Anritsu

Spectrum Master™
MS2721A

Benchtop Performance in a Handheld Spectrum Analyzer

SiteMaster | SpectrumMaster | CellMaster

User's Guide

WARRANTY

The Anritsu product(s) listed on the title page is (are) warranted against defects in materials and workmanship for one year from the date of shipment.

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VxWorks Runtime License
2000-1189

WindML Target License
2000-1372

NI Device License
2000-1486

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

产品中有毒有害物质或元素的名称及含量

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。						

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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）。

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: Spectrum Master

Model Number: MS2721A

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 73/23/EEC as amended by Council directive 93/68/EEC

Electromagnetic Interference:

Emissions: CISPR 11:1990/EN55011:1991 Group 1 Class A

Immunity: EN 61000-4-2:1995/EN50082-1:1997 - 4kV CD, 8kV AD
EN 61000-4-3:1997/EN50082-1:1997 - 3V/m
ENV 50204/EN50082-1:1997 – 3V/m
EN 61000-4-4:1995/EN50082-1:1997 - 0.5kV SL, 1kV PL
EN 61000-4-5:1995/EN50082-1: 1997 - 1kV L-L, 2kV L-E
EN 61000-4-6:1994/EN61326: 1998 – 3V
EN 61000-4-11:1994/EN61326: 1998 – 1 cycle@100%

Electrical Safety Requirement:

Product Safety:The Product Complies when used with Company supplied Power
Supply (tested to EN 60950)

_____
Corporate Quality Director

Morgan Hill, CA

1 July 2004
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close,

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Chapter 1
General Information

Introduction

This chapter provides a description, performance specifications, optional accessories, preventive maintenance, and calibration requirements for the Anritsu Handheld Spectrum Analyzer model listed below. Throughout this manual, this instrument may be referred to as a Spectrum Master.

Model	Frequency Range
MS2721A	100 kHz to 7.1 GHz

Description

Spectrum Master is a synthesizer-based hand held spectrum analyzer that provides quick and accurate measurement results. Measurements can be easily made by using the main instrument functions: frequency, span, amplitude and bandwidth. Dedicated keys for common functions and a familiar calculator-type keypad are available for fast data entry.

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of more than 1000 measurement setups and more than 1000 traces. The bright daylight-viewable, high-resolution color liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions. Spectrum Master is capable of up to three hours of continuous operation from a fully charged battery and can be operated from a 12 VDC source, which also simultaneously charges the battery.

Spectrum Master is designed for monitoring, measuring, and analyzing signal environments. Typical measurements include: in-band interference, transmit spectrum analysis, plus cell site and 802.11a/b/g interference testing. A full range of marker capabilities such as peak, center and delta functions are provided for faster, more comprehensive analysis of displayed signals. Upper and lower multi-segmented limit lines are available to create quick, simple pass/fail measurements. A menu option provides for an audible alert when the limit value is exceeded.

Anritsu Master Software Tools, a PC-based software program, provides for storing measurement data. Master Software Tools can also convert the Spectrum Master display into several graphic formats.

Measurements may be stored in either internal memory or the external Compact Flash. Stored measurements can be downloaded to a PC using the included USB and Ethernet cables. Once stored, the measurement can then be displayed, scaled, or enhanced with markers and limit lines. Historical graphs can be overlaid with current data using the PC mouse in a drag-and-drop fashion. The underlying data can be extracted and used in spreadsheets or for other analytical tasks.

Accessories

The following standard accessories are supplied with the MS2721A:

Part Number	Description
10580-00103	MS2721A User's Guide
61382	MS2721A Soft Carrying Case
2300-498	Master Software Tools Program CD ROM
633-44	MS2721A Rechargeable Li-Ion Battery
40-168	MS2721A AC-DC Adapter
806-141	MS2721A Automotive Cigarette Lighter 12 Volt DC Adapter
2000-1360	USB A/5-pin mini-B Cable
2000-1371	Ethernet Cable, 7 feet (213 cm)
1091-27	Type-N male to SMA female Adapter
1091-172	Type-N male to BNC female Adapter
2000-1358	64 MB Compact Flash Memory Module
64343	Tilt Bail Stand

One year Warranty (includes battery, firmware, and software)

CAUTION

When using the Automotive Cigarette Lighter 12 VDC Adapter, Anritsu Part Number 806-141, 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.

The following optional accessories are available for the MS2721A:

Part Number	Description
42N50A-30	30 dB, 50W, Bi-dir., DC-18 GHz, N(m) to N(f) Attenuator
34NN50A	Precision Adapter, DC to 18 GHz, 50Ω, N(m) to N(m)
34NFNF50C	Precision Adapter, DC to 18 GHz, 50Ω, N(f) to N(f)
15NNF50-1.5B	Test port cable armored, 1.5 meter, N(m) to N(f), 18.0 GHz
15NN50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(m), 6 GHz
15NN50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(m), 6 GHz
15NN50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(m), 6 GHz
15NNF50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(f), 6 GHz
15NNF50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(f), 6 GHz
15NNF50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(f), 6 GHz
15ND50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(m), 6.0 GHz
15NDF50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(f), 6.0 GHz
12N50-75B	75Ω Adapter, 7.5 dB loss
510-90	Adapter, 7/16 DIN (f) to N(m), DC to 7.5 GHz, 50Ω
510-91	Adapter, 7/16 DIN (f)-N(f), DC to 7.5 GHz, 50Ω
510-92	Adapter, 7/16 DIN (m)-N(m), DC to 7.5 GHz, 50Ω
510-93	Adapter, 7/16 DIN(m)-N(f), DC to 7.5 GHz, 50Ω
510-96	Adapter 7/16 DIN (m) to 7/16 DIN (m), DC to 7.5 GHz, 50Ω
510-97	Adapter 7/16 DIN (f) to 7/16 DIN (f), 7.5 GHz
61382	Spare Soft Carrying Case
40-168	Spare AC/DC Adapter
806-141	Spare Automotive Cigarette Lighter 12 Volt DC Adapter
760-235	MS2721A Transit Case
2300-498	Master Software Tools Program CD ROM
10580-00103	Anritsu User's Guide, Model MS2721A (spare)
10580-00104	Anritsu Programming Manual, Model MS2721A
10580-00105	Anritsu Maintenance Manual, Model MS2721A
633-44	Rechargeable battery, Li-Ion
2000-1374	Dual Battery charger, Li-Ion with universal power supply

Part Number	Description
2000-1030	Portable antenna, 50Ω, SMA (m) 1.71-1.88 GHz
2000-1031	Portable antenna, 50Ω, SMA (m) 1.85-1.99 GHz
2000-1032	Portable antenna, 50Ω, SMA (m) 2.4-2.5 GHz
2000-1035	Portable antenna, 50Ω, SMA (m) 896-941 MHz
2000-1200	Portable antenna, 50Ω, SMA (m) 806-869 MHz
2000-1361	Portable Antenna, 50Ω, SMA (m) 5725-5825 MHz
2000-1358	64 MB Compact Flash Memory Module
2000-1411	Portable Yagi Antenna, 10 dBd, N(f), 822 to 900 MHz
2000-1412	Portable Yagi antenna, 10 dBd, N(f), 885 to 975 MHz
2000-1413	Portable Yagi antenna, 10 dBd, N(f), 1.71 to 1.88 GHz
2000-1414	Portable Yagi antenna, 9.3 dBd, N(f), 1.85 to 1.99 GHz
2000-1415	Portable Yagi antenna, 10 dBd, N(f), 2.4 to 2.5 GHz
2000-1416	Portable Yagi antenna, 10 dBd, N(f), 1.92 to 2.23 GHz

Performance Specifications

Frequency

Frequency Range:	100 kHz to 7.1 GHz
Tuning Range:	9 kHz to 7.1 GHz
Tuning Resolution:	1 Hz
Frequency Reference:	Aging: ±1 ppm/yr.
	Accuracy: ±1 ppm (25°C ± 25°C) + long term drift
Frequency Span:	10 Hz to 7.1 GHz plus 0 Hz (zero span)
Span Accuracy:	Same as frequency reference accuracy
Sweep Time:	Minimum 100 ms swept, 10 µs in zero span
Sweep Time Accuracy:	± 2% in zero span
Sweep Trigger:	Free run, Single, Video, External
Resolution Bandwidth:	(-3 dB width) 10 Hz to 3 MHz in 1-3 sequence ± 10%, 8 MHz demodulation bandwidth. When the quasi-peak detector is selected, available resolution bandwidths are 220 Hz, 9 kHz and 120 kHz to meet CISPR requirements.
Video Bandwidth:	(-3 dB) 1 Hz to 3 MHz in 1-3 sequence
	When the quasi-peak detector is selected, the available video bandwidths are 220 Hz, 9 kHz and 120 kHz to meet CISPR requirements.
SSB Phase Noise:	-100 dBc/Hz max at 10, 20 and 30 kHz offset from carrier.
	-102 dBc/Hz max at 100 kHz offset from carrier.

Amplitude

Measurement Range:	DANL to +30 dBm

Absolute Amplitude Accuracy:

Power levels:	≥-50 dBm, <35 dB input attenuation
	100 kHz to 10 MHz ±1.5 dB
	>10 MHz to 4 GHz ±1.25 dB
	>4 to 7.1 GHz ±1.75 dB
	40 to 55 dB input attenuation
	100 kHz to 10 MHz ±1.5 dB
	>10 MHz to 4 GHz ±1.75 dB
	>4 to 6.5 GHz ±1.75 dB
	>6.5 to 7.1 GHz ±2 dB
	60 to 65 dB input attenuation
	100 kHz to 10 MHz ±1.5 dB
	>10 MHz to 6.5 GHz ±1.75 dB
	>6.5 to 7.1 GHz ±3 dB
	Preamplifier on, 0 or 10 dB input attenuation
	100 kHz to 4 GHz ±1.5 dB
	>4 to 7.1 GHz ±1.75 dB

Second Harmonic Distortion (0 dB input attenuation, -30 dBm input):
-50 dBc, 0.05 to 0.75 GHz

-40 dBc, >0.75 to 1.05 GHz
-50 dBc, >1.05 to 1.4 GHz
-70 dBc, >1.4 to 2 GHz
-80 dBc, >2 GHz
Third Order Intercept (TOI) (preamplifier off)

Frequency	Typical
50 MHz to 300 MHz	>8 dBm
>300 MHz to 2.2 GHz	>10 dBm
>2.2 to 2.8 GHz	>15 dBm
>2.8 to 4.0 GHz	>10 dBm
>4.0 to 7.1 GHz	>13 dBm

0 dB attenuation, -20 dBm reference level, -20 dBm tones, spaced 100 kHz

Displayed Average Noise Level: DANL in 10 Hz RBW

Frequency	Preamplifier On		Preamplifier Off	
	Typical	Max	Typical	Max
>10 MHz to 1 GHz	-153	-151	-130	-127
>1 GHz to 2.2 GHz	-150	-149	-126	-123
>2.2 to 2.8 GHz	-146	-143	-120	-116
>2.8 to 4.0 GHz	-150	-149	-129	-126
>4.0 to 7.1 GHz	-148	-144	-121	-117

Test conditions: Input attenuation: 0 dB, RMS detection, Reference level = -20 dBm for preamplifier off and -50 dBm for preamplifier on.

> NOTE: Discrete spurious signals are not included in the measurement of DANL as they are covered by the residual spurious specification.

Noise Figure (derived from DANL measurement) 0 dB attenuation, 23°C: Preamp On

Frequency	Typical
>10 MHz to 1 GHz	11 dB
>1 GHz to 2.2 GHz	14 dB
>2.2 to 2.8 GHz	18 dB
>2.8 to 4.0 GHz	14 dB
>4.0 to 7.1 GHz	16 dB

Display Range: 1 to 15 dB/div in 1dB steps. Ten divisions displayed.

Amplitude Units:
Log Scale Modes: dBm, dBV, dBmv, dBµV,
Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW

Attenuator Range: 0 to 65 dB
Attenuator Resolution: 5 dB steps
Input-Related Spurious: -60 dBc max*, (<-70 dBc typical), -30 dBm input, 0 dB RF attenuation
*Exceptions:

Input Frequency	Spur Level
1674 MHz	-46 dBc max (-56 dBc typical), 0 to 2800 MHz
>1674 to 1774 MHz	-50 dBc max (-60 dBc typical) at (F input -1674 MHz)

Residual Spurious, preamplifier off: (RF input terminated, 0 dB RF attenuation)
-90 dBm max**, 100 kHz to <3200 MHz
-84 dBm max**, 3200 to 7100 MHz

**Exceptions:

Frequency	Spur Level
250, 300, and 350 MHz	-85 dBm max
~4010 MHz	-80 dBm max (-90 dBm typical)
~5084 MHz	-70 dBm max (-83 dBm typical)
~5894 MHz	-75 dBm max (-87 dBm typical)
~7028 MHz	-80 dBm max (-92 dBm typical)

Residual Spurious, preamplifier on: -100 dBm max
(RF input terminated, 0 dB RF attenuation)

General

RF Input VSWR: 2.0:1 maximum, 1.5:1 typical (≥10 dB attenuation)
Max Continuous Input: (≥10 dB attenuation), +30 dBm

Input Damage Level*:
≥10 dB attenuation, >+43 dBm, ±50 VDC
<10 dB attenuation, >+23 dBm, ±50 VDC
* Input protection relay opens at >+30 dBm with 10 dB input attenuation and at approximately +10 to +23 dBm with <10 dB attenuation

ESD Damage Level: >10 kV 10 dB attenuation

Ext. Ref. Frequencies: 1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10,
                         13 and 19.6608 MHz at -10 to +10 dBm
Display:
Bright daylight-viewable color transmissive LCD, Full SVGA, 8.4"

Languages:
Built-in English, Spanish, Italian, French, German, Japanese, Korean, and Chinese. The instrument also has the capability to have two customized languages installed from Master Software Tools.

Marker Modes:
6 Markers, 9 Modes: Normal, Delta, Marker to Peak, Marker to Center, Marker to Reference Level, Next Peak Left, Next Peak Right, All Markers Off, Noise Marker, Frequency Counter Marker (1 Hz resolution), Marker to Channel, Marker 1 Reference, Fixed or Tracking Markers.

Sweeps:
Full span, Zero span, Span Up/Span Down in 1-2-5 increments

Detection:
Peak, Negative, Sample, RMS, Quasi-Peak

Memory:
The internal memory provides for the storage and recall of more than 1000 measurement setups and more than 1000 traces.The contents of the internal memory can be copied to and from a removable Compact Flash card. The removable compact flash card can be any size, although it must be a minimum of 64 MB to be able to hold the entire contents of the internal flash memory. Measurements may be stored directly to a Compact Flash memory module.

Traces:
Displayed Traces: Three Traces with trace overlay. One trace is always the live data; two traces can be either stored data or traces which have been mathematically manipulated. All three traces can show recalled measurements. Trace A can show normal live data, Max Hold, Min Hold, or the average of multiple measurements. Trace B can hold a stored measurement that can originate from either Trace A or C. Trace C can be set to be Max Hold, Min Hold, a stored measurement originating either from Trace A or Trace C, or a trace math measurement that can be either A-B or B-A.

Interfaces:
Type N female RF connector
BNC female connectors for external reference and external trigger
5-pin Mini-B USB 2.0 for data transfer to a PC
RJ45 connector for Ethernet 10/100 Base-T
2.5 mm 3-wire headset connector (standard, non-Nokia, cellular telephone headset)

Size & Weight:
Size: 12 x 8 x 3 inches (305 x 203 x 76 mm)
Weight: < 6.9 pounds (3.1 kg) typical

Environmental:
MIL-PRF-28800F class 2
Operating: -10º C to 55º C, humidity 85% or less
Storage: -51º C to 71º C
Altitude: 4600 meters, operating and non-operating

Safety:
Conforms to EN 61010-1 for Class 1 portable equipment

Electromagnetic Compatibility:
Meets European Community requirements for CE marking.

Preventive Maintenance

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

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

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

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

Calibration Requirements

The Spectrum Master loads factory calibration data during start-up, eliminating the need for daily calibration checks.

Although Spectrum Master does not require daily field calibration, Anritsu recommends annual calibration and performance verification by local Anritsu service centers. Anritsu service centers are listed in this chapter.

ESD Cautions

The MS2721A, like other high performance instruments, is susceptible to ESD damage. Very often, coaxial cables and antennas build up a static charge, which, if allowed to discharge by connecting directly to the MS2721A without discharging the static charge, may damage the MS2721A input circuitry. MS2721A operators should 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. As these apply to the MS2721A, it is recommended that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the MS2721A. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the MS2721A. 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.

Battery Replacement

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

Battery
Compartment
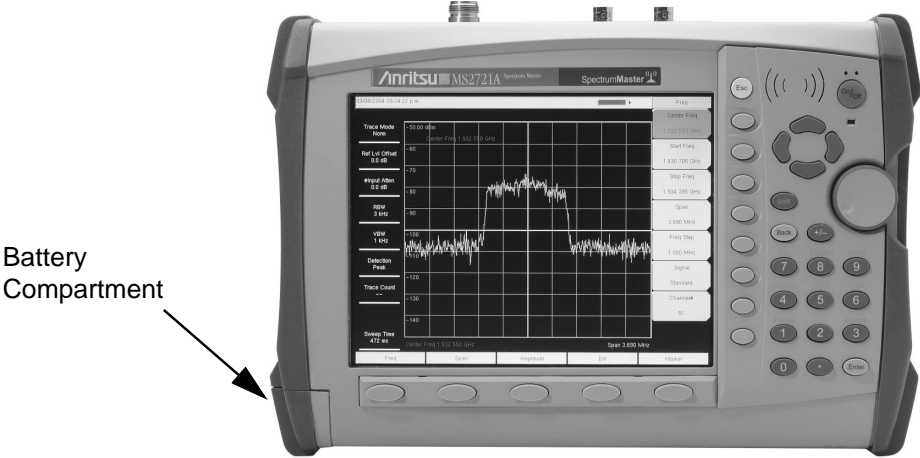
Table 1: Battery Compartment

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

The battery supplied with the Spectrum Master may need charging before use. The battery can be charged in the Spectrum Master, using either the AC-DC Adapter (40-168) or the 12 Volt DC adapter (806-141), or separately in the optional Dual Battery Charger (2000-1374).

CAUTION

When using the Automotive Cigarette Lighter 12 VDC Adapter, Anritsu Part Number 806-141, 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.

Soft Carrying Case

The instrument can be operated while in the soft carrying case. On the front of the case is a large storage pouch for accessories and supplies. When the case is open, the cover can be folded back and used as a tilt stand.

> NOTE: When the tilt bail is installed, the instrument cannot be placed into the soft carrying case.

To install the instrument into the soft carrying case:

Step 1.   Place the soft carrying case face up on a stable surface.
Step 2.   Fully open the front cover of the case and lay it flat.
Step 3.   Release the hook and loop fastener panel on the back left of the case to open the left side cover. Raise the left side cover as shown below.

Table 2: Soft Case Left Side Cover

Step 4.   Carefully slide the instrument into the soft carrying case as shown.

Table 3: Inserting the Instrument into the Soft Case

Step 5.   When sliding the instrument into the soft carrying case, take care to lift the upper-left strap as necessary to clear the connectors.

Lift strap to clear
connectors

Table 4: Clearing the Connectors

Step 6.   The instrument is fully seated when the carrying strap on the right side of the case is easily accessible. Close the left side cover and reattach the hook and loop fastener panel.

The soft carrying case includes a detachable shoulder strap which can be connected to the D-rings on the upper corners of the case as required for comfort or convenience.

Tilt Bail Stand Installation

The supplied Tilt Bail can be installed for desktop operation. When properly installed, the tilt bail provides a backward tilt for improved stability and air flow. When the tilt bail is installed, the unit cannot be placed into the soft carrying case. The tilt bail kit (part number 64343) is a standard accessory supplied with the MS2721A and consists of:

Part Number	Qty.	Description
64344	1	Tilt Bail
64354	1	Right Support Bumper Assembly
64355	1	Left Support Bumper Assembly
4905-2691	2	M3 x 12 mm stainless steel slotted pan head screw
5905-2692	2	6.2 mm OD stainless steel split lock washer

Step 1.   If the instrument is in the soft carrying case, release the hook and loop fastener flap at the left rear of the case and open the left side flap. Pull the instrument straight out of the left side of the case.

NOTE: When the tilt bail is installed, the unit cannot be placed back into the soft carrying case.

Step 2.   With a flat-blade screwdriver, remove only the top screw from the carrying strap D-ring holder on the right side of the instrument. Save the screw and the D-ring holder, as they will need to be reinstalled if the tilt bail is removed.

Step 3.   Remove the carrying strap D-ring from the holder removed in Step 2 and install the D-ring on to the new right support bumper assembly, item number 64354.

Step 4.   Using one M3 x 12 mm stainless steel slotted pan head screw and one 6.2 mm OD stainless steel split lock washer provided, install the new right support bumper assembly on to the instrument.

NOTE: Do not use the screw removed in Step 2 to install the new right support bumper assembly on to the instrument. Use only the screws provided with the kit.

Step 5.   Use the other M3 x 12 mm stainless steel slotted pan head screw and 6.2 mm OD stainless steel split lock washer to attach the left support bumper assembly, item number 64355, to the left side of the instrument.

Step 6.   Flex the tilt bail to install it into the two bumper assemblies.

Table 5: Tilt Bail Installed

Anritsu Service Centers

UNITED STATES
ANRITSU COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: 1-800-ANRITSU
FAX: 408-776-1744

ANRITSU COMPANY
10 New Maple Ave., Unit 305
Pine Brook, NJ 07058
Telephone: (973) 227-8999
1-800-ANRITSU
FAX: 973-575-0092

ANRITSU COMPANY
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Richardson, TX 75081
Telephone: 1-800-ANRITSU
FAX: 972-671-1877

AUSTRALIA
ANRITSU PTY. LTD.
Unit 21, 270 Ferntree Gully Road
Notting Hill, VIC 3168
Australia
Telephone: 03-9558-8177
FAX: 03-9558-8255

BRAZIL
ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440, Sala
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CEP22250-040, Rio de Janeiro,
RJ, Brasil
Telephone: 021-527-6922
FAX: 021-53-71-456

CANADA
ANRITSU INSTRUMENTS LTD.
700 Silver Seven Road, Suite 120
Kanata, Ontario K2V 1C3
Telephone: (613) 591-2003
FAX: (613) 591-1006

CHINA
ANRITSU ELECTRONICS
(SHANGHAI) CO. LTD.
2F, Rm B, 52 Section Factory
Building
No. 516 Fu Te Rd (N)
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Chapter 2
Quick Start Guide

Introduction

This chapter provides a brief overview of the Anritsu MS2721A Spectrum Master. The intent of this chapter is to provide the user with a starting point for making basic measurements. For more detailed information, see Chapter 3, *Key Functions* and Chapter 4, *Measurement Fundamentals*.

Turning the MS2721A On for the First Time

The Anritsu MS2721A Spectrum Master is capable of up to three hours of continuous operation from a fully charged, field-replaceable battery (see Chapter 1). The MS2721A 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 (Anritsu part number 40-168) or 12 VDC Automotive Cigarette Lighter Adapter (Anritsu part number 806-141). Both items are included as standard accessories (see the list of accessories in Chapter 1).

CAUTION

When using the Automotive Cigarette Lighter 12 VDC Adapter, Anritsu Part Number 806-141, 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.

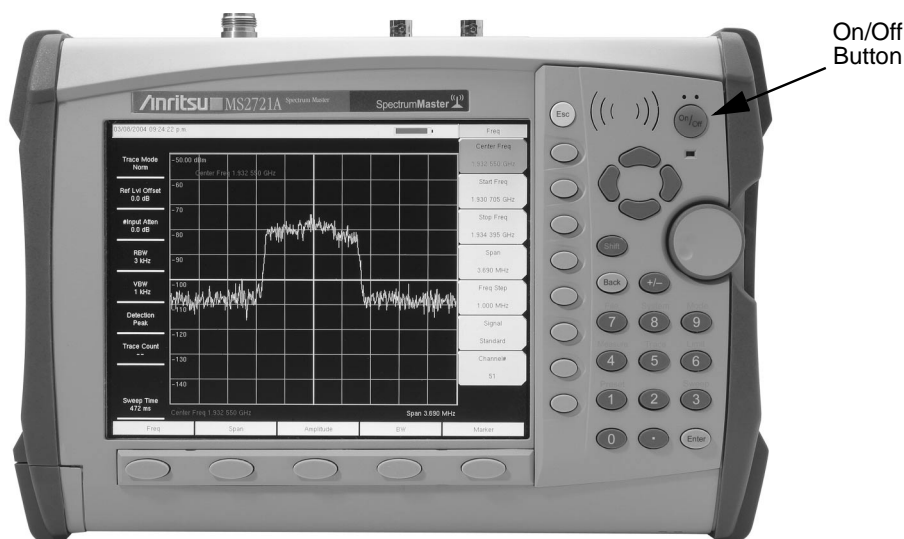To turn on the MS2721A, press the **On/Off** front panel button (Figure 2-1).

Figure 2-1. MS2721A On/Off Button

The MS2721A Spectrum Master takes about thirty-five seconds to complete power up and load the application software. At the completion of this process, the instrument is ready to use.

For information on making measurements with the Spectrum Master, refer to "Making a Spectrum Analyzer Measurement," later in this chapter. For advanced applications, refer to Chapter 4, *Measurement Fundamentals*, and Chapter 5, *Field Measurements*.

Front Panel Overview

The Spectrum Master menu-driven interface is easy to use and requires little training. Hard keys on the front panel are used to initiate function-specific menus. There are five function hard keys located below the display: Frequency, Span, Amplitude, Bandwidth and Marker.

There are 21 hard keys and a rotary knob located to the right of the display. Eight of the hard keys are dual purpose, depending on the current mode of operation. The dual-purpose keys are labeled with a number on the key itself, and the alternate function printed on the panel above the key. Use the shift key to access the functions printed on the panel. The **Escape** key, used for aborting data entry, is the round button located above soft keys. The rotary knob and the keypad can both be used to change the value of an active parameter.

There are also eight soft keys to the right of the display which change function depending upon the current menu selection. The current soft key function is indicated in the active function block to the right of the display. The locations of the different keys are shown in Figure 2-2, below.
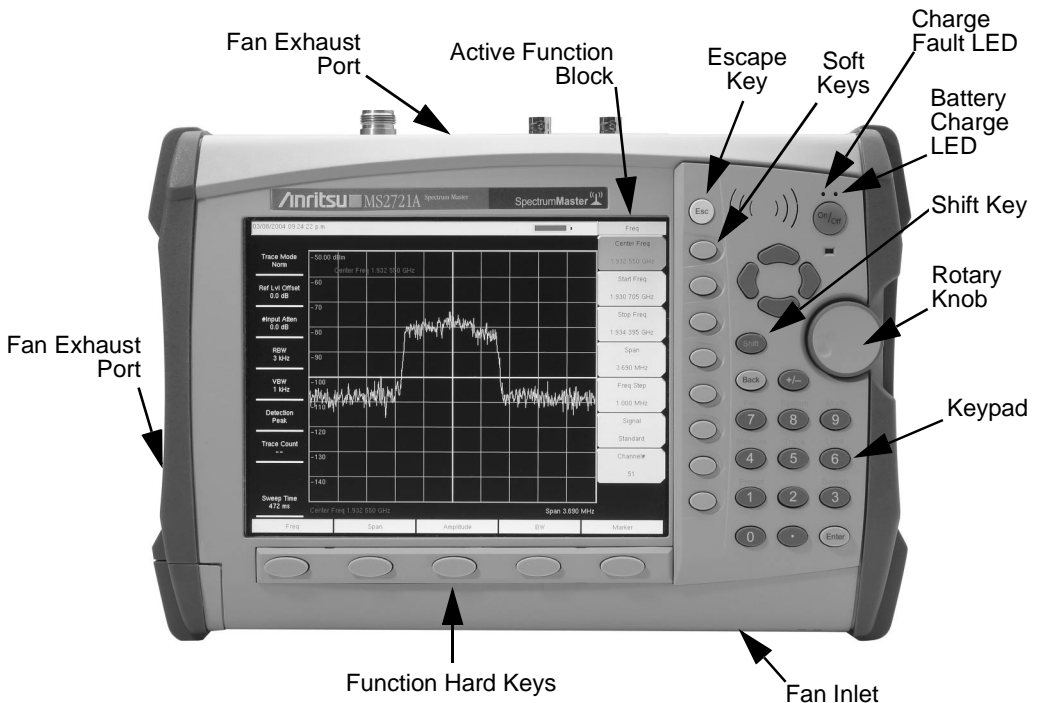
Figure 2-2. Spectrum Master Overview

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

Charge Fault LED (red)
The Charge Fault LED will remain on steady under a battery charger fault condition. Fault conditions include a battery cell voltage that is too low to charge, or a battery temperature outside the temperature range (-5º C to +50º C) to charge.

Fan Inlet and Exhaust Ports

It is important to keep the fan inlet and exhaust ports clear of obstructions at all times for proper ventilation and cooling of the instrument.

