channel cards, power amplifier, filter, or antenna system.

**OTA Mapping**, with Google Maps, allows analysis of signal quality at a particular location, or series of locations. This is an excellent way to find coverage and interference problems.



## Support Signals
### Control Channels and Syn Signal (SS Power)




**Control Channels** are used to allow user equipment to find and use the LTE network and to assess RF channel quality.

Power/RE is the Resource Element power, which is often reported by User Equipment. Total Power per control channel is often reported by e-NodeB equipment.

**Guideline**: Control Channels typically are all set to the same power level. However, usage may vary as experience with LTE increases.

**Consequences**: Control channels set at the wrong levels may prevent user equipment from detecting the cell or registering. This may in turn cause dropped calls or data sessions and blocked calls.

**Common Faults**: Improper settings in the signal processing and control section of the eNodeB.

**Sync Signal (SS) Power** sets cell size. It's the average of P-SCH and S-SCH. A 1.5 dB change means 15% change in coverage area.

SS is an in-service measurement if the BTS has a test port.

Use the high accuracy power meter and a test signal for the best accuracy (±0.16 dB).

**Guideline**: The signal should be within ± 2.0 dB of specification under normal conditions.

**Consequences**: High values create excessive cell overlap leading to interference and low capacity. High or low values will cause low capacity, dropped and blocked calls.

**Common Faults**: Check MCPA calibration followed by large VSWR faults and damaged connectors.

## Rx Noise Floor

When looking for uplink interference a good first step is to check the Rx Noise Floor. To do this, connect to an Rx test port, or the Rx antenna, for the affected sector and make measurements when calls are not up.

Look first for a high received Rx noise floor by using the LTE RF channel power measurement on the uplink channel.

Also, use the spectrum analyzer to check for signals outside the Rx channel but still passed through the Rx filter.

**Guideline**: Less than approximately −80 dBm received noise floor when no calls are up. This level varies with the LTE RF channel bandwidth.

**Consequences**: Call blocking, denial of services, call drops, low data rate, and low capacity.

**Common Faults**: Receiver desensitization from co-channel interference, in-band interference, or passive intermodulation.



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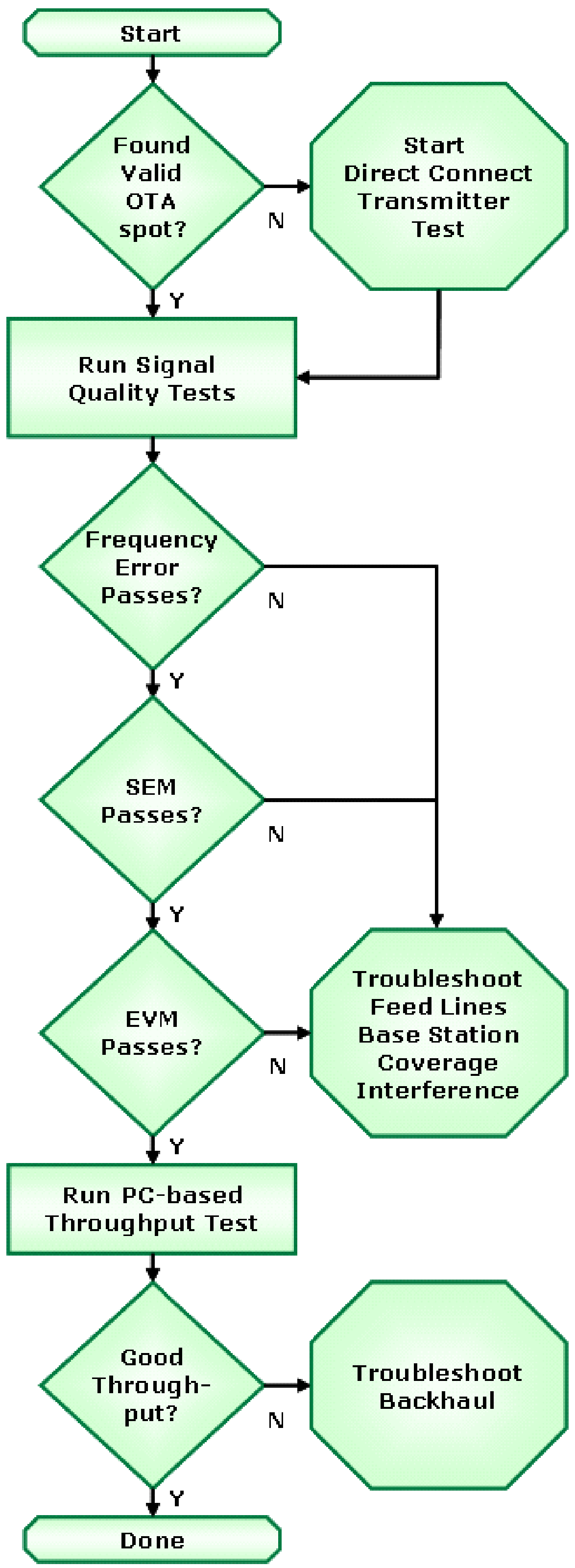
# TD-LTE eNodeB Troubleshooting Guide – utilizing Anritsu's Handheld BTS Master™, Cell Master™ or Spectrum Master™ with Options 0551, 0552 and 0556

## Start Here

Use Over-the-Air (OTA) tests to spot-check a transmitter's coverage and signal quality. Use the Direct Connect tests to check transmitter power and EVM when the OTA test results are ambiguous.



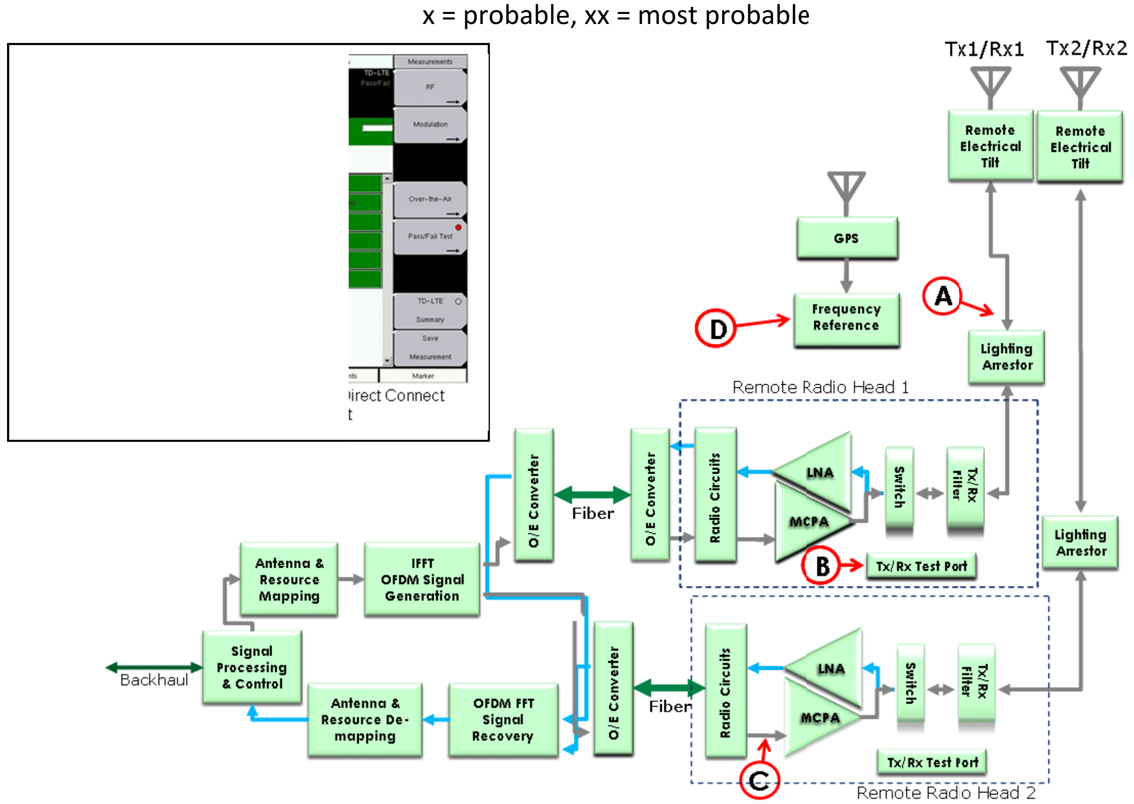

## Troubleshooting Hints

These two tables provide guidance from the first indication of a fault, a poor Key Performance Indicator (KPI), to the BTS Master, Cell Master or Spectrum Master test, and finally, to the field replaceable unit.

| Key Performance Indicators vs. Test | Sync Power | RS Power | Occupied BW, ACLR, & SEM | EVM (pk) | EVM (rms) | Freq Error | Rx Noise Floor | OTA EVM |
|---|---|---|---|---|---|---|---|---|
| **Call/Session Blocking** | | | | | | | | |
| *Power shortage* | x | x | | x | | | | |
| *Resource Block shortage* | | | x | xx | xx | | | |
| *UL Interference* | | | x | | | | xx | |
| **Call/Session Drop** | | | | | | | | |
| *Radio Link Timeout* | x | x | | x | x | x | x | x |
| *UL Interference* | | | x | | | | x | |
| *DL Interference* | x | x | | x | x | x | | x |

| Test vs. BTS Field Replaceable Units | Freq Ref | Signal Generation | MCPA | Filters | Antenna | Antenna Down Tilt |
|---|---|---|---|---|---|---|
| Sync Power | | x | xx | | x | |
| RS Power | | x | xx | | x | |
| Occupied BW | | x | xx | xx | | |
| Adjacent Channel Leakage Ratio (ACLR) | | x | x | xx | x | |
| Spectral Emission Mask (SEM) | | x | x | xx | x | |
| Error Vector Magnitude Peak EVM (pk) | | x | xx | | | |
| Error Vector Magnitude EVM (rms) | | x | x | x | x | |
| Frequency Error | xx | | | | | |
| OTA EVM | | x | x | x | x | x |

x = probable, xx = most probable




## Locating Over-the-Air Test Spots

To test an eNodeB Over-the-Air (OTA) it is necessary to find a location with good Sync Signal (SS) dominance. The SS dominance measurements are ideal for this task. OTA testing requires SS dominance readings higher than 10 dB.

To find a good OTA test site, look for a place squarely in the sector, a block or two from the tower, and away from surfaces that may reflect radio waves. A directional antenna will help to screen out unwanted signals.

In some urban areas, locating a good OTA site can be difficult. In these cases, it may be quicker to connect to the BTS for testing.

**Anritsu BTS Master™**

## Direct Connect Transmitter Tests

Transmitter tests can be run while connected to the:

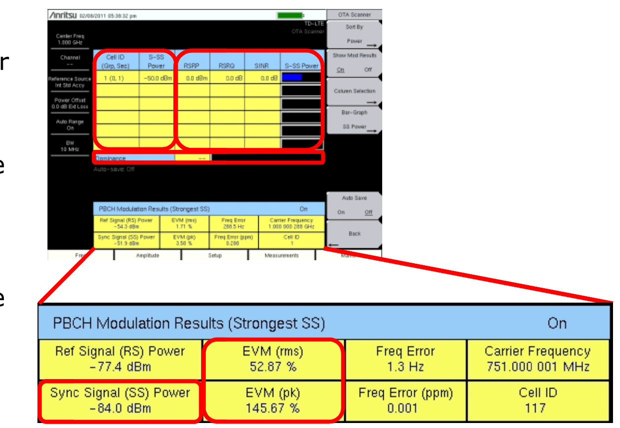
- Output of the eNodeB (Point "A").
- Test port (Point "B") which is essentially the output of the Multi-Carrier Power Amplifier (MCPA) or the input to the receiver, depending on the timing.
- Input to the MCPA (Point "C") if the signal is accessible
- Frequency reference system (Point "D") for carrier frequency errors

The goal of these measurements is to increase data rate and capacity by accurate power settings, low out-of-channel emissions, and good signal quality tests. Good signals allow the cell to generate more revenue and provide a better return on investment.

The antenna is the last link in the transmission path. If connected at point "A", it is helpful to sweep the antenna(s) at the same time, to ensure a high quality signal.

## Multiple Sector Coverage Checks

### Sync Signal Power, Dominance, Cell ID, and EVM




**Sync Signal (SS)** affects cell size. SS is also used OTA to check coverage. It should be highest near the tower, declining to a minimum level at the handoff point.

**Dominance**: The strength of the strongest SS compared to the others.

**EVM** indicates the quality of the received signal. In this screen, EVM is measured on the PBCH signal, so as to not be affected by traffic.

**Cell, Group, and Sector ID**: Identifies the source of the OTA signals detected.

**Guidelines**:

**Dominance**: Higher than 10 dB for OTA signal quality testing.

**EVM**: Should be lower than 17.5% when Dominance is over 10 dB.

**Cell, Group, and Sector ID**: Should be set as defined by engineering.

**Consequences**:

**Poor Dominance**: Poor spot to test the BTS OTA. May be a result of excessive coverage, which will result in a loss of system capacity due to excessive co-channel interference.

**Poor EVM**: Call drops, call blocking, low data rate, and low capacity.

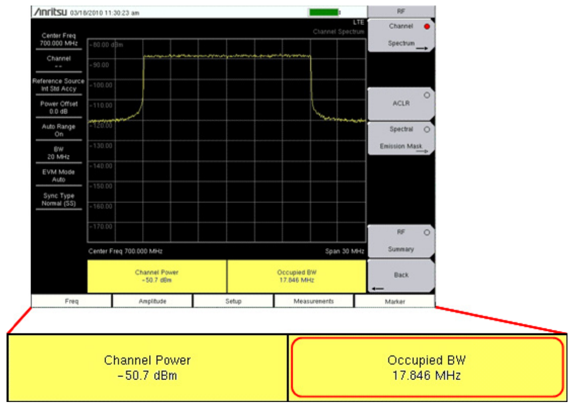
**Wrong Cell, Group or Sector ID**: Dropped handoffs and island sectors.

**Common Faults**:

Antenna down tilt, damaged antennas, control channel power settings, and co-channel interference.

# TD-LTE eNodeB Troubleshooting Guide – utilizing Anritsu's Handheld BTS Master™, Cell Master™ or Spectrum Master™ with Options 0551, 0552 and 0556

## Channel Spectrum
### Occupied Bandwidth




The transmitter's signal should be centered in the display, which indicates that the proper RF channel has been chosen. This display is also useful when looking for gross RF problems such as a low or missing signal.

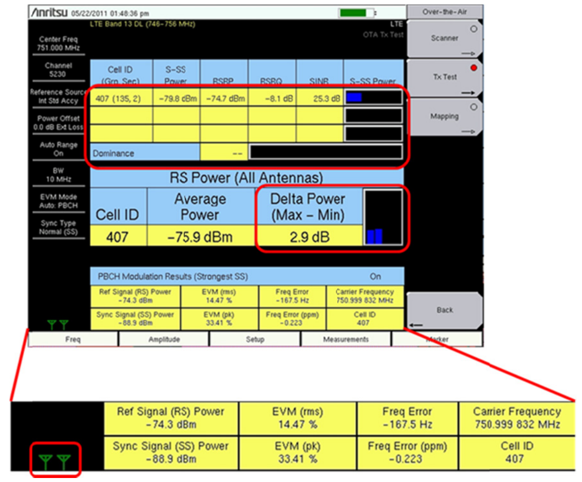
**Occupied Bandwidth** measures the width of the frequency spectrum occupied by the transmitter's signal. The Occupied Bandwidth contains 99% of the signal's power.

**Guideline**: The defined LTE Occupied Bandwidths are 1.4, 3.0, 5.0, 10, 15, and 20 MHz.

**Consequences**: Excessive Occupied BW results in interference with neighboring carriers, dropped calls, and low capacity.

**Common Faults**: The Tx filters, MCPA, Signal Processing, and antennas may contribute to Occupied Bandwidth faults.

## Tx Test
### MIMO Verification




**Tx Test** measurement can be used OTA to verify low co-channel interference, MIMO operation, OTA EVM and frequency error. It is particularly useful for Remote Radio Head (RRH) installations where it's difficult to get direct access to the transmitters.

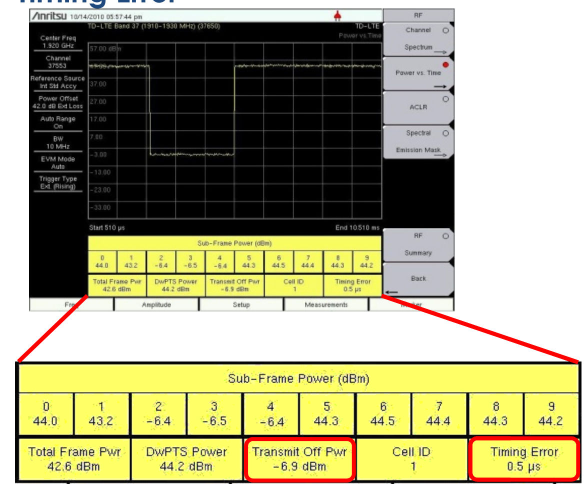
However, it can also be used in direct connect configuration to verify each MIMO transmitter. The MIMO indicator verifies which transmitter is connected.

**Guideline**: OTA as a quality indicator - One cell ID detected at measurement position (use directional antenna) or at least 20 dB dominance, RS Delta power < 3 dB, EVM < 10%. Frequency Error < 10 Hz (GPS). Measure at installation, track changes.

**Consequences**: Poor or no MIMO operation will result in poor throughput, low sector capacity, dropped and blocked calls. Low dominance means high co-channel interference with similar consequences.

**Common Faults**: Disconnected or misconnected (inter-sector cross connections) MIMO transmitters, faulty power amplifiers, poor antenna installation.

## Power vs. Time
### Timing Error




**Timing Error** is a measure of how well eNodeB's and TD-LTE base stations are synchronized.

**Transmit Off Pwr** is a measure of the received power when the eNodeB is not transmitting. See the Rx Noise Floor section for details.

**Guideline**: Timing Error maximum values will be determined by experience. However, a value of 10% of the shortest guard period, or 100 micro-seconds, is approximately right.

**Consequences**: Excessive timing error leads directly to co-channel interference with neighboring eNodeB's and TD-LTE base stations.

**Common Faults**: Poor GPS signal or a faulty timing distribution system.

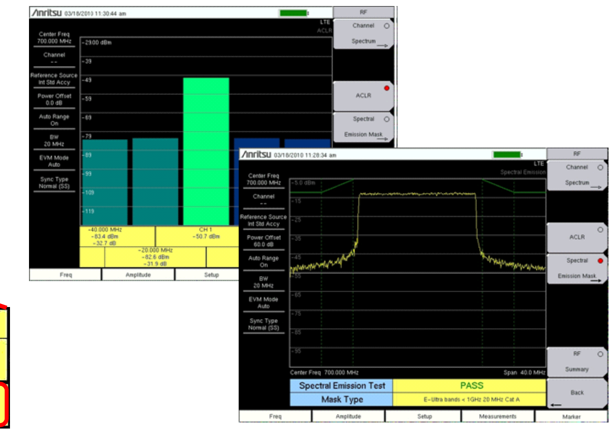
**Frequency Error** (second column from the left) is a check to see that the carrier frequency is precisely set.

**Guideline**: +/- 0.05 ppm

**Consequences**: Calls will drop when mobiles travel at higher speed. In some cases, cell phones cannot hand off into, or out of the cell.

**Common Faults**: GPS faults, reference frequency system errors, failures in the clock distribution system, and backhaul faults.

## Out-of-Channel Emissions
### Adjacent Channel Leakage Ratio (ACLR)
### Spectral Emission Mask (SEM)



ACLR and SEM are used to measure how much of the transmitted signal leaks into adjacent channels. ACLR is used to look for error conditions further away, and SEM is used to look for error conditions closer to the carrier.

**ACLR** measures how much of the carrier gets into neighboring RF channels. ACLR checks the closest (adjacent) and second closest (alternate) RF channels on TD–LTE signals.

**Guidelines**: -45 dBc for the adjacent channels, -45 dBc for the alternate channels.

**Consequences**: The eNodeB will create interference for neighboring carriers. This is also an indication of low signal quality and low capacity, which can lead to blocked calls.

**Common Faults**: First, check the Tx filter, then the MCPA and the channel cards. Also, the antenna system can generate intermodulation due to corrosion.

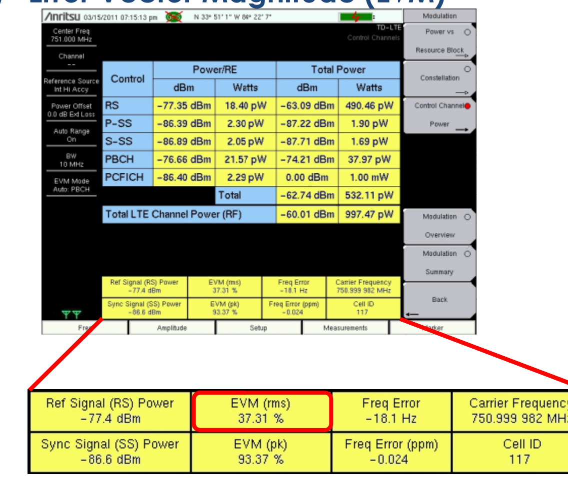
**SEM** checks closer to the signal than ACLR does. It also is sensitive to absolute power levels. Regulators in many countries require regular measurements of spectral emissions.

**Guideline**: Must be below the mask. Received power levels matter so be sure to use the right external attenuation value.

**Consequences**: Failing this test leads to interference with neighboring carriers, legal liability, and low signal quality.

**Common Faults**: Check amplifier output filtering first. Also look for intermodulation distortion or spectral re-growth.

## Signal Quality
### Error Vector Magnitude (EVM)




**EVM** is the ratio of errors, or distortions, in the actual signal, compared with a perfect signal. EVM, in this screen, measures the PBCH, if there is no data traffic, and the PDSCH if there is traffic.

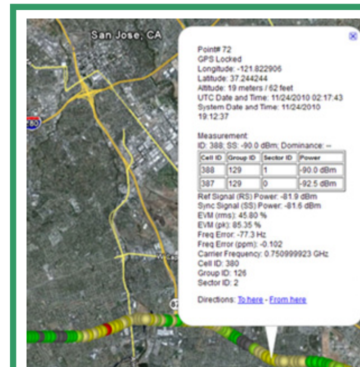
EVM is the single most important signal quality measurement.

EVM by modulation type is also reported in the Modulation Summary screen.

**Guideline**: 17.5% for QPSK modulation, 12.5% for 16 QAM modulation and 8% for 64 QAM modulation when measured while connected to the eNodeB.

**Consequences**: Poor EVM leads to dropped calls, low signal quality, low data rate, low sector capacity, and blocked calls.

**Common Faults**: EVM faults can be caused by distortion in the channel cards, power amplifier, filter, or antenna system.



**OTA Mapping**, with Google Maps, allows analysis of signal quality at a particular location, or series of locations. This is a good way to find coverage and interference problems.

## Rx Noise Floor

When looking for uplink interference a good first step is to check the Rx Noise Floor. To do this, check the Power vs. Time measurement.

The Transmit Off Power level both shows and measures co-channel interference when connected to an antenna port.

Another good idea is to use the spectrum analyzer to check for signals outside the Tx/Rx band but still passed through the Tx/Rx filter.

**Guideline**: Less than approximately –80 dBm. This level varies with the TD- LTE RF channel bandwidth.

**Consequences**: Call blocking, denial of services, call drops, low data rate, and low capacity.

**Common Faults**: Receiver desensitization from co-channel interference, in-band interference, or passive intermodulation.

Anritsu



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**Maintenance Manual**

# Cell Master™ MT821xE

## Compact Handheld Base Station Analyzer

**MT8212E**
**2 MHz to 4 GHz Cable and Antenna Analyzer**
**100 kHz to 4 GHz Spectrum Analyzer**
**10 MHz to 4 GHz Power Meter**

**MT8213E**
**2 MHz to 6 GHz Cable and Antenna Analyzer**
**100 kHz to 6 GHz Spectrum Analyzer**
**10 MHz to 6 GHz Power Meter**

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

Part Number: 10580-00255
Revision: J
Published: June 2014

## Safety Symbols

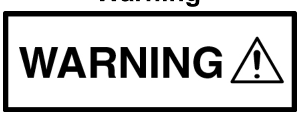
To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

## 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**



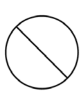

This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

**Caution**

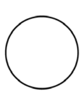
This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

## 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.

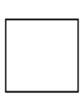


This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

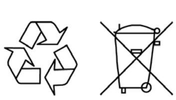


This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.

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

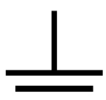
**Warning**

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

**Warning**


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

**Caution**

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

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

**Warning**

This equipment 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 data sheet.

# Table of Contents

## Chapter 6—Battery Information



## Chapter 7—Assembly Replacement

# Chapter 1 — General Information

## 1-1 Introduction

This manual provides maintenance instructions for Anritsu Cell Master Models MT8212E and MT8213E.

This manual includes:

- General information in this chapter, including:
  - Lists of necessary test equipment to perform verification testing

    Table 1-1, "Test Equipment Required for Verifying Spectrum Analyzer Functions"

    Table 1-2, "Required Equipment for Cable and Antenna Analyzer Verification"

    Table 1-3, "Required Equipment for Power Meter Functions"

    Table 1-4, "Additional Test Equipment Required for Verifying Options"
  - Replaceable parts list (Table 1-5)
- Performance verification procedures:
  - Chapter 2, "Spectrum Analyzer Verification"
  - Chapter 3, "Cable and Antenna Analyzer Verification"
  - Chapter 4, "Power Meter Verification"
  - Chapter 5, "Option Verification"
- Battery pack information (Chapter 6, "Battery Information")
- Parts replacement procedures (Chapter 7, "Assembly Replacement")
- Blank test records are included in Appendix A-1.

  Copy the blank test records from Appendix A-1 and use them to record measured values. These test records form a record of the performance of your instrument. Anritsu recommends that you make a copy of the blank test records to document the measurements each time a Performance Verification is performed. Continuing to document this process each time it is performed provides a detailed history of instrument performance, which can allow you to observe trends.

Familiarity with the basic operation of the front panel keys (for example, how to change measurement mode, preset the instrument, or the meaning of submenu key or **main menu** key) is assumed. Note that submenu key and Soft Key are synonymous, and that **main menu** key and **Function Hard Key** are synonymous.

| | |
|---|---|
| **Caution** | Before making any measurement, verify that all equipment has warmed up for at least 30 minutes. |

## 1-2 Anritsu Customer Service Centers

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

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

Choose a country for regional contact information.

# 1-3 Recommended Test Equipment

The following test equipment is recommended for use in testing and maintaining Anritsu Cell Master Models MT8212E and MT8213E. Table 1-1 is a list of test equipment that is required for verifying the spectrum analyzer functions. Table 1-2 is a list of test equipment that is required for verifying the spectrum analyzer functions. Table 1-3 is a list of test equipment that is required for verifying the power meter functions. Table 1-4 is a list of test equipment that is required for verifying the functions of installed options.

**Table 1-1.** Test Equipment Required for Verifying Spectrum Analyzer Functions

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Synthesized Signal Generator | Frequency: 0.1 Hz to 20 GHz,<br>Power Output: +16 dBm,<br>Step attenuator installed | Anritsu Model MG3692A/B/C with Options 2A, 3, 4, 22, 15x[a]<br>(Quantity 2) |
| Power Meter | Power Range: –70 dBm to +20 dBm | Anritsu Model ML2438A |
| Power Sensor | Frequency: 10 MHz to 18 GHz<br>Power Range: –67 dB to +20 dB | Anritsu Model MA2442D (Quantity 2) |
| Frequency Reference | Frequency: 10 MHz | Symmetricom Model RubiSource T&M |
| Low Pass Filter | 50 MHz Low Pass Filter | Anritsu Model 1030-96 |
| Fixed Attenuator | 10 dB Attenuation | Aeroflex/Weinschel Model 44-10 |
| Fixed Attenuator | 2 dB Attenuation | Aeroflex/Weinschel Model 44-2 (Quantity 2) |
| Fixed Attenuator | 6 dB Attenuation | Aeroflex/Weinschel Model 44-6 (Quantity 2) |
| Fixed Attenuator | 20 dB Attenuation | Aeroflex/Weinschel Model 44-20 (Quantity 2) |
| Power Splitter | Frequency: DC to 18 GHz | Aeroflex/Weinschel Model 1870A |
| Adapter | Frequency: DC to 20 GHz<br>N(m) to N(m), 50 ohm | Anritsu Model 34NN50A |
| Adapter | Frequency: DC to 20 GHz<br>K(m) to N(f), 50 ohm | Anritsu Model 34RKNF50 |
| 50 ohm Termination | Frequency: DC to 18 GHz | Anritsu Model 28N50-2 |
| RF Coaxial Cable | Frequency: DC to 18 GHz<br>N(m) to N(m), 50 ohm | Anritsu Model 15NN50-1.5C |
| Coaxial Cable | BNC(m) to BNC(m), 50 ohm | Anritsu Model 2000-1627-R |

a.MG3692A models require Option 15 to achieve power of +16 dBm at 3.5 GHz. MG3692B models do not require Option 15 to achieve power of +16 dBm at 3.5 GHz.

**Table 1-2.** Required Equipment for Cable and Antenna Analyzer Verification

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Frequency Counter | Frequency: 2 GHz | Anritsu Model MF2412B |
| Open/Short | Frequency: DC to 18 GHz | Anritsu Model 22N50 |
| Termination | Frequency: DC to 18 GHz<br>Return Loss: 40 dB min. | Anritsu Model 28N50-2 |
| RF Coaxial Cable | Frequency: DC to 18 GHz<br>N(m) to N(f), 50 ohm | Anritsu Model 15NNF50-1.5C |
| 6 dB Offset Termination | Frequency: DC to 6.0 GHz | Anritsu Model SC7424 |
| 20 dB Offset Termination | Frequency: DC to 6.0 GHz | Anritsu Model SC7423 |

**Table 1-3.** Required Equipment for Power Meter Functions

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Synthesized Signal Source | Frequency: 0.1 Hz to 20 GHz<br>Power Output: +13 dBm | Anritsu Model MG3692A or B with options 2A, 4, 22, 15[a] |
| Power Meter | Power Range: –70 to +20 dBm | Anritsu Dual Channel Model ML2438A |
| Power Sensor | Frequency: 10 MHz to 18 GHz<br>Power Range: –67 dB to +20 dB | Anritsu Model MA2442D (Quantity 2) |
| Fixed Attenuator | 10 dB Attenuation | Aeroflex/Weinschel Model 44-10 |
| Power Splitter | Frequency: DC to 18 GHz | Aeroflex/Weinschel Model 1870A |
| Adapter | Frequency: DC to 20 GHz<br>N(m) to N(m), 50 ohm | Anritsu Model 34NN50A |
| Adapter | Frequency: DC to 20 GHz<br>K(m) to N(f), 50 ohm | Anritsu Model 34RKNF50 |
| RF Coaxial Cable | Frequency: DC to 18 GHz<br>N(m) to N(m), 50 ohm | Anritsu Model 15NN50-1.5C |
| Frequency Reference | Frequency: 10 MHz | Symmetricom Model RubiSource T&M |

a. Option 15 is required for MG3692A models to achieve power of +13 dBm. MG3692B models do not require Option 15.

**Table 1-4.** Additional Test Equipment Required for Verifying Options (1 of 3)

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Synthesizer (Opt. 31) | Frequency: 0.1 Hz to 20 GHz<br>Power Output: +16 dBm | Anritsu Model MG3692A or MG3692B with options 2A, 4, 15, and 22[a] |

**Table 1-4.** Additional Test Equipment Required for Verifying Options (2 of 3)

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Vector Signal Generator<br>(Opt. 30, 32, 40, 41, 42, 43, 44, 45, 46, 47, 57, 60, 61, 62, 63, 64, 65, 66, 67, 78, 79, 541, 542, 551, 552) | Frequency: 100 kHz to 3 GHz | Anritsu Model MG3700A with Options MG3700A-002 and MG3700A-021<br>b. Waveform licenses for TD-SCDMA (MX370001A), LTE (MX370108A) and TD-LTE (MX370110A) are required and must be purchased. |
| Power Meter | Power Range: –70 to + 20 dBm | Anritsu Model ML2438A |
| Power Sensor | Frequency: 10 MHz to 18 GHz<br>Power Range: –60 to +20 dBm | Anritsu Model MA2482D with Option 1 (Quantity 2) |
| Frequency Reference | Frequency: 10 MHz | Symmetricom Model RubiSource T&M |
| Programmable Attenuator (Opt. 30, 32, 44, 45, 57, 64, 65, 79) | Frequency: DC to 2 GHz<br>Attenuation:100 dB<br>(1 dB and 10 dB steps) | Anritsu Model MN63A |
| Bit Error Rate Tester (Opt. 57) | DVB ASI Input | Anritsu MP8931A |
| Sonet Analyzer (Opt. 51, 52, 53) | | Anritsu MP1570A with MP0121A and MP0122A modules |
| Test Fixture (Opt. 52) | | Anritsu PN T3450 |
| Digital Oscilloscope (Opt. 51, 52, 53) | | LeCroy Model WaveRunner 62Xi with ET-PMT Electrical Telecom Mask software and TF-ET Telecom Adapter Set |
| Fixed Attenuator | Frequency Range: DC to 18 GHz<br><br>Attenuation: 10 dB | Aeroflex/Weinschel Model 44-10 (Quantity 2) |
| RF Limiter (Opt. 30, 32, 79) | | Anritsu Model 1N50C |
| Power Splitter | Frequency: DC to 18 GHz | Aeroflex/Weinschel Model 1870A |
| RF Power Amplifier (Opt. 32, 44, 45, 57, 64, 65) | Frequency:100 to 1000 MHz<br>Gain: 35 dB min | Mini Circuits Model TIA-1000-1R8 (Quantity 2 BNC(m) to N(f) Adapters required) |
| 50 ohm Termination (Opt. 21) | Frequency: DC to 18 GHz | Anritsu Model 28N50-2 |
| 50 ohm Termination (Opt. 21) | Frequency: DC to 18 GHz | Anritsu Model 28NF50-2 |
| High Power Load (Opt. 44, 45, 65) | DC to 18 GHz, 10W | Aeroflex/Weinschel Model M1418 |
| Coupler (Opt. 44, 45, 65) | Frequency: 881.5 MHz<br>Coupling Factor: 30 dB | Midwest Microwave Model CPW-5140-30-NNN-05 or CPW-5141-30-NNN-05<br>Alternative: Anritsu part number 1091-307<br>[Two SMA(m) to N(f) adapters required.] |
| Circulator (Opt. 44, 45, 65) | Frequency Range: 800 MHz to 1000 MHz<br>Isolation: 20 dB min | Meca Electronics, Inc. part number CN-0.900<br>Alternative: Anritsu part number 1000-50<br>[Two SMA(m) to N(f) adapter and one SMA(m) to SMA(m) Adapter required.] |
| RF Coaxial Cable | Frequency: DC to 18 GHz<br>N(m) to N(m), 50 ohm | Anritsu Model 15NN50-1.5C(Quantity 3) |

**Table 1-4.** Additional Test Equipment Required for Verifying Options (3 of 3)

| Instrument | Critical Specification | Recommended Manufacturer/Model |
|---|---|---|
| Coaxial Cable | BNC(m) to BNC(m), 50 ohm | Anritsu Model 2000-1627-R (Quantity 3) |
| Cable T1 Bantam Plug to Bantam Plug (Opt. 51, 53) | | Anritsu PN 806-16 (Quantity 2) |
| Cable 75 ohm BNC(m) to BNC(m) (Opt. 52, 53) | | Anritsu PN 3-806-169 (Quantity 2) |
| Cable RJ48 to dual Bantam (Opt. 52) | | Anritsu PN 806-117 |
| GPS Antenna (Opt. 31) | | Anritsu 2000-1528-R |
| Adapter (Opt. 10) | 40 ohm Load | Anritsu Model T2904 |
| Adapter (Opt. 10) | 78 ohm Load | Anritsu Model T3536 |
| Adapter (Opt. 10) | 105 ohm Load | Anritsu Model T3377 |
| Adapter (Opt. 30, 32, 57, 64, 79) | Frequency: 881.5 MHz<br>BNC(m) to N(f), 50 ohm | ADT-2615-NF-BNM-02 (Quantity 2) |
| Adapter (Opt. 44, 45, 65) | Frequency: 881.5 MHz<br>SMA(m) to N(f), 50 ohm | Midwest Microwave Model ADT-2582-NF-SMM-02 (Quantity 4)<br>[Required only if Anritsu Coupler and Circulator are used.] |
| Adapter (Opt. 44, 45, 65) | Frequency: 881.5 MHz<br>SMA(m) to SMA(m), 50 ohm | Midwest Microwave Model ADT-2594-MM-SMA-02<br>[Required only if Anritsu Coupler and Circulator are used.] |
| Adapter (Opt. 44, 45, 65) | Frequency: DC to 20 GHz N(m) to N(m), 50 ohm | Maury Microwave Model 8828B<br>Quantity: 2 each<br>[One each required only if Anritsu Coupler and Circulator are used] |
| Adapter | Frequency: DC to 20 GHz K(m) to N(f), 50 ohm | Anritsu Model 34RKNF50 |
| Adapter | Frequency: DC to 20 GHz N(m) to N(m), 50 ohm | Anritsu Model 34NN50A |
| Adapter (Opt. 51, 52, 53) | BNC | LeCroy PP090 75 ohm Telecom |
| Adapter (Opt. 52) | | LeCroy AP120 120 ohm Telecom |

a. Option 15 is required for MG3692A models to achieve power of +13 dBm. MG3692B models do not require Option 15.

# 1-4 Replaceable Parts

**Table 1-5.** List of Replaceable Parts

| Part Number | Description |
|---|---|
| ND70944 | MT8212E MB/VNA/SPA PCB Assy[a] (Instruments without options 57/79) s/n < 1147089 |
| ND74530 | MT8212E MB/VNA/SPA PCB Assy[a], with 20 MHz IF BW (Instruments without options 57/79) s/n > 1147088 and s/n < 1230032 |
| ND74540 | MT8212E MB/VNA/SPA/BER PCB Assy[a], with 20 MHz IF BW (Instruments with option 57/79) s/n < 1230032 |
| ND75288 | MT8212E MB/VNA/SPA PCB Assy[a], with 20 MHz IF BW and locking keypad connector (Instruments without options 57/79) s/n > 1230031 |
| ND75290 | MT8212E MB/VNA/SPA/BER PCB Assy[a], with 20 MHz IF BW and locking keypad connector (Instruments with option 57/79) s/n > 1230031 |
| ND71743 | MT8213E MB/VNA/SPA PCB Assy[a] (Instruments without options 57/79) s/n < 1147089 |
| ND74531 | MT8213E MB/VNA/SPA PCB Assy[a], with 20 MHz IF BW (Instruments without options 57/79) s/n > 1147088 and s/n < 1231006 |
| ND74541 | MT8213E MB/VNA/SPA/BER PCB Assy[a], with 20 MHz IF BW (Instruments with option 57/79) s/n < 1231006 |
| ND75289 | MT8213E MB/VNA/SPA PCB Assy[a], with 20 MHz IF BW and locking keypad connector (Instruments without options 57/79) s/n > 1231005 |
| ND75291 | MT8213E MB/VNA/SPA/BER PCB Assy[a], with 20 MHz IF BW and locking keypad connector (Instruments with option 57/79) s/n > 1231005 |
| ND70945 | T1 Assembly (Opion 51) |
| ND70946 | E1 Assembly (Opion 52) |
| ND70947 | T3/T1 Assembly (Opion 53) |
| 3-67304-8 | Model MT8212E ID Label |
| 3-67304-10 | Model MT8213E ID Label |
| ND70320 | GPS Module (Opion 31) |
| 3-15-147 | LCD Display for units with Inverter PCB (unit s/n less than 1329107, plus unit s/n 1332170) |
| 3-15-165 | LCD Display for units with no Inverter PCB (unit s/n greater than 1329106, except unit s/n 1332170) |
| 3-68567-3 | Inverter PCB Assembly for LCD Backlight |
| 2000-1654-R | Soft Carrying Case |
| ND73191 | Front Case with Gasket (excludes Model ID label, LCD, touch screen, encoder, and keypad assemblies.) |
| ND74508 | Front Case Kit (includes Keypad PCB, Rubber Keypad, Keypad Washers, Keypad Screws, Encoder, Encoder Knob, Speaker Assembly with gaskets) |
| ND73199 | Back Case (Excludes Tilt Bale) |
| ND73201 | Battery Door |
| 633-44 | 6600 mAH Li-Ion Battery Pack |
| 633-75 | 7500 mAH Li-Ion Battery Pack |
| 3-513-100 | RF In Connector and RF Out Connector |
| 40-187-R | AC to DC Power Converter |
| 3-410-103 | Encoder (excluding knob) |

**Table 1-5.** List of Replaceable Parts

| Part Number | Description |
|---|---|
| 3-61360-2 | Knob (excluding encoder) |
| ND73200 | Tilt Bale Assy |
| 3-72779 | Fan Assembly |
| ND75294 | Main Numeric Keypad PCB (Non-Locking connector) |
| ND75295 | Main Numeric Keypad PCB (Locking connector) |
| 3-72773 | Rubber Keypad |
| 3-72767 | Keypad Washer |
| 3-905-2744 | Keypad Screw |
| ND73192 | Speaker |
| 3-72758 | Vent 1 (Fan Vent, above battery door) |
| 3-72759 | Vent 2 (Intake Vent, top vent on keypad side) |
| 3-72760 | Vent 3 (Battery Vent, bottom vent on keypad side) |
| 3-72771 | Cable, Keypad to Main PCB, 15cm, non-locking connectors |
| 3-74842-3 | Cable, Keypad to Main PCB, 15cm, locking connectors |
| 3-72770 | Cable, Keypad to Inverter PCB, 6cm |
| 3-71625-1 | Cable, LCD to Keypad, units with LCD Display 3-15-165 |
| 3-72621-4 | Cable, LCD to Main PCB, 7cm |
| 3-803-110 | Cable, Ribbon, 2x20, Main to SPA PCB |
| 3-806-197 | Cable, MMCX-MMCX, DSP to SPA PCB, units without BER |
| 3-68764-3 | Cable, MMCX-MMCX, 205mm, J1 to J6, units with BER |
| 3-68764-4 | Cable, MMCX-MMCX, 215mm, J2 to J3, units with BER |
| 3-68764-5 | Cable, MMCX-MMCX, 215mm, J4 to J4, units with BER |
| 3-68764-6 | Cable, MMCX-MMCX, 225mm, J61 to J5, units with BER |
| ND80480 | Touch Screen with Protective Film |
| 2000-1797-R | Protective Film (Touch Screen not included) |

a.When ordering the Main PCB Assembly, in order to ensureinstallation of correct options, all options that areinstalled on the instrument must be declared on the order. The options are listed and shown in the **System** / Status display.

# Chapter 2 — Spectrum Analyzer Verification

## 2-1 Introduction

These tests verify that the Spectrum Analyzer of the Model MT821xE Cell Master is functional. The functional tests include:


- "Frequency Accuracy Verification" on page 2-2
- "Single Side Band (SSB) Phase Noise Verification" on page 2-4
- "Spurious Response (Second Harmonic Distortion) Verification" on page 2-6
- "Resolution Bandwidth Accuracy Verification" on page 2-8
- "Spectrum Analyzer Absolute Amplitude Accuracy Verification" on page 2-9
- "Residual Spurious Response Verification" on page 2-17
- "Displayed Average Noise Level (DANL)" on page 2-19
- "Third Order Intercept (TOI) Verification" on page 2-21

# 2-2 Frequency Accuracy Verification

The following test is used to verify the CW frequency accuracy of the Spectrum Analyzer in the MT821xE Cell Master.

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- 10 MHz Reference Standard
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- BNC male to BNC male Coaxial Cable

### Procedure

1. Connect the 10 MHz Reference source to the Anritsu MG3692X Synthesized Signal Source.

| | |
|---|---|
| **Caution** | Do not connect the external 10 MHz Reference to the Cell Master. |

2. Turn On the 10 MHz Reference Standard and the Anritsu MG3692X Synthesized Signal Source.
3. Set the MG3692X output to 1 GHz CW, with an RF Output Level of –30 dBm.
4. Connect the output of the source to the RF In of the Cell Master.
5. Turn On the Cell Master.
6. Press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight **Spectrum Analyzer** and then press the **Enter** key to switch to Spectrum Analyzer mode.
7. Press the **Shift** key, then the **Preset** (1) key, and then the Preset submenu key to reset the instrument to the default starting conditions.
8. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then the Performance submenu key.
9. Press the **Amplitude** main menu key, and then press the Reference Level submenu key.
10. Use the keypad to enter –10 and press the dBm submenu key.
11. Press the Span submenu key, use the keypad to enter 10, and press the kHz submenu key.
12. Press the BW submenu key and press the RBW submenu key.
13. Use the keypad to enter 100 and press the Hz submenu key.
14. Press the VBW submenu key, use the keypad to enter 30, and then press the Hz submenu key.
15. Press the **Freq** main menu key and press the Center Freq submenu key.
16. Use the keypad to enter 1 and press the GHz submenu key.
17. Press the **Marker** main menu, then the More submenu key, set Counter Marker to On, press the Back submenu key, and then press the Peak Search submenu key.

| | |
|---|---|
| **Note** | Without the Counter Marker On, the frequency resolution will not allowviewing the kHz accuracy. |

18. Verify that the marker frequency is 1 GHz ± 1.5 kHz (± 1.5 ppm) and record in Table A-1, “Spectrum Analyzer Frequency Accuracy” on page A-2.
19. Set the MG3692X frequency to 3.9 GHz and then 5.9 GHz (for MT8213E only).
20. Set the MT821xE center frequency to 3.9 GHz and then 5.9 GHz (for MT8213E only).

21. Press the **Marker** main menu, then the More submenu key, set Counter Marker to On, press the Back submenu key, and then press the Peak Search submenu key.

22. Verify that the marker frequency is 3.9 GHz ± 5.85 kHz (± 1.5 ppm) and then 5.9 GHz ± 8.85 kHz (± 1.5 ppm) for the MT8213E only, and record in Table A-1.

| | |
|---|---|
| **Note** | If the instrument fails the Section 2-2 "Frequency Accuracy Verification" test, then contact your local Anritsu Service Center (http://www.anritsu.com/Contact.asp). |

## 2-3 Single Side Band (SSB) Phase Noise Verification

This test is used to verify the single side band (SSB) phase noise of the spectrum analyzer in the MT821xE Cell Master.

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- 10 MHz Reference Standard
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable

### Procedure

1. Connect the 10 MHz reference source to the Anritsu MG3692X Synthesized Signal Source.
2. Turn On the 10 MHz reference source and the Anritsu MG3692X Synthesized Signal Source.
3. Set the MG3692X output to 1.00 GHz CW, with an RF output level of +0 dBm.
4. Connect the output of the MG3692X Synthesized Signal Source to the RF In connector of the Cell Master.
5. Turn on the Cell Master.
6. Press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight Spectrum Analyzer and then press the **Enter** key to switch to Spectrum Analyzer mode.
7. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset to the default starting conditions.
8. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
9. Press the **Amplitude** main menu key, then press the Reference Level submenu key.
10. Use the keypad to enter 0 and press the dBm submenu key.
11. Press the Atten Lvl submenu key, use the keypad to enter 15, and press the dB submenu key.
12. Press the **Freq** main menu key and press the Center Freq submenu key.
13. Use the keypad to enter 1.00 and press the GHz submenu key.
14. Press the Span submenu key, use the keypad to enter 110, and press the kHz submenu key.
15. Press the BW submenu key and press the RBW submenu key.
16. Use the keypad to enter 1 and press the kHz submenu key.
17. Press the VBW submenu key and use the keypad to enter 3, then press the Hz submenu key.
18. Press the **Shift** key and then press the **Trace** (5) key. Then press the Trace A Operations submenu key.
19. Press the # of Averages submenu key, use the keypad to enter 7, then press the **Enter** key.
20. Wait until the Trace Count displays “7/7”.
21. Press the **Marker** key and press the Peak Search submenu key.
22. Press the Delta On/Off submenu key to turn Delta On.
23. Use the keypad to enter 10 and press the kHz submenu key.
24. Enter the measured value in Table A-2, “Spectrum Analyzer SSB Phase Noise Verification” on page A-2.
25. Subtract 30 dB from the average value and verify that the result is less than –100 dBc/Hz (for 10 kHz offset) or less than –105 dBc/Hz (for 100 kHz offset) or less than –115 dBc/Hz (for 1 MHz offset), and record the Calculated Value results in Table A-2.

    **For example:** `–70 dBc measured – 30 dB = –100 dBc/Hz`

**26.** Repeat Step 23 through Step 25 for 100 kHz (set Span to 220 kHz) and 1 MHz offset (set Span to 2.04 MHz). Enter the test results and calculations in the appropriate rows of Table A-2.

## 2-4 Spurious Response (Second Harmonic Distortion) Verification

The following test is used to verify the input related spurious response of the spectrum analyzer in the MT821xE Cell Master.

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- 10 MHz Reference Standard
- Anritsu 34RKNF50 50 ohm Adapter or equivalent
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Anritsu 1030-96 50 MHz Low Pass Filter
- BNC male to BNC male Coaxial Cable

### Procedure

1. Connect the 10 MHz reference source to the Anritsu MG3692X Synthesized Signal Source.
2. Turn On the 10 MHz reference source and the Anritsu MG3692X Synthesized Signal Source.
3. Set the MG3692X output to 50.1 MHz CW, with an RF Output Level of –30 dBm.
4. Connect one end of the 50 MHz Low Pass Filter to the output of the source and the other end to the Cell Master RF In with the coaxial cable.
5. Turn On the Cell Master.
6. Press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight **Spectrum Analyzer** and then press the **Enter** key to switch to Spectrum Analyzer mode.
7. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset to the default starting conditions.
8. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
9. Press the **Amplitude** main menu key and then press the Reference Level submenu key.
10. Use the keypad to enter –27 and press the dBm submenu key.
11. Press the Atten Lvl submenu key and enter 0, then press the dB submenu key.
12. Press the **Freq** main menu key and press the Center Freq submenu key.
13. Use the keypad to enter 50.1 and press the MHz submenu key.
14. Press the Span submenu key, use the keypad to enter 100, and press the kHz submenu key.
15. Press the BW submenu key and press the RBW submenu key.
16. Use the keypad to enter 1 and press the kHz submenu key.
17. Press the VBW submenu key. Use the keypad to enter 10 and then press the Hz submenu key.
18. Press the **Amplitude** main menu key.
19. Press the Detection submenu key, and then the Peak submenu key.
20. Press the **Shift** key and then press the **Trace** (5) key. Then press the Trace A Operations submenu key.
21. Press the # of Averages submenu key, use the keypad to enter 5, and then press the **Enter** key.
22. Wait until the Trace Count displays “5/5”.
23. Press the **Marker** key and press the Peak Search submenu key.
24. Record the amplitude for 50.1 MHz. Use Table A-3, “Spectrum Analyzer Spurious Response (Second Harmonic Distortion)” on page A-2.
25. Press the **Freq** main menu key and press the Center Freq submenu key.

26. Use the keypad to enter 100.2 and press the MHz submenu key.
27. Press the **Shift** key and then press the **Trace** (5) key. Then press the Trace A Operations submenu key.
28. Press the # of Averages submenu key, use the keypad to enter 5, and then press the **Enter** key.
29. Wait until the Trace Count displays "5/5".
30. Press the **Marker** key and press the Peak Search submenu key.
31. Record the amplitude for 100.2 MHz in the test records. Use Table A-3.
32. Calculate the second Harmonic level in dBc by subtracting the 50.1 MHz amplitude from the 100.2 MHz amplitude using the following formula:

```
Second Harmonic Level Amplitude at 100.2 MHz =
100.2 MHz amplitude – 50.1 MHz amplitude = _____ dBc
```

33. Verify that the calculated Second Harmonic Level is ≤ –56 dBc and record in the test records. Use Table A-3.

## 2-5 Resolution Bandwidth Accuracy Verification

The following test is used to verify the resolution bandwidth accuracy of the spectrum analyzer in the MT821xE Cell Master.

#### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- 10 MHz Reference Standard
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- BNC male to BNC male Coaxial Cable

#### Procedure

1. Connect the 10 MHz reference source to the Anritsu MG3692X Synthesized Signal Source and the MT821xE Cell Master.
2. Turn On the MG3692X, set the frequency to 1 GHz CW, and set the level to –30 dBm.
3. Connect the output of the Anritsu MG3692X Synthesized Signal Source to the MT821xE Spectrum Analyzer RF In.
4. Turn On the MT821xE Cell Master.
5. Press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight **Spectrum Analyzer** and then press the **Enter** key to switch to Spectrum Analyzer mode.
6. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset to the default starting conditions.
7. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
8. Press the **Amplitude** main menu key and then press the Reference Level submenu key.
9. Use the keypad to enter –10 and press the dBm submenu key.
10. Press the Atten Lvl submenu key and enter 0, then press the dB submenu key.
11. Press the Scale submenu key and enter 10, then press the dB/div submenu key.
12. Press the **Freq** main menu key and press the Center Freq submenu key.
13. Use the keypad to enter 1 and press the GHz submenu key.

### RBW Test

14. Press the Span submenu key, use the keypad to enter the span that is listed in the test records. Refer to the **Span** column of Table A-4, "Spectrum Analyzer Resolution Bandwidth Accuracy" on page A-3.
15. Press the BW submenu key and press the RBW submenu key.
16. Use the keypad to enter 3 and press the MHz submenu key.
17. Set the VBW from the value listed in the test records. Refer to the **VBW** column of Table A-4.
18. Press the **Shift** key, press the **Measure** (4) key, then press the "Power and Bandwidth" soft key, and then press the OCC BW submenu key.
19. Press the dBc submenu key and enter 3, then press the **Enter** key.
20. Press the OCC BW On/Off submenu key to turn On occupied bandwidth.
21. Record the OCC BW reading in the test records. Use the **Measured Value** column of Table A-4.
22. Verify that the OCC BW reading frequency is within 10% of the RBW.
23. Repeat Step 14 through Step 22 for the other settings.

# 2-6 Spectrum Analyzer Absolute Amplitude Accuracy Verification

The tests in this section verify the absolute amplitude accuracy of the Spectrum Analyzer in the MT821xE Cell Master. The two parts of this test are "50 MHz Amplitude Accuracy Verification" immediately below and "Amplitude Accuracy Across Frequency Verification" on page 2-13.