Display Overview

Figure 2-3 illustrates some of the key information areas of the MS2721A display. Refer to Chapter 3, *Key Functions*, for more detailed key descriptions.
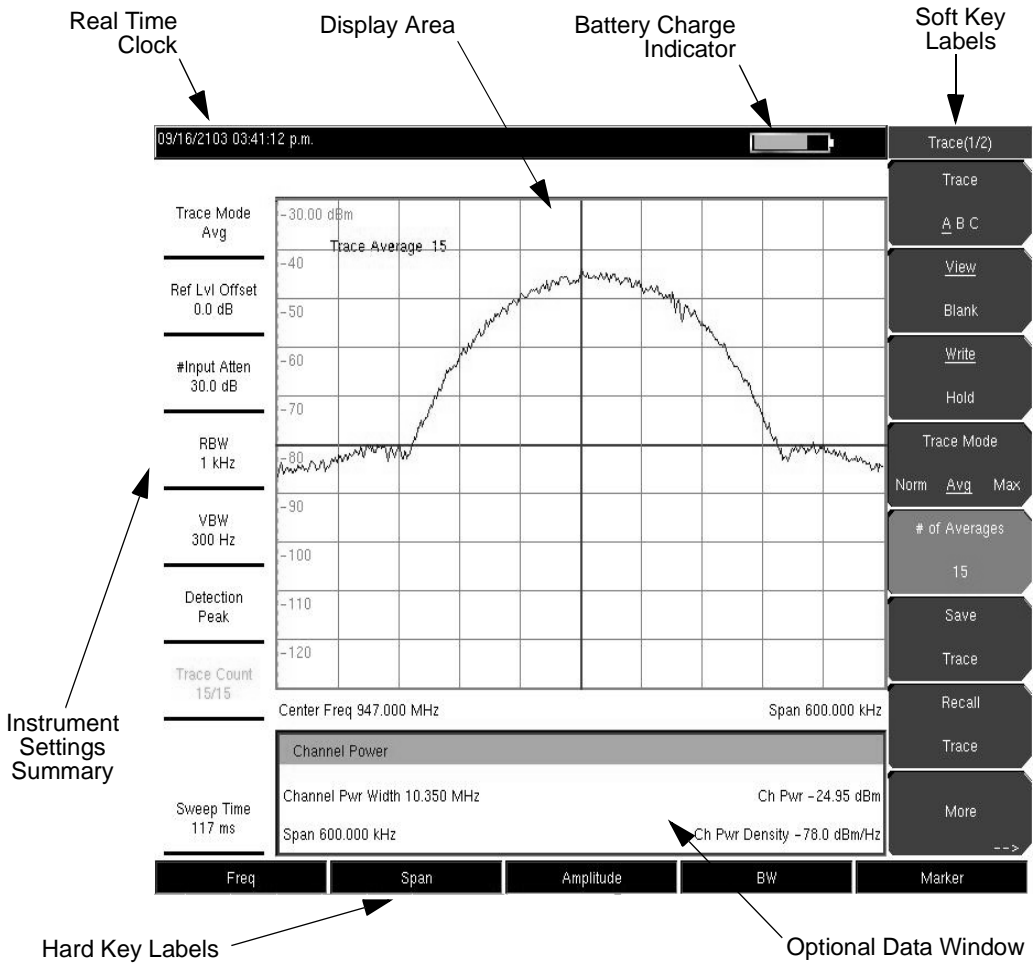

Figure 2-3. Display Overview

Test Panel Connectors

The connectors and indicators located on the test panel are shown in Figure 2-4 and described below.
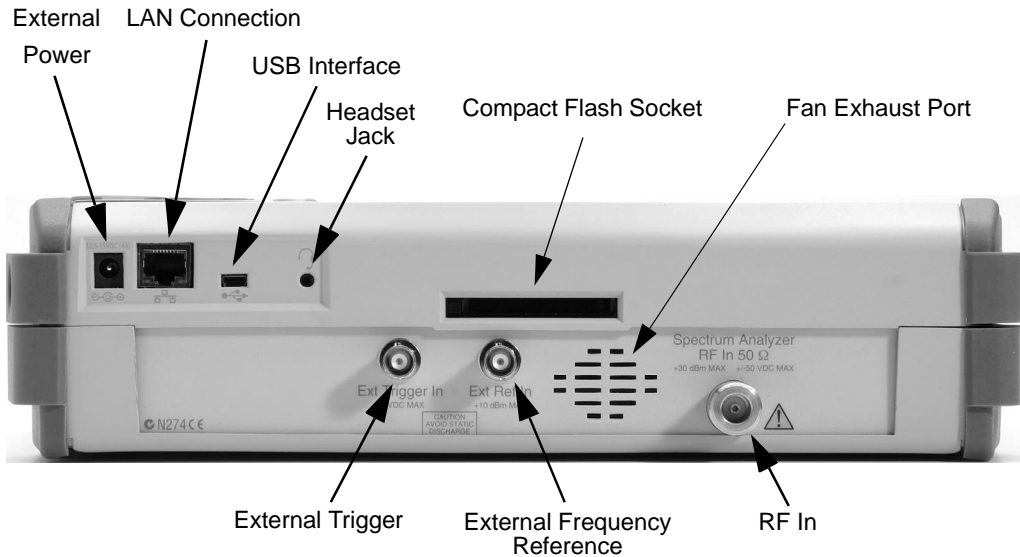

Figure 2-4. Test Panel Connectors

External Power

The external power connector is used to power the unit and for battery charging. Input is 12 to 15 VDC at up to 5.0A. A green flashing indicator light near the power switch shows that the instrument battery is being charged by the external charging unit. The indicator is steadily illuminated when the battery is fully charged.

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

LAN Connection

The RJ-45 connector is used to connect the Spectrum Master to a local area network. Integrated into this connector are two LEDs. The amber LED indicates the presence of LAN voltages—a live LAN connection—while the green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the System Options soft key and the Ethernet Config soft key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address and subnet mask.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the MS2721A to the network and select DHCP protocol in the Ethernet Config menu.

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

To display the IP address with the instrument on, press the **Shift** key, then the **System** key, then the System Options soft key and the Ethernet Config soft key. The IP address will be displayed as shown in Figure 2-5.
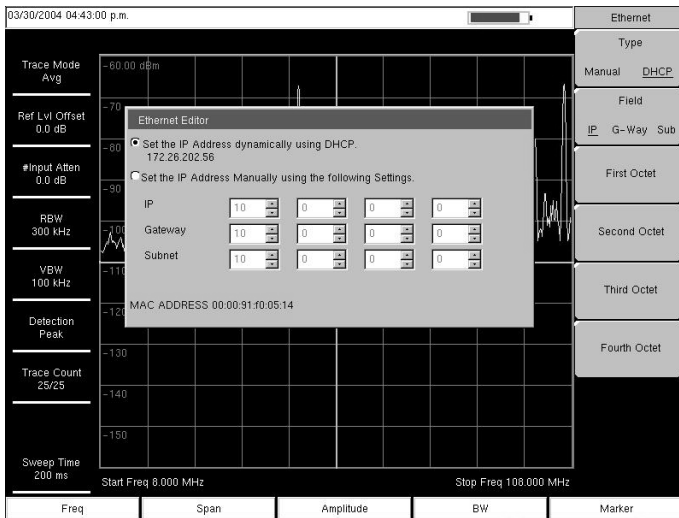
Figure 2-5. IP Address Assigned Using DHCP

More about DHCP

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

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

> NOTE: The MS2721A must be connected to the network *before* it is turned on for DHCP to work. Key elements of the DHCP lease are only performed during the instrument's startup operations, or when switching from manual to DHCP.

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

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

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

IP Address

This is the Static IP address on the network.

Default Gateway

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

Subnet Mask

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

Example 1

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

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

Example 2

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

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

There are a few tools built into the Microsoft Windows operating system that can assist in making some determinations about the network the PC is plugged into. Typing ipconfig at a command prompt will display information about the in-use parameters of the PC and its network connection. Below is an example of the typical results expected.

> NOTE: The ipconfig display does not report if the information is from a DHCP server or a Static IP setup.

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

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

```
Y:\>ping 172.26.202.172
Pinging 172.26.202.172 with 32 bytes of data:
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
```

Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Ping statistics for 172.26.202.172:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

USB Interface

The USB 2.0 interface can be used to connect the MS2721A Spectrum Master directly to a PC. The first time the MS2721A is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM shipped with the instrument contains a driver for Windows 2000 and Windows XP that is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

> NOTE: Install Master Software Tools (see Chapter 8) before connecting the instrument to the PC USB port.

Headset Jack

The headset jack provides audio output from the built-in AM/FM/SSB demodulator and other audio signals 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

A TTL signal applied to the External Trigger female BNC input connector causes a single sweep to occur. This mode 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.

Ext Freq Ref

BNC female connector for connection of an external frequency reference or external trigger. Select the Ext Ref Freq soft key under the System menu to select the frequency of the external reference from the list presented. Valid frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz and 19.6608 MHz at amplitude from -10 dBm to +10 dBm.

RF In

50Ω Type-N female connector.

Compact Flash

The Spectrum Master is shipped with a 64 MB Compact Flash Memory Module, Anritsu Part Number 2000-1358. The removable compact flash card can be any size, although it must be a minimum of 64 MB to be able to hold the entire contents of the internal flash memory.

Symbols and Indicators

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

Battery Symbol:

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

Figure 2-6.

Green: Battery is 30 to 100% charged
Yellow: Battery is 10 to 30% charged
Red: Battery 0 to 10% charged

When the battery is charging, either from the AC-DC Adapter (40-168) or the 12 Volt DC adapter (806-141), the symbol will change to:

Figure 2-7.

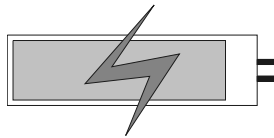The Battery Charge LED will flash when the battery is charging, and remain on steady when the battery is fully charged.

> NOTE: Use only Anritsu approved batteries, adapters and chargers with this instrument.

Hold

The Spectrum Master is on hold. To resume sweeping, toggle from Hold to Run in the Sweep menu.

Single Sweep

Single Sweep is selected. Select Continuous sweep to resume sweeping.

Self Test

At turn on, the Spectrum Master runs through a series of quick checks to ensure the system is functioning properly. The System self test runs a series of test related to the instrument. The Application Self Test runs a series of test related to the application portion of the instrument.

If the self test fails, and the battery is fully charged, and the Spectrum Master is within the specified operating temperature range, contact your Anritsu Service Center.

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

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

Making Spectrum Analyzer Measurements

Required Equipment

- MS2721A Handheld Spectrum Analyzer

- Optionally, an antenna appropriate for the frequency range to be measured

Making a Measurement

To make a measurement, locate and display the signal(s) of interest by selecting the desired frequency, span, and amplitude value, as explained below.

> NOTE: In most cases, information and parameters can be entered into the Spectrum Master through the keypad, the directional arrows or the rotary knob. The numerical keypad enters the information directly. The up and down arrow keys change a frequency parameter by the value entered through the Freq Step soft key (default value is 1 MHz). The left and right arrow keys change the frequency parameter by one graticule, that is, one-tenth of the total span. The rotary knob changes the frequency parameter by one pixel per step. There are 551 pixels across the screen in normal mode and 661 pixels in full-screen mode. Choose whichever method is most convenient to enter the required information.

Step 1. Connect the input signal or antenna to the RF In test port.
Step 2. Press the **Freq** key to display the Frequency menu.
Step 3. To enter a center frequency, select the Center Freq soft key and enter the desired center frequency.
Step 4. To set a specific frequency band, select the Start Freq soft key and enter the desired start frequency, then select the Stop Freq soft key and enter the desired stop frequency.
Step 5. Press the **Span** key to display the Span menu and enter the span, or for a full span, select the Full Span soft key. Selecting a full span will override any previously set Start and Stop frequencies. For a single frequency measurement, select the Zero Span soft key.

> NOTE: To quickly move the span value up or down, select the Span Up 1-2-5 or Span Down 1-2-5 soft keys. These keys facilitate a zoom-in, zoom-out in a 1-2-5 sequence.

Setting the Amplitude

Step 1. Press the **Amplitude** key.

> NOTE: To change the current measurement units, press the Units soft key and select the required units from the soft keys presented. Press the Back soft key to return to the Amplitude menu.

Step 2. Press the Reference Level soft key and use the Up/Down arrow keys or the keypad to set the reference level. Press **Enter** to set the reference level.
Step 3. Press the Scale soft key and use the Up/Down arrow keys or the keypad to enter the desired scale. Press **Enter** to set the scale.

> NOTE: The Scale parameter cannot be changed when linear units are selected (Watts or Volts).
> Press the Amplitude soft key and select Auto Atten coupling of the attenuator setting and the reference level to help ensure that harmonics and spurs are not introduced into the measurements. See *Attenuator Functions* (page 4-2) for more information.

Selecting a Signal Standard

Selecting a signal standard sets the center frequency, channel spacing, integration bandwidth and span for the first channel of the selected standard. Appendix A contains a table of the signal standards available in the instrument.

To select a signal standard:

Step 1. Press the **Freq** key to display the Frequency menu.

Step 2. Press the Signal Standard soft key and use the Up/Down arrow keys or the rotary knob to highlight the desired signal standard. Press **Enter** to select the highlighted signal standard.

Step 3. Press the Channel# soft key to choose the required channel. By default, if a channel number has not yet been entered, the lowest channel number for that standard is automatically selected. The channel numbers that can be selected correspond to the channel numbering schemes of the various signal standards.

Setting Bandwidth Parameters

Both resolution bandwidth (RBW) and video bandwidth (VBW) can be automatically or manually coupled to the frequency span. That is, the wider the span, the wider the RBW. The ratio of the span width to the resolution bandwidth is 300:1 by default, and if necessary, can be changed as follows:

Step 1. Press the BW key.

Step 2. Select the Span/RBW soft key. The current Span/RBW ratio is shown as part of the soft key label. Change the value using the keypad, the directional arrows or the rotary knob.

When auto coupling between the span and the RBW is selected, it is indicated on the left side of the display as RBW XXX, where XXX is the bandwidth value. If manual RBW coupling is selected, a "#" is shown in front of RBW on the left side of the display, and the resolution bandwidth can be adjusted independently of the span. If a non-existent resolution bandwidth is entered, the instrument will select the next higher resolution bandwidth. If a value greater than the widest RBW is entered, the widest RBW will be selected.

Auto coupling of the VBW links the video bandwidth to the resolution bandwidth, so that the wider the RBW, the wider the VBW. Auto coupling is indicated on the left side of the display as VBW XXX. If manual VBW coupling is selected, a "#" is shown in front of VBW on the left side of the display, and the video bandwidth can be adjusted independently of the RBW. If a non-existent video bandwidth is entered, the instrument will select the next higher video bandwidth. If a value greater than the widest VBW is entered, the widest VBW will be selected.

The ratio of the resolution bandwidth to the video bandwidth can be changed by pressing the **BW** key, the RBW/VBW soft key, and then using the keypad, the directional arrows or the rotary knob to set the ratio. The current value of the ratio is shown as part of the soft key label.

Setting Sweep Parameters

To set the sweep parameters, press the **Shift** key and then the **Sweep** (3) key.

Single/Continuous

When this soft key is pressed the instrument toggles between single sweep and continuous sweep. In single sweep mode, after the sweep the instrument waits in Hold mode until the Manual Trigger soft key is pressed or another triggering mode is selected.

Trigger Type
To select a specific type of triggering, press the Trigger Type soft key. Selections are:

Free Run
The default trigger type is "Free Run" in which the instrument begins another sweep as soon as one is finished.

External
A TTL signal applied to the External Trigger BNC input connector causes a single sweep to occur. This mode 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.

Video
This mode is used in zero span to set the power level at which a sweep is initiated. The power level can be set from -120 dBm to +20 dBm. Trigger is based on the measured signal level. If no signal reaches or exceeds the trigger level, there will be no trace on the screen.

Change Trigger Position
This soft key is used in conjunction with video triggering to set the horizontal position on the display where a signal that meets the video triggering criterion will be placed. The value can be from 0% to 100%. Zero percent places the triggering event at the left edge of the screen while 100% places the triggering at the right edge of the screen. When the trigger position is any value other than 0%, the portion of the trace before the trigger event is displayed very quickly since the trace data is stored in memory. The portion of the trace after the trigger point is painted on the screen at the normal rate as the signal is swept.

Manual Trigger
This soft key can be used in zero span to immediately trigger a sweep when the trigger type is set to External or Video.

Chapter 3
Key Functions

Introduction

This chapter describes the MS2721A keys and how to use them. The major key sections are arranged in alphabetical order with soft key menus under those key selections listed in the order they appear on the instrument, from top to bottom.

There are five hard keys located below the display that are used to initiate function-specific menus (Frequency, Span, Amplitude, Bandwidth and Marker). There are 21 hard keys and a rotary knob located to the right of the display. Eight of the hard keys are dual purpose, depending on the current mode of operation. The dual-purpose keys are labeled with a number on the key itself, and the alternate function printed on the panel above the key. Use the shift key to access the functions printed on the panel. The **Escape** key, used for aborting data entry, is the round button located above soft keys. The rotary knob and the keypad can both be used to change the value of an active parameter.

There are also eight soft keys to the right of the display which change function depending upon the current menu selection. The current soft key function is indicated in the active function block on the right of the display.

Amplitude

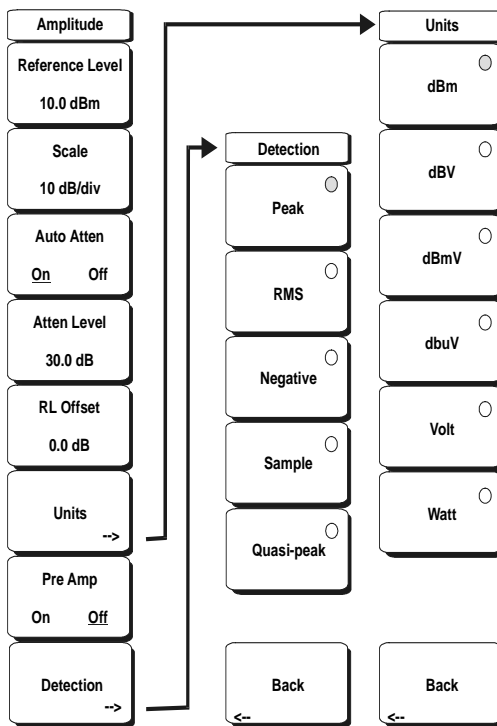The Amplitude hard key is located below the display. The Amplitude menu soft keys are:

Figure 3-1. Amplitude Menu Soft Keys

Reference Level

The reference level is the top graticule line on the display, and can be set from +30 dBm to -150 dBm. A value may be entered from the key pad, using the ± key as the minus sign. After entering the value press the dBm soft key or the **Enter** key. The Up/Down arrow keys change the reference level in 10 dB steps, and the Left/Right arrow keys change the value by 1 dB. The rotary knob changes the value by 0.1 dB per detent.

The reference level value may be modified by the reference level offset value, discussed later in this chapter.

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 keypad, the rotary knob or the Up/Down arrow keys.

Auto Atten On/Off

Input attenuation can be either tied to the reference level (On) or manually selected (Off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.

Atten Lvl

Input attenuation can be set from 0 to 65 dB, in 5 dB steps. Select this soft key and use the keypad, the rotary knob or the Up/Down arrow keys to change the attenuation value. When the Preamplifier is turned on, the allowed attenuation settings are 0 and 10 dB.

RL Offset

Reference Level Offset compensates for the presence of input attenuation or gain external to the instrument. Enter a positive value to compensate for an external amplifier or a negative value to compensate for an external attenuator. Use the ± key to enter the negative sign when a negative attenuation value is being entered.

Units

Select the display units from the soft key menu shown on page 3-1. Press the Back soft key to return to the Amplitude menu.

Pre Amp On/Off

This soft key turns the low-noise front-end preamplifier on or off. The preamplifier lowers the noise floor by approximately 25 dB. To assure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be <-50 dBm.

Detection

Several detection methods tailor the performance of the instrument to meet specific measurement requirements. In general, there are more measurement points across the screen than display points. The various detection methods are different ways of dealing with selecting which measurement point will be shown at each display point.

Peak

This method causes the largest measurement point to be shown for each display point, and assures that a narrow peak is not missed.

RMS

This method performs a root-mean-square calculation of all the measurement points in each display point, and is particularly useful in displaying the average value of noise.

Negative

This method causes the smallest measurement point to be shown for each display point. Typically this mode is used to help detect small discrete signals in the presence of nearly equal values of noise. The display points that contain only noise will tend to show lower amplitudes than those that contain discrete signals.

Sample

This is the fastest detection method since for each display point only one frequency point is measured. Use this method when speed is of paramount importance and the possibility of missing a narrow peak is not important.

Quasi-peak

When this selection is made resolution bandwidths and video bandwidths of 220 Hz, 9 kHz and 120 kHz are available. This detection method is designed to meet CISPR requirements.
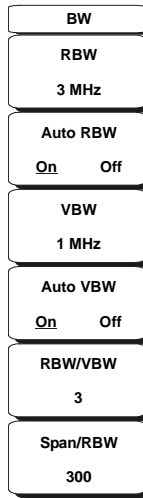
Back

Returns to the previous menu.

BW (Bandwidth)

The **BW** hard key is located below the display. The BW menu soft keys are:

BW
RBW 3 MHz
Auto RBW _On_   Off
VBW 1 MHz
Auto VBW _On_   Off
RBW/VBW 3
Span/RBW 300

Figure 3-2. BW Menu Soft Keys

RBW

The current resolution bandwidth value is displayed in this soft key. The RBW can be changed using the keypad, the Up/Down arrow keys, or the rotary knob. The range is 10 Hz to 3 MHz in a 1-3 sequence, from 10 Hz to 30 Hz to 100 Hz, and so on.

Auto RBW

When Auto RBW is On, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the Span/RBW soft key.

VBW

The current video bandwidth value is displayed in this soft key. The VBW can be changed using the keypad, the Up/Down arrow keys, or the rotary knob. The range is 1 Hz to 3 MHz in a 1-3 sequence.

Auto VBW

When Auto VBW is On, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW/VBW soft key.

RBW/VBW

This soft key displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, select this soft key and use the keypad, the Up/Down arrow keys, or the rotary knob to select a new ratio. The default ratio is 3. When the quasi-peak detector is selected, the RBW/VBW ratio is changed to 1.

Span/RBW

This soft key displays the ratio between the span width and the resolution bandwidth. The default value is 300, meaning that the span width is approximately 300 times the resolution bandwidth. The value is approximate because resolution bandwidth filters come in discrete steps while span width can be set to any value up to 7.1 GHz. To change the ratio, select

this soft key and use the keypad, the Up/Down arrow keys, or the rotary knob to select a new ratio.

File

To access the functions under the File menu, select the **Shift** key, then the **File** (7) key. The File menu soft keys are:
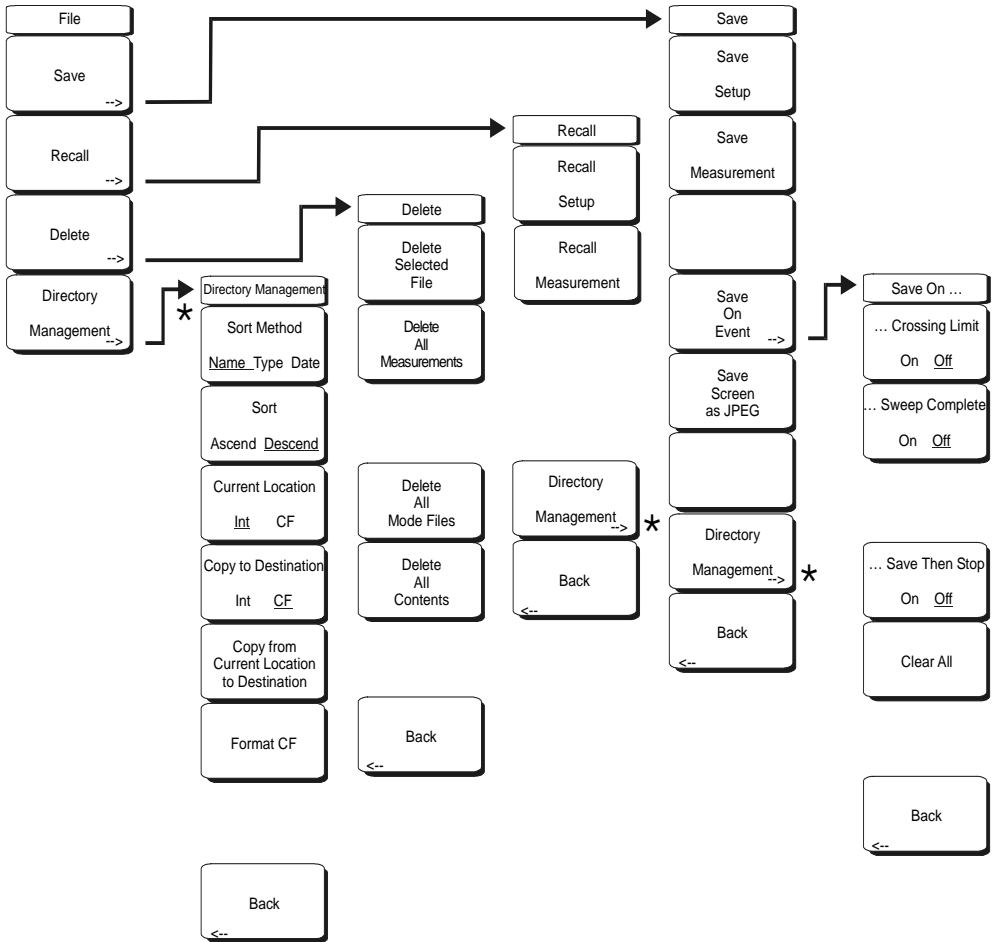
Figure 3-3. File Menu Soft Keys

Save

Measurements may be saved to the internal memory or to a Type-1 Compact Flash module. The Spectrum Master is shipped with a 64 MB Compact Flash Memory Module, Anritsu Part Number 2000-1358. The removable compact flash card must be a minimum of 64 MB to be able to hold the entire contents of the internal memory. Modules up to 512 MB have been tested. Compact Flash modules with greater storage capacity may not function properly, and should be properly tested before relying on them.

Save Setup

Opens a dialog box 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 keypad to select numbers, the rotary

knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement

Initiates a dialog box to name and save the current active trace A. The saved measurement trace can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the Shift key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press Enter to save the measurement trace. Measurements are saved in a directory called /usr on the Compact Flash memory module.

> 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, etc.) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or select the soft key for each letter.

Save On Event…

The instrument can be configured to automatically save a measurement if a selected condition is satisfied. As measurements are saved, an on-screen message indicates approximately how many more files can be saved. Approximately 1500 spectrum analyzer measurements can be saved before the internal memory is full. The number of measurements that can be stored in the external Compact Flash memory depends on the size of the memory module. When measurements are saved, they are saved into subdirectories that are automatically created in the /usr subdirectory. The names are based on the date and time. Each subdirectory can contain a maximum of 100 measurements.

CF Memory Size	Approximate # of SPA Files Stored
64 MB	2600
128 MB	4700
256 MB	8900
512 MB	17800
1 GB	31000
2 GB	63000

… Crossing Limit On/Off

When Crossing Limit is On, and an upper or lower limit line is set, if any point in a measurement exceeds either the upper or lower limit line, the measurement is automatically saved at the end of the sweep. The saved measurement is named "LIM" followed by the date and time in the format: LIMyyyymmddhhmmss. The time value in the file name will generally be slightly earlier than the measurement time stamp shown in the file list, since the file name is created at the time the limit violation is noted and the time stamp is the time at which the measurement file is actually saved.

If a limit line has not been set, selecting this soft key results in the on-screen message: "You must have a limit ON first."

… Sweep Complete On/Off

When Sweep Complete is On, the measurement is automatically saved at the end of a sweep. This is particularly useful for very slow sweeps. The saved measurement is named "EOS" with a file name in the format: EOSyyyymmddhhmmss.

Save Then Stop On/Off

When the Save Then Stop soft key is set to On, the instrument will save just one measurement when the Crossing Limit or Sweep Complete soft keys are set to On, and the qualifying event occurs. Sweeping stops after a measurement is saved. If it is set to Off, sweeping continues after a measurement is saved and more measurements may be saved. The default for this selection is Off.

Clear All

Pressing this soft key turns off both save on event conditions and sets Save then Stop to Off, the default state.

Back

Returns to the top-level file menu.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with .jpg appended.

> 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, etc.) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or select the soft key for each letter.

Directory Management
Sort Method
Name Type Date

File lists can be sorted by the name of the file, the type of file (SPA file, STP file, etc.) or by the date that the file was saved.

Sort
Ascending Descending

Selects whether the selected sort is sorted from lowest to highest (ascending) or highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort).

Current Location
Int CF

This choice lets you select where measurements and setups will be saved. Pressing the soft key toggles between storing files on the internal memory or a Compact Flash memory module. The "current location" and the "copy to destination" will never be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location.

Copy to Destination
Int CF
This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, the current location is automatically changed if the current location is the same as the selected copy to destination..

Copy From Current Location To Destination
Pressing this soft key causes all measurements, setups and jpg files stored in the user selected "current location" to be copied to the "copy to destination". If no storage module installed in the instrument an error message is displayed.

Format CF
This selection erases all files on an installed Compact Flash module. A message is displayed warning that all files will be erased. Press Enter to confirm that you want to erase and Esc to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups and jpg files.

Back
The Back key returns to the previous menu.

Recall
Recall Setup
This soft key brings up a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the Up/Down arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

Recall Measurement
Brings up a selection box that allows recall of a previously stored measurement trace from the currently selected storage location. Use the rotary knob or the Up/Down arrow keys to highlight the saved measurement trace, and press **Enter**, the rotary knob, or the Recall soft key to select. A recalled trace may be displayed as trace A, in place of the live trace, or as trace B or C along with the live trace. Use the rotary knob or the Up/Down arrow keys to highlight the recalled trace option, and press the **Enter** key to select. Press the **Esc** key to cancel the recall.