## 50 MHz Amplitude Accuracy Verification

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- 10 MHz Reference Standard
- Anritsu ML2438A Dual Channel Power Meter
- Anritsu MA2442D High Accuracy Power Sensors (2)
- Anritsu 34NN50A 50 ohm Adapter
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator

### Setup

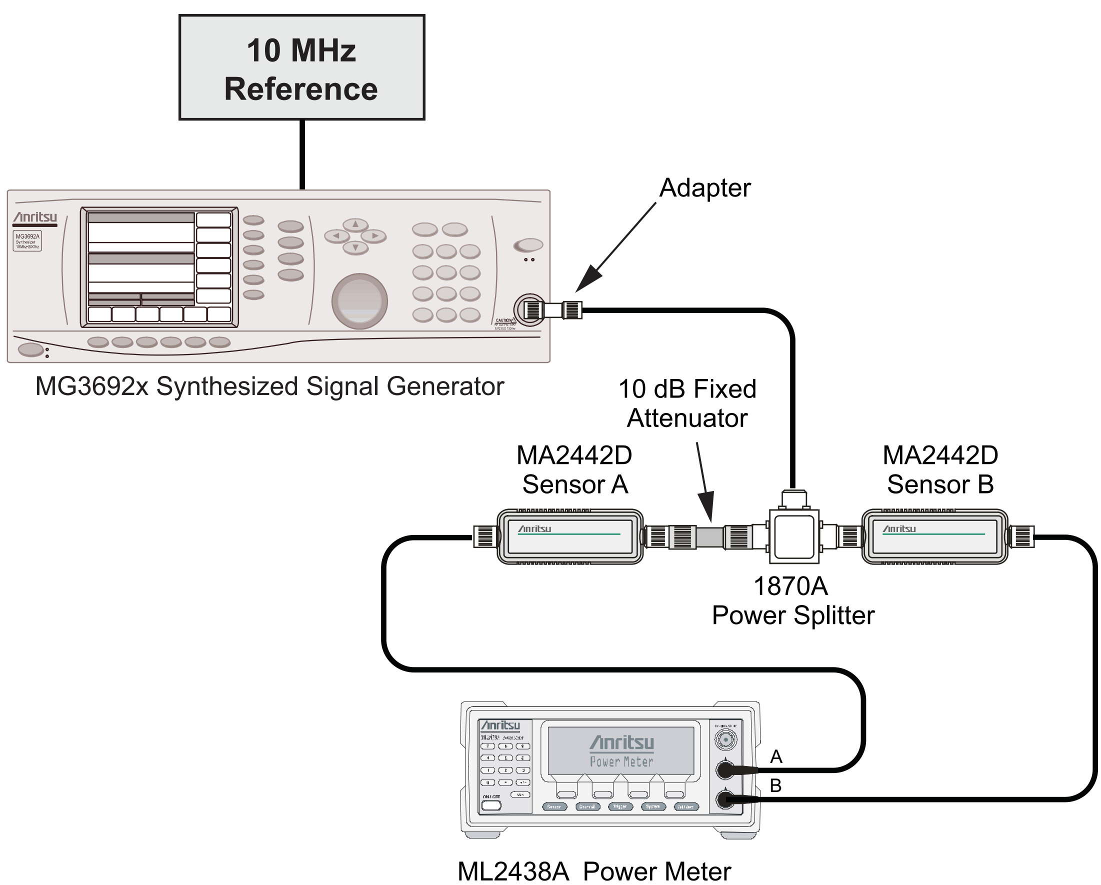



**Figure 2-1.** Absolute Amplitude Accuracy Verification Pretest Setup

### Test Setup Components Characterization

1. Turn On the ML2438A Power Meter, the MG3692X Signal Source, and the MT821xE Cell Master.
2. On the power meter, press the Channel soft key, the Setup soft key, and then the Channel soft key to display **Channel 2 Setup** menu.
   a. Press the **Input** key twice to set the Input Configuration to B.
   b. Press the **Sensor** key to display both Sensor A and Sensor B readings.
   c. Connect the power sensors to the power meter and calibrate the sensors.
   d. Connect the Power Splitter to the MG3692X Output, and connect Sensor B to one of the Power Splitter Outputs.
3. Install the 10 dB Fixed Attenuator to the other Power Splitter Output, and then connect Sensor A to the end of the attenuator as shown in Figure 2-1 on page 2-9.
4. Set the MG3692X to a frequency of 50 MHz.
5. On the Power Meter, press the **Sensor** key, the Cal Factor soft key, and then the Freq soft key.
   a. Use the keypad to enter 50 MHz as the input signal frequency. Do this for both Sensor A and Sensor B, which sets the power meter to the proper power sensor calibration factor.
   b. Press the **Sensor** key on the power meter to display the power reading.
6. Starting with 0 dBm, adjust the power level of the MG3692x to get a reading on Sensor A that matches the power level in the **Test Power Level at 50 MHz** column of Table A-5, “Spectrum Analyzer 50 MHz Absolute Amplitude Accuracy Setup Table” on page A-5.
7. Record the Sensor B reading in the **Required Sensor B Reading** column of Table A-5.
8. Repeat Step 6 and Step 7 for the other input levels from –4 dBm to –50 dBm, as listed in Table A-5.

| | |
|---|---|
| **Caution** | Before continuing, allow a 30 minute warm-up period for the internal circuitry to stabilize. |

### Measuring the Instrument for 50 MHz Amplitude Accuracy

1. Remove Sensor A, add the adapter, and connect it to the Spectrum Analyzer RF In connector of the MT821xE Cell Master as shown in Figure 2-2.

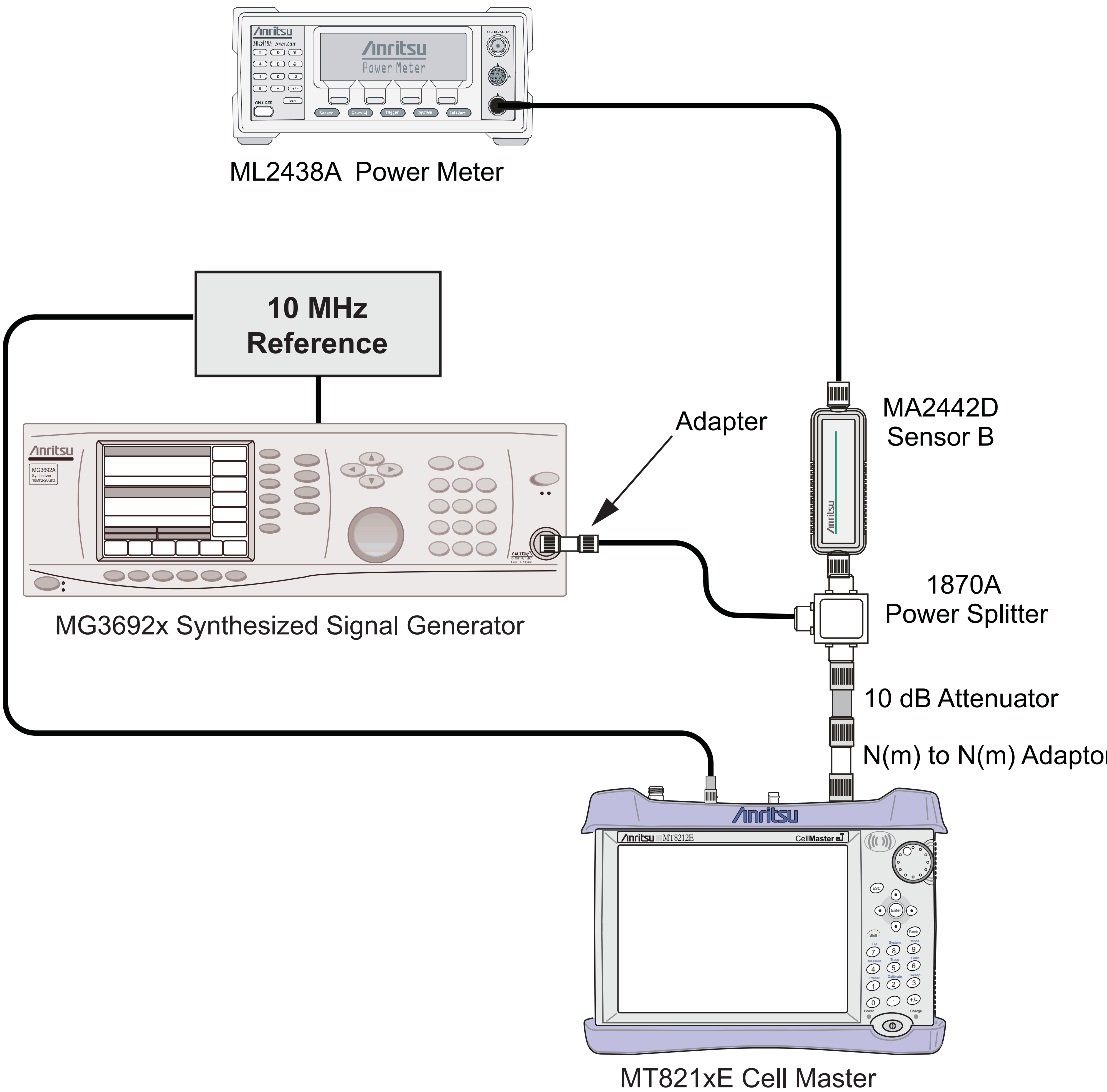



**Figure 2-2.** Absolute Amplitude Accuracy Verification Test Setup

2. On the MT821xE, press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight Spectrum Analyzer and then press the **Enter** key to switch to Spectrum Analyzer mode.
3. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset to the default starting conditions.
4. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode submenu key, and then press the Performance submenu key.
5. Press the **Freq** main menu key and press the Center Freq submenu key.
6. Use the keypad to enter 50 and press the MHz submenu key.
7. Press the BW submenu key and the RBW submenu key.
8. Use the keypad to enter 1 and press the kHz submenu key.
9. Press the VBW submenu key and use the keypad to enter 10, then press the Hz submenu key.

10. Press the Span submenu key, use the keypad to enter 10, and press the kHz submenu key.
11. Press the **Amplitude** main menu and then press the Reference Level submenu key.
12. Use the keypad to enter 10 and press the dBm submenu key.
13. Press the Atten Lvl submenu key and enter 30, then press the dB submenu key.
14. Adjust the source power so that the power meter displays the corresponding desired Sensor B reading as recorded for 0 dBm in the **Required Sensor B Reading** column of Table A-5 on page A-5.
15. Press the **Marker** main menu and press the Peak Search submenu key.
16. Record the Marker 1 amplitude reading in the **0 dBm** row of Table A-6, "Spectrum Analyzer 50 MHz Absolute Amplitude Accuracy" on page A-5.
17. Verify that the Marker 1 amplitude reading is within the specification.
18. Repeat Step 14 through Step 17 for the other power level settings. Refer to Table A-5 for Required Sensor B Readings. Use Table A-6 to record test results. The last two settings are with the pre-amp turned on, to ensure pre-amp functionality.

## Amplitude Accuracy Across Frequency Verification

This procedure is the second test that is used to verify the absolute amplitude accuracy of the Spectrum Analyzer in the MT821xE Cell Master. The first procedure test was described in Section "50 MHz Amplitude Accuracy Verification" on page 2-9.

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- Anritsu ML2438A Dual Channel Power Meter
- Anritsu MA2442D High Accuracy Power Sensors (2)
- 10 MHz Reference Standard
- Anritsu 34NN50A 50 ohm Adapter
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator

### Test Setup Component Characterization

1. Connect both MA2442D power sensors to the power meter and calibrate the sensors.
2. Connect the equipment as shown in Figure 2-3.

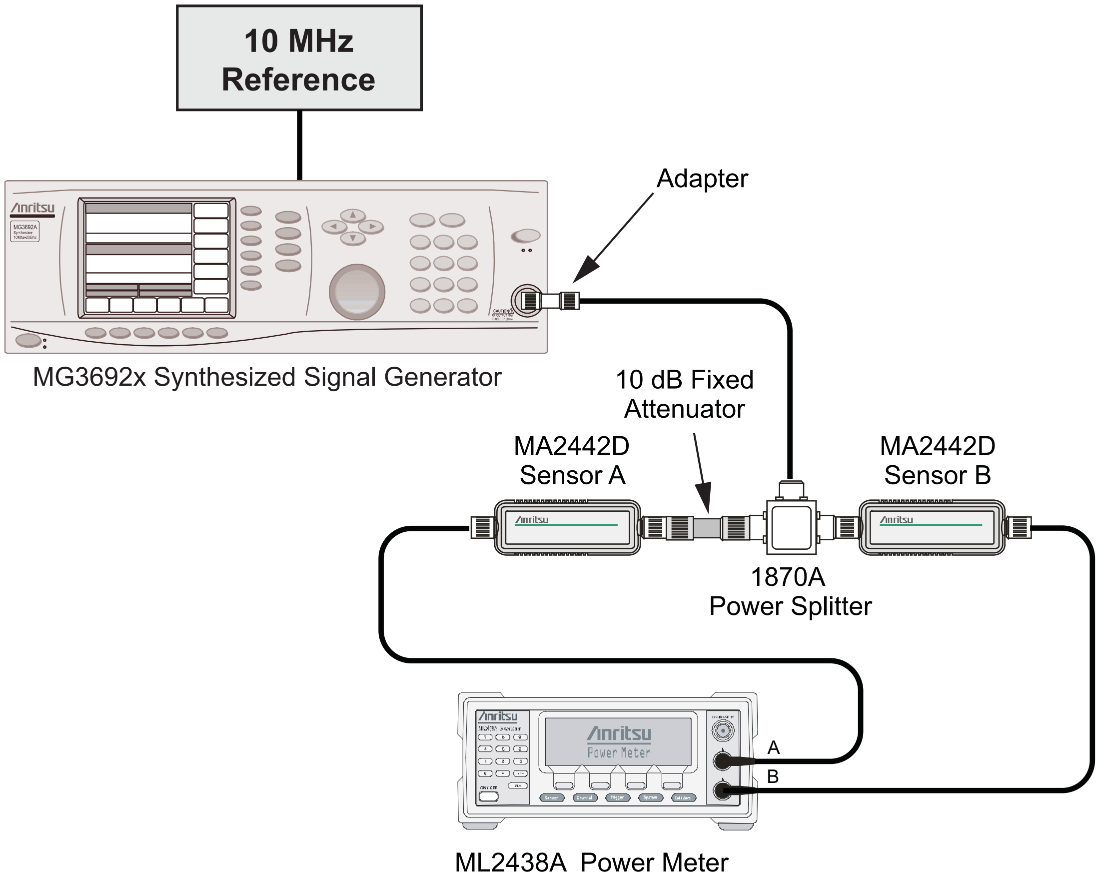



**Figure 2-3.** Fixed Level with Varying Frequency Setup

3. Set the power meter to display both Channel A and Channel B. Press the **Sensor** key, the Cal Factor soft key, and then the Freq soft key. Use the keypad to enter the value matching the frequency of the MG3692x as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Repeat for Channel B. Press the **System** key to display the power reading.
4. Set the MG3692x frequency to 10.1 MHz and adjust the level so that the Sensor A reading is –2 dBm ± 0.1 dB.
5. Record the Sensor B reading into the **–2 dBm** column of Table A-7, “Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency Setup Table” on page A-6.
6. Adjust the MG3692x output level so that the Sensor A reading is –30 dBm ± 0.1 dB.
7. Record the Sensor B reading into the **–30 dBm** column of Table A-7.
8. Adjust the MG3692x output level so that the Sensor A reading is –50 dBm ± 0.1 dB.
9. Record the Sensor B reading into the **–50 dBm** column of Table A-7
10. Repeat Step 2 through Step 9 for all of the frequencies that are listed in Table A-7.

| | |
|---|---|
| **Caution** | Before continuing, allow a 30 minute warm-up for the internal circuitry to stabilize. |

### Setup

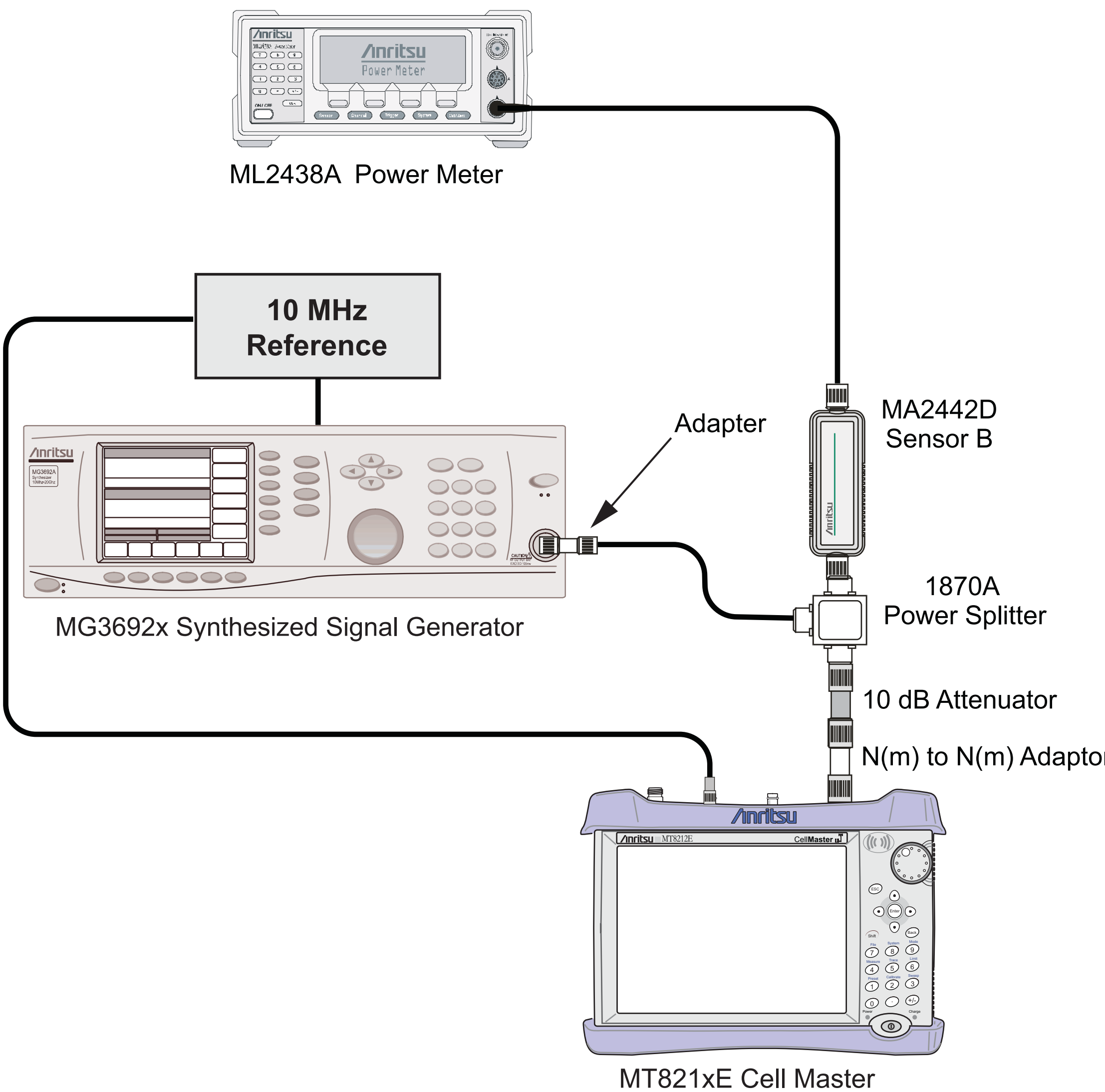



**Figure 2-4.** Absolute Amplitude Accuracy Across Frequency Verification Test Setup

### Measuring Amplitude Accuracy Across Frequency

1. Connect the equipment as shown in Figure 2-4.

| | |
|---|---|
| **Caution** | To maintain test setup integrity, do not disconnect Sensor B, the power splitter, or the fixed attenuator. |

2. Set the MT821xE to Spectrum Analyzer mode and then preset the instrument.
3. Press the **Shift** key, the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
4. Press the BW submenu key. Then set the RBW to 1 kHz and the VBW to 10 Hz.
5. Press the Span submenu key, set span to 10 kHz.
6. Press the Freq soft key and set the Center Frequency to 10.1 MHz.
7. Press the Amplitude soft key and set the Reference Level to -40 dBm and turn the Pre-Amp On.

8. Set the Attenuation Level to 15 dB.
9. Set the power meter to display Channel B. Press the **Sensor** key, the Cal Factor soft key, and then the Freq soft key. Use the keypad to enter the value matching the frequency of the MG3692x as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.Table A-7
10. Set the MG3692x frequency to 10.1 MHz.
11. Adjust the MG3692x output power so that the power meter displays a reading which matches the Sensor B reading for **–50 dBm** in Table A-7.
12. Press the **Marker** key and press the Peak Search submenu key.
13. Record the Marker 1 amplitude reading in Table A-8, "Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency".
14. Verify that the Marker 1 amplitude reading is within the specification.
15. Repeat Step 6 to Step 14 for other frequencies, input power, reference level, attenuation and pre-amp settings in Table A-8.

# 2-7 Residual Spurious Response Verification

The following two tests are used to verify the residual spurious response of the Spectrum Analyzer of the MT821xE Cell Master. They are performed using the positive peak detection mode. The two parts to this test are the "Residual Spurious Response Test with Preamp Off" immediately below, and the "Residual Spurious Response Test with Preamp On" on page 2-18.

## Residual Spurious Response Test with Preamp Off

### Equipment Required

- Anritsu 28N50-2 50 ohm Termination

### Procedure

1. Connect the 50 ohm Termination to the MT821xE Spectrum Analyzer RF In connector.
2. Press the **On/Off** key to turn On the MT821xE Cell Master.
3. On the MT821xE:
    a. Press the **Shift** key and then the **Mode** (9) key.
    b. Rotate the knob to highlight **Spectrum Analyzer** and then press the **Enter** key to switch to Spectrum Analyzer mode.
4. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset the instrument to the default starting conditions.
5. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
6. Press the **Amplitude** main menu, then press the Reference Level submenu key.
7. Use the keypad to enter –40 and press the dBm submenu key.
8. Press the Atten Lvl submenu key and enter 0, then press the dB submenu key.
9. Make sure that the Pre Amp On/Off submenu key is in the Off position.
    - If the preamp is On, press the Pre Amp On/Off submenu key to turn it Off.
10. Press the Amplitude soft key, then press the Detection submenu key, and then press the Peak soft key.
11. Press the **Freq** main menu key and press the Start Freq submenu key.
12. Use the keypad to enter 10 and press the MHz submenu key.
13. Press the Stop Freq submenu key, enter 50, and press the MHz submenu key.
14. Press the BW submenu key and press the RBW submenu key.
15. Use the keypad to enter 1 and press the kHz submenu key.
16. Press the VBW submenu key, use the keypad to enter 300, and then press the Hz submenu key.
17. Wait until one sweep is completed.
18. Press the **Marker** main menu and press the Peak Search submenu key.
19. Verify that the Marker 1 amplitude reading is less than –90 dBm.

| | |
|---|---|
| **Note** | If a spur larger than –90 dBm appears, then wait another full sweep and observe whether the spur re-appears at the same point on the second sweep.<br>If the spur does not appear at the same point on the second sweep, then the spur on the first sweep was not real. |

20. Record the “Marker 1 amplitude” reading into Table A-9, “Spectrum Analyzer Residual Spurious with Preamp Off” on page A-11.
21. Repeat Step 11 through Step 20 for the other frequency band settings in Table A-9 as applicable to the instrument under test.

## Residual Spurious Response Test with Preamp On

### Equipment Required

- Anritsu 28N50-2 50 ohm Termination

### Procedure

1. Connect the 50 ohm Termination to the MT821xE Spectrum Analyzer RF In connector.
2. Press the **On/Off** key to turn On the MT821xE Cell Master.
3. On the MT821xE, press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight **Spectrum Analyzer**, and then press the **Enter** key to switch to Spectrum Analyzer mode.
4. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset the instrument to the default starting conditions.

| | |
|---|---|
| **Caution** | Before continuing, allow a 30 minute warm-up period for the internal circuitry to stabilize. |

5. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
6. Press the **Amplitude** main menu, then press the Reference Level submenu key.
7. Use the keypad to enter –50 and press the dBm submenu key.
8. Press the Atten Lvl submenu key and enter 0, then press the dB submenu key.
9. Make sure that the Pre Amp On/Off submenu key is in the On position. If the pre amp is Off, press the Pre Amp On/Off submenu key to turn it On.
10. Press the Amplitude soft key, then press the Detection submenu key, and then press the Peak soft key.
11. Press the BW submenu key and press the RBW submenu key.
12. Use the keypad to enter 10 and press the kHz submenu key.
13. Press the VBW submenu key and use the keypad to enter 1, then press the kHz submenu key.
14. Press the **Freq** main menu key and press the Start Freq submenu key.
15. Use the keypad to enter 10 and press the MHz submenu key.
16. Press the Stop Freq submenu key, enter 1, and press the GHz submenu key.
17. Wait until one sweep is completed.
18. Press the **Marker** main menu and press the Peak Search submenu key.
19. Record the **“Marker 1 amplitude”** reading in the test records and verify that it is less than –90 dBm. Use Table A-10, “Spectrum Analyzer Residual Spurious with Preamp On” on page A-11.
20. Repeat Step 14 through Step 19 for the other Start and Stop frequencies as applicable for the instrument under test, and record the results inTable A-10.

| | |
|---|---|
| **Note** | If a spur larger than –90 dBm appears, then wait another full sweep and observe whether the spur re-appears at the same point on the second sweep.<br>If the spur does not appear at the same point on the second sweep, then the spur on the first sweep was not real. |

# 2-8 Displayed Average Noise Level (DANL)

The following test is used to verify the Displayed Average Noise Level (DANL) of the spectrum analyzer systems in the MT821xE Cell Master. This test is performed using the RMS detection mode.

### Equipment Required

- Anritsu 28N50-2 50 ohm Termination

### Procedure

1. Connect the 50 ohm Termination to the MT821xE Spectrum Analyzer RF In connector.
2. Press the **On/Off** key to turn On the MT821xE Cell Master.
3. On the MT821xE, press the **Shift** key and then the **Mode** (9) key. Rotate the knob to highlight **Spectrum Analyzer** and then press the **Enter** key to switch to Spectrum Analyzer mode.
4. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key to reset the instrument to the default starting conditions.

| **Caution** | Before continuing, allow a 30 minute warm-up period for the internal circuitry to stabilize. |
|---|---|

5. Press the **Shift** key, then the **Sweep** (3) key, then the Sweep Mode key, and then press the Performance submenu key.
6. Press the **Amplitude** main menu key, then press the Reference Level submenu key.
7. Use the keypad to enter –20 and press the dBm submenu key.
8. Press the Atten Lvl submenu key and enter 0, then press the dB submenu key.
9. Make sure that the Pre Amp is Off.
10. Press the **Amplitude** main menu key, then press the Detection submenu key, and then press the RMS/AVG soft key.
11. Press the BW submenu key and press the RBW submenu key.
12. Use the keypad to enter 100 and press the kHz submenu key.
13. Press the VBW submenu key.
14. Use the keypad to enter 1 and press the kHz submenu key.
15. Press the **Freq** main menu key and press the Start Freq submenu key.
16. Use the keypad to enter 10 and press the MHz submenu key.
17. Press the Stop Freq submenu key, enter 2.4, and press the GHz submenu key.
18. Wait until one sweep is completed.
19. Press the **Marker** main menu key, and then press Peak Search submenu key.
20. Record the Marker reading into the test records. Use the **Measured Value at 100 kHz RBW** column of Table A-11, “Spectrum Analyzer DANL with Pre Amp Off” on page A-11.

| **Note** | The noise floor consists of totally random signals in which a spur is a fixed spike of varying amplitude that is always visible. |
|---|---|

21. Repeat Step 15 through Step 20 for the other frequency settings in Table A-11 that are applicable for the instrument under test. Change the VBW setting as indicated in the **VBW** column of Table A-11.

22. For each measured 100 kHz RBW value in the test record, convert it to 1 Hz RBW value by subtracting 50 dB. For example:

```
–100 dBm – 50 dB = –150 dBm
```

For example, if the marker shows a value of –100 dBm at 100 kHz RBW, then the calculated value at 1 Hz RBW is –150 dBm.

23. Enter the calculated values in the test records. Use the **Calculated for 1 Hz RBW** column of Table A-11.
24. Verify that the calculated value is less than or equal to the value in the **Specification** column of Table A-11.
25. Press the **Amplitude** main menu, then press the Reference Level submenu key.
26. Use the keypad to enter –50 and press the dBm submenu key.
27. Press the Pre Amp On/Off submenu key to turn the preamplifier On.
28. Repeat Step 11 through Step 24.
29. Record the Marker reading and calculated value in the test record using Table A-12, "Spectrum Analyzer DANL with Pre Amp On" on page A-12.

# 2-9 Third Order Intercept (TOI) Verification

The following test verifies the Third Order Intercept point (also known as TOI or IP3) of the Spectrum Analyzer in the MT821xE

### Equipment Required

- Anritsu MG3692x Synthesizer (Quantity 2)
- Anritsu ML2438A Power Meter
- Anritsu MA2442D Power Sensor
- Fixed Attenuator, Aeroflex/Weinschel Model 44-2 (Quantity 2)
- Fixed Attenuator, Aeroflex/Weinschel Model 44-6 (Quantity 2)
- Fixed Attenuator, Aeroflex/Weinschel Model 44-20 (Quantity 2)
- Power Splitter, Aeroflex/Weinschel Model 1870A
- Adapter, Anritsu Model 34NN50A
- 10 MHz Reference Standard

### Procedure for 800 MHz TOI

1. Connect the 10 MHz Reference from the frequency reference to the 10 MHz Reference input connections of the two MG3692x synthesizers and the MT821xE.
2. Zero/cal the MA2442D Power Sensor, and set the calibration factor of the sensor to 800 MHz.
3. Connect the MA2442D Power Sensor to the input of the 1870A splitter.
4. Connect the 28 dB of Attenuation to each output side of the 1870A splitter.
5. Connect one MG3692x to one 28 dB attenuator, and connect the other MG3692x to the other 28 dB attenuator. (The normal RF output connections will become input connections, and the normal input connection will become the RF oputput connection.
6. Set one MG3692x to 799.951 MHz, and set the other MG3692x to 800.051 MHz.
7. Turn Off the RF Output of one MG3692x and turn On the other RF Output. Set the level of the MG3692x that is On so that the MA2442D power sensor reads –20 dBm.
8. Turn Off the MG3692x that is On and turn On the MG3692x that is Off. Set the level so that the MA2442D power sensor reads –20 dBm.
9. Disconnect the MA2442D from the splitter and connect the splitter to the MT821xE RF In port using the 34NN50A adapter.
10. Turn On the RF Output of the Synthensizer that is Off, so that both MG3692x synthesizers are On.
11. Press the **On/Off** key to turn On the MT821xE Cell Master.

| | |
|---|---|
| **Caution** | Before continuing, allow a 30 minute warm-up period for the internal circuitry to stabilize. |

12. Put MT821xE into **Spectrum Analyzer** Mode and Preset the instrument.
13. Using the Frequency menu, set the Center Frequency to 799.851 MHz and set the Span to 100 Hz.
14. Using the BW menu, set the RBW to 10 Hz and set VBW to 1 Hz.
15. Using the Amplitude menu, set the Reference Level to –15 dBm, ensure that the Pre Amp is Off, set Attenuation Level to 10 dB, and press the Detection submenu key, and press RMS/Avg.
16. Using the Marker menu, press Peak Search and write down the level value.
17. Using the Frequency menu, set the Center Frequency to 800.151 MHz.
18. Using the Marker menu, press Peak Search and write down the level value.

19. Choose the larger of the two values from Step 16 and Step 18 and put this value into the following equation as the “max” variable:

```
TOI = -20 + [(-20 - max) / 2] dBm
```

20. Record the **Measured Max Value** and **Calculated TOI** values into the test record using Table A-13, “Third Order Intercept (TOI) Verification” on page A-12.

### Procedure for 2400 MHz TOI

1. Connect the 10 MHz Reference from the frequency reference to the 10 MHz Referenc input connections of the two MG3692x sythesizers and the MT821xE.
2. Zero/cal the MA2442D Power Sensor, and set the calibration factor of the sensor to 2400 MHz.
3. Connect the MA2442D Power Sensor to the input of the 1870A splitter.
4. Connect the 28 dB of Attenuation to each output side of the 1870A splitter.
5. Connect one MG3692x to one 28 dB attenuator and connect the other MG3692x to the other 28 dB attenuator. (The normal RF output connections will become input connections, and the normal input connection will become the RF oputput connection.
6. Set one MG3692x to 2399.951 MHz and set the other MG3692x to 2400.051 MHz.
7. Turn Off the RF Output of one MG3692x, and turn On the other RF Output. Set the level of the MG3692x that is On so that the MA2442D sensor reads –20 dBm.
8. Turn Off the MG3692x that is On, and turn On the MG3692x that is Off. Set the level so that the MA2442D reads –20 dBm.
9. Disconnect the MA2442D from the splitter, and connect the splitter to the MT821xE RF In port using the 34NN50A adapter.
10. Turn On the RF Output of the Synthensizer that is Off, so that both MG3692x Synthesizers are On.
11. Press the **On/Off** key to turn On the MT821xE Cell Master.

| **Caution** | Before continuing, allow a 30 minute warm-up period for the internal circuitry to stabilize. |
|---|---|

12. Put MT821xE into **Spectrum Analyzer** mode and Preset the instrument.
13. Using the Frequency menu, set the Center Frequency to 2399.851 MHz, and set the Span to 100 Hz.
14. Using the BW menu, set the RBW to 10 Hz and VBW to 1 Hz.
15. Using the Amplitude menu, set the Reference Level to –15 dBm, ensure that the Pre Amp is Off, set Attenuation Level to 10 dB, press the Detection submenu key, and press RMS/Avg.
16. Using the Marker menu, press Peak Search and write down the level value.
17. Using the Frequency menu, set the Center Frequency to 2400.151 MHz.
18. Using the Marker menu, press Peak Search and write down the level value.
19. Choose the larger of the two values from Step 16 anad Step 18, and put this value into the following equation as the **“max”** variable.

```
TOI = -20 + [(-20 - max) / 2] dBm
```

20. Record the **Measured Max Value** and **Calculated TOI** value into the test record using Table A-13, “Third Order Intercept (TOI) Verification” on page A-12.

# Chapter 3 — Cable and Antenna Analyzer Verification

## 3-1 Introduction

These tests verify that the Cable and Antenna Analyzer of the Model MT821xE Cell Master is functional. The functional tests include:

- "Frequency Accuracy Verification"
- "Return Loss Accuracy Verification" on page 3-2

## 3-2 Frequency Accuracy Verification

The following test is used to verify the CW frequency accuracy of the RF source in the MT821xE in Cable and Antenna Analyzer mode.

### Equipment Required

- Frequency Counter, Anritsu Model MF2412B
- RF Coaxial Cable, Anritsu Model 15NNF50-1.5C

### Procedure

1. Verify that the MT821xE is in **Cable and Antenna Analyzer** mode and preset the instrument.
2. Verify that no external 10 MHz reference is connected to the MT821xE.
3. Press **Shift** then the **Sweep** key.
4. Verify that the RF Immunity is set to High.
5. Press the **Freq/Dist** key and set both the Start Freq and Stop Freq to 2 GHz.
6. Connect the RF cable from the MT821xE VNA Reflection RF Out to the Frequency Counter.
7. Turn on the Frequency Counter and press the **Preset** key.
8. Record the frequency data in Table A-14, "VNA Frequency Accuracy" on page A-13.

# 3-3 Return Loss Accuracy Verification

The following test can be used to verify the accuracy of return loss measurements. Measurement calibration of MT821xE in Cable and Antenna Analyzer mode is required for this test.

### Equipment Required

- Open/Short, Anritsu Model 22N50
- Termination, Anritsu Model 28N50-2
- 6 dB Offset Termination, Anritsu Model SC7424
- 20 dB Offset Termination, Anritsu Model SC7423

### Procedure

1. Verify that the MT821xE is in **Cable and Antenna Analyzer** mode and preset the instrument.
2. Press the **Measurement** key, then press the Return Loss submenu key.
3. Press the **Shift** key, then press the **Calibrate** (2) key.
4. Press the Start Cal submenu key. Follow the instructions on the screen to perform a calibration.
5. After the calibration is complete, install the 20 dB offset termination.
6. Press the **Amplitude** key, set Top to 17 dB, and set Bottom to 23 dB.
7. Verify that the data display falls between 18.4 dB and 21.6 dB.
8. Press the **Marker** key and press the Marker to Peak submenu key. Record the marker value, then press the Marker to Valley submenu key and record the marker value. Record the worst case of the two values into Table A-15, "VNA Return Loss Accuracy Verification" on page A-13.
9. Remove the 20 dB offset and install the 6 dB offset.
10. Press the **Amplitude** key, set Top to 4.0 dB, and set Bottom to 8.0 dB.
11. Verify that the data display falls between 5 dB and 7 dB.
12. Press the **Marker** key and press the Marker to Peak submenu key. Record the marker value, then press the Marker to Valley submenu key and record the marker value. Record the worst case of the two values into Table A-15.

# Chapter 4 — Power Meter Verification

## 4-1 Power Meter Level Accuracy

The following test verifies the level accuracy of the Power Meter function in the MT821xE.

### Equipment Required

- Anritsu MG3692X Synthesized Signal Source
- Anritsu ML2438A Dual Channel Power Meter
- Anritsu MA2442D High Accuracy Power Sensors (2)
- 10 MHz Reference Standard
- Anritsu 34NN50A 50 ohm Adapter
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator

### Setup

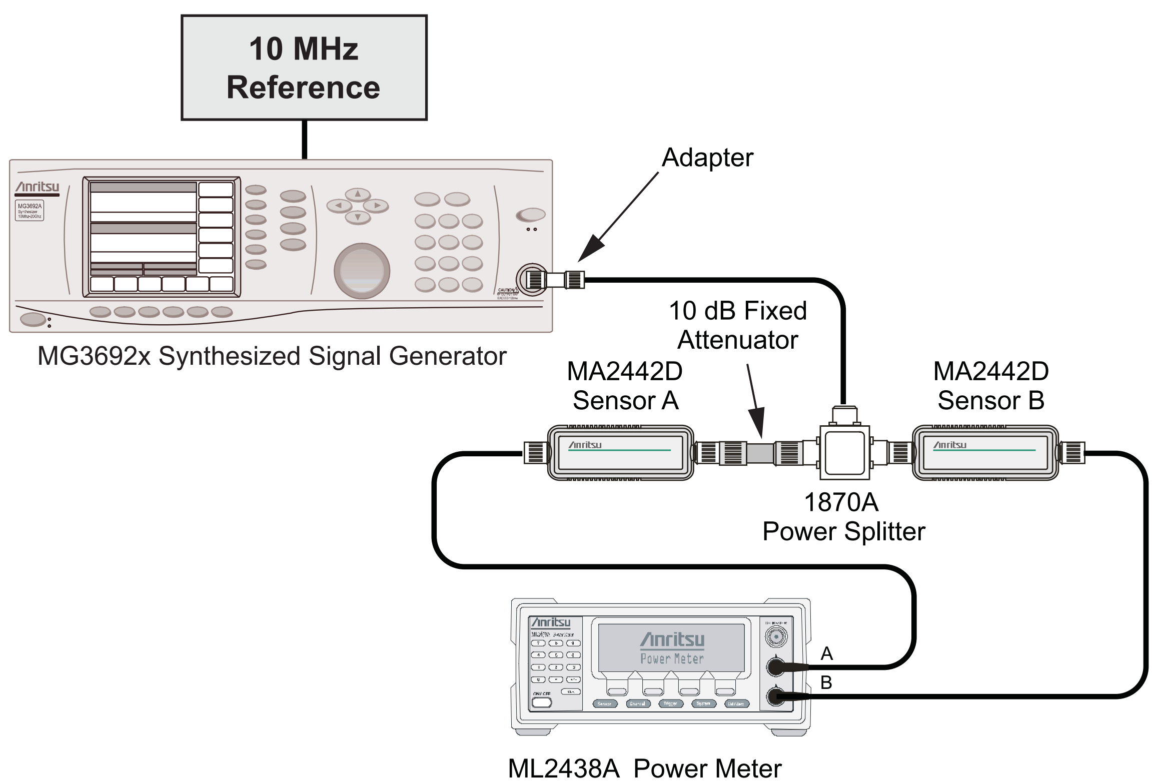



**Figure 4-1.** Power Meter Measurement Accuracy

**Procedure Component Characterization:**

1. Connect both MA2442D power sensors to the power meter and calibrate the sensors.
2. Connect the model 1870A power splitter to the MG3692A/B output, and connect Sensor B to one power splitter output as shown in Figure 4-1 on page 4-1.
3. Install the 10 dB Fixed Attenuator to the other power splitter output, and then connect Sensor A to the end of the Attenuator.
4. Set the power meter to display both Channel A and Channel B. Press the **Sensor** key, the Cal Factor soft key, and then the Freq soft key. Use the keypad to enter the value matching the frequency of the MG3692A/B as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Repeat for Channel B. Press the **System** key to display the power reading.
5. Adjust the power level of the MG3692A/B to get a reading on Sensor A that matches the power level (within ± 0.1 dB) in the first column of Table A-16, "Characterization Chart for Power Meter Verification" on page A-14.
6. Record the Sensor B reading in the **Required Sensor B Reading** column of Table A-16.
7. Repeat **Step 5** and **Step 6** for the other power level in the first column of Table A-16, recording the Sensor B reading in the second column.
8. Repeat **Step 4** through **Step 7** for the next input frequency.

### Power Meter Measurement Accuracy Procedure

1. Connect the equipment as shown in Figure 4-2.

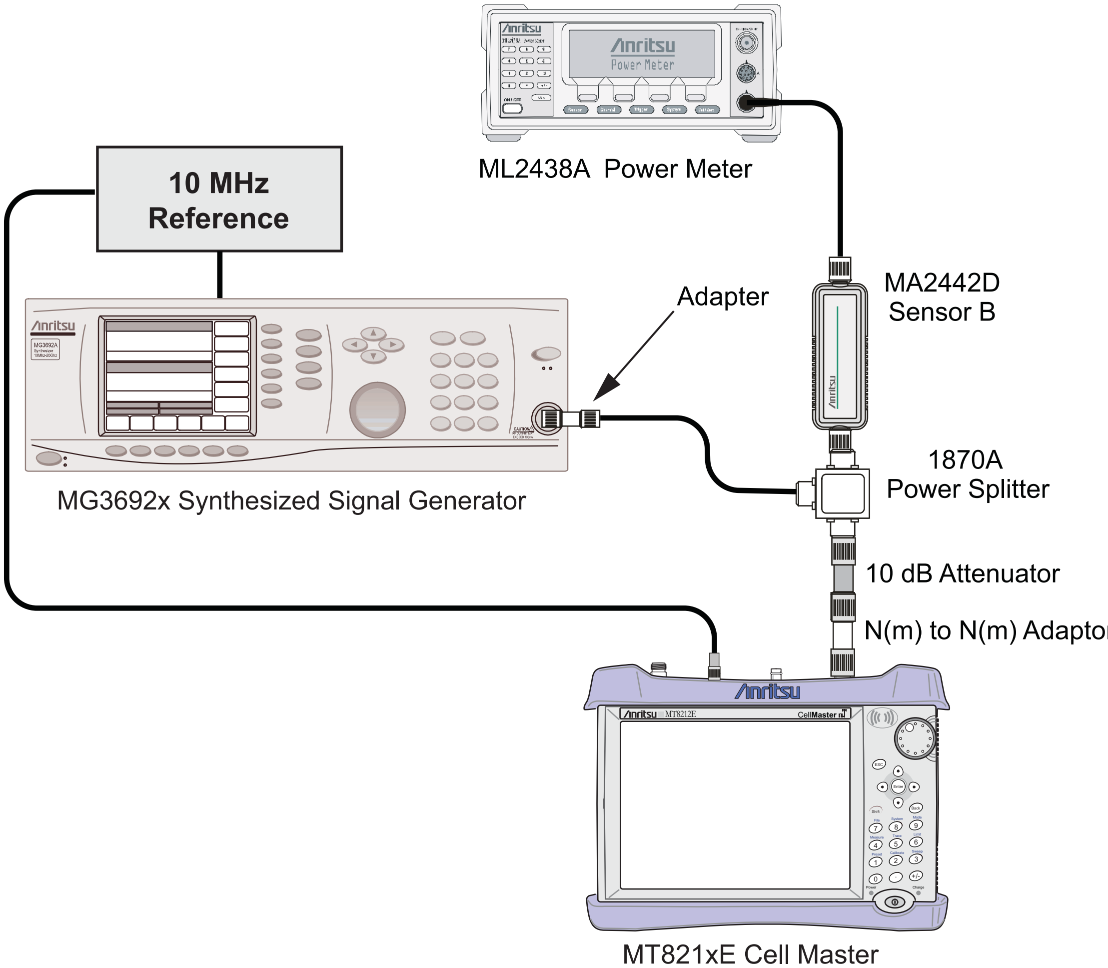



**Figure 4-2.** Power Meter Measurement Accuracy

2. Verify that the MT821xE is in the **Power Meter** mode and preset the instrument.
3. Set the MT821xE span to 3 MHz.
4. Set the MT821xE center frequency to 50 MHz.
5. Adjust the MG3692A/B power so that the power meter Sensor B matches the Sensor B value shown in Table A-16, “Characterization Chart for Power Meter Verification” on page A-14.
6. Record the reading on the MT821xE display in Table A-17, “Internal Power Meter Accuracy Verification” on page A-14.
7. Repeat **Step 5** through **Step 6** for the next test power level in Table A-16.
8. Repeat **Step 4** through **Step 6** for the next test frequency in Table A-16.

# Chapter 5 — Option Verification

## 5-1 Introduction

This chapter describes the verification process for options that are available for the MT821xE Cell Master. The option verification tests are:

## 5-2 Bias Tee Verification, Option 10

This test verifies that the optional Bias Tee in Model MT821xE Cell Master is functional. These tests include:

- "Low Current Test Verification"
- "High Current Test Verification" on page 5-3
- "Fault Verification" on page 5-4

### Low Current Test Verification

The tests in this section verify the Bias Tee Option 10 low current operation of the MT821xE in Cable and Antenna Analyzer mode.

#### Equipment Required

- Anritsu 40-187-R External Power Supply
- Anritsu T3377 105 ohm Load

#### Procedure

1. Connect the external power supply (Anritsu PN 40-187-R) to the MT821xE Cell Master.
2. Press the **On/Off** key to turn On the MT821xE.
3. Set the MT821xE to **Cable and Antenna Analyzer** mode and preset the instrument.
4. Press the **Shift** key, and then the **System** (8) key, then press the Applications Options submenu key.

#### Low Current Test

1. Press the Bias Tee Voltage submenu key and change voltage from 15 V to 12 V and confirm that the Current soft key is set to Low.
2. Connect the Anritsu T3377 105 ohm load to the RF In test port.
3. Press the Bias Tee On/Off submenu key to turn On the Bias Tee.
4. Record the Voltage and Current readings that are displayed on the left side of the screen into the **105 ohm Load Low Current** section of Table A-18, "Option 10 Bias-Tee" on page A-15. Verify that the voltage and current readings are within the specifications.
5. Press the Bias Tee On/Off submenu key to turn Off the Bias Tee.
6. Repeat Step 3 through Step 5, entering each of the voltage settings that are listed in the **105 ohm Load Low Current** section of Table A-18.

## High Current Test Verification

The tests in this section verify the Bias Tee Option 10 high current operation of the MT821xE in Cable and Antenna Analyzer mode.

### Equipment Required

- Anritsu 40-187-R External Power Supply
- Anritsu T2904 40 ohm Load
- Anritsu T3536 78 ohm Load

### Procedure

1. Connect the external power supply (Anritsu PN 40-187-R) to the MT821xE Cell Master.
2. Press the **On/Off** key to turn On the MT821xE.
3. Set the MT821xE to **Cable and Antenna Analyzer** mode and preset the instrument.
4. Press the **Shift** key, and then the **System** (8) key, and then press the Applications Options submenu key.

### High Current Test

1. Press the Bias Tee Voltage submenu key and verify that the voltage setting is 15 V. Confirm that the Current soft key is set to High.
2. Connect the Anritsu T2904 40 ohm load to the RF In test port.
3. Press the Bias Tee On/Off submenu key to turn On the Bias Tee.
4. Record the Voltage and Current readings that are displayed on the left side of the screen in the **40 ohm Load High Current** section of Table A-18. Verify that the voltage and current readings are within the specifications.
5. Press the Bias Tee On/Off submenu key to turn Off the Bias Tee. Disconnect the Anritsu T2904 40 ohm load and connect the Anritsu T3536 78 ohm load to the RF In port.
6. Press the Bias Tee Voltage submenu key and enter 32 V.
7. Press the Bias Tee On/Off submenu key to turn On the Bias Tee.
8. Record the Voltage and Current readings that are displayed on the left side of the screen in the **78 ohm Load High Current** section of Table A-18. Verify that the voltage and current readings are within the specifications.
9. Press the Bias Tee On/Off submenu key to turn Off the Bias Tee.

## Fault Verification

The tests in this section verify the Bias Tee Option 10 fault condition of the MT821xE in Cable and Antenna Analyzer mode.

### Equipment Required

- Anritsu 40-187-R External Power Supply
- Anritsu T2904 40 ohm Load

### Procedure

1. Connect the external power supply (Anritsu PN 40-187-R) to the MT821xE Cell Master.
2. Press the **On/Off** key to turn On the MT821xE.
3. Set the MT821xE to **Cable and Antenna Analyzer** mode and preset the instrument.
4. Press the **Shift** key, and then the **System** (8) key, and then press the Applications Options submenu key.

### Fault Test

5. Press the Bias Tee submenu key and confirm that the Current submenu key is set to Low.
6. Press the Bias Tee Voltage submenu key and enter 32 V.
7. Connect the Anritsu T2904 40 ohm load to the RF In port.
8. Press the Bias Tee On/Off submenu key to turn On the Bias Tee.
9. Verify that the instrument indicates a **"Bias-T Fault Condition"** and makes a clicking sound, and that the Bias Tee current reading that is displayed on the left side of the screen is 0 mA.
10. Press the Bias Tee On/Off submenu key to turn Off the Bias Tee.

# 5-3 System Dynamic Range Verification, Option 21

The following test can be used to verify the system dynamic range, when using Option 21, 2 Port Transmission Measurement Mode.

### Equipment Required

- Termination, Anritsu Model 28N50-2
- Termination, Anritsu Model 28NF50-2
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C

### Procedure

1. Verify that the MT821xE is in **Transmission Measurement** mode and preset the instrument.
2. Press the **Shift** key, then press the **Sweep** (3) key.
3. Verify that High Dynamic Range is set to On
4. Verify that the Output Power is set to High.
5. Press the **Measure** main menu key.
6. Press the Start Cal submenu key and follow the on-screen instructions to perform calibration.
7. After the calibration is complete, disconnect one end of the cable and connect loads so that both the RF Out (Reflection In) and RF In ports are terminated.
8. Press the Sweep/Setup main menu key, and press the Averaging submenu key. Confirm that Averaging Off is selected, indicated by the red dot in the top right-hand corner.
9. Press the **Amplitude** main menu key and set the Top to –50 dB and Scale to 10 dB/div.
10. For MT8212E Cell Masters, verify that the trace is below –80 dB for the entire frequency band (2 MHz to 4 GHz). Record the peak value in Table A-19, “VNA System Dynamic Range Verification” on page A-15.
11. For MT8213 Cell Masters, verify that the trace is below –80 dB from 2 MHz to 4 GHz, and verify that the trace is below –70 dB from 4 GHz to 6 GHz. Record the peak value for each of the two segments in Table A-19.

# 5-4 ISDB-T and BER Verification, Options 30 and 79

## Introduction

The tests in this section verify the performance of the optional ISDB-T Signal Analyzer option of the MT821xE. These tests include:


- "Frequency Accuracy Verification" on page 5-7
- "Frequency Lock Range Verification" on page 5-8
- "Level Accuracy Verification" on page 5-10
- "Displayed Average Noise Level (DANL) Verification" on page 5-13
- "Phase Noise Verification" on page 5-13
- "BER Measurement Functional Check, Option 79 Only" on page 5-15


### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu MN63A Programmable Attenuator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensors (2)
- Anritsu 1N50C RF Limiter
- Anritsu 34NN50A Adapter
- Anritsu 15NNF50-1.5C RF Coaxial Cables (3)
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator
- Mini-Circuits TIA-1000-1R8 RF Power Amplifier
- Midwest Microwave ADT-2615-NF-BNM-02 Adapters (2)
- 10 MHz Reference Standard

## Frequency Accuracy Verification

The test in this section can be used to verify the frequency accuracy of the MT821xE in ISDB-T Signal Analyzer mode.

### Setup

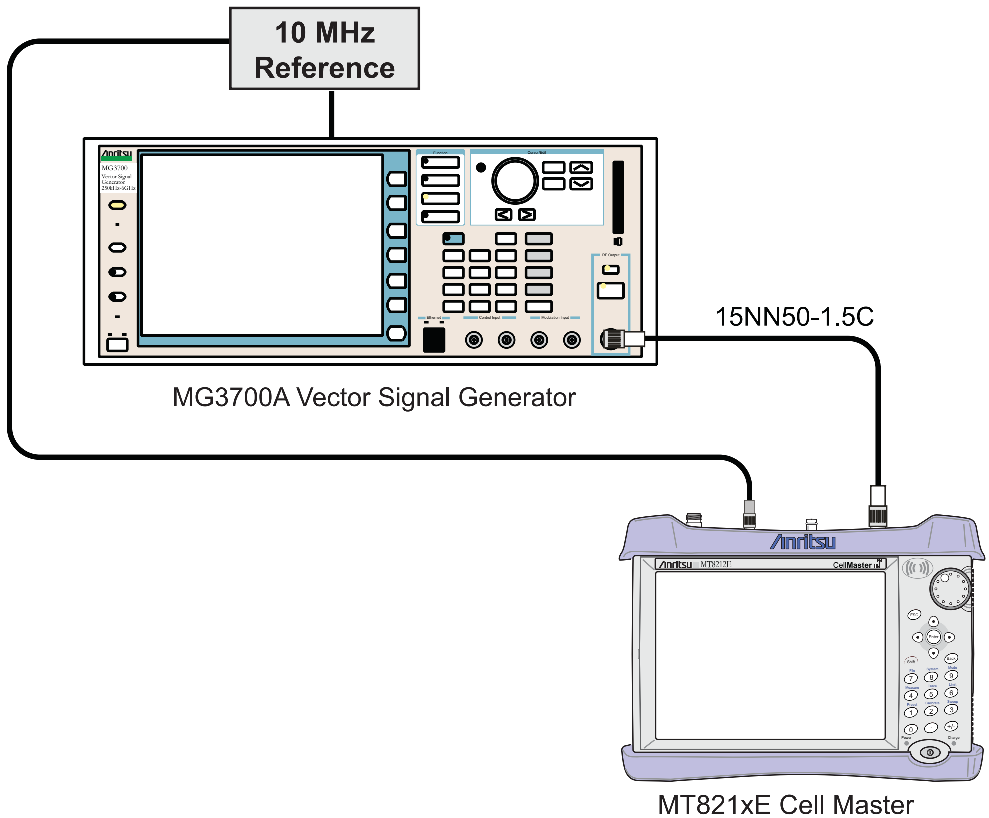



**Figure 5-1.** ISDB-T Signal Analyzer Test Setup

### Procedure

1. Connect the equipment as shown in Figure 5-1.
2. On MG3700A press the **Preset** key (Yellow key on the upper left-hand side)
3. Press the **Down Arrow** key to select Yes.
4. Press the **Set** key.

| **Note** | The MG3700A has two **Set** keys, and that they both have the same function. |
|---|---|

5. Press the (F1) soft key to select Load File to Memory.
6. Press the (F1) soft key again to select Select Package.
7. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
8. Press the **Set** key.
9. Press the F6 (Return) soft key.
10. Press the **Set** key.

11. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
12. Press the **Set** key.
13. Using the **Down Arrow** key, step through the selection list until the **"ISDB-T_1layer_1ch"** option is highlighted.
14. Press the **Set** key.
15. Set the frequency to 473.14285714 MHz.
16. Set the level to –20 dBm.
17. Confirm that the **Modulation On/Off** key and the **Output** key both have LEDs On.
18. Set the mode of the MT821xE to **ISDB-T Signal Analyzer**. Press the **Shift** key, the **Preset** (1) key, and then press the Preset submenu key to reset the instrument.
19. Confirm that the Channel is set to 13.
20. Press the **Meas Selection** main menu key, then press Modulation Analysis.
21. On the MT821xE, press the **Frequency/Level** main menu key, set the Reference Level to –20dBm.
22. Press the **Meas Setup** main menu key and then the Meas Mode submenu key.
23. Use the rotary knob to highlight **"Average"** and then press the **Enter** key.
24. Set the Average Count to 10.
25. Wait until the Average (10/10) appears at the top of the display.
26. Record the frequency error as shown on the MT821xE display into Table A-20, "ISDB-T Signal Analyzer Frequency Accuracy" on page A-16.
27. Press the Frequency/Level main menu key, and set the MT821xE to Channel 38.
28. Set the frequency of the MG3700A to 623.14285714 MHz.
29. On the MT821xE, press the Execute Measure main menu key.
30. Wait until the Average (10/10) appears at the top of the display.
31. Record the frequency error as shown on the MT821xE display into Table A-20.
32. Set the MT821xE to Channel 62.
33. Set the frequency of the MG3700A to 767.14285714 MHz.
34. Press the Execute Measure main menu key.
35. Wait until the Average (10/10) appears at the top of the display.
36. Record the frequency error as shown on the MT821xE display into Table A-20.
37. On the MG3700A, set the frequency to 473.14285714 MHz and set the output level to –50 dBm.
38. On the MT821xE, press the Frequency/Level main menu key, then press the Pre Amp submenu key to turn Pre Amp On.
39. Set the Reference Level to –50dBm and change the channel to 13.
40. Press the Execute Measure main menu key.
41. Repeat Step 25 through Step 36 and record the results in Table A-20.

## Frequency Lock Range Verification

The test in this section can be used to verify the frequency lock range of the MT821xE in ISDB-T Signal Analyzer mode.

### Procedure

1. Connect the equipment as shown in Figure 5-1 on page 5-7.
2. Preset the MG3700A.
3. Load the **"ISDB-T_1layer_1ch"** pattern on the MG3700A. Refer to "Frequency Accuracy Verification" on page 5-7 if needing help on loading patterns.
4. Set the frequency to 473.23285714 MHz.
5. Set the level to –20 dBm.
6. Confirm the **Modulation On/Off** key and the **Output** key both have LEDs On.
7. Set the mode of the MT821xE to **ISDB-T Signal Analyzer**. Press the **Shift** key, the **Preset** (1) key, and then press the Preset submenu key to reset the instrument.
8. On the MT821xE, press the Frequency/Level main menu key, and confirm that Channel is set to 13.
9. Set the Reference Level to –20 dBm.
10. Press the **Meas Selection** main menu key and press Modulation Analysis.
11. Press the **Meas Setup** main menu key and then the Meas Mode submenu key.
12. Use rotary knob to highlight **"Average"** and press the **Enter** key.
13. Press the Average Count submenu key, then enter **10** and press the **Enter** key.
14. Wait until Average (10/10) appears at the top of the display.
15. Record the Frequency Error in Table A-21, "ISDB-T Signal Analyzer Frequency Lock Range" on page A-16.
16. On the MG3700A, set the frequency to 473.05285714 MHz.
17. Press **Execute Measure** to read the new frequency.
18. Wait until Average (10/10) appears at the top of the display.
19. Record the frequency error in Table A-21.

## Level Accuracy Verification

The tests in this section verify the level accuracy of the MT821xE in ISDB-T Signal Analyzer mode.

### Setup

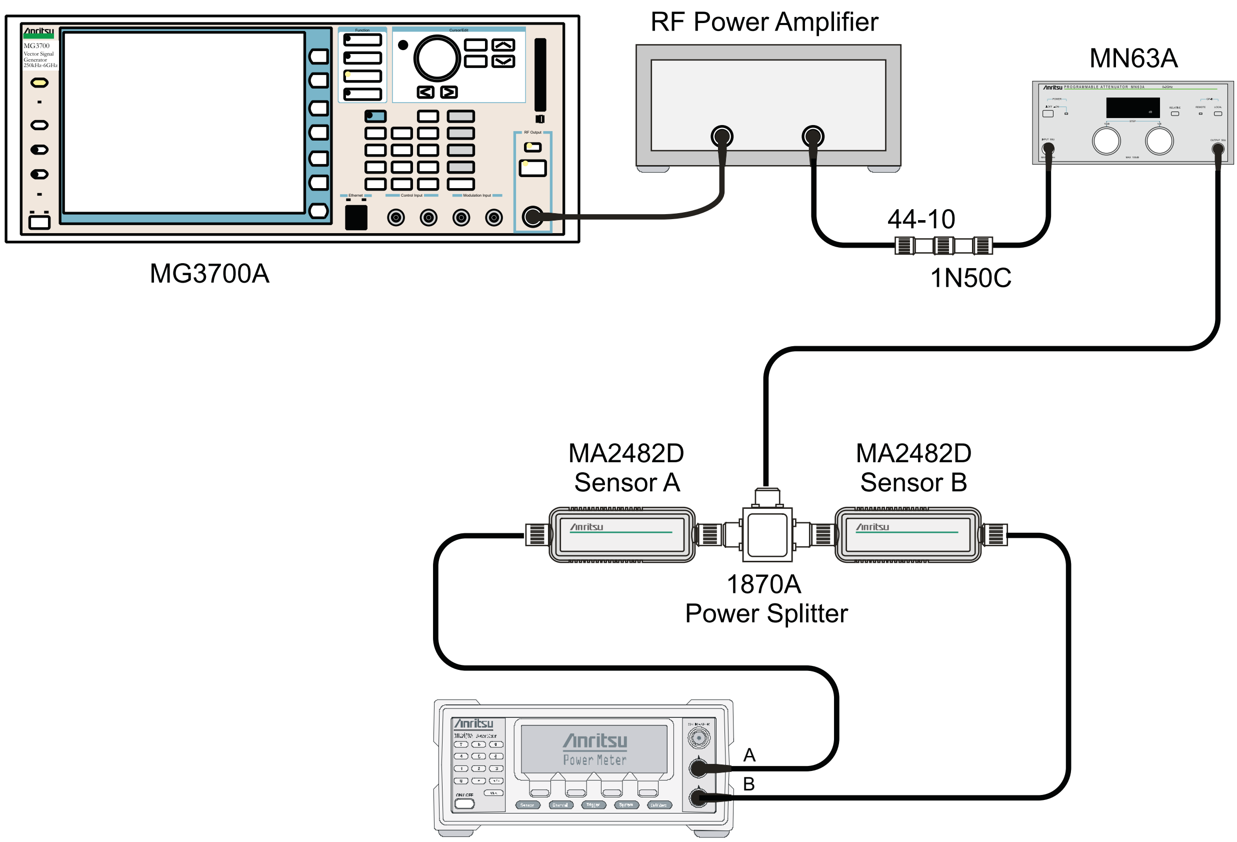



**Figure 5-2.** ISDB-T Level Accuracy and 1 dB Compression Level Pre-test Setup

### Procedure

1. Perform Zero/Cal on Sensor A and Sensor B of the power meter. Set the calibration factor of both sensors to 473 MHz.
2. Confirm that the Power Amplifier is off.
3. Connect the MG3700A Signal Generator, Power Amplifier with N(f)-BNC(m) adapters, RF Limiter, MN63A Programmable Attenuator, Power Divider, Power Meter, and Power Sensors as shown in Figure 5-2.
4. Preset the MG3700A.
5. Load the **“ISDB-T_1layer_1ch”** pattern on the MG3700A. Refer to “Frequency Accuracy Verification” on page 5-7 if needing help on loading patterns.
6. Set the MG3700A frequency to 473.14285714 MHz.
7. Set the MG3700A level to –25 dBm.
8. Confirm that the **Modulation On/Off** key and the **Output** key both have LEDs On.
9. Turn On the power amplifier and allow it to warm up for at least 5 minutes.
10. Adjust the MN63A attenuator so that the Sensor A reading is –10 dBm ± 1 dB. Record the attenuation reading in the **AT(–10)** column of Table A-22, “Level Accuracy Verification, AT(–10)” on page A-16.

11. On the MG3700A, adjust the power level so that Power Meter Sensor A reading is –10.0 dBm ± 0.2 dB.
12. Record Power Meter Sensor A reading and Sensor B reading in Table A-22.
13. Subtract Sensor A reading from Sensor B reading and record the result in the **ΔAB(–10)** column of Table A-22.
14. Calculate the AT(set) values for Test Levels –10 dBm through –45 dBm and record the values into the **AT(set) column** of Table A-24, "ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 13ch at 473.14285714 MHz" on page A-18.
15. Remove Sensor A from the Power Splitter and then connect the Power Splitter to the MT821xE Spectrum Analyzer RF In with an N male to N male adapter as shown in Figure 5-3.

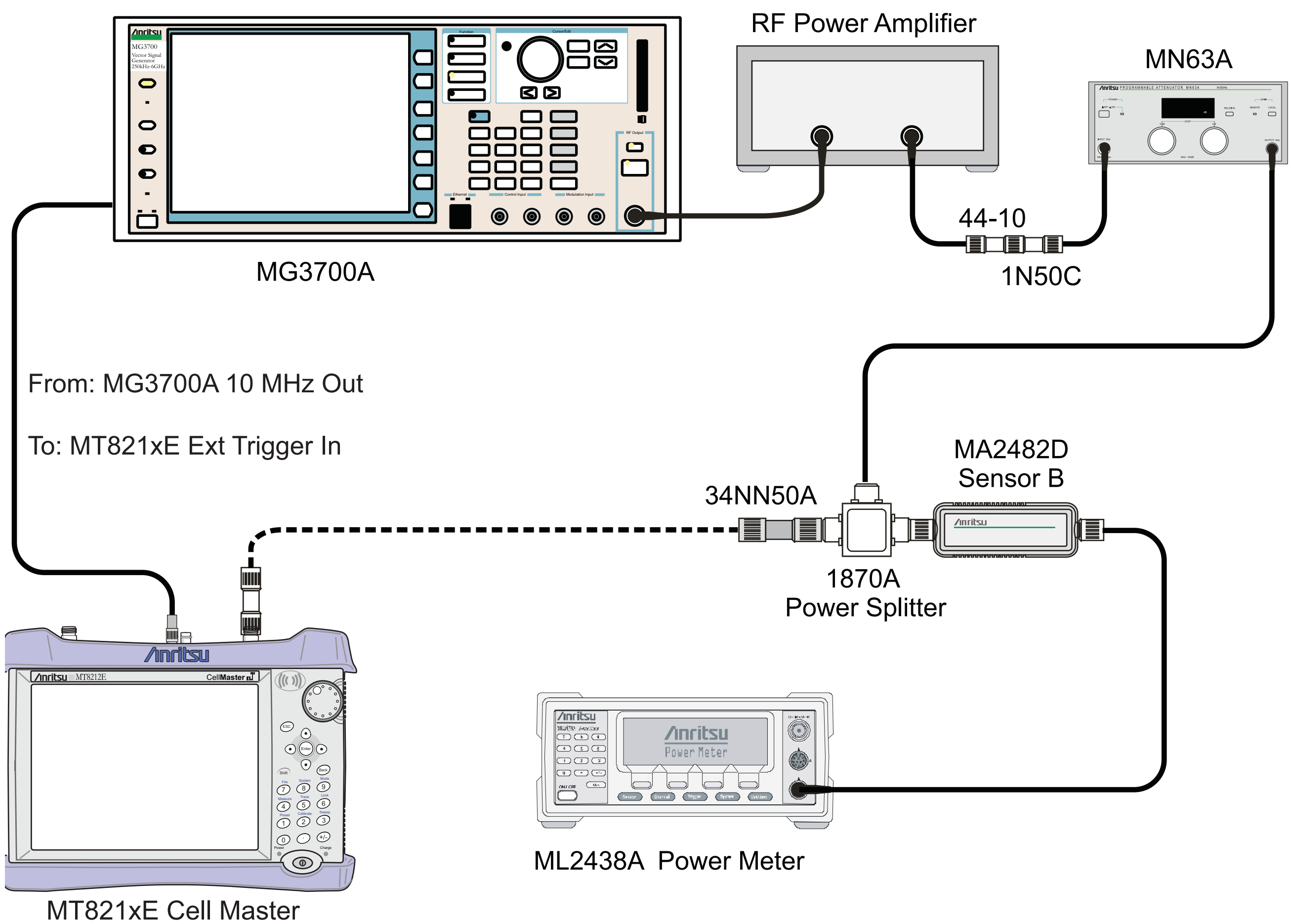



**Figure 5-3.** ISDB-T Level Accuracy and 1 dB Compression Level Post-test Setup

16. Record the new Power Meter Sensor B reading to the **SB(–10)** box in Table A-24.
17. On the MT821xE, set the mode to **ISDB-T Signal Analyzer** and preset the instrument.
18. Press the **Meas Selection** main menu key, confirm that Field Strength is selected.
19. Press the **Frequency/Level** main menu key, ensure that Channel is 13 and that Pre Amp is Off.
20. Change the Reference Level to –10 dBm.
21. Press the **Meas Setup** main menu key and then the Meas Mode submenu key.
22. Use **Up/Down** arrow keys, highlight Average, and then press the **Enter** key.
23. Change the Average Count to 50.

24. After Average (50/50) appears at the top of the display, record the Channel Power from the MT821xE into the **M(Level)** column under **Pre Amp Off** in Table A-24.
25. Calculate the Deviation using the following formula:

    `Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)`

| | |
|---|---|
| **Note** | Because AT(–10) is the same as AT(set), `[– AT(–10) + AT(set)] = 0` |

26. Record the result into the **Dev** column under **Pre Amp Off** in Table A-24 and verify that it is within specification.
27. Set the MN63A attenuation to the next **AT(set)** value in Table A-24.
28. Press the **Frequency/Level** main menu key and set the Reference Level of the MT821xE to –15 dBm.
29. After Average (50/50) appears, record the –15 dBm channel power from the MT821xE to the **M(Level)** column under **Pre Amp Off** in Table A-24.
30. Calculate the Deviation using the following formula:

    `Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)`

31. Record the result into the **Dev** column under **Pre Amp Off** in Table A-24 and verify that it is within specification.
32. Set the MN63A attenuation to the next **AT(set)** value in Table A-24.
33. Set the Reference Level of MT821xE to –20 dBm.
34. After Average (50/50) appears, record the –20 dBm Channel Power from the MT821xE into the **M(Level)** column under Pre Amp Off in Table A-24.
35. Calculate the Deviation using the following formula:

    `Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)`

36. Record the result into the **Dev** column under **Pre Amp Off** in Table A-24 and verify that it is within specification.
37. Press the **Frequency/Level** main menu key and set Pre Amp to On. Change the Reference Level if required.
38. After Average (50/50) appears, record the –20 dBm Channel Power from the MT821xE into the **M(Level)** column under **Pre Amp On** in Table A-24.
39. Calculate the Deviation using the following formula:

    `Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)`

40. Record the result into the **Dev** column under **Pre Amp On** in Table A-24 and verify that it is within specification.
41. Repeat Step 32 through Step 40 for test levels –25 dBm to –45 dBm. Change Reference Level and switch Pre Amp per the **Pre Amp On** or **Pre Amp Off** columns in the test record.
42. Turn Off the power amplifier, disconnect the power splitter from the MT821xE, and re-connect Sensor A to the power splitter as shown in Figure 5-2 on page 5-10.
43. Set the MN63A attenuation to 10 dB.
44. Set the MG3700A level to –60 dBm.
45. Turn On the power amplifier and allow it to warm up for at least 5 minutes.
46. Adjust the MN63A attenuator so that the Sensor A reading is –50 dBm ± 1 dB. Record the attenuation reading in Table A-23, "Level Accuracy Verification, AT(–50)" on page A-17 as **AT(–50)**.
47. On the MG3700A, adjust power level so that the Power Meter Sensor A reading is –50.0 dBm ± 0.2 dB.
48. Record Power Meter Sensor A and Sensor B readings in Table A-23.

49. Subtract Sensor A reading from Sensor B reading and record the result in the **ΔAB(QP50)** column of Table A-23.
50. Calculate the **AT(set)** values for test levels –55 dBm through –84 dBm and record the values into the **AT(set)** column in Table A-24.
51. Remove Sensor A from the Power Splitter and then connect the Power Splitter to the MT821xE Spectrum Analyzer RF In with an N male to N male adapter.
52. Record the new Power Meter Sensor B reading into the **SB(–50)** box in Table A-24.
53. Repeat Step 32 through Step 40 for Test levels –50 dBm to –84 dBm. Change Reference Level and switch Pre Amp per the **Pre Amp On** and **Pre Amp Off** columns in the test record. Use the following formula to calculate Deviation:

    `Deviation = M(Level) – SB(–50) – ΔAB(–50) – AT(–50) + AT(set)`

54. Repeat Step 5 through Step 53 for frequencies 623.14285714 MHz (Ch 38) and 767.14285714 MHz (Ch 62). Set the calibration factor of both power sensors to 623 MHz or 767 MHz, as required.
55. Record the results in Table A-25, "ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 38ch at 623.14285714 MHz" on page A-19 and Table A-26, "ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 62ch at 767.14285714 MHz" on page A-20.

## Displayed Average Noise Level (DANL) Verification

The tests in this section verify the DANL of the MT821xE in ISDB-T Signal Analyzer mode.

### Procedure

1. Set the mode of the MT821xE to **ISDB-T Signal Analyzer** and preset the instrument.
2. Install a 50 ohm termination to the Spectrum Analyzer RF In connector.
3. Press the **Meas Selection** main menu key, then press Field Strength.
4. Press the **Freq/Level** main menu key and confirm that the channel is set to 13 and that Pre Amp is Off.
5. Set the Reference Level t –25 dBm.
6. Press the **Meas Setup** main menu key. Change Meas Mode to Average and leave Average Count set to 50.
7. After Average (50/50) appears, record the Channel Power in Table A-27, "ISDB-T Signal Analyzer DANL with Pre Amp Off" on page A-21.
8. Set the Reference Level to –50 dBm and the Pre Amp to On.
9. After Average (50/50) appears, record the Channel Power in Table A-28, "ISDB-T Signal Analyzer DANL with Pre Amp On" on page A-21.
10. Change the channel to 38. Set the Pre Amp to Off.
11. Repeat Step 5 through Step 9 for Channel 38
12. Change the channel to 62. Set the Pre Amp to Off.
13. Repeat Step 5 through Step 9 for Channel 62.

## Phase Noise Verification

This test verifies the phase noise measurements of the MT821xE in the ISDB-T Signal Analyzer mode.

1. Connect the 10 MHz Frequency Reference signal to the MG3700A and the MT821xE.
2. Set the MG3700A frequency to 473.14285714 MHz. Set the level to –10 dBm.
3. Press the **Mod On/Off** key so that the LED is Off.
4. Input the RF signal from MG3700A into the MT821xE Spectrum Analyzer RF In.

5. Set the mode of the MT821xE to **ISDB-T Signal Analyzer** and preset the instrument.
6. Press the **Frequency/Level** main menu key and confirm that the instrument is set to Channel 13. Change the Reference Level to –10 dBm and ensure that the Pre Amp is Off.
7. Press the **Meas Selection** main menu key and press Phase Noise (red dot appears on label).
8. Press the **Meas Setup** main menu key and then the Meas Mode submenu key. Use the **Down Arrow** key to select Average and press the **Enter** key.
9. Wait until Average counter displays (10/10).
10. Record the 10 kHz and the 100 kHz phase noise readouts in Table A-29, "ISDB-T Signal Analyzer Phase Noise" on page A-22.
11. Record the Frequency Error in Table A-29.
12. Set the frequency of the MG3700A to 623.14285714 MHz and change the MT821xE Channel to 38.
13. Wait until the Average counter displays (10/10).
14. Record the 10 kHz and the 100 kHz phase noise readouts in Table A-29.
15. Record the Frequency Error in Table A-29.
16. Set the frequency of the MG3700A to 767.14285714 MHz and change the MT821xE Channel to 62.
17. Wait until Average counter displays (10/10).
18. Record the 10 kHz and the 100 kHz phase noise readouts in Table A-29.
19. Record the Frequency Error in Table A-29.

## BER Measurement Functional Check, Option 79 Only

This section provides the procedures to check the functionality of the BER measurement hardware that is included with Option 79 in the Cell Master ISDB-T Field Analyzer.

### Equipment Required:

- Anritsu MG3700A Vector Signal Generator
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C

### Procedure:

1. Turn On the MG3700A and the Cell Master.
2. Connect the MG3700A Signal Generator and Cell Master as shown in Figure 5-1 on page 5-7.
3. On the MG3700A, press the yellow **Preset** key, located on the upper-left side of the instrument.
4. Press the **Down Arrow** key to select Yes.
5. Press the **Set** key (Note that two **Set** keys are available, and they both do the same thing).
6. Set the MG3700A Frequency to 473.142857 MHz.
7. Press the **Baseband** key.
8. Press the **More** key, located at the bottom of the row.
9. Press the F5 Pattern Combination soft key as required until **Edit** appears.
10. Press the **More** key.
11. Press the F3 soft key so that Output B appears.
12. Press the **Baseband** key and then the F1 soft key.
13. Press the F2 soft key so that Memory A is highlighted.
14. Press the F1 key and use the **Down Arrow** key to highlight **Digital_Broadcast**.
15. Press the **Set** key.
16. Use the **Arrow** key to highlight **ISDBT_6M_AWGN** and press the **Set** key. If an Overwrite question appears, then answer Yes.
17. Press the F2 soft key so that Memory B is highlighted
18. Highlight **ISDBT_3_LAYER** and press the **Set** key. If an Overwrite question appears, then answer Yes.
19. Press the F6 (Return) soft key.
20. Use the **Arrow** keys to highlight the blank line between **Pattern:[** and the small green **A** memory symbol.
21. Press the **Set** key.
22. Ensure that **Digital_Broadcast** is highlighted and press the **Set** key.
23. Ensure that **ISDBT_6M_AWGN** is highlighted and press the **Set** key.
24. Use the **Arrow** keys to highlight the blank line between **Pattern:[** and the small violet **B** memory symbol.
25. Press the **Set** key.
26. Ensure that **Digital_Broadcast** is highlighted and press the **Set** key.
27. Ensure that **ISDBT_3_LAYER** is highlighted and press the **Set** key.
28. Press the **MOD On/Off** and **Output** keys so that both LEDs are On (illuminated).
29. Adjust the Level so that the MG3700A reads –25.0 dBm.
30. Set the Cell Master to **ISDB-T Signal Analyzer** mode and preset the instrument.
31. Ensure thst the Channel is set to 13, press Auto Reference Level, and ensure that the Pre Amp is set to Off.

**32.** Press the **Meas Selection** main menu key, then press BER. Press the **Stop Measurement** main menu key.

**33.** To verify option 79 is functional, press the **Start Measurement** main menu key and verify the Signal Sync turns from Unlocked to Locked.

# 5-5 GPS Verification, Option 31

This test verifies that the optional GPS receiver of the model MT821xE Cell Master is functional.

## Frequency Accuracy Verification

The test in this section verifies the Spectrum Analyzer Frequency Accuracy with GPS Option 31 of the MT821xE Cell Master in Spectrum Analyzer mode.

### Equipment Required

- Anritsu MG3692X Signal Generator
- 10 MHz Reference Standard
- Anritsu 34RKNF50 50 ohm Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Anritsu 2000-1528-R GPS Antenna

### Procedure

1. Connect the GPS antenna to the GPS Antenna connector on the MT821xE. On the MT821xE, change the mode to **Spectrum Analyzer** and preset the instrument.

| | |
|---|---|
| **Note** | If a fixed GPS antenna is not available, then the Anritsu 2000-1528-R GPS antenna can be used for this test.<br>Confirm that the Anritsu 2000-1528-R GPS antenna is in direct line-of-sight relationship to the satellites, or place the antenna outside without any obstructions. |

2. Press the **Shift** key and then the **System** key.
3. Press the GPS submenu key, then press the GPS On/Off submenu key to turn the GPS On.
4. When the GPS fix is acquired, the GPS indicator at the top of the LCD display turns green.
5. The latitude and the longitude are also displayed next to the GPS indicator.
6. Wait for approximately three minutes after the Reference Source indicator in the lower left-hand corner of the LCD display has changed to GPS High Accuracy.

| | |
|---|---|
| **Note** | If a GPS fix is acquired by using the Anritsu 2000-1528-R GPS antenna placed outside, then bringing the instrument inside will cause a loss of satellite tracking. A red cross will appear on the green GPS indicator, and the Reference Source indicator will change to “Int Std Accy”. The following test verifies frequency accuracy to a lesser specification. |

7. Connect the external 10 MHz Reference to the Anritsu MG3692x Signal Generator.

| | |
|---|---|
| **Caution** | Do not connect the external 10 MHz Reference to the MT821xE Cell Master. |

8. Connect the output of the Signal Generator to the Spectrum Analyzer RF In of the MT821xE.
9. Set the MG3692x output to 4 GHz CW, with an RF output level of –30 dBm.
10. On the MT821xE, press the **Amplitude** key, and set the Reference Level to –10 dBm.
11. Press the **Freq** main menu key and set the center frequency to 4.0 GHz.
12. Press the **Span** main menu key and set the span to 10 kHz.
13. Press the **BW** main menu key and set RBW to 100 Hz.

14. Press the VBW submenu key and set to 30 Hz.
15. Press the **Marker** key, and press the Peak Search submenu key.
16. Note the Reference Source value and use the appropriate table row to record the data in the following steps.
17. Record the marker frequency in the **Measured Value** column of Table A-30, “Option 31 GPS Receiver” on page A-23.
18. Subtract the marker value from 4 GHz and record the result in the **Error column** of Table A-30. Verify that it is within specification.
19. If the value of Reference Source indicates GPS High Accuracy, then remove the GPS antenna and wait until the Reference Source indicates Int Std Accy and repeat Step 16 through Step 18.

# 5-6 ISDB-T SFN Verification, Option 32

## Introduction

The tests in this section verify the performance of the optional ISDB-T SFN Analyzer option of the MT821xE. These tests include:


- "Level Accuracy Verification" on page 5-20
- "Displayed Average Noise Level (DANL) Verification" on page 5-24


### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu MN63A Programmable Attenuator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensors (2)
- Anritsu 1N50C RF Limiter
- Anritsu 34NN50A Adapter
- Anritsu 15NNF50-1.5C RF Coaxial Cables (3)
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator
- Mini-Circuits TIA-1000-1R8 RF Power Amplifier
- Midwest Microwave ADT-2615-NF-BNM-02 Adapters (2)

## Level Accuracy Verification

The tests in this section verify the level accuracy of the MT821xE in ISDB-T SFN Signal Analyzer mode.

### Setup

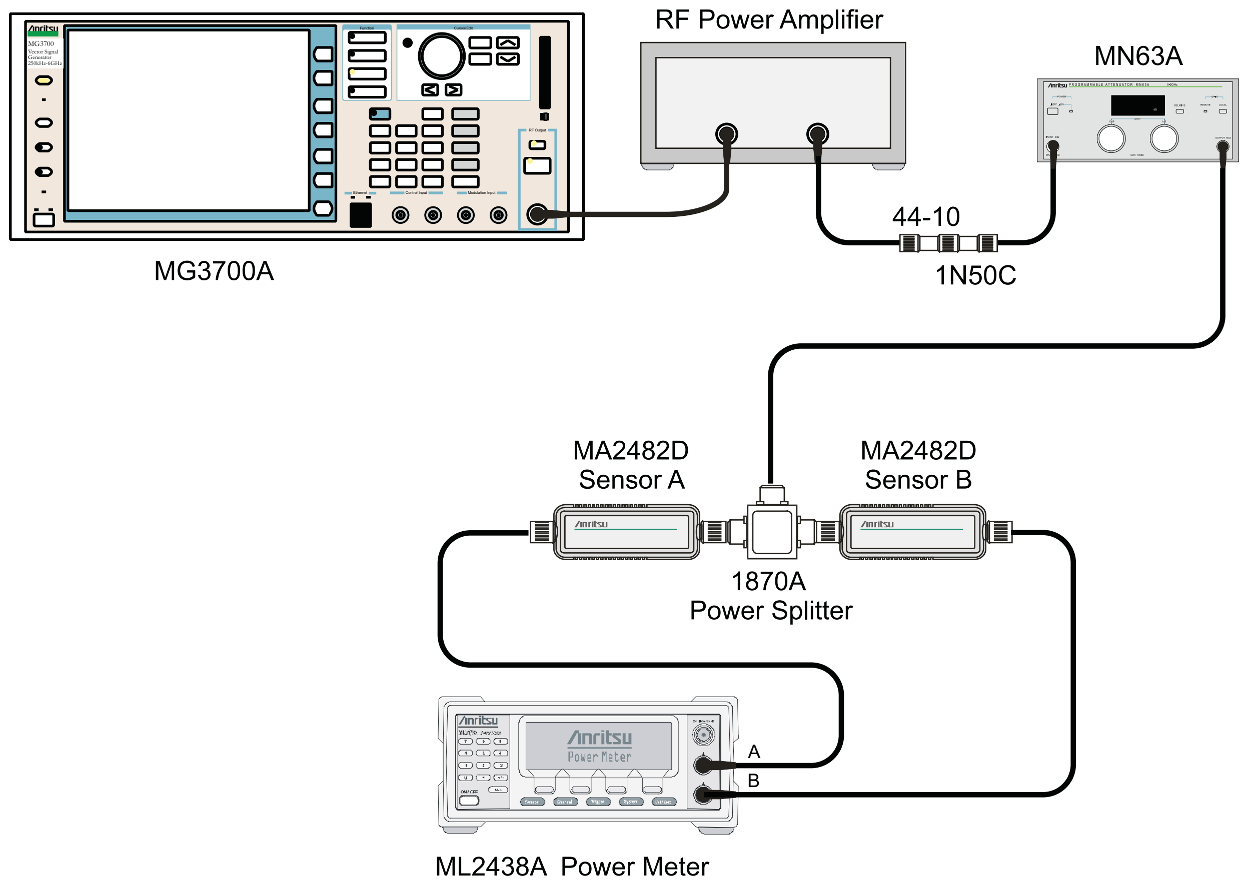



**Figure 5-4.** ISDB-T SFN Level Accuracy and 1 dB Compression Level Pre-test Setup

### Procedure

1. Confirm that the Power Amplifier is Off.
2. Perform a Zero/Cal on Sensor A and Sensor B of the power meter. Set the calibration factor of both sensors to 473 MHz.
3. Connect the MG3700A Signal Generator, Power Amplifier with N(f)-BNC(m) adapters, RF Limiter, MN63A Programmable Attenuator, Power Divider, Power Meter, and Power Sensors as shown in Figure 5-4.
4. On the MG3700A, press the **Preset** key (Yellow key on the upper left-hand side).
5. Press the **Down Arrow** key to select Yes.
6. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

7. Press the (F1) soft key to select **"Load File to Memory"**.
8. Press the (F1) soft key again to select **"Select Package"**.

9. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
10. Press the **Set** key.
11. Press the F6 (Return) soft key.
12. Press the **Set** key.
13. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
14. Press the **Set** key.
15. Using the **Down Arrow** key, step through the selection list until the **"ISDB-T_1layer_1ch"** option is highlighted.
16. Press the **Set** key.
17. Set the MG3700A frequency to 473.14285714 MHz.
18. Set the level to –25 dBm.
19. Confirm that the **Modulation On/Off** key and the **Output** key both have LEDs On.
20. Turn On the power amplifier and allow it to warm up for at least 5 minutes.
21. Adjust the MN63A attenuator so that the Sensor A reading is –10 dBm ± 1 dB. Record the attenuation reading as **AT(–10)** in Table A-31, "ISDB-T SFN Level Accuracy Verification, AT(–10)" on page A-24.
22. On the MG3700A, adjust power level so that the Power Meter Sensor A reading is – 10.0 dBm ± 0.2 dB.
23. Record Power Meter Sensor A and Sensor B readings in Table A-31.
24. Subtract Sensor A reading from Sensor B reading and record the result in the **ΔAB(– 10)** column of Table A-31.
25. Calculate the **AT(set)** values for Test Levels –10 dBm through –45 dBm and record the values in the **AT(set)** column of Table A-32, "ISDB-T SFN Analyzer Level Accuracy Measurement Channel = 13ch at 473.14285714 MHz" on page A-25.
26. Remove Sensor A from the Power Splitter and then connect the Power Splitter to the MT821xE Spectrum Analyzer RF In with an N male to N male adapter, as shown in Figure 5-5 on page 5-22.
27. Record the new Power Meter Sensor B reading into the **SB(– 10)** box in Table A-32.
28. On the MT821xE, set the mode to **ISDB-T SFN Analyzer** and preset the instrument.
29. Press the **Meas Setup** main menu key, and change the Meas Mode to Continuous.
30. Press the **Frequency/Level** main menu key, confirm that Channel is 13 and that Pre Amp is Off.
31. Change the Reference Level to –10 dBm.
32. After the Measuring percentage gets to 100%, record the Channel Power from the MT821xE into the **M(Level)** column under **Pre Amp Off** in Table A-32.
33. Calculate the Deviation using the following formula:

```
Deviation = M(Level) – SB(-10) – ΔAB(-10) – AT(-10) + AT(set)
```

| | |
|---|---|
| **Note** | Since AT(–10) is the same as AT(set), `[– AT(-10) + AT(set)] = 0` |

34. Record the result into the **Dev** column under **Pre Amp Off** in Table A-32 and verify that it is within specification.
35. Set the MN63A attenuation to the next **AT(set)** value in Table A-32.

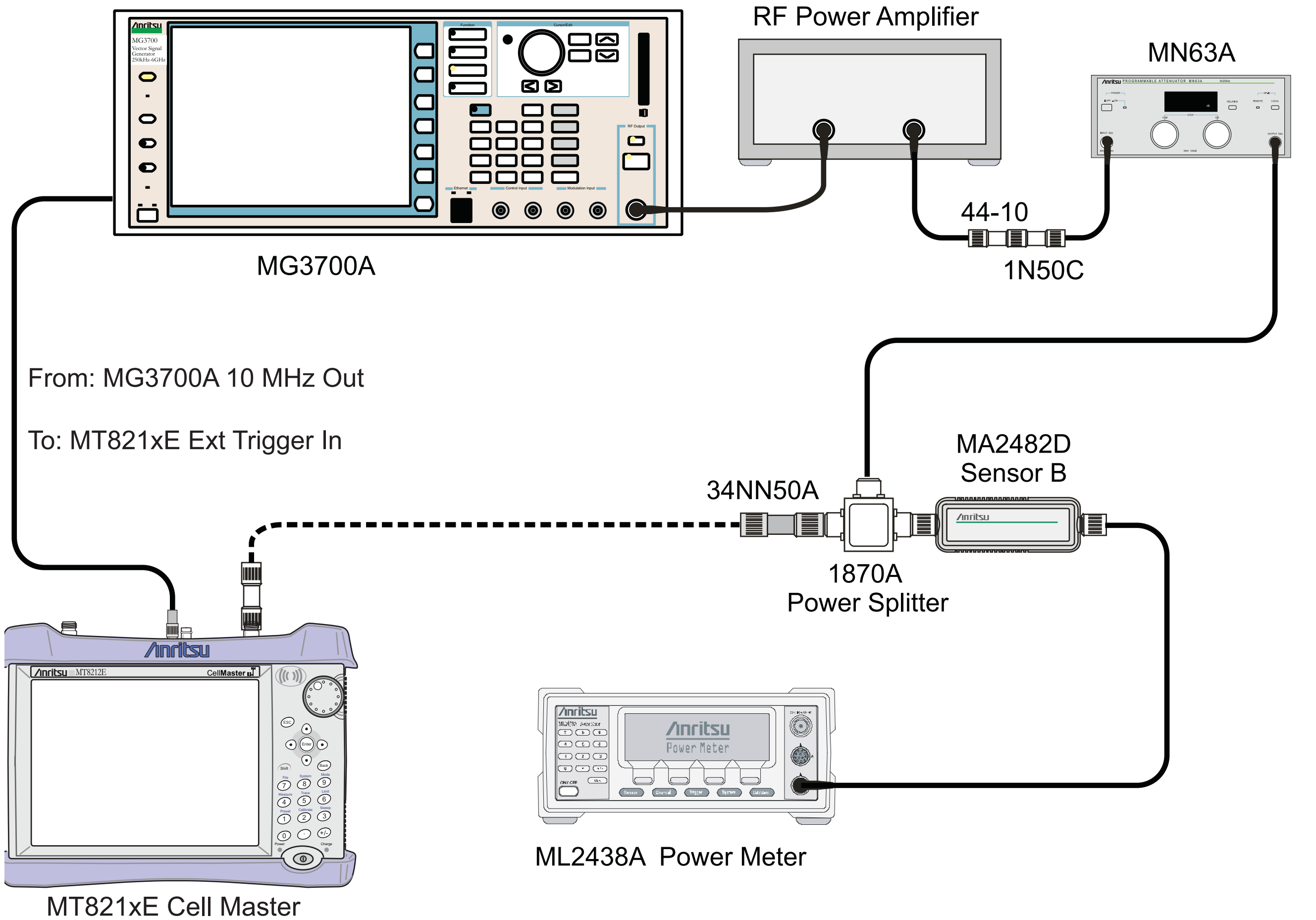



**Figure 5-5.** ISDB-T SFN Level Accuracy and 1 dB Compression Level Post-test Setup

36. Press the **Frequency/Level** main menu key and set the Reference Level of the MT821xE to –15 dBm.
37. After the Measuring percentage gets to 100%, record the –15 dBm Channel Power from the MT821xE to the **M(Level)** column under **Pre Amp Off** in Table A-32.
38. Calculate the Deviation using the following formula:

`Deviation = M(Level) – SB(-10) – ΔAB(-10) – AT(-10) + AT(set)`

39. Record the result into the **Dev** column under **Pre Amp Off** in Table A-32 and verify that it is within specification.
40. Set the MN63A attenuation to the next **AT(set)** value in Table A-32.
41. Set the Reference Level of the MT821xE to –20 dBm.
42. After the Measuring percentage gets to 100%, record the –20 dBm Channel Power from the MT821xE into the **M(Level)** column under **Pre Amp Off** in Table A-32.
43. Calculate the Deviation using the following formula:

`Deviation = M(Level) – SB(-10) – ΔAB(-10) – AT(-10) + AT(set)`

44. Record the result to the **Dev** column under **Pre Amp Off** in Table A-32 and verify that it is within specification.
45. Press the **Frequency/Level** main menu key and set Pre Amp to On. Change Reference Level if required.

46. After the Measuring percentage gets to 100%, record the **–20 dBm** Channel Power from the MT821xE into the **M(Level)** column under **Pre Amp On** in Table A-32.
47. Calculate the Deviation using the following formula:

    `Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)`

48. Record the result to the **Dev** column under **Pre Amp On** in Table A-32 and verify that it is within specification.
49. Repeat Step 40 through Step 48 for Test Levels –25 dBm to –45 dBm. Change Reference Level and switch Pre Amp per the **Pre Amp On** and **Pre Amp Off** columns in Table A-32.
50. Turn Off the power amplifier, disconnect the power splitter from the MT821xE, and re-connect Sensor A to the power splitter, as shown in Figure 5-4 on page 5-20.
51. Set the MN63A attenuation to 10 dB.
52. Set the MG3700A level to –60 dBm.
53. Turn On power amplifier and allow it to warm up for at least 5 minutes.
54. Adjust the MN63A attenuator so that the Sensor A reading is –50 dBm ± 1 dB. Record the attenuation reading as **AT(–50)** in Table A-33, “ISDB-T SFN Level Accuracy Verification, AT(–50)” on page A-26.
55. On the MG3700A, adjust power level so that the Power Meter Sensor A reading is –50.0 dBm ± 0.2 dB.
56. Record Power Meter Sensor A and Sensor B readings in Table A-33.
57. Subtract Sensor A reading from Sensor B reading and record the result in the **ΔAB(–50)** column of Table A-33.
58. Calculate the **AT(set)** values for Test Levels –55 dBm through –84 dBm and record the values into the **AT(set)** column in Table A-32.
59. Remove Sensor A from the Power Splitter and then connect the Power Splitter to the MT821xE Spectrum Analyzer RF In with an N male to N male adapter.
60. Record the new Power Meter Sensor B reading into the **SB(–50)** box in Table A-32.
61. Repeat Step 40 through Step 48 for Test levels –50 dBm to –84 dBm. Change Reference Level and switch Pre Amp On or Off per the **Pre Amp On** or **Pre Amp Off** column in Table A-32. Use the following formula to calculate Deviation:

    `Deviation = M(Level) – SB(–50) – ΔAB(–50) – AT(–50) + AT(set)`

62. Repeat Step 17 through Step 61 for frequencies 623.14285714 MHz (Ch 38) and 767.14285714 MHz (Ch 62). Set the calibration factor of both power sensors to 623 MHz or 767 MHz, as required.
63. Record the results in Table A-34, “ISDB-T SFN Analyzer Level Accuracy Measurement Channel = 38ch at 623.14285714 MHz” on page A-27 and Table A-35, “ISDB-T SFN Signal Analyzer Level Accuracy Measurement Channel = 62ch at 767.14285714 MHz” on page A-28.

## Displayed Average Noise Level (DANL) Verification

The tests in this section verify the DANL of the MT821xE in ISDB-T SFN Signal Analyzer mode.

### Procedure

1. Set the mode of the MT821xE to **ISDB-T SFN Signal Analyzer** and preset the instrument.
2. Install a 50 ohm termination to the Spectrum Analyzer RF In connector.
3. Confirm that the channel is set to 13 and that Pre Amp is Off.
4. Set the Reference Level to –25 dBm.
5. Press the **Meas Setup** main menu key. Change Meas Mode to Continuous.
6. After Measuring percentage gets to 100%, record the Channel Power in Table A-36, "ISDB-T SFN Analyzer DANL with Pre Amp Off" on page A-29.
7. Set the Reference Level to –50 dBm and the Pre Amp to On.
8. After Average (50/50) appears, record the Channel Power in Table A-37, "ISDB-T SFN Analyzer DANL with Pre Amp On" on page A-29.
9. Change the channel to 38. Set the Pre Amp to Off.
10. Repeat Step 4 through Step 8 for Channel 38
11. Change the channel to 62. Set the Pre Amp to Off.
12. Repeat Step 4 through Step 8 for Channel 62.

# 5-7 GSM/GPRS/EDGE Signal Analyzer Verification, Options 40 and 41

# Option 40, Option 41, or Both

The tests in this section verify that the optional GSM/GPRS/EDGE Signal Analyzer functions correctly in Anritsu Model MT821xE Cell Master. The tests are as follows:

- "GSM Signal Analyzer Option Verification (Option 40 and Option 41)"
- "EDGE Burst Power, Frequency Error, and Residual Error Tests (Options 40 and 41)" on page 5-29

## GSM Signal Analyzer Option Verification (Option 40 and Option 41)

The tests in this section verify the function of the optional GSM Signal Analyzer in Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter (2)
- Anritsu 15NNF50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

## Setup

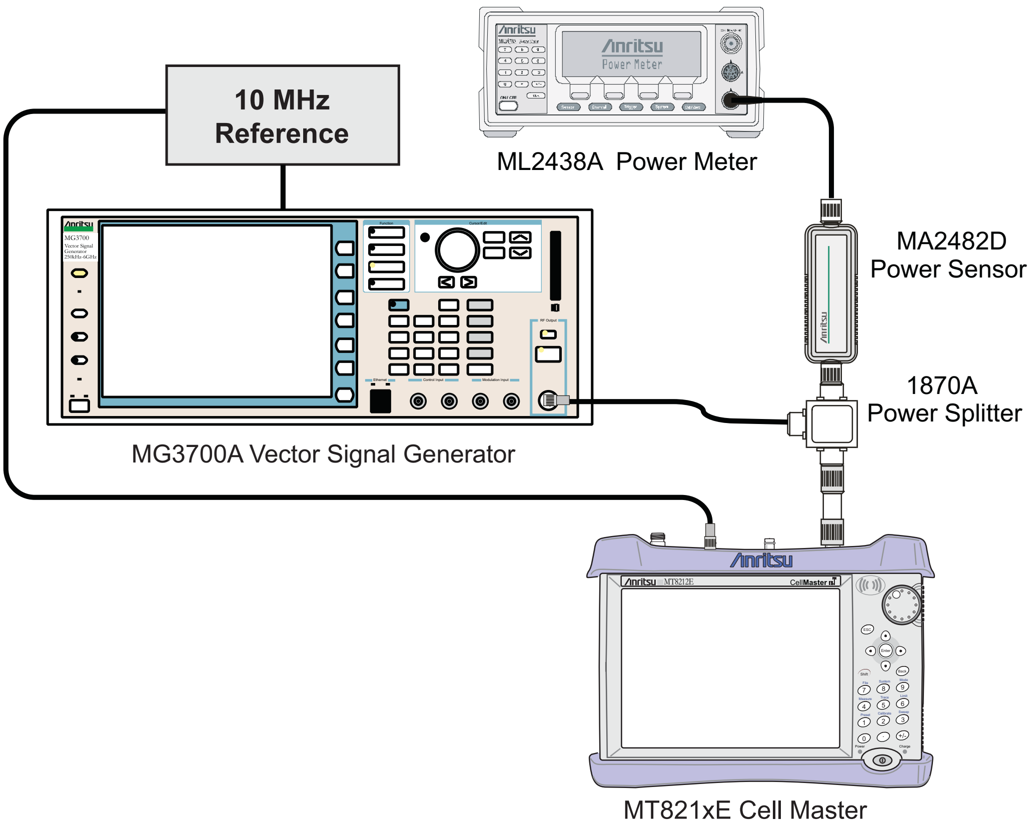



**Figure 5-6.** GSM/EDGE Signal Analyzer Option Verification

## Procedure

1. Calibrate the power sensor prior to connecting to the power splitter.
2. Connect the equipment as shown in Figure 5-6.
3. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 850 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
4. On the power meter, press the **Sensor** key, the Setup soft key, and then the MODE soft key until **Measurement MODE** is Mod average. Press the **System** key to display the power reading.
5. Set the MT821xE mode to **GSM/GPRS/EDGE Signal Analyzer**. Press **Shift** and press **Preset** (1) to preset the MT821xE.
6. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
7. Press the **Down Arrow** key or turn the knob to select Yes.
8. Press the **Set** key.

| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

9. Press the (F1) soft key to select Load File to Memory.

10. Press the (F1) soft key again to select Select Package.
11. Using the **Down Arrow** key, step through the selection list until the **"GSM"** option is highlighted.
12. Press the **Set** key.
13. Press the F6 (Return) soft key.
14. Press the **Set** key. The Select Package box appears. Use the rotary knob to highlight **GSM** and press the **Set** key to select.
15. Another File List appears. Use the rotary knob to select **GsmBurst_1slot** and press the **Set** key to select.
16. Press the **MOD On/Off** key to turn the Modulation LED On and verify that the **"Playing"** indicator in the center of the LCD is flashing.
17. Press the **Frequency** key and enter 850 MHz.
18. Press the **Level** key, enter –10, and press the dBm submenu key.
19. Adjust the MG3700A output so that the power meter reads –10 dBm ± 0.2 dB.
20. On the MT821xE, press the **Freq** main menu key and set 850 MHz as the Center Frequency.
21. Press the **Measurements** main menu key and press GSM/EDGE Summary (a red dot appears on the label when active).
22. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 9.2 dB. Then subtract this value from the power meter reading in Step 19. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 850 MHz, –10 dBm Level, TCH Pattern** in Table A-38, "Option 40 GSM/GPRS/EDGE RF Measurements" on page A-30.
23. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed Phase Err RMS (deg) in section **At 850 MHz, –10 dBm Level, TCH Pattern** in Table A-39, "Option 41 GSM/GPRS/EDGE Demodulator" on page A-31.
24. Verify that the measured value in Step 22 or Step 23 (or both) are within specifications.
25. On the MG3700A, change the selected signal pattern to **GsmBurst_8slot**.
26. Adjust the Level of the MG3700A so that the power meter reads –50 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
27. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 0.2 dB. Then subtract this value from the power meter reading in Step 26. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 850 MHz, –50 dBm Level, TCH ALL Pattern** in Table A-38.
28. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed Phase Err RMS (deg) in section **At 850 MHz, –50 dBm Level, TCH ALL Pattern** in Table A-39.
29. Verify that the measured value in Step 27 or Step 28 (or both) are within specifications.
30. Change the frequency of MG3700A to 1800 MHz.
31. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 1800 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
32. Adjust the level of the MG3700A so that the power meter reads –10 dBm ± 0.2 dB.
33. On the MT821xE, set the Center Frequency to 1800 MHz. Then wait 15 seconds to allow the MT821xE to update its measured results.
34. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 0.2 dB. Then subtract this value from the power meter reading in Step 32. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 1800 MHz, –10 dBm Level, TCH ALL Pattern** in Table A-38.

35. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed Phase Err RMS (deg) in section **At 1800 MHz, –10 dBm Level, TCH ALL Pattern** in Table A-39.
36. Verify that the measured values in Step 34 or Step 35 (or both) are within specifications.
37. On the MG3700A, change the selected pattern to **GsmBurst_1slot**.
38. Adjust the level of the MG3700A so that the power meter reads –50 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
39. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 9.2 dB. Then subtract this value from the power meter reading in Step 38. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 1800 MHz, –50 dBm Level, TCH Pattern** in Table A-38.
40. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed Phase Err RMS (deg) in section **At 1800 MHz, –50 dBm Level, TCH Pattern** in Table A-39.
41. Verify that the measured values in Step 39 or Step 40 (or both) are within specifications.

## EDGE Burst Power, Frequency Error, and Residual Error Tests (Options 40 and 41)

The tests in this section verify the function of the optional GSM Signal Analyzer in Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

### Procedure

1. Confirm that the equipment settings are unchanged from the previous test. Refer to Figure 5-6 on page 5-26.
2. On the MG3700A, change the selected pattern to **DL_MCS-9_1SLOT**.
3. Adjust the level of the MG3700A so that the power meter reads –50 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
4. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 9 dB. Then subtract this value from the power meter reading in Step 3. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 1800 MHz, –50 dBm Level, DL_MCS-9_1SLOT Pattern** in Table A-38 on page A-30.
5. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed EVM (rms) in section **At 1800 MHz, –50 dBm Level, DL_MCS-9_1SLOT Pattern** in Table A-39 on page A-31.
6. Verify that the measured values in Step 4 or Step 5 (or both) are within specifications.
7. On the MG3700A, change the selected pattern to **DL_MCS-9_4SLOT**.
8. Adjust the level of the MG3700A so that the power meter reads –10 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
9. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 3 dB. Then subtract this value from the power meter reading in Step 8. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 1800 MHz, –10 dBm Level, DL_MCS-9_4SLOT Pattern** in Table A-38.
10. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed EVM (rms) in section **At 1800 MHz, –10 dBm Level, DL_MCS-9_4SLOT Pattern** in Table A-39.
11. Verify that the measured values in Step 9 or Step 10 (or both) are within specifications.
12. Change the frequency of MG3700A to 850 MHz.
13. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 850 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
14. Adjust the level of the MG3700A so that the power meter reads –50 dBm ± 0.2 dB.
15. On the MT821xE, set the Center Frequency to 850 MHz. Then wait 15 seconds to allow the MT821xE to update its measured results.
16. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 3 dB. Then subtract this value from the power meter reading in Step 14.

Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 850 MHz, –50 dBm Level, DL_MCS-9_4SLOT Pattern** in Table A-38.

17. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed EVM (rms) in section **At 850 MHz, –50 dBm Level, DL_MCS-9_4SLOT Pattern** in Table A-39.
18. Verify that the measured values in Step 16 or Step 17 (or both) are within specifications.
19. On the MG3700A, change the selected pattern to **DL_MCS-9_1SLOT**.
20. Adjust the level of the MG3700A so that the power meter reads –10 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
21. For an MT821xE with Option 40 (GSM/GPRS/EDGE RF Measurements), take the displayed Burst Power value and subtract an offset of 9 dB. Then subtract this value from the power meter reading in Step 20. Then record the calculated Burst Power error and the displayed value of Freq Error in section **At 850 MHz, –10 dBm Level, DL_MCS-9_1SLOT Pattern** in Table A-38.
22. For an MT821xE with Option 41 (GSM/GPRS/EDGE Demodulator), record the displayed EVM (rms) in section **At 850 MHz, –10 dBm Level, DL_MCS-9_1SLOT Pattern** in Table A-39.
23. Verify that the measured values in Step 21 or Step 22 (or both) are within specifications.

# 5-8 CDMA Signal Analyzer Verification, Options 42 and 43

# Option 42, Option 43, or Both

The tests in this section verify the optional CDMA Signal Analyzer functions in Anritsu Model MT821xE Cell Master. The tests are as follows:

- "cdmaOne Channel Power, Frequency Error, Rho, and Tau Verification (Option 42 and 43)"
- "CDMA2000 Channel Power, Frequency Error, Rho, and Tau Verification (Option 42 and 43)"

## cdmaOne Channel Power, Frequency Error, Rho, and Tau Verification (Option 42 and 43)

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (3)
- 10 MHz Reference Standard

### Setup

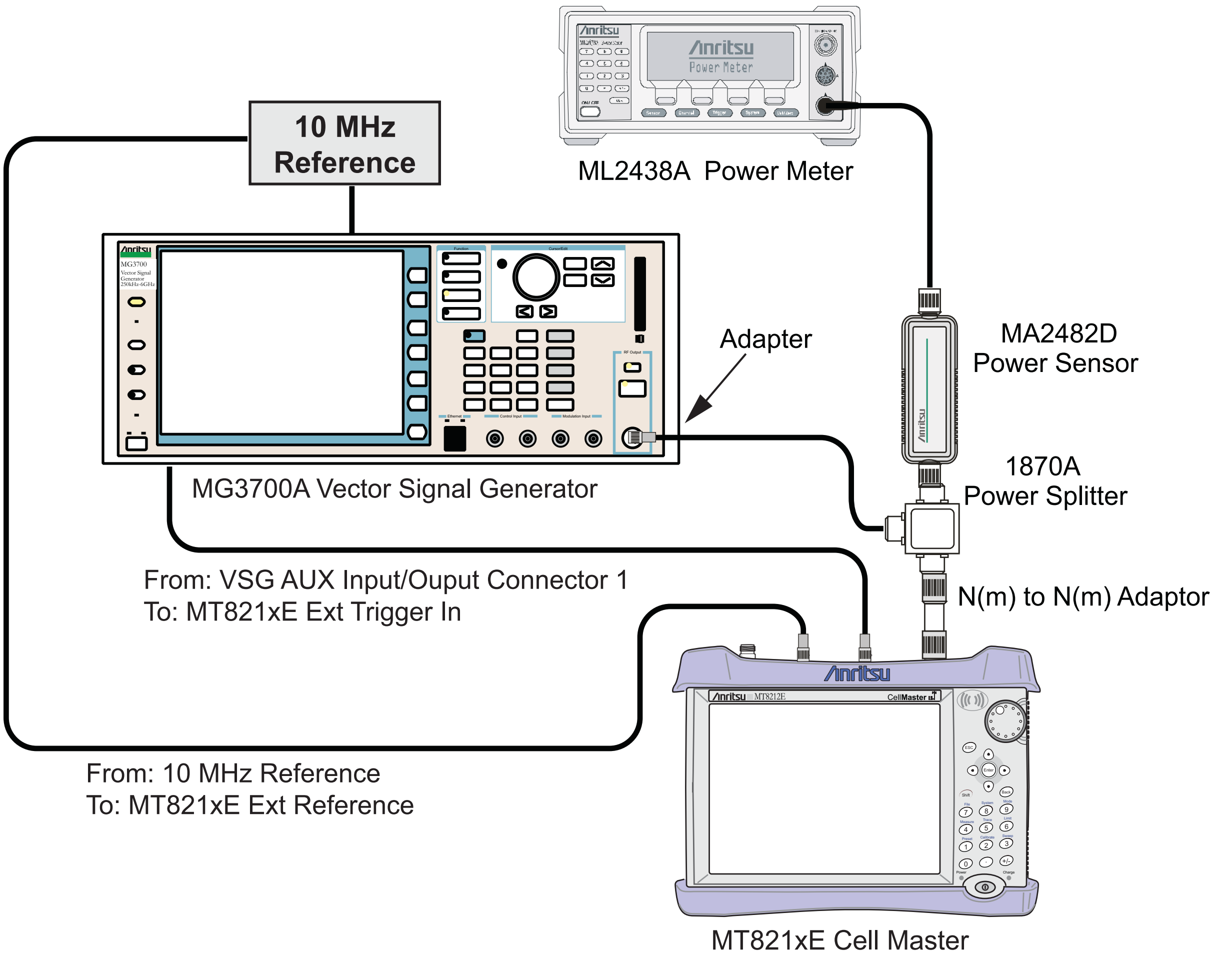



**Figure 5-7.** CDMA Signal Analyzer Option Verification

### Procedure

1. Calibrate the power sensor prior to connecting to the power splitter.
2. Connect the equipment as shown in Figure 5-7.
3. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 870.3 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
4. Set the MT821xE mode to **CDMA Signal Analyzer**. Press **Shift** and press **Preset** (1) to preset the MT821xE.
5. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
6. Press the **Down Arrow** key or turn the knob to select Yes.
7. Press the **Set** key.

| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

8. Press the (F1) soft key to select Load File to Memory.
9. Press the (F1) soft key again to select Select Package.
10. Using the **Down Arrow** key, step through the selection list until the **“CDMA2000”** option is highlighted.

11. Press the **Set** key.
12. Press the F6 (Return) soft key.
13. Press the **Set** key. The Select Package box appears. Use the rotary knob to highlight **"CDMA2000"** and press the **Set** key to select.
14. Another File List appears. Use the rotary knob to select **"FWD_RC1-2_9channel"** and press the **Set** key to select.
15. Press the **MOD On/Off** key to turn the Modulation LED On and verify that the **"Playing"** indicator in the center of the LCD is flashing.
16. Press the **Frequency** key, enter 870.03 MHz.
17. Press the **Level** key, enter –30 and press the dBm submenu key.
18. Adjust the MG3700A output so that the power meter reads –30 dBm ± 0.2 dB.
19. On the MT821xE, press the **Freq** main menu key and set 870.03 MHz as Center Frequency.
20. Press the **Measurements** main menu key and press CDMA Summary (a red dot appear on the label when active).
21. Press the **Setup** main menu key and press PN Setup. Then change PN Trigger to Ext by pressing the PN Trigger submenu key twice. Then wait 15 seconds to allow the MT821xE to update its measured results.
22. For an MT821xE with Option 42 (CDMA RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 18. Then record the calculated Channel Power error in section **At 870.03 MHz, –30 dBm Level, cdmaOne** in Table A-40, "Option 42 CDMA RF Measurements" on page A-32.
23. For an MT821xE with Option 43 (cdmaOne and CDMA2000 1xRTT Demodulator), record the displayed Freq Error, Rho, and Tau in section **At 870.03 MHz, –30 dBm Level, cdmaOne** in Table A-41, "Option 43 cdmaOne and CDMA2000 1xRTT Demodulator" on page A-33.
24. Verify that the measured values in Step 22 or Step 23 (or both) are within specifications.
25. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 1930 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
26. Set the MG3700A frequency to 1930.05 MHz.
27. Adjust the MG3700A output so that the power meter reads –30 dBm ± 0.2 dB.
28. On the MT821xE, press the **Freq** main menu key and set 1930.05 MHz as Center Frequency. Then wait 15 seconds to allow the MT821xE to update its measured results.
29. For an MT821xE with Option 42 (CDMA RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 27. Then record the calculated Channel Power error in the test record in section **At 1930.05 MHz, –30 dBm Level, cdmaOne** in Table A-40.
30. For an MT821xE with Option 43 (cdmaOne and CDMA2000 1xRTT Demodulator), record the displayed Freq Error, Rho, and Tau in section **At 1930.05 MHz, –y30 dBm Level, cdmaOne** in Table A-41.
31. Verify that the measured values in Step 29 or Step 30 (or both) are within specifications.

## CDMA2000 Channel Power, Frequency Error, Rho, and Tau Verification (Option 42 and 43)

The tests in this section verify the function of the optional CDMA Signal Analyzer in Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

### Procedure

1. Confirm that the equipment settings are unchanged from the previous test. Refer to Figure 5-7 on page 5-32.
2. On the MG3700A, change the selected pattern to **"FWD_RC3-5_9channel"**.
3. Adjust the level of the MG3700A so that the power meter reads –30 dBm ± 0.2 dB. Then wait 15 seconds to allow the MT821xE to update its measured results.
4. For an MT821xE with Option 42 (CDMA RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 3. Then record the calculated Channel Power error in section **At 1930.05 MHz, –30 dBm Level, CDMA2000** in Table A-40, "Option 42 CDMA RF Measurements" on page A-32.
5. For an MT821xE with Option 43 (cdmaOne and CDMA2000 1xRTT Demodulator), record the displayed Freq Error, Rho, and Tau in section **At 1930.05 MHz, –30 dBm Level, CDMA2000** in Table A-41, "Option 43 cdmaOne and CDMA2000 1xRTT Demodulator" on page A-33.
6. Verify that the measured values in Step 4 or Step 5 (or both) are within specifications.
7. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 870.03 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
8. Set the MG3700A frequency to 870.03 MHz.
9. Adjust the MG3700A output so that the power meter reads –30 dBm ± 0.2 dB.
10. On the MT821xE, press the **Freq** main menu key and set 870.03 MHz as Center Frequency. Then wait 15 seconds to allow the MT821xE to update its measured results.
11. For an MT821xE with Option 42 (CDMA RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 9. Then record the calculated Channel Power error in section **At 870.03 MHz, –30 dBm Level, CDMA2000** in Table A-40.
12. For an MT821xE with Option 43 (cdmaOne and CDMA2000 1xRTT Demodulator), record the displayed Freq Error, Rho, and Tau into the test record in section **At 870.03 MHz, –30 dBm Level, CDMA2000** in Table A-41.
13. Verify that the measured values in Step 11 or Step 12 (or both) are within specifications.

# 5-9 WCDMA/HSDPA Signal Analyzer Verification, Options 44, 45, 65,

# Option 44 and Option 45 or Option 65

The tests in this section verify the optional WCDMA Signal Analyzer functions in Anritsu Model MT821xE Cell Master. The tests are as follows



## WCDMA Absolute Power Accuracy Verification (Option 44)

This test verifies the WCDMA absolute power accuracy in WCDMA/HSDPA Signal Analyzer Mode in the Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Mini Circuits Model TIA-1000-1R8 RF Power Amplifier
- Anritsu PN 1000-50 Circulator
- Aeroflex/Weinschel Model M1418 High Power Load
- Anritsu PN 1091-307 Coupler
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor (2)
- Anritsu 15NN50-1.5C RF Coaxial Cable (3)
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu Model MN63A Programmable Attenuator

### Setup

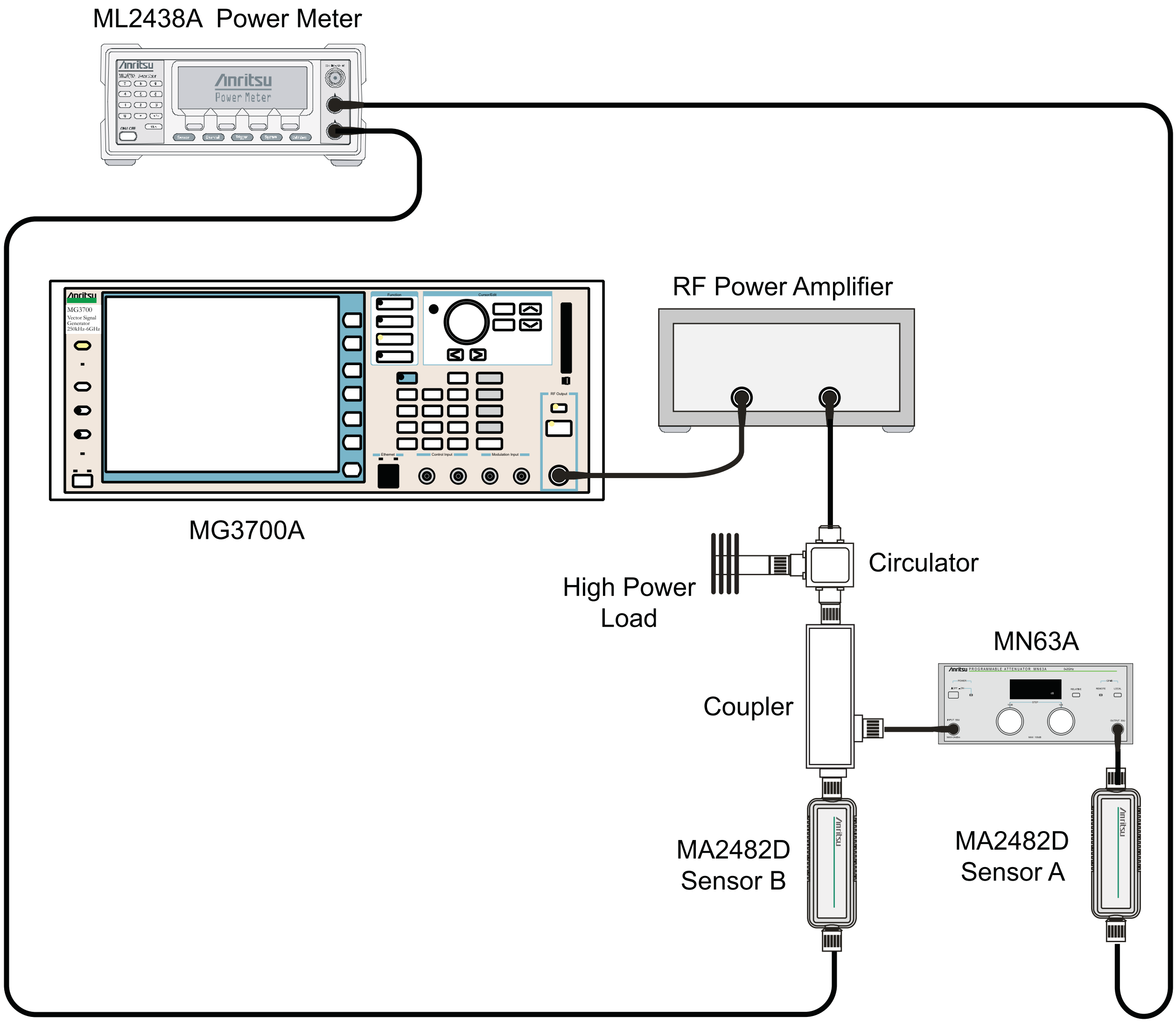



**Figure 5-8.** WCDMA Signal Analyzer Option Verification (Setup 1)

### Procedure

1. Connect the power sensors to the power meter and then calibrate the sensors.
2. Connect the MG3700A, RF power amplifier, attenuator, power meter, and sensors as shown in Figure 5-8.
3. Turn On the MG3700A, RF amplifier, attenuator, and the power meter.
4. Press the **On/Off** key to turn On the MT821xE and wait until the measurement display appears. Then press the **Shift** key and press the **Mode** (9) key to activate the mode selection menu.
5. Use the **Up/Down** arrow keys to select **WCDMA** and press the **Enter** key.
6. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key.
7. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
8. Press the **Down Arrow** key to select Yes.

9. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

10. Press the (F1) soft key to select **Load File to Memory**.
11. Press the (F1) soft key again to select **Select Package**.
12. Using the **Down Arrow** key, step through the selection list until the **W-CDMA(BS Tx test)** option is highlighted.
13. Press the **Set** key.
14. Press the F6 (Return) soft key.
15. Press the **Set** key. The Select Package list box appears. Again select **W-CDMA(BS Tx test)** and then press the **Set** key.
16. Another file list appears. Using the **Down Arrow** key, step through the selection list until the **TestModel_1_16DPCH** option is highlighted.
17. Press the **Set** key.
18. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
19. Press the **Frequency** key, enter 881.5 MHz, then press the MHz submenu key.
20. Press the **Level** key, enter –28, and press the dBm submenu key.
21. Use the knob to adjust the power level so that Sensor B reads +10 dBm.
22. Set the MN63A attenuator to 0 dB.
23. Record the Sensor A reading **(PMA.10)** in Table A-42, "Option 44, Sensor A and B Reading Components Characterization Table" on page A-34. This should be approximately –20 dBm.
24. Record the Sensor B reading **(PMB.10)** in Table A-42.
25. Calculate Delta 1, which is the error of the coupler output port deviation from ideal +10 dBm by using the following formula:

    ```
    Delta 1 (dBm) = (10 dBm – PMB.10)
    ```

26. Record the Delta 1 value in Table A-42.
27. Calculate the accurate value of Sensor A reading for coupler port output of +10 dBm **(PMA.10C)** ny using the following formula:

    ```
    PMA.10C = PMA.10 + Δ1
    ```

28. Record the calculated value in Table A-42.
29. Set the MN63A attenuator to 10 dB and record the Sensor A reading **(PMA.20)** in Table A-42.
30. Calculate the accurate attenuation value using the following formula:

    ```
    ATT.10 = (PMA.10 – PMA.20)
    ```

31. Record the calculated value in Table A-42.
32. Turn Off the RF output of the MG3700A.
33. Disconnect the coupler from Sensor B and connect the coupler to the MT821xE SPA RF In connector. Refer to Figure 5-9

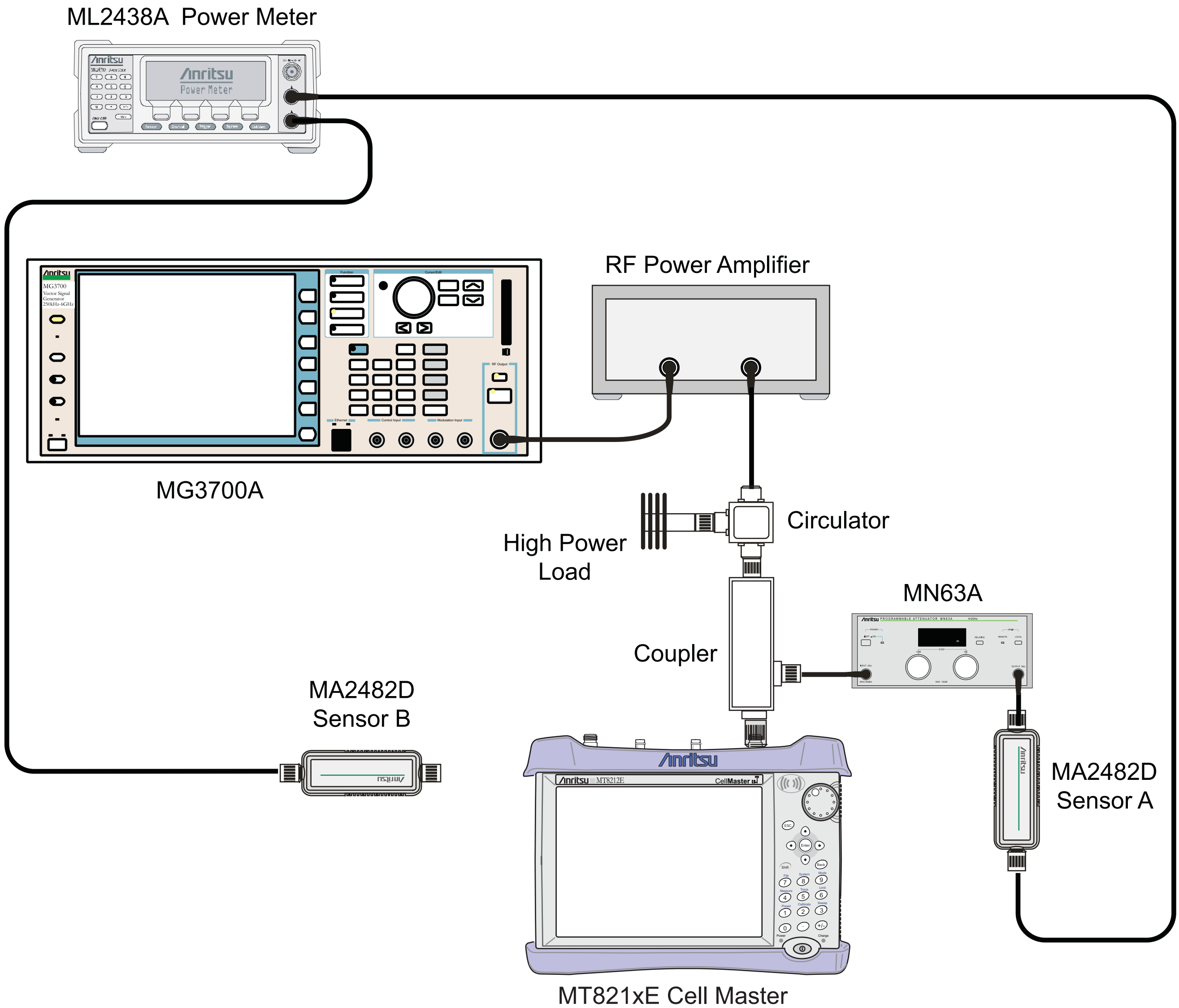



**Figure 5-9.** WCDMA Signal Analyzer Option Verification (Setup 2)

34. Set the MN63A attenuator to 0 dB.
35. On the MT821xE press the Center Freq submenu key, enter 881.5, and then press the MHz submenu key.
36. Press the **Measurements** main menu key, then the RF Measurement submenu key, then the Channel Spectrum submenu key.
37. On the MG3700A, turn On the RF output and use the knob to adjust power level to read the value of **PMA.10C** on Sensor A.
38. Record the MG3700A power level setting **(MG3700A.10)** in Table A-43, "Option 44, Power Level Setting Components Characterization Table" on page A-34.
39. On the MT821xE, press the **Amplitude** key and then press the Adjust Range submenu key.
40. Record the channel power reading in the **Measured Power** column of the **+10 dBm** row of Table A-44, "Option 44, WCDMA Absolute Power Accuracy" on page A-34.
41. Use the following formula to calculate the absolute power accuracy of the MT821xE at +10 dBm:

```
Error = Measured Power –10
```

42. Record the calculated value in the **Error** column of the **+10 dBm** row of Table A-44 and verify that it is within specification.
43. Turn Off the RF output of the MG3700A.
44. Set the MN63A attenuator to 10 dB.
45. Calculate the value of the MG3700A setting **(MG3700A.20)** for +20 dBm Test Level by using the following formula:

    `MG3700A.20 = MG3700A.10 + ATT.10`

46. Record the calculated value in Table A-43.
47. On the MG3700A, turn On the RF output and use the knob to adjust power level to the recorded **MG3700A.20** value in the Table A-43.
48. On the MT821xE, press the **Amplitude** key and then press the Adjust Range submenu key.
49. Record the channel power reading in the **Measured Power** column of the **+20 dBm** row of Table A-44.
50. Use the following formula to calculate the absolute power accuracy of the MT821xE at +20 dBm:

    `Error = Measured Power – 20`

51. Record the calculated value in the **Error** column of the **+20 dBm** row of Table A-44 and verify that it is within specification.
52. Turn Off the RF output of the MG3700A.
53. Set the MN63A attenuator to 0 dB.
54. Set power level of the MG3700A to –38 dBm.
55. Calculate the value of the Sensor A reading **(PMA.10)** for –10 dBm Test Level by using the following formula:

    `PMA.10 = PMA.10C – 30`

56. Record the calculated value in Table A-43.
57. Turn On the RF output and use the knob to adjust power level to read the value of **PMA.10** on Sensor A.
58. On the MT821xE, press the **Amplitude** key and then press the Adjust Range submenu key.
59. Record the channel power reading in the **Measured Power** column of the **–10 dBm** row of Table A-44.
60. Use the following formula to calculate the absolute power accuracy of the MT821xE at –10 dBm:

    `Error = Measured Power – (–10)`

61. Record the calculated value in the **Error** column of the **–10 dBm** row of Table A-44 and verify that it is within specification.
62. Turn Off the RF output of the MG3700A.
63. Decrease power level of the MG3700A by 10 dB.
64. Calculate the value of the Sensor A reading **(PMA.20)** for –20 dBm Test Level by using the following formula:

    `PMA.20 = PMA.10C – 30`

65. Record the calculated value in Table A-43.
66. Turn On the RF output and use the knob to adjust power level to read the value of PMA.20 on Sensor A.
67. On the MT821xE, press the **Amplitude** key and then press the Adjust Range submenu key.
68. Record the channel power reading in the **Measured Power** column of the **–20 dBm** row of Table A-44.
69. Turn Off the RF output of the MG3700A.
70. Use the following formula to calculate the absolute power accuracy of MT821xE at –20 dBm:

    `Error = Measured Power – (–20)`

71. Record the calculated value in the **Error** column of the **–20 dBm** row of Table A-44 and verify that it is within specification.

## WCDMA Occupied Bandwidth (OBW) Verification (Option 44)

The tests in this section verify the function of the WCDMA occupied bandwidth in WCDMA/HSDPA Signal Analyzer Mode on Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- Aeroflex/Weinschel Model 44-10 Attenuator (2)
- 10 MHz Reference Standard

### Setup

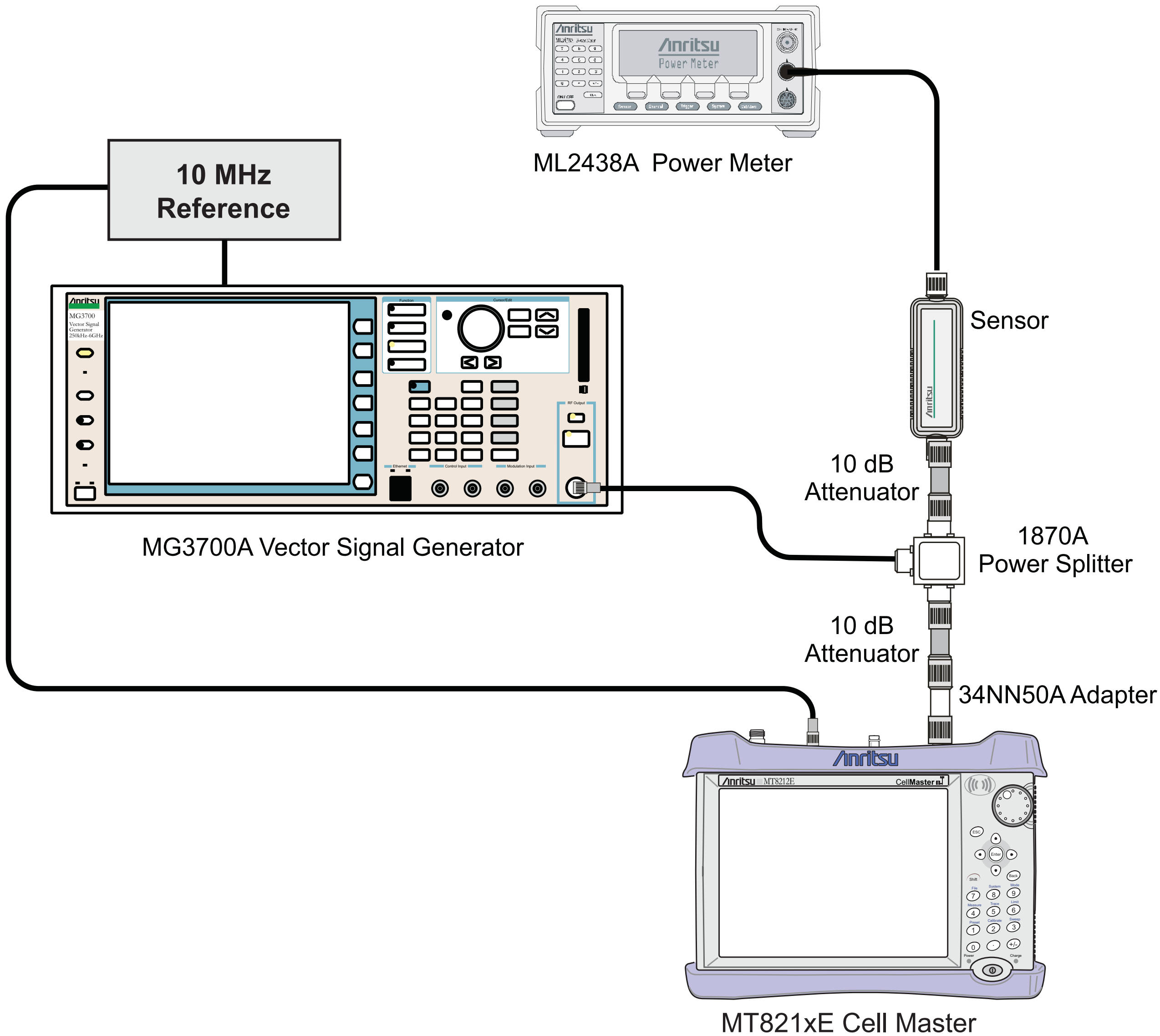



**Figure 5-10.** WCDMA Occupied Bandwidth (OBW) Verification

### Procedure

1. Turn On the MG3700A Vector Signal Generator and the ML2438A power meter.
2. Connect the power sensor to the power meter and calibrate the sensor.
3. Connect the MG3700A, splitter, attenuator, power meter, and Sensor as shown in Figure 5-10.
4. Press the **On/Off** key to turn On the MT821xE and wait until the measurement display appears, then press the **Shift** key, and then press the **Mode** (9) key to activate the mode selection menu.
5. Use the **Up/Down** arrow keys to select **WCDMA** and press the **Enter** key.
6. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key.
7. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
8. Press the **Down Arrow** key to select Yes.

9. Press the **Set** key.

| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

10. Press the (F1) soft key to select Load File to Memory.
11. Press the (F1) soft key again to select Select Package.
12. Using the **Down Arrow** key, step through the selection list until the W-CDMA(BS Tx test) option is highlighted.
13. Press the **Set** key.
14. Press the F6 (Return) soft key.
15. Press the **Set** key. The Select Package list box appears. Again select W-CDMA(BS Tx test) and then press the **Set** key.
16. Another file list appears. Using the **Down Arrow** key, step through the selection list until the TestModel_1_16DPCH option is highlighted.
17. Press the **Set** key.
18. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
19. Press the **Frequency** key, then enter the frequencies from Table A-45, "Option 44, WCDMA Occupied Bandwidth (OBW)" on page A-34 starting with 881.5, and press the MHz submenu key.
20. Press the **Level** key, then enter –2, and press the dBm submenu key.
21. Use the knob to adjust the power level so that the power meter reads –20 dBm, and then record the reading in the **Power Meter Reading** column of Table A-45.
22. On the MT821xE, press the Center Frequency submenu key, enter frequencies from Table A-45 starting with 881.5, then press the **Enter** key.
23. Press the **Measurements** main menu key, then the RF Measurement submenu key, and then press the Channel Spectrum soft key.
24. Press the **Amplitude** key, then press the Adjust Range submenu key.
25. Record the OBW reading in the **OBW** column of Table A-45 and verify that it is within 4.2 MHz ± 100 kHz.
26. Repeat Step 19 through Step 25 for the other frequencies that are listed Table A-45.

## WCDMA RF Channel Power Accuracy (Option 44)

### WCDMA RF Channel Power Accuracy Verification (Option 44)

The tests in this section verify the function of the WCDMA RF Channel Power Accuracy in WCDMA/HSDPA Signal Analyzer Mode on Model MT821xE Cell Master.

#### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- Aeroflex/Weinschel Model 44-10 Attenuator (2)
- 10 MHz Reference Standard

#### Procedure

1. Turn On the MG3700A Vector Signal Generator and the ML2438A power meter.
2. Connect the power sensor to the power meter and calibrate the sensor.
3. Connect the MG3700A, splitter, attenuator, power meter, and Sensor as shown in Figure 5-10 on page 5-41.
4. Press the **On/Off** key to turn On the MT821xE and wait until the measurement display appears. Then press the **Shift** key and press the **Mode** (9) key to activate the mode selection menu.
5. Use the **Up/Down** arrow keys to select **WCDMA** and press the **Enter** key.
6. Press the **Shift** key, the **Prese** (1) key, and then the Preset submenu key.
7. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
8. Press the **Down Arrow** key to select Yes.
9. Press the **Set** key.

| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

10. Press the (F1) soft key to select Load File to Memory.
11. Press the (F1) soft key again to select Select Package.
12. Using the **Down Arrow** key, step through the selection list until the W-CDMA(BS Tx test) option is highlighted.
13. Press the **Set** key.
14. Press the F6 (Return) soft key.
15. Press the **Set** key. The Select Package list box appears. Again select W-CDMA(BS Tx test) and then press the **Set** key.
16. Another file list appears. Using the **Down Arrow** key, step through the selection list until the TestModel_1_16DPCH option is highlighted.
17. Press the **Set** key.
18. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
19. Press the **Frequency** key, then enter 881.5, and press the MHz submenu key.

20. Press the **Level** key, then enter –2, and press the dBm submenu key.
21. Use the knob to adjust the power meter to read –20 dBm, and record the Power Meter reading in the **Power Meter Reading** column of Table A-46, “Option 44, WCDMA RF Channel Power Accuracy” on page A-35.
22. On the MT821xE, press the Center Frequency submenu key, enter 881.5, and then press the **Enter** key.
23. Press the **Measurements** main menu key, then the RF Measurement submenu key, and press ACLR.
24. Press the **Amplitude** key, then press the Adjust Range submenu key.
25. Record the measured CH 1 power in dBm in the **Measured RF Channel Power** column of Table A-46.
26. Calculate the RF Channel Power Error using the following formula:

```
RF Channel Power Error (dB) =
Measured RF Channel Power – 0.246 – Power Meter reading
```

27. Record calculated value into the **RF CH Power Error** column of Table A-46 and verify that it is within specification (± 1.25 dB).
28. Repeat Step 19 to Step 27 for the other frequencies listed in Table A-46.

## HSDPA RF Channel Power Accuracy (Option 44)

### HSDPA RF Channel Power Accuracy Verification (Option 44)

The tests in this section verify the function of the RF Channel Power Accuracy for HSDPA signals in WCDMA/HSDPA Signal Analyzer Mode on Model MT821xE Cell Master.

#### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- Aeroflex/Weinschel Model 44-10 Attenuator (2)
- 10 MHz Reference Standard

#### Procedure

1. Turn On the MG3700A Vector Signal Generator and the ML2438A power meter.
2. Connect the power sensor to the power meter and calibrate the sensor.
3. Connect the MG3700A, splitter, attenuator, power meter, and Sensor according to Figure 5-10.
4. Press the **On/Off** key to turn On the MT821xE and wait until the measurement display appears. Then press the **Shift** key and the **Mode** (9) key to activate the mode selection menu.
5. Use the **Up/Down** arrow keys to select **WCDMA** and press the **Enter** key.
6. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key.
7. On the MG3700A, press the **Preset** key (Yellow key on the upper left hand side).
8. Press the **Down Arrow** key to select Yes.
9. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

10. Press the (F1) soft key to select Load File to Memory.
11. Press the (F1) soft key again to select Select Package.
12. Using the **Down Arrow** key, step through the selection list until the W-CDMA(BS Tx test) option is highlighted.
13. Press the **Set** key.
14. Press the F6 (Return) soft key.
15. Press the **Set** key. The Select Package list box appears. Again select **W-CDMA(BS Tx test)** and then press the **Set** key.
16. Another file list appears. Using the **Down Arrow** key, step through the selection list until the TestModel_5_8HSPDSCH option is highlighted.
17. Press the **Set** key.
18. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
19. Press the **Frequency** key, then enter 2680.5, and press the MHz submenu key.

20. Press the **Level** key, then enter –2, and press the dBm submenu key.
21. Use the knob to adjust the power meter to read –20 dBm and record the Power Meter reading in the **Power Meter Reading** column of Table A-47, "Option 44, HSDPA RF Channel Power Accuracy" on page A-36.
22. On the MT821xE, press the **Freq** main menu key, then the Center Freq submenu key, enter 2680.5, and then press the MHz submenu key.
23. Press the **Measurements** main menu key, then the RF Measurement submenu key and press ACLR.
24. Press the **Amplitude** key, then press the Adjust Range submenu key.
25. Record the measured CH 1 power in dBm into the **Measured RF Channel Power** column Table A-47.
26. Calculate the RF Channel Power Error by using the following formula:

```
RF Channel Power Error (dB) =
Measured RF Channel Power – 0.246 – Power Meter reading
```

27. Record calculated value to the **RF CH Power Accuracy** column of Table A-47 and verify that it is within specification (± 1.25 dB).

## Error Vector Magnitude (EVM) Verification (Option 45 or 65)

The tests in this section can be used to verify the functionality of the WCDMA and/or HSDPA Demodulator of the WCDMA/HSDPA Signal Analyzer Mode on Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- Aeroflex/Weinschel Model 44-10 Attenuator (2)
- 10 MHz Reference Standard

### Procedure

1. Turn On the MG3700A Vector Signal Generator and the ML2438A power meter.
2. Connect the power sensor to the power meter and calibrate the sensor.
3. Connect the MG3700A, splitter, attenuator, power meter, and Sensor as shown in Figure 5-10.
4. Press the **On/Off** key to turn On the MT821xE and wait until the measurement display appears. Then press the **Shift** key and the **Mode** (9) key to activate the mode selection menu.
5. Use the **Up/Down** arrow keys to select **WCDMA** and press the **Enter** key.
6. Press the **Shift** key, the **Preset** (1) key, and then the Preset submenu key.
7. On the MG3700A, press the **Preset** key (Yellow key on the upper left-hand side).
8. Press the **Down Arrow** key to select Yes.
9. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

10. Press the (F1) soft key to select Load File to Memory.
11. Press the (F1) soft key again to select Select Package.
12. Using the **Down Arrow** key, step through the selection list until the W-CDMA(BS Tx test) option is highlighted.
13. Press the **Set** key.
14. Press the F6 (Return) soft key.
15. Press the **Set** key. The Select Package list box appears. Again select W-CDMA(BS Tx test) and then press the **Set** key.
16. Another file list appears. Using the **Down Arrow** key, step through the selection list until the TestModel_4_opt option is highlighted.
17. Press the **Set** key.
18. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
19. Press the **Frequency** key, then enter 1962.5, and press the MHz submenu key.
20. Press the **Level** key, then enter –2, and press the dBm submenu key.

21. Use the knob to adjust the power meter to read –20 dBm.
22. On the MT821xE, press the Center Frequency submenu key, enter 1962.5, and then press the MHz submenu key.
23. Press the **Measurements** main menu key, then press the Demodulator submenu key, and press the Modulation Summary submenu key.
24. Press the **Setup** main menu key, then press the Auto Scrambling submenu key to turn it On.
25. Press the Max Spreading Factor submenu key to set it to 512.
26. Press the **Amplitude** key, then press the Adjust Range submenu key.
27. Record the EVM reading in Table A-48, "Option 45 or 65, WCDMA Error Vector Magnitude (Test Model 4)" on page A-36 and verify that it is within 2.5%.
28. This completes the EVM test for MT821xE with Option 45 and the first EVM test for MT821xE with Option 65.

### Continue Here for the MT821xE with Option 65

29. On the MG3700A, press the **Preset** key (Yellow key on the upper left-hand side).
30. Press the **Down Arrow** key to select Yes.
31. Press the **Set** key.

| Note | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

32. Press the (F1) soft key to select Load File to Memory.
33. Press the (F1) soft key again to select Select Package.
34. Using the **Down Arrow** key, step through the selection list until the W-CDMA(BS Tx test) option is highlighted.
35. Press the **Set** key.
36. Press the F6 (Return) soft key.
37. Press the **Set** key. The Select Package list box appears. Again select W-CDMA(BS Tx test) and then press the **Set** key.
38. Another file list appears. Using the **Down Arrow** key, step through the selection list until the TestModel_5_8HSPDSCH option is highlighted.
39. Press the **Set** key.
40. Press the **MOD On/Off** key and verify that the Modulation indicator on the display is On.
41. Press the **Frequency** key, then enter 1962.5, and press the MHz submenu key.
42. Press the **Level** key, then enter –2, and press the dBm submenu key.
43. Use the knob to adjust the power meter to read –20 dBm.
44. On the MT821xE, press the Center Frequency submenu key, enter 1962.5, and then press the MHz submenu key.
45. Press the **Measurements** main menu key, then press the Demodulator submenu key, and press the Modulation Summary submenu key.
46. Press the **Setup** main menu key, and verify that the Scrambling Code is set to Auto.
47. Verify that the Max Spreading Factor submenu key is set to 512.
48. Press the **Amplitude** key, then press the Adjust Range submenu key.
49. Record the EVM reading in Table A-49, "Option 65, HSDPA Error Vector Magnitude (Test Model 5)" on page A-36 and verify that it is within 2.5%.

This completes the two EVM tests for an MT821xE with Option 65.

# 5-10 Fixed WiMAX Signal Analyzer Verification, Options 46 and 47

## Option 46, Option 47, or Both

The tests in this section verify the performance of the optional Fixed WiMAX Signal Analyzer of the MT821xE Cell Master. The tests are as follows:

- "Fixed WiMAX Signal Analyzer Option Verification (Option 46)"
- "Fixed WiMAX Signal Analyzer Option Verification (Option 47)" on page 5-53

### Fixed WiMAX Signal Analyzer Option Verification (Option 46)

The tests in this section verify the Channel Power Accuracy of the optional Fixed WiMAX Signal Analyzer in Model MT821xE Cell Master.

#### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- Anritsu PN 2000-1627-R Coaxial Cables (3)
- 10 MHz Reference Standard

## Setup

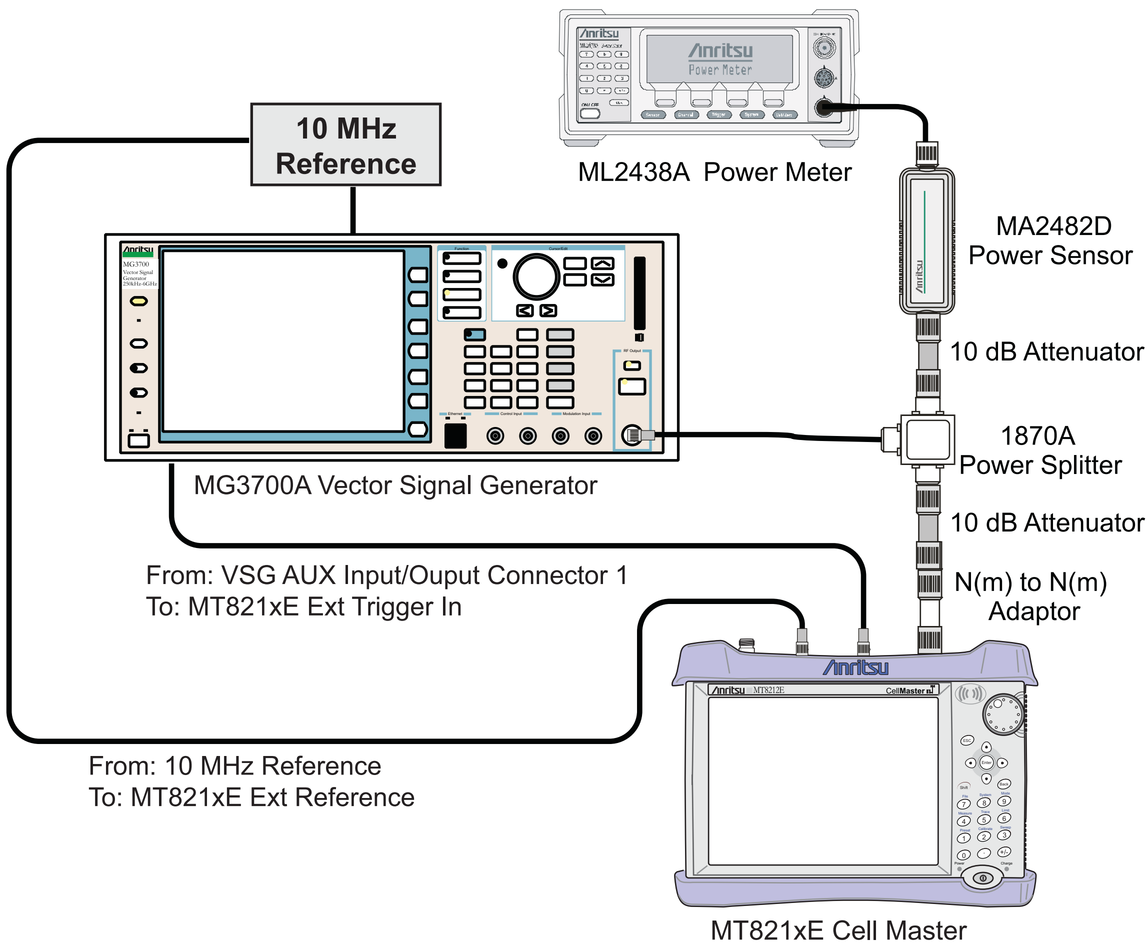



**Figure 5-11.** Fixed WiMAX Signal Analyzer Option Verification

## Procedure

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the calibration factor frequency of the power sensor to 2600.5 MHz.
3. Connect the equipment as shown in Figure 5-11.
4. Set the MG3700A as follows:
   a. Press the yellow **Preset** key (answer Yes to the question).
   b. Press the **Set** key.
   c. Press the (F1) soft key to select Load File to Memory.
   d. Press the (F1) soft key again to select Select Package.
   e. Using the **Down Arrow** key, step through the selection list until WiMax is highlighted.
   f. Press the **Set** key.
   g. Press the F6 (Return) soft key.
   h. Press the **Set** key. The Select Package list box appears. Again select WiMax and the **Set** key.
   i. Another file list appears. Select (highlight) Mx10g32.
   j. Press the **Set** key.

  k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the **"Playing"** indicator is displaying the moving pattern.
  l. Press the **Frequency** key, then enter 2600.5 MHz.
  m. Press the **Level** key, then enter 2 dBm. Turn the output On.

5. Adjust the MG3700A level setting with the knob so that the power meter reads –15.0 dBm ± 0.2 dB.
6. Set the MT821xE to **Fixed WiMax Signal Analyzer** mode and preset the instrument.
7. Set the MT821xE as follows:
   a. Press the **Freq** main menu key and set the center frequency to 2600.5 MHz.
   b. Press the **Setup** main menu key and set the Bandwidth to 10 MHz.
   c. In the **Setup** menu, verify that the CP Ratio is set to 1/8.
   d. Press the **Measurements** main menu key and press RF Measurements, then press Power vs Time.
8. Record the MT821xE Channel Power (RSSI) reading in the **Measured Channel Power (RSSI)** column of Table A-50, "Option 46, Fixed WiMAX Channel Power Accuracy" on page A-37.
9. Calculate the Channel Power Error by subtracting the MT821xE Channel Power (RSSI) reading from the power meter reading in Step 5. Record the result in the **Error** column of Table A-50.
10. Verify that the error is within specification.
11. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm.
12. Record the MT821xE Channel Power (RSSI) reading in the **Measured Channel Power (RSSI)** column of Table A-50.
13. Calculate the Channel Power Error by subtracting the MT821xE Channel Power (RSSI) reading from the power meter reading in Step 11. Record the result in the **Error** column of Table A-50.
14. Verify that the error is within specification.
15. Set the calibration factor frequency of the power sensor to 3600.5 MHz.
16. Set the MG3700A frequency to 3600.5 MHz.
17. Change the MT821xE center frequency to 3600.5 MHz.
18. Measure the Channel Power (RSSI) for both –15 dBm and –50 dBm and then record the measured results and calculated errors in Table A-50.
19. Verify that the errors are within specification.
20. Set the calibration factor frequency of the power sensor to 5600.5 MHz.
21. Set the MG3700A frequency to 5600.5 MHz.
22. Change the MT821xE center frequency to 5600.5 MHz.
23. Repeat Step 18 and Step 19.

## Fixed WiMAX Signal Analyzer Option Verification (Option 47)

The tests in this section verify the Residual EVM and Frequency Error of the optional Fixed WiMAX Signal Analyzer in Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

### Procedure

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the calibration factor frequency of the power sensor to 2600.5 MHz.
3. Connect the equipment as shown in Figure 5-11 on page 5-51.
4. Set the MG3700A as follows:
    a. Press the yellow **Preset** key (answer Yes to the question).
    b. Press the **Set** key.
    c. Press the (F1) soft key to select Load File to Memory.
    d. Press the (F1) soft key again to select Select Package.
    e. Using the **Down Arrow** key, step through the selection list until WiMax is highlighted.
    f. Press the **Set** key.
    g. Press the F6 (Return) soft key.
    h. Press the **Set** key. The Select Package list box appeasr. Again select WiMax and press the **Set** key.
    i. Another file list appears. Select (highlight) Mx10g32.
    j. Press the **Set** key.
    k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the **“Playing”** indicator is displaying the moving pattern.
    l. Press the **Frequency** key, then enter 2600.5 MHz.
    m. Press the **Level** key, then enter 2 dBm. Turn the output On.
5. Adjust the MG3700A level setting with the knob so that the power meter reads –15.0 dBm ± 0.2 dB.
6. Set the MT821xE to **Fixed WiMax Signal Analyzer** mode and preset the instrument.
7. Set the MT821xE as follows:
    a. Press the **Freq** main menu key and set the center frequency to 2600.5 MHz.
    b. Press the **Setup** main menu key and set the Bandwidth to 10 MHz.
    c. Press the CP Ratio (G) submenu key (in the **Setup** menu) and set the CP Ratio to 1/32.
    d. Press the **Measurements** main menu key and press Demodulator, then press Modulation Summary.

8. Record the MT821xE EVM(rms) reading in Table A-51, "Option 47, Fixed WiMAX Residual EVM" on page A-38.
9. Verify that the measured EVM is within specification.
10. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.2 dB.
11. Record the MT821xE EVM(rms) reading in Table A-51.
12. Verify that the measured EVM is within specification.
13. Record the MT821xE frequency error reading in Table A-52, "Option 47, Fixed WiMAX Frequency Error" on page A-38.
14. Verify that the measured frequency error is within specification.
15. Set the calibration factor frequency of the power sensor to 3600.5 MHz.
16. Set the MG3700A frequency to 3600.5 MHz.
17. Change the center frequency of the MT821xE to 3600.5 MHz.
18. Measure the EVM(rms) for both –15 dBm and –50 dBm. Record the measured results in Table A-51.
19. Verify that the measured EVM is within specification.
20. Set the calibration factor frequency of the power sensor to 5600.5 MHz.
21. Set the MG3700A frequency to 5600.5 MHz.
22. Adjust the MG3700A level setting with the knob so that the power meter reads –15.0 dBm ± 0.2 dBm.
23. Change the center frequency of the MT821xE to 5600.5 MHz.
24. Record the MT821xE EVM(rms) reading in Table A-51.
25. Verify that the measured EVM is within specification.
26. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.2 dB.
27. Record the MT821xE EVM(rms) reading in Table A-51.
28. Verify that the measured EVM is within specification.
29. Record the MT821xE frequency error reading in Table A-52.
30. Verify that the measured frequency error is within the specification.

# 5-11 T1 Analyzer Verification, Option 51

These tests verify the functionality of the T1 Analyzer in the Model MT821xE Cell Master. These tests include:

- "T1 Clock Frequency Test Verification"
- "T1 Transmit Level Test Verification"

### Equipment Required

- Anritsu MP1570A Sonet Analyzer with MP0121A and MP0122A modules
- Anritsu PN 806-16 Cable T1 Bantam Plug to Bantam Plug (Quantity 2)
- LeCroy Model WaveRunner 62Xi Digital Oscilloscope with ET-PMT Electrical Telecom Mask software and TF-ET Telecom Adapter Set
- Anritsu PN 2000-1627-R Coaxial Cable

## T1 Clock Frequency Test Verification

This test will verify that the internal signal is being clocked at the correct frequency and also verify that the clock recovery circuit can generate the correct frequency.

### Procedure

1. Connect the External 10 MHz Reference Signal to the rear panel of the MP1570A.
2. On the MT821xE, press **Shift**, **Mode** (9), and use the **Up/Down** keys to select **T1 Analyzer**.
3. Press **Shift**, **Preset** (1). Press the Preset soft key to preset the instrument.

| | |
|---|---|
| **Note** | **Basic Instructions for Operation of MP1570A:**<br>The **Test Menu**, **Result**, and **Analyze** keys all should be pressed so that their LEDs are **On**.<br>The green **Start/Stop** key should also be pressed so that its LED is **On**.<br>The **Setup** key toggles between two displays. You will need to change Parameters under both these displays.<br>If the required parameter is not visible under the present display, then press the **Setup** key to change the display (the required parameter will appear).<br>**Changing the Setup Parameters:**<br>Use the arrow keys to highlight different parameters that will need to be changed. Use the **Set** key to display the menu of choices for each parameter.<br>Use the **Up/Down** arrow keys to highlight the desired setting, then press the **Set** key to accept the highlighted setting. |

4. Set up the MP1570A as follows:
   - Mapping set to Tx&Rx
   - Configuration set to SDH/PDH
   - Meas. Mode set to Out_of_service
   - Bit Rate set to 1.5 M
   - MUX/DEMUX: set to OFF (not present on all units).
   - Frame set to ON
   - 1.5 M Code set to B8ZS
   - Framed set to ESF
   - DSX set to 0 ft.
   - Clock set to internal
   - Monitor Mode is set to OFF
5. Change to the other Setup display (press the **Setup** key again) and set as follows:
   - Test Pattern set to PRBS15
   - Invert mode set to OFF
   - Analyze set to Freq. monitor.
6. Using an 806-16 bantam cable, connect the MT821xE TX connector to the MP1570A AMI/B8ZS Input (on the MP0122A module).
7. Using another 806-16 bantam cable, connect the MT821xE RX connector to the MP1570A AMI/B8ZS Output (on the MP0122A module).

8. On the MT821xE, press the **Configuration** main menu key near the bottom-left corner of the display and verify that Tx Clock is set to Internal, Line Code is set to B8ZS, and Framing is set to ESF. Then set Tx LBO to 0 dB and Pattern to PRBS-15.
9. The MT821xE T1 frequency and ppm error appear on the MP1570A. Record the ppm error value in the **Internal Clock Error** row of Table A-53, "Option 51, T1 Frequency Clock" on page A-39.
10. On the MP1570A, change Pattern to All One.
11. On the MT821xE, press the **Configuration** main menu key.
12. Use the rotary knob to select Tx Clock, and set Tx Clock to Recovered.
13. Press the **Measurements** main menu key and then press Rx Signal.
14. Press the **Start/Stop** main menu key so that "Measure On" is displayed.
15. Record the Frequency value on the MT821xE into the **Recovered Clock Frequency** row of Table A-53.

## T1 Transmit Level Test Verification

The tests in this section verify the transmit level of the T1 signal from the MT821xE in **T1 Analyzer** mode.

### Procedure

1. Install the LeCroy AP100 100 ohm Telecom Adapter to Channel 1 input of LeCroy Oscilloscope.
2. Connect the bantam to bantam cable from the Tx port on the T1 interface of the MT821xE to the input of the LeCroy AP100 adapter on the Oscilloscope.
3. Set the MT821xE to **T1 Analyzer Mode** and preset the instrument.
4. Press the **Configuration** main menu key and set up the MT821xE as follows:
   - Test Mode — DS1
   - Line code — B8ZS
   - Tx Clock — Internal
   - Receive Input — Terminate
   - Framing — ESF
   - Payload Type — 1.544Mb
   - Tx LBO — 0dB
5. Press the **Pattern/Loop** main menu key and select All Ones, then press the Select Pattern submenu key.
6. On the LeCroy Oscilloscope, use the stylus to tap on File on the Toolbar. Select Recall Setup… and then tap the Recall Default button to reset the Oscilloscope.
7. Press the **Auto Setup** key and then tap the "Confirm" button. Wait until the oscilloscope displays a stable trace.
8. Tap on Measure on the Toolbar and select Std Vertical.
9. Record the displayed peak-to-peak voltage in the **Tx LBO: 0 dB** row of Table A-54, "T1 Transmitted Level Voltage" on page A-39.
10. Verify that the measured peak-to-peak voltage is between 4.8 volts and 7.6 volts.
11. Change Tx LBO to –7.5 dB on the MT821xE.
12. Record the displayed peak-to-peak voltage in the **Tx LBO: –7.5 dB** row of Table A-54 and verify that it is between 1.9 volts and 3.1 volts.
13. Change Tx LBO to –15 dB on the MT821xE.
14. Record the displayed peak-to-peak voltage in the **Tx LBO: –15 dB** row of Table A-54 and verify that it is between 0.5 volts and 1.7 volts.

15. Disconnect the bantam cable from the Oscilloscope and connect it to the Rx port on the MT821xE.
16. On the MT821xE, press the **Measurements** main menu key and press Rx Signal.
17. Press the **Start/Stop** main menu key to turn measurement On.
18. Read the Vpp value from the displayed table and record it in the **Tx LBO: –15 dB** row of Table A-55, "T1 Transmitted Level Vpp Reading".
19. Verify that the measured Vpp value is between 0.5 volts and 1.7 volts.
20. Change Tx LBO to –7.5 dB on the MT821xE.
21. Record the displayed peak-to-peak voltage in the **Tx LBO: –7.5 dB** row of Table A-55 and verify that it is between 1.9 volts and 3.1 volts.
22. Change Tx LBO to 0 dB on the MT821xE.
23. Record the displayed peak-to-peak voltage in the **Tx LBO: 0 dB** row of Table A-55 and verify that it is between 4.8 volts and 7.6 volts.

# 5-12 E1 Analyzer Verification, Option 52

These tests verify the functionality of the E1 Analyzer in the Model MT821xE Cell Master. These tests include:

- "E1 Clock Frequency Test Verification"
- "E1 Transmit Level Test Verification" on page 5-61

## E1 Clock Frequency Test Verification

This test will verify that the internal signal is being clocked at the correct frequency and also verify that the clock recovery circuit can generate the correct frequency.

### Equipment Required

- Anritsu MP1570A Sonet Analyzer with MP0121A and MP0122A modules
- Anritsu PN 3-806-169 Cable 75 ohm BNC(m) to BNC(m) (Quantity 2)
- Anritsu PN 2000-1627-R Coaxial Cable
- Anritsu PN 806-117 Cable RJ48 to dual Bantam
- Anritsu PN T3450 Test Fixture
- LeCroy Model WaveRunner 62Xi Digital Oscilloscope with ET-PMT Electrical Telecom Mask software and TF-ET Telecom Adapter Set

### Procedure

1. Connect the External 10 MHz Reference Signal to the rear panel of the MP1570A.

**Note**

**Basic Instructions for Operation of MP1570A:**

The **Test Menu**, **Result**, and **Analyze** keys all should be pressed so that their LEDs are **On**.

The green **Start/Stop** key should also be pressed so that its LED is **On**.

The **Setup** key toggles between two displays. You will need to change Parameters under both these displays.

If the required parameter is not visible under the present display, then press the **Setup** key, and the required parameter will appear on the new display.

**Changing the Setup Parameters:**

Use the arrow keys to highlight different parameters that will need to be changed. Use the **Set** key to display the menu of choices for each parameter.

Use the **Up/Down** arrow keys to highlight the desired setting, then press the **Set** key to accept the highlighted setting.