To remove a recalled measurement trace from the screen, select the **Shift** key and the **Trace** (5) key to open the Trace menu. Use the Trace soft key to select the trace to be removed from the screen and use the View/Blank soft key to view or blank the trace. Use the Trace key to select an active trace after blanking a recalled trace.

Directory Management '
See page 3-7.

Back
Returns to the previous menu.

Delete

Brings up a selection box that shows all stored setups and traces in the currently selected
location (see Directory Management, page 3-7). The list shows the setup and measurement
names, the type (stp for a saved setup, spa for a saved trace, jpg for a JPEG file) and the
date and time the information was saved. Use the rotary knob or the Up/Down arrow keys
to highlight the file to be deleted, and press **Enter**, or the Delete soft key to delete. Press
the **Esc** key to cancel the operation. Note that there is no mechanism to retrieve deleted
files.

Delete Selected File

Use the up and down arrow buttons or the rotary knob to select the file that is to be
deleted. Press Enter to confirm that you want to delete the file or Esc to exit without
deleting.

Delete ALL Measurements

Deletes all measurements of the current mode in the currently selected storage location.
The memory from which measurements will be deleted is set in the Directory Manage-
ment menu and is the Current Location.

Delete ALL Mode Files

Deletes all measurements of the type saved in the current operating mode of the instru-
ment. In addition all jpg and setup files (regardless of the mode) are deleted.

Delete ALL Contents

Deletes all measurements, jpg files and setup files of ALL measurement types.

Back

The Back key returns to the previous menu.

Print

The Print key can be used to save a measurement trace as a graphics file. This file can then be downloaded to a PC using Master Software Tools and printed.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with .jpg appended.

Back

The Back key returns to the previous menu.

Save On Event…

The instrument can be configured to automatically save a measurement if a selected condition is satisfied. Approximately 1500 measurements can be saved before the memory is full.

… Crossing Limit On/Off

When Crossing Limit is On, and an upper or lower limit line is set, if any point in a measurement exceeds either the upper or lower limit line, the measurement is automatically saved at the end of the sweep. The saved measurement is named "LIM" followed by the date and time in the format: LIMyyyymmddhhmmss. The time value in the file name will generally be slightly earlier than the measurement time stamp shown in the file list, since the file name is created at the time the limit violation is noted and the time stamp is the time at which the measurement file is actually saved.

If a limit line has not been set, selecting this soft key results in the on-screen message: "You must have a limit ON first."

… Sweep Complete On/Off

When Sweep Complete is On, the measurement is automatically saved at the end of a sweep. This is particularly useful for very slow sweeps. The saved measurement is named "EOS" with a file name in the format: EOSyyyymmddhhmmss.

Save Then Stop On/Off

When the Save Then Stop soft key is set to On, the instrument will save just one measurement when the Crossing Limit or Sweep Complete soft keys are set to On, and the qualifying event occurs. Sweeping stops after a measurement is saved. If it is set to Off, sweeping continues after a measurement is saved and more measurements may be saved. The default for this selection is Off.

> NOTE: This feature should be used with care. With Save Then Stop set to Off (the default) a large number of measurements can be saved when the Crossing Limit or Sweep Complete soft keys are set to On, making it time-consuming to retrieve saved measurements or to delete unwanted measurements. When there are many saved measurements, the time required to display a file list can be several minutes.

Clear All

Pressing this soft key turns off both save on event conditions and sets Save then Stop to Off, the default state.

Back

Returns to the top-level file menu.

Freq (Frequency)

The tuning frequency range for the MS2721A can be entered in several different ways depending on what makes the most sense for the user or for the application. The center frequency and span can be specified, the start and stop frequencies can be entered, or a signal standard and channel number can be selected from the built-in list. The **Freq** hard key is located below the display. The Freq menu soft keys are:

Figure 3-4. Freq Menu Soft Keys

Center Frequency
Press the **Freq** key followed by the Center Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz and Hz. Select the appropriate units key. Selecting the **Enter** key has the same affect as the MHz soft key.

> NOTE: When using the up and down arrows, the frequency moves in steps defined by the value entered using the Freq Step soft key.
> When using the left or right arrow keys, the frequency of the active parameter moves by 10% of the current frequency span. If the instrument is in zero span, the left and right arrows do nothing.
> Turning the rotary knob changes the active frequency parameter in increments of one display point for each click of the knob. There are 551 display points across the screen (661 points in full-screen mode).

Start Frequency
Press the **Freq** key followed by the Start Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If a start frequency higher than the current stop frequency is entered, the stop frequency will be changed to yield a 10 Hz span.

Stop Frequency
Press the **Freq** key followed by the Stop Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If a stop frequency lower than the

current start frequency is entered, the start frequency will be changed to yield a 10 Hz span.

Span

Press the **Freq** key followed by the Span soft key and enter the desired span. The Span menu is used to set the frequency range over which the instrument will sweep. For the MS2721A, the span can be set from 10 Hz to 7.1 GHz. Span can also be set to zero span.

The soft key shows the current value for span in units of GHz, MHz, kHz or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys or the rotary knob to increase or decrease the span frequency. If the span is changed using the Up/Down arrow keys, the span changes by the value of the Frequency Step for each key press.

Freq Step

Press the **Freq** key followed by the Freq Step soft key to enter the desired frequency step size. The frequency step specifies the amount by which a frequency will change when the Up/Down arrow keys pressed. The center frequency, start frequency, and stop frequency values can be changed using Freq Step. The active parameter will be changed by the frequency step when the Up/Down arrow keys are pressed. If Freq Step is the active parameter, nothing happens when the arrow keys are pressed. The frequency step size can be any value from 1 Hz to 7.1 GHz with a resolution of 1 Hz.

Use the keypad or the rotary knob to change the Frequency Step size.

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 particular 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 tuned to the center of the spectrum analyzer display.

Limit

To access the functions under the Limit menu, select the **Shift** key, then the **Limit** (6) key. The Limit menu soft keys are:
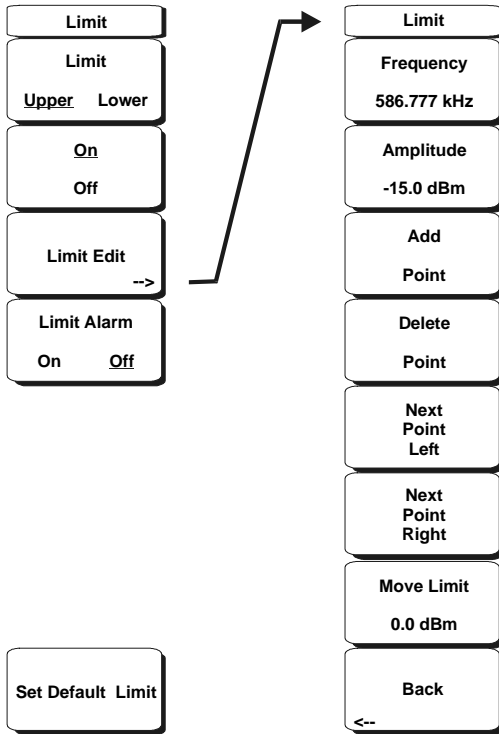
Figure 3-5. Limit Menu Soft Keys

Two types of limit lines can be specified, lower limit lines and upper limit lines. 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 is above the upper limit line or below the lower 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 soft key.

Limit Upper/Lower
This soft key selects which limit line will be active for editing. The limit line that is currently selected for editing is underlined.

On/Off
This soft key turns the active limit line (upper or lower) on or off.

Limit Edit
A submenu is displayed by this soft key that allows 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.

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Move Limit

This soft 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.

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 soft key description for more details. Use the keypad, the Left/Right arrow keys or the rotary knob to change the frequency of a point.

Amplitude

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 soft key description for more details.

Add Point

The precise behavior of this soft 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 soft 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 soft 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 soft 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 soft 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

Moves the limit value.

Back

Returns to the higher-level Limit menu.

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Limit Alarm
This soft key selects, for the currently active limit line, if an alarm beep will occur when a
data point exceeds the limit.

Set Default Limit
This soft key deletes all limit points for the currently active limit line and defaults to a sin-
gle limit whose position is 2.5 graticule lines from the top of the screen for the upper limit
line and 2.5 graticule lines from the bottom of the screen for the lower limit line. The other
limit line is not altered.

Marker

Press the **Marker** function hard key to open the Marker menu. The MS2721A is equipped
with six markers. Any or all markers can be employed simultaneously. The **Marker** hard key
is located below the display. The Marker menu soft keys are:
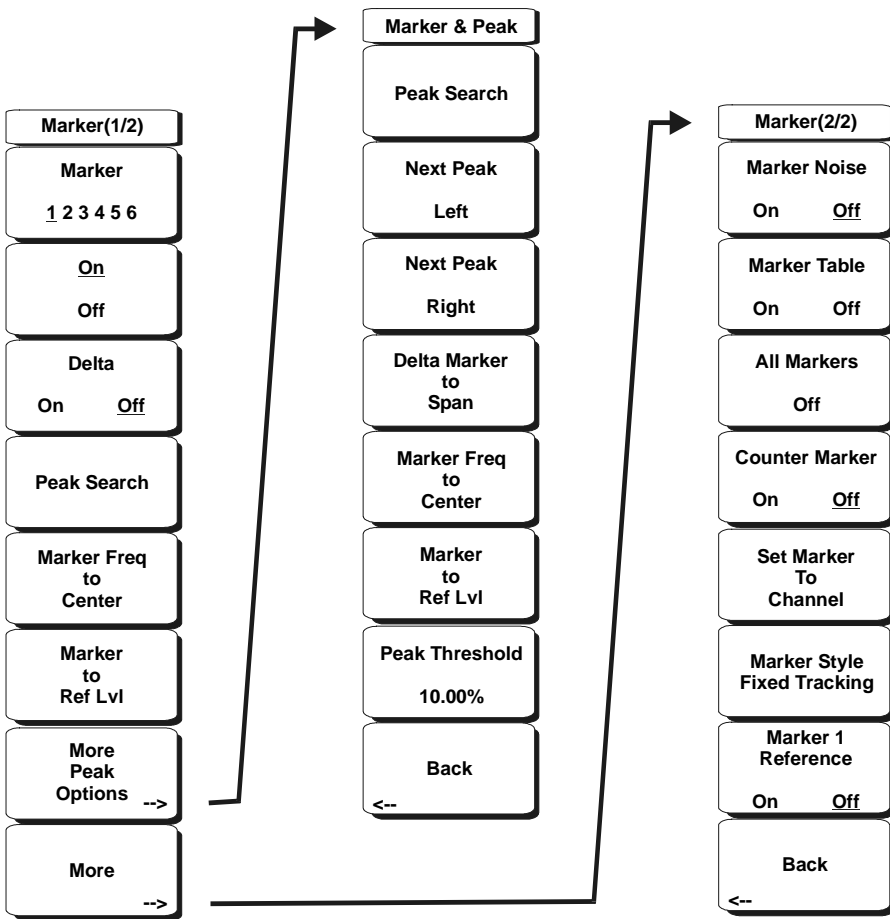
Figure 3-6. Marker Menu Soft Keys

Marker 1 2 3 4 5 6
Use this soft key to select the active marker. The underlined marker number is the active
marker. Each press of the soft key moves the underline to the next marker number. Press-
ing the **Shift** button causes subsequent button presses to move from higher marker num-
bers to lower numbers. Press the **Shift** button again to change back to the original
direction.

3-15

On/Off

This soft key make the active marker, selected by the Marker soft key above, active for editing. It does this without changing the value of the associated Delta marker. However, if the marker is currently active for editing, pressing the On/Off key causes the selected marker and the associated Delta marker to be turned off.

Delta On/Off

If the Delta marker is on, but not active for editing, pressing this soft key makes the Delta marker active for editing. If the marker is currently active for editing, pressing the On/Off key causes the delta marker to be turned off.

Peak Search

This soft key places the currently active marker on the highest signal amplitude currently displayed on screen.

Marker Freq to Center

This soft key changes the center frequency to place the currently active marker at the center of the display.

Marker to Ref Level

This soft key causes the amplitude of the currently active marker to become the reference level, which is the top horizontal line of the display.

More Peak Options

This soft key brings up a secondary menu of soft keys for more peak searching options.

Peak Search

This soft key places the currently active marker on the highest amplitude signal currently on screen.

Next Peak Left

From the current position of the active marker, the instrument searches to the left (toward lower frequencies) for a peak signal that rises at least a certain amount above the previous valley. If no such peak is found, the marker is placed at the left end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Next Peak Right

From the current position of the active marker, the instrument searches to the right (toward higher frequencies) for a peak signal that rises at least a certain above the previous valley. If no such peak is found, the marker is placed at the right end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Delta Marker to Span

Sets the total span width to the value of the delta marker. If the delta marker is zero, the span is set to 10 Hz. If there is no delta marker, or the delta marker value is set to less than 10 Hz, then the span will be set to 10 Hz.

Marker Freq to Center

Sets the center frequency to the frequency of the currently active marker.

Marker to Ref Lvl

Sets the amplitude of the currently active marker to the top graticule line as the reference level.

Peak Threshold

This soft key allows the user to specify how far above the average noise floor a signal must rise before it is considered a peak.

Back
Returns to the higher-level menu.

More
Opens a submenu of further Marker options.

Marker Noise
This marker option turns the markers into noise markers with units of dBm/Hz. When this option is selected, the detection method is automatically changed to RMS and the displayed value is compensated for the noise bandwidth of resolution bandwidth filter.

Marker Table
Pressing this soft key 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
This soft key turns off all markers and the marker table.

Counter Marker On Off
Sets the frequency counter mode for all markers. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. Using Counter Marker in association with Marker to Peak will result in the exact frequency of the peak within the pixel to a resolution of 1 Hz.

Set Marker To Channel
If a signal standard has been selected, pressing this soft key brings up a dialog box to select a channel. Select a channel number for the current signal standard, and the active marker will be set to the center frequency of the channel.

If no signal standard has been selected, a message "No standard selected. Press Enter or Escape to Continue." is displayed. Press either button to leave the settings as they were before the soft key was pressed.

Marker Style Fixed Tracking
This soft key changes the behavior of the reference markers. If Fixed is selected, reference markers stay at the amplitude they were at when the associated delta marker was turned on. If Tracking is selected, the amplitude of the reference marker changes as the signal amplitude is changed. Note that the reference marker tracks the amplitude, not the frequency of a signal.

Marker 1 Reference On Off
This soft key selects whether Marker 1 is the reference for all six delta markers, or whether each of the six reference markers has an associated delta marker.

Back
Returns to the previous menu.
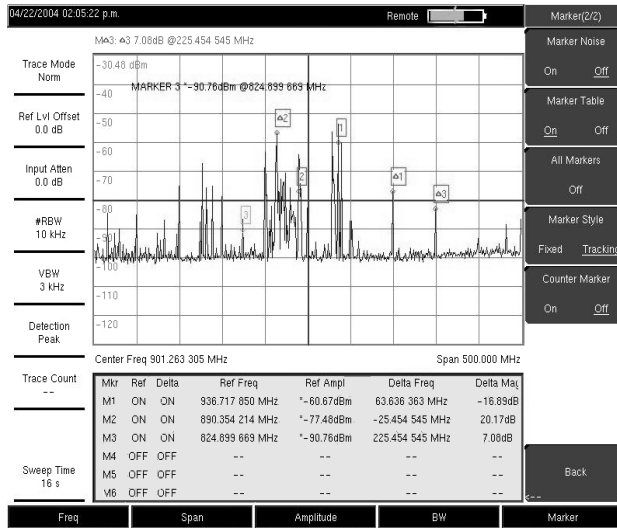
Figure 3-7. Markers

NOTE: When using the up and down arrows, the active marker moves in steps defined by the value entered using the Freq Step soft key (page 3-9).
When using the left or right arrow keys, the active marker moves by one division.

Measure

To access the functions under the Measure menu, select the **Shift** key, then the **Measure** (4) key. The Measure menu soft keys are:
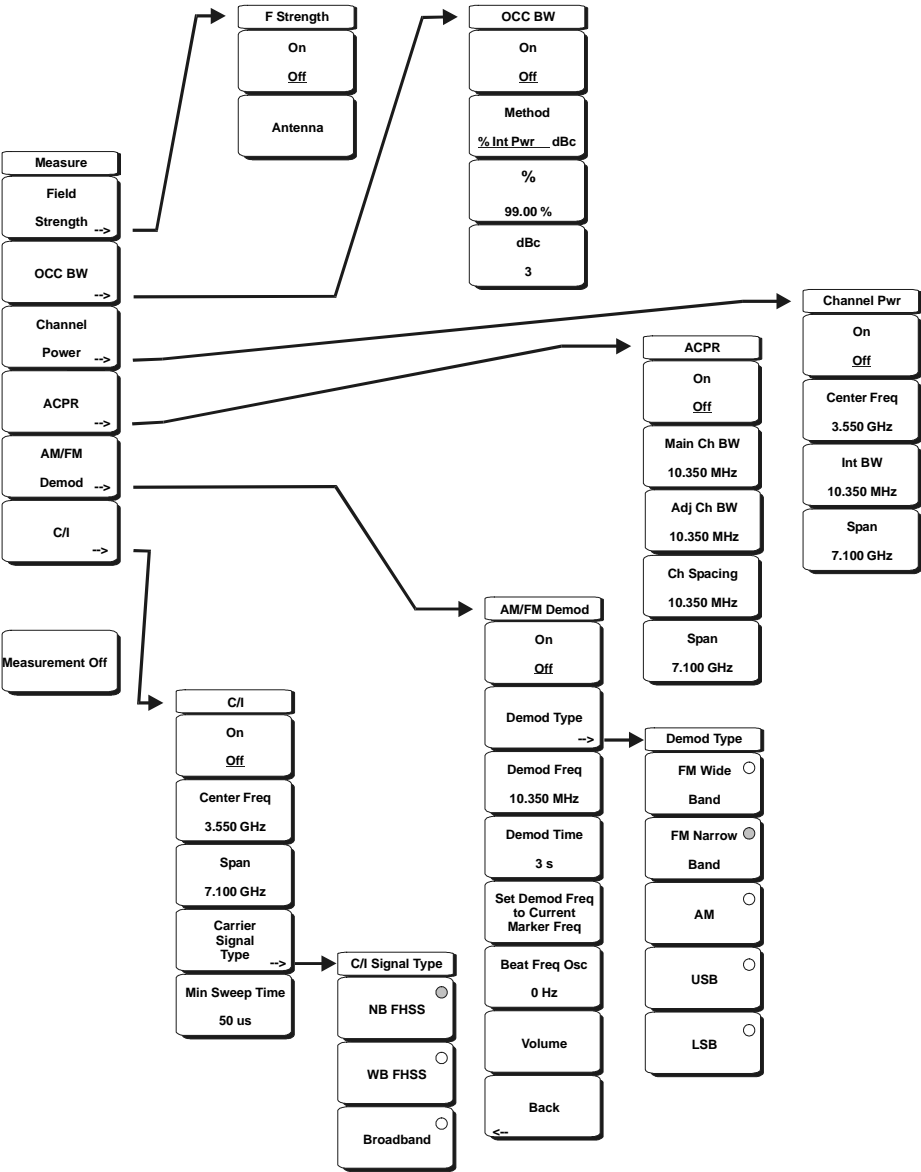
Figure 3-8. Measure Menu Soft Keys

Field Strength

This measurement allows the use of an antenna with known gain characteristics and measures the field strength over the frequency range of the antenna in units of dBm/meter, dbV/meter, dBmV/meter, dBµV/meter, volts/meter or watts/meter.

On Off

Turns field strength measurements on or off.

Antenna

This soft key brings up a dialog box that lists all the antennas for which the instrument has data, including both standard antennas and custom antenna that have been added using Master Software Tools. Use the Up/Down arrow keys or the rotary knob to select the desired antenna and press **Enter**.

Back

Returns to the previous menu.

OCC BW

Activates the occupied bandwidth menu. Select either % or dBc method of occupied bandwidth measurement.

Method % Down/dBc Down

Select either the % of Power (default) or dB Down measurement method as displayed in the message area.

%

Use the keypad, the directional arrow keys or the rotary knob to enter the percent of power, from 0 to 99%.

dBc

Use the keypad, the directional arrow keys or the rotary knob to enter the dBc value (0 to 120 dB).

Back

Returns to the previous menu.

Channel Power

Activates the Channel Power measurement function. Channel Power and Channel Power Density are measured based on the selection in the Units menu.

On Off

Begins or ends the channel power measurement. When the measurement is on, Ch Pwr will appear below the display. The detection method will automatically be changed to RMS Average when the measurement is started. The detection method can be modified by pressing the **Shift** and the **Sweep** keys and selecting the Detection soft key.

Center Freq

Activates the center frequency function, and sets the center frequency of the Spectrum Master for the channel power measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency.

Int BW

Sets the integration bandwidth for channel power measurement. Modifying this value automatically adjusts the channel span to maintain the same ratio. Use the keypad, the directional arrow keys or the rotary knob to enter the integration bandwidth.

Span

Sets the channel span for channel power measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the channel span.

Back

Returns to the previous menu.

ACPR

Accesses a menu of Adjacent Channel Power Ratio measurement options:

On Off

Begins or ends the ACPR measurement.

Main Ch BW

Sets the bandwidth of the main channel for ACPR measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input. Changing this value automatically changes the adjacent channel bandwidth and channel spacing.

Adj Ch BW

Sets the bandwidth of the adjacent channels for ACPR measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input.

Ch Spacing

Sets the channel spacing between the main and adjacent channels. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input. This value must be greater than or equal to half of the main channel bandwidth, plus half of the adjacent channel bandwidth.

Back

Returns to the previous menu.

AM/FM Demod

The user can select AM, Narrow Band FM (300 µs de-emphasis), Wide Band FM (50 µs de-emphasis), Upper Sideband or Lower Sideband.

On <u>Off</u>

Turns AM/FM Demodulation on or off.

Demod Type

Provides soft keys to select the type of signal to be demodulated:

    FM Wide Band
    FM Narrow Band
    AM
    USB
    LSB

Demod Freq

Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency of the signal to be demodulated. This frequency does not have to be within the current frequency sweep range to which the instrument is set.

Demod Time

Use the keypad, the directional arrow keys or the rotary knob to increase or decrease the demodulation time, and press the **Enter** key to select. The demodulation time can be set from 100 milliseconds to 500 seconds. The instrument sweeps one time for every demodulation period. Sweeping pauses during the demodulation time.

Set Demod Freq to Current Marker Freq

Sets the demodulation frequency to the frequency of the current marker.

Beat Freq Osc

Sets the beat frequency of the oscillator to exactly set the demodulation frequency of USB and LSB signals.

Volume

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

Back

Returns to the previous menu.

C/I

The Carrier to Interference ratio is a two-step measurement sequence that first measures the amplitude of a carrier, then, with the carrier turned off, measures the amplitude of all other interfering signals within the channel bandwidth.

On Off

Starts and stops the carrier to interference measurement.

Center Freq

Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency.

Span

Use the keypad, the directional arrow keys or the rotary knob to enter the frequency span.

Carrier Signal Type

Opens a menu to select the carrier signal type.

NB FHSS (Narrow Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11b.

WB FHSS (Wide Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11a or 802.11g.

Broadband

Use this setting when the signal being measured is a digital modulation format such as CDMA, GSM, etc.

Back

Returns to the previous menu.

Min Sweep Time

Set the minimum sweep time for the measurement.

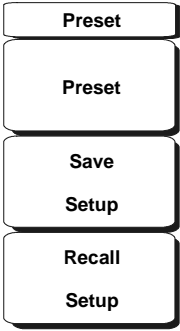### Back

Returns to the previous menu.

Measurement Off

Pressing this soft key turns off any active measurement, including demodulation.

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Mode

To access the functions under the Mode menu, select the **Shift** key, then the **Mode** (9) key. Available modes include Spectrum Analyzer, Interference Analyzer, and Channel Scanner.

Preset

To access the functions under the Preset menu, select the **Shift** key, then the **Preset** (1) key. The Preset menu soft keys are:

```
┌─────────────┐
│   Preset    │
└─────────────┘
┌─────────────┐
│   Preset    │
└─────────────┘
┌─────────────┐
│    Save     │
│   Setup     │
└─────────────┘
┌─────────────┐
│   Recall    │
│   Setup     │
└─────────────┘
```

Figure 3-9. Preset Menu Soft Keys

Preset

This key resets the instrument to the default starting conditions of full band sweep, 10 dBm log reference level, 10 dB/division scaling, 0 dB reference level offset, all measurements turned off and trigger set to free run.

Save Setup

Opens a dialog box 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 keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the setup.

Recall Setup

This soft key brings up a selection box that allows selection and recall of a previously stored instrument setup. Use the rotary knob or the Up/Down arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

Span

The Span menu is used to set the frequency range over which the instrument will sweep. For the MS2721A, the span can be set from 10 Hz to 7.1 GHz. The Span can also be set to zero span.

Press the **Span** function key located below the display to access the Span menu. The Span menu soft keys are:

Figure 3-10. Span Menu Soft Keys

Span
This soft key shows the current value for span in units of GHz, MHz, kHz or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys or the rotary knob to increase or decrease the span frequency. If the span is changed by using the up and down arrow keys, the span changes by the value of the Frequency Step entered in the Frequency menu.

Span Up 1-2-5
This is a convenient way to quickly arrive at a wider span value. The first time the soft key is pressed, the span value increases to the nearest even value that starts with 1, 2 or 5. For example if the span is 1.8 MHz, pressing the soft key for the first time changes the span to 2.0 MHz, the next press takes the value to 5.0 MHz and so on.

Span Down 1-2-5
This is a convenient way to narrow the frequency span. The first time the soft key is pressed, the span value decreases to the nearest even value that starts with 1, 2 or 5. For example if the span is 1.8 MHz, pressing the soft key for the first time changes the span to 1.0 MHz, the next press takes the value to 500 kHz, then 200 kHz and so on.

Full Span
Pressing this button sets the span to cover the entire tunable spectrum of the MS2721A from 0 Hz to 7.1 GHz.

Zero Span
This soft key sets zero span. In this mode the display shows amplitude changes at a single frequency. This function is frequently used to allow the easy monitoring of power variations over time. For example, if information about the amplitude of an 802.11a access point signal is needed, the access point frequency would be set as the center frequency, resolution bandwidth would be set to a value wide enough to encompass the signal and the tester would walk around the access point usable area while the Spectrum Master records the amplitude using slow sweep.

Last Span
This soft key returns the span to the most recent span value immediately before a change was made.

Sweep

To access the functions under the Sweep menu, select the **Shift** key, then the **Sweep** (3) key. The Sweep menu soft keys are:
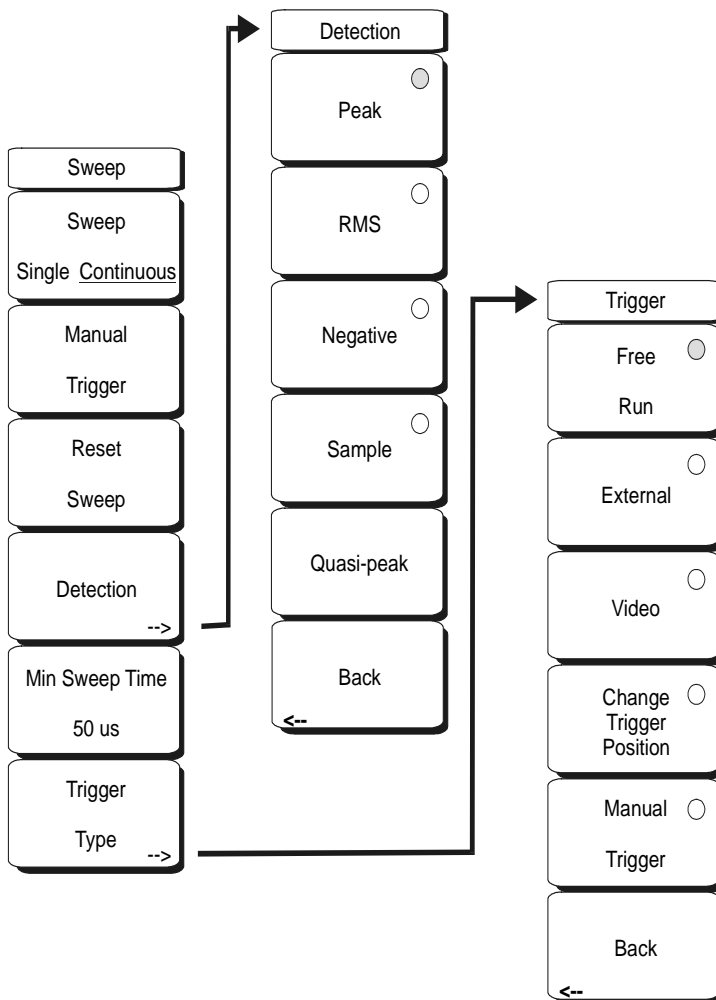
Figure 3-11. Sweep Menu Soft Keys

Sweep Single/Continuous

This soft 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.

Manual Trigger

Pressing this soft 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.

Reset Sweep

This soft key stops the current sweep, clears trace averaging results, clears the maximum hold results, if selected, and restarts the sweep at the left side of the screen.

Detection

Several detection methods tailor the performance of the instrument to meet specific measurement requirements. In general, there are more measurement points across the screen than display points. The various detection methods are different ways of dealing with selecting which measurement point will be shown at each display point.