2. Set up the MP1570A as follows:
    - Set Mapping to Tx&Rx
    - Set Config. to SDH/PDH
    - Set Bit Rate to 2M
    - Set Frame to ON
    - Set Channel to 30ch
    - Set CRC4 to ON
    - Set Signalling to OFF
    - Set Interface to Unbalanced
    - Set Clock to internal
    - Set Monitor Mode to OFF
3. Press the **Test Menu** key and set up the MP1570A as follows:
    - Set Test menu to Manual
    - Set Test Pattern to PRBS15
    - Set Invert mode to OFF
    - Set Analyze to Freq. monitor
4. Set the Mode of the instrument to **E1 Analyzer** and preset the instrument.
5. Press the **Configuration** main menu key (below the display)
6. Confirm that Tx Clock is set to Internal.
7. Use the **Down Arrow** key to highlight Input Connector.
8. Press the BNC 75 Ohms soft key.
9. Press the **Pattern** main menu key. Use the rotary knob to highlight PRBS15 and press the Select Pattern soft key.
10. Connect a 75 ohm BNC cable (part number 3-806-169) between the Tx port of the MT821xE and the CMI/HDB3 Input of the MP0121A Module on the MP1570A.
11. Connect a 75 ohm BNC cable (part number 3-806-169) between the Rx port of the MT821xE and the CMI/HDB3 Output of the MP0121A Module on the MP1570A.
12. On the MP1570A, allow the status bar on the bottom of the display to complete at least one sweep.
13. Record the ppm reading in the **Internal Clock Error** row of Table A-56, “Option 52, E1 Frequency Clock” on page A-40.
14. On the MT821xE, press the **Measurements** main menu key and then the Rx Signal soft key.
15. Press the **Start/Stop** main menu key to turn measurement On, “Measure ON” appears in the lower-left corner of the display.
16. Record the Frequency reading on the display in the **Recover Clock Frequency** row of Table A-56.
17. Press the **Start/Stop** main menu key to stop the measurement.

## E1 Transmit Level Test Verification

The tests in this section verify the transmit level of the E1 signal from the MT821xE in E1 Analyzer mode.

### Procedure

**BNC (75 Ohm unbalanced [Single End]) Interface Check:**

1. Install the LeCroy PP090 75 ohm Telecom Adapter to the Channel 1 input of the LeCroy Oscilloscope.
2. Connect the 75 ohm BNC cable (part number 3-806-169) from the Tx port on the E1 interface of the MT821xE to the 75 ohm adapter on the Oscilloscope.
3. Set the MT821xE to **E1 Analyzer** mode and preset the instrument.
4. Use the rotary knob to highlight Input Connector and then press the BNC 75 Ohms soft key to switch the input connector.
5. Press the **Pattern** main menu key and use the **Right Arrow** key to highlight All Ones. Press the Select Pattern soft key.
6. On the LeCroy Oscilloscope, use the stylus to tap on File on the Toolbar. Press Recall Setup… and then tap the Recall Default button to reset the Oscilloscope.
7. Press the **Auto Setup** key and then tap the Confirm button. Wait until the oscilloscope displays a stable trace.
8. Tap on Measure on the Toolbar and select Std Vertical.
9. Record the displayed P1 peak-to-peak voltage in the **75 ohm** row of Table A-57, “Option 52, E1 Transmitted Level Voltage” on page A-40.
10. Verify that the measured peak-to-peak voltage is between 4.2 volts and 5.2 volts.
11. Disconnect the BNC cable from the Oscilloscope and connect it to the Rx port on the MT821xE .
12. On the MT821xE, press the **Measurements** main menu key and press Rx Signal.
13. Press the **Start/Stop** main menu key to turn measurement On (“Measure ON” appears in the lower left corner of the display).
14. Read the Vpp value from the displayed table and record the value in the **75 ohm** row of Table A-58, “Option 52, E1 Transmitted Level Vpp Reading” on page A-40.

**RJ48 (120 Ohm balanced [Differential Pair]) Interface Check:**

15. Install the LeCroy AP120 120 ohm Telecom Adapter to the Channel 1 input of LeCroy Oscilloscope.
16. Connect the RJ48 end of the Bantam “Y” Plug (part number 806-117) to the E1 RJ48 interface of the MT821xE .
17. Connect the Transmit Bantam plug of the Bantam “Y” cable to the T3450 Test Fixture, and then connect a bantam plug to the Siemens jack adapter cable between the open Bantam jack on the T3450 Test Fixture and the Siemens connector of the Telecom adapter on the Oscilloscope.
18. Set the MT821xE to **E1 Analyzer** mode and preset the instrument.
19. Use the rotary knob to highlight Input Connector and then press the RJ48 120 Ohms soft key to switch the input connector.
20. Press the **Pattern** main menu key and use the **Right Arrow** key to highlight All Ones. Press the Select Pattern soft key.
21. On the LeCroy Oscilloscope, use the stylus to tap on File on the Toolbar. Select Recall Setup… and then tap the Recall Default button to reset the Oscilloscope.
22. Press the **Auto Setup** key and then tap the Confirm button. Wait until the oscilloscope displays a stable trace.
23. Tap on Measure on the Toolbar and select Std Vertical.
24. Record the displayed P1 peak-to-peak voltage in the **120 ohm** row of Table A-57.

25. Verify that the measured peak-to-peak voltage is between 5.4 volts and 6.6 volts.
26. On the T3450 Test Fixture, disconnect the Bantam plug end of the cable from the Oscilloscope.
27. Connect the Receive Bantam plug of the Bantam “Y” Plug of the RJ48 cable to the open jack of the T3450 Test Fixture.
28. On the MT821xE, press the **Measurements** main menu key and press Rx Signal.
29. Press the **Start/Stop** main menu key to turn measurement On (“Measure ON” appears in the lower-left corner of the display).
30. Read the Vpp value from the displayed table and record it in the **120 ohm** row of Table A-58.

# 5-13 T1/T3 Analyzer Verification, Option 53

These tests verify the functionality of the T1/T3 Analyzer in the Model MT821xE Cell Master. These tests include:


- "T1 Clock Frequency Test Verification" on page 5-64
- "T1 Transmit Level Test Verification" on page 5-66
- "T3 Clock Frequency Test Verification" on page 5-67
- "T3 Transmit Level Test Verification" on page 5-68


### Equipment Required

- Anritsu MP1570A Sonet Analyzer with MP0121A and MP0122A modules
- Anritsu PN 806-16 Cable T1 Bantam Plug to Bantam Plug (Quantity 2)
- LeCroy Model WaveRunner 62Xi Digital Oscilloscope with ET-PMT Electrical Telecom Mask software and TF-ET Telecom Adapter Set
- Anritsu PN 3-806-169 Cable 75 ohm BNC(m) to BNC(m) (Quantity 2)
- Anritsu PN 2000-1627-R Coaxial Cable

## T1 Clock Frequency Test Verification

This test will verify that the internal signal is being clocked at the correct frequency and verify that the clock recovery circuit can generate the correct frequency.

### Procedure

1. Connect the External 10 MHz Reference Signal to the rear panel of the MP1570A.
2. On the MT821xE, press **Shift**, **Mode**, and use the **Up/Down** keys to select **T1/T3 Analyzer**.
3. Press **Shift**, **Preset** (1). Press the Preset soft key to preset the instrument.

| Note | |
|---|---|
| | **Basic Instructions for Operation of MP1570A:**<br>The **Test Menu**, **Result**, and **Analyze** keys all should be pressed so that their LEDs are On.<br>The green **Start/Stop** key should also be pressed so that its LED is **On**.<br>The **Setup** key toggles between two displays. You will need to change Parameters under both these displays.<br>If the required parameter is not visible under the present display, then press the **Setup** key, and the required parameter will appear on the new display.<br>**Changing the Setup Parameters:**<br>Use the arrow keys to highlight different parameters that will need to be changed. Use the **Set** key to display the menu of choices for each parameter.<br>Use the **Up/Down** arrow keys to highlight the desired setting, then press the **Set** key to accept the highlighted setting. |

4. Set up the MP1570A as follows:
   - Mapping set to Tx&Rx
   - Configuration set to SDH/PDH
   - Meas. Mode set to Out_of_service
   - Bit Rate set to 1.5M
   - MUX/DEMUX: set to OFF (not present on all units).
   - Frame set to ON
   - 1.5M Code set to B8ZS
   - Framed set to ESF
   - DSX set to 0 ft.
   - Clock set to internal
   - Monitor Mode is set to OFF
5. Change to the other Setup display (press the **Setup** key again) and set as follows:
   - Test Pattern set to PRBS15
   - Invert mode set to OFF
   - Analyze set to Freq. monitor.
6. Using an 806-16 bantam cable, connect the MT821xE TX connector to the MP1570A AMI/B8ZS Input (on the MP0122A module).
7. Using another 806-16 bantam cable, connect the MT821xE RX connector to the MP1570A AMI/B8ZS Output (on the MP0122A module).
8. On the MT821xE, press the **Configuration** main menu key near the bottom-left corner of the display and verify that Tx Clock is set to Internal, Line Code is set to B8ZS, and Framing is set to ESF. Then set Tx LBO to 0 dB and Pattern/Loop to PRBS-15.
9. The MT821xE T1 frequency and ppm error will appear on the MP1570A. Record the ppm error in the **Internal Clock Error** row of Table A-59, "Option 53, T1/T3 Frequency Clock" on page A-41.
10. On the MP1570A, change Pattern to All One.
11. On the MT821xE, press the **Configuration** main menu key.
12. Use the rotary knob to select Tx Clock and set Tx Clock to Recovered.
13. Press the **Measurements** main menu key and press Rx Signal.
14. Press the **Start/Stop** main menu key so that Measure On is displayed in the lower-left corner of the monitor screen.
15. Record the Frequency value on the MT821xE in the **Recovered Clock Frequency** row of Table A-59.

## T1 Transmit Level Test Verification

The tests in this section verify the transmit level of the T1 signal from the MT821xE in T1/T3 Analyzer mode.

### Procedure

1. Install the LeCroy AP100 100 ohm Telecom Adapter to the Channel 1 input of the LeCroy Oscilloscope.
2. Connect the bantam to bantam cable from the Tx port on the T1 interface of the MT821xE to the input of the LeCroy AP100 adapter on the Oscilloscope.
3. Set the MT821xE to **T1/T3 Analyzer** mode and preset the instrument.
4. Press the **Configuration** main menu key and set up the MT821xE as follows:
   - Test Mode — DS1
   - Line code —- B8ZS
   - Tx Clock — Internal
   - Tx LBO — 0dB
   - Rx Input — Terminate
   - Framing — ESF
   - Payload Type — 1.544Mb
5. Press the **Pattern/Loop** main menu key, select All Ones.
6. On the LeCroy Oscilloscope, use the stylus to tap on File on the Toolbar. Select Recall Setup… and then tap the Recall Default button to reset the Oscilloscope.
7. Press the **Auto Setup** key and then tap the Confirm button. Wait until the oscilloscope displays a stable trace.
8. Tap on Measure on the Toolbar and select Std Vertical.
9. Record the displayed peak-to-peak voltage in the **Tx LBO: 0 dB** row of Table A-60, “Option 53, T1 Transmitted Level Voltage” on page A-41.
10. Verify that the measured peak-to-peak voltage is between 4.8 volts and 7.6 volts.
11. Change Tx LBO to –7.5 dB on the MT821xE.
12. Record the displayed peak-to-peak voltage in the **Tx LBO: –7.5 dB** row of Table A-60 and verify that it is between 1.9 volts and 3.1 volts.
13. Change Tx LBO to –15 dB on the MT821xE.
14. Record the displayed peak-to-peak voltage in the **Tx LBO: –15 dB** row of Table A-60 and verify that it is between 0.5 volts and 1.7 volts.
15. Disconnect the bantam cable from the Oscilloscope and connect it to the Rx port on the MT821xE.
16. On the MT821xE, press the **Measurements** main menu key and press Rx Signal.
17. Press the **Start/Stop** main menu key to turn measurement On.
18. Read the Vpp value from the displayed table and record it in the **Tx LBO: –15 dB** row of Table A-61, “Option 53, T1 Transmitted Level Vpp Reading” on page A-41.
19. Verify that the measured Vpp value is between 0.5 volts and 1.7 volts.
20. Change Tx LBO to –7.5 dB on the MT821xE.
21. Record the displayed peak-to-peak voltage in the **Tx LBO: –7.5 dB** row of Table A-61 and verify that it is between 1.9 volts and 3.1 volts.
22. Change Tx LBO to 0 dB on the MT821xE.
23. Record the displayed peak-to-peak voltage in the **Tx LBO: 0 dB** row of Table A-61 and verify that it is between 4.8 volts and 7.2 volts.

## T3 Clock Frequency Test Verification

This test will verify that the internal signal is being clocked at the correct frequency and verify that the clock recovery circuit can generate the correct frequency.

### Procedure

1. Connect the External 10 MHz Reference Signal to the rear panel of the MP1570A.
2. On the MT821xE, confirm that the mode is set to **T1/T3 Analyzer**. Preset the instrument.
3. Press the **Configuration** main menu key, highlight Test Mode, and press the DS3 soft key.
4. Set Tx Clock to Internal.
5. Set Tx LBO to DSX.
6. Press the **Pattern/Loop** main menu key and then select the All Ones pattern.
7. Set up the MP1570A as follows:
    - Set Mapping to Tx&Rx
    - Set Config. to SDH/PDH
    - Set Meas. Mode to Out_of_service
    - Set Bit Rate to 45M
    - Set MUX/DEMUX to OFF (not present on all units)
    - Set Frame to ON
    - Set 45M Framed to C-bit
    - Set X-Bit to 11
    - Set DSX to 0 ft
    - Set Clock to internal
    - Set Monitor Mode to OFF
8. Change to the other Setup display and set the Test Pattern to All 1.
9. Set **Analyze** to Freq Monitor.
10. Using a 75 ohm BNC cable (part number 3-806-169), connect the MT821xE Tx connector to the MP1570A B3ZS Input (on the MP0122xB module).
11. Using a second 75 ohm BNC cable, connect the MT821xE Rx connector to the MP1570A B3ZS Output (on the MP0122xB module).
12. Allow the status bar on the bottom of the display to complete at least one sweep.
13. View the ppm error that is shown on the MP1570A and record it in the **Internal Clock Error** row of Table A-62, "Option 53, T3 Frequency Clock" on page A-41.
14. On the MT821xE, change the Tx Clock setting to Recovered.
15. Press the **Measurements** main menu key, and activate Rx Signal (red dot appears on label).
16. Press the **Start/Stop** main menu key to turn the measurement On ("Measure ON" appears in the lower-left corner of the display).
17. Record the Frequency reading (center of display) in the **Recovered Clock Frequency** row in Table A-62.

## T3 Transmit Level Test Verification

The tests in this section verify the transmit level of the T3 signal from the MT8221B in T1/T3 Analyzer mode.

### Procedure

1. Preset the MT821xE. Press the **Configuration** main menu key, highlight Test Mode, and press the DS3 soft key.
2. Confirm that Tx LBO is set to Low.
3. Press the **Pattern/Loop** main menu key and then select the All Ones pattern.
4. Connect the PP090 75 ohm adapter to the oscilloscope Channel 1 input.
5. Install a 75 ohm BNC-BNC cable between the T3 Tx output and the 75 ohm adapter on the oscilloscope.
6. On the oscilloscope, press the blue **Auto Setup** button. Confirm that the Touch Screen button is activated.
7. View the Channel 1 peak-to-peak voltage and record it the **LOW** row of Table A-63, "Option 53, T3 Transmitted Level Voltage" on page A-42. (Horizontal instability of the signal is normal.)
8. On the MT821xE, change the Tx LBO setting to DSX.
9. Record the "DSX" Measured Voltage (peak-to-peak) in the **DSX** row of Table A-63.
10. Press the **Measurements** main menu key and press Rx Signal.
11. Disconnect the BNC cable from the oscilloscope and use the cable to connect the T3 Tx and Rx connectors together.
12. Press the **Start/Stop** main menu key to turn the measurement On ("Measure ON" appears in the lower-left corner of the display).
13. Record the Vpp measurement that is shown on the MT821xE display in the **DSX** row of Table A-64, "Option 53, T3 Transmitted Level Vpp Reading" on page A-42.
14. Change the Tx LBO (press the **Configuration** main menu key) to Low.
15. Press the **Measurements** main menu key, view the Vpp value, and record in the **LOW** row of Table A-64.

# 5-14 TD-SCDMA Signal Analyzer Verification, Options 60 and 61

## Option 60, Option 61, or Both

The tests in this section verify the performance of the optional TD-SCDMA Signal Analyzer option of the MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- Anritsu PN 2000-1627-R Coaxial Cables (3)
- 10 MHz Reference Standard

### Setup

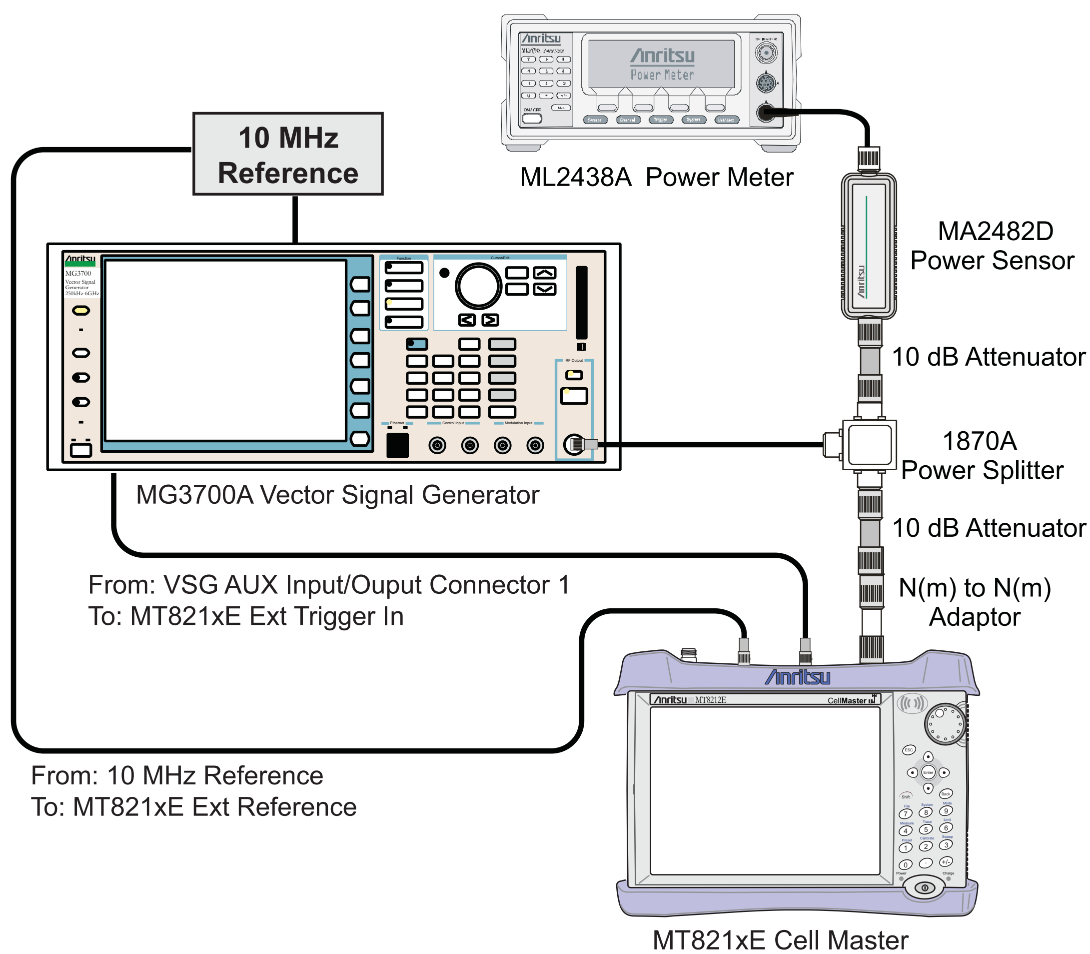



**Figure 5-12.** TD-SCDMA Signal Analyzer Option Verification

### Procedure

| Note | The TD-SCDMA pattern requires a Waveform Data license MX370001A, which must be purchased. |
|---|---|

1. Calibrate the power sensor prior to connecting to the power splitter.
2. Connect the equipment as shown in Figure 5-12.
3. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 2010 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
4. Set the power meter to Averaging, Moving and 256 samples.
5. Set the MT821xE to **TD-SCDMA Signal Analyzer** mode and preset the instrument.
6. On the MG3700A, press the **Preset** key (yellow key on the upper left-hand side).
7. Press the **Down Arrow** key or turn the knob to select Yes.
8. Press the **Set** key.

| Note | The MG3700A has two **Set** keys, and they both have the same function. |
|---|---|

9. Press the F1 submenu key to select Load File to Memory.
10. Press the F1 submenu key again to select Select Package.
11. Using the **Down Arrow** key, step through the selection list until the TD-SCDMA(MX370001A) option is highlighted.
12. Press the **Set** key.
13. Press the F6 (Return) soft key.
14. Press the **Set** key. The Select Package box appears. Use the rotary knob to highlight TD-SCDMA(MX370001A) and press the **Set** key to select.
15. Another file list appears. Use the rotary knob to select rmc-P-CCPCH_bs_dl and press the **Set** key to select.
16. Press the **MOD On/Off** key to turn the Modulation LED On and verify that the **"Playing"** indicator in the center of the LCD is flashing.
17. Press the **Frequency** key, enter 2010 MHz.
18. Press the **Level** key, enter –20 and press the dBm submenu key.
19. Adjust the MG3700A output so that the power meter reads –45 dBm ± 0.5 dB.
20. On the MT821xE, press the **Frequency** main menu key and enter 2010 MHz as center frequency.
21. Press the Measurements main menu key and press TD-SCDMA Summary (a red dot will appear on the label).
22. Press the Setup main menu key and press Trigger. Then change Trigger Type to Ext by pressing the Trigger Type submenu key twice. Then wait 15 seconds to allow the MT821xE to update its measured results.
23. For an MT821xE with Option 60 (TD-SCDMA RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 19. Then record the calculated Channel Power Error in Table A-65, "Option 60, 61, TD-SCDMA Verification (at 2010 MHz, –45 dBm Level, TD-SCDMA)" on page A-42.
24. For an MT821xE with Option 61 (TD-SCDMA Demodulator), record the displayed Freq error and Tau values in Table A-65.
25. Verify that the measured values in Step 23 and Step 24 are within specifications.

# 5-15 EVDO Signal Analyzer Verification, Options 62 and 63

# Option 62, Option 63, or Both

The tests in this section verify the optional EVDO Signal Analyzer functions in Anritsu Model MT821xE Cell Master. The tests are as follows:


- "8-PSK Modulation Channel Power, Frequency Error, Rho, and Tau Verification" on page 5-72
- "QPSK Modulation Channel Power, Frequency Error, Rho, and Tau Verification" on page 5-73
- "16-QAM Modulation Channel Power, Frequency Error, Rho, and Tau Verification " on page 5-74
- "Idle Slot Channel Power, Frequency Error, Rho, and Tau Verification, Options 62 and 63" on page 5-75


### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu PN 2000-1627-R Coaxial Cables (3)
- 10 MHz Reference Standard

### Setup

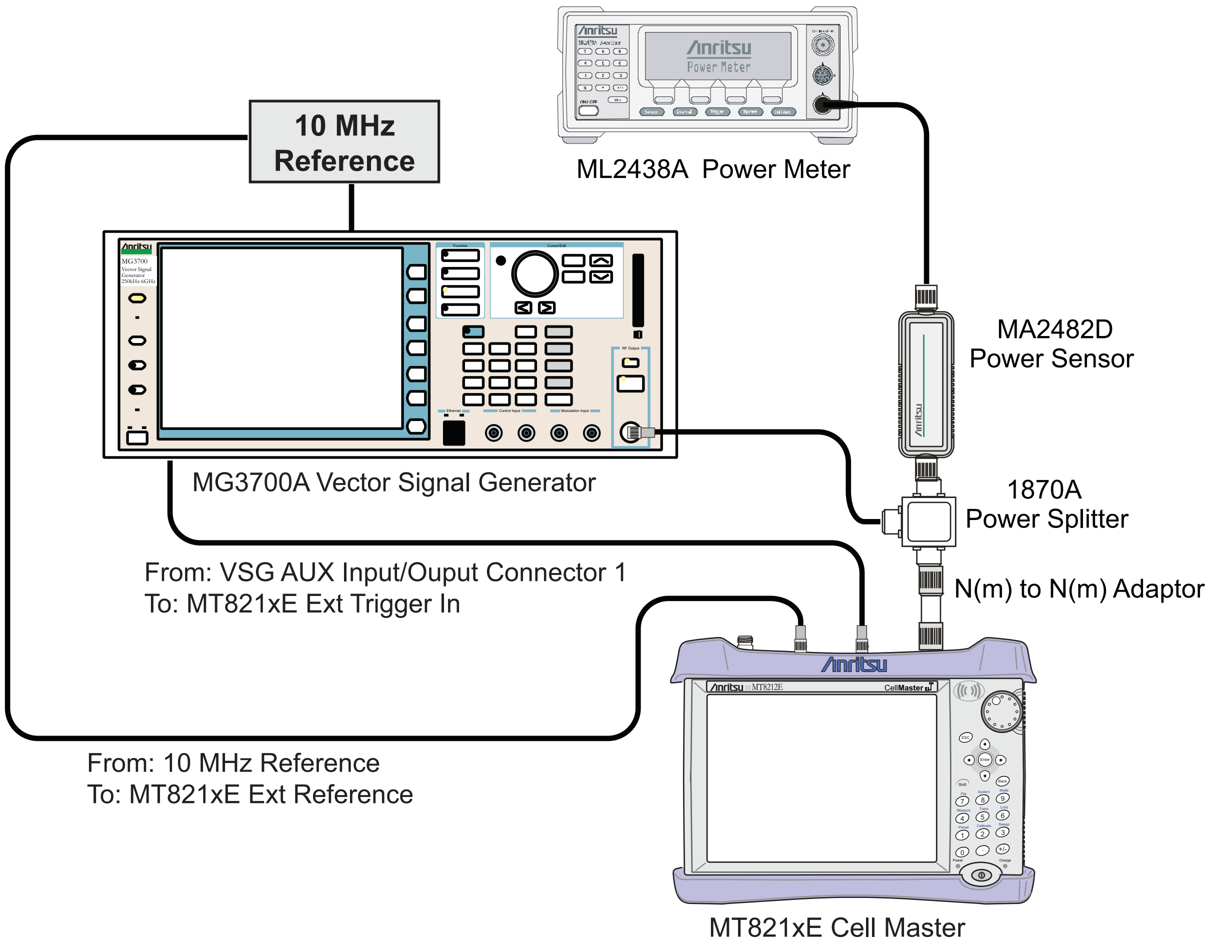



**Figure 5-13.** EVDO Signal Analyzer Option Verification

## 8-PSK Modulation Channel Power, Frequency Error, Rho, and Tau Verification

The tests in this section verify the function of the optional EVDO Signal Analyzer in the Model MT821xE Cell Master.

### Procedure

1. Calibrate the power sensor.
2. Connect the equipment as shown in Figure 5-13.
3. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 870.03 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
4. Set the MT821xE mode to **EVDO Signal Analyzer**. Preset the instrument.
5. On the MG3700A, press the **Preset** key (Yellow key on the upper left-hand side).
6. Press the **Down Arrow** key or turn the knob to select Yes.
7. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

8. Press the (F1) soft key to select Load File to Memory.
9. Press the (F1) soft key again to select Select Package.
10. Using the **Down Arrow** key, step through the selection list until the CDMA2000_1xEV-DO option is highlighted.
11. Press the **Set** key.
12. Press the F6 (Return) soft key.
13. Press the **Set** key. The Select Package box appears. Use the rotary knob to highlight CDMA2000_1xEVDO and press the **Set** key to select.
14. Another File List appears. Use the rotary knob to select FWD_921_6KBPS_2SLOT and press the **Set** key to select.
15. Press the **MOD On/Off** key to turn the Modulation LED On, and verify that the **"Playing"** indicator in the center of the LCD is flashing.
16. Press the **Frequency** key, enter 870.03 MHz.
17. Press the **Level** key, enter –40 and press the dBm submenu key.
18. Adjust the MG3700A output so that the power meter reads –50 dBm ± 0.2 dB.
19. On the MT821xE, press the **Frequency** main menu key and set 870.03 MHz as Center Frequency.
20. Press the **Measurements** main menu key and press EVDO Summary (red dot will appear on the label).
21. Press the **Setup** main menu key and press PN Setup. Then change PN Trigger to Ext by pressing the PN Trigger submenu key twice. Then wait 15 seconds to allow the MT821xE to update its measured results.
22. For an MT821xE with Option 62 (EVDO RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 18. Then record the calculated Channel Power Error in the **At 870.03 MHz, –50 dBm Level, 921.6kps 8-PSK Modulation** section of Table A-66, "Option 62, EVDO RF Measurements" on page A-43.
23. For an MT821xE with Option 63 (EVDO Demodulator), record the displayed Freq Error, Rho Pilot, and Tau in the **870.03 MHz, –50 dBm Level, 921.6kps 8-PSK Modulation** section of Table A-67, "Option 63, EVDO Demodulator" on page A-44.
24. Verify that the measured values in Step 22 and Step 23 are within specifications.

## QPSK Modulation Channel Power, Frequency Error, Rho, and Tau Verification

The tests in this section verify the function of the optional EVDO Signal Analyzer in Model MT821xE Cell Master.

### Procedure

1. Confirm that the equipment settings are unchanged from the previous test.
2. On the MG3700A, change the selected pattern to "FWD_38_4KBPS_16SLOT".
3. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 1930 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
4. Set the MG3700A frequency to 1930.05 MHz.
5. Adjust the MG3700A output so that the power meter reads 0 dBm ± 0.2 dB.
6. On the MT821xE, press the **Frequency** main menu key and set 1930.05 MHz as Center Frequency. Then wait 15 seconds to allow the MT821xE to update its measured results.

7. For an MT821xE with Option 62 (EVDO RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 5. Then record the calculated Channel Power error to the **At 1930.05 MHz, 0 dBm Level, 38.4kps QPSK Modulation** section of Table A-66 on page A-43.
8. For an MT821xE with Option 63 (EVDO Demodulator), record the displayed Freq Error, Rho Pilot, and Tau to the **At 1930.05 MHz, 0 dBm Level, 38.4kps QPSK Modulation** section of Table A-67 on page A-44.
9. Verify that the measured values in Step 7 and Step 8 are within specifications.

## 16-QAM Modulation Channel Power, Frequency Error, Rho, and Tau Verification

The tests in this section verify the function of the optional EVDO Signal Analyzer in Model MT821xE Cell Master.

### Procedure

1. Confirm that the equipment settings are unchanged from the previous test. The power sensor calibration factor frequency should still be at 1930 MHz, and the MG3700A frequency and MT821xE Center Frequency should still be at 1930.05 MHz.
2. On the MG3700A, change the selected pattern to FWD_2457_6KBPS_1SLOT.
3. Adjust the MG3700A output so that the power meter reads –50 dBm ± 0.2 dB.
4. Then wait 15 seconds to allow the MT821xE to update its measured results.
5. For an MT821xE with Option 62 (EVDO RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 3. Then record the calculated Channel Power error in the **At 1930.05 MHz, –50 dBm Level, 2457.6kps 16-QAM Modulation** section of Table A-66.
6. For an MT821xE with Option 63 (EVDO Demodulator), record the displayed Freq Error, Rho Pilot, and Tau in the **At 1930.05 MHz, –50 dBm Level, 2457.6kps 16-QAM Modulation** section of Table A-67.
7. Verify that the measured values in Step 5 and Step 6 are within specifications.

### Idle Slot Channel Power, Frequency Error, Rho, and Tau Verification, Options 62 and 63

## Option 62, Option 63, or Both

The tests in this section verify the function of the optional EVDO Signal Analyzer in Model MT821xE Cell Master.

#### Procedure

1. Confirm that the equipment settings are unchanged from the previous test. The power sensor calibration factor frequency should still be at 1930 MHz, and the MG3700A frequency and MT821xE Center Frequency should still be at 1930.05 MHz.
2. On the MG3700A, change the selected pattern to FWD_IDLE.
3. Adjust the MG3700A output so that the power meter reads –50 dBm ± 0.2 dB.
4. Then wait 15 seconds to allow the MT821xE to update its measured results.
5. For an MT821xE with Option 62 (EVDO RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 3. Then record the calculated Channel Power error in the **At 1930.05 MHz, –50 dBm Level, IDLE SLOT** section of Table A-66 on page A-43.
6. For an MT821xE with Option 63 (EVDO Demodulator), record the displayed Freq Error, Rho Pilot, and Tau in the **At 1930.05 MHz, –50 dBm Level, IDLE SLOT** section of Table A-67 on page A-44.
7. Verify that the measured values in Step 5 and Step 6 are within specifications.
8. On the power meter, press the **Sensor** key, the Cal Factor soft key, and then the FREQ soft key. Use the keypad to enter 870.03 MHz as the input signal frequency, which sets the power meter to the proper power sensor calibration factor. Press the **System** key to display the power reading.
9. Set the MG3700A frequency to 870.03 MHz.
10. Adjust the MG3700A output so that the power meter reads –10 dBm ± 0.2 dB.
11. On the MT821xE, press the **Frequency** main menu key and set 870.03 MHz as Center Frequency. Then wait 15 seconds to allow the MT821xE to update its measured results.
12. For an MT821xE with Option 62 (EVDO RF Measurements), subtract the displayed Channel Power value from the power meter reading in Step 10. Then record the calculated Channel Power error in the **At 870.03 MHz, –10 dBm Level, IDLE SLOT** section of Table A-66.
13. For an MT821xE with Option 63 (EVDO Demodulator), record the displayed Freq Error, Rho Pilot, and Tau in the **At 870.03 MHz, –10 dBm Level, IDLE SLOT** section of Table A-67.
14. Verify that the measured values in Step 12 and Step 13 are within specifications.

# 5-16 DVB-T/H Signal Analyzer Verification, Options 64 and 57

## Option 64, Option 57, or Both

The tests in this section verify the performance of the optional DVB-T/H Signal Analyzer option of the Cell Master. These tests include:


- "Frequency Accuracy and Residual MER Verification" on page 5-77
- "Frequency Lock Range Verification" on page 5-79
- "Level Accuracy Verification" on page 5-80
- "Displayed Average Noise Level (DANL) Verification" on page 5-85
- "BER Measurement Functional Check, Option 57 Only" on page 5-86


### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

## Frequency Accuracy and Residual MER Verification

The tests in this section verify the frequency accuracy and residual modulation error ratio (MER) of the Cell Master in DVB-T/H Signal Analyzer mode.

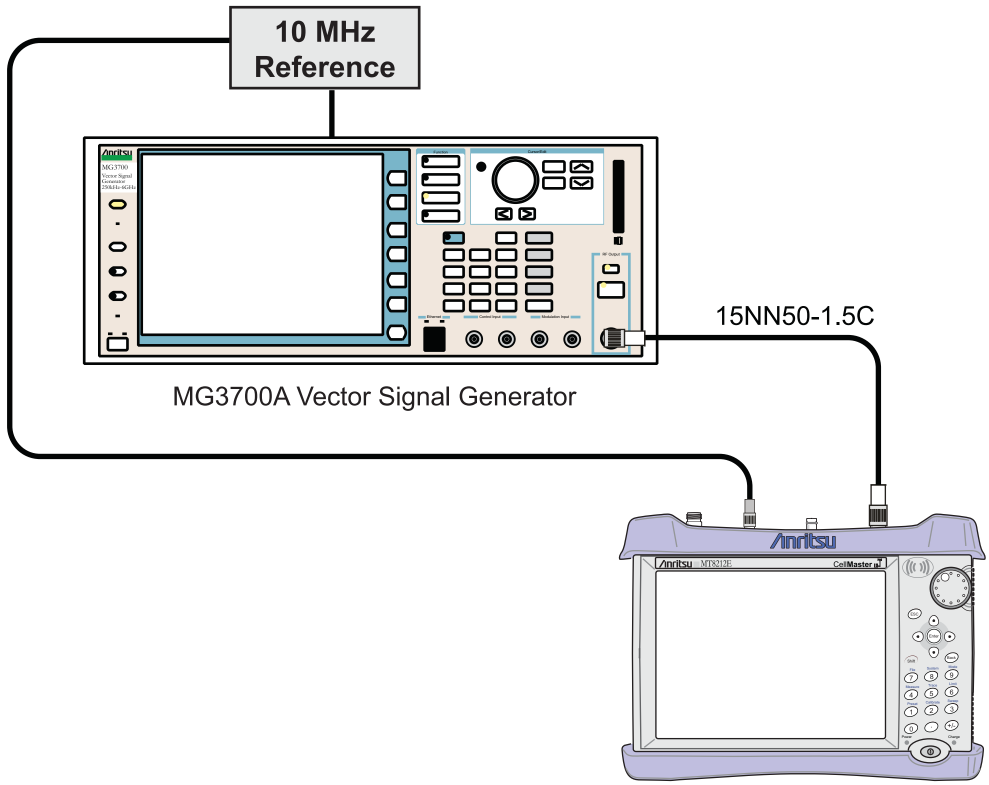



**Figure 5-14.** Frequency Accuracy and Residual MER Verification

### Procedure

1. Connect the 10 MHz External Reference signal into the MG3700A and Cell Master as shown in Figure 5-14.
2. On the MG3700A, press the yellow **Preset** key on the upper-left side of the instrument.
3. Press the **Down Arrow** key to select Yes.
4. Press the **Set** key (Note that two Set keys are available, and they both do the same thing).
5. Press the F1 soft key to select Load File to Memory.
6. Press the F1 soft key again to select Select Package.
7. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
8. Press the **Set** key.
9. Press the F6 (Return) soft key.
10. Press the **Set** key.
11. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
12. Press the **Set** key.
13. Use the **Down Arrow** key to step through the selection list until the DVB-T_H_00 option is highlighted.

14. Press the **Set** key.
15. Set the Level to –20 dBm.
16. Set the Frequency to 470 MHz.
17. Press the **Baseband** key and then the More key.
18. Press the F5 soft key labeled Pattern Combination [Defined].
19. Press the **Set** key.
20. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
21. Press the **Set** key.
22. Use the **Down Arrow** key to step through the selection list until the DVB-T_H_00 option is highlighted.
23. Press the **Set** key.
24. Rotate the knob to highlight Freq Offset and use the numeric keypad to enter 4 MHz.
25. Ensure that the **Mod On/Off** key and the **Output** key each have an illuminated LED.
26. Connect the MG3700A Output to the Cell Master RF In connector.
27. Set the mode of the Cell Master to **DVB-T/H Signal Analyzer** and preset the instrument.
28. Press the **Measurements** main menu key then the Modulation Analysis soft key and choose Composite View.
29. Press the **Amplitude** main menu key, and set the Reference Level to –20 dBm.
30. Press the **Frequency** main menu key then the Signal Standard soft key and choose Digital Terrestrial TV UHF (Europe). Ensure that Channel is set to 21.
31. Press the **Shift** key and the **Sweep** (3) key, and then press the Meas Mode soft key.
32. Use the **Up/Down Arrow** keys to highlight Moving Average and press the **Enter** key.
33. Press the Average Count soft key, then enter 10, and press the **Enter** key.
34. Wait until Average (10/10) appears at the top of the display.
35. Record the Frequency Offset reading on the Cell Master into the **"Frequency Error"** column in Table A-68, "Option 64, DVB-T/H Signal Analyzer, Frequency Accuracy for –20 dBm Reference Level" on page A-45.
36. Record the MER Total reading on the Cell Master in the **"Total MER"** column in Table A-70, "Option 64, DVB-T/H Signal Analyzer, Residual MER Pre Amp Off" on page A-45
37. Set the MG3700A Level to –50 dBm.
38. On the Cell Master turn On the Pre Amp by pressing the **Amplitude** main menu key and pressing the Pre Amp soft key. Set the Reference Level to –50 dBm.
39. Wait until Average (10/10) appears at the top of the display.
40. Record the Frequency Offset reading on the Cell Master into the **"Frequency Error"** column in Table A-69, "Option 64, DVB-T/H Signal Analyzer, Frequency Accuracy for –50 dBm Reference Level" on page A-45.
41. Record the MER Total reading on the Cell Master in the **"Total MER"** column in Table A-71, "Option 64, DVB-T/H Signal Analyzer, Residual MER Pre Amp On" on page A-45.
42. Set Cell Master Pre Amp to Off.
43. Set the MG3700A Frequency to 662 MHz and Level to –20 dBm.
44. Change the Cell Master to Channel 45, and set Reference Level to –20 dBm.
45. Repeat Step 34 through Step 41.
46. Set Cell Master Pre Amp to Off.

47. Set the MG3700A Frequency to 854 MHz and Level to –20 dBm.
48. Change the Cell Master to Channel 69 and set Reference Level to –20 dBm.
49. Repeat Step 34 through Step 41.

## Frequency Lock Range Verification

The test in this section can be used to verify the frequency lock range of the Cell Master in DVB-T/H Signal Analyzer mode.

### Equipment Required:

- Anritsu MG3700A Vector Signal Generator
- 10 MHz Frequency Reference
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C
- Anritsu PN 2000-1627-R Coaxial Cables (2)

### Procedure:

1. Connect the 10 MHz Frequency Reference source to the Anritsu MG3700A and Cell Master as shown in Figure 5-14 on page 5-77.
2. On the MG3700A, press the yellow **Preset** key located on the upper-left side of the instrument.
3. Press the **Down Arrow** key to select Yes.
4. Press the **Set** key (Note that two Set keys are available, and they both do the same thing.)
5. Press the F1 soft key to select Load file to Memory.
6. Press the F1 soft key again to select Select Package.
7. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
8. Press the **Set** key.
9. Press the F6 (Return) soft key.
10. Press the **Set** key.
11. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
12. Press the **Set** key.
13. Use the **Down Arrow** key to step through the selection list until the DVB-T_H_00 option is highlighted.
14. Press the **Set** key.
15. Set the Frequency to 474.09 MHz.
16. Set the Level to –20 dBm.
17. Ensure the **Mod On/Off** key and the **Output** key each have an illuminated LED.
18. Set the mode of the Cell Master to **DVB-T/H Signal Analyzer**. Press the **Shift** key, the **Preset** (1) key, and then press the Preset soft key to reset the Cell Master.
19. Connect the MG3700A output signal to the Spectrum Analyzer RF In connector on the Cell Master.
20. On the Cell Master, press the **Frequency** main menu key, then the Signal Standard soft key, choose Digital Terrestrial TV UHF (Europe), and ensure that Channel is set to 21.
21. Press the **Amplitude** main menu key and set the Reference Level to –20 dBm.
22. Press the **Measurements** main menu key, then Modulation Analysis, and press Composite View.
23. Press the **Shift** and **Sweep** (3) hard keys and then the Meas Mode soft key.

24. Use the rotary knob to highlight Moving Average and press the **Enter** key.

25. Press the Average Count soft key, then enter 10, and press the **Enter** key.

26. Wait until Average (10/10) appears at the top of the display.

27. Record the Frequency Error in the **"474.09 MHz"** row of Table A-72, "Option 64, DVB-T/H Signal Analyzer, Frequency Lock Range" on page A-46.

28. On the MG3700A, set the frequency to 473.91 MHz.

29. Press the **Execute Measure** main menu key. After Average (10/10) appears, record the Frequency Offset in the **"473.91 MHz"** row of Table A-72, "Option 64, DVB-T/H Signal Analyzer, Frequency Lock Range" on page A-46.

## Level Accuracy Verification

The tests in this section verify the level accuracy of the Cell Master in DVB-T/H Signal Analyzer mode.

### Equipment Required:

- Anritsu MG3700A Vector Signal Generator
- Power Meter, Anritsu Model ML2438A
- Programmable Attenuator, Anritsu Model MN63A
- RF Power Amplifier, Mini Circuits Model TIA-1000-1R8
- Power Sensor, Anritsu Model MA2482D (2)
- Power Splitter, Aeroflex/Weinschel Model 1870A
- Fixed Attenuator, Aeroflex/Weinschel Model 44-10
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C (3)
- Adapter, Anritsu Model 34NN50A
- Midwest Microwave ADT-2615-NF-BNM-02 Adapters (2)
- Anritsu 1N50C RF Limiter
- Anritsu PN 2000-1627-R Coaxial Cable

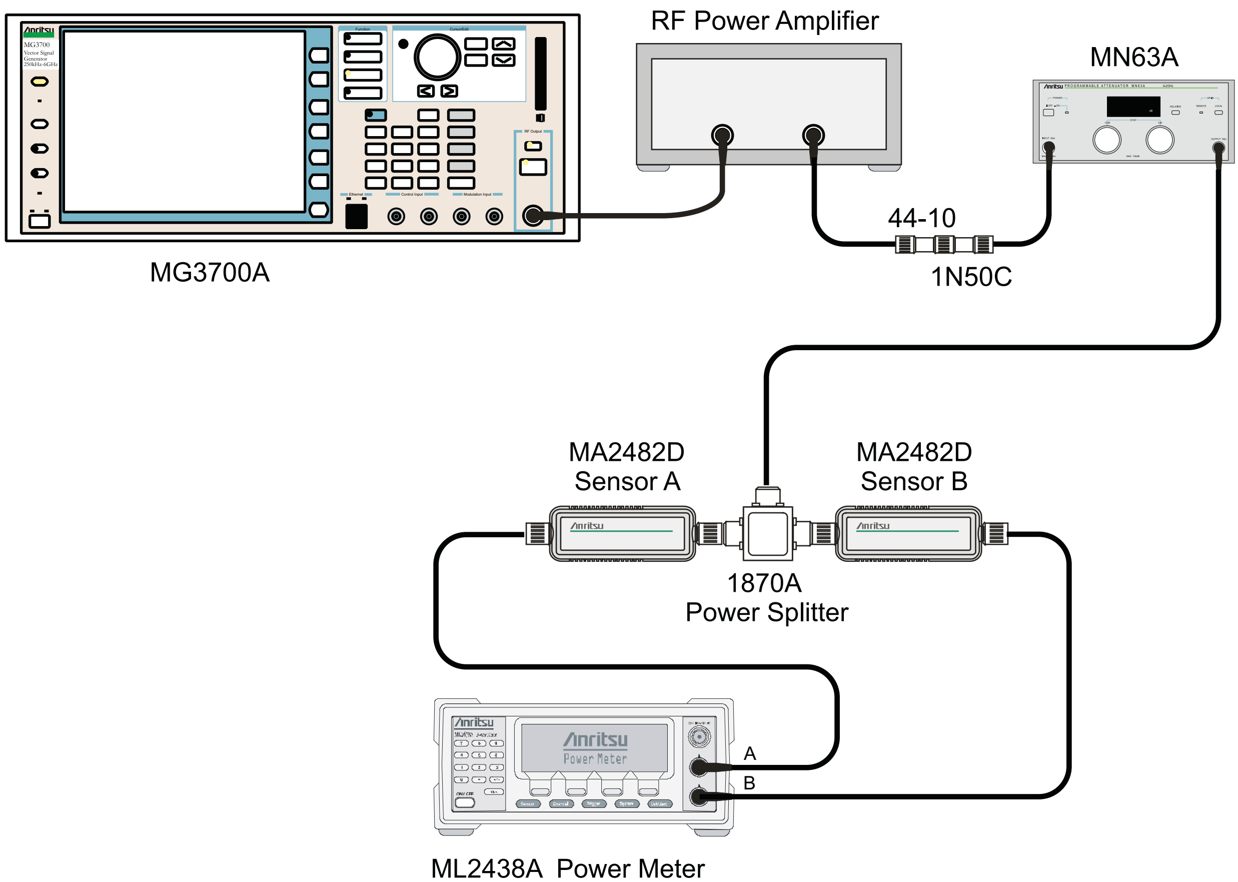



**Figure 5-15.** Level Accuracy Verification Setup

**Procedure:**

1. Ensure that the Power Amplifier is Off.
2. Connect the MG3700A Signal Generator, Power Amplifier with N(f)-to-BNC(m) adapters, RF Limiter, MN63A Programmable Attenuator, Power Divider, Power Meter, and Power Sensors as shown in Figure 5-15
3. On the MG3700A, press the yellow **Preset** key located on the upper-left side of the instrument.
4. Press the **Down Arrow** key to select Yes.
5. Press the **Set** key (Note that two **Set** keys are available, and they both do the same thing.)
6. Press the F1 soft key to select Load File to Memory.
7. Press the F1 soft key again to select Select Package.
8. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
9. Press the **Set** key.
10. Press the F6 (Return) soft key.
11. Press the **Set** key.
12. Use the **Down Arrow** key to step through the selection list until the Digital_Broadcast option is highlighted.
13. Press the **Set** key.

14. Use the **Down Arrow** key to step through the selection list until the DVB-T_H_00 option is highlighted.
15. Press the **Set** key.
16. Perform a Zero/Cal on Sensor A and Sensor B on the power meter. Set the calibration factor of both sensors to 474 MHz.
17. Set the MG3700A Frequency to 474 MHz.
18. Set the Level to –25 dBm.
19. Ensure that the **Mod On/Off** key and the **Output** key each have an illuminated LED.
20. Turn On the power amplifier and allow it to warm up for at least 5 minutes.
21. Adjust the MN63A Attenuator so that the Sensor A reading is –10 dBm ± 1 dBm. Record the actual attenuation reading in Table A-73, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Verification, –10" on page A-46
22. On the MG3700A, adjust the power level so that the Power Meter Sensor A reading is –10.0 dBm ± 0.2 dBm.
23. Record the following values to the appropriate table cells inTable A-73:

    Power Meter Sensor A reading to **"Sensor A Reading"**

    Power Meter Sensor B reading to **"Sensor B Reading"**
24. Subtract the value of the Sensor A reading from the value of the Sensor B reading and record the result to the **"DAB (–10)"** column of Table A-73
25. Calculate the **AT(set)** values for Test Levels –10 dBm through –45 dBm and record the values in the **"AT(set) (dB)"** column in Table A-75, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 21 at 474 MHz" on page A-47

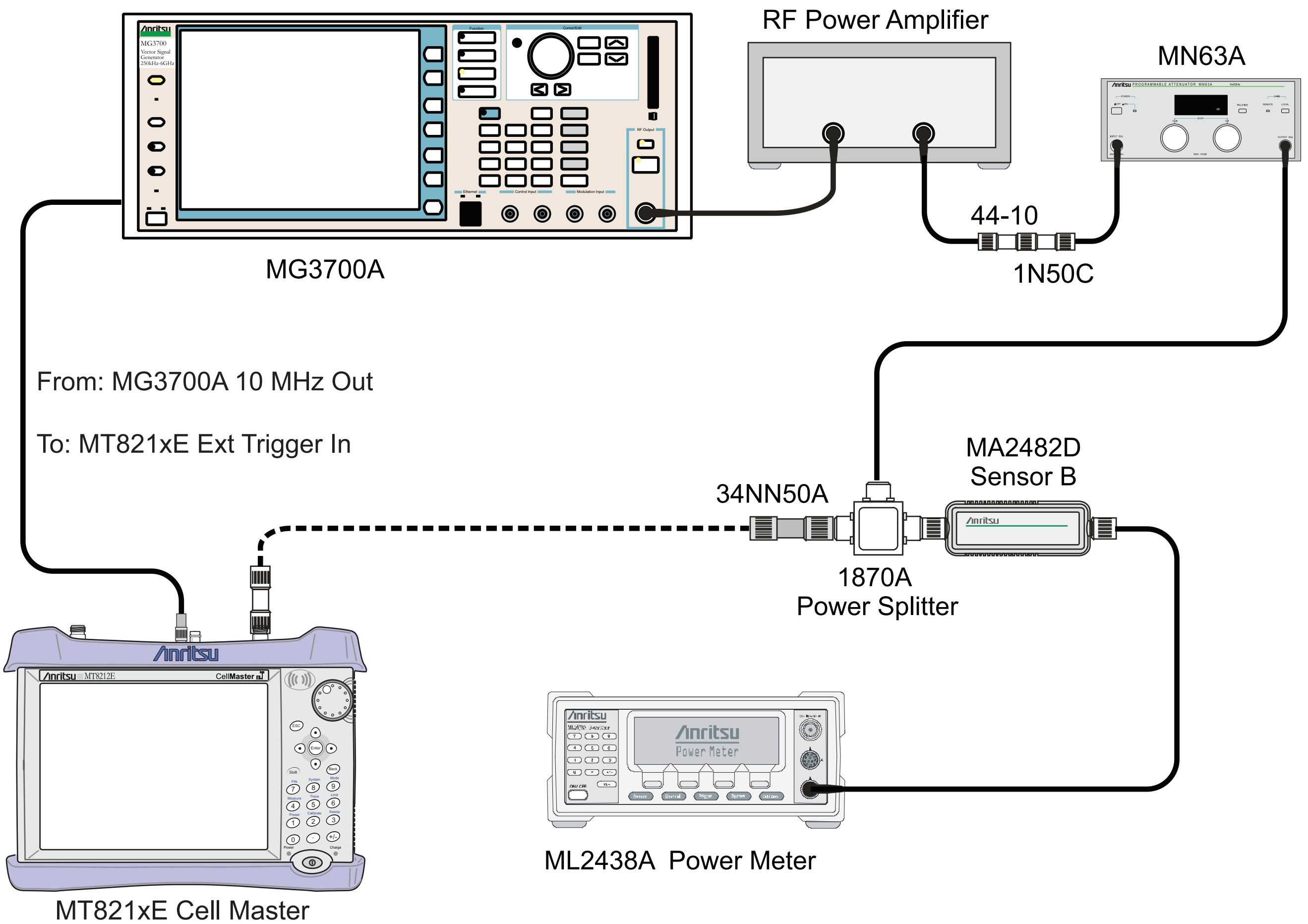



**Figure 5-16.** Level Accuracy Verification

26. Remove Sensor A from the Power Splitter, and then connect the Power Splitter to the Cell Master RF In port with the N(m)-to-N(m) adapter, as shown in Figure 5-16.
27. Record the new Power Meter Sensor B reading into the **"SB(–10)"** box in Table A-75, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 21 at 474 MHz" on page A-47.
28. On the Cell Master, set the mode to **DVB-T/H Signal Analyzer** and preset the instrument.
29. Press the **Frequency** main menu key, then the Signal Standard soft key and choose Digital Terrestrial TV UHF (Europe). Ensure that Channel 21 is selected and that the Pre Amp is Off.
30. Change the Reference Level to –10 dBm.
31. Press the **Shift** and **Sweep** (3) hard keys, then press Meas Mode.
32. Use the **Up/Down Arrow** keys to highlight Moving Average, and press the **Enter** key.
33. Change the Average Count to 50, if required.
34. After Average (50/50) appears at the top of the display, record the Channel Power from the Cell Master to the **"Pre Amp Off M(Level) (dBm)"** column in Table A-75.
35. Calculate the Deviation by using the following formula:

```
Deviation = M(Level) – SB(–10) – ΔAB(–10) – AT(–10) + AT(set)
```

| | |
|---|---|
| **Note** | Because AT(–10) is the same as AT(set), the value of [–AT(–10) + AT(set)] is equal to zero. |

36. Record the result in the **"Pre Amp Off Dev (dB)"** column in Table A-75 on page A-47, and verify that it is within specification.

37. Set the MN63A attenuation to the next **AT(set)** value in Table A-75.

38. Press the **Amplitude** main menu key and set the Reference Level of the Cell Master to –15 dBm.

39. After Average (50/50) appears, record the –15 dBm Channel Power from the Cell Master into the **"Pre Amp Off M(Level) (dBm)"** column in Table A-75

40. Calculate the Deviation by using the following formula:

```
Deviation = M(Level) – SB(–10) – ΔAB (–10) – AT(–10) + AT(set)
```

41. Record the result in the **"Pre Amp Off Dev (dB)"** column in Table A-75, and verify that it is within specification.

42. Set the MN63A attenuation to the next **AT(set)** value in Table A-75.

43. Set the Reference Level of the Cell Master to –20 dBm.

44. After Average (50/50) appears, record the –20 dBm Channel Power from the Cell Master into the **"Pre Amp Off M(Level) (dBm)"** column in Table A-75

45. Calculate the Deviation by using the following formula:

```
Deviation = M(Level) – SB(–10) – ΔAB (–10) – AT(–10) + AT(set)
```

46. Record the result in the **"Pre Amp Off Dev (dB)"** column in Table A-75, and verify that it is within specification.