Peak

This method causes the largest measurement point to be shown for each display point, and assures that a narrow peak is not missed.

RMS

This method performs a root-mean-square calculation of all the measurement points in each display point, and is particularly useful in displaying the average value of noise.

Negative

This method causes the smallest measurement point to be shown for each display point. Typically this mode is used to help detect small discrete signals in the presence of nearly equal values of noise. The display points that contain only noise will tend to show lower amplitudes than those that contain discrete signals.

Sample

This is the fastest detection method since for each display point only one frequency point is measured. Use this method when speed is of paramount importance and the possibility of missing a narrow peak is not important.

Quasi-peak

Selects the quasi-peak detector. When the quasi-peak detector is selected, the allowed resolution bandwidths are 200 Hz, 9 kHz and 120 kHz. Also, the RBW/VBW ratio is set to 1 so the video bandwidth is the same as the resolution bandwidth.

Back

Returns to the previous menu.

Min Sweep Time

This function allows a minimum sweep time to be specified. Use the keypad, the directional arrow keys or the rotary knob to set the minimum sweep time from 10 microseconds to 600 seconds. When using the keypad, the available time units are minutes, seconds, milliseconds and microseconds.

If the required sweep time for accurate measurement is longer than the specified minimum, then the time required for accurate measurements will prevail.

Trigger Type

Sets the type of trigger to be used.

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Free Run

In this mode, a new sweep is started immediately upon completion of an old sweep. No trigger event is required to initiate a sweep.

External

A TTL signal applied to the External Trigger BNC input connector causes a single sweep to occur. This mode 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.

Video

This mode is used in zero span to set the power level at which a sweep is initiated. The power level can be set from -120 dBm to +20 dBm. The trigger is based on the measured signal level. If no signal reaches or exceeds the trigger level, there will be no trace on the screen. This mode is used in Zero Span.

Change Trigger Position

This soft key is used in conjunction with video triggering to set the horizontal position on the display where a signal that meets the video triggering criterion will be placed. The value can be from 0% to 100%. Zero percent places the triggering event at the left edge of the screen while 100% places the triggering at the right edge of the screen. When the trigger position is any value other than 0%, the portion of the trace before the trigger event is displayed very quickly since the trace data is stored in memory. The portion of the trace after the trigger point is displayed on the screen at the normal rate as the signal is swept. This mode is used in Zero Span.

Back

Returns to the previous menu.

System

To access the functions under the System menu, select the **Shift** key, then the **System** (8) key. The System menu soft keys are:
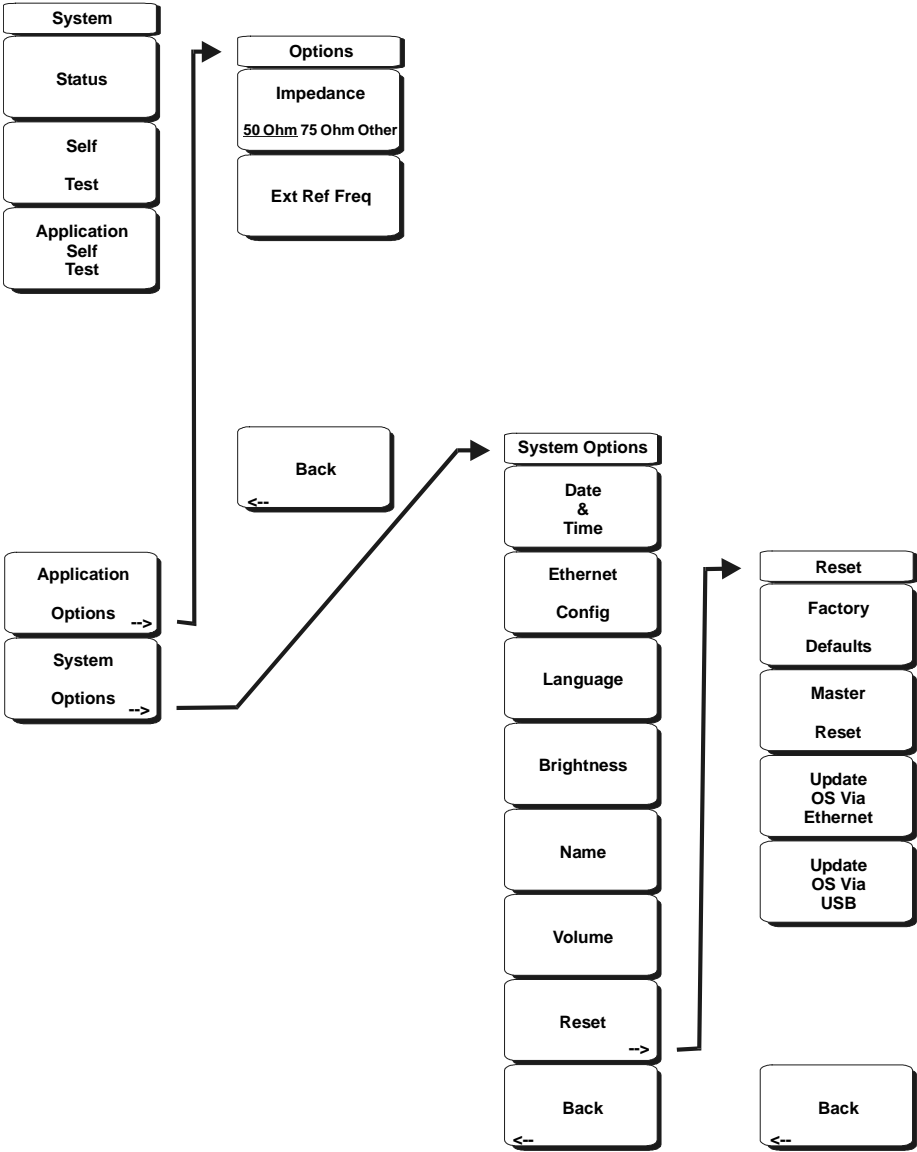

Figure 3-12. System Menu Soft Keys

Status

Pressing this soft 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 soft key initiates a series of diagnostic tests that test 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 soft key initiates a series of diagnostic tests related to the performance of the spectrum analyzer. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Options

This soft key presents a menu to select application options.

Impedance 50 Ohm/75 Ohm/Other

Select either 50 ohm, 75 ohm, or other impedance value. Selecting 75 ohm selects the 7.5 dB loss of the Anritsu 12N50-75B adapter. For other adapters, select Other and enter the appropriate loss.

Ext Ref Freq

Select the frequency of the external reference from the list presented. Valid frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz and 19.6608 MHz at amplitude from -10 dBm to +10 dBm.

Back

Returns to the previous menu.

System Options

This key opens a selection of system option soft keys.

Date and Time

This soft key brings up a dialog box for setting the current date and time. Use the soft 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. Select **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Ethernet Configuration

This soft key brings up a dialog box to set the IP address of the instrument.

Type Manual/DHCP

This softkey selects whether the address will be entered manually, or supplied automatically by a network DHCP server. If Manual is selected, use the soft 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 enter the input. Select **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Language

This soft key brings up a selection box allowing selection from a list of built-in languages for the spectrum 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 selected if they have been defined using the Master Software Tools software and loaded into the MS2721A. Two custom languages may be

loaded into the instrument. Select **Enter** to accept the change, or press the **Esc** key to return to normal operation without changing anything.

Brightness
The brightness of the display can be adjusted 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 10, 10 being the brightest. Select **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, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. 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
Opens a menu of reset and update options.

Factory Defaults
Restores the instrument to the factory default values, including Ethernet, language and brightness settings. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Master Reset
This will restore factory setting to all system parameters, including Time/Date, Ethernet, language and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Update OS Via Ethernet
Select this soft key to update the instrument operating system via the Ethernet connection. Press Enter to begin the update, or press **Esc** to return to normal operation without updating.

Update OS Via USB
Select this soft key to update the instrument operating system via the USB connection. Press Enter to begin the update, or press **Esc** to return to normal operation without updating.

Back
Returns to the previous menu.

Trace

To access the functions under the Trace menu, select the **Shift** key, then the **Trace** (5) key. The MS2721A is capable of displaying up to three traces, one with live data, Trace B with either live data or a stored measurement and Trace C with a stored measurement. The Trace menu soft keys are:
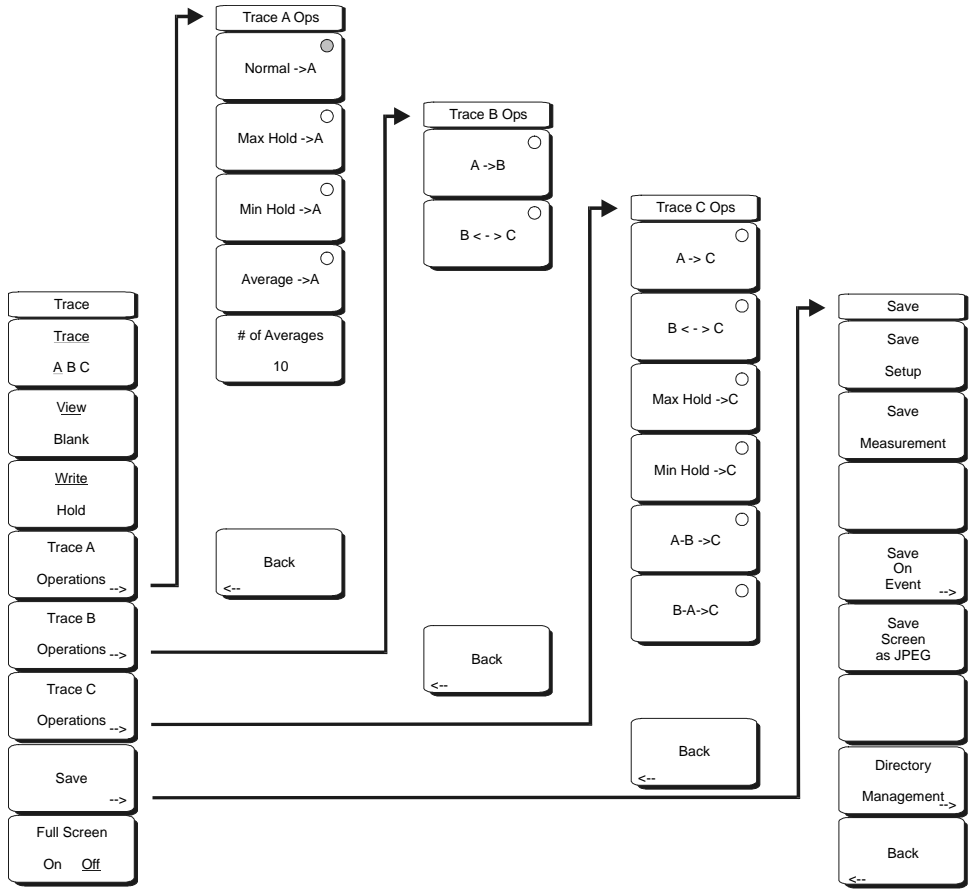
Figure 3-13. Trace Menu Soft Keys

Trace A, B, C
This soft key selects which trace is the active trace. The active trace is the one that is underlined. As the key is pressed, the underline advances from A to B to C and back to A.

View Blank
This soft key toggles the currently active trace to be either visible or hidden.

Write/Hold
Hold is used to temporarily stop writing measurement points to the screen. The instrument will continue to sweep in the background without updating the screen. This is useful if Max Hold or Averaging are running in the background to capture an elusive event, while enabling close observation of the last sweep update.

Selecting Write will update the screen with all the accumulated measurement data collected while Hold was activated. Hold is not applicable to Trace B, and is only available on Trace C when using Trace Math operations.

Trace A Operations

All choices related to Trace A, which is the default main trace are organized under this soft key.

Normal -> A

Displays a trace based on the detection method selected: Peak, RMS, Negative or Sample. These detection choices are explained in the amplitude and sweep menus since you can make a choice in either place.

Max Hold -> A

Displays the largest signal for each display point over multiple sweeps. Using this function along with Min Hold on trace C allows the simultaneous live display of the maximum and minimum values of sweeps.

Min Hold -> A

Displays the smallest signal for each display point over multiple sweeps. Using this function along with Max Hold on trace C allows the simultaneous live display of the maximum and minimum values of sweeps.

Average -> A

Displays the average value of multiple sweeps for each display point.

of Averages

This soft key lets the user choose how many traces to average. The value can be anywhere from 1 to 65535.

Back

Returns to the previous menu.

Trace B Operations

All choices related to Trace B are under this menu. Trace B displays only stored traces, never live, dynamic traces.

A -> B

Takes the trace currently displayed in trace A and copies it into trace B. If trace B was turned off, pressing this button not only copies the trace but also turns on trace B for viewing, the same as selecting trace B and pressing the "View/Blank" soft key.

B <- -> C

Swaps trace B and trace C.

Back

Returns to the previous menu.

Trace C Operations

A -> C

Stores trace A into trace C and turns on trace C if it was off.

B<- ->C

Swaps traces B and C.

Max Hold ->C

Shows the live maximum value of trace A in trace C. Note that by using traces C and A, one with max hold and one with min hold you can simultaneously see both values.

Min Hold -> C

Shows the live minimum value of trace A in trace C.

A - B -> C

Shows the difference between the trace A and trace B values in trace C. This can be a live trace if trace A is a live trace.

B - A -> C

Subtracts the value of trace A from trace B and places the results in trace C. This function is very useful for observing the changes in values of live trace A compared to a trace stored in trace B. Display scaling can be set to a value that makes the differences easy to see.

Back

Returns to the previous menu.

Save

Selecting this soft key opens a list of save function soft keys, as explained below.

Save Setup

Opens a dialog box 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 keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement

Initiates a dialog box to name and save the current active trace A. The saved measurement trace can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement trace.

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, etc.) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or select the soft key for each letter.

Save On Event…

The instrument can be configured to automatically save a measurement if a selected condition is satisfied. Approximately 1500 measurements can be saved before the memory is full.

… Crossing Limit On/Off

When Crossing Limit is On, and an upper or lower limit line is set, if any point in a measurement exceeds either the upper or lower limit line, the measurement is automatically saved at the end of the sweep. The saved measurement is named "LIM" followed by the date and time in the format: LIMyyyymmddhhmmss. The time value in the file name will generally be slightly earlier than the measurement time stamp shown in the file list, since the file name is created at the time the limit violation is noted and the time stamp is the time at which the measurement file is actually saved.

If a limit line has not been set, selecting this soft key results in the on-screen message: "You must have a limit ON first."

… Sweep Complete On/Off

When Sweep Complete is On, the measurement is automatically saved at the end of a sweep. This is particularly useful for very slow sweeps. The saved measurement is named "EOS" with a file name in the format: EOSyyyymmddhhmmss.

Save Then Stop On/Off

When the Save Then Stop soft key is set to On, the instrument will save just one measurement when the Crossing Limit or Sweep Complete soft keys are set to On, and the qualifying event occurs. Sweeping stops after a measurement is saved. If it is set to Off, sweeping continues after a measurement is saved and more measurements may be saved. The default for this selection is Off.

NOTE: This feature should be used with care. With Save Then Stop set to Off (the default) a large number of measurements can be saved when the Crossing Limit or Sweep Complete soft keys are set to On, making it time-consuming to retrieve saved measurements or to delete unwanted measurements. When there are many saved measurements, the time required to display a file list can be several minutes.

Clear All

Pressing this soft key turns off both save on event conditions and sets Save then Stop to Off, the default state.

Back

Returns to the top-level file menu.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with .jpg appended.

Directory Management

Sort Method
<u>Name</u> Type Date

File lists can be sorted by the name of the file, the type of file (SPA file, STP file, etc.) or by the date that the file was saved.

Sort
Ascending <u>Descending</u>

Selects whether the selected sort is sorted from lowest to highest (ascending) or highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort).

Current Location
<u>Int</u>   CF

This choice lets you select where measurements and setups will be saved. Pressing the soft key toggles between storing files on the internal memory or a Compact Flash memory module. The "current location" and the "copy to destination" will never be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location.

Copy to Destination
Int <u>CF</u>

This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, the cur-

rent location is automatically changed if the current location is the same as the selected copy to destination..

Copy From Current Location To Destination
Pressing this soft key causes all measurements, setups and jpg files stored in the user selected "current location" to be copied to the "copy to destination". If no storage module installed in the instrument an error message is displayed.

Format Compact Flash
This selection erases all files on an installed Compact Flash module. A message is displayed warning that all files will be erased. Press Enter to confirm that you want to erase and Esc to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups and jpg files.

Back
The Back key returns to the previous menu.

Full Screen On/Off
Toggles between a standard screen display, with 551 measurement data points, and the Full Screen mode, with 661 measurement data points. The increased size of the full screen X-Y display hides the data labels on the left side of the display. When in Full Screen mode, measurement and marker boxes are not available.

Chapter 4
Measurement Fundamentals

Introduction

Measurement fundamentals include the use of additional spectrum analyzer functions beyond frequency, span, amplitude and marker functions. In particular, this section focuses on resolution bandwidth, video bandwidth, sweep, and attenuator functions.

Resolution Bandwidth

Resolution Bandwidth is determined by the intermediate frequency (IF) filter bandwidth. The spectrum analyzer traces the shape of the IF filter as it tunes past a signal. If more than one IF filter is used in a spectrum analyzer, the narrowest one dominates and is considered the resolution bandwidth. The choice of resolution bandwidth depends on several factors. Filters take time to settle. That is, when a signal first appears at the input of the filter, it will take a while before the signal appears at the output. Additionally, the output of the filter will take some time to settle to the correct value, so that it can be measured. The narrower the filter bandwidth (resolution bandwidth) the longer the settling time needs to be and so the slower the sweep speed.

The choice of resolution bandwidth will depend on the signal being measured. If two closely-spaced signals are to be measured individually, then a narrow bandwidth is required. If a wider bandwidth is used, then the energy of both signals will be included in the measurement. Thus, the wider bandwidth does not have the ability to look at frequencies selectively but instead simultaneously measures all signals falling within the resolution bandwidth. Therefore, a broadband measurement would include all signals and noise within the measurement bandwidth into a single measurement.

On the other hand, a narrow-band measurement will separate the frequency components, resulting in a measurement that includes separate peaks for each signal. There are advantages to each. The ultimate decision will depend on the type of measurement required by the user.

There is always some amount of noise present in a measurement. Noise is often broadband in nature; that is, it exists at a broad range of frequencies. If the noise is included in the measurement, the measured value could be in error (too large) depending on the noise level. With a wide bandwidth, more noise is included in the measurement. With a narrow bandwidth, less noise enters the resolution bandwidth filter, and the measurement is more accurate. If the resolution bandwidth is narrower, the noise floor will drop on the spectrum analyzer display. This is because the IF filter of the analyzer has been made narrower in bandwidth, which lets in less noise. As the measured noise level drops, smaller signals that were previously obscured by the noise can now be measured.

Video Bandwidth

Spectrum analyzers typically use another type of filtering after the detector called video filtering. This filter also affects the noise on the display but in a different manner than the resolution bandwidth. In video filtering, the average level of the noise remains the same but the variation in the noise is reduced. Hence, the effect of video filtering is a "smoothing" of the signal noise. The resultant effect on the analyzer's display is that the noise floor compresses into a thinner trace, while the position of the trace remains the same.

Changing the video bandwidth (VBW) does not improve sensitivity, but it does improve repeatability when making low-level measurements. As a general rule of thumb, most field spectrum analyzer measurements are made at a video bandwidth that is a factor of 10 to 100

less than the resolution bandwidth. In the MS2721A Spectrum Master, this ratio can be specified in the BW menu. For a resolution bandwidth of 30 kHz, the typical video bandwidth setting options are either 3 kHz or 300 Hz.

Sweep Limitations

With some spectrum analyzers, the user has control over sweep time (the elapsed time of each sweep, sometimes called scan time). An analyzer cannot be swept arbitrarily fast while maintaining its specified accuracy, but will have a sweep rate limitation depending on the resolution bandwidth, video bandwidth, and frequency range selected. The sweep rate is not usually chosen by the user but is determined by the frequency range swept divided by the sweep time. The limitation on sweep rate comes from the settling or response time of the resolution and video bandwidth filters. If an analyzer is swept too quickly, the filters do not have time to respond, and the measurement is inaccurate. Under such conditions, the analyzer display tends to have a "smeared" look to it, with the spectral lines being wider than normal and shifted to the right.

Fortunately, the Anritsu Handheld Spectrum Master is designed to relieve the user from having to calculate the sweep speed or experiment to discover a sweep speed that yields accurate results. When changing the RBW and VBW with Spectrum Master, the sweep speed automatically changes to the fastest sweep speed that will yield accurate results. The sweep speed will be faster for a wide RBW or VBW and slower for a narrow RBW or VBW. The sweep speed can also be changed manually, by pressing the **Shift** and **Sweep** keys, then selecting the Min Sweep Time soft key. Enter a sweep time from 0.05 ms to 4294 seconds. If the minimum sweep time entered by the user is less than the value needed to assure accurate results, the value that delivers accurate results will be used. Regardless of the minimum sweep time setting, the Spectrum Master will never sweep faster than the RBW and VBW settings will allow. Spectrum Master is designed to assure that no uncalibrated measurement conditions will occur.

Attenuator Functions

Attenuation adjusts the hand held spectrum analyzer input attenuator. In Auto mode, as the reference level is increased, the attenuation is increased. In Manual mode, the input attenuation can be adjusted using the keypad or the Up/Down arrow keys. The attenuator range is 0 to 65 dB, in 5 dB steps. When the preamplifier is on, input attenuation can be either 0 dB or 10 dB.

Preamplifier Operation

The preamplifier can be turned on and off by pressing the **Amplitude** key, then selecting the Preamp On/Off soft key. The preamplifier has a gain of approximately 25 dB and generally will lower the noise floor by that amount. When the preamplifier is on, input attenuation can be either 0 dB or 10 dB.

Preamplifier Measurement Example

Figures 4-1 and 4-2 show the same signal with the preamplifier off and then on. Notice that when the preamplifier is turned on, the noise floor drops significantly allowing spectral regrowth components that were lost in the noise without the preamplifier to become easily visible.
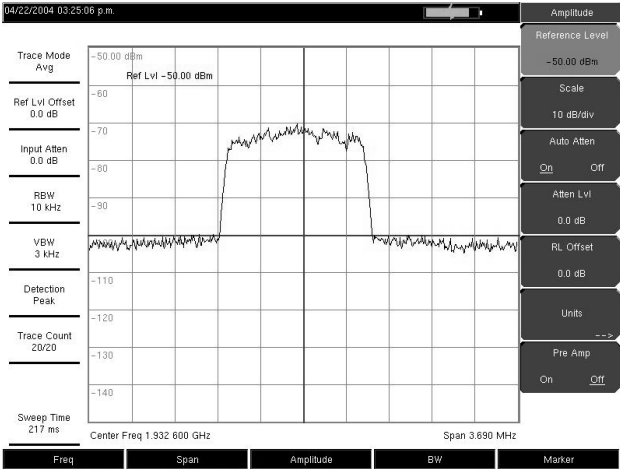
Figure 4-1. Preamplifier Off
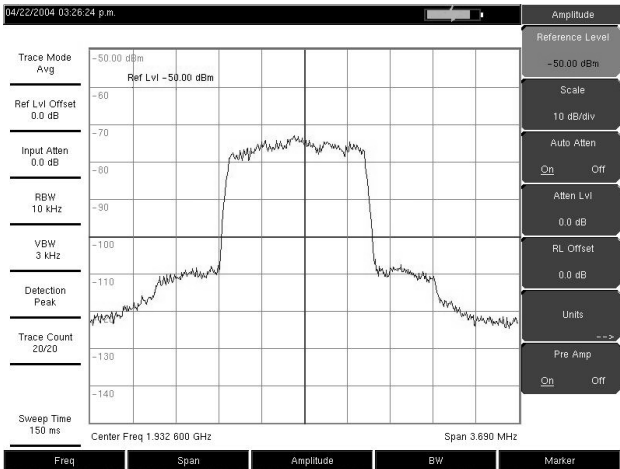
Figure 4-2. Preamplifier On

Chapter 5
Field Measurements

Introduction

There are one-button measurements built into the Spectrum Master MS2721A for field strength, occupied bandwidth, channel power, adjacent channel power ratio, and carrier to interference ratio (C/I) tests. In addition, AM/FM/SSB demodulation is available to aid in the identification of interfering signals. This chapter presents brief examples demonstrating the use of these measurements.

Occupied Bandwidth Measurement

Occupied bandwidth (OBW) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation depending on the technique used to modulate the carrier.

% Down Method
The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.

dBc Down Method
The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is a desired number of dB below the peak carrier level.

Required Equipment

- Anritsu MS2721A Handheld Spectrum Analyzer

- Test Port Extension Cable, Anritsu part number 15NNF50 - 1.5C

- 30 dB, 50 Watt, bi-directional, DC -18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is >+30 dBm)

Procedure

Step 1. Using the test port extension cable and the 30 dB, 50 watt, bi-directional attenuator (if needed) connect the MS2721A to the appropriate transmitter test port or signal source.

Step 2. Press the **Freq** key followed by the Center Freq soft key and enter the center frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz and Hz. Select the appropriate units key. Selecting the **Enter** key has the same affect as the MHz soft key.

Step 3. If the attenuator was connected in Step 1, press the **Amplitude** key and select the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss in the attenuator.

Step 4. Press the **Amplitude** key then press the Reference Level soft key to set the appropriate reference level.

Step 5. Press the Atten Lvl soft key to set the input attenuation level or leave Auto Atten set to On.

Step 6. Press the **BW** key to set the resolution bandwidth and video bandwidth if desired.

Step 7. Press the **Shift** key then the **Measure** (4) key followed by the OCC BW soft key. Choose the measurement method (dBc Down or % Down) by pressing the Method soft key. The selected method is underlined.

Step 8.   Press the dBc or % soft keys to adjust the settings as needed. Common values are 99% and 30 dBc.

Step 9.   Press the On/Off soft key to start the measurement. An information box will appear below the graph while occupied bandwidth measurement is on.
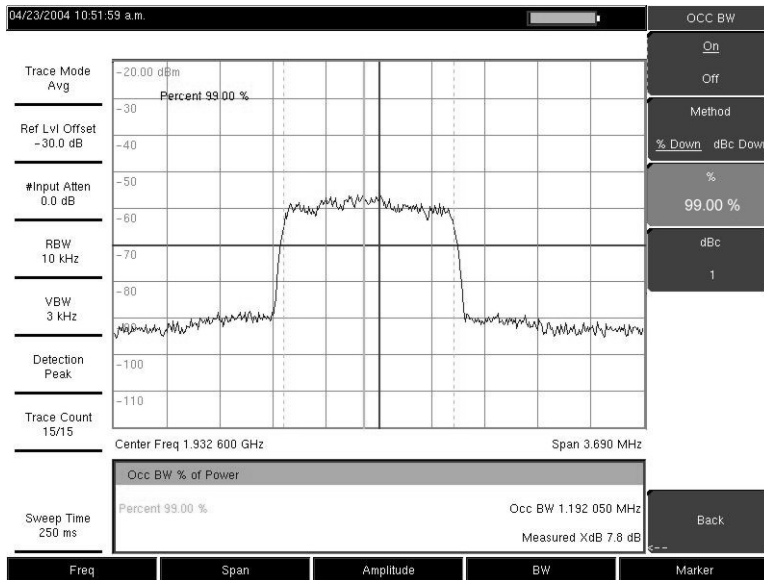
Figure 5-1. Occupied Bandwidth Results Using the % of Power Method

Figure 5-1 shows the occupied bandwidth results using the % of power method on a CDMA signal. Occupied Bandwidth is a constant measurement; once it is turned on, it remains on until it is turned off by pressing the On/Off soft key again. Occupied bandwidth is calculated at the end of each sweep.

Channel Power Measurement

Channel power measurement is one of most common measurements for a radio transmitter. This test measures the output power, or channel power, of a transmitter over the frequency range. Out-of-specification power measurements indicate system faults, which can be in the power amplifiers or in filter circuits. Channel Power measurements can be used to validate transmitter performance, comply with government regulations, or to keep overall system interference at a minimum.

Frequency and span settings for many signal standards can be automatically set by pressing the **Frequency** key and then the Signal Standard soft key. Choose the desired standard and press **Enter**. Press the Channel # soft key to enter the channel number at which the measurement is to take place.

CDMA Channel Power

The MS2721A can be used to measure CDMA signals in terms of channel power. It is important to use the proper settings to accurately measure a CDMA signal because a CDMA signal is different from a CW signal in many respects.

The following are the recommended settings for IS-95 CDMA measurements:

- CDMA Channel Bandwidth: 1.23 MHz

- Auto RBW setting: 10 kHz

- Auto VBW setting: 3 kHz

These values are set automatically when the appropriate signal standard is selected. Averaging may be used if desired.

CDMA Channel Power Measurement

Required Equipment
- MS2721A Handheld Spectrum Analyzer

- 30 dB, 50 Watt, bi-directional, DC -18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is >+30 dBm)

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure
Step 1.   Using the test port extension cable and 30 dB attenuator (if needed), connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS2721A.

Step 2.   Press the **Freq** key followed by the Signal Standard soft key. Scroll through the dialog box using the rotary knob or Up/Down arrow keys to highlight the desired air interface standard. In this case, select CDMA US PCS - Downlink and press **Enter**.

Step 3.   Press the Channel# soft key and enter the channel number using the keypad, the arrow keys, or the rotary knob. In this case, select channel 50.

Step 4.   If the attenuator was connected in Step 1, press the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss of the attenuator.

Step 5.   Press the **Amplitude** key and select the Reference Level soft key. Set the reference level to -50 dBm.

Step 6.   Press the Scale soft key and set the scale to 10 dB/division.

Step 7.   Press the **Shift** key then the **Measure** (4) key, and select the Channel Power soft key.

Step 8.   Select the Center Freq soft key and verify that the center frequency of the Spectrum Master is set to that of the CDMA signal, 1.9326 GHz in this example. This value is automatically set when the air interface standard and channel number are selected.

Step 9.   Press the Int BW soft key and verify that the integration bandwidth is set to 1.23 MHz.

Step 10. Press the Span soft key and verify that the span is set to 3.69 MHz.

> NOTE: The integration bandwidth is defined as the frequency span in which the spectrum analyzer integrates measured power readings, while the channel span is the frequency range of the analyzer sweeps.

Step 11. Make the measurement by pressing the On/Off soft key. The MS2721A displays the measurement results in the message area.

> NOTE: Channel power is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off key again.

GSM Channel Power Measurement

Global Systems for Mobile (GSM) communication is a globally accepted standard for digital cellular communication. There are three frequency bands allocated to GSM mobile phones, one at 850 MHz, one at 900 MHz, and another at 1800 MHz. 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, 80 MHz apart. GSM uses the Gaussian Minimum Shift Keying (GMSK) modulation method. Due to the nature of TDMA, GSM transmitters ramp RF power rapidly. If the transmitter keys on too quickly, users on different frequencies (especially those close to the channel of interest) may experience significant interference. This is one of the reasons that spurious measurements are extensively used in GSM applications.

Required Equipment
- MS2721A Handheld Spectrum Master

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure
Step 1. Using the test port extension cable, connect the signal source to the RF In test port of the MS2721A.

Step 2. Press the **Amplitude** key and select the Reference Level soft key to set the reference level to -20 dBm. Adjust the values given in this procedure to match your measurement conditions.

Step 3. Press the Scale soft key and set the scale to 10 dB/division.

Step 4. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

Step 5. Press the **Freq** key followed by the Signal Standard soft key. Scroll through the dialog box using the rotary knob or Up/Down arrow keys to highlight the GSM900 standard for the measurement and press **Enter**.

Step 6. Press the Channel# soft key and enter the channel number using the keypad, the arrow keys, or the rotary knob. For this example, select Channel 60.

Step 7. Press the **Shift** key then the **Measure** (4) key and press the Channel Power soft key.

Step 8. Select the Center Freq soft key and verify that the center frequency of the Spectrum Master is set to that of the GSM signal, in this case 947.0 MHz.

Step 9. Select the Int BW soft key and enter 200 kHz for the integration bandwidth, or set the integration bandwidth appropriate for the particular application.

Step 10. Select the Span soft key and enter 800 kHz as the channel span, or set the channel span to a value appropriate for the particular application.

Step 11. Make the measurement by pressing the Measure soft key. The MS2721A displays the measurement results in the message area.

> NOTE: Channel Power is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

AMPS Channel Power Measurement

The MS2721A can be used to test Advanced Mobile Phone System (AMPS) base stations. These systems are narrow-band FM voice transceivers with system control functionality. The energy of the AMPS signal is represented by multiple narrow band FM channels spread over a wide frequency range. AMPS frequency allocations are within the 800 and 900 MHz cellular telephone spectrum. Each service provider can use half of the 825-845 MHz range for receiving signals from cellular phones and half the 870-890 MHz range for transmitting to cellular phones. The bands are divided into 30 kHz channels with 12 kHz maximum frequency deviation.

Required Equipment
- MS2721A Handheld Spectrum Master

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

- 30 dB, 50 Watt, bi-directional, DC -18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is >+30 dBm)

5-4

Procedure

Step 1.	Using the test port extension cable, and the 30 dB attenuator if needed, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS2721A.

Step 2.	If the attenuator was connected in Step 1, press the **Amplitude** key and select the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss in the attenuator.

Step 3.	Press the **Amplitude** key and select the Reference Level soft key to set the reference level to -50 dBm.

Step 4.	Press the Scale soft key and set the scale to 10 dB/division.

Step 5.	Press the **Amplitude** key followed by the Auto Atten soft key if needed to turn On auto attenuation.

Step 6.	Press the **BW** key and verify that RBW Auto and VBW Auto are On.

Step 7.	Press the **Shift** key then the **Trace** (5) key. Press the Trace Mode soft key as needed to select Max (maximum hold).

Step 8.	Press the **Shift** key then the **Measure** (4) key and press the Channel Power soft key.

Step 9.	Select the Center Freq soft key and set the center frequency of the Spectrum Master to that of the signal, in this example 888.852728 MHz.

Step 10.	Select the Int BW soft key and enter 30 kHz for the integration bandwidth.

Step 11.	Select the Channel Span soft key and enter 90 kHz as the channel span, or set the channel span to a value appropriate for the particular application.

Step 12.	Make the measurement by pressing the On/Off soft key.

> NOTE: Channel Power is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

Adjacent Channel Power Ratio

Another common transmitter measurement is that of Adjacent Channel Power Ratio (ACPR), or adjacent channel leakage power. This is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel. This measurement can be used to replace the traditional two-tone intermodulation distortion (IMD) test for system non-linear behavior.

The result of an ACPR measurement is expressed as a power ratio. In order to calculate the upper and lower adjacent channel values, the MS2721A needs to know the values of four parameters:

- Main Channel Center Frequency

- Measurement Channel Bandwidth

- Adjacent Channel Bandwidth

- Channel Spacing

When a signal standard is selected from the list in the MS2721A, these four values are automatically set for that signal standard.

Adjacent Channel Power Measurement

Required Equipment

- MS2721A Handheld Spectrum Analyzer

- 30 dB, 50 watt, Bi-Directional, DC - 18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (if needed for the power level being measured)

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure

Step 1.   Using the test port extension cable, and the 30 dB attenuator if needed, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS2721A.

Step 2.   If the attenuator was connected in Step 1, press the **Amplitude** key and select the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss of the attenuator.

Step 3.   Press the **Amplitude** key and select the Reference Level soft key to set the reference level to the appropriate reference level.

Step 4.   Press the Atten Lvl soft key to set the input attenuation level needed for the measurement. This value depends on the input power level and any external attenuator. Enter an attenuation level to achieve roughly -40 dBm at the input mixer.

Step 5.   Press the **BW** key and verify that RBW Auto and VBW Auto are On.

Step 6.   There are two ways to set the measurement parameters. If the signal standard and channel are known, press the **Freq** key and set the Signal Standard and Select Channel soft keys for the signal to be measured then skip to Step 12. If the signal standard and channel are not known, follow the procedure in Steps 6 through 11 below.

Step 7.   Press the **Freq** key, select the Center Freq soft key, and enter the desired center frequency.

Step 8.   Press the **Shift** key then the **Measure** key and press the ACPR soft key.

Step 9.   Press the Main Ch BW soft key, and enter the desired main channel bandwidth. For an IS-95 CDMA signal, enter 1.23 MHz.

Step 10.   Press the Adj Ch BW soft key, and enter the desired adjacent channel bandwidth. For an IS-95 CDMA signal, enter 1.23 MHz.

Step 11.   Press the Ch Spacing soft key, and enter the desired channel spacing. For an IS-95 CDMA signal, enter 1.23 MHz.

Step 12.   Begin making measurement by pressing the On/Off soft key. The MS2721A displays the measurement results in the message area.

NOTE: Adjacent Channel Power Ratio is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off key again.

GSM Adjacent Channel Power Measurement

Required Equipment

- MS2721A Handheld Spectrum Analyzer

- 30 dB, 50 watt, Bi-Directional, DC - 18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (if required for the power level being measured)

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure

Step 1.   Using the test port extension cable and 30 dB attenuator, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS2721A.

Step 2.   If the attenuator was connected in Step 1, press the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss of the attenuator.

Step 3.   Press the **Amplitude** key and select the Reference Level soft key to set the reference level to 60 dBm.

Step 4.   Press the Atten Lvl soft key to set the input attenuation level needed for the measurement. This value depends on the input power level and any external attenuator. Enter an attenuation level to achieve roughly -40 dBm at the input mixer.

Step 5.   Press the **BW** key and verify that RBW Auto and VBW Auto are On.

Step 6.   There are two ways to set the measurement parameters. If the signal standard and channel are known, press the **Freq** key and set the Signal Standard and Select Channel soft keys for the signal to be measured then skip to Step 12. If the signal standard and channel are not known, follow the procedure in Steps 7 through 12 below.

Step 7.   Press the **Freq** key, select the Center Freq soft key, and enter the desired center frequency.

Step 8.   Press the **Shift** key then the **Measure** key and select the ACPR soft key.

Step 9.   Select the Main Ch BW soft key, and enter the main channel bandwidth.

Step 10. Select the Adj Ch BW soft key, and enter the adjacent channel bandwidth.

Step 11. Select the Ch Spacing soft key, and enter the channel spacing.

Step 12. Make the measurement by pressing the On/Off soft key. The detection method is automatically changed to RMS Average.

Solid vertical lines are drawn on the display to indicate the main channel. Dashed vertical lines define the adjacent channels. The MS2721A will display the measurement results in the message area.

> NOTE: Adjacent Channel Power Ratio is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

# AMPS (TDMA) Adjacent Channel Power Measurement

Required Equipment

- MS2721A Handheld Spectrum Analyzer

- 30 dB, 50 watt, Bi-Directional, DC - 18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (if needed for the power level being measured)

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure

Step 1.   Using the test port extension cable, and the 30 dB attenuator if needed, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS2721A.

Step 2.   If the attenuator was connected in Step 1, press the **Amplitude** key and select the RL Offset soft key and set the reference level offset to -30 dB to compensate for the loss in the attenuator.

Step 3.   Press the **Amplitude** key and select the Reference Level soft key to set the reference level to -50 dBm.

Step 4.   Press the RL Offset soft key to set the reference level offset to -30 dB.

Step 5.   Press the Auto Atten soft key and set automatic attenuation to On.

Step 6.   Press the **Freq** key, select the Center Freq soft key, and enter 835 MHz.

Step 7.   Press the **Shift** key then the **Measure** key and press the ACPR soft key.

Step 8.   Press the Main Ch BW soft key to enter the main channel bandwidth. For an AMPS signal, enter 30 kHz.

Step 9.   Press the Adj Ch BW soft key, and enter the adjacent channel bandwidth. For an AMPS signal, enter 30 kHz.

Step 10. Select the Ch Spacing soft key, and enter the channel spacing. For an AMPS signal, enter 30 kHz.

Step 11. Make the measurement by pressing the On/Off soft key.

The detection method is automatically changed to RMS Average. Solid vertical lines are drawn on the display to indicate the main channel. Dashed vertical lines define the adjacent channels. The MS2721A will display the measurement results in the message area.

> NOTE: Adjacent Channel Power Ratio is a constant measurement. Once it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

Out-of-Band Spurious Emission Measurement

Required Equipment

- MS2721A Handheld Spectrum Analyzer

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure

Step 1. Using the test port extension cable, connect the signal source to the RF In test port of the MS2721A.

Step 2. Press the **Freq** key, select the Center Freq soft key, and enter the center frequency.

Step 3. Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 4. Press the **Amplitude** key, then press the Reference Level soft key and set the reference level to -20 dBm.

Step 5. Press the Auto Atten soft key set the attenuation to On.

Step 6. Press the **BW** key and use the RBW and VBW soft keys to set the resolution bandwidth to 3 kHz and the video bandwidth to 300 Hz.

Step 7. Press the **Marker** key and press the Marker 1 2 3 4 5 6 soft key to select marker 1. The underlined number indicates the active marker.

Step 8. Press the On/Off soft key and use the arrow keys, the keypad and the knob to move the marker over one of the spurs.

Step 9. Compare the value of the marker to the specified allowable level of out-of-band spurious emissions for the corresponding channel transmit frequency.

Step 10. Repeat Steps 9 and 10 for the remaining spurs. Use either Marker 1 again, or choose another marker. Figure 5-2 shows a simulated out-of-band spurious signal 21.000 MHz from the carrier using a delta marker.
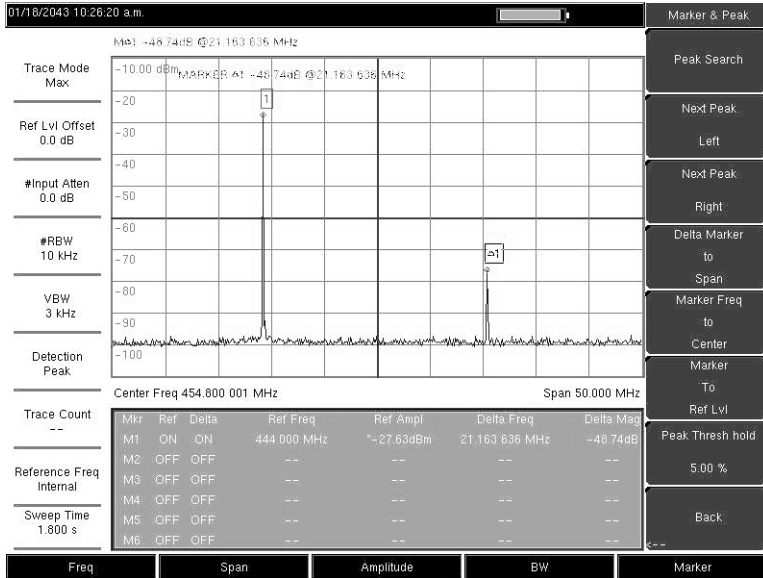
Figure 5-2. Simulated Out-of-Band Spurious Emission Measurement

In-band/Out-of-Channel Measurements

The in-band/out-of-channel measurements are those measurements that measure distortion and interference within the system band, but outside of the transmitting channel. These measurements include in-band spurious emissions and adjacent channel power ratio (also called spectral regrowth). There are stringent regulatory controls on the amount of interference that a transmitter can spill to neighboring channels. In order to determine compliance with the allowable level of spurious emissions, two parameters need to be specified:

- Measurement channel bandwidth

- Allowable level of spurious emissions

In-band Spurious Measurement

Required Equipment
- MS2721A Handheld Spectrum Analyzer

- 30 dB, 50 watt, Bi-Directional, DC - 18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30

- Test Port extension cable, Anritsu 15NNF50 - 1.5C

Procedure
Step 1. Using the test port extension cable and 30 dB, 50 watt, Bi-directional attenuator, connect the MS2721A to appropriate transmit test port.

Step 2. Press the **Freq** key, select the Center Freq soft key, and enter the center frequency.

Step 3. Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 4. Press the **Amplitude** key and then press the Reference Level soft key to set the reference level to -20 dBm.

Step 5. Select the RL Offset soft key to set the reference level offset to -30 dB to compensate for the loss of the attenuator

Step 6. Press the Auto Atten soft key set the attenuation to On.

Step 7. Press the **BW** key and use the RBW and VBW soft keys to set the resolution bandwidth to 10 kHz and the video bandwidth to 300 Hz.

Step 8. Press the **Marker** key and press the Marker 1 2 3 4 5 6 soft key to select marker 1. The underlined number indicates the active marker.

Step 9. Press the On/Off soft key and use the arrow keys, the keypad and the knob to move the marker over one of the spurs.

Step 10. Compare the value of the marker to the specified allowable level of in-band/out-of-channel spurious emissions for the corresponding channel transmit frequency.

Step 11. Repeat steps 9 and 10 for the remaining spurs. Use either Marker 1 again, or choose another marker.

Figure 5-3 shows a simulated in-band spur at 1.625 MHz from the carrier frequency. The carrier is measured by M1. The delta marker on M1 shows the signal at fc+ 1.625 MHz to be 60.17 dB down from the carrier. These values should be compared against the specification for the transmitter being tested.
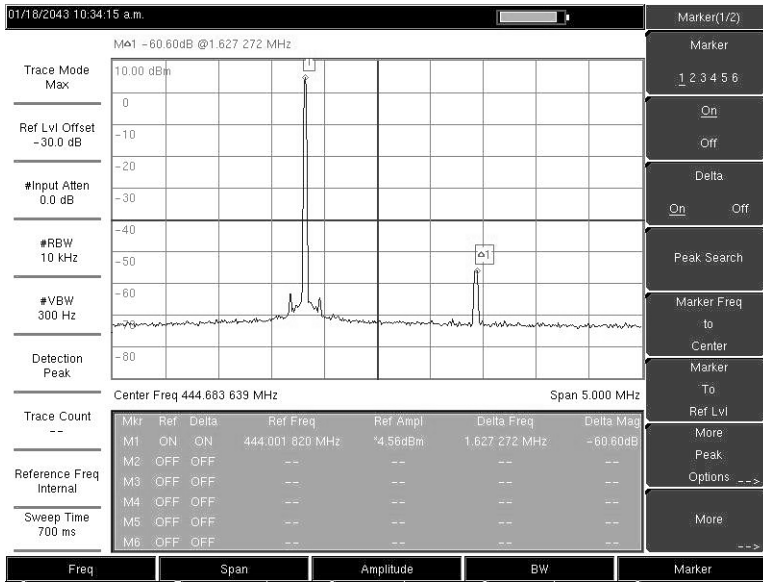
Figure 5-3. In-band Spurious Measurement

NOTE: The resolution bandwidth of a spectrum analyzer is determined by the intermediate frequency (IF) filter bandwidth. The MS2721A traces the shape of the IF filter as it sweeps past a signal. Therefore, if two equal-amplitude signals are very close to each other, the measurement result can appear to be one single response because the IF or resolution bandwidth is not small enough to resolve the two signals. Similarly, if two signals are not equal in amplitude but are very close together, the smaller signal may not be seen because it is hidden under the large response.

Field Strength

Required Equipment
*   MS2721A Handheld Spectrum Analyzer

*   Portable Antenna for which antenna factors or antenna gain and bandwidth data are available.

Procedure
Step 1.   Press the **Shift** key then the **Measure** key and press the Field Strength soft key.

Step 2.   Press the Antenna soft key and use the Up/Down arrow keys or the rotary knob to select the desired antenna. Press the **Enter** key to select.

NOTE: Select an antenna from the standard list available in the MS2721A, or use the Antenna Editor feature of Anritsu Master Software Tools (see Chapter 8) to define a custom antenna and upload the antenna information to the MS2721A antenna list.

Step 3.   Connect the antenna to the MS2721A.

Step 4.   Press the **Freq** key, select the Center Freq soft key, and enter the center frequency.

Step 5.   Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 6.   Press the **BW** key and verify that RBW Auto and VBW Auto are On.

Step 7.   To change the units of measurement, press the **Amplitude** hard key, then press the Units soft key and select dBm, dBV, dBmV or dBµV.

Step 8.   Select either the Volts or Watts soft key, as required. The MS2721A automatically adjusts the measurement by the antenna factors selected. Marker values will be displayed in the same units as selected for the amplitude.

Antenna Calculations
The following is a list of various antenna calculations should you find it necessary to convert from one to another:

Conversion of signal levels from W to V in a 50 ohm system:

$P = V^2/R$

where:

P = power in Watts
V = voltage level in Volts
R = resistance in Ohms

Note that $1 \text{ mW} = 10^{-3} \text{ W}$ and $1 \mu V = 10^{-6} V$.

For power in dBm, and voltage in dB(µV).

$V_{dB(\mu V)} = P_{(dBm)} + 107 \text{ dB}$

Power density to field strength. An alternate measure of field strength to electric field is power density:

$Pd = E^2/120\pi$

where:

E = field strength in V/m
P = Power density in W/m

Power density at a point:

$$P_d = P_t G_t/(4\pi r^2)$$

In the far field, where electric and magnetic fields are related by the impedance of free space:

Where P_d = power density in W/m

P_t = power transmitted in Watts

G_r = gain of transmitting antenna

r = distance from the antenna in meters

AM/FM/SSB Demodulation

The Spectrum Master built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows a technician to hear an interfering signal to ease identification. The demodulated signal can be heard using either the built-in speaker, or through a monaural headset connected to the 2.5-mm jack on the test panel.

Demodulation Procedure

Step 1.   Press the **Shift** key followed by the **Measure** (4) key and the AM/FM Demod soft key.

Step 2.   Press the Demod Type soft key and select FM Wide Band, FM Narrow Band, AM, USB, or LSB to match the modulation format of the signal.

Step 3.   Press the Back soft key.

Step 4.   Press the Demod Freq soft key and use the keypad or rotary knob to enter the center frequency of the signal to be demodulated. For USB and LSB signals, fine tune the signal by adjusting the Beat Freq Osc. By default the BFO frequency is set to zero, meaning that the re-injected carrier is exactly at the demodulation frequency. The Beat Freq Osc soft key allows adjustment of the beat frequency oscillator to fine tune the signal through a span of ±10000 Hz.

Step 5.   Press the On/Off soft key to enable the measurement.

Step 6.   Press the Volume soft key and use the Up/Down arrow keys or rotary knob to change the audio volume from 0% to 100%. For most headsets a volume of 40% is adequate.

Step 7.   The Demod Time soft key sets the time the Spectrum Master will demodulate the signal. Enter a value from 100 ms to 500 seconds.

Carrier to Interference Ratio Measurement

Carrier to Interference Ratio (C/I) Measurement is a two-step process, first measuring the carrier level and then, with the carrier turned off, measuring the remaining signals and noise in the band of interest. After the two measurements are complete, the ratio of the carrier level to the noise plus interference is displayed using three assumptions:

• The interferer is a narrowband frequency hopping signal (NB FHSS)

• The interferer is a wideband frequency hopping signal (WB FHSS)

• The interferer is a broadband signal (BB).

The primary application for this type of measurement is determining the magnitude of interference problems for 802.11b, 802.11g and 802.11a access points (hot spots).

Procedure

Step 1.   Press the **Frequency** key followed by the Signal Standard soft key. Select the appropriate signal standard based on the signal to be measured and press **Enter**.

Step 2.   Press the Select Channel soft key, select the operating channel of the access point being measured and press **Enter**.

Step 3.   Press the **Shift** key followed by the **Measure** (4) key and the C/I soft key.

Step 4.   Press the Center Freq soft key and enter the desired frequency, unless a Signal Standard and Channel have already been selected in the **Frequency** menu.

Step 5.   If needed, press the Span soft key and set an appropriate span width for the signal to be measured.

Step 6.   If the signal environment includes slow frequency hopping signals, such as cordless telephones, press the Min Sweep Time soft key to set a sweep time of one second or more to give a good chance of capturing instances of the interfering signal.

Step 7.   Press the On/Off soft key and follow the on-screen prompts to complete the measurement.

NOTE: Access to the transmitter is required to complete this procedure as the transmitted carrier must be turned off for the second portion of the measurement.

Step 8.   After the measurement is complete, the measurement box gives results for the three different signal types. Some measurement results may show as Error, and this is to be expected.

The following figures show the C/I measurement steps, ready to measure the carrier, with the carrier measured, and the measurement results.
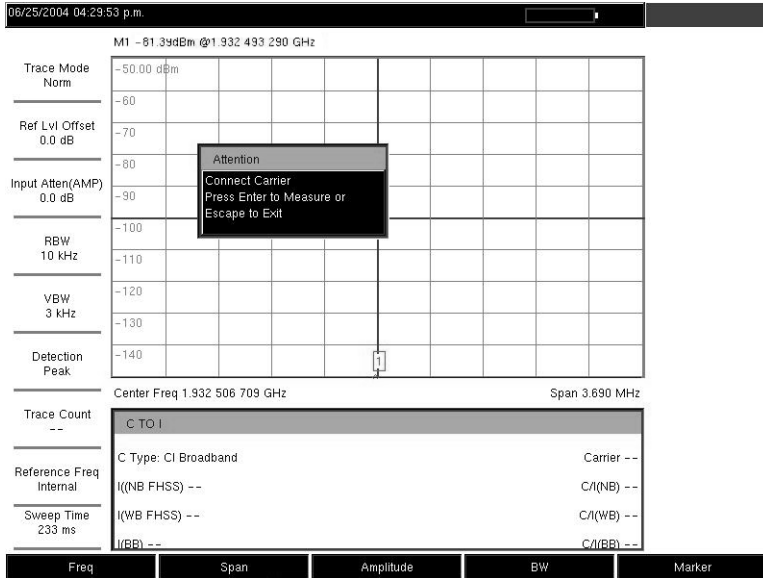
Figure 5-4. C/I Measurement, Ready to Measure the Carrier
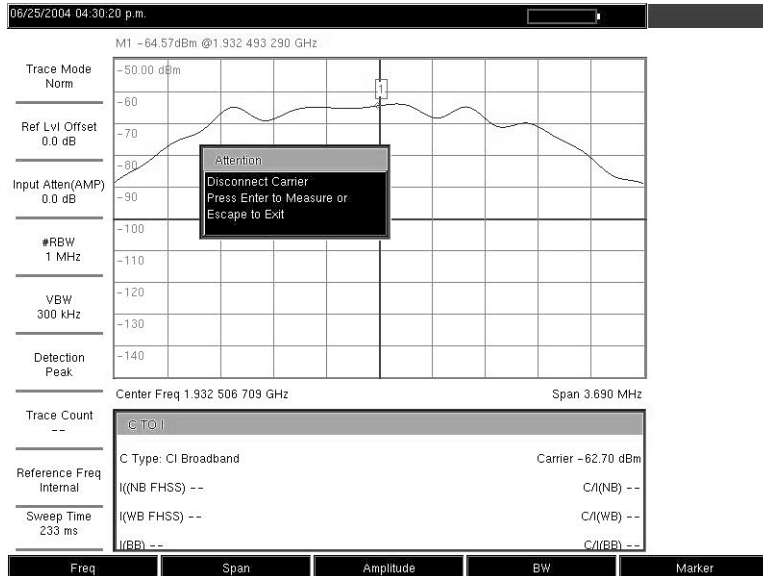
Figure 5-5. C/I Measurement, Carrier Measured
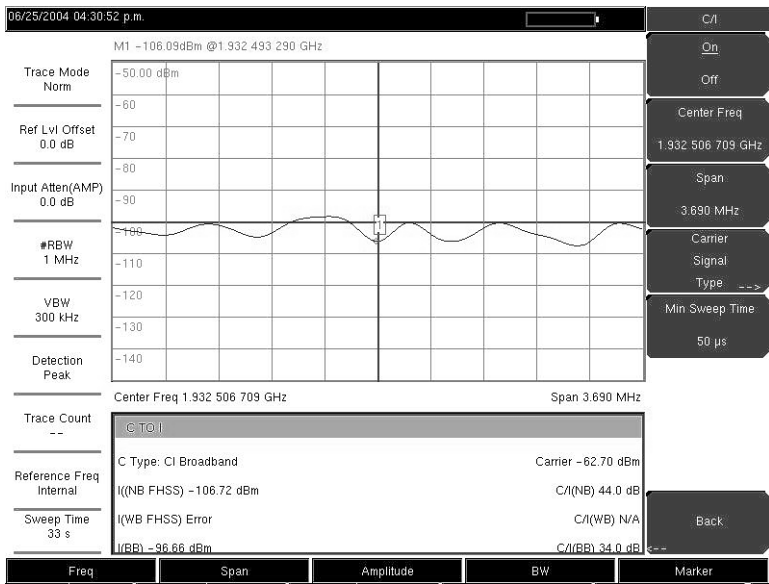
Figure 5-6. C/I Measurement, Results

Chapter 6
Interference Analysis
Measurements

Introduction

Many wireless networks operate in complicated signal environments. Three or four base station antennas may be located on the same tower, and can create interference problems, which can affect system capacity and coverage.

The Interference Analyzer option adds three measurement capabilities to the Spectrum Master to aid in the solving of interference problems:

- Spectrogram

- Signal Strength

- RSSI

The instrument also has a spectrum mode which displays signals in a traditional spectrum analyzer view.

The following menus are available in Interference Analyzer mode.

Freq Menu

Freq
Center Freq 3.550 GHz
Start Freq 0 Hz
Stop Freq 7.100 GHz
Span -->
Freq Step 1.000 MHz
Signal Standard
Channel -- --

Span
Span 7.100 GHz
Span Up 1-2-5
Span Down 1-2-5
Full Span
Zero Span
Last Span
Back <--
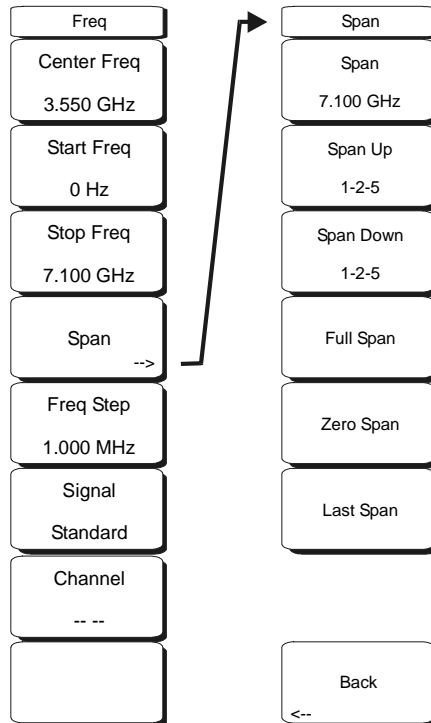
Figure 6-1. Interference Analyzer Mode Freq Menu

The tuning frequency range for the MS2721AMS2721A can be entered in several different ways depending on what makes the most sense for the user or for the application. The center frequency and span can be specified, the start and stop frequencies can be entered, or a signal standard and channel number can be selected from the built-in list.