47. Press the **Amplitude** main menu key and set Pre Amp to On. Change the Reference Level if required.

48. After Average (50/50) appears, record the –20 dBm Channel Power from the Cell Master into the **"Pre Amp On M(Level) (dBm)"** column in Table A-75.

49. Calculate the Deviation by using the following formula:

```
Deviation = M(Level) – SB(–10) – ΔAB (–10) – AT(–10) + AT(set)
```

50. Record the result in the **"Pre Amp On Dev (dB)"** column in Table A-75, and verify that it is within specification.

51. Repeat Step 42 through Step 50 for Test levels –25 dBm to –45 dBm. Change Reference Level and switch Pre Amp per the **"Ref Level Pre Amp Off/On"** column in Table A-75.

52. Turn Off the power amplifier, disconnect the power splitter from the Cell Master, and reconnect Sensor A to the power splitter as shown in Figure 5-15 on page 5-81.

53. Set the MN63A Attenuation to 10 dB.

54. Set the MG3700A Level to –60 dBm.

55. Turn On the power amplifier and allow it to warm up for at least 5 minutes.

56. Adjust the MN63A Attenuator so that the Sensor A reading is –50 dBm ± 1 dBm. Record the attenuation reading in Table A-75.

57. On the MG3700A, adjust the power level so that the Power Meter Sensor A reading is –50.0 dBm ± 0.2 dBm.

58. Record the following values to the appropriate columns in Table A-74, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Verification, –50" on page A-46:

    Power Meter Sensor A reading to the **"Sensor A Reading"** column

    Power Meter Sensor B reading to the **"Sensor B Reading"** column

59. Subtract the value of the Sensor A reading from the value of the Sensor B reading and record the result in the **"DAB(–50)"** column in Table A-74.

```
DAB(–50) = Sensor B Reading – Sensor A Reading
```

60. Calculate the **AT(set)** values for Test Levels –55 dBm through –84 dBm and record the values in the **AT(set)** column of Table A-75 on page A-47.
61. Remove Sensor A from the Power Splitter, and then connect the Power Splitter to the Cell Master RF In port with the N(m)-to-N(m) adapter, as shown in Figure 5-16 on page 5-83.
62. Record the new Power Meter Sensor B reading in the **"SB(–50)"** box in Table A-75.
63. Repeat Step 42 through Step 50 for Test Levels –50 dBm to –84 dBm. Change the Reference Level and switch the Pre Amp On or Off per the **"Ref Level Pre Amp Off/On"** column in Table A-75. Use the following formula to calculate Deviation:

    `Deviation = M(Level) – SB(–50) – ΔAB(–50) – AT(–50) + AT(set)`

64. Repeat Step 16 through Step 63 for frequencies 666 MHz (Ch 45) and 858 MHz (Ch 69). Set the calibration factor of both power sensors to 666 MHz or 858 MHz, as required.

    For 666 MHz - Channel 45, use Table A-76, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 45 at 666 MHz" on page A-48.

    For 858 MHz - Channel 69, use Table A-77, "Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 69 at 858 MHz" on page A-49.

## Displayed Average Noise Level (DANL) Verification

The tests in this section verify the DANL of the Cell Master in DVB-T/H Signal Analyzer mode.

### Equipment Required:

- 50 ohm termination, Anritsu Model 28N50-2
- Cell Master MT821xE

### Procedure:

1. Set the mode of the Cell Master to **DVB-T/H Analyzer** and preset the instrument.
2. Install a 50 ohm termination to the Cell Analyzer RF In connector.
3. Press the **Frequency** main menu key and choose a Signal Standard of Digital Terrestrial TV UHF (Europe). Ensure that the Channel is set to 21 and that Pre Amp is Off.
4. Press the **Shift** and **Sweep** (3) hard keys. Change Meas Mode to Moving Average, and leave Average Count set to 50.
5. Press the **Amplitude** main menu key and set the Reference Level to –25 dBm.
6. After Averages (50/50) appears at the top of the display, record the Channel Power into the **"Pre Amp Off"** row of Table A-78, "Option 64, DVB-T/H Signal Analyzer, DANL, Pre Amp Off" on page A-50.
7. Set the Pre Amp to **On**.
8. Set the Reference Level to –50 dBm.
9. After Averages (50/50) appears at the top of the display, record the Channel Power in Table A-79, "Option 64, DVB-T/H Signal Analyzer, DANL, Pre Amp On" on page A-50.
10. Change the channel to Channel 45. Set Pre Amp to Off and Reference Level to –25 dBm.
11. Repeat Step 5 through Step 9 for Channel 45.
12. Change the channel to Channel 69. Set Pre Amp to Off and Reference Level to –25 dBm.
13. Repeat Step 5 through Step 9 for Channel 69.

## BER Measurement Functional Check, Option 57 Only

This section provides the procedures to check the functionality of the BER measurement hardware that is included with Option 57 in the Cell Master Base Station Analyzer.

**Equipment Required:**

- Anritsu MG3700A Vector Signal Generator
- Power Meter, Anritsu Model ML2438A
- Anritsu MP8931A Bit Error Rate Tester
- Power Splitter, Aeroflex/Weinschel Model 1870A
- Power Sensor, Anritsu Model MA2482D
- Adapter, Anritsu Model 34NN50A
- RF Coaxial Cable, Anritsu Model 15NN50-1.5C
- RF Coaxial Cable, BNC-to-BNC, 75 ohm, Anritsu Model 3-806-169

### Setup

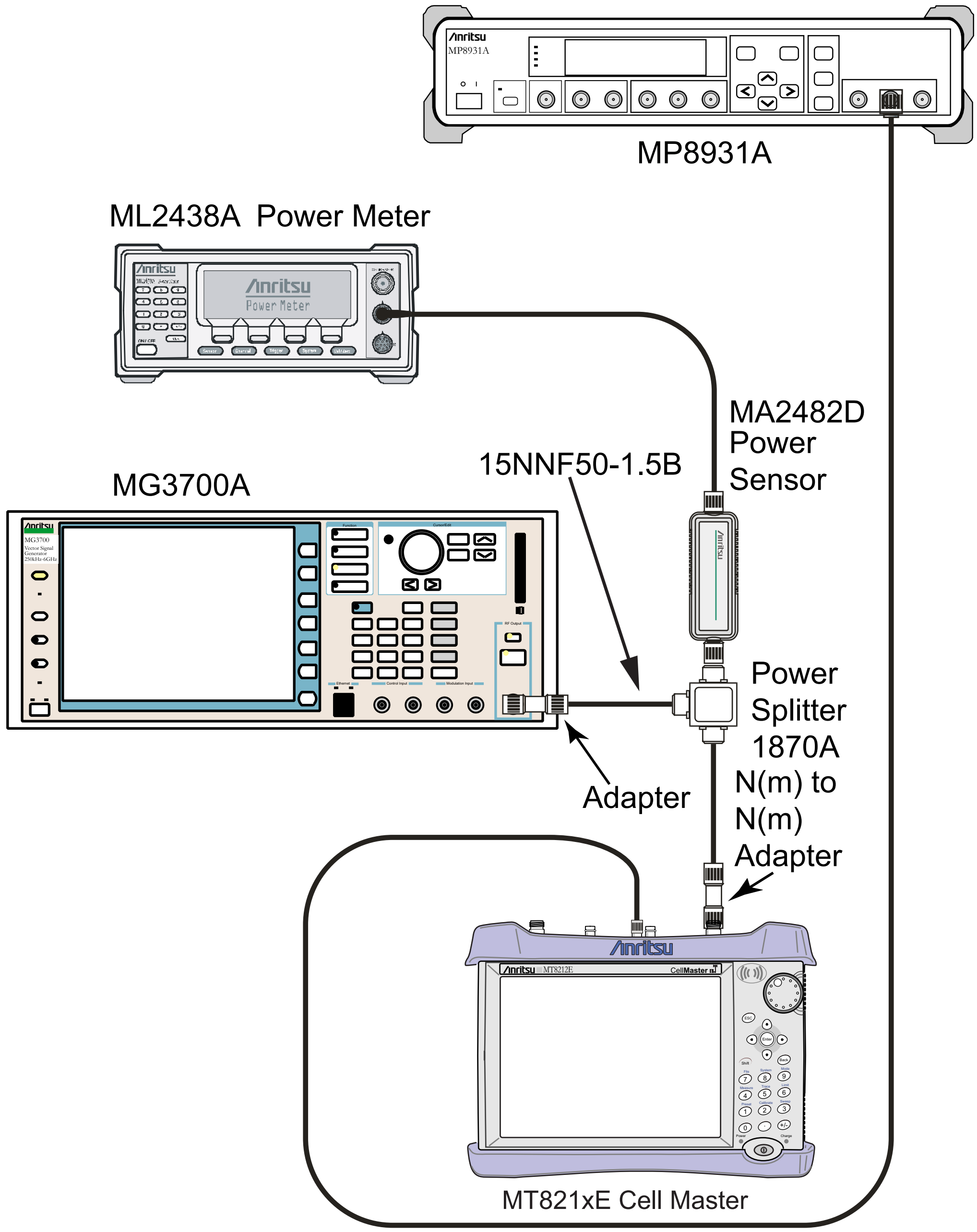



**Figure 5-17.** DVB-T/H BER, Option 57 – BER Functional Check Setup

**Procedure:**

1. Turn On the MG3700A, MP8931A, ML2438A, and the Cell Master.
2. Perform a Zero/Cal on Sensor A on the power meter. Set the calibration factor of the sensor to 474 MHz.
3. Connect the MG3700A Signal Generator, Power Splitter, Power Sensor, 34NN50A Adapter, Cell Master, and the MP8931A as shown in Figure 5-17.

| | |
|---|---|
| **Note** | Use a 75 ohm BNC cable to connect between the DVB-ASI Input connector of the MP8931A and the DVB-ASI Out connector of the Cell Master. |

4. On the MP8931A, press the **Menu** key.
5. Press the **Down Arrow** key until the triangle pointer is at **System*** on the display.
6. Press the **Right Arrow** key so that Initialize appears in the display.
7. Press the **Enter** key twice.
8. Pres the **Menu** key and then the **Up Arrow** or **Down Arrow** key until the triangle pointer is at Pattern.
9. Press the **Enter** key to select.
10. Press the **Up Arrow** or **Down Arrow** key until the triangle pointer is at ALL0 and then press the **Enter** key.
11. Press the **Down Arrow** key. The pointer should be at Interface. Then press **Enter** to select.
12. Press the **Right Arrow** key and then press the **Down Arrow** key until the pointer is at DVB-ASI. Press the **Enter** key to select.
13. Press the **Menu** key and then the **Up Arrow** or **Down Arrow** key until the triangle pointer is at DVB-ASI*. Press the **Right Arrow** key and confirm that the PKT is set to (1) + 187 + (16).
14. On the MG3700A, press the yellow **Preset** key located on the upper-left side of the instrument.
15. Press the **Down Arrow** key to select Yes.
16. Press the **Set** key (Note that two Set keys are available, and they both do the same thing).
17. Set the MG3700A Frequency to 470 MHz.
18. Press the **Baseband** key.
19. Press the **More** key, located at the bottom of the row.
20. Press the F5 Pattern Combination soft key as required until Edit appears.
21. Press the **More** key.
22. Press the F3 soft key so that Output B appears.
23. Press the **Baseband** key and then the F1 soft key.
24. Press the F2 soft key so that Memory A is highlighted.
25. Press the F1 key and use the **Down Arrow** key to highlight MS8911B-057_Inspection.
26. Press the **Set** key.
27. Use the **Arrow** key to highlight 8M_AWGNand press the **Set** key. If an Overwrite question appears, then answer Yes.
28. Press the F2 soft key so that Memory B is highlighted
29. Highlight 8M_8k_64QAM_2_3_ALL0 and press the **Set** key. If an Overwrite question appears, then answer Yes.
30. Press the F6 (Return) soft key.
31. Use the **Arrow** keys to highlight the blank line between Pattern:[ and the small green A memory symbol.
32. Press the **Set** key.
33. Ensure that MS8911B-057_Inspection is highlighted, and press the **Set** key.
34. Ensure that 8M_AWGN is highlighted, and press the **Set** key.
35. Use the **Arrow** keys to highlight the blank line between Pattern:[ and the small violet B memory symbol.
36. Press the **Set** key.
37. Ensure that MS8911B-057_Inspection is highlighted and press the **Set** key.
38. Ensure that 8M_8k_64QAM_2_3_ALL0 is highlighted and press the **Set** key.
39. Use the **Arrow** keys to highlight the Frequency Offset and enter 4 MHz.

40. Press the **MOD On/Off** and **Output** keys so that both LEDs are On (illuminated).
41. Adjust the Level so that the power meter reads –25.0 dBm ± 0.2 dB.
42. Set the Cell Master to **DVB-T/H Signal Analyzer** mode and preset the instrument.
43. Press the **Frequency** main menu key, then press Signal Standard and select Digital Terrestrial TV UHF (Europe).
44. Ensure that the Channel is set to 21, change the Reference Level to –25 dBm, and Pre Amp is set to Off.
45. Press the **Measurements** main menu key, then press BER. Verify that the Moving Avg value of the MER(quick) [dB] is > 27 dB.
46. On the MP8931A, press the **Start/Stop** key and verify that 0e–9 is displayed. This verifies that the DVB ASI Out is functioning properly.

# 5-17 DVB-T/H SFN Verification, Option 78

## Introduction

The tests in this section verify the performance of the optional DVB-T/H SFN Analyzer option of the MT821xE. These tests include:

- "Level Accuracy Verification" on page 5-20
- "Displayed Average Noise Level (DANL) Verification" on page 5-24

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensors (2)
- Anritsu 34NN50A Adapter
- Anritsu 15NNF50-1.5C RF Coaxial Cables
- Aeroflex/Weinschel 1870A Power Splitter
- Anritsu 28N50-2 50 Ohm Terminator
- Anritsu PN 2000-1627-R Coaxial Cables (2)

## Level Accuracy Verification

The tests in this section verify the level accuracy of the MT821xE in DVB-T/H SFN Signal Analyzer mode.

### Setup

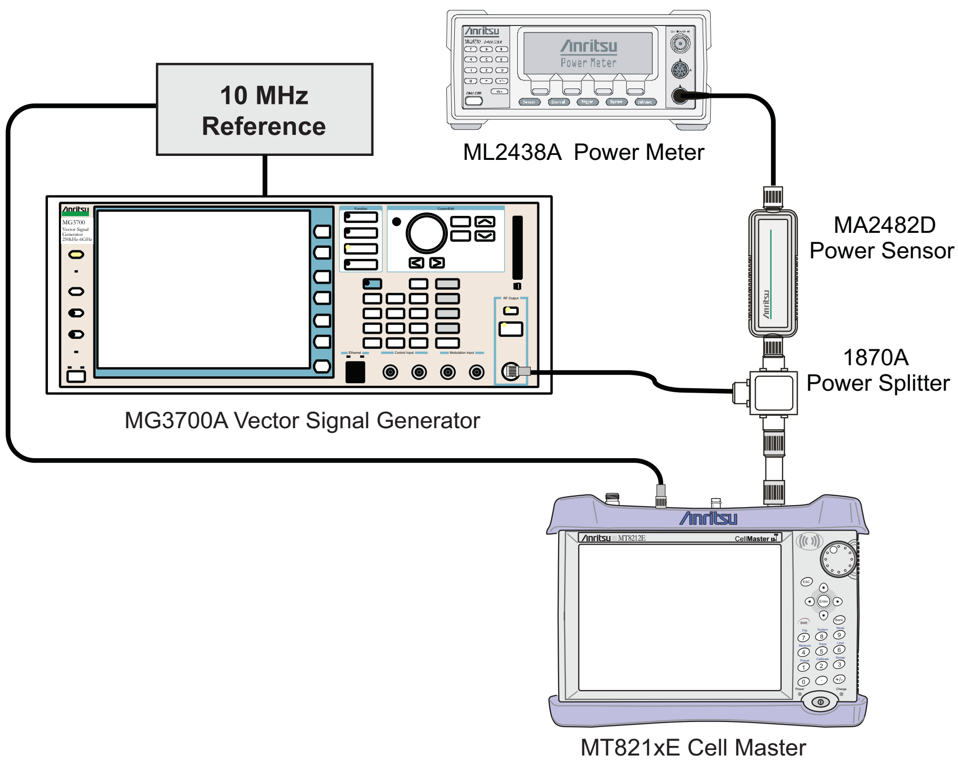



**Figure 5-18.** DVB-T/H SFN Level Accuracy Setup

### Procedure

1. Perform a Zero/Cal on Sensor B of the power meter. Set the calibration factor of the sensor to 474 MHz.
2. Connect the MG3700A Signal Generator, Power Splitter, Power Meter, and Power Sensors as shown in Figure 5-18.
3. On the MG3700A, press the **Preset** key (Yellow key on the upper left-hand side).
4. Press the **Down Arrow** key to select Yes.
5. Press the **Set** key.

| | |
|---|---|
| **Note** | The MG3700A has two **Set** keys, and they both have the same function. |

6. Press the (F1) soft key to select **"Load File to Memory"**.
7. Press the (F1) soft key again to select **"Select Package"**.
8. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
9. Press the **Set** key.

10. Press the F6 (Return) soft key.
11. Press the **Set** key.
12. Using the **Down Arrow** key, step through the selection list until the **"Digital_Broadcast"** option is highlighted.
13. Press the **Set** key.
14. Using the **Down Arrow** key, step through the selection list until the **"DVB-T_H_00"** option is highlighted.
15. Press the **Set** key.
16. Set the MG3700A frequency to 474 MHz.
17. Confirm that the **Modulation On/Off** key and the **Output** key both have LEDs On.
18. On the MT821xE, set the mode to **DVB-T/H SFN Analyzer** and preset the instrument.
19. Press the **Setup** main menu key, and change the Meas Mode to Continuous.
20. Press the **Frequency** main menu key and set the Center Frequency to 474 MHz.
21. Set the level on the MG3700A so Sensor B reads –10 dBm +/- 0.2 dBm.
22. Press the **Amplitude** main menu key and set the Reference Level to –10 dBm and ensure Pre Amp is Off.
23. After the Measuring percentage gets to 100%, record the Channel Power from the MT821xE into the **Measured Level** column under **Pre Amp Off** in Table A-80.
24. Repeat steps 21 through 23 for the other test levels in Table A-80 for Pre Amp Off.
25. Press the **Amplitude** main menu key and turn the Pre Amp On.
26. Set the Reference Level to –10 dB.
27. Set the level on the MG3700A so Sensor B reads –10 dBm +/- 0.2 dBm.
28. After the Measuring percentage gets to 100%, record the Channel Power from the MT821xE into the **Measured Level** column under **Pre Amp On** in Table A-80.
29. Repeat steps 26 through 28 for the other test levels in Table A-80 for Pre Amp On.
30. Repeat steps 1 through 29 for frequency 666 MHz and record results in Table A-81.
31. Repeat steps 1 through 29 for frequency 858 MHz and record results in Table A-82.

## Displayed Average Noise Level (DANL) Verification

The tests in this section verify the DANL of the MT821xE in DVB-T/H SFN Signal Analyzer mode.

### Procedure

1. Set the mode of the MT821xE to **DVB-T/H SFN Signal Analyzer** and preset the instrument.
2. Install a 50 ohm termination to the Spectrum Analyzer RF In connector.
3. Confirm that the Pre Amp is Off.
4. Set the Reference Level to –25 dBm.
5. Press the **Setup** main menu key. Change Meas Mode to Continuous.
6. After Measuring percentage gets to 100%, record the Channel Power in Table A-83, “Option 78, DVB-T/H SFN Analyzer DANL with Pre Amp Off” on page A-51.
7. Repeat for the other frequencies in Table A-83.
8. Set the Reference Level to –50 dBm and the Pre Amp to On.
9. Set the Frequency to 474 MHz.
10. After Average (50/50) appears, record the Channel Power in Table A-84, “Option 78, DVB-T/H SFN Analyzer DANL with Pre Amp On” on page A-51.
11. Repeat for the other frequencies in Table A-84.

# 5-18 Mobile WiMAX Signal Analyzer Verification, Options 66 and 67

## Option 66, Option 67, or Both

The tests in this section verify the functionality of the Mobile WiMAX Signal Analyzer of the MT821xE. The tests are as follows:

- "Mobile WiMAX Channel Power Accuracy Tests (Option 66)"
- "Mobile WiMAX Residual EVM and Frequency Error Tests (Option 67)" on page 5-97

### Mobile WiMAX Channel Power Accuracy Tests (Option 66)

The tests in this section verify the function of the optional Mobile WiMAX Signal Analyzer in Model MT821xE Cell Master.

#### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- 10 MHz Reference Standard
- Anritsu PN 2000-1627-R Coaxial Cables (2)

### Setup

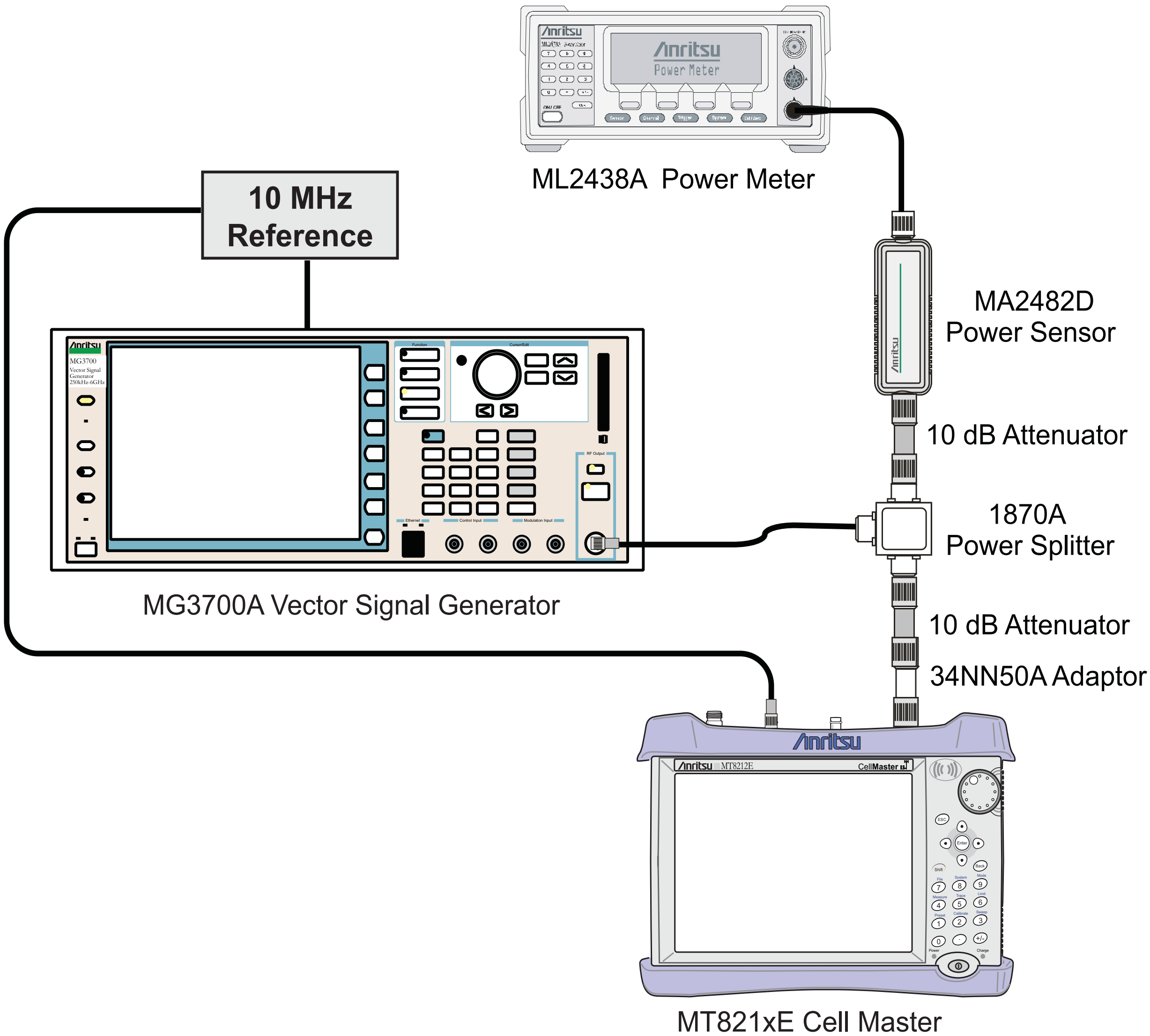



**Figure 5-19.** Mobile WiMAX Signal Analyzer Option Verification

### Procedure

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the Power Meter Measurement MODE to True RMS, set Averaging MODE to Moving, and set Averaging NUMBER to 256.
3. Set the calibration factor frequency of the power sensor to 2600.5 MHz.
4. Connect the equipment as shown in Figure 5-19.

### Channel Power Accuracy (10 MHz Bandwidth and 10 ms Frame Length)

5. Set the MG3700A as follows:
   a. Press the yellow **Preset** button (answer Yes to the question).
   b. Press the **Set** key
   c. Press the (F1) soft key to select Load File to Memory.
   d. Press the (F1) soft key again to select Select Package.

e. Using the **Down Arrow** key, step through the selection list until “mWiMax” is highlighted.

f. Press the **Set** key.

g. Press the F6 (Return) soft key.

h. Press the **Set** key. The Select Package list box appears. Again select mWiMax and press **Set**.

i. Another file list appears. Select (highlight) 10m1024g8_0_10_cap.

j. Press the **Set** key.

k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.

l. Press the **Frequency** key, then enter 2600.5 MHz.

m. Press the **Level** key, then enter 2 dBm. Turn the output On.

6. Adjust the MG3700A level setting with the knob so that the power meter reads –15.0 dBm ± 0.2 dB.
7. Set the MT821xE to **Mobile WiMax Signal Analyzer** mode and preset the instrument.
8. Set the MT821xE as follows:

a. Press the **Freq** main menu key and set the Center Freq to 2600.5 MHz.

b. Press the **Setup** main menu key and set the Bandwidth to 10 MHz.

c. Press the Frame Length submenu key and set the Frame Length to 10 ms.

d. Press the **Measurements** main menu key and press RF Measurements, then press Power vs Time.

9. Record the MT821xE Channel Power (RSSI) reading in the **Measured Channel Power (RSSI)** column, **2600.5 MHz, –15 dBm** row of Table A-85, “Option 66, Mobile WiMAX Channel Power Accuracy (10 MHz Bandwidth and 10 ms Frame Length)”.
10. Calculate the Channel Power Error by subtracting the MT821xE “Channel Power (RSSI)” reading from the power meter reading in Step 6. Record the result into the test record in the **Error** column, **2600.5 MHz, –15 dBm** row of Table A-85.
11. Verify that the error is within specification.
12. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.2 dB.
13. Record the MT821xE Channel Power (RSSI) reading in the **2600.5 MHz, –50 dBm** row of Table A-85.
14. Calculate the Channel Power Error by subtracting the MT821xE “Channel Power (RSSI)” reading from the power meter reading that was recorded in Step 13. Record the result in Table A-85.
15. Verify that the error is within specification.
16. Set the calibration factor frequency of the power sensor to 3600.5 MHz.
17. Set the MG3700A frequency to 3600.5 MHz.
18. Change the MT821xE center frequency to 3600.5 MHz.
19. Measure the Channel Power (RSSI) for both –15 dBm and – 50 dBm and then record the measured result and calculated error in Table A-85.
20. Verify that the error is within specification.

### Channel Power Accuracy (5 MHz Bandwidth and 5 ms Frame Length)

21. Set the MG3700A as follows:

a. Press the yellow **Preset** button (answer Yes to the question).

b. Press the **Set** key

c. Press the (F1) soft key to select Load File to Memory.

d. Press the (F1) soft key again to select Select Package.

e. Using the **Down Arrow** key, step through the selection list until mWiMax is highlighted.

f. Press the **Set** key.

g. Press the F6 (Return) soft key.

h. Press the **Set** key. The Select Package list box appears. Again select mWiMax and press **Set**.

i. Another file list appears. Select (highlight) 5m512g8_2_5_cap.

j. Press the **Set** key.

k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.

l. Press the **Frequency** key, then enter 2600.5 MHz.

m. Press the **Level** key, then enter 2 dBm. Turn the output On.

22. Set the calibration factor frequency of the power sensor to 2600.5 MHz.

23. Adjust the MG3700A level setting with the knob so that the power meter reads –15.0 dBm ± 0.2 dB.

24. Set the MT821xE to **Mobile WiMax Signal Analyzer** mode and preset the instrument.

25. Set the MT821xE as follows:

a. Press the **Freq** main menu key and set the Center Frequency to 2600.5 MHz.

b. Press the **Setup** main menu key and set the Bandwidth to 5 MHz.

c. Press the Frame Length submenu key and set the Frame Length to 5 ms.

d. Press the **Measurements** main menu key and press RF Measurements, then press Power vs Time.

26. Repeat Step 9 through Step 20, recording the results into the test record in Table A-86, “Option 66, Mobile WiMAX Channel Power Accuracy (5 MHz Bandwidth and 5 ms Frame Length)”.

## Mobile WiMAX Residual EVM and Frequency Error Tests (Option 67)

The tests in this section verify the function of the optional Mobile WiMAX Signal Analyzer in Model MT821xE Cell Master.

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

### Setup

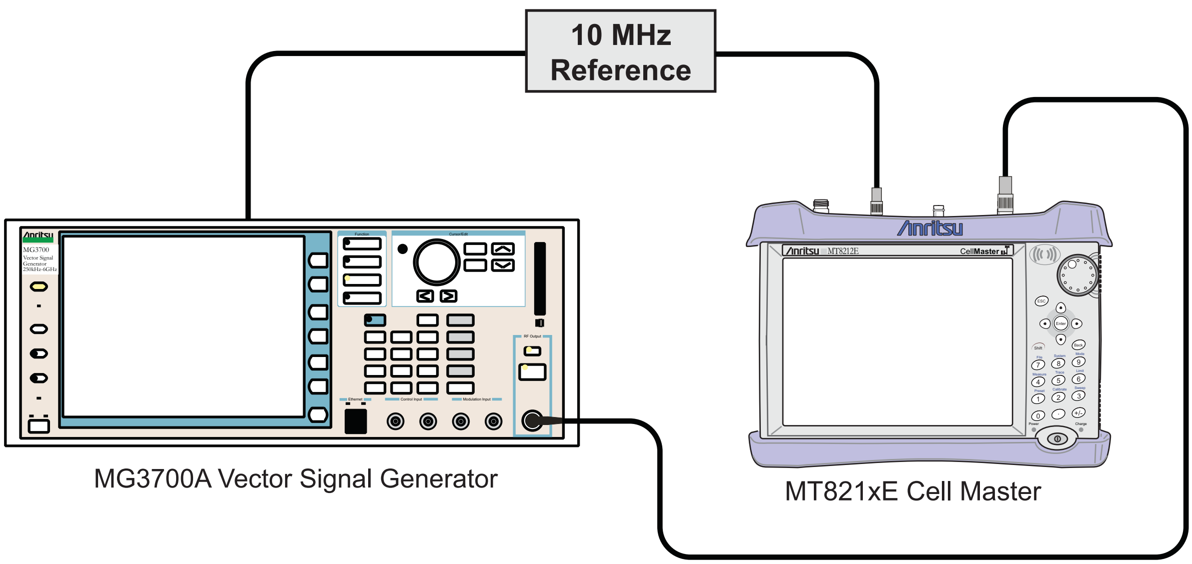



**Figure 5-20.** Mobile WiMAX Residual EVM and Frequency Error Test Setup

### Procedure

1. Connect the equipment as shown in Figure 5-20.

### Residual EVM and Frequency Error (10 MHz Bandwidth and 10 ms Frame Length)

2. Set the MG3700A as follows:
   a. Press the yellow **Preset** button (answer Yes to the question).
   b. Press the **Set** key
   c. Press the (F1) soft key to select Load File to Memory.
   d. Press the (F1) soft key again to select Select Package.
   e. Using the **Down Arrow** key, step through the selection list until mWiMax is highlighted.
   f. Press the **Set** key.
   g. Press the F6 (Return) soft key.
   h. Press the **Set** key. The Select Package list box appears. Again select mWiMax and press Set.
   i. Another file list appears. Select (highlight) 10m1024g8_0_10_cap.
   j. Press the **Set** key.

   k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.

   l. Press the **Frequency** key, then enter 2600.5 MHz.

   m. Press the **Level** key, then enter –15 dBm. Turn the output On.

3. Set the MT821xE to **Mobile WiMax Signal Analyzer** mode and preset the instrument.
4. Set the MT821xE as follows:

   a. Press the **Freq** main menu key and set the Center Frequency to 2600.5 MHz.

   b. Press the **Setup** main menu key and set the Bandwidth to 10 MHz.

   c. In the **Setup** menu, verify that the CP Ratio is set to 1/8.

   d. Press the Frame Length submenu key and set the Frame Length to 10 ms.

   e. Press the Demod submenu key and set Demod to FCH.

   f. Press the **Measurements** main menu key and press Demodulator, then press Modulation Summary.

5. Record the MT821xE EVM (rms) reading in the **2600.5 MHz, –15 dBm** row of Table A-87, “Option 67, Mobile WiMAX Residual EVM (10 MHz Bandwidth and 10 ms Frame Length)”.
6. Verify that the measured EVM is within specification.
7. Set the MG3700A level to –50.0 dBm.
8. Record the MT821xE EVM (rms) reading in the **2600.5 MHz, –50 dBm** row of Table A-87.
9. Verify that the measured EVM is within specification.
10. On the MT821xE, press the **Setup** main menu key and set Demod to Auto.
11. Record the MT821xE Frequency Error reading in the 2600.5 MHz, –50 dBm row of Table A-88, “Option 67, Mobile WiMAX Frequency Error (10 MHz Bandwidth and 10 ms Frame Length)”.
12. Verify that the measured Frequency Error is within specification.
13. Set the MG3700A frequency to 3600.5 MHz.
14. On the MT821xE, change the Center Frequency to 3600.5 MHz.
15. Press the **Setup** main menu key and set Demod to FCH.
16. Measure the EVM (rms) for both –15 dBm and –50 dBm and then record the measured results in Table A-87.
17. Verify that the measured EVM is within specification.
18. Repeat Step 10 through Step 12 to measure the Frequency Error at –50 dBm, and record the results in Table A-88.

### Residual EVM and Frequency Error (5 MHz Bandwidth and 5 ms Frame Length)

**19.** Set the MG3700A as follows:

  **a.** Press the yellow **Preset** button (answer Yes to the question).

  **b.** Press the **Set** key

  **c.** Press the (F1) soft key to select Load File to Memory.

  **d.** Press the (F1) soft key again to select Select Package.

  **e.** Using the **Down Arrow** key, step through the selection list until “mWiMax” is highlighted.

  **f.** Press the **Set** key.

  **g.** Press the F6 (Return) soft key.

  **h.** Press the **Set** key. The Select Package list box appears. Again select mWiMax and press **Set**.

  **i.** Another file list appears. Select (highlight) 5m512g8_2_5_cap.

  **j.** Press the **Set** key.

  **k.** Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.

  **l.** Press the **Frequency** key, then enter 2600.5 MHz.

**20.** Press the **Level** key, then enter –15 dBm. Turn the output On.

**21.** Set the MT821xE as follows:

  **a.** Press the **Freq** main menu key and set the Center Frequency to 2600.5 MHz

  **b.** Press the **Setup** main menu key and set the Bandwidth to 5 MHz.

  **c.** In the **Setup** menu, verify that the CP Ratio is set to 1/8.

  **d.** Press the Frame Length submenu key and set the Frame Length to 5 ms.

  **e.** Press the Demod submenu key and set Demod to FCH.

**22.** Press the **Measurements** main menu key and press Demodulator, then press Modulation Summary.

**23.** Record the MT821xE EVM (rms) in Table A-89, “Option 67, Mobile WiMAX Residual EVM (5 MHz Bandwidth and 5 ms Frame Length)” and the Frequency Error readings in Table A-90, “Option 67, Mobile WiMAX Frequency Error (5 MHz Bandwidth and 5 ms Frame Length)”.

**24.** Repeat Step 19 through Step 22, using the differenct frequencies and power levels within Table A-89 and Table A-90.

# 5-19 LTE Signal Analyzer Verification, Options 541 and 542

# Option 541, Option 542, or Both

The tests in this section verify the functionality of the LTE Signal Analyzer of the MT821xE Cell Master. There are tests for the following:

- "LTE Channel Power Accuracy Tests (Option 541)" on page 5-101
- "LTE Frequency Error Tests (Option 542)" on page 5-103

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

**Procedure**

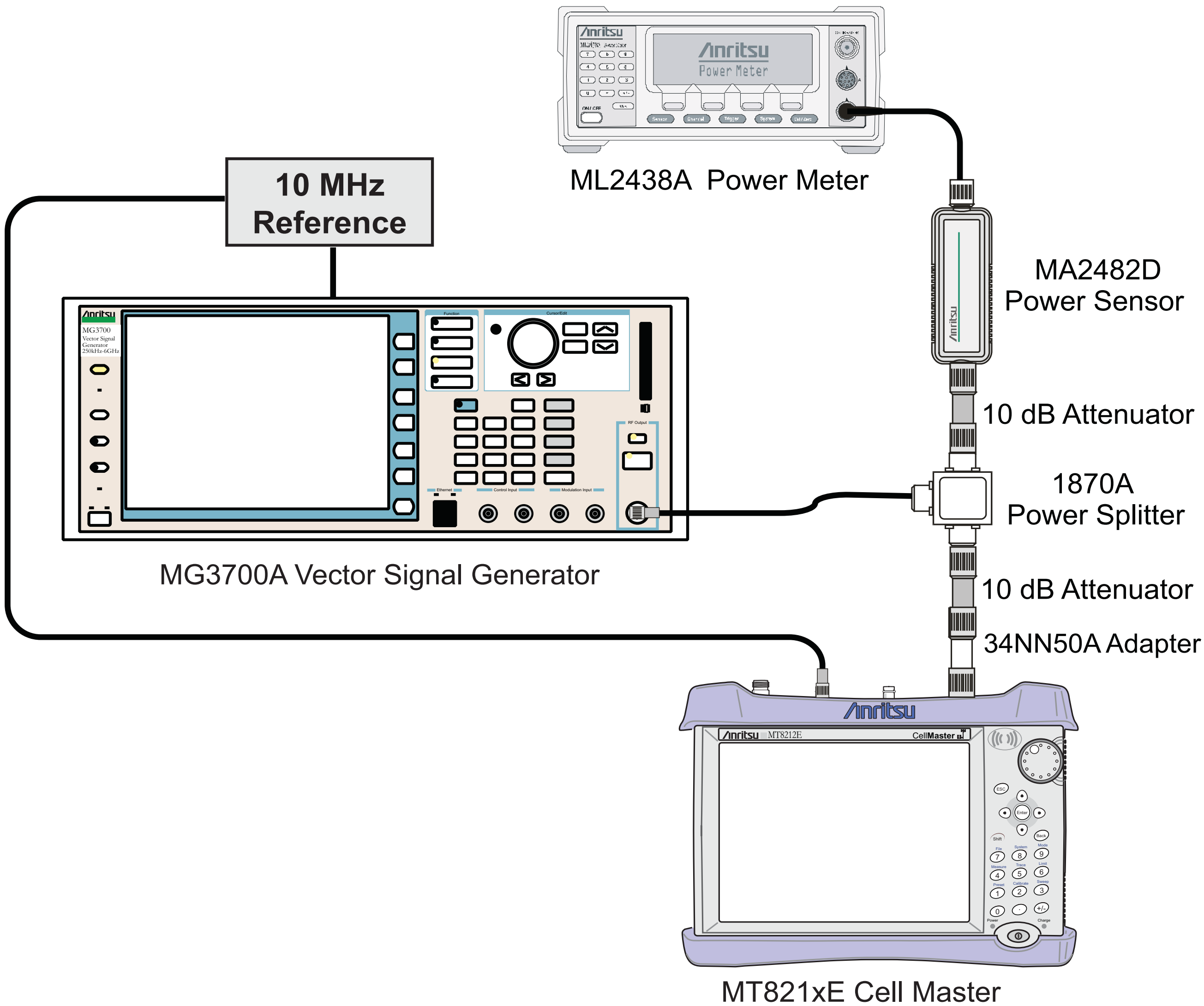



**Figure 5-21.** LTE Signal Analyzer Option Verification

## LTE Channel Power Accuracy Tests (Option 541)

The tests in this section verify the function of the optional LTE Signal Analyzer in Model MT821xE Cell Master..

| **Note** | The LTE pattern requires a Waveform Data license MX370108A that must be purchased. |
|---|---|

**Procedure**

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the Power Meter Measurement MODE to True RMS, set Averaging MODE to Moving, and set Averaging NUMBER to 256.
3. Set the calibration factor frequency of the power sensor to 750 MHz.
4. Connect the equipment as shown in Figure 5-21
5. Set the MG3700A as follows:

a. Press the yellow **Preset** button (answer yes to the question).

b. Press the **Set** key. .

| | |
|---|---|
| **Note** | Both **Set** keys on the MG3700A perform the same function. |

c. Press the (F1) soft key to select Load File to Memory.

d. Press the (F1) soft key again to select Select Package.

e. Using the **Down Arrow** key, step through the selection list until "LTE_DL_E-TM" is highlighted.

f. Press the **Set** key.

g. Press the F6 (Return) soft key.

h. Press the **Set** key. The Select Package list box appears. Again select LTE_DL_E-TM and then press the **Set** key.

i. Another file list appears. Select (highlight) E-TM_1-1_10M.

j. Press the **Set** key.

k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the "playing" indicator is displaying the moving pattern.

l. Press the **Frequency** key, then enter 750 MHz.

m. Press the **Level** key, then enter –3 dBm.

n. Turn the output On.

6. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.

7. Set the MT821xE to **LTE Signal Analyzer** mode and preset the instrument.

8. Set the MT821xE as follows:

a. Press the **Freq** main menu key and set the Center Frequency to 750 MHz.

b. Press the **Measurements** main menu key and press RF, then press Channel Spectrum.

9. Record the MT821xE Channel Power reading in the **750 MHz, –20 dBm** row, **Measured Channel Power** column of Table A-91, "Option 541, LTE Channel Power Accuracy" on page A-54.

10. Calculate the Channel Power Error by subtracting the MT821xE "Channel Power" reading from the power meter reading in Step 6. Record the result in the **750 MHz, –20 dBm** row, **Error** column of Table A-91.

11. Verify that the error is within specification.

12. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.

13. Record the MT821xE Channel Power reading in the **750 MHz, –50 dBm** row, **Measured Channel Power** column of Table A-91.

14. Calculate the Channel Power Error by subtracting the MT821xE "Channel Power" reading from the power meter reading that was recorded in Step 13. Record the result in the **750 MHz, –50 dBm** row, **Error** column of Table A-91.

15. Verify that the error is within specification.

16. Set the calibration factor frequency of the power sensor to 2150 MHz.

17. Set the MG3700A frequency to 2150 MHz. Press the **Set** key.

18. Change the MT821xE center frequency to 2150 MHz.

19. Measure the Channel Power for –20 dBm and –50 dBm and then record the measured result in the **Measured Channel Power** column and the calculated error in the **Error** column of Table A-91.

20. Verify that the error is within specification.

21. For units with 20 MHz IF BW Available, which can be seen within the System Status window, repeat Step 3 through Step 20 using the 20 MHz pattern, E-TM_1-1_20M.

## LTE Frequency Error Tests (Option 542)

The tests in this section verify the function of the optional LTE Signal Analyzer in Model MT821xE Cell Master.

| | |
|---|---|
| **Note** | The LTE pattern requires a Waveform Data license MX370108A that must be purchased. |

### Procedure

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the Power Meter Measurement MODE to True RMS, set Averaging MODE to Moving, and set Averaging NUMBER to 256.
3. Set the calibration factor frequency of the power sensor to 750 MHz.
4. Connect the equipment as shown in Figure 5-21.
5. Set the MG3700A as follows:
   a. Press the yellow **Preset** button (answer yes to the question).
   b. Press the **Set** key.

| | |
|---|---|
| **Note** | Both **Set** keys on the MG3700A perform the same function. |

   c. Press the (F1) soft key to select Load File to Memory.
   d. Press the (F1) soft key again to select Select Package.
   e. Using the **Down Arrow** key, step through the selection list until LTE_DL_E-TM is highlighted.
   f. Press the **Set** key.
   g. Press the F6 (Return) soft key.
   h. Press the **Set** key. The Select Package list box appears. Again select LTE_DL_E-TM and press **Set**.
   i. Another file list appears. Select (highlight) E-TM_3-1_10M.
   j. Press the **Set** key.
   k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.
   l. Press the **Frequency** key, then enter 750 MHz.
   m. Press the **Level** key, then enter –3 dBm.
   n. Turn the output On.
6. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.
7. Set the MT821xE to **LTE Signal Analyzer** mode and preset the instrument.
8. Set the MT821xE as follows:
   a. Press the **Freq** main menu key and set the Center Frequency to 750 MHz.
   b. Press the **Measurements** main menu key and press Modulation.
   c. Press the Constellation submenu key.
9. Record the MT821xE Frequency Error reading in the **750 MHz, –20 dBm** section of Table A-92, “Option 542, Frequency Accuracy” on page A-55.
10. Verify that the value is within specification.

11. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.
12. Record the MT821xE Frequency Error reading into the **750 MHz, –50 dBm** section of Table A-92.
13. Verify that the value is within specification.
14. Set the calibration factor frequency of the power sensor to 2150 MHz.
15. Set the MG3700A frequency to 2150 MHz. Press the **Set** key.
16. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.
17. Change the MT821xE center frequency to 2150 MHz.
18. Record the MT821xE Frequency Error reading into the **2150 MHz, –20 dBm** section of Table A-92.
19. Verify that the value is within specification.
20. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.
21. Record the MT821xE Frequency Error reading in the **2150 MHz, –50 dBm** section of Table A-92.
22. Verify that the value is within specification.
23. For units with 20 MHz IF BW Available, which can be seen within the System Status window, repeat Step 3 through Step 22 using the 20 MHz pattern, E-TM_3-1_20M.

# 5-20 TD-LTE Signal Analyzer Verification, Options 551 and 552

## Option 551, Option 552, or Both

The tests in this section verify the functionality of the TD-LTE Signal Analyzer of the MT821xE Cell Master. There are tests for the following:

- "TD-LTE Channel Power Accuracy Tests (Option 551)" on page 5-106
- "TD-LTE Frequency Error Tests (Option 552)" on page 5-108

### Equipment Required

- Anritsu MG3700A Vector Signal Generator
- Anritsu ML2438A Power Meter
- Anritsu MA2482D Power Sensor
- Anritsu 34NN50A Adapter
- Anritsu 15NN50-1.5C RF Coaxial Cable
- Aeroflex/Weinschel 1870A Power Splitter
- Aeroflex/Weinschel 44-10 10 dB Fixed Attenuator (2)
- Anritsu PN 2000-1627-R Coaxial Cables (2)
- 10 MHz Reference Standard

**Procedure**

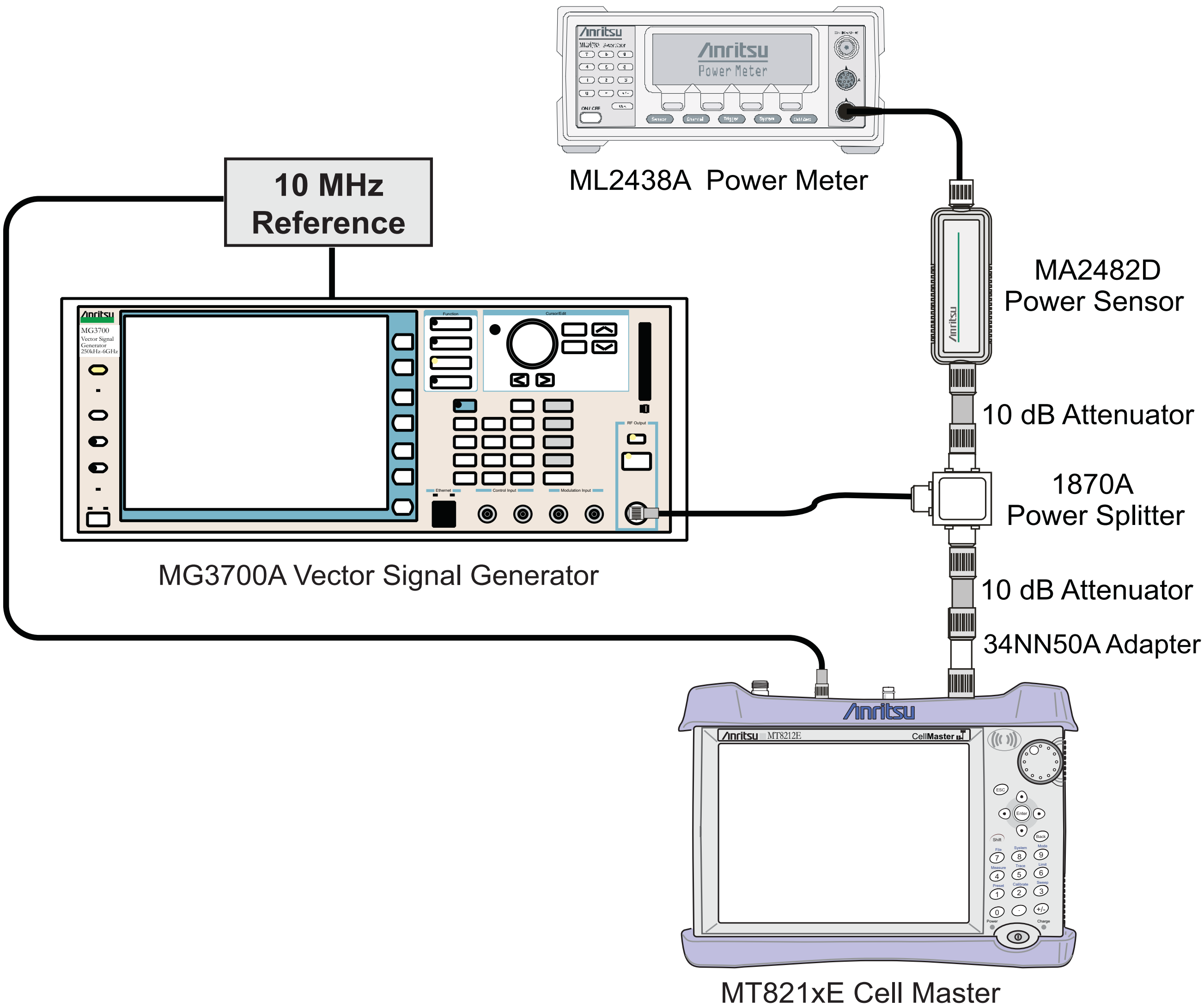



**Figure 5-22.** TD-LTE Signal Analyzer Option Verification

## TD-LTE Channel Power Accuracy Tests (Option 551)

The tests in this section verify the function of the optional TD-LTE Signal Analyzer in Model MT821xE Cell Master.

| | |
|---|---|
| **Note** | The TD-LTE pattern requires a Waveform Data license MX370110A that must be purchased. |

**Procedure**

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the Power Meter Measurement MODE to True RMS, set Averaging MODE to Moving, and set Averaging NUMBER to 256.
3. Set the calibration factor frequency of the power sensor to 750 MHz.
4. Connect the equipment as shown in Figure 5-22.
5. Set the MG3700A as follows:

a. Press the yellow **Preset** button (answer yes to the question).

b. Press the **Set** key.

| | |
|---|---|
| **Note** | Both **Set** keys on the MG3700A perform the same function. |

c. Press the (F1) soft key to select Load File to Memory.

d. Press the (F1) soft key again to select Select Package.

e. Using the **Down Arrow** key, step through the selection list until "LTE_TDD" is highlighted.

f. Press the **Set** key.

g. Press the F6 (Return) soft key.

h. Press the **Set** key. The Select Package list box appears. Again select LTE_TDD and then the **Set** key.

i. Another file list appears. Select (highlight) TDLTE-E-TM-1-1_10M.

j. Press the **Set** key.

k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the "playing" indicator is displaying the moving pattern.

l. Press the **Frequency** key, then enter 750 MHz.

m. Press the **Level** key, then enter –3 dBm.

n. Turn the output On.

6. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.
7. Set the MT821xE to **TD-LTE Signal Analyzer** mode and preset the instrument.
8. Set the MT821xE as follows:

a. Press the **Freq** main menu key and set the Center Frequency to 750 MHz.

b. Press the Measurements main menu key and press RF, then press Channel Spectrum.

9. Record the MT821xE Channel Power reading in the **750 MHz, –20 dBm** row, **Measured Channel Power** column of Table A-93, "Option 551, TD-LTE Channel Power Accuracy".
10. Calculate the Channel Power Error by subtracting the MT821xE "Channel Power" reading from the power meter reading in Step 6. Record the result in the **750 MHz, –20 dBm** row, **Error** column of Table A-93.
11. Verify that the error is within specification.
12. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.
13. Record the MT821xE Channel Power reading in the **750 MHz, –50 dBm** row, **Measured Channel Power** column of Table A-93.
14. Calculate the Channel Power Error by subtracting the MT821xE "Channel Power" reading from the power meter reading that was recorded in Step 13. Record the result in the **750 MHz, –50 dBm** row, **Error** column of Table A-93.
15. Verify that the error is within specification.
16. Set the calibration factor frequency of the power sensor to 2150 MHz.
17. Set the MG3700A frequency to 2150 MHz. Press the **Set** key.
18. Change the MT821xE center frequency to 2150 MHz.
19. Measure the Channel Power for –20 dBm and –50 dBm and then record the measured result in the **Measured Channel Power** column and the calculated error in the **Error** column of Table A-93.
20. Verify that the error is within specification.

21. For units with 20 MHz IF BW Available, which can be seen within the System Status window, repeat Step 3 throughStep 20 using the 20 MHz pattern, TDLTE-E-TM_1-1_20M.

## TD-LTE Frequency Error Tests (Option 552)

The tests in this section verify the function of the optional TD-LTE Signal Analyzer in Model MT821xE Cell Master.

| | |
|---|---|
| **Note** | The TD-LTE pattern requires a Waveform Data license MX370110A that must be purchased. |

### Procedure

1. Connect the MA2482D Power Sensor to the power meter and zero the sensor.
2. Set the Power Meter Measurement MODE to True RMS, set Averaging MODE to Moving, and set Averaging NUMBER to 256.
3. Set the calibration factor frequency of the power sensor to 750 MHz.
4. Connect the equipment as shown in Figure 5-22.
5. Set the MG3700A as follows:
   a. Press the yellow **Preset** button (answer Yes to the question).
   b. Press the **Set** key.

| | |
|---|---|
| **Note** | Both **Set** keys on the MG3700A perform the same function. |

   c. Press the (F1) soft key to select Load File to Memory.
   d. Press the (F1) soft key again to select Select Package.
   e. Using the **Down Arrow** key, step through the selection list until LTE_TDD is highlighted.
   f. Press the **Set** key.
   g. Press the F6 (Return) soft key.
   h. Press the **Set** key. The Select Package list box appears. Again select LTE_TDD and press **Set**.
   i. Another file list appears. Select (highlight) TDLTE-E-TM3-3_10M.
   j. Press the **Set** key.
   k. Press the **MOD On/Off** key and verify that the LED is On. Confirm that the “playing” indicator is displaying the moving pattern.
   l. Press the **Frequency** key, then enter 750 MHz.
   m. Press the **Level** key, then enter –3 dBm.
   n. Turn the output On.
6. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.
7. Set the MT821xE to **TD-LTE Signal Analyzer** mode and preset the instrument.
8. Set the MT821xE as follows:
   a. Press the **Freq** main menu key and set the Center Frequency to 750 MHz.
   b. Press the **Measurements** main menu key and press Modulation.
   c. Press the Constellation submenu key.
9. Record the MT821xE Frequency Error reading in the **750 MHz, –20 dBm** section of Table A-94, “Option 552, TD-LTE Frequency Accuracy” on page A-57.
10. Verify that the value is within specification.

11. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.
12. Record the MT821xE Frequency Error reading into the **750 MHz, –50 dBm** section of Table A-94.
13. Verify that the value is within specification.
14. Set the calibration factor frequency of the power sensor to 2150 MHz.
15. Set the MG3700A frequency to 2150 MHz. Press the **Set** key.
16. Adjust the MG3700A level setting with the knob so that the power meter reads –20.0 dBm ± 0.5 dB.
17. Change the MT821xE center frequency to 2150 MHz.
18. Record the MT821xE Frequency Error reading into the **2150 MHz, –20 dBm** section of Table A-94.
19. Verify that the value is within specification.
20. Adjust the MG3700A level setting to approximately –33 dBm so that the power meter reads –50.0 dBm ± 0.5 dB.
21. Record the MT821xE Frequency Error reading in the **2150 MHz, –50 dBm** section of Table A-94.
22. Verify that the value is within specification.
23. For units with 20 MHz IF BW Available, which can be seen within the System Status window, repeat Step 3 through Step 22 using the 20 MHz pattern, TDLTE-E-TM_3-3_20M.

# Chapter 6 — Battery Information

## 6-1 Introduction

The following information relates to the care and handling of the Anritsu battery pack and Lithium-Ion batteries in general.

- The battery supplied with the Cell Master may need charging before use. Before using the instrument, the internal battery may be charged either in the instrument, using either the AC-DC Adapter (40-187-R) or the 12-Volt DC adapter (806-141-R), or separately in the optional Dual Battery Charger (2000-1374).
- Use only Anritsu approved battery packs.
- Recharge the battery only in the Cell Master or in an Anritsu approved charger.
- When the Cell Master or the charger is not in use, disconnect it from the power source.
- Do not charge batteries for longer than 24 hours; overcharging may shorten battery life.
- If left unused a fully charged battery will discharge itself over time.
- Temperature extremes affect the ability of the battery to charge: allow the battery to cool down or warm up as necessary before use or charging.
- Discharge the battery from time to time to improve battery performance and battery life.
- The battery can be charged and discharged hundreds of times, but it will eventually wear out.
- The battery may need to be replaced when the operating time between charging becomes noticeably shorter than normal.
- Never use a damaged or worn out charger or battery.
- Storing the battery in extreme hot or cold places will reduce the capacity and lifetime of the battery.
- Never short-circuit the battery terminals.
- Do not drop, mutilate or attempt to disassemble the battery.
- Do not dispose of batteries in a fire!
- Batteries must be recycled or disposed of properly. Do not place batteries in household garbage.
- Always use the battery for its intended purpose only.

| | |
|---|---|
| **Warning** | This equipment 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 data sheet. |

# 6-2 Battery Pack Removal and Replacement

This section provides instructions for the removal and replacement of the Cell Master battery pack.

1. Locate the battery access door as illustrated in Figure 6-1.


**Figure 6-1.** Battery Access Door Location

2. Place a finger in the battery access door notch and push the door latch down towards the bottom of the instrument, as illustrated in Figure 6-2.

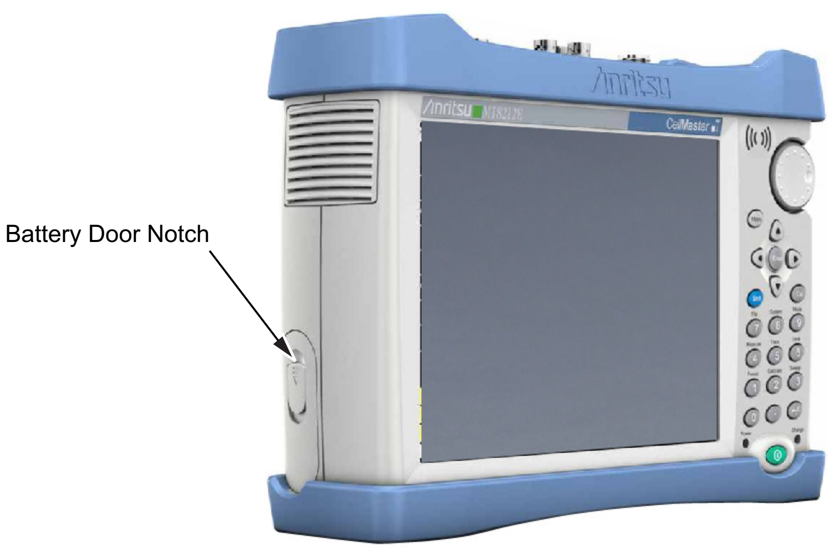



**Figure 6-2.** Battery Access Door Notch

3. Remove the battery access door, the top will pop out a bit and then pull it up out of the access enclosure.

4. With the battery access door completely removed, grasp the battery lanyard and pull the battery straight out of the instrument, as illustrated in Figure 6-3.


**Figure 6-3.** Removing the Battery

5. Replacement is the opposite of removal. Note the orientation of the battery contacts, and be sure to insert the new battery with the contacts facing the front of the instrument, as illustrated in Figure 6-4.

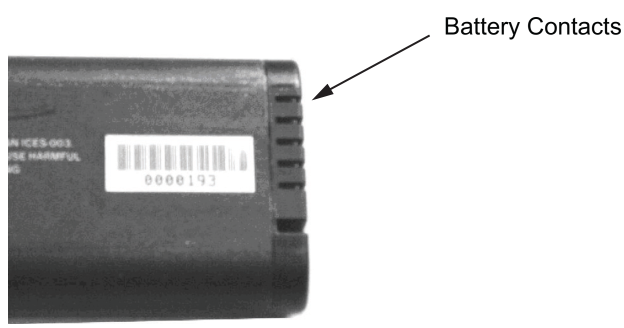



**Figure 6-4.** Battery Contacts

# Chapter 7 — Assembly Replacement

## 7-1 Replaceable Parts List

Refer to Table 1-5, “List of Replaceable Parts” on page 1-6 for the list of replaceable parts. Refer to the following sections for basic replacement instructions.

| | |
|---|---|
| **Note** | Many of the procedures in this section are generic, and apply to many similar instruments. Photos and illustrations used are representative and may not match your instrument. |

| | |
|---|---|
| **Caution** | Only qualified personnel should open the case and replace internal assemblies. Assemblies shown in Table 1-5 are typically the only items that may be replaced. Because they are highly fragile, items that must be soldered may not be replaced without specialized training.<br>Removing RF shields from PC boards or adjustment of screws on or near the shields may detune sensitive RF circuits and will result in degraded instrument performance. All work should be performed in a static-safe work area. |

## 7-2 Opening the Cell Master Case

| | |
|---|---|
| **Caution** | Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument.<br>Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.<br>The Cell Master contains components that can be easily damaged by electrostatic discharge (ESD). An ESD safe work area and proper ESD handling procedures that conform to ANSI/ESD S20.20-1999 or ANSI/ESD S20.20-2007 is mandatory to avoid ESD damage when handling subassemblies or components found in the instrument. |

This procedure provides instructions for opening the Cell Master case. With the case opened, the internal assemblies can be removed and replaced, as detailed in the following sections.

1. Remove the battery door and battery as shown in Section 6-2 “Battery Pack Removal and Replacement ” on page 6-2.
2. Remove the top and bottom bumpers (Figure 7-1) to expose the screw holes on the back of the instrument.


**Figure 7-1.** Top Bumper and Option 31

3. Place the Cell Master face down on a stable work surface that will not scratch the display.
4. Use a Phillips screwdriver to remove the six screws securing the two halves of the Cell Master case together (Figure 7-2).

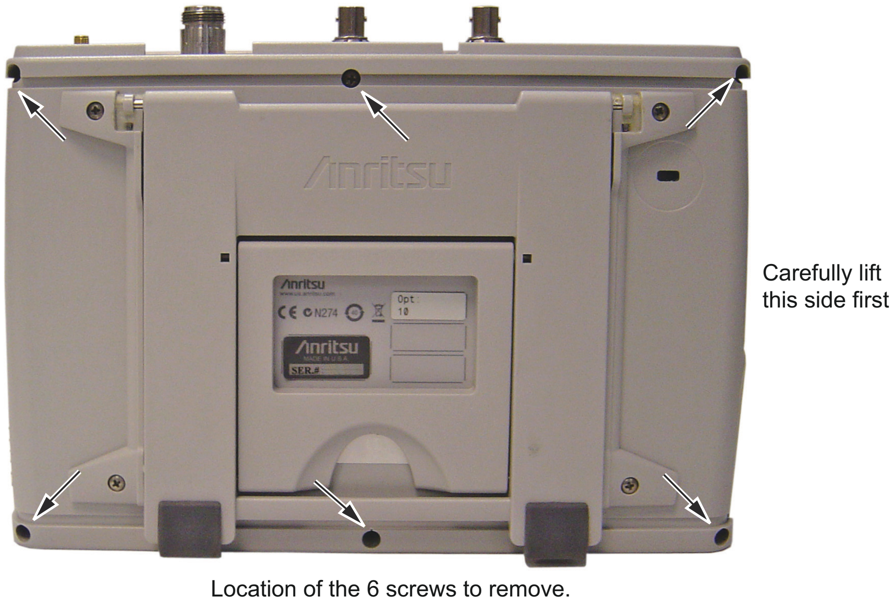



**Figure 7-2.** Remove the Four Screws

5. Carefully lift up on the side of the case indicated above and begin to separate the two halves.
6. Lay the Cell Master flat and remove the battery connector cable between the two halves (Figure 7-3).

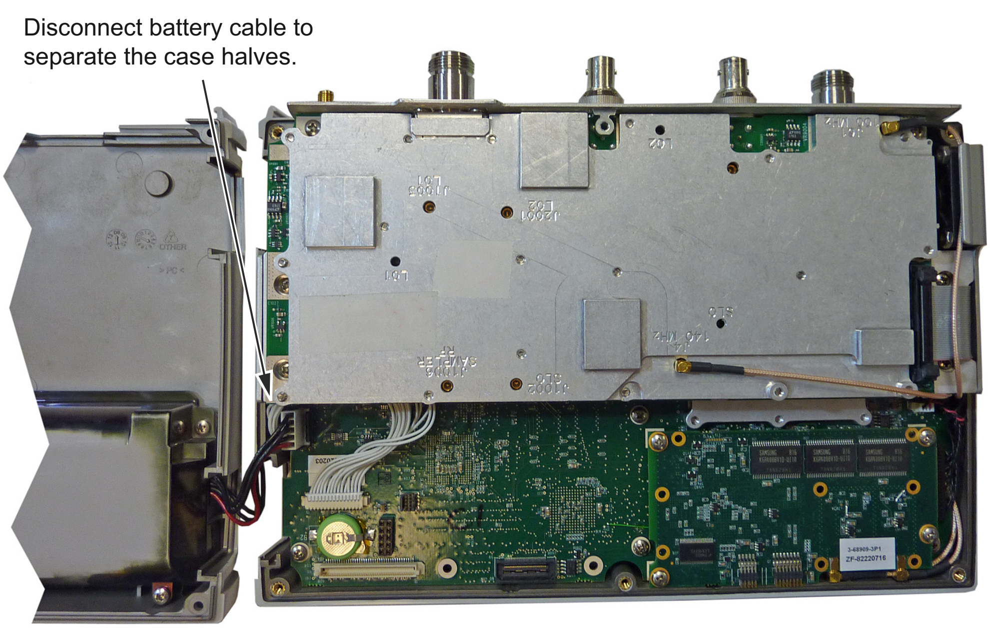



**Figure 7-3.** Cell Master Opened 180 Degrees

7. Closing the case is the reverse of opening. Ensure all cables are properly seated and none are pinched before closing the case.

# 7-3 PCB Assembly Replacement

| | |
|---|---|
| **Note** | Procedures in this section are generic, and apply to many similar instruments. Photos and illustrations used are representative and may not match your instrument. |

This section describes the removal and replacement of the SPA and MB/VNA boards which are attached to each other and attached to the Cell Master Case.

1. Open the case as described in Section 7-2 "Opening the Cell Master Case".
2. Disconnect the Keypad PCB connector, the Fan Assembly connector, and the LCD connector.
3. Use a Phillips screwdriver to remove the 8 screws securing the Assemblies to the Case (Figure 7-4).

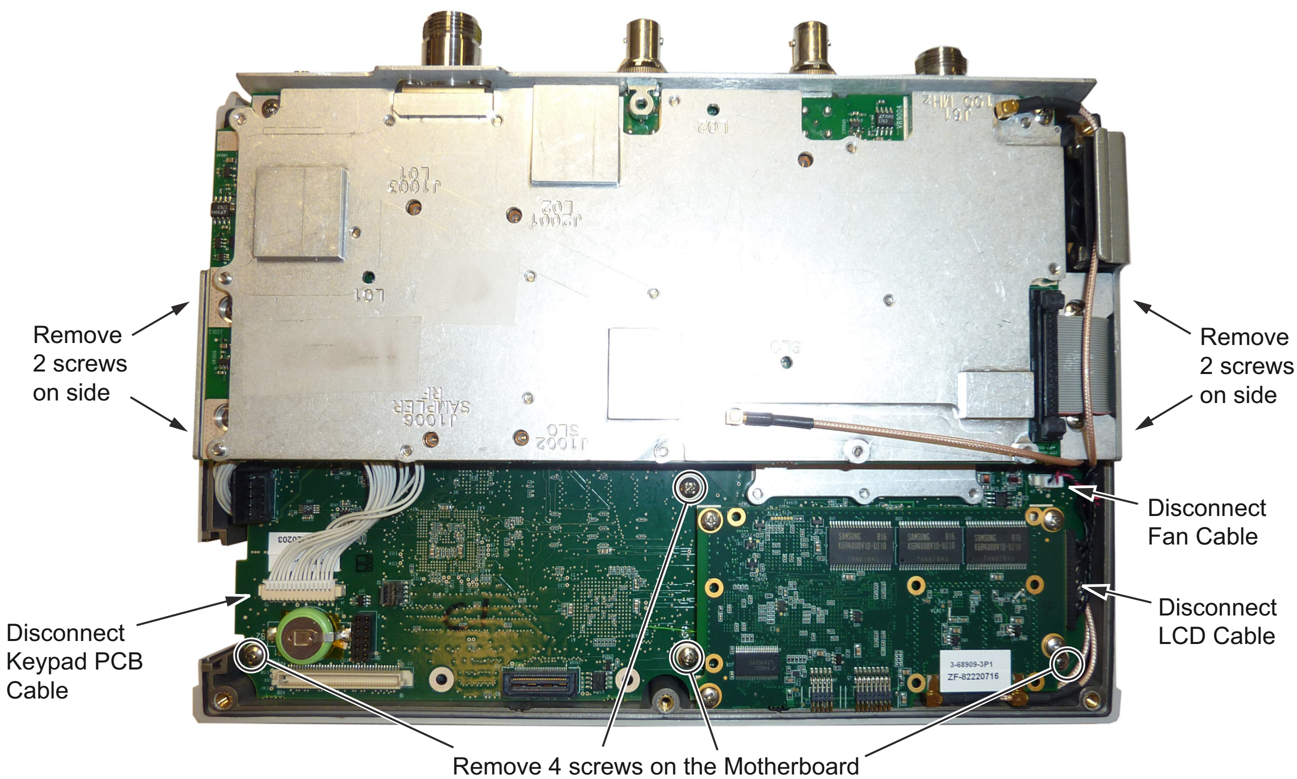



**Figure 7-4.** Removing the PCB Assemblies out of the Case

4. After the screws are removed the entire Assembly including the top connector panel will slide out of the case.
5. Installation is the reverse of removal. During installation ensure the Keypad PCB cable along with all other cables are properly seated at both ends. Also take care to properly fit the connector panel into the grooves in the top of the case and confirm that none of the cables will be pinched when the back case is replaced.

# 7-4 SPA Assembly Replacement

This section describes the removal of the SPA Assembly board.

1. Open the case as described in Section 7-2 "Opening the Cell Master Case".
2. Remove the PCB Assembly from the front panel as described in Section 7-3 "PCB Assembly Replacement".
3. Remove the castle nuts from the External Reference connector and the External Trigger connector (Figure 7-5).
4. Remove the motherboard ribbon connector.
5. Remove the 2 MCX connectors between the SPA board and the DSP board.
6. Remove the 6 screws retaining the SPA board.
7. Slide the SPA board out of the top panel.
8. Installation is the reverse of removal.

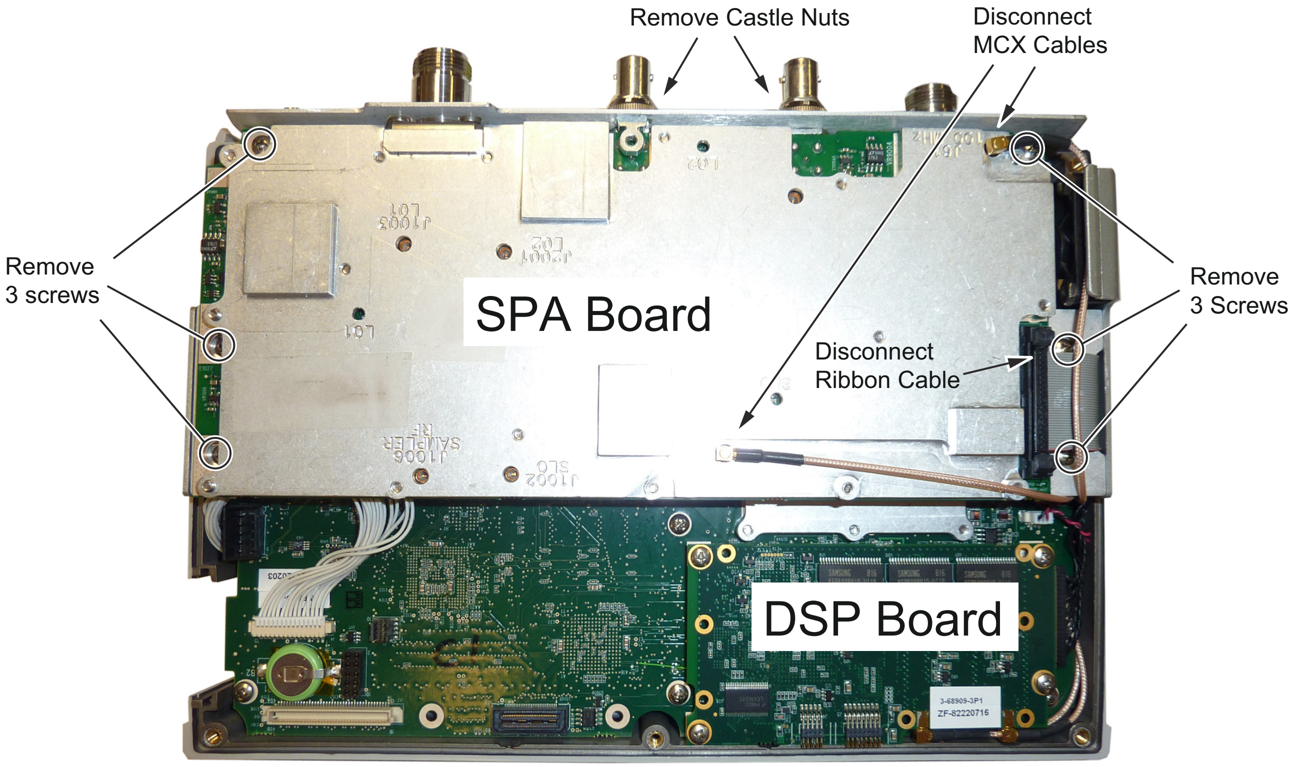



**Figure 7-5.** Removing the SPA Assemblies

# 7-5 SPA and MB/VNA N Connector Replacement

This procedure provides instructions for replacing the N connector attached to the SPA assembly or MB/VNA assembly.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the PCB Assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Remove the SPA assembly as described in Section 7-4 “SPA Assembly Replacement”.
4. If removing the MB/VNA N connector, remove the top plate from the MB/VNA.
5. Remove the four screws attaching the N connector to the shield (Figure 7-6).

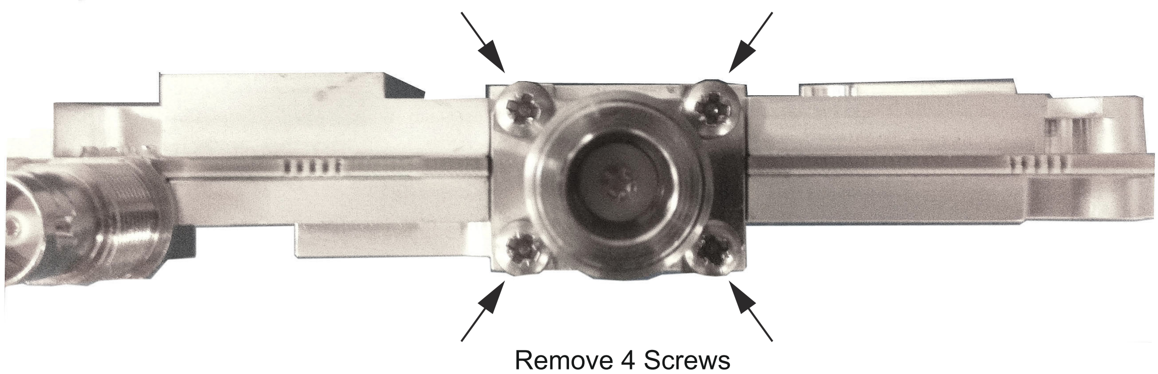



**Figure 7-6.** Remove 4 Screws

6. Disconnect the N connector from the SPA or MB/VNA by gently pulling the N connector away from the SPA or MB/VNA (Figure 7-7).

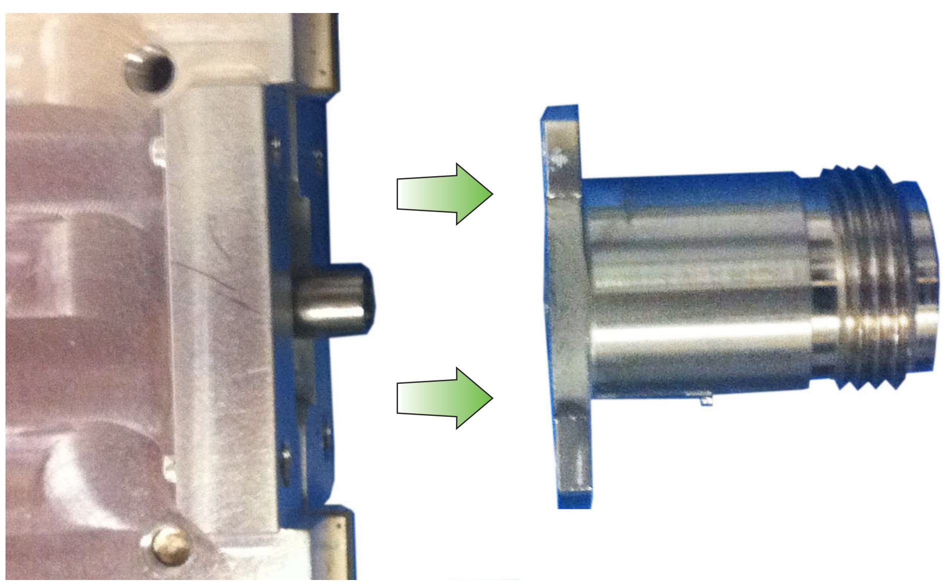


**Figure 7-7.** Remove N Connector from SPA or MB/VNA

7. Installation is the reverse of removal.

## 7-6 GPS (Option 31) Replacement

This procedure provides instructions for removing and replacing the GPS Module.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the PCB Assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Remove the SPA board as described in Section 7-4 “SPA Assembly Replacement”.

| | |
|---|---|
| **Note** | The SPA board cables, connector and the DSP board do not need to be removed when replacing the GPS Module. Remove the screws and move the SPA board to the side. |

4. Use a 5/16 inch wrench to remove the nut and washer from the GPS SMA connector. Push the connector through the top panel.
5. Remove the 2 screws retaining the GPS module to the Motherboard.
6. Carefully lift straight up on the GPS module to remove. The back of the GPS module board is directly connected to the Motherboard.
7. Installation is the reverse of removal.

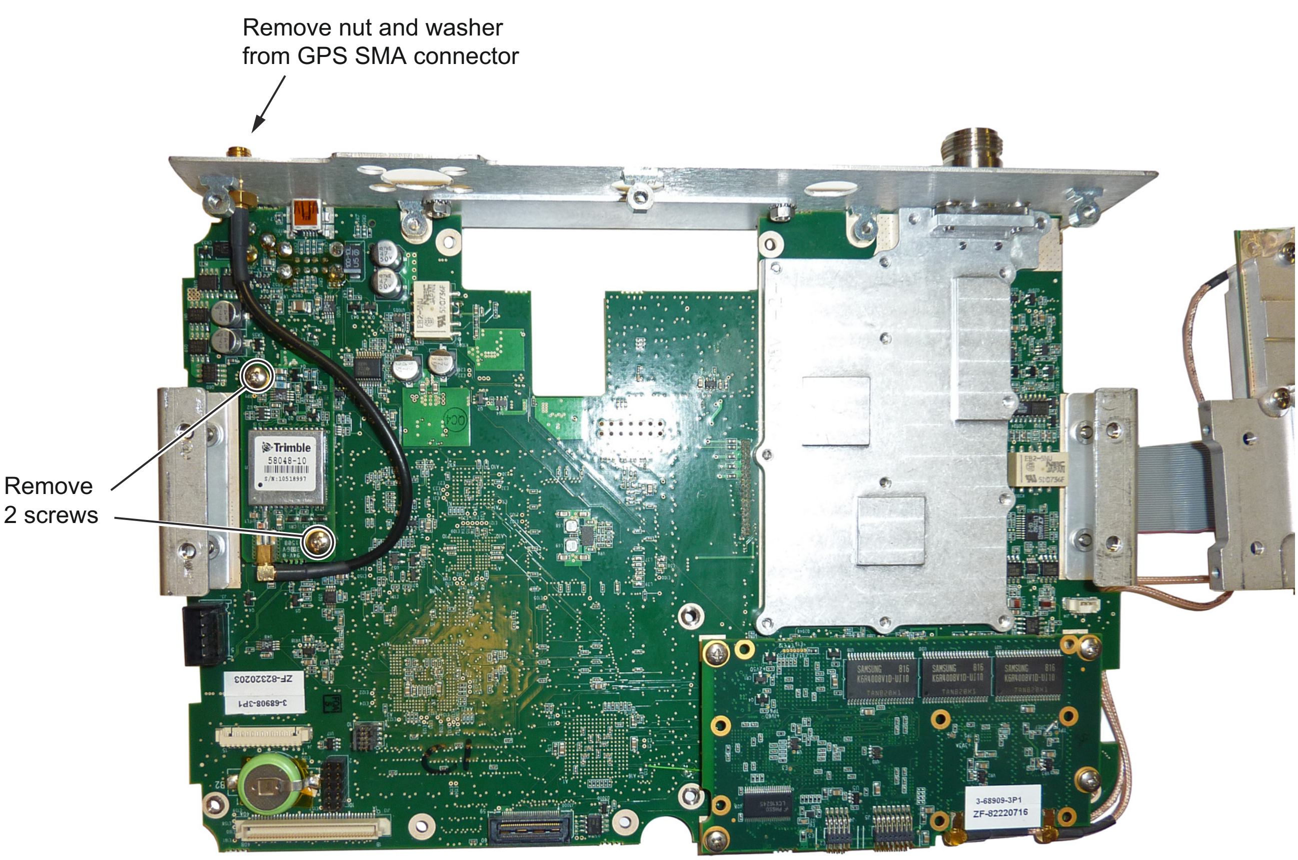



**Figure 7-8.** Removing the GPS Module from the Motherboard (SPA board set to the side)

## 7-7 Motherboard/VNA PCB Assembly Replacement

This procedure provides instructions for removing and replacing the Motherboard/VNA Assembly.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the PCB Assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Remove the SPA board as described in Section 7-4 “SPA Assembly Replacement”.
4. Remove the GPS board as described in Section 7-6 “GPS (Option 31) Replacement”.

| **Note** | When ordering the Main/VNA PCB Assembly all options that areinstalled on the instrument must be stated on the order. |
|---|---|

5. Installation is the reverse of removal.

## 7-8 Fan Assembly Replacement

This procedure provides instructions for removing and replacing the Fan Assembly.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the Main VNA/PCB assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Remove the 3 screws and nuts holding the Fan Assembly to the LCD Assembly housing. Refer to (Figure 7-9).

| **Note** | The fan connector cable is routed through the LCD Assembly housing |
|---|---|

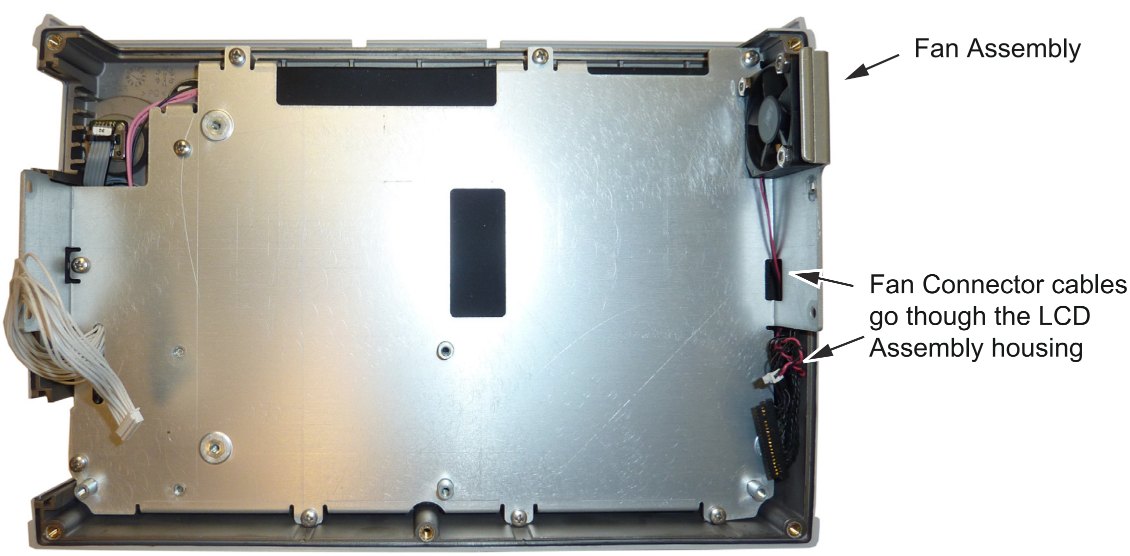



**Figure 7-9.** Front Panel Keypad Bezel

4. Reverse the above steps to install the replacement Fan Assembly.

# 7-9 LCD Assembly Replacement

This procedure provides instructions for removing and replacing the Liquid Crystal Display (LCD) once the Main PCB assembly has been separated from the Cell Master.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the Main PCB assembly as described in Section 7-3 “PCB Assembly Replacement”.
3. Remove the 9 screws connecting the LCD Assembly to the front half of the case (Figure 7-10).

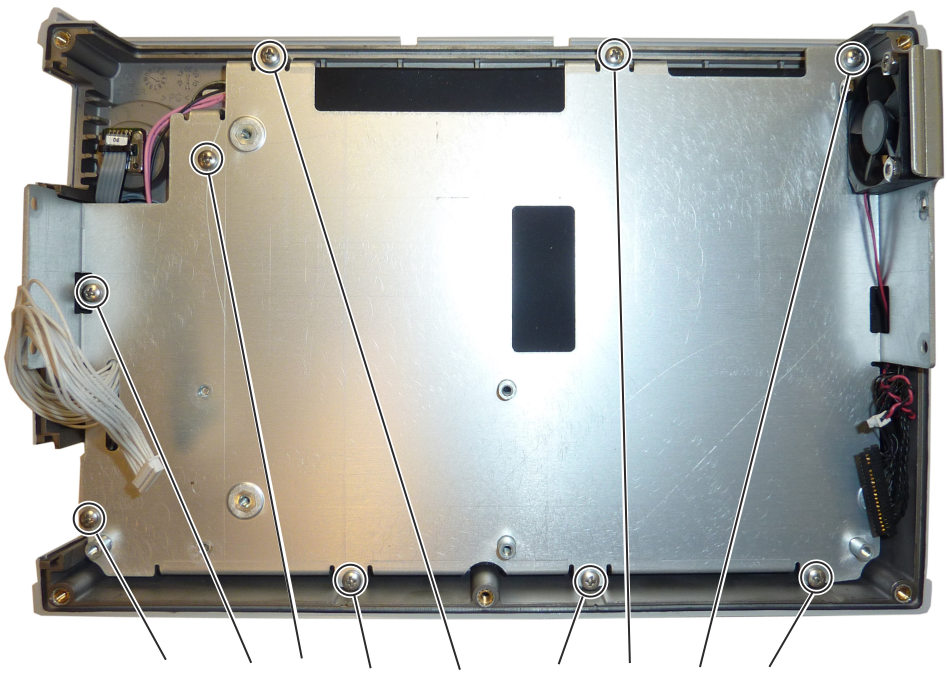



**Figure 7-10.** Removing the LCD Assembly

4. Turn the LCD assembly over and disconnect the front half of the case from the LCD Assembly (Figure 7-11).

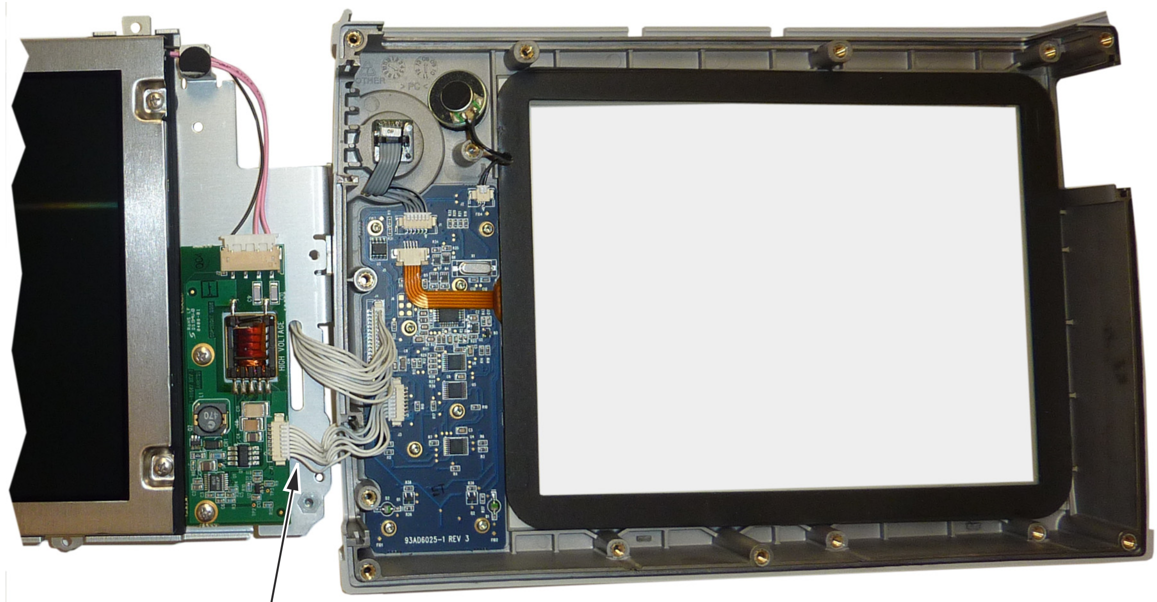



**Figure 7-11.** Replacing the LCD Assembly

5. Use a Phillips screw driver to remove the four screws securing the LCD to the housing (Figure 7-12).

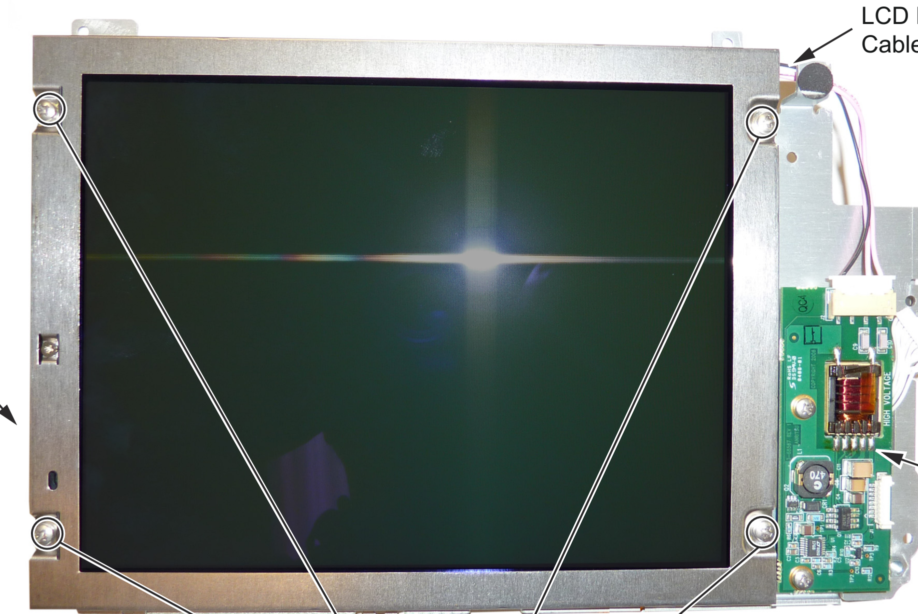



**Figure 7-12.** Replacing the LCD

6. Disconnect the LCD backlight cable from the LCD backlight PCB.
7. Disconnect the LCD cable from the side of the LCD.
8. Carefully remove the LCD.
9. Reverse the above steps to install the replacement LCD.

| | |
|---|---|
| **Note** | Pay attention to the routing of the LCD Backlight Cable. The cable must be positioned so it is not pinched when the instrument is reassembled. |

## 7-10 LCD Backlight PCB Removal and Replacement

This procedure provides instructions for removing and replacing the Cell Master LCD backlight PCB.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the Main PCB assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Perform Step 1 through Step 4 of Section 7-9 “LCD Assembly Replacement”.
4. Disconnect the LCD backlight cable from the LCD backlight PCB.
5. Use a Phillips screw driver to remove the two screws securing the LCD backlight PCB to the Main PCB assembly (Figure 7-13).

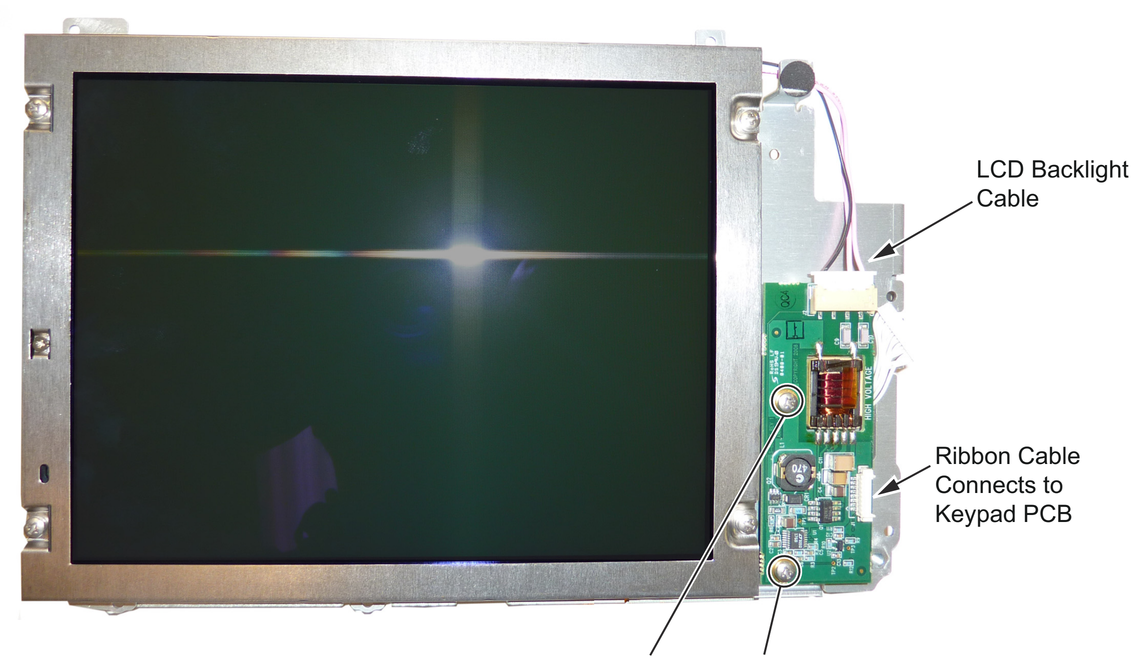



**Figure 7-13.** Replacing the LCD PCB

6. Carefully remove the LCD Backlight PCB.
7. Reverse the above steps to install the replacement LCD backlight PCB.

| | |
|---|---|
| **Note** | Pay attention to the routing of the LCD Backlight Cable. The cable must be positioned so it is not pinched when the instrument is reassembled. |

# 7-11 Keypad and Keypad PCB Replacement

This procedure provides instructions for removing and replacing the keypad and the keypad PCB.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the Main VNA/PCB assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Perform Step 1 through Step 4 of Section 7-9 “LCD Assembly Replacement”.
4. Remove the 8 screws and the cable connectors to remove the Keypad PCB (Figure 7-14). The Rubber Keypad is located under the Keypad PCB.

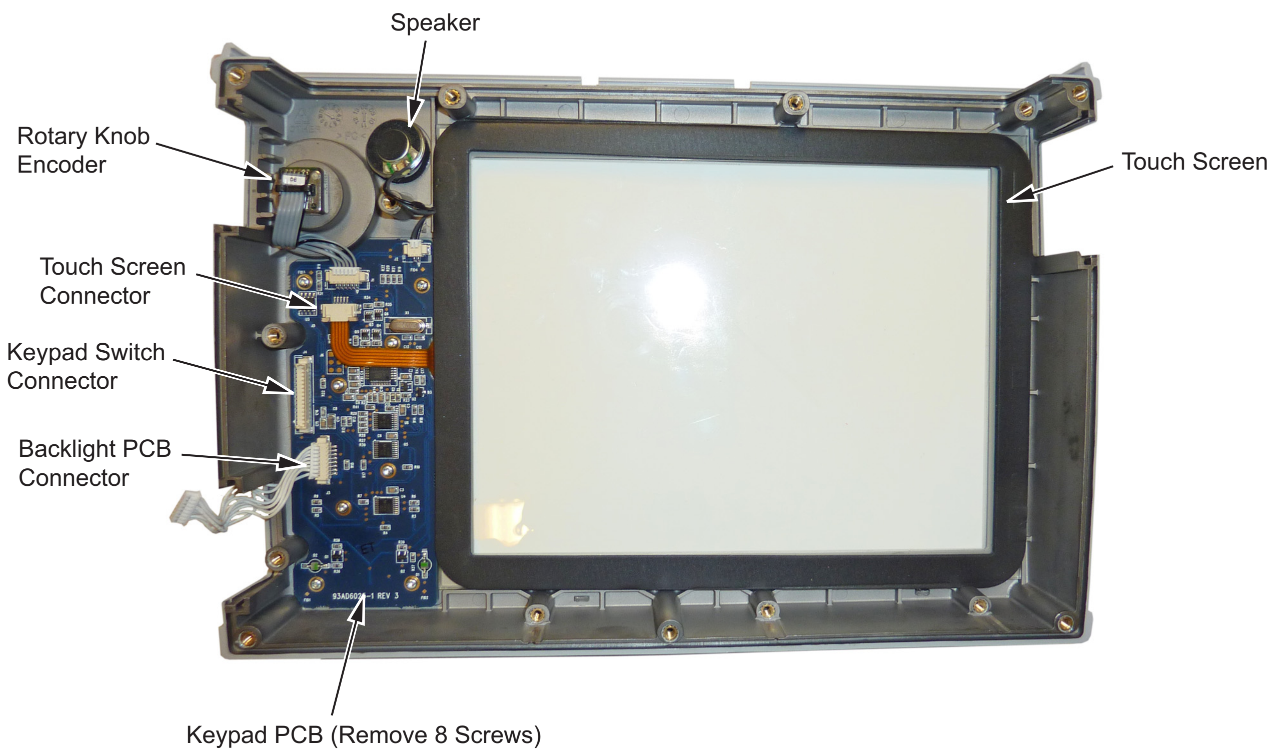



**Figure 7-14.** Front Panel Keypad Bezel

5. Reverse the above steps to install the replacement Keypad and/or Keypad PCB.
6. The Keypad PCB stores the touch screen calibration data. If the Keypad PCB is replaced, then a touch screen calibration must be performed. If no touch screen calibration data is stored in the new Keypad PCB when powering on a instrument, it will stay at the boot up screen with the Anritsu logo shown and a message at the bottom of the screen stating:

   `Failed to load touch screen calibration data. Please reboot the instrument.`

   If this message is displayed, power off the instrument and power the instrument up in bootstrap mode by pressing and holding down the **Shift** - **4** - **0** keys while pressing the power on button. Now the instrument will boot up in bootstrap mode and prompt you to perform a touch-screen calibration. After following the on-screen calibration directions, power the instrument off and it will boot up correctly on the next power cycle.
7. If the Keypad PCB was replaced with a PCB that has touch screen calibration data, the instrument will boot up properly, but the touch-screen calibration data will be invalid. Perform a touch-screen calibration by pressing the **Shift** key and then **0** key, and follow the touch-screen calibration directions on the screen.

## 7-12 Touch Screen Replacement

This procedure provides instructions for removing and replacing the touch screen.

1. Open the case as described in Section 7-2 “Opening the Cell Master Case”.
2. Remove the Main VNA/PCB assembly from the front panel as described in Section 7-3 “PCB Assembly Replacement”.
3. Perform Step 1 through Step 4 of Section 7-9 “LCD Assembly Replacement”.
4. Remove the touch screen flex circuit connector from the Keypad PCB by pulling the tabs on each side of the connector away from the connector and in the direction of the flex circuit. Refer to Figure 7-15.
5. Pull the Touch Screen cable out of the connector housing.
6. Remove the Touch Screen from the Bezel by pulling it straight up.

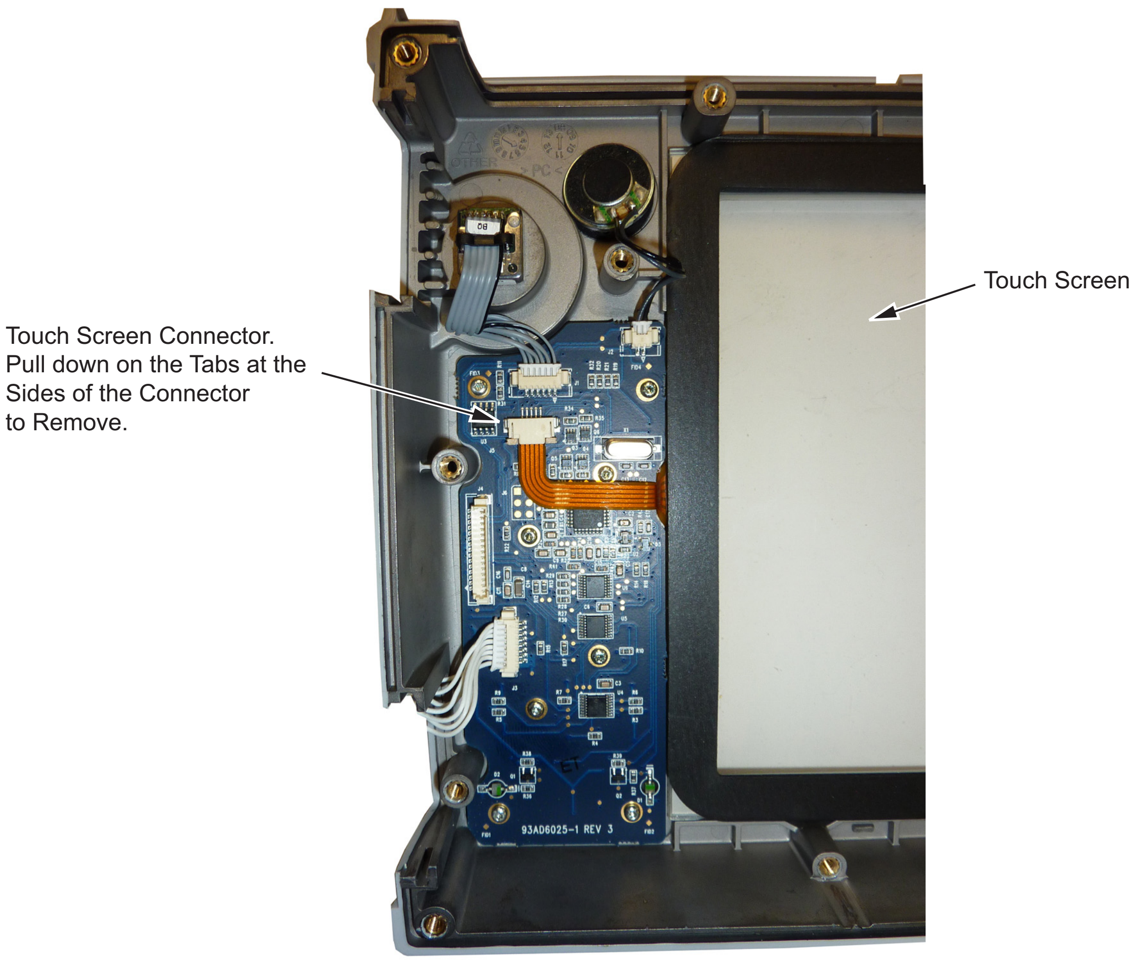



**Figure 7-15.** Replacing the Touch Screen

7. Reverse the above steps to install the replacement Touch Screen.

| | |
|---|---|
| **Note** | Firmware version 1.30 and greater was modified to accept touch screen calibration data needed for touch screen part number ND73867. Ensure that firmware version 1.30 or greater is installed. If not, install the latest firmware. |

8. Perform a touch screen calibration by pressing the **Shift** key and then the **0** key, and follow the on-screen calibration directions.

# Chapter 8 — Troubleshooting

## 8-1 Introduction

This chapter describes the primary troubleshooting operations that can be performed by all Anritsu Service Centers. Perform the troubleshooting suggestions in the order they are listed. Operators of the MT821xE should refer to the User Guide for troubleshooting help.

Only qualified Anritsu personnel should replace internal assemblies. Major subassemblies shown in Table 1-5, "List of Replaceable Parts" on page 1-6 are typically the items that may be replaced. Because they are highly fragile, items that must be soldered may not be replaced without special training. Removal of RF shields from PC boards or adjustment of screws on or near the shields will detune sensitive RF circuits and will result in degraded instrument performance.

## 8-2 Turn-on Problems

**Instrument cannot boot-up, no activity occurs when the On/Off key is pressed:**

1. Battery may be fully discharged. Confirm the battery is installed into the instrument and connect the AC to DC converter (Anritsu part number 40-187-R) to the instrument allowing the battery to charge.
2. Battery may be the wrong type. Use only Anritsu approved battery packs. Some non-approved battery packs will fit into the MT821xE, but are electrically incompatible and will not charge correctly.
3. External power supply may have failed or be the wrong type. Replace the external power supply.
4. On/Off switch is damaged. Replace the keypad PCB or rubber keypad.
5. Main PCB has failed. Replace the Main PCB/Spectrum Analyzer assembly.

**Instrument begins the boot process, but does not complete boot-up:**

1. Using Master Software Tools, perform the Emergency Repair procedure, then update the system software (via the Tools menu).
2. During the boot-up process, the instrument stops with the message:

   `Failed to load touch screen calibration data. Please reboot the instrument.`

   a. Power the instrument off and boot up in boot strap mode (hold down the **Shift** - **4** - **0** keys while pressing the power on button).
   b. In boot strap mode, the instrument prompts you to perform a touch screen calibration. Follow the on-screen directions until the touch screen calibration is complete, and then power cycle the instrument.
   c. Once the instrument boots up, ensure the firmware version is 1.30 or greater. If not, load the latest firmware and perform a touch screen calibration.
3. The Main PCB has failed. Replace the Main PCB/Spectrum Analyzer assembly.

**Instrument makes normal boot-up sounds, but the display has a problem:**

1. If the display is dim, check the brightness setting under the System Menu / System Options.
2. Replace the Backlight Driver PCB.
3. Replace the LCD assembly.
4. The Main PCB has failed. Replace the Main PCB/Spectrum Analyzer assembly.

**Boot-up Self Test fails:**

1. Perform a Master Reset.
2. If the message relates to the RTC battery, replace the RTC battery on the Main PCB.
3. The Main PCB has failed. Replace the Main PCB/Spectrum Analyzer assembly.

# 8-3 Other Problems

### Touch Screen Problems:

Instrument boots correctly, but the touch screen is unresponsive.

1. **The touch screen may have lost its calibration data. Press Shift then 0 to enter the touch screen calibration procedure. Follow the on-screen directions.**
2. Check the firmware version installed on the instrument and ensure it is version 1.30 or greater. If not, install the latest firmware version and redo the touch screen calibration as described in Step 1.
3. Replace the touch screen.

### Battery Pack Charging Problems:

Refer to Chapter 6, "Battery Information".

### Lock Error messages:

1. This message normally appears for 2 to 3 seconds when an external 10 MHz Reference is applied.
2. Spectrum Analyzer PCB has failed. Replace the Main/Spectrum Analyzer assembly.

### Spectrum Analyzer Problems:

1. Inspect the Spectrum Analyzer RF In connector for damage.
2. Refer to the User Guide.
3. Update system software using Master Software Tools (via Tools menu).
4. Spectrum Analyzer PCB has failed. Replace the Main/Spectrum Analyzer assembly.

### Cable and Antenna Analyzer Problems:

1. Inspect the VNA RF In and VNA Reflection connectors for damage.
2. Inspect the Open, Short, Load and cable(s) for damage. Verify their operation on a suitable measurement instrument.
3. Refer to the User Guide.
4. Update system software using Master Software Tools (via Tools menu).
5. VNA module has failed. Replace the VNA module. No recalibration is required.

### Option 51, 52 or 53 Problems:

1. Replace the Option 51, 52, or 53 PCB (see Table 1-5, "List of Replaceable Parts" on page 1-6). No recalibration is required.

### Other Issues:

1. Perform a Master Reset.
2. Refer to the User Guide.
3. Update system software using Master Software Tools (via Tools menu).
4. Replace the Main PCB/Spectrum Analyzer assembly.

# Appendix A — Test Records

## A-1 Test Records

This appendix provides test records that can be used to record the performance of the MT8212E and MT8213E. Anritsu recommends that you make a copy of the following test record pages and document the measurements each time a Performance Verification is performed. Continuing to document this process each time it is performed provides a detailed history of instrument performance, which can allow you to observe trends.