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

NOTE: When using the up and down arrows, the frequency moves in steps defined by the value entered using the Freq Step soft key.
When using the left or right arrow keys, the frequency of the active parameter moves by 10% of the current frequency span. If the instrument is in zero span, the left and right arrows do nothing.
Turning the rotary knob changes the active frequency parameter in increments of one display point for each click of the knob. There are 551 display points across the screen (661 points in full-screen mode).

Start Freq
Press the **Freq** key followed by the Start Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If a start frequency higher than the current stop frequency is entered, the stop frequency will be changed to yield a 10 Hz span.

Stop Freq
Press the **Freq** key followed by the Stop Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If a stop frequency lower than the current start frequency is entered, the start frequency will be changed to yield a 10 Hz span.

Span
Press the **Freq** key followed by the Span soft key and enter the desired span. The Span menu is used to set the frequency range over which the instrument will sweep. For the MS2721A, the span can be set from 10 Hz to 7.1 GHz. The span can also be set to zero.

The soft key shows the current value for span in units of GHz, MHz, kHz or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys or the rotary knob to increase or decrease the span frequency. If the span is changed using the Up/Down arrow keys, the span changes by the value of the Frequency Step for each key press.

Freq Step
Press the **Freq** key followed by the Freq Step soft key to enter the desired frequency step size. The frequency step specifies the amount by which a frequency will change when the Up/Down arrow key is pressed. The center frequency, start frequency, and stop frequency values can be changed using Freq Step. The active parameter will be changed by the frequency step when the Up/Down arrow keys are pressed. If Freq Step is the active parameter, nothing happens when the arrow keys are pressed. The frequency step size can be any value from 1 Hz to 7.1 GHz with a resolution of 1 Hz.

Use the keypad or the rotary knob to change the Frequency Step size.

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 particular 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 tuned to the center of the spectrum analyzer display.

Amplitude Menu
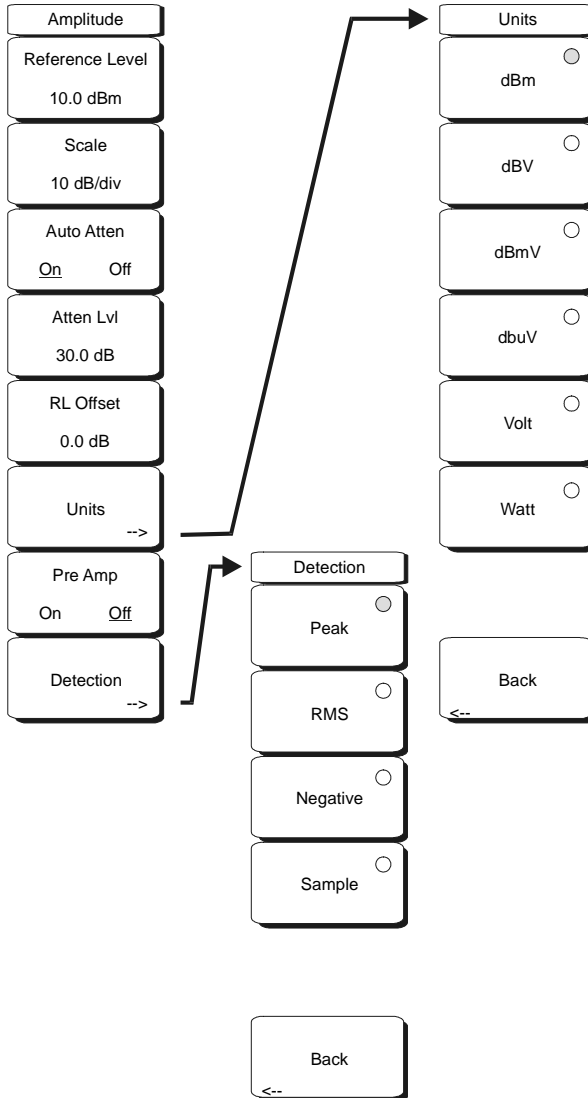
Figure 6-2. Interference Analyzer Mode Amplitude Menu

Reference Level
The reference level is the top graticule line on the display, and can be set from +30 dBm to -150 dBm. A negative value may be entered from the key pad, using the ± key as the minus

sign. After entering the value press the dBm soft key or the **Enter** key. The Up/Down arrow keys change the reference level in 10 dB steps, and the Left/Right arrow keys change the value by 1 dB. The rotary knob changes the value by 0.1 dB per detent.

The reference level value may be modified by the reference level offset value to compensate for an external attenuator, as discussed later in this chapter.

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 keypad, the rotary knob or the Up/Down arrow keys.

Auto Atten On/Off
Input attenuation can be either tied to the reference level (On) or manually selected (Off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.

Atten Lvl
Input attenuation can be set from 0 to 65 dB, in 5 dB steps. Select this soft key and use the keypad, the rotary knob or the Up/Down arrow keys to change the attenuation value. When the Preamplifier is turned on, the allowed attenuation settings are 0 and 10 dB.

RL Offset
Reference Level Offset compensates for the presence of input attenuation or gain external to the instrument. Enter a positive value to compensate for an external amplifier or a negative value to compensate for an external attenuator. Use the ± key to enter the negative sign when a negative attenuation value is being entered.

Units
Select the display units from this soft key menu:

> dBm
> dBV
> dBmV
> dBµV
> Volt
> Watt

The Units soft key is only available in the Spectrum view. Press the Back soft key to return to the Amplitude menu.

Pre Amp On/Off
This soft key turns the low-noise front-end preamplifier on or off. The preamplifier lowers the noise floor by approximately 25 dB. To assure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be <-50 dBm.

BW (Bandwidth) Menu
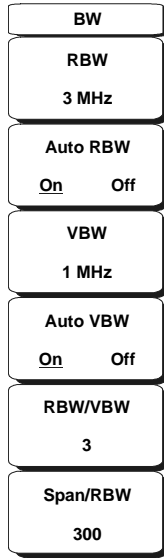
Figure 6-3. Interference Analyzer Mode BW Menu

RBW
The current resolution bandwidth value is displayed in this soft key. The RBW can be changed using the keypad, the Up/Down arrow keys, or the rotary knob. The range is 10 Hz to 3 MHz in a 1-3 sequence, from 10 Hz to 30 Hz to 100 Hz, and so on.

Auto RBW
When Auto RBW is On, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the Span/RBW soft key.

VBW
The current video bandwidth value is displayed in this soft key. The VBW can be changed using the keypad, the Up/Down arrow keys, or the rotary knob. The range is 1 Hz to 3 MHz in a 1-3 sequence.

Auto VBW
When Auto VBW is On, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW/VBW soft key.

RBW/VBW
This soft key displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, select this soft key and use the keypad, the Up/Down arrow keys, or the rotary knob to select a new ratio. The default ratio is 3.

Span/RBW
This soft key displays the ratio between the span width and the resolution bandwidth. The default value is 300, meaning that the span width is approximately 300 times the resolution bandwidth. The value is approximate because resolution bandwidth filters come in discrete steps while span width can be set to any value up to 7.1 GHz. To change the ratio, select this soft key and use the keypad, the Up/Down arrow keys, or the rotary knob to select a new ratio.

Measurements Menu
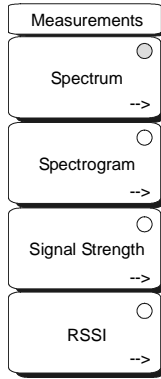
Figure 6-4. Interference Analyzer Mode Measurements Menu

NOTE: The red circle on the soft key indicates the currently active measurement.

Spectrum
Selecting the Spectrum soft key sets the instrument to a traditional spectrum analyzer display. When Spectrum is active, pressing the Spectrum soft key opens a menu for Spectrum Analyzer measurements.

Spectrogram
Selecting the Spectrogram soft key sets the instrument to display a representation of the spectrum over time, with color used to show power. When Spectrogram is active, pressing the Spectrogram soft key opens a menu of spectrogram settings.

Signal Strength
Selecting the Signal Strength soft key sets the instrument to display an analog meter movement showing signal strength. When Signal Strength is active, pressing the Signal Strength soft key opens a menu of signal strength settings.

RSSI
Selecting the RSSI soft key sets the instrument to display the received signal strength. When RSSI is active, pressing the RSSI soft key opens a menu of RSSI settings.

Spectrum Menu
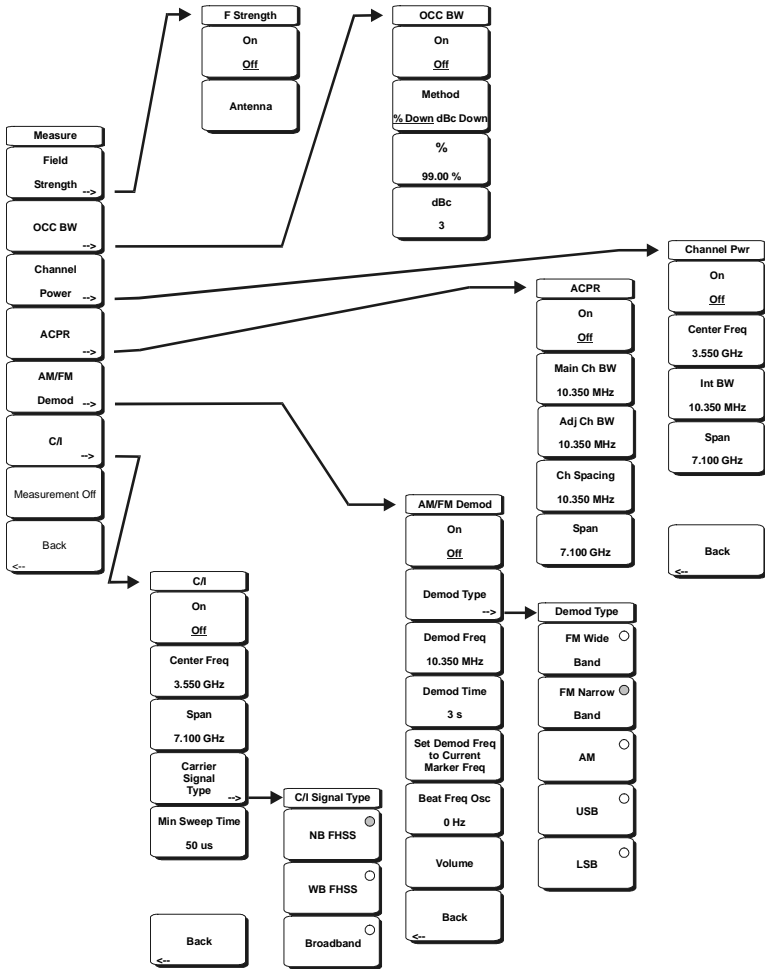
Figure 6-5. Interference Analyzer Mode Spectrum Menu

Field Strength

This measurement allows the use of an antenna with known gain characteristics and measures the field strength over the frequency range of the antenna in units of $dBm/meter^2$, $dbV/meter^2$, $dBmV/meter^2$, $dB\mu V/meter^2$, volts/meter or watts/meter.

On Off

Turns field strength measurements on or off.

Antenna

This soft key brings up a dialog box that lists all the antennas for which the instrument has data, including both standard antennas and custom antenna that have been added using Master Software Tools. Use the Up/Down arrow keys or the rotary knob to select the desired antenna and press **Enter**.

Back

Returns to the previous menu.

OCC BW

Activates the occupied bandwidth menu. Select either % or dBc method of occupied bandwidth measurement.

Method % Down/dBc Down

Select either the % of Power (default) or dB Down measurement method as displayed in the message area.

%

Use the keypad, the directional arrow keys or the rotary knob to enter the percent of power, from 0 to 99%.

dBc

Use the keypad, the directional arrow keys or the rotary knob to enter the desired value (0 to 120 dB) as dB below the carrier.

Back

Returns to the previous menu.

Channel Power

Activates the Channel Power measurement function. Channel Power and Channel Power Density are measured based on the selection in the Units menu.

On Off

Begins or ends the channel power measurement. When the measurement is on, Ch Pwr will appear below the display. The detection method will automatically be changed to RMS Average when the measurement is started. The detection method can be modified by pressing the **Shift** and the **Sweep** keys and selecting the Detection soft key.

Center Freq

Activates the center frequency function, and sets the center frequency of the Spectrum Master for the channel power measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency.

Int BW

Sets the integration bandwidth for channel power measurement. Modifying this value automatically adjusts the channel span to maintain the same ratio. Use the keypad, the directional arrow keys or the rotary knob to enter the integration bandwidth.

Span

Sets the channel span for channel power measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the channel span.

Back

Returns to the previous menu.

ACPR

Accesses a menu of Adjacent Channel Power Ratio measurement options:

On Off

Begins or ends the ACPR measurement.

Main Ch BW

Sets the bandwidth of the main channel for ACPR measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input. Changing this value automatically changes the adjacent channel bandwidth and channel spacing.

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Adj Ch BW

Sets the bandwidth of the adjacent channels for ACPR measurement. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input.

Ch Spacing

Sets the channel spacing between the main and adjacent channels. Use the keypad, the directional arrow keys or the rotary knob to enter the a specific frequency. When using the keypad, select the GHz, MHz, kHz, or Hz soft key to accept the frequency input. This value must be greater than or equal to half of the main channel bandwidth, plus half of the adjacent channel bandwidth.

Back

Returns to the previous menu.

AM/FM Demod

The user can select AM, Narrow Band FM (300 µs de-emphasis), Wide Band FM (50 µs de-emphasis), Upper Sideband or Lower Sideband.

On Off

Turns AM/FM Demodulation on or off.

Demod Type

Provides soft keys to select the type of signal to be demodulated:

    FM Wide Band
    FM Narrow Band
    AM
    USB
    LSB

Demod Freq

Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency of the signal to be demodulated. This frequency does not have to be within the current frequency sweep range to which the instrument is set.

Demod Time

Use the keypad, the directional arrow keys or the rotary knob to increase or decrease the demodulation time, and press the **Enter** key to select. The demodulation time can be set from 100 milliseconds to 200 seconds. The instrument sweeps one time for every demodulation period. Sweeping pauses during the demodulation time.

Set Demod Freq to Current Marker Freq

Sets the demodulation frequency to the frequency of the current marker.

Beat Freq Osc

Sets the beat frequency of the oscillator to exactly set the demodulation frequency of USB and LSB signals.

Volume

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

Back

Returns to the previous menu.

C/I

The Carrier to Interference ratio is a two-step measurement sequence that first measures the amplitude of a carrier, then, with the carrier turned off, measures the amplitude of all other interfering signals within the channel bandwidth.

On Off

Starts and stops the carrier to interference measurement.

Center Freq

Use the keypad, the directional arrow keys or the rotary knob to enter the center frequency.

Span

Use the keypad, the directional arrow keys or the rotary knob to enter the frequency span.

Carrier Signal Type

Opens a menu to select the carrier signal type.

NB FHSS (Narrow Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11b.

WB FHSS (Wide Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11a or 802.11g.

Broadband

Use this setting when the signal being measured is a digital modulation format such as CDMA, GSM, etc.

Back

Returns to the previous menu.

Min Sweep Time

Set the minimum sweep time for the measurement.

Back

Returns to the previous menu.

Spectrogram Menu

Figure 6-6. Interference Analyzer Mode Spectrogram Menu

Sweep Interval
Press the Sweep Interval soft key and use the rotary knob or keypad to set the time from 0 seconds to 60 seconds.

Time Span
To set the total time span for a display, press the Time Span soft key and use the rotary knob or keypad to enter a time between 1 and 4320 minutes (72 hours). When the time span is reached, the measurement stops. When set to zero (Auto) time span, the measurement runs continuously. Entering a time span value causes the corresponding sweep interval value to be automatically computed and shown when the Sweep Interval soft key is pressed.

Auto Save
When the Time Span is set to an interval other than Auto, the spectrogram plots can be automatically saved when the waterfall display is full by pressing the Auto Save soft key.

Time Cursor
The Time Cursor is used to view the spectrum at any spot in the spectrogram display. Press the Time Cursor soft key to turn on the horizontal time cursor. Use the Up/Down arrow key to move the cursor vertically through the spectrogram. The date and time that the measurement at the cursor position was taken is displayed at the top of the screen.

Reset/Restart Measurement
Resets or Restarts the measurement.

Signal Strength Menu
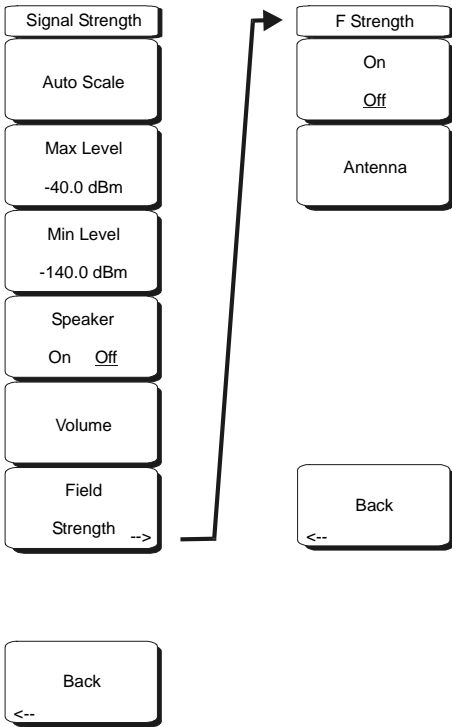
Figure 6-7. Interference Analyzer Mode Signal Strength Menu

Auto Scale
Press the Auto Scale soft key to automatically scale the display range.

Max Level
Set the desired maximum display range value by selecting the Max Level soft key.

Min Level
Set the desired maximum display range value by selecting the Max Level soft key.

Speaker On/Off
Press the Speaker On/Off soft key to turn on the audio output.

Volume
If necessary, press the Volume soft key to set the speaker or headphone volume to a comfortable level. Use the Up/Down arrow keys to adjust the volume.

Field Strength
This measurement allows the use of an antenna with known gain characteristics and measures the field strength over the frequency range of the antenna in units of $dBm/meter^2$,

$dbV/meter^2$, $dBmV/meter^2$, $dB\mu V/meter^2$, volts/meter or watts/meter.

On Off
Turns field strength measurements on or off.

Antenna
This soft key brings up a dialog box that lists all the antennas for which the instrument has data, including both standard antennas and custom antenna that have been added

using Master Software Tools. Use the Up/Down arrow keys or the rotary knob to select the desired antenna and press **Enter**.

Back
Returns to the previous menu.

RSSI (Received Signal Strength Indicator) Menu
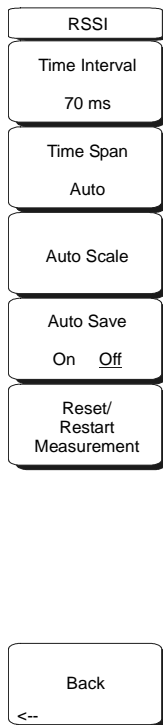
Figure 6-8. Interference Analyzer Mode RSSI Menu

Time Interval
Press the Time Interval soft key to set the time between adjacent measurement points. This time may be set from 70 ms to 1 minute.

Time Span
Press the Time Span soft key to set the overall time span for the RSSI measurement. This time can be set from zero, to give manual control of the time span, to a maximum of seven days. After the specified time span, the measurement is halted. Depending on the time interval selected, the data will scroll to the left once the trace fills the screen.

Auto Scale
Press the Auto Scale soft key to automatically set the reference level and scale factor to place the trace on the screen.

Auto Save On/Off
To store the RSSI data, press the Auto Save On/Off soft key to turn on data logging. The data is named Log - followed by the time at which the data was stored. Each screen full of 551 data points will be stored as a separate display, and can save up to seven days of data at a time (see Time Span above). The unit saves the data in the saved trace directory and it can be recalled by selecting recall trace measurement.

Reset/Restart Measurement

Resets or Restarts the measurement. The RSSI trace is erased and begins anew at the right side of the display.

Back

Returns to the previous menu.

Marker Menu
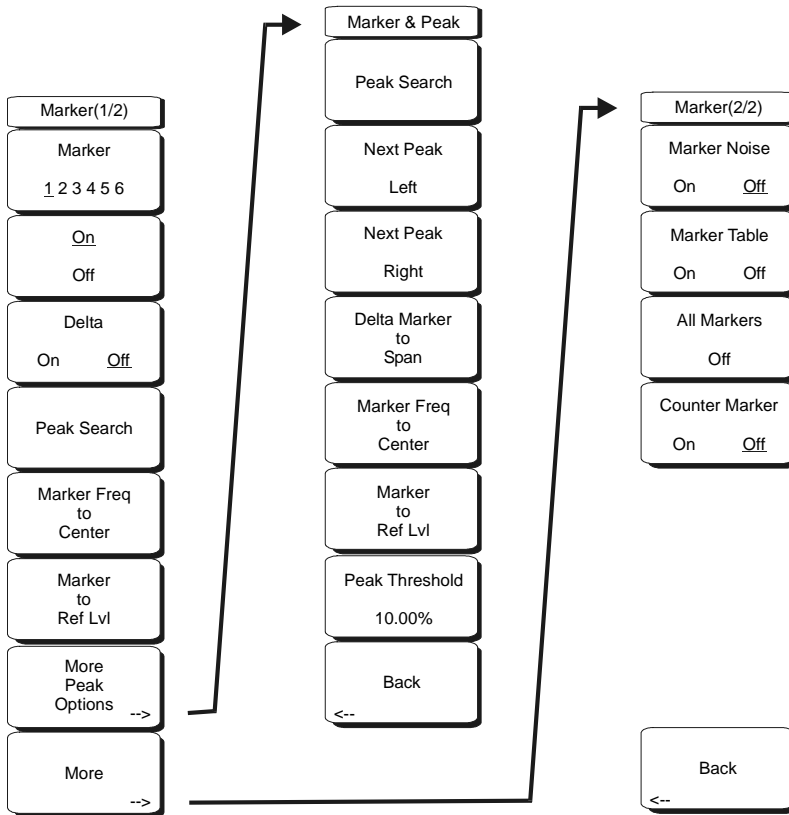
Figure 6-9. Interference Analyzer Mode Marker Menu

Markers are available in Spectrum and Spectrogram measurements. Press the **Marker** function hard key to open the Marker menu. The MS2721A is equipped with six markers. Any or all markers can be employed simultaneously.

Marker 1 2 3 4 5 6

Use this soft key to select the active marker. The underlined marker number is the active marker. Each press of the soft key moves the underline to the next marker number.

On/Off

This soft key turns the active marker, selected by the Marker soft key above, on or off.

Delta On/Off

This function turns on a delta marker and prompts for a delta offset frequency, either positive or negative from the frequency of the currently active marker.

Peak Search

This soft key places the currently active marker on the highest signal amplitude currently displayed on screen.

Marker Freq to Center

This soft key changes the center frequency to place the currently active marker at the center of the display.

Marker to Ref Level

This soft key causes the amplitude of the currently active marker to become the reference level, which is the top horizontal line of the display.

More Peak Options

This soft key brings up a secondary menu of soft keys for more peak searching options.

Peak Search

This soft key places the currently active marker on the highest amplitude signal currently on screen.

Next Peak Left

From the current position of the active marker, the instrument searches to the left (toward lower frequencies) for a peak signal that rises at least a certain amount above the average noise level. If no such peak is found, the marker is placed at the left end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Next Peak Right

From the current position of the active marker, the instrument searches to the right (toward higher frequencies) for a peak signal that rises at least a certain above the average noise level. If no such peak is found, the marker is placed at the right end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Delta Marker to Span

Sets the total span width to the value of the delta marker. If the delta marker is zero, the span is set to 10 Hz. If there is no delta marker, or the delta marker value is set to less than 10 Hz, then the span will be set to 10 Hz.

Marker Freq to Center

Sets the center frequency to the frequency of the currently active marker.

Marker to Ref Lvl

Sets the reference level, top graticule line, to the amplitude of the currently active marker.

Peak Threshold

This soft key allows the user to specify how far above the average noise floor a signal must rise before it is considered a peak. This feature can be especially useful in noisy environments, where there are a lot of small noise spikes. The default peak threshold is 10%. In noisy environments, increase the peak threshold to avoid stopping on noise spikes or small signals.

Back

Returns to the higher-level menu.

More

Opens a submenu of further Marker options.

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Marker Noise

This marker option turns the markers into noise markers with units of dBm/Hz. When this option is selected, the detection method is automatically changed to RMS and the displayed value is compensated for the noise bandwidth of resolution bandwidth filter.

Marker Table

Available only in Spectrum view, pressing this soft key causes a table to be displayed below the sweep window. The table is automatically sized for all possible markers and delta markers. 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

This soft key turns off all markers and the marker table, if it is on.

Counter Marker On Off

Sets the frequency counter mode for all markers. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. Using Counter Marker in association with Marker to Peak will result in the exact frequency of the peak within the pixel to a resolution of 1 Hz.

Back

Returns to the previous menu.

Spectrogram Procedure

A Spectrogram is a three dimensional representation of frequency, time and power useful for identifying intermittent interference. Color is used to represent power levels.

Procedure

The following procedure demonstrates one example of an Interference Analyzer Spectrogram setup.

Step 1.   Select the **Shift** key, then the **Mode** (9) key, using rotary knob or Up/Down arrow keys select Interference Analyzer and press the **Enter** key to select.

Step 2.   Press the **Freq** function hard key.

Step 3.   Select the Signal Standard soft key and select the desired air interface standard from the dialog box displayed. Alternatively, choose the appropriate soft keys and enter the center, start and stop frequencies and the span.

Step 4.   For the most effective spectrogram display, press the **Amplitude** key, select the Reference Level soft key and set the reference level such that the largest signal to be displayed will be near the top of the spectrum analyzer area of the screen. The reference value required can be determined by observing the color of the highest signal and changing the reference level to place that value near the top of the spectrum analyzer area.

Step 5.   Select the Scale soft key and set the scale value to place the lowest signal near the bottom of the screen. In general, 4 or 5 dB/division will be good starting values.

Step 6.   Select the **BW** function hard key and set Auto RBW and Auto VBW On, or set the applicable RBW and VBW values by selecting the RBW and VBW soft keys.

Step 7.   Press the **Measurements** function hard key and the Spectrogram soft key.

Step 8.   Set the time between sweeps by selecting the Sweep Interval soft key, or set the total time for a full spectrogram by selecting the Time Span soft key.

Step 9.   To change the time between sweeps, press the Sweep Interval soft key and use the rotary knob or keypad to set the time from 0 seconds to 660 seconds. Entering the time interval value causes the corresponding time span value to be automatically computed. The time span can be viewed or changed by selecting the Time Span soft key and using the rotary knob or keypad to set the span. As expected, changing the time span will automatically change the sweep interval.

> NOTE: Setting a Sweep Interval value >0 will change the detection method to Max Hold, so that any event within the time interval will be captured to the screen. This allows for extended measurement times to be set.

Step 10. To set the total time span for a complete display, press the Time Span soft key and use the rotary knob or keypad to enter a time between 1 and 4320 minutes (72 hours). Entering a time span value causes the corresponding sweep interval value to be automatically computed and shown when the Sweep Interval soft key is pressed.

Step 11. The instrument can be set so that spectrogram plots can be automatically saved when the display is full. Press the Auto Save soft key to toggle auto save On or Off.

Step 12. The Time Cursor soft key is used to turn on the horizontal time cursor. Use the Up/Down arrow key to move the cursor vertically through the spectrogram. The date and time that the measurement at the cursor position was taken is displayed at the top of the screen.

> NOTE: When the Time Cursor is activated and not on the zero trace position, the unit will automatically stop making measurements to allow analysis of signals of interest.

Step 13.   Press the **Marker** key to place up to six markers on the signal and display the power and frequency of the currently active marker.
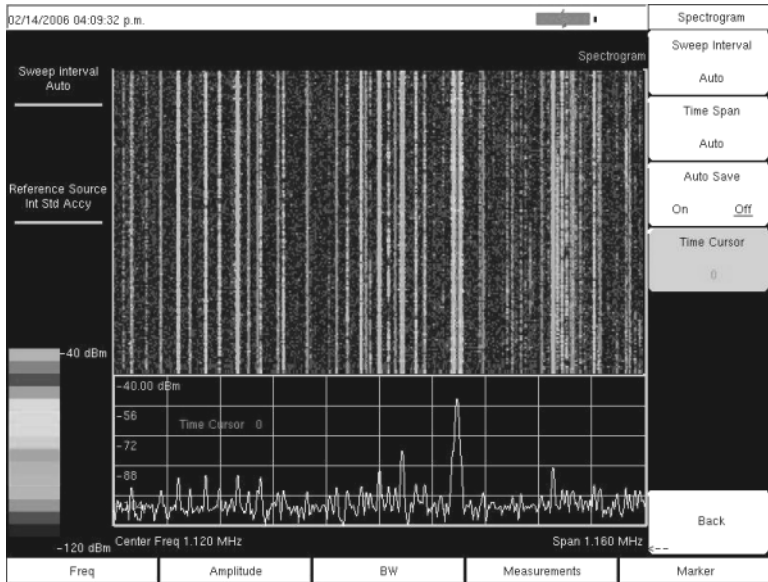
Figure 6-10. Interference Analyzer Mode Sample Spectrogram Display

Signal Strength

The Signal Strength meter is useful for tracking down the source of an interfering signal. This measurement is done at a single frequency in zero span. The power at a frequency (in dBm and watts) is displayed along with an audible indicator that may be turned on or off. Connect a directional antenna and the audio beep frequency will increase as the measured signal strength increases. This mode is especially useful when attempting to locate an emitter using a directional antenna.

For field strength measurements, antenna factors are included. Antenna factors for all antennas offered by Anritsu are stored in the unit. Custom antenna factors can be created and downloaded into the instrument using Anritsu Master Software Tools software.

Procedure:

The following procedure demonstrates a common Interference Analyzer Signal Strength setup.

Step 1. Select the **Shift** key, then the **Mode** (9) key, using rotary knob or Up/Down arrow keys select Interference Analyzer and press the **Enter** key to select.

Step 2. Press the **Freq** function hard key to set the desired frequency. Select the Center soft key, and use the soft keys to tune the center frequency to place the signal of interest in the center of the display.

Step 3. Connect the appropriate directional antenna to the RF In port and press the **Measurements** key.

Step 4. Press the Signal Strength soft key to activate the signal strength measurement menu.

Step 5. Press the Auto Scale soft key to automatically scale the display range, or set the desired and maximum and minimum values by selecting the Max Level and Min Level soft keys.

Step 6. Press the Speaker On/Off soft key to turn on the audio output.

Step 7. If necessary, press the Volume soft key to set the speaker or headphone volume to a comfortable level. Use the Up/Down arrow keys to adjust the volume.
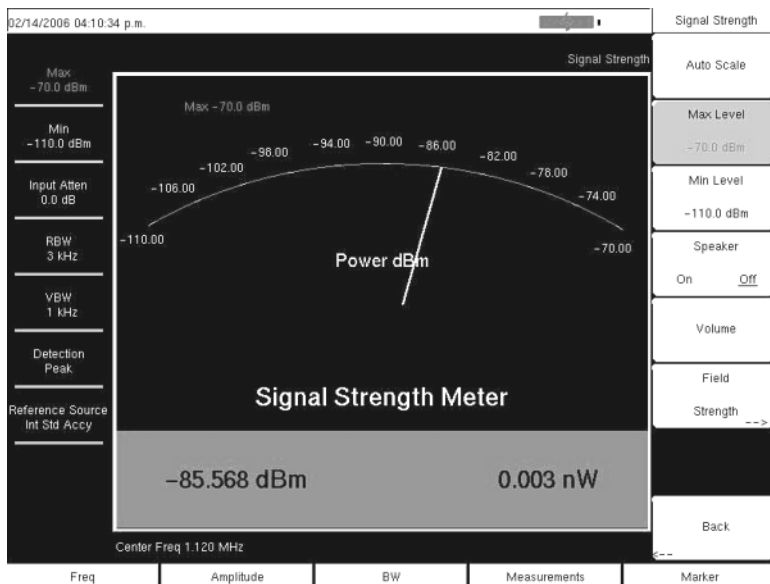
Figure 6-11. Interference Analyzer Mode Signal Strength Display

RSSI Procedure

The Received Signal Strength Indicator, RSSI. is useful for observing signal strength at a single frequency over time.

Procedure

The following procedure demonstrates a common Interference Analyzer RSSI setup. To select Interference Analyzer mode:

Step 1.   Select the **Shift** key, then the **Mode** (9) key, using rotary knob or Up/Down arrow keys select Interference Analyzer and press the **Enter** key to select.

Step 2.   Press the **Freq** function hard key to set the desired frequency. Select the Center soft key, and use the soft keys to tune the center frequency to place the signal of interest in the center of the display.

Step 3.   Press the **Measurements** key and select the RSSI soft key.

Step 4.   Press the Time Interval soft key to set the time between adjacent measurement points. This time may be set from 70 ms to 1 minute.

Step 5.   Press the Time Span soft key to set the overall time span for the RSSI measurement. This time can be set from zero, to give manual control of the time span, to a maximum of seven days. After the specified time span, the measurement is halted. Depending on the time interval selected, the data will scroll to the left once the trace fills the screen.

Step 6.   Press the Auto Scale key to automatically set the reference level and scale factor to place the trace on the screen.

> NOTE: The Time Span only captures the last display, not the entire time of the Time Span. Use a longer time interval to extend the effective trace capture time.

Step 7.   To store the RSSI data, press the Auto Save On/Off soft key to turn on data logging. The data is named Log - followed by the time at which the data was stored. Each screen full of 551 data points will be stored as a separate display, and up to seven days of data can be saved in one measurement. The unit saves the data in the saved trace directory and it can be recalled by selecting recall trace measurement.
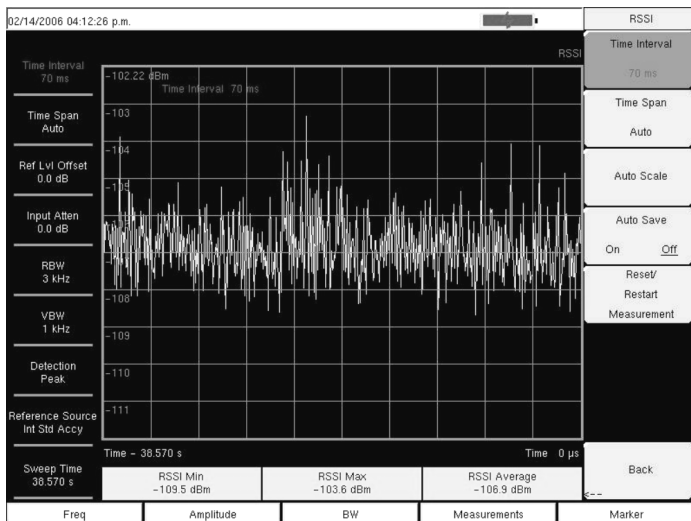
Figure 6-12. Interference Analyzer Mode RSSI Display

Chapter 7
Channel Scanner
Measurements

Introduction

This chapter presents Channel Scanner information and procedures. The Channel Scanner option measures the signal power of multiple transmitted signals. The power can be displayed as either a bar graph or a text display showing the channel power of selected channels for a given air interface standard, or the manually entered channels. Up to 20 channels can be measured.

The operating frequency range for Channel Scanner mode can either be set manually, or the desired air interface standard can be selected from the Signal Standard and channel list in the instrument. When the channels are selected from the Signal Standard list, all frequency related parameters for the standard are automatically set to the appropriate values. The frequency and bandwidth settings can be manually entered using the Scan Frequencies selection if none of the available air interface standards meet the measurement need. A custom channel list can also be created to allow up to 20 independent channels to be defined.

Scanner:
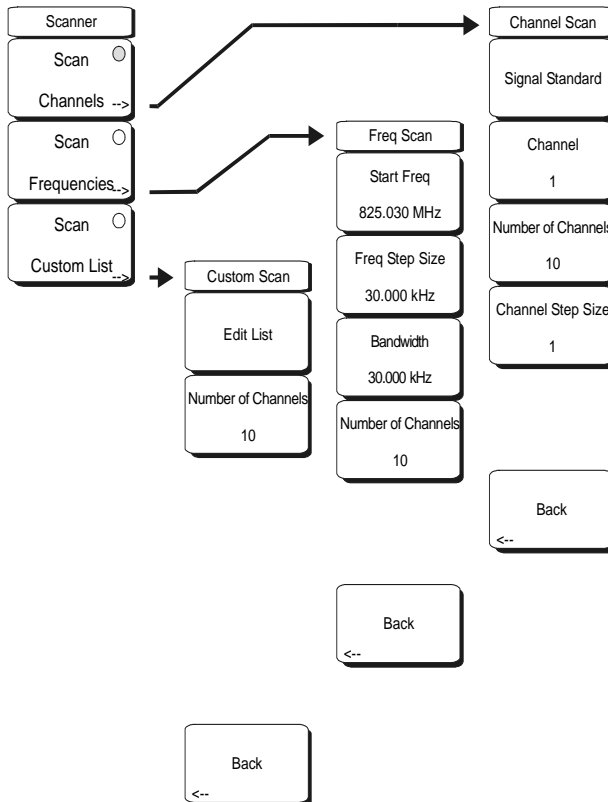
Figure 7-1. Channel Scanner Mode Scanner Menu

Scan Channels
Select scan channels to activate the scan channel menus:

Signal Standard
Sets the signal standard.

Channel
Sets the starting channel on the display.

Number of Channels
Sets the number of channels to be displayed. From 1 to 20 channels can be displayed.

Channel Step Size
Sets the number of channels to skip between displayed channels.

Back
Returns to the previous menu.

Scan Frequencies
Select scan frequencies to activate the scan frequencies menu:

Start Freq
Sets the center frequency of the first channel to be displayed.

Freq Step Size
Sets the spacing between frequencies on the display.

Bandwidth
The channel bandwidth can be manually entered in GHz, MHz, kHz or Hz.

Number of Channels
Sets the number of channels to be displayed (1 to 20).

Back
Returns to the previous menu.

Scan Custom List
Edit List
Edit the Signal Standard, Channel, Frequency and Bandwidth for a selected standard.

Number of Channels
Sets the number of channels to be displayed (1 to 20).

Back
Returns to the previous menu.

Amplitude
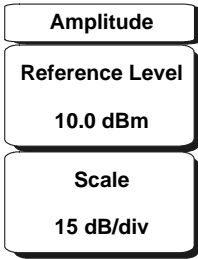
Figure 7-2. Channel Scanner Mode Amplitude Menu

Reference Level
Activates the amplitude reference level function which sets the amplitude at the top of the display. Valid reference levels are from +30 to -130 dBm.

Scale
Activates the scale function which sets the dB/division value from 1 dB/div to 15 dB/div in 1 dB steps.

Custom Setup
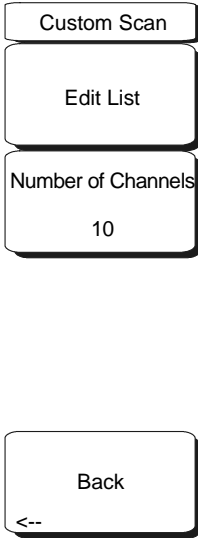
Figure 7-3. Channel Scanner Mode Custom Setup Menu

Edit List
Edit the Signal Standard, Channel, Frequency and Bandwidth for selected item.

Number of Channels
Sets the number of channels to be displayed (1 to 20).

Back
Returns to the previous menu.

Measurements

Figure 7-4. Channel Scanner Mode Measurements Menu

Display Graph/Table
Toggles the display between table and graph formats (see figures below).
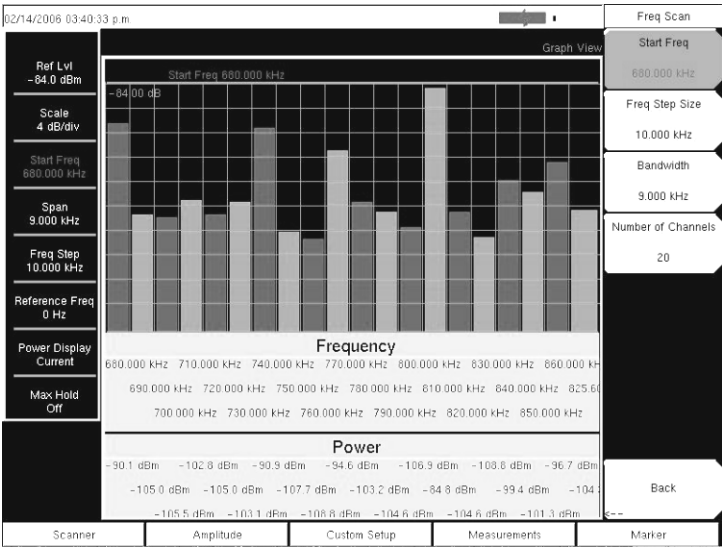
Figure 7-5. Channel Scanner Mode Sample Graph Display
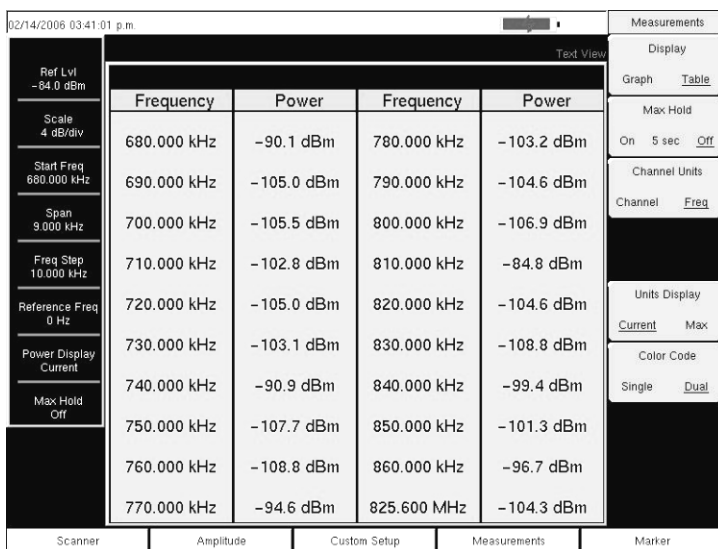
Figure 7-6. Channel Scanner Mode Sample Table Display

Max Hold On/5 sec/Off

Turns on or off small yellow lines for every channel/frequency on the display that indicate the highest level that channel or frequency has reached. The 5 sec option holds the small yellow line at the highest level in the last 5 seconds.

Channel Units Channel/Freq

Toggles the display channel units between channel number and frequency.

Units Display Current/Max

The current power units are displayed at the bottom of the channels, or the maximum power is displayed (activated only when Max Hold is set to On or 5 sec).

Color Code Single/Dual

The channels can be represented in one color or two alternating colors.

Sample Procedure

The following procedure demonstrates a common channel scanner setup.

Step 1.   On the Spectrum Master, select the **Shift** key, then the **Mode** (9) key.

Step 2.   Use the directional arrow keys or the rotary knob to highlight Channel Scanner and press the **Enter** key to select.

Step 3.   Press the **Scanner** key to activate the Scanner menu. The power can be scanned using a signal standard and channel numbers or by entering a start frequency, frequency step size and bandwidth. The channels can be customized using the Scan Custom List or Custom Setup. For this example, select the channels by pressing the Scan Channels soft key, then the Signal Standard soft key. Select the CDMA US PCS signal standard.

Step 4.   Select the Number of Channels soft key and enter 20.

Step 5.   Select the **Amplitude** key and set the Reference Level and Scale so that the power of all the channels is displayed on the screen.

Step 6.   Select the **Measurements** key to activate the Measurement menu.

Step 7.   Press the Display soft key and select Graph display to display the measurements in the graph format.

Step 8.   Press the Channel Units soft key and select Channel to display the measurements in channel format.

Step 9.   Press the Units Display soft key and choose Max to display the maximum measured power for each channel.

Step 10.   Press the Color Code soft key and select Dual to display the measurements in dual colors.

> NOTE: Measurements can be made when the base station is in service, out of service, or over the air.

Custom Setup

Procedure

Step 1.   On the Spectrum Master, select the **Shift** key, then the **Mode** (9) key.

Step 2.   Use the directional arrow keys or the rotary knob to highlight Channel Scanner and press the **Enter** key to select.

Step 3.   Press the **Custom Setup** key.

Step 4.   Press the Number of Channels soft key to define how many channels to include in the custom list. This choice can be changed later if needed.

Step 5.   Press the Edit List soft key to bring up the list of channels. The channel highlighted in blue is the channel active for editing. Use the up and down arrows to select the channel to edit. Each channel can be set up differently.

Step 6.   Press either the Select Signal Standard soft key or the Set Freq soft key. If the Select Signal Standard soft key was selected, select the desired air interface standard from the dialog box displayed. When a standard is selected, the usual bandwidth for that standard is automatically set. The bandwidth can be changed if desired. After the air interface standard is selected, press the Set Channel soft key to enter the desired channel number.

If the Set Freq soft key was selected, the frequency value of the active channel will be highlighted in a red box. Use the rotary knob or the numeric key pad to enter the desired center frequency in Hz, kHz, MHz or GHz.

Step 7.   Press the Set Bandwidth soft key and use the rotary knob or numeric keypad to enter the desired value in Hz, kHz, MHz or GHz.

Step 8.   Repeat steps 5 through 7 for all channels.

Custom Setup Example

This example explains how to monitor several signals, plus a potential intermodulation product, to see if there is a correlation between the nearby signals and an intermittent interference problem.

The signals on or near the rooftop are:

- An FM broadcast station at 106.5 MHz

- A paging transmitter at 157.86 MHz

- Three cellular sites:
     US CDMA PCS channel 50 (1932.5 MHz)
     AMP/EIA 553 channel 525 (885.750 MHz)
     GSM 1800 channel 512 (1805.2 MHz)

- A Ham repeater at 147.36 MHz

- A Ham repeater at 446.5 MHz

- A land mobile repeater at 451.7875 MHz

- A public safety repeater at 485.5625 MHz

- In addition, the site is near the flight path of an airport. The approach frequency is 121.4 MHz.

Set up a measurement channel for each of the signals to be observed plus extra channels for any intermodulation products to be observed.

After the channels are set up, press | Shift | File | Save, Recall, Delete, & Copy | Save Setup| and name the setup for easy recall later.

Chapter 8
Master Software Tools

Introduction

This chapter provides a description of the Anritsu Master Software Tools program. Master Software Tools is a suite of Microsoft Windows programs for transferring saved measurements, along with markers and limit lines, to a PC display. The programs provide the ability to modify display parameters, overlay multiple traces, upload and download traces, print traces using local or networked printers, create or modify language files, edit the cable and signal standard lists, and convert .dat files to the new .vna format.

Master Software Tools requires Windows 2000 or Windows XP, and will not function on earlier versions of the Microsoft Windows operating system, as the program relies on the Windows 2000 and Windows XP .NET Framework.

Features

The Master Software Tools Suite provides the following features and capabilities:

- Download measurements saved in the instrument memory to the PC for storage and analysis
- Capture live traces from the instrument and view them on the PC
- Upload measurements from the PC to the instrument memory
- Obtain VSWR, Cable Loss, Phase, and Smith Chart plots from one Return Loss Measurement
- Compare multiple traces using drag, drop, and trace overlay features
- Add or modify Limit Lines and Markers
- Modify the Cable List and Signal Standard List and new lists to the instruments using the Cable and Signal Editors
- Display power level, calibration status, GPS Information, and Bias Tee information along with a trace in one professional report
- Create custom language files that can be uploaded to the instrument
- Export measurement data as text files for use in a spreadsheet (.txt and .dat file formats)
- Export measurements as graphic files (.jpg, .wmf, .bmp, and .png file formats)
- Convert VNA measurements previously stored by Handheld Software Tools as .dat files to the new Master Software Tools .VNA format

System Requirements

Minimum requirements and recommendations are:

- Microsoft Windows 2000 or Windows XP
- Intel Pentium 233 MHz microprocessor minimum (Pentium II 350 MHz or better recommended)
- 128 MB of RAM minimum (256 MB or above recommended)
- Hard disk drive with approximately 80 MB of available space (An additional 80 MB free space for storage of captured plots is recommended.)
- A USB port (USB 1.2 required, USB 2.0 recommended) or an Ethernet 10/100 T connection for communication with the instrument

Installation

To install the Master Software Tools program, insert the Anritsu Master Software Tools disk in the CDROM drive. Follow the instructions in the installation program to install the software. If the autorun feature is disabled in your computer, click on the Windows Start menu, and select Run. Type: X:\Setup.exe, where X is the drive letter of the CDROM drive, and follow the instructions in the installation program.

> NOTE: Master Software Tools requires Windows 2000 or Windows XP. Master Software Tools will not function on earlier versions of the Microsoft Windows operating system, as the program relies on the Windows 2000 and Windows XP .NET Framework.

The readme.doc file on the disk provides updated information about the program, and the Help function provides detailed operating information from within the program.

To start the Master Software Tools program, double-click on the Master Software Tools desktop icon, or select Programs from the Windows Start menu and select Anritsu, then Master Software Tools to launch the program.

Connection

The instrument can be connected to the PC using a USB connection, an Ethernet LAN connection, or a Direct Ethernet connection.

USB Connection

The instrument can be connected to the PC using the included USB cable (2000-1360). Connect the cable to the USB port on the computer and to the USB port on the instrument.

When using the USB cable to connect to the instrument, select Connection from the menu bar, and then Connect: USB to establish a connection.

If a USB connection was already established in a previous session, the Connect: USB icon will be displayed on the tool bar. Click on the icon to connect to the instrument.

The Connect: USB icon will change from red to green when communication is established. If the status bar is turned on (View Status Bar), a message at the bottom will display Connected to device using USB when communication is established.

Ethernet LAN Connection

The RJ-45 connector is used to connect the VNA Master to a local area network using the provided Ethernet cable (2000-1371). Integrated into the connector on the instrument are two LEDs. The amber LED indicates the presence of LAN voltages—a live LAN connection—while the green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the System Options soft key and the Ethernet Config soft key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address and subnet mask. Refer to Chapter 2 for more information on using DHCP.

The Network Connection window can be used to search the local subnet (hub) for connected instruments. Double click on the matching IP address of the instrument to establish a connection to the instrument.

The Connect: Ethernet icon will change from red to green when communication is established. If the status bar is turned on, a message at the bottom will display Connected to Ethernet when communication is established.

To set or view the IP address of the instrument:

Step 1.   On the instrument, press the **Shift** key, then the **System** (8) key.
Step 2.   Select the System Options soft key, and then the Ethernet Config soft key.
           The Ethernet Editor will display the present IP information of the unit. When
           using DHCP, the Ethernet cable must be connected before the instrument is turned
           on.
Step 3.   Press the **Esc** key to close the Ethernet Editor dialog box.
Step 4.   On the PC, open the Connection window and select Enter IP Address.
Step 5.   Enter the IP address of the instrument as shown in the Ethernet Editor dialog box.
Step 6.   Click on the Connect: Ethernet icon to establish the connection. The icon will
           change from red to green when communication is established.

Direct Ethernet Connection

When using a direct Ethernet connection, the instrument address must be set as follows:

Step 1.   On the instrument, press the **Shift** key, then the **System** (8) key.
Step 2.   Select the System Options soft key, and then the Ethernet Config soft key.
Step 3.   Press the Type soft key to select Manual.
Step 4.   Set the IP address to 10.0.0.2 using the soft 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 enter the input. Press **Enter** to accept the changes.
Step 5.   Set the Subnet mask to 255.255.255.0 and press **Enter**.
Step 6.   On the computer click Start, Settings, Control Panel.
Step 7.   Double-click on Network Connections.
Step 8.   Double-click on the Local Area connection to which the instrument is connected
           and click on Properties.
Step 9.   In the scroll box select Internet Protocol (TCP/IP).
Step 10.   Set the IP address to 10.0.0.1.
Step 11.   Set the submask to 255.255.255.0.
Step 12.   Click OK or Close for each window that is open.
Step 13.   Reboot both the computer and the instrument.

After the connection is established, the message Connected to 10.0.0.2 will be displayed at
the bottom of the Connection Manager window.

Using Master Software Tools

An example of the Master Software Tools screen is shown below highlighting some of the features that are further explained in this section.
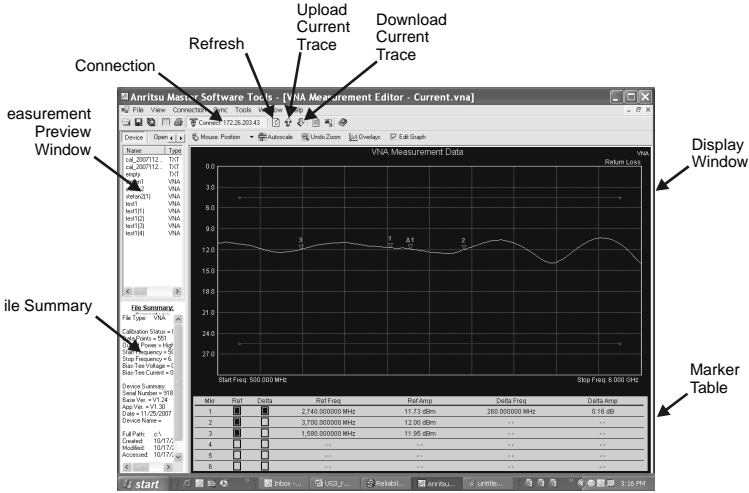
Figure 8-1. Master Software Tools Screen

Measurement Preview Window

Click on the Device tab in the Measurement Preview Window and the name and type of all files stored in the internal memory of the connected instrument will be displayed in this window. Double click on a file name to view it on the PC screen. A copy of the file will be placed in the C:\Program Files\Anritsu\Anritsu Master Software Tools directory unless the settings are changed in the File Manager pane on the left of the screen.

If a new measurement is saved in the instrument memory, select the Sync menu and select Refresh Device Measurement List to add it to the list in Master Software Tools.

The Open tab displays a list of all the measurements that were opened in the current session.

The Network tab displays a list of all the instruments connected to the local network that are on the same SubNet.

The Local tab opens a window to locate measurements already on the PC. Double click on a file name to view it on the PC screen.

File Summary

The File Summary window displays the file type, when it was last saved, the size, when it was modified, and the location on the network or hard drive. To show or hide the file summary, select the View menu and select or deselect File Summary.

Connection

Click on the Connection window to establish a connection to the instrument.

Refresh

If a new measurement is saved in the instrument memory, click on the Refresh icon, or select the Sync menu and select Refresh Device Measurement List to add it to the list.

Download the Current Trace to the PC

To download the current trace on the instrument display to the PC, select the Sync menu and select Capture Current Measurement or click on the down arrow icon. The current measurement on the instrument screen will be displayed on the PC screen.

Upload the Current Trace From the PC to the Instrument

To upload a trace file from the PC to the instrument, select the Sync menu and select Upload Active Window or click on the up arrow icon to upload the currently selected file from the PC to the instrument.

Download Stored Files From the Instrument to the PC

Select the Sync menu and select Download all Measurements. Select the location on the PC to store the measurements and select OK.

Plot Properties

Right clicking on the display window will bring up the Plot Properties window. All the functions needed to add or edit markers, limit lines, display modes, amplitude scaling, and trace math can be found in this window.

Graph Display Options

The graph display options allow viewing of the measurement data in different graphical displays. It is possible to extract the phase data from a magnitude display and vice versa for 1-port and 2-port measurements. Right click on the measurement window, select Data Display Mode, open up the Data Display Options window and select the display option. It is possible to view up to four graph displays at the same. The following display mode conversions are possible:

1-Port
Return Loss <-> Phase <-> Smith Chart <-> VSWR <-> Cable Loss

2-Port
2-port Gain <-> Phase

Distance-To-Fault (DTF):
DTF Return Loss <-> DTF VSWR
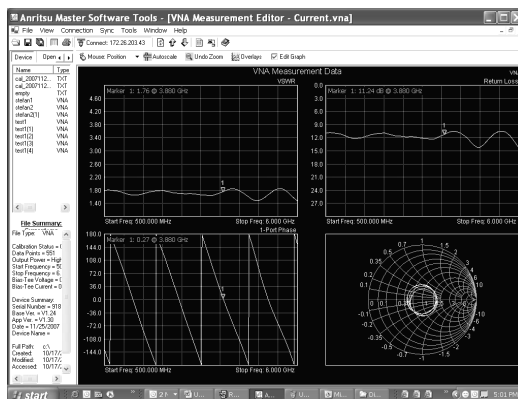
Figure 8-2. Multiple Graph Selections

Markers

Up to six reference and delta markers can be turned on and edited as needed using Master Software Tools. The Marker Table displays the amplitude and frequency values for all reference and delta markers simultaneously. To access the marker functions, right click on the Display Window and select Data Markers, then Marker Table, or right click on the Display Window and select Data Display Mode... then Data Display Option, then Marker Table.

Add Marker

To add a new Marker, display the Marker Table and mark the selection box for the desired reference or delta marker. Up to six markers and delta markers can be displayed at the same time.

Edit Marker

To edit a Marker, place the cursor on the marker, press the left mouse button and drag the marker to the new position. The markers can be turned on and off by selecting or deselecting the selection box in the Marker Table. The value of one marker is always displayed in the upper right part of the display. If more than one marker is turned on, and the Marker Table is turned off, click on the marker to display its value.

The marker can also be moved by rolling the scroll button on the mouse up or down to move the marker to the right or left, respectively.

Limit Lines

Single and segmented upper and lower limit lines can be turned on as needed. To turn on the Limit Lines, right click on the Display Window, select Data Display Mode… and select Data Display Options, or right click on the Display Window and select View Limit Lines (Upper and Lower).
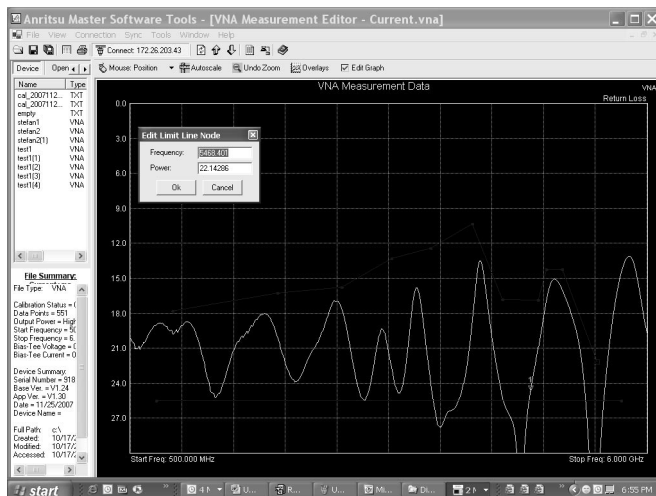
Figure 8-3. Limit Lines

Edit a Single Limit Line

There are several ways to edit the limit lines.

Method 1 (Enter the value of the Limit Line)

Step 1.   Right Click on the Display Window.
Step 2.   Select Data Display Mode.
Step 3.   Enter the value of the upper and/or lower limit line.