**MT821_E Firmware Rev:** ______________ **Operator:** ____________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# A-2 Test Records for Spectrum Analyzer Verification

## Frequency Accuracy Verification

**Table A-1.** Spectrum Analyzer Frequency Accuracy

| Frequency | Measured Value | Deviation | Specification |
|---|---|---|---|
| 1 GHz | GHz | kHz | ± 1.5 kHz (± 1.5 ppm) |
| 3.9 GHz | GHz | kHz | ± 5.85 kHz (± 1.5 ppm) |
| 5.9 GHz | GHz | kHz | ± 8.85 kHz (± 1.5 ppm) |

## Single Side Band (SSB) Phase Noise Verification

**Table A-2.** Spectrum Analyzer SSB Phase Noise Verification

| Frequency | Measured Value | Calculated Value | Specification |
|---|---|---|---|
| 10 kHz | dBc/Hz | dBc/Hz | ≤ – 100 dBc/Hz |
| 100 kHz | dBc/Hz | dBc/Hz | ≤ – 105 dBc/Hz |
| 1 MHz | dBc/Hz | dBc/Hz | ≤ – 115 dBc/Hz |

## Spurious Response (Second Harmonic Distortion) Verification

**Table A-3.** Spectrum Analyzer Spurious Response (Second Harmonic Distortion)

| Frequency | Measured Value | 2nd Harmonic Distortion | Specification |
|---|---|---|---|
| 50.1 MHz | | | |
| 100.2 MHz | | dBc | ≤ –56 dBc |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Spectrum Analyzer Verification (Continued)

## Resolution Bandwidth Accuracy Verification

**Table A-4.** Spectrum Analyzer Resolution Bandwidth Accuracy

| BW Setting | Span | VBW | Lower Limit | Measured Values | Upper Limit |
|---|---|---|---|---|---|
| 3 MHz | 4.5 MHz | Auto | 2.7 MHz | Hz | 3.3 MHz |
| 1 MHz | 1.5 MHz | Auto | 900 kHz | Hz | 1.1 MHz |
| 300 kHz | 450 kHz | Auto | 270 kHz | Hz | 330 kHz |
| 100 kHz | 150 kHz | Auto | 90 kHz | Hz | 110 kHz |
| 30 kHz | 45 kHz | Auto | 27 kHz | Hz | 33 kHz |
| 10 kHz | 15 kHz | Auto | 9 kHz | Hz | 11 kHz |
| 3 kHz | 4.5 kHz | Auto | 2.7 kHz | Hz | 3.3 kHz |
| 1 kHz | 2 kHz | Auto | 900 Hz | Hz | 1.1 kHz |
| 300 Hz | 450 Hz | Auto | 270 Hz | Hz | 330 Hz |
| 100 Hz | 150 Hz | Auto | 90 Hz | Hz | 110 Hz |
| 30 Hz | 50 Hz | 3 Hz | 27 Hz | Hz | 33 Hz |
| 10 Hz | 30 Hz | 3 Hz | 9 Hz | Hz | 11 Hz |
| Below settings are used only for units with 20 MHz IF BW Available (found in System Status menu) | | | | | |
| 3 Hz | 10 Hz | 1 Hz | 2.7 Hz | | 3.3 Hz |
| 1 Hz | 10 Hz | 1 Hz | 0.9 Hz | | 1.1 Hz |

**MT821_E** **Firmware Rev:** _______________ **Operator:** __________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ______________________________________________________

# Test Records for Spectrum Analyzer Verification (Continued)

## Spectrum Analyzer Absolute Amplitude Accuracy Verification

**Table A-5.** Spectrum Analyzer 50 MHz Absolute Amplitude Accuracy Setup Table

| Test Power Level at 50 MHz | Required Sensor B Reading |
|---|---|
| 0 dBm | dBm |
| –4 dBm | dBm |
| –10 dBm | dBm |
| –14 dBm | dBm |
| –20 dBm | dBm |
| –24 dBm | dBm |
| –30 dBm | dBm |
| –34 dBm | dBm |
| –40 dBm | dBm |
| –44 dBm | dBm |
| –50 dBm | dBm |

**Table A-6.** Spectrum Analyzer 50 MHz Absolute Amplitude Accuracy

| Input Power Level | Reference Level | Input Atten. Level | Measured Reading | Specification |
|---|---|---|---|---|
| 0 dBm | 10 dBm | 30 dB | dBm | ± 1.25 dB |
| –4 dBm | 10 dBm | 30 dB | dBm | ± 1.25 dB |
| –10 dBm | 0 dBm | 20 dB | dBm | ± 1.25 dB |
| –14 dBm | 0 dBm | 20 dB | dBm | ± 1.25 dB |
| –20 dBm | –10 dBm | 10 dB | dBm | ± 1.25 dB |
| –24 dBm | –10 dBm | 10 dB | dBm | ± 1.25 dB |
| –30 dBm | –20 dBm | 0 dB | dBm | ± 1.25 dB |
| –34 dBm | –20 dBm | 0 dB | dBm | ± 1.25 dB |
| –40 dBm | –30 dBm | 0 dB | dBm | ± 1.25 dB |
| –44 dBm | –30 dBm | 0 dB | dBm | ± 1.25 dB |
| –50 dBm | –40 dBm | 0 dB | dBm | ± 1.25 dB |
| Turn Pre-Amp On (for the below measurement) | | | | |
| -44 dBm | -40 dBm | 10 dB | dBm | ± 1.25 dB |
| -50 dBm | -45 dBm | 5 dB | dBm | ± 1.25 dB |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ____________________________________________

# Test Records for Spectrum Analyzer Verification (Continued)

## Spectrum Analyzer Absolute Amplitude Accuracy Verification

**Table A-7.** Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency Setup Table

| Frequency | Required Sensor B reading for –2 dBm at Attenuator output | Required Sensor B reading for –30 dBm at Attenuator output | Required Sensor B reading for –50 dBm at Attenuator output |
|---|---|---|---|
| 10.1 MHz | dBm | dBm | dBm |
| 50 MHz | dBm | dBm | dBm |
| 100 MHz | dBm | dBm | dBm |
| 500 MHz | dBm | dBm | dBm |
| 1000 MHz | dBm | dBm | dBm |
| 2000 MHz | dBm | dBm | dBm |
| 3000 MHz | dBm | dBm | dBm |
| 3990 MHz | dBm | dBm | dBm |
| 5000 MHz | dBm | dBm | dBm |
| 5990 MHz | dBm | dBm | dBm |

**MT821_E** **Firmware Rev:** _____________ **Operator:** _______________ **Date:** ____________

**Serial Number:** _____________ **Options:** ______________________________________________

**MT821_E** **Firmware Rev:** _____________ **Operator:** _______________ **Date:** ____________

**Serial Number:** _____________ **Options:** ______________________________________________

# Test Records for Spectrum Analyzer Verification (Continued)

## Spectrum Analyzer Absolute Amplitude Accuracy Verification (continued)

**Table A-8.** Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency (1 of 4)

| Freq (MHZ) | Input Power (dBm) | Reference Level Setting (dBm) | Atten. Level Setting (dB) | Pre-Amp Setting | Marker 1 Reading (dBm) | Spec (dB) |
|---|---|---|---|---|---|---|
| 10.1 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |
| 50 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |

**MT821_E** **Firmware Rev:** _______________ **Operator:** __________________ **Date:** ______________

**Serial Number:** ________________ **Options:** _______________________________________________________

**Table A-8.** Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency (2 of 4)

| Freq (MHZ) | Input Power (dBm) | Reference Level Setting (dBm) | Atten. Level Setting (dB) | Pre-Amp Setting | Marker 1 Reading (dBm) | Spec (dB) |
|---|---|---|---|---|---|---|
| 100 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |
| 500 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |
| 1000 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |

**Table A-8.** Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency (3 of 4)

| Freq (MHZ) | Input Power (dBm) | Reference Level Setting (dBm) | Atten. Level Setting (dB) | Pre-Amp Setting | Marker 1 Reading (dBm) | Spec (dB) |
|---|---|---|---|---|---|---|
| 2000 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |
| 3000 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |
| 3990 | –50 | –40 | 15 | On | | ±1.25 |
| | –30 | –20 | 0 | Off | | ±1.25 |
| | –30 | –20 | 5 | Off | | ±1.25 |
| | –30 | –20 | 10 | Off | | ±1.25 |
| | –30 | –20 | 20 | Off | | ±1.25 |
| | –2 | 0 | 30 | Off | | ±1.25 |
| | –2 | 0 | 40 | Off | | ±1.25 |
| | –2 | 0 | 50 | Off | | ±1.25 |
| | –2 | 0 | 55 | Off | | ±1.25 |

**Table A-8.** Spectrum Analyzer Absolute Amplitude Accuracy Across Frequency (4 of 4)

| Freq (MHZ) | Input Power (dBm) | Reference Level Setting (dBm) | Atten. Level Setting (dB) | Pre-Amp Setting | Marker 1 Reading (dBm) | Spec (dB) |
|---|---|---|---|---|---|---|
| 5000 | –50 | –40 | 15 | On | | ±1.50 |
| (MT8213E Only) | –30 | –20 | 0 | Off | | ±1.50 |
| | –30 | –20 | 5 | Off | | ±1.50 |
| | –30 | –20 | 10 | Off | | ±1.50 |
| | –30 | –20 | 20 | Off | | ±1.50 |
| | –2 | 0 | 30 | Off | | ±1.50 |
| | –2 | 0 | 40 | Off | | ±1.50 |
| | –2 | 0 | 50 | Off | | ±1.50 |
| | –2 | 0 | 55 | Off | | ±1.50 |
| 5990 | –50 | –40 | 15 | On | | ±1.50 |
| (MT8213E Only) | –30 | –20 | 0 | Off | | ±1.50 |
| | –30 | –20 | 5 | Off | | ±1.50 |
| | –30 | –20 | 10 | Off | | ±1.50 |
| | –30 | –20 | 20 | Off | | ±1.50 |
| | –2 | 0 | 30 | Off | | ±1.50 |
| | –2 | 0 | 40 | Off | | ±1.50 |
| | –2 | 0 | 50 | Off | | ±1.50 |
| | –2 | 0 | 55 | Off | | ±1.50 |

# Test Records for Spectrum Analyzer Verification (Continued)

## Residual Spurious Response Verification

**Table A-9.** Spectrum Analyzer Residual Spurious with Preamp Off

| Start Freq. | Stop Freq. | RBW | VBW | Measured Values | Specification |
|---|---|---|---|---|---|
| 10 MHz | 50 MHz | 1 kHz | 300 Hz | dBm | ≤ – 90 dBm |
| 50 MHz | 2.0 GHz | 3 kHz | 10 kHz | dBm | ≤ – 90 dBm |
| 2.0 GHz | 4.0 GHz | 1 kHz | 1 kHz | dBm | ≤ – 90 dBm |
| 4.0 GHz | 5.0 GHz | 1 kHz | 3 kHz | dBm | ≤ – 90 dBm |
| 5.0 GHz | 5.2 GHz | 1 kHz | 1 kHz | dBm | ≤ – 90 dBm |
| 5.2 GHz | 5.7 GHz | 300 Hz | 3 kHz | dBm | ≤ – 90 dBm |
| 5.7 GHz | 5.9 GHz | 300 Hz | 3 kHz | dBm | ≤ – 90 dBm |
| 5.9 GHz | 6.0 GHz | 1 kHz | 100 Hz | dBm | ≤ – 90 dBm |

**Table A-10.** Spectrum Analyzer Residual Spurious with Preamp On

| Start Freq. | Stop Freq. | Measured Values | Specification |
|---|---|---|---|
| 10 MHz | 1.0 GHz | dBm | ≤ – 90 dBm |
| 1.0 GHz | 4.0 GHz | dBm | ≤ – 90 dBm |
| 4.0 GHz | 6.0 GHz | dBm | ≤ – 90 dBm |

## Displayed Average Noise Level (DANL)

**Table A-11.** Spectrum Analyzer DANL with Pre Amp Off

| Start Freq | Stop Freq | RBW | VBW | Measured Value at 100 kHz RBW | Calculated for 1 Hz RBW | Specification |
|---|---|---|---|---|---|---|
| 10 MHz | 2.4 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –141 dBm |
| 2.4 GHz | 4.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –137 dBm |
| 4.0 GHz | 5.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –134 dBm |
| 5.0 GHz | 6.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –126 dBm |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Spectrum Analyzer Verification (Continued)

## Displayed Average Noise Level (DANL) (continued)

**Table A-12.** Spectrum Analyzer DANL with Pre Amp On

| Start Freq | Stop Freq | RBW | VBW | Measured Value at 100 kHz RBW | Calculated for 1 Hz RBW | Specification |
|---|---|---|---|---|---|---|
| 10 MHz | 2.4 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –157 dBm |
| 2.4 GHz | 4.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –154 dBm |
| 4.0 GHz | 5.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –150 dBm |
| 5.0 GHz | 6.0 GHz | 100 kHz | 1 kHz | dBm | dBm | ≤ –143 dBm |

## Third Order Intercept (TOI) Verification

**Table A-13.** Third Order Intercept (TOI) Verification

| Frequency | Measured Max Value | Calculated TOI TOI = –20 + [(–20 - max) / 2] | Specification |
|---|---|---|---|
| 800 MHz | dBm | dBm | ≥ 16 dBm |
| 2400 MHz | dBm | dBm | ≥ 20 dBm |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# A-3 Test Records for Cable and Antenna Analyzer Verification

## Frequency Accuracy Verification

**Table A-14.** VNA Frequency Accuracy

| Frequency | Measured Value | Specification |
|---|---|---|
| 2 GHz (2000 MHz) | MHz | ± 5.0 kHz (± 2.5 ppm) |

## Return Loss Accuracy Verification

**Table A-15.** VNA Return Loss Accuracy Verification

| Frequency | Measured Value | Specification |
|---|---|---|
| 6 dB | dB | -4.8 dB $\geq$ x $\geq$ -7.2 dB |
| 20 dB | dB | -18.3 dB $\geq$ x $\geq$ -21.7 dB |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# A-4 Test Records for Power Meter Verification

## Power Meter Level Accuracy

**Table A-16.** Characterization Chart for Power Meter Verification

| Test Power Level at 50 MHz | Required Sensor B Reading |
|---|---|
| 0 dBm | dBm |
| –50 dBm | dBm |
| **Test Power Level at 4000 MHz** | **Required Sensor B Reading** |
| 0 dBm | dBm |
| –50 dBm | dBm |
| **Test Power Level at 6000 MHz** | **Required Sensor B Reading** |
| 0 dBm | dBm |
| –50 dBm | dBm |

**Table A-17.** Internal Power Meter Accuracy Verification

| Frequency | Input Power | Measured Values | Specification |
|---|---|---|---|
| 50 MHz | 0 dBm | dBm | ± 1.25 dB |
| | –50 dBm | dBm | ± 1.25 dB |
| 4.0 GHz | 0 dBm | dBm | ± 1.25 dB |
| | –50 dBm | dBm | ± 1.25 dB |
| 6.0 GHz | 0 dBm | dBm | ± 1.50 dB |
| | –50 dBm | dBm | ± 1.50 dB |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# A-5 Test Records for Options Verification

## Bias Tee Verification, Option 10

**Table A-18.** Option 10 Bias-Tee

| Voltage Setting | Measured Values | | Voltage Specification | Current Specification |
|---|---|---|---|---|
| **105 ohm Load, Low Current** | | | | |
| 12 V | V | mA | 12 ± 1.2 V | 85 mA to 145 mA |
| 18 V | V | mA | 18 ± 1.8 V | 142 mA to 202 mA |
| 24 V | V | mA | 24 ± 2.4 V | 199 mA to 259 mA |
| **40 ohm Load, High Current** | | | | |
| 15 V | V | mA | 15 ± 1.5 V | 325 mA to 425 mA |
| **78 ohm Load, High Current** | | | | |
| 32 V | V | mA | 32 ± 3.2 V | 370 mA to 450 mA |

## System Dynamic Range Verification, Option 21

**Table A-19.** VNA System Dynamic Range Verification

| Frequency | Measured Value | Specification |
|---|---|---|
| 2 MHz to 4 GHz | dB | ≤ –80 dB |
| > 4 GHz to 6 GHz | dB | ≤ –70 dB |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ____________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79

**Table A-20.** ISDB-T Signal Analyzer Frequency Accuracy

| Channel | Frequency | Ref Level | Pre Amp Off Freq Error | Spec. | Ref Level | Pre Amp On Freq Error | Spec. |
|---|---|---|---|---|---|---|---|
| 13 | 473.14285714 MHz | –20 dBm | Hz | ± 0.3 Hz | –50 dBm | Hz | ± 0.3 Hz |
| 38 | 623.14285714 MHz | –20 dBm | Hz | ± 0.3 Hz | –50 dBm | Hz | ± 0.3 Hz |
| 62 | 767.14285714 MHz | –20 dBm | Hz | ± 0.3 Hz | –50 dBm | Hz | ± 0.3 Hz |

**Table A-21.** ISDB-T Signal Analyzer Frequency Lock Range

| Channel | Frequency | Measured Frequency Error | Specification |
|---|---|---|---|
| 13 | 473.23285714 MHz | Hz | 90,000 ± 0.3 Hz |
| 13 | 473.05285714 MHz | Hz | –90,000 ± 0.3 Hz |

**Table A-22.** Level Accuracy Verification, AT(–10)

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | ∆AB(–10) | MN63A Attenuation Reading, AT(–10) |
|---|---|---|---|---|
| 473.14285714 MHz (Ch 13) | | | | |
| 623.14285714 MHz (Ch 38) | | | | |
| 767.14285714 MHz (Ch 62) | | | | |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ____________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-23.** Level Accuracy Verification, AT(–50)

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | ΔAB(–50) | MN63A Attenuation Reading, AT(–50) |
|---|---|---|---|---|
| 473.14285714 MHz (Ch 13) | | | | |
| 623.14285714 MHz (Ch 38) | | | | |
| 767.14285714 MHz (Ch 62) | | | | |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-24.** ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 13ch at 473.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off M(Level) (dBm) | Pre Amp Off Dev (dB) | Pre Amp On M(Level) (dBm) | Pre Amp On Dev (dB) | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-25.** ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 38ch at 623.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | Pre Amp On M(Level) (dBm) | Dev (dB) | |
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-26.** ISDB-T Signal Analyzer Level Accuracy Measurement Channel = 62ch at 767.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off M(Level) (dBm) | Pre Amp Off Dev (dB) | Pre Amp On M(Level) (dBm) | Pre Amp On Dev (dB) | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-27.** ISDB-T Signal Analyzer DANL with Pre Amp Off

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 13 | 473.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |
| 38 | 623.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |
| 62 | 767.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |

**Table A-28.** ISDB-T Signal Analyzer DANL with Pre Amp On

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 13 | 473.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |
| 38 | 623.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |
| 62 | 767.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T and BER Verification, Options 30 and 79 (continued)

**Table A-29.** ISDB-T Signal Analyzer Phase Noise

| Channel | Frequency (MHz) | at 10 kHz Offset (dBc / Hz) | Phase (10 kHz) | at 100 kHz Offset (dBc/Hz) | Phase (100 kHz) | Freq Error Spec. | Freq Error |
|---|---|---|---|---|---|---|---|
| 13 | 473.14285714 | ≤ –100 | dBc/Hz | ≤ –105 | dBc/Hz | ± 0.2 Hz | Hz |
| 38 | 623.14285714 | ≤ –100 | dBc/Hz | ≤ –105 | dBc/Hz | ± 0.2 Hz | Hz |
| 62 | 767.14285714 | ≤ –100 | dBc/Hz | ≤ –105 | dBc/Hz | ± 0.2 Hz | Hz |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## GPS Verification, Option 31

**Table A-30.** Option 31 GPS Receiver

| Frequency | Measured Value | Error | Specification |
|---|---|---|---|
| **Spectrum Analyzer Frequency Accuracy with GPS High Frequency Accuracy** | | | |
| 4.0 GHz | GHz | Hz | ± 200 Hz (± 50 ppb) |
| **Spectrum Analyzer Frequency Accuracy with Internal Standard Frequency Accuracy** | | | |
| 4.0 GHz | GHz | Hz | ± 1.2 kHz (± 0.3 ppm) |

**MT821_E Firmware Revision:** ________________ **Operator:** _______________ **Date:** ______________

**Serial Number:** ________________ **Options:** _______________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32

**Table A-31.** ISDB-T SFN Level Accuracy Verification, AT(–10)

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | ΔAB(–10) | MN63A Attenuation Reading, AT(–10) |
|---|---|---|---|---|
| 473.14285714 MHz (Ch 13) | | | | |
| 623.14285714 MHz (Ch 38) | | | | |
| 767.14285714 MHz (Ch 62) | | | | |

**MT821_E Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32 (continued)

**Table A-32.** ISDB-T SFN Analyzer Level Accuracy Measurement Channel = 13ch at 473.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(−10) or SB(−50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | M(Level) (dBm) | Dev (dB) | |
| −10 | AT(−10) = | | | −10 / NA | | | – NA – | – NA – | ± 2.0 |
| −15 | AT(−10) + 5 = | – NA – | | −15 / NA | | | – NA – | – NA – | ± 2.0 |
| −20 | AT(−10) + 10 = | – NA – | | −20 / −20 | | | | | ± 2.0 |
| −25 | AT(−10) + 15 = | – NA – | | −25 / −20 | | | | | ± 2.0 |
| −30 | AT(−10) + 20 = | – NA – | | −25 / −30 | | | | | ± 2.0 |
| −35 | AT(−10) + 25 = | – NA – | | −25 / −30 | | | | | ± 2.0 |
| −40 | AT(−10) + 30 = | – NA – | | −25 / −40 | | | | | ± 2.0 |
| −45 | AT(−10) + 35 = | – NA – | | −25 / −40 | | | | | ± 2.0 |
| −50 | AT(−50) = | | | −25 / −50 | | | | | ± 2.0 |
| −55 | AT(−50) + 5 = | – NA – | | −25 / −50 | | | | | ± 2.0 |
| −60 | AT(−50) + 10 = | – NA – | | −25 / −50 | | | | | ± 2.0 |
| −65 | AT(−50) + 15 = | – NA – | | NA / −50 | – NA – | – NA – | | | ± 2.0 |
| −70 | AT(−50) + 20 = | – NA – | | NA / −50 | – NA – | – NA – | | | ± 2.0 |
| −75 | AT(−50) + 25 = | – NA – | | NA / −50 | – NA – | – NA – | | | ± 2.0 |
| −80 | AT(−50) + 30 = | – NA – | | NA / −50 | – NA – | – NA – | | | ± 2.0 |
| −84 | AT(−50) + 34 = | – NA – | | NA / −50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision: _______________ Operator: _______________ Date: _____________**

**Serial Number: _______________ Options: ___________________________________________________**

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32 (continued)

**Table A-33.** ISDB-T SFN Level Accuracy Verification, AT(–50)

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | ΔAB(–50) | MN63A Attenuation Reading, AT(–50) |
|---|---|---|---|---|
| 473.14285714 MHz (Ch 13) | | | | |
| 623.14285714 MHz (Ch 38) | | | | |
| 767.14285714 MHz (Ch 62) | | | | |

**MT821_E** **Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ______________________________________________

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32 (continued)

**Table A-34.** ISDB-T SFN Analyzer Level Accuracy Measurement Channel = 38ch at 623.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | Pre Amp On M(Level) (dBm) | Dev (dB) | |
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32 (continued)

**Table A-35.** ISDB-T SFN Signal Analyzer Level Accuracy Measurement Channel = 62ch at 767.14285714 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off M(Level) (dBm) | Pre Amp Off Dev (dB) | Pre Amp On Pre Amp On M(Level) (dBm) | Pre Amp On Dev (dB) | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## ISDB-T SFN Verification, Option 32 (continued)

**Table A-36.** ISDB-T SFN Analyzer DANL with Pre Amp Off

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 13 | 473.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |
| 38 | 623.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |
| 62 | 767.14285714 MHz | –25 dBm | dBm | ≤ –70 dBm |

**Table A-37.** ISDB-T SFN Analyzer DANL with Pre Amp On

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 13 | 473.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |
| 38 | 623.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |
| 62 | 767.14285714 MHz | –50 dBm | dBm | ≤ –90 dBm |

**MT821_E** **Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## GSM/GPRS/EDGE Signal Analyzer Verification, Options 40 and 41

**Table A-38.** Option 40 GSM/GPRS/EDGE RF Measurements

| Error Type | Measured Value | Specification |
|---|---|---|
| **At 850 MHz, –10 dBm Level, TCH Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 850 MHz, –50 dBm Level, TCH ALL Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 1800 MHz, –10 dBm Level, TCH ALL Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 1800 MHz, –50 dBm Level, TCH Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 850 MHz, –10 dBm Level, DL_MCS-9_1SLOT Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 850 MHz, –50 dBm Level, DL_MCS-9_4SLOT Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 1800 MHz, –10 dBm Level, DL_MCS-9_4SLOT Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |
| **At 1800 MHz, –50 dBm Level, DL_MCS-9_1SLOT Pattern** | | |
| Burst Power Error | dB | ±1.5 dB |
| Frequency Error | Hz | ±10 Hz |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## GSM/GPRS/EDGE Signal Analyzer Verification, Options 40 and 41 (continued)

**Table A-39.** Option 41 GSM/GPRS/EDGE Demodulator

| Measurement | Measured Value | Specification |
|---|---|---|
| **At 850 MHz, –10 dBm Level, TCH Pattern** | | |
| Phase Err RMS (Deg) | Deg | ≤ 1 Deg |
| **At 850 MHz, –50 dBm Level, TCH ALL Pattern** | | |
| Phase Err RMS (Deg) | Deg | ≤ 1 Deg |
| **At 1800 MHz, –10 dBm Level, TCH ALL Pattern** | | |
| Phase Err RMS (Deg) | Deg | ≤ 1 Deg |
| **At 1800 MHz, –50 dBm Level, TCH Pattern** | | |
| Phase Err RMS (Deg) | Deg | ≤ 1 Deg |
| **At 850 MHz, –10 dBm Level, DL_MCS-9_1SLOT Pattern** | | |
| EVM RMS | % | ≤ 2.5% |
| **At 850 MHz, –50 dBm Level, DL_MCS-9_4SLOT Pattern** | | |
| EVM RMS | % | ≤ 2.5% |
| **At 1800 MHz, –10 dBm Level, DL_MCS-9_4SLOT Pattern** | | |
| EVM RMS | % | ≤ 2.5% |
| **At 1800 MHz, –50 dBm Level, DL_MCS-9_1SLOT Pattern** | | |
| EVM RMS | % | ≤ 2.5% |

**MT821_E** **Firmware Rev:** _______________ **Operator:** __________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ______________________________________________________

# Test Records for Options Verification (continued)

## CDMA Signal Analyzer Verification, Options 42 and 43

**Table A-40.** Option 42 CDMA RF Measurements

| Measurement | Measured Value | Specification |
|---|---|---|
| **At 870.03 MHz, –30 dBm Level, cdmaOne** | | |
| Channel Power | dB | ±1.5 dB |
| **At 1930.05 MHz, –30 dBm Level, cdmaOne** | | |
| Channel Power | dB | ±1.5 dB |
| **At 1930.05 MHz, –30 dBm Level, CDMA2000** | | |
| Channel Power | dB | ±1.5 dB |
| **At 870.03 MHz, –30 dBm Level, CDMA2000** | | |
| Channel Power | dB | ±1.5 dB |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ____________________________________________________

# Test Records for Options Verification (continued)

## CDMA Signal Analyzer Verification, Options 42 and 43 (continued)

**Table A-41.** Option 43 cdmaOne and CDMA2000 1xRTT Demodulator

| Measurement | Measured Value | Specification |
|---|---|---|
| **At 870.03 MHz, –30 dBm Level, cdmaOne** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho | | 0.99 ≤ x ≤ 1 |
| Tau | µs | ± 1 µs |
| **At 1930.05 MHz, –30 dBm Level, cdmaOne** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho | | 0.99 ≤ x ≤ 1 |
| Tau | µs | ± 1 µs |
| **At 1930.05 MHz, –30 dBm Level, CDMA2000** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho | | 0.99 ≤ x ≤ 1 |
| Tau | µs | ± 1 µs |
| **At 870.03 MHz, –30 dBm Level, CDMA2000** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho | | 0.99 ≤ x ≤ 1 |
| Tau | µs | ± 1 µs |

**MT821_E** **Firmware Rev:** _____________ **Operator:** ________________ **Date:** ____________

**Serial Number:** ______________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## WCDMA/HSDPA Signal Analyzer Verification, Options 44, 45, 65,

**Table A-42.** Option 44, Sensor A and B Reading Components Characterization Table

| Frequency | PMA.10 (dBm) | PMB.10 (dBm) | Δ1 (dBm) | PMA.10C (dBm) | PMA.20 (dBm) | ATT.10 (dB) |
|---|---|---|---|---|---|---|
| 881.5 MHz | | | | | | |

**Table A-43.** Option 44, Power Level Setting Components Characterization Table

| Frequency | MG3700A.10 Setting (dBm) | MG3700A.20 Setting (dBm) | PMA.10 (dBm) | PMA.20 (dBm) |
|---|---|---|---|---|
| 881.5 MHz | | | | |

**Table A-44.** Option 44, WCDMA Absolute Power Accuracy

| Test Level | Measured Power | Error | Specification |
|---|---|---|---|
| +20 dBm | dBm | dB | ± 1.25 dB |
| +10 dBm | dBm | dB | ± 1.25 dB |
| –10 dBm | dBm | dB | ± 1.25 dB |
| –20 dBm | dBm | dB | ± 1.25 dB |

**Table A-45.** Option 44, WCDMA Occupied Bandwidth (OBW)

| Frequency | Power Meter Reading | OBW | Specification |
|---|---|---|---|
| 881.5 MHz | dBm | | 4.2 MHz ± 100 kHz |
| 1962.5 MHz | dBm | | 4.2 MHz ± 100 kHz |
| 2680.5 MHz | dBm | | 4.2 MHz ± 100 kHz |

**MT821_E** **Firmware Rev:** ______________ **Operator:** _________________ **Date:** _____________

**Serial Number:** _______________ **Options:** ___________________________________________________

# Test Records for Options Verification (continued)

## WCDMA/HSDPA Signal Analyzer Verification, Options 44, 45, 65, (continued)

**Table A-46.** Option 44, WCDMA RF Channel Power Accuracy

| Frequency | Power Meter Reading | Measured RF Channel Power | RF Channel Power Error | Specification |
|---|---|---|---|---|
| 881.5 MHz | | | | ±1.25 dB |
| 1962.5 MHz | | | | ±1.25 dB |
| 2680.5 MHz | | | | ±1.25 dB |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________________

# Test Records for Options Verification (continued)

## WCDMA/HSDPA Signal Analyzer Verification, Options 44, 45, 65, (continued)

**Table A-47.** Option 44, HSDPA RF Channel Power Accuracy

| Frequency | Power Meter Reading | Measured RF Channel Power | RF Channel Power Accuracy | Specification |
|---|---|---|---|---|
| 2680.5 MHz | | | | ± 1.25 dB |

**Table A-48.** Option 45 or 65, WCDMA Error Vector Magnitude (Test Model 4)

| Frequency (MHz) | Measured Value | Specification |
|---|---|---|
| 1962.5 | EVM % | ≤ 2.5% |

**Table A-49.** Option 65, HSDPA Error Vector Magnitude (Test Model 5)

| Frequency (MHz) | Measured Value | Specification |
|---|---|---|
| 1962.5 | EVM % | ≤ 2.5% |

**MT821_E Firmware Revision: _______________ Operator: _______________ Date: _____________**

**Serial Number: _______________ Options: ___________________________________________________**

# Test Records for Options Verification (continued)

## Fixed WiMAX Signal Analyzer Verification, Options 46 and 47 (continued)

### Fixed WiMAX Signal Analyzer Option Verification (Option 46)

**Table A-50.** Option 46, Fixed WiMAX Channel Power Accuracy

| Frequency | Input Power | Measured Channel Power (RSSI) | Error | Specification |
|---|---|---|---|---|
| 2600.5 MHz | –15 dBm | dBm | dB | ± 1.5 dB |
| 2600.5 MHz | –50 dBm | dBm | dB | ± 1.5 dB |
| 3600.5 MHz | –15 dBm | dBm | dB | ± 1.5 dB |
| 3600.5 MHz | –50 dBm | dBm | dB | ± 1.5 dB |
| 5600.5 MHz | –15 dBm | dBm | dB | ± 1.5 dB |
| 5600.5 MHz | –50 dBm | dBm | dB | ± 1.5 dB |

# Test Records for Options Verification (continued)

## Fixed WiMAX Signal Analyzer Verification, Options 46 and 47 (continued)

### Fixed WiMAX Signal Analyzer Option Verification (Option 47)

**Table A-51.** Option 47, Fixed WiMAX Residual EVM

| Frequency | Power | BW | EVM (RMS) | Specification |
|---|---|---|---|---|
| 2600.5 MHz | –15 dBm | 10 MHz | % | ≤ 3.5% |
| 2600.5 MHz | –50 dBm | 10 MHz | % | ≤ 3.5% |
| 3600.5 MHz | –15 dBm | 10 MHz | % | ≤ 3.5% |
| 3600.5 MHz | –50 dBm | 10 MHz | % | ≤ 3.5% |
| 5600.5 MHz | –15 dBm | 10 MHz | % | ≤ 3.5% |
| 5600.5 MHz | –50 dBm | 10 MHz | % | ≤ 3.5% |

**Table A-52.** Option 47, Fixed WiMAX Frequency Error

| Frequency | Power | Frequency Error | Specification |
|---|---|---|---|
| 2600.5 MHz | –50 dBm | Hz | ± 182 Hz |
| 5600.5 MHz | –50 dBm | Hz | ± 392 Hz |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________________

# Test Records for Options Verification (continued)

## T1 Analyzer Verification, Option 51

**Table A-53.** Option 51, T1 Frequency Clock

| Measurement | Measured Value | Specification |
|---|---|---|
| Internal Clock Error | | ± 5 ppm |
| Recovered Clock Frequency | | 1543992 to 1544008 Hz |

**Table A-54.** T1 Transmitted Level Voltage

| Measurement | Measured Value | Specification |
|---|---|---|
| Tx LBO: 0 dB | | 4.8 to 7.6 Vp-p |
| Tx LBO: –7.5 dB | | 1.9 to 31 Vp-p |
| Tx LBO: –15 dB | | 0.5 to 1.7 Vp-p |

**Table A-55.** T1 Transmitted Level Vpp Reading

| Measurement | Vpp Reading | Specification |
|---|---|---|
| Tx LBO: 0 dB | | 4.8 to 7.6 Vp-p |
| Tx LBO: –7.5 dB | | 1.9 to 3.1 Vp-p |
| Tx LBO: –15 dB | | 0.5 to 1.7 Vp-p |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ______________________________________________________

# Test Records for Options Verification (continued)

## E1 Analyzer Verification, Option 52

**Table A-56.** Option 52, E1 Frequency Clock

| Measurement | Measured Value | Specification |
|---|---|---|
| Internal Clock Error | | ± 5 ppm |
| Recovered Clock Frequency | | 204790 to 2048010 Hz |

**Table A-57.** Option 52, E1 Transmitted Level Voltage

| Measurement | Measured Value | Specification |
|---|---|---|
| 120 ohm (RJ48 Interface) | | 5.4 to 6.6 Vp-p |
| 75 ohm (BNC Interface) | | 4.2 to 5.2 Vp-p |

**Table A-58.** Option 52, E1 Transmitted Level Vpp Reading

| Measurement | Vpp Reading | Specification |
|---|---|---|
| 120 ohm (RJ48 Interface) | | 5.4 to 6.6 Vp-p |
| 75 ohm (BNC Interface) | | 4.2 to 5.2 Vp-p |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________________

# Test Records for Options Verification (continued)

## T1/T3 Analyzer Verification, Option 53

**Table A-59.** Option 53, T1/T3 Frequency Clock

| Measurement | Measured Value | Specification |
|---|---|---|
| Internal Clock Error | | ± 5 ppm |
| Recovered Clock Frequency | | 1543992 to 1544008 Hz |

**Table A-60.** Option 53, T1 Transmitted Level Voltage

| Measurement | Measured Value | Specification |
|---|---|---|
| Tx LBO: 0 dB | | 4.8 to 7.2 Vp-p |
| Tx LBO: –7.5 dB | | 1.9 to 3.1 Vp-p |
| Tx LBO: –15 dB | | 0.5 to 1.7 Vp-p |

**Table A-61.** Option 53, T1 Transmitted Level Vpp Reading

| Measurement | Vpp Reading | Specification |
|---|---|---|
| Tx LBO: 0 dB | | 4.8 to 7.2 Vp-p |
| Tx LBO: –7.5 dB | | 1.9 to 3.1 Vp-p |
| Tx LBO: –15 dB | | 0.5 to 1.7 Vp-p |

**Table A-62.** Option 53, T3 Frequency Clock

| Measurement | Measured Value | Specification |
|---|---|---|
| Internal Clock Error | | ± 5 ppm |
| Recovered Clock Frequency | | 44735776 to 44736224 Hz |

**MT821_E Firmware Revision: ________________ Operator: ________________ Date: ______________**

**Serial Number: ________________ Options: ________________________________________________________**

# Test Records for Options Verification (continued)

## T1/T3 Analyzer Verification, Option 53 (continued)

**Table A-63.** Option 53, T3 Transmitted Level Voltage

| Measurement | Measured Value | Specification |
|---|---|---|
| DSX | | 0.72 to 1.7 Vp-p |
| LOW | | 0.72 to 1.7 Vp-p |

**Table A-64.** Option 53, T3 Transmitted Level Vpp Reading

| Measurement | Vpp Reading | Specification |
|---|---|---|
| DSX | | 0.72 to 1.7 Vp-p |
| LOW | | 0.72 to 1.7 Vp-p |

## TD-SCDMA Signal Analyzer Verification, Options 60 and 61

**Table A-65.** Option 60, 61, TD-SCDMA Verification (at 2010 MHz, –45 dBm Level, TD-SCDMA)

| Measurement | Measured Value | Specification |
|---|---|---|
| Channel Power (Error) | | ± 1.5 dB |
| Frequency Error | | ± 10 Hz |
| Tau | | ± 0.2 μs |

**MT821_E Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## EVDO Signal Analyzer Verification, Options 62 and 63

**Table A-66.** Option 62, EVDO RF Measurements

| Measurement | Measured Value | Specification |
|---|---|---|
| **At 870.03 MHz, –50 dBm Level, 921.6kps 8-PSK Modulation** | | |
| Channel Power Error | dB | ± 1.5 dB |
| **At 1930.05 MHz, 0 dBm Level, 38.4kps QPSK Modulation** | | |
| Channel Power Error | dB | ± 1.5 dB |
| **At 1930.05 MHz, –50 dBm Level, 2457.6kps 16-QAM Modulation** | | |
| Channel Power Error | dB | ± 1.5 dB |
| **At 1930.05 MHz, –50 dBm Level, Idle Slot** | | |
| Channel Power Error | dB | ± 1.5 dB |
| **At 870.03 MHz, –10 dBm Level, Idle Slot** | | |
| Channel Power Error | dB | ± 1.5 dB |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## EVDO Signal Analyzer Verification, Options 62 and 63 (continued)

**Table A-67.** Option 63, EVDO Demodulator

| Measurement | Measured Value | Specification |
|---|---|---|
| **At 870.03 MHz, –50 dBm Level, 921.6kps 8-PSK Modulation** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho Pilot | | 0.99 ≤ x ≤ 1 |
| Tau | μs | ± 1 μs |
| **At 1930.05 MHz, 0 dBm Level, 38.4kps QPSK Modulation** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho Pilot | | 0.99 ≤ x ≤ 1 |
| Tau | μs | ± 1 μs |
| **At 1930.05 MHz, –50 dBm Level, 2457.6kps 16-QAM Modulation** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho Pilot | | 0.99 ≤ x ≤ 1 |
| Tau | μs | ± 1 μs |
| **At 1930.05 MHz, –50 dBm Level, Idle Slot** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho Pilot | | 0.99 ≤ x ≤ 1 |
| Tau | μs | ± 1 μs |
| **At 870.03 MHz, –10 dBm Level, Idle Slot** | | |
| Frequency Error | Hz | ± 10 Hz |
| Rho Pilot | | 0.99 ≤ x ≤ 1 |
| Tau | μs | ± 1 μs |

**MT821_E Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## DVB-T/H Signal Analyzer Verification, Options 64 and 57

**Table A-68.** Option 64, DVB-T/H Signal Analyzer, Frequency Accuracy for –20 dBm Reference Level

| Channel | Reference Level | Frequency Error | Specification |
|---|---|---|---|
| 21 | –20 dBm | Hz | ± 0.3 Hz |
| 45 | –20 dBm | Hz | ± 0.3 Hz |
| 69 | –20 dBm | Hz | ± 0.3 Hz |

**Table A-69.** Option 64, DVB-T/H Signal Analyzer, Frequency Accuracy for –50 dBm Reference Level

| Channel | Reference Level | Frequency Error | Specification |
|---|---|---|---|
| 21 | –50 dBm | Hz | ± 0.3 Hz |
| 45 | –50 dBm | Hz | ± 0.3 Hz |
| 69 | –50 dBm | Hz | ± 0.3 Hz |

**Table A-70.** Option 64, DVB-T/H Signal Analyzer, Residual MER Pre Amp Off

| Channel | Total MER | Specification |
|---|---|---|
| 21 | dB | ≥ 42 dB |
| 45 | dB | ≥ 42 dB |
| 69 | dB | ≥ 42 dB |

**Table A-71.** Option 64, DVB-T/H Signal Analyzer, Residual MER Pre Amp On

| Channel | Total MER | Specification |
|---|---|---|
| 21 | dB | ≥ 37 dB |
| 45 | dB | ≥ 37 dB |
| 69 | dB | ≥ 37 dB |

**MT821_E Firmware Revision:** _______________ **Operator:** _______________ **Date:** _____________

**Serial Number:** _______________ **Options:** ____________________________________________________

# Test Records for Options Verification (continued)

## DVB-T/H Signal Analyzer Verification, Options 64 and 57 (continued)

**Table A-72.** Option 64, DVB-T/H Signal Analyzer, Frequency Lock Range

| Channel | Frequency | Measured Frequency Offset | Specification |
|---|---|---|---|
| 21 | 474.09 MHz | Hz | 90 kHz ± 0.3 Hz |
| 21 | 473.91 MHz | Hz | –90 kHz ± 0.3 Hz |

**Table A-73.** Option 64, DVB-T/H Signal Analyzer, Level Accuracy Verification, –10

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | DAB(–10) | MN63A Attenuation Reading, AT(–10) |
|---|---|---|---|---|
| 474 MHz (Ch 21) | | | | |
| 666 MHz (Ch 45) | | | | |
| 858 MHz (Ch 69) | | | | |

**Table A-74.** Option 64, DVB-T/H Signal Analyzer, Level Accuracy Verification, –50

| Frequency (Channel) | Sensor A Reading | Sensor B Reading | DAB(–50) | MN63A Attenuation Reading, AT(–50) |
|---|---|---|---|---|
| 474 MHz (Ch 21) | | | | |
| 666 MHz (Ch 45) | | | | |
| 858 MHz (Ch 69) | | | | |

**MT821_E Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## DVB-T/H Signal Analyzer Verification, Options 64 and 57 (continued)

**Table A-75.** Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 21 at 474 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | Pre Amp On M(Level) (dBm) | Dev (dB) | |
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision: _______________ Operator: _______________ Date: _____________**

**Serial Number: _______________ Options: ____________________________________________________**

## DVB-T/H Signal Analyzer Verification, Options 64 and 57 (continued)

**Table A-76.** Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 45 at 666 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | Pre Amp On M(Level) (dBm) | Dev (dB) | |
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________

# Test Records for Options Verification (continued)

## DVB-T/H Signal Analyzer Verification, Options 64 and 57 (continued)

**Table A-77.** Option 64, DVB-T/H Signal Analyzer, Level Accuracy Measurement, Channel = 69 at 858 MHz

| Test Level (dBm) | AT(set) (dB) | SB(–10) or SB(–50) (dBm) | Input Level (dBm) | Ref Level Pre Amp Off / On (dBm) | Pre Amp Off | | Pre Amp On | | Spec (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | M(Level) (dBm) | Dev (dB) | Pre Amp On M(Level) (dBm) | Dev (dB) | |
| –10 | AT(–10) = | | | –10 / NA | | | – NA – | – NA – | ± 2.0 |
| –15 | AT(–10) + 5 = | – NA – | | –15 / NA | | | – NA – | – NA – | ± 2.0 |
| –20 | AT(–10) + 10 = | – NA – | | –20 / –20 | | | | | ± 2.0 |
| –25 | AT(–10) + 15 = | – NA – | | –25 / –20 | | | | | ± 2.0 |
| –30 | AT(–10) + 20 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –35 | AT(–10) + 25 = | – NA – | | –25 / –30 | | | | | ± 2.0 |
| –40 | AT(–10) + 30 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –45 | AT(–10) + 35 = | – NA – | | –25 / –40 | | | | | ± 2.0 |
| –50 | AT(–50) = | | | –25 / –50 | | | | | ± 2.0 |
| –55 | AT(–50) + 5 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –60 | AT(–50) + 10 = | – NA – | | –25 / –50 | | | | | ± 2.0 |
| –65 | AT(–50) + 15 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –70 | AT(–50) + 20 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –75 | AT(–50) + 25 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –80 | AT(–50) + 30 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |
| –84 | AT(–50) + 34 = | – NA – | | NA / –50 | – NA – | – NA – | | | ± 2.0 |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** _______________________________________________________

# Test Records for Options Verification (continued)

## DVB-T/H Signal Analyzer Verification, Options 64 and 57 (continued)

**Table A-78.** Option 64, DVB-T/H Signal Analyzer, DANL, Pre Amp Off

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 21 | 474 MHz | –25 dBm | dBm | ≤ –69 dBm |
| 45 | 666 MHz | –25 dBm | dBm | ≤ –69 dBm |
| 69 | 858 MHz | –25 dBm | dBm | ≤ –69 dBm |

**Table A-79.** Option 64, DVB-T/H Signal Analyzer, DANL, Pre Amp On

| Channel | Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|---|
| 21 | 474 MHz | –50 dBm | dBm | ≤ –89 dBm |
| 45 | 666 MHz | –50 dBm | dBm | ≤ –89 dBm |
| 69 | 858 MHz | –50 dBm | dBm | ≤ –89 dBm |

**Table A-80.** Option 78, DVB-T/H SFN, Level Accuracy for Channel 21, 474 MHz

| Test Level (dBm) | Ref Level Pre Amp Off(dBm) | Pre Amp Off | RefLevel Pre Amp On (dBm) | Pre Amp On | Specification (dBm) |
|---|---|---|---|---|---|
| | | Measured Level (dBm) | | Measured Level (dBm) | |
| –10 | –10 | | -10 | | -10 ± 2.0 |
| –20 | –10 | | -10 | | -20 ± 2.0 |
| –30 | –10 | | -10 | | -30 ± 2.0 |
| –40 | –10 | | -10 | | -40 ± 2.0 |

**MT821_E** **Firmware Revision:** ______________ **Operator:** ______________ **Date:** ____________

**Serial Number:** ______________ **Options:** ______________________________________________

# Test Records for Options Verification (continued)

**Table A-81.** Option 78, DVB-T/H SFN, Level Accuracy for Channel 45, 666 MHz

| Test Level (dBm) | Ref Level Pre Amp Off(dBm) | Pre Amp Off | RefLevel Pre Amp On (dBm) | Pre Amp On | Specification (dBm) |
|---|---|---|---|---|---|
| | | Measured Level (dBm) | | Measured Level (dBm) | |
| –10 | –10 | | -10 | | -10 ± 2.0 |
| –20 | –10 | | -10 | | -20 ± 2.0 |
| –30 | –10 | | -10 | | -30 ± 2.0 |
| –40 | –10 | | -10 | | -40 ± 2.0 |

**Table A-82.** Option 78, DVB-T/H SFN, Level Accuracy for Channel 69, 858 MHz

| Test Level (dBm) | Ref Level Pre Amp Off(dBm) | Pre Amp Off | RefLevel Pre Amp On (dBm) | Pre Amp On | Specification (dBm) |
|---|---|---|---|---|---|
| | | Measured Level(dBm) | | Measured Level (dBm) | |
| –10 | –10 | | -10 | | -10 ± 2.0 |
| –20 | –10 | | -10 | | -20 ± 2.0 |
| –30 | –10 | | -10 | | -30 ± 2.0 |
| –40 | –10 | | -10 | | -40 ± 2.0 |

**Table A-83.** Option 78, DVB-T/H SFN Analyzer DANL with Pre Amp Off

| Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|
| 474 MHz | –25 dBm | dBm | ≤ –69 dBm |
| 666 MHz | –25 dBm | dBm | ≤ –69 dBm |
| 858 MHz | –25 dBm | dBm | ≤ –69 dBm |

**Table A-84.** Option 78, DVB-T/H SFN Analyzer DANL with Pre Amp On

| Frequency | Ref Level | Measured Value | Specification |
|---|---|---|---|
| 474 MHz | –50 dBm | dBm | ≤ –89 dBm |
| 666 MHz | –50 dBm | dBm | ≤ –89 dBm |
| 858 MHz | –50 dBm | dBm | ≤ –89 dBm |

**MT821_E Firmware Revision:** ________________ **Operator:** ________________ **Date:** ______________

**Serial Number:** ________________ **Options:** ________________________________________________________

# Test Records for Options Verification (continued)

## Mobile WiMAX Channel Power Accuracy Tests (Option 66)

**Table A-85.** Option 66, Mobile WiMAX Channel Power Accuracy (10 MHz Bandwidth and 10 ms Frame Length)

| Frequency (MHz) | Input Power (dBm) | Measured Channel Power (RSSI) | Error | Specification |
|---|---|---|---|---|
| 2600.5 | –15 | dBm | dB | ± 1.5 dB |
| 2600.5 | –50 | dBm | dB | ± 1.5 dB |
| 3600.5 | –15 | dBm | dB | ± 1.5 dB |
| 3600.5 | –50 | dBm | dB | ± 1.5 dB |

**Table A-86.** Option 66, Mobile WiMAX Channel Power Accuracy (5 MHz Bandwidth and 5 ms Frame Length)

| Frequency (MHz) | Input Power (dBm) | Measured Channel Power (RSSI) | Error | Specification |
|---|---|---|---|---|
| 2600.5 | –15 | dBm | dB | ± 1.5 dB |
| 2600.5 | –50 | dBm | dB | ± 1.5 dB |
| 3600.5 | –15 | dBm | dB | ± 1.5 dB |
| 3600.5 | –50 | dBm | dB | ± 1.5 dB |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ________________________________________________**

# Test Records for Options Verification (continued)

## Mobile WiMAX Signal Analyzer Verification, Options 66 and 67 (continued)

## Mobile WiMAX Residual EVM and Frequency Error Tests (Option 67)

**Table A-87.** Option 67, Mobile WiMAX Residual EVM (10 MHz Bandwidth and 10 ms Frame Length)

| Frequency (MHz) | Power (dBm) | BW (MHz) | EVM (rms) | Specification |
|---|---|---|---|---|
| 2600.5 | –15 | 10 | % | ≤ 3.0% |
| 2600.5 | –50 | 10 | % | ≤ 3.0% |
| 3600.5 | –15 | 10 | % | ≤ 3.0% |
| 3600.5 | –50 | 10 | % | ≤ 3.0% |

**Table A-88.** Option 67, Mobile WiMAX Frequency Error (10 MHz Bandwidth and 10 ms Frame Length)

| Frequency (MHz) | Power (dBm) | Freq Error | Specification |
|---|---|---|---|
| 2600.5 | –50 | Hz | ± 52.01 Hz |
| 3600.5 | –50 | Hz | ± 72.01 Hz |

**Table A-89.** Option 67, Mobile WiMAX Residual EVM (5 MHz Bandwidth and 5 ms Frame Length)

| Frequency (MHz) | Power (dBm) | BW (MHz) | EVM (rms) | Specification |
|---|---|---|---|---|
| 2600.5 | –15 | 5 | % | ≤ 3.0% |
| 2600.5 | –50 | 5 | % | ≤ 3.0% |
| 3600.5 | –15 | 5 | % | ≤ 3.0% |
| 3600.5 | –50 | 5 | % | ≤ 3.0% |

**Table A-90.** Option 67, Mobile WiMAX Frequency Error (5 MHz Bandwidth and 5 ms Frame Length)

| Frequency (MHz) | Power (dBm) | Freq Error | Specification |
|---|---|---|---|
| 2600.5 | –50 | Hz | ± 52.01 Hz |
| 3600.5 | –50 | Hz | ± 72.01 Hz |

**MT821_E Firmware Revision: ________________ Operator: ________________ Date: ______________**

**Serial Number: ________________ Options: ________________________________________________________**

# Test Records for Options Verification (continued)

## LTE Signal Analyzer Verification, Options 541 and 542

**Table A-91.** Option 541, LTE Channel Power Accuracy

| Frequency (MHz) | Input Power (dBm) | Measured Channel Power | Error | Specification |
|---|---|---|---|---|
| **10 MHz IF BW, Pattern E-TM_1-1_10M** | | | | |
| 750 | –20 | dBm | dB | ± 1.5 dB |
| 750 | –50 | dBm | dB | ± 1.5 dB |
| 2150 | –20 | dBm | dB | ± 1.5 dB |
| 2150 | –50 | dBm | dB | ± 1.5 dB |
| **20 MHz IF BW, Pattern E-TM_1-1_20M (Only for units with 20 MHz IF BW Available)** | | | | |
| 750 | –20 | dBm | dB | ± 1.5 dB |
| 750 | –50 | dBm | dB | ± 1.5 dB |
| 2150 | –20 | dBm | dB | ± 1.5 dB |
| 2150 | –50 | dBm | dB | ± 1.5 dB |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## LTE Signal Analyzer Verification, Options 541 and 542 (continued)

**Table A-92.** Option 542, Frequency Accuracy

| Measurement | Frequency Error | Specification |
|---|---|---|
| **10 MHz IF BW, Pattern E-TM_3-1_10M** | | |
| **750 MHz at –20 dBm** | Hz | ± 10 Hz |
| **750 MHz at –50 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –20 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –50 dBm** | Hz | ± 10 Hz |
| **20 MHz IF BW, Pattern E-TM_3-1_20M (Only for units with 20 MHz IF BW Available)** | | |
| **750 MHz at –20 dBm** | Hz | ± 10 Hz |
| **750 MHz at –50 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –20 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –50 dBm** | Hz | ± 10 Hz |

**MT821_E Firmware Revision: ________________ Operator: ________________ Date: ______________**

**Serial Number: ________________ Options: ________________________________________________**

# Test Records for Options Verification (continued)

## TD-LTE Signal Analyzer Verification, Options 551 and 552

**Table A-93.** Option 551, TD-LTE Channel Power Accuracy

| Frequency (MHz) | Input Power (dBm) | Measured Channel Power | Error | Specification |
|---|---|---|---|---|
| **10 MHz IF BW, Pattern TDLTE-E-TM_1-1_10M** | | | | |
| 750 | –20 | dBm | dB | ± 1.5 dB |
| 750 | –50 | dBm | dB | ± 1.5 dB |
| 2150 | –20 | dBm | dB | ± 1.5 dB |
| 2150 | –50 | dBm | dB | ± 1.5 dB |
| **20 MHz IF BW, Pattern TDLTE-E-TM_1-1_20M (Only for units with 20 MHz IF BW Available)** | | | | |
| 750 | –20 | dBm | dB | ± 1.5 dB |
| 750 | –50 | dBm | dB | ± 1.5 dB |
| 2150 | –20 | dBm | dB | ± 1.5 dB |
| 2150 | –50 | dBm | dB | ± 1.5 dB |

**MT821_E Firmware Revision: ______________ Operator: ______________ Date: ____________**

**Serial Number: ______________ Options: ______________________________________________**

# Test Records for Options Verification (continued)

## TD-LTE Signal Analyzer Verification, Options 551 and 552 (continued)

**Table A-94.** Option 552, TD-LTE Frequency Accuracy

| Measurement | Frequency Error | Specification |
|---|---|---|
| **10 MHz IF BW, Pattern TDLTE-E-TM_3-3_10M** | | |
| **750 MHz at –20 dBm** | Hz | ± 10 Hz |
| **750 MHz at –50 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –20 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –50 dBm** | Hz | ± 10 Hz |
| **20 MHz IF BW, Pattern TDLTE-E-TM_3-3_20M (Only for units with 20 MHz IF BW Available)** | | |
| **750 MHz at –20 dBm** | Hz | ± 10 Hz |
| **750 MHz at –50 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –20 dBm** | Hz | ± 10 Hz |
| **2150 MHz at –50 dBm** | Hz | ± 10 Hz |

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