Method 2 (Enter the value of the nodes)

Step 1. Turn on the Limit Line.
Step 2. Place the cursor on the start or end node and click once on the node.
Step 3. Right Click and select Edit Node
Step 4. Enter the frequency and amplitude of the start node.
Step 5. Move the cursor to the end node.
Step 6. Right click and select Edit Node.
Step 7. Enter the frequency and amplitude of the end node

Method 3 (Drag the start and end points)

Step 1. Turn on the Limit Line.
Step 2. Place the cursor on the start node and drag it to the desired position.
Step 3. Place the cursor on the end node and drag it to the desired position.

Edit Segmented Limit Lines

Segmented limit lines can be created in Master Software Tools.

Step 1. Right click on the Display Window and select View Limit Lines.
Step 2. Right click on the start or stop node and select Add Node to add a node or Delete Node to delete a node.
Step 3. Use the left mouse button and drag the new node to its new location or select Edit Node and enter the desired amplitude and frequency value of the new node.

Change the Amplitude Scale

Right click on the Display Window and select Data Display Mode then Plot Properties. Enter the top and bottom value for the appropriate graph selection.

Autoscale adjusts the Top and Bottom values so that the trace will be shown in the middle of the display.

Change the Display Units

Right click on the Display Window and select Data Display Mode then Plot Properties. Possible selections for DTF measurements are meters, feet, and time (ns).
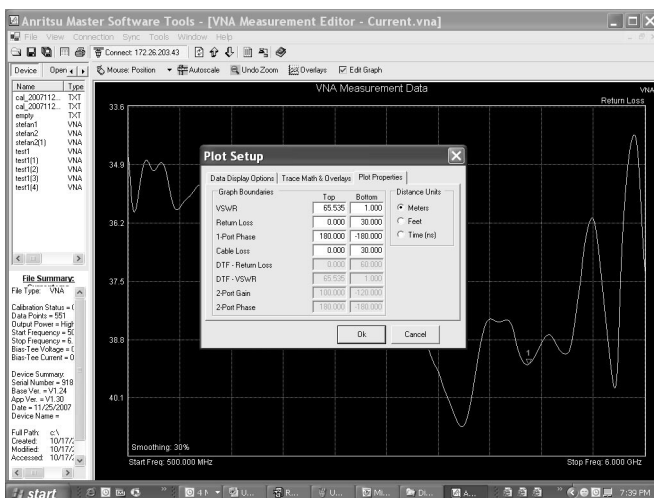
Figure 8-4. Scale Window

Trace Math

To use trace math to add or subtract two traces, right click on the Display Window and select Data Display Options then Trace Math & Overlays. Select Add and locate the file that the current trace will be compared to.

There are three mathematical operations available:

Current Trace - Memory
Memory - Current Trace
Current Trace + Memory.

Select Show Original Trace to show the current trace along with the trace obtained from the Trace Math.

Trace Smoothing

Trace Smoothing averages each point with X other datapoints. If smoothing is set to 5% and the number of datapoints is 551, then each point will be averaged with a total of 27 points (5% of 551) or 13 points to the left and 13 points to the right of each point. If the datapoint that is being averaged does not have enough datapoints to the left or to the right to average with, averaging will be done with all the available datapoints.

To select Trace Smoothing, right click on the Display Window and select Data Display Mode, then Trace Math & Overlays.

Select the Smoothing box and enter the desired smoothing percentage. It is also possible to view the original trace and see how the smoothing changes.

The percentage of smoothing can be changed on the display by placing the cursor on the smoothing percentage number at the bottom left of the display. Use the scroll button on the mouse and scroll up or down to increase or decrease the smoothing percentage and view the changes in real time.
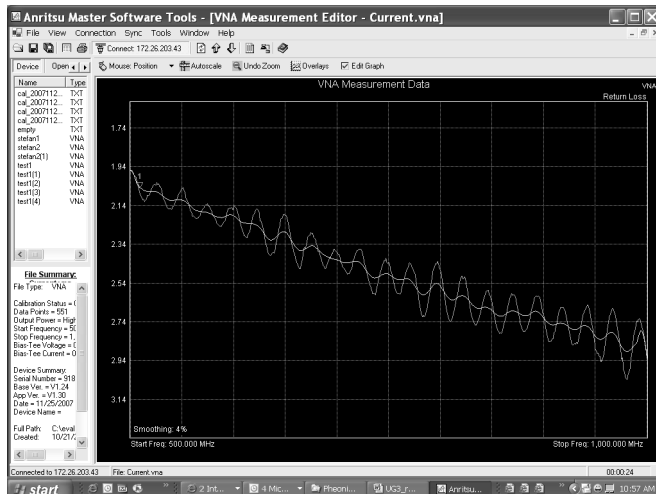
Figure 8-5. Trace Smoothing

Mouse Function

Click on the arrow in the Mouse Position drop down box and select Position, Distance, Zoom, or Overlay.

Position

Place the cursor on a point of the trace and click the left mouse button to display frequency and amplitude values. For DTF measurements, distance and amplitude values are displayed.

Distance

Place the cursor on the trace, hold down the left mouse button and move the mouse to the left or to the right. The difference relative to the starting point will be displayed in Hz for frequency measurements or meters (feet) for DTF measurements.

Zoom

To zoom in on a portion of a measurement, position the mouse cursor so as to draw a box over the area to be expanded. Press the left mouse button and drag the mouse to the right to cover the area. When the mouse button is released, the display zooms in on the selected area. The amplitude is auto-scaled so that the entire amplitude range of the selected frequency range can be seen.

To undo the zoom, right click and select Undo Zoom or click on the Undo Zoom button at the top of the display.

Overlay

With the mouse in Trace Overlay mode, and two or more traces open, use the left mouse button to drag a trace from one window to another. To undo the trace overlay, select the Undo Trace Overlay button at the top of the display. Up to five plots can be overlaid.

Program Options

Select the Tools menu and select Program Options. The following display features can be turned on and off in this window.
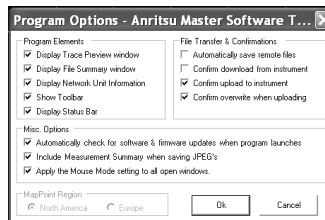
Figure 8-6. Program Options

Display Trace Preview Window

Shows selected measurement in the bottom left part of the display.

Display File Summary Window

Shows information about the file: File type, last saved, size, modified, location on the network or hard drive.

Display Network Unit Information

The unit will not show up on the network list if this option is deselected. To verify that unit shows or does not show up on the network, click on Network Unit Summary in the View window.

Show Toolbar

Allows selection to show toolbar in the top part of the display.

Display Status Bar

Allows selection to show the display bar.

Automatically Save Remote Files

Files downloaded from the instrument will automatically be saved to the local hard drive and placed in C:\Program Files\Anritsu\Anritsu Master Software Tools.

Confirm download from the Instrument

Display a message when download has been completed.

Confirm upload from the Instrument

Display a message when upload has been completed.

Confirm overwrite when uploading

Displays a message when files uploaded to the instrument are being overwritten.

Invert Colors when saving JPGs

Inverts the background color from black to white for better visibility.

Window

The Window menu allows various display options when there is more than one file open.

Cascade

Cascades all open measurement display windows.

Tile Horizontal

Tiles all open measurement display windows horizontally.

Tile Vertical

Tiles all open measurement display windows vertically.

Close All

Closes all open measurement display windows.

File

The File Menu allows the creation of new files and the saving of files.

NOTE: File saving options can also be accessed by right clicking on an open measurement file.

New

Create new Signal Standard List.

Open

Opens a measurement file that has been saved in the local computer.

Save

Saves the currently open measurement to the PC hard disk or other selected PC storage device (floppy disk drive, etc.).

Save as

Saves the currently open measurement with a new file name

Save All

Save all open measurements

Export CSV

Exports measurements in .csv format.

Save JPG

Saves the file in jpg format.

Help

The Help menu provides access to the Help files and other documentation.

Help Contents

Shows the email and phone number for Anritsu support.

Anritsu on the web

Opens up the URL for the Anritsu homepage.

App Notes and Instruments Documentation

Download frequently used application notes and users guides.

Language Editor

The Language Editor allows for modification of the languages already in the instrument (except English) and also provides the ability to add two custom languages to the instrument.

NOTE: Special fonts for some languages must be installed on the system in order to edit those languages. Please contact your font vendor for specifics.

Modifying or Defining a Language

The standard language files provided in the instrument may be modified, except for the default English file. In addition, there are two Custom files, in English, that may be completely rewritten in another language if desired.

For most entries, there is a limit on message length due to the need to fit the message on a soft key or in a message box. The fonts used for the onscreen messages are proportional, meaning different characters can take different amounts of space. Some creativity may be necessary to fit the words into the allotted space. Ideally, the customized language message should not take up significantly more space than the English equivalent.

Always test the customized language by uploading it into the instrument and reviewing the menus to be sure the key labels fit in the available space and are fully discernible.

To modify an existing language, or to add a Custom language:

To modify a language file, select the Sync menu, select Download Language Table, and select System Language File.
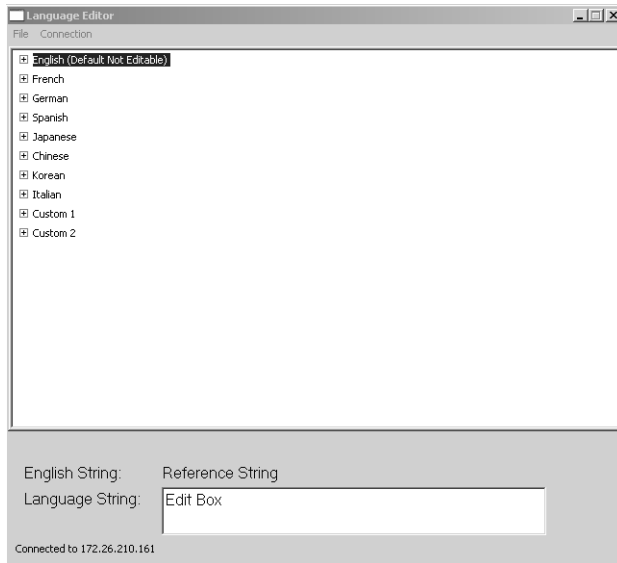
Figure 8-7. Language Editor Screen with a Language File Loaded

Select the language to be modified by clicking on the plus sign to the left of the language name. The file tree expands to show the three groups of labels available for editing.

Select the group of labels to be edited: Button Captions, Generic Text, or Parameter Names.

The figure below shows the groups and group labels under the Spanish language Parameter Name section, for example.
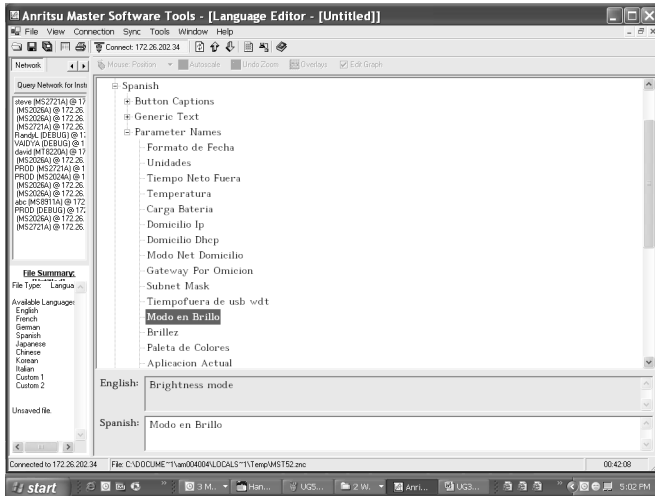
Figure 8-8. Group Labels Under the Spanish Language Parameter Name Section

To change the label of a parameter, click to select the Parameter to be changed and type the new text in the bottom window.

Save the modified language file to the PC hard disk, then upload it into the instrument.

NOTE: The files should be saved as vna.znc for the vector network analyzer language file, and system.znc for the system language file, before uploading to the instrument.

Signal Standards Editor

The Signal Standards Editor is a software application for viewing, editing and creating signal standards files. Select a signal standard entry from the list to make it active.

The Signal Standards Editor can:

- Create new signal standards files

- View and edit the signal standard definitions

- Copy and paste signal standard definitions

- Retrieve the signal standards file from a test unit

- Store an updated signal standards file back onto the test unit

- Generate a report of the signal standards file

Creating a New Signal Standards File

To create a new signal standards file, select New Signal Standards File from the File drop-down menu. An empty signal standards file will be displayed. To add a signal standard, select Add Signal Standard from the Edit menu.

To add an existing signal standard from a different signal standards file, use the Cut, Copy and Paste icons, or select Cut, Copy and Paste from the Edit menu.
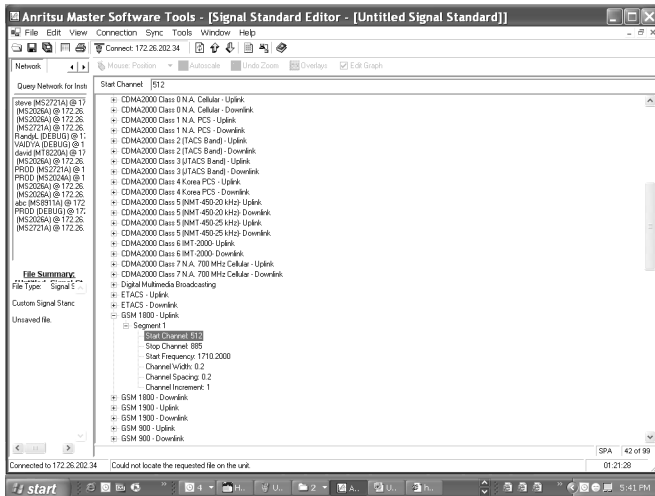
Figure 8-9. Signal Standard Editor

Editing a Signal Standard

Step 1.   Open up the Signal Standard File that is being edited.
Step 2.   Select Sync -> Download Signal Standards -> VNA Signal Standards to download the Signal Standard list from the instrument.
Step 3.   Select the Standard that is being edited.
Step 4.   Click on the plus sign and click on Segment1.
Step 5.   Enter the new value in the text entry box under the main toolbar.
Step 6.   Save the file and upload it to the instrument

Cut, Copy and Paste

Use the Cut, Copy and Paste icons, or select Cut, Copy and Paste from the Edit menu to add, copy or remove signal standards. Cut moves the currently selected signal standard onto the clipboard and the signal standard is deleted from the Signal Standards list. If the signal standards file is saved, the cut signal standard will be permanently deleted from that list.

Copy puts a copy of the signal standard on the clipboard, but does not delete it from the current Signal Standards list.

Paste copies a signal standard from the clipboard into the current Signal Standards list.

Appendix A
Signal Standards

Introduction

This appendix provides a list of the signal standards included in the Spectrum Master. The standards displayed depend on the operating mode selected.

AMPS / EIA 553 - Uplink
C-450(P) - Uplink
C-450(P) - Downlink
C-450(SA) - Uplink
C-450(SA) - Downlink
CDMA China 1 - Uplink
CDMA China 1 - Downlink
CDMA China 2 - Uplink
CDMA China 2 - Downlink
CDMA Japan - Uplink
CDMA Japan - Downlink
CDMA Korea PCS - Uplink
CDMA Korea PCS - Downlink
CDMA US Cellular - Uplink
CDMA US Cellular - Downlink
CDMA US PCS - Uplink
CDMA US PCS - Downlink
CDMA2000 Class 0 Korea Cellular - Uplink
CDMA2000 Class 0 Korea Cellular - Downlink
CDMA2000 Class 0 N.A. Cellular - Uplink
CDMA2000 Class 0 N.A. Cellular - Downlink
CDMA2000 Class 1 N.A. PCS - Uplink
CDMA2000 Class 1 N.A. PCS - Downlink
CDMA2000 Class 2 (TACS Band) - Uplink
CDMA2000 Class 2 (TACS Band) - Downlink
CDMA2000 Class 3 (JTACS Band) - Uplink
CDMA2000 Class 3 (JTACS Band) - Downlink
CDMA2000 Class 4 Korea PCS - Uplink
CDMA2000 Class 4 Korea PCS - Downlink
CDMA2000 Class 5 (NMT-450-20 kHz)- Uplink
CDMA2000 Class 5 (NMT-450-20 kHz)- Downlink
CDMA2000 Class 5 (NMT-450-25 kHz)- Uplink
CDMA2000 Class 5 (NMT-450-25 kHz)- Downlink
CDMA2000 Class 6 IMT-2000- Uplink
CDMA2000 Class 6 IMT-2000- Downlink
CDMA2000 Class 7 N.A. 700 MHz Cellular - Uplink
CDMA2000 Class 7 N.A. 700 MHz Cellular - Downlink
DCS 1800 - Uplink
DCS 1800 - Downlink
Digital Multimedia Broadcasting
ETACS - Uplink
ETACS - Downlink
GSM 450 - Uplink
GSM 450 - Downlink

GSM 480 - Uplink
GSM 480 - Downlink
GSM 850 - Uplink
GSM 850 - Downlink
GSM 900 - Uplink
GSM 900 - Downlink
P-GSM 900 - Uplink
P-GSM 900 - Downlink
E-GSM 900 - Uplink
E-GSM 900 - Downlink
R-GSM 900 - Uplink
R-GSM 900 - Downlink
GSM 1800 - Uplink
GSM 1800 - Downlink
GSM 1900 - Uplink
GSM 1900 - Downlink
JTACS - Uplink
JTACS - Downlink
MATS-E - Uplink
MATS-E - Downlink
N-AMPS / IS-88L - Uplink
N-AMPS / IS-88L - Downlink
N-AMPS / IS-88M - Uplink
N-AMPS / IS-88M - Downlink
N-AMPS / IS-88U - Uplink
N-AMPS / IS-88U - Downlink
NADC IS136 Cellular - Uplink
NADC IS136 Cellular - Downlink
NADC IS136 PCS - Uplink
NADC IS136 PCS - Downlink
NMT-411-25kHz - Uplink
NMT-411-25kHz - Downlink
NMT-450-20kHz - Uplink
NMT-450-20kHz - Downlink
NMT-450-25kHz - Uplink
NMT-450-25kHz - Downlink
NMT-470-20kHz - Uplink
NMT-470-20kHz - Downlink
NMT-900 - Uplink
NMT-900 - Downlink
NMT-900(Offset) - Uplink
NMT-900(Offset) - Downlink
NTACS - Uplink
NTACS - Downlink
PCS 1900 - Uplink
PCS 1900 - Downlink
PDC 800 Analog - Uplink
PDC 800 Analog - Downlink
PDC 1500 (JDC) - Uplink
PDC 1500 (JDC) - Downlink
PHS - Uplink
PHS - Downlink
SMR 800 - 12.5 kHz - Uplink
SMR 800 - 12.5 kHz - Downlink

A-2

SMR 800 - 25 kHz - Uplink
SMR 800 - 25 kHz - Downlink
SMR 1500 - Uplink
SMR 1500 - Downlink
TACS - Uplink
TACS - Downlink
Digital Terrestrial TV Japan
Terrestrial TV Japan
Terrestrial TV USA
Terrestrial TV Eur. UHF-8MHz
UMTS Band I Uplink 9612-9888 Europe
UMTS Band I Downlink 10562-10838 Europe
UMTS Band II Uplink(General) 9262-9538 US
UMTS Band II Uplink(Additional) 12-287 US
UMTS Band II Downlink(General) 9662-9938 US
UMTS Band II Downlink(Additional) 412-687 US
UMTS Band III Uplink 8562-8913 Europe
UMTS Band III Downlink 9037-9388 Europe
UMTS Band IV Uplink(General) 8562-8763
UMTS Band IV Uplink(Additional) 1162-1362
UMTS Band IV Downlink(General) 10562-10763
UMTS Band IV Downlink(Additional) 1462-1662
UMTS Band V Uplink(General) 4132-4233 US
UMTS Band V Uplink(Additional) 782-782 US
UMTS Band V Downlink(General) 4357-4458 US
UMTS Band V Downlink(Additional) 1007-1007 US
UMTS Band VI Uplink(General) 4162-4188 Japan
UMTS Band VI Uplink(Additional) 812-837 Japan
UMTS Band VI Downlink(General) 4387-4413 Japan
UMTS Band VI Downlink(Additional) 1037-1062 Japan
802.11a
802.11b
802.11 FH
802.11 DS
802.11g

Appendix B
Error Messages

Introduction

This chapter provides a list of error messages that could be displayed on the Spectrum Master MS2721A. If any error condition persists, contact your local Anritsu Service Center (page 1-11).

Self Test or Application Self Test Errors

Overall Status FAILED

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

ADC Self Test FAILED

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

DDC FAILED

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

Lock Test FAILED

One or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Over Power FAILED

RF Power applied to the input connector is too high. Remove or reduce the input power or add additional attenuation. Sometimes out of band frequencies may be present that can cause an Over Power Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list of available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the Span to maximum in the peak detect mode of operation. Another resolution may be to reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Over Power Start FAILED

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

Mixer Saturation: Increase Attenuation

or

Mixer Overdrive FAILED

Too much power applied with too little Attenuation. Increase attenuation. Sometimes even out of band frequencies may be present that would cause a Mixer Overdrive Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the SPAN to maximum in peak detect mode of operation. Another resolution may be to Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Operation Errors

ADC Over range: Increase Reference Level

Input signal is too large for the Analog to Digital converter to process. Increase the internal or external attenuation or, if using Auto attenuation, increasing the Reference Level should resolve the error. See also the Mixer Overdrive error above for information on Out of band RF power.

Calibrator Reading Error

Calibration reference source is not providing quality signal. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Fatal Error

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

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

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

Measurement not valid in Zero Span

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

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

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

Minimum permitted Sweep time is 50µs

An attempt was made to set the minimum Sweep time to less than 50us.

Invalid Attenuation for Preamp

The only valid attenuation settings while the Preamp is operational are 0dB and 10dB. All other settings attempted by the user will result in this message. Select 0dB or 10dB or select AUTO Attenuation to let the system determine the correct setting based on the reference level selected.

Valid Attenuations with Preamp on are 0dB and 10dB

Same as above

Unable to add additional limit points. %d is the maximum.

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

Use Demod type USB or LSB to use Beat Frequency Osc

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

Trace A/B/C has no data to view

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

DSP Memory Failure, Address, Ext High, Ext Middle, Ext low, Ext1, Ext2

One of the DSP memory locations has failed. The DSP will attempt to resolve the memory Failure location and Byte. There are two external memory banks (Ext1 = bank one, Ext2 = Bank 2) with three bytes wide (Ext High, Ext Middle and Ext Low. Byte)

Locking to Internal Ref failed

Switching from an external frequency reference to the internal reference has failed. Some additional warm up time may be needed if the unit has been on external reference for a long time or the unit is not warmed up enough.

Locking to External Ref failed Lock attempt Failed

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

EEPROM TEST: FAIL

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

EEPROM TEST: UNKNOWN ERROR

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

Fatal error, Unknown

Hardware communications between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of

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

Fatal error, EEPROM failed

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

Fatal error, no SPA board connected

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

Fatal error not decoded by DSP

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

UNKNOWN ERROR In SPA

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

DSP version different from released version

May occur during firmware update. Likely cause is incomplete firmware package installation. Finish complete firmware update with Master Code Loader.

Operation not Permitted in Recall Mode

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

Cannot change scale in Linear mode

Linear display mode of operation does not support a scaling change like the Log display mode.

Cannot turn on delta marker because Ref Marker is invalid

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

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

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

Current Marker is not ON

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

Marker must be ON to Use the feature

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

Triggering valid only in Zero Span

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

Cannot change Modes for Recalled/Inactive Traces

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

Cannot change average for Recalled/Inactive Traces

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

Pretune Calibration Failure

Pretune Result Warning

Pretune Calibration Table fault.

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

Lock failed during initialization

One or more of the Phase Lock Loops failed to achieve lock status during startup. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Reference LVL Cal is OFF

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

IF Cal is OFF

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

Lock failure

One or more of the Phase Lock Loops cannot keep the frequency controlled accurately. Insure that the battery level is adequate for operation and that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Cannot set Delta Mkr Freq to Demod Freq

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

Fan Failure

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

It is important to keep the fan inlet and exhaust ports clear of obstructions. The cooling fan will vary the speed in relation to the internal temperature of the instrument. The fan will turn on at low speed when the internal temperature of the instrument reaches 44°C, and will increase the fan speed to maximum at 54°C. As the internal temperature of the instrument decreases, the fan will reduce speed until the temperature reaches 39°C, at which point the fan will turn off.
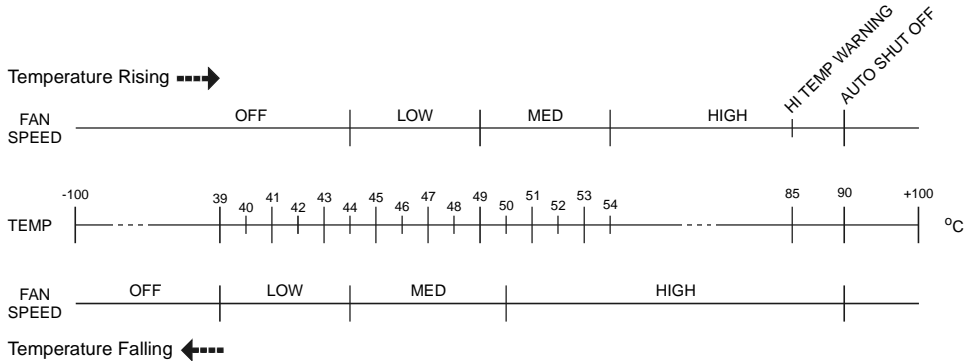
Figure 6-1. Fan Speed vs. Temperature

High Temp Warning

The internal temperature has reached an excessive level, 85°C. Verify that the ventilation openings are unobstructed and that the fan is running. Internal temperatures may be manually verified by using the SELF TEST function. Turn off the unit and allow the temperature to cool down. If the fault is not resolved and the internal temperature reaches 90°C, a countdown of 10 seconds will begin to give the user a chance to save the current setup before it will turn itself off before internal temperatures can cause any damage. If the error persists after removing any obstructions and allowing the unit to cool, reset to the factory defaults with either Factory Defaults, ESC+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Copy failed. Please check External Card

Attempt to copy user saved data to external the Compact Flash Card has failed. Do not attempt to remove or power down the unit before the copy has completed. Be sure that the CF is not already full and that it is fully inserted into the CF-Card slot.

Interference Analyzer Messages

Information Messages

Attenuation has been changed
Reference Level has been changed
Minimum permitted Sweep time is 10µs
Preamp has been turned off
Preamp has been turned on
Units has been changed to dBm
Reference Locked Successfully
Startup Selftest successful
Startup DSP Memory test successful
Reference LVL Cal is OFF
IF Cal is OFF
Successfully locked
Attempting to lock to Internal ref
Attempting to lock to External ref
Attempting to lock to ext ref
Press ESC to clear Recall Trace
Sweep Stopped After Saving On Event
Connect Carrier\nPress Enter to Measure or Escape to Exit
Disconnect Carrier\nPress Enter to Measure or Escape to Exit
Press Escape to keep old settings, or Enter to use Recalled Values
Changing Active trace to A
Use Min/Max buttons under the Signal Strength Sub-Menu to change measure range
Cannot change scale in Linear mode
Use Min/Max buttons under the Signal Strength Sub-Menu to change display range
Valid Attenuations with Preamp on are 0dB and 10dB
Cannot turn on delta marker because Ref Marker is a counter Marker
Current Marker is not ON
Turning off Delta Marker
ADC Over range: Increase Reference Level
Mixer Saturation: Increase Attenuation

Error Messages

Trace not saved. Please wait for complete sweep and try again.
Measurement has been turned OFF
Measurement not valid in Zero Span
Measurements can not be displayed in Full Screen mode
The Freq range of the Antenna is invalid for this setup. Please select another Antenna
DDC Failure
Lock failed during initialization
Invalid Attenuation for PreAmp Setting
Unable to add additional limit points. %d is the maximum.
Hidden inflection points prevent this action. Decrease Span to reveal hidden points.
Trace A has no data to view
Trace B has no data to view
Trace C has no data to view
Turning off Trace Overlay
Only HOLD is valid for Trace C when trace C is not being updated from A
Auto Save not available when Time Span is Auto
The specified Time span is too big to save all measurments. Automatically adjusted Time
Span to a valid number
DSP Memory Failure

Pretune Calibration Failure
Lock failure %x
Locking to Internal Ref failed
Locking to External Ref failed
Lock attempt Failed
Timed Measurement Done. Press Reset/Restart Meas to continue measuring
Current measurement is stopped when Cursor is not zero
OVER POWER ERROR
Fatal error, Unknown
Fatal error, EEPROM failed
Fatal error, no IA board connected
Fatal error not decoded by DSP
UNKNOWN ERROR In IA
Operation not Permitted in Recall Mode
Operation not Permitted in this Mode
Marker must be ON to Use the feature
Triggering valid only in Zero Span
Only HOLD is valid for Trace B
Cannot change average for Recalled/Inactive Traces
Cannot set Delta Mkr Freq to Demod Freq

Channel Scanner Messages

Information Messages
Reference Locked Successfully
Startup Selftest successful
Startup DSP Memory test successful
Attempting to lock to Internal ref
Attempting to lock to External ref
Attempting to lock to ext ref
Press ESC to clear Recall Trace

Error Messages
Error Recalling Measurement
Not Available when Max Hold is OFF
Operation not Permitted in Recall Mode
ADC Over range: Increase Reference Level
Mixer Saturation: Increase Attenuation

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