Anritsu

MS2711A
Hand Held
Spectrum Analyzer

User's Guide

Hand-Held Spectrum Analyzer for Measuring,
Monitoring and Analyzing Signal Environments

color cover part #: 00986-00040

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

LIMITATION OF WARRANTY

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

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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: Site Master

Model Number: MS2711A

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

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

5 - MAY - 00
Date

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

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Revision: D

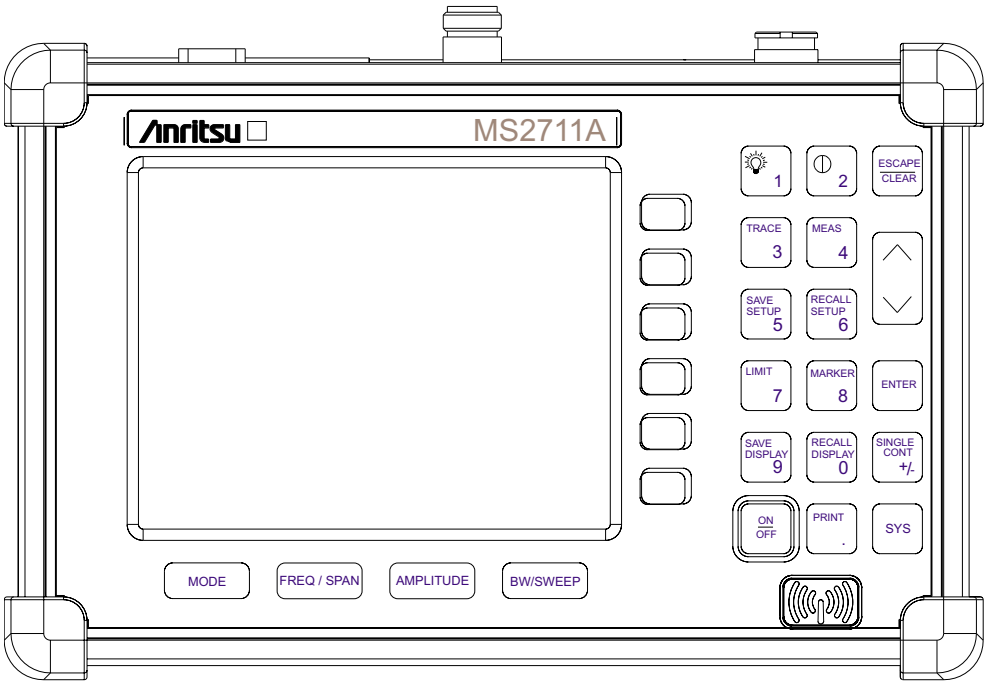

Figure 1-1. Anritsu MS2711A Hand Held Spectrum Analyzer™

Chapter 1
General Information

Introduction

1

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

Model	Frequency Range
MS2711A	100 kHz to 3000 MHz

Description

The Anritsu HHSA is a synthesized-based hand held spectrum analyzer that provides quick and accurate signal 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. Automatic time and date stamping of measurement data of up to 200 results is provided as is storage and recall of up to 10 different measurement setups. A large, high-resolution liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions. The Anritsu HHSA is capable of up to two and one-half hours of continuous operation from a fully charged battery and can be operated from a 12.5 Vdc source (which will also simultaneously charge the battery). Built-in energy conservation features can be used to extend battery life over an eight-hour workday.

The Anritsu HHSA is designed for monitoring, measuring, and analyzing signal environments. Typical measurements include: in-band interference, transmit spectrum analysis, antenna isolation and cell area interference. A full range of marker capabilities such as peak, center and delta functions are provided for faster, more comprehensive measurement of displayed signals. Limit lines are available for creating quick, simple pass/fail measurements. A menu option provides for an audible beep when the limit value is exceeded. To permit use in low-light environments, the LCD can be back lit using a front panel key.

Standard Accessories

Anritsu HHSA Software Tools, a PC based software program, provides an on-line database record for storing measurement data. Software Tools can also convert the Anritsu HHSA display to a Microsoft Windows 95/98™ graphic. Measurements stored in the Anritsu HHSA internal memory can be down-loaded to a PC using the included null-modem serial cable. Once stored, the graphic trace 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.

The following standard accessories are supplied with the MS2711A:

- Soft Carrying Case
- AC-DC Adapter
- Automotive Cigarette Lighter 12 Volt DC Adapter
- CD ROM containing the Software Tools program.
- Serial Interface Cable (Null Modem Type)
- Rechargeable NiMH Battery
- One year Warranty (includes battery, firmware, and software)
- User's Guide

Options

- Option 5 — Add RF Wattmeter Power Monitor (RF detector not included)

Printers

- 2000-766 HP DeskJet Printer, with Interface Cable, Black Print Cartridge, and U.S. Power Cable
- 2000-753 Serial-to-Parallel Converter Cable
- 2000-661 Black Print Cartridge
- 2000-662 Rechargeable Battery for DeskJet Printer
- 2000-663 Power Cable (Europe) for DeskJet Printer
- 2000-664 Power Cable (Australia) for DeskJet Printer
- 2000-665 Power Cable (U.K.) for DeskJet Printer
- 2000-667 Power Cable (So. Africa) for DeskJet Printer
- 2000-1008 Sieko DPU-414-30BU Thermal Printer with Internal Battery, Thermal Printer Paper, Serial Cable, Power Cable
- 2000-755 Five rolls of Thermal Paper
- 2000-1002 U.S. Adapter for Seiko DPU-414-30B
- 2000-1003 Euro Adapter for Seiko DPU-414-30B
- 2000-1004 Battery Pack Adapter for Seiko DPU-414-30B
- 2000-1012 Serial 9-pin male to 9-pin female cable for Seiko DPU-414-30B
- 2000-1046 Serial-to-parallel Converter Cable w/ DIP switch labeling, 36-pin female Centronics to DB25 female

Optional Accessories

Optional Accessories are shown in Table 1-1

Table 1-1. Optional Accessories

Part Number	Description
5400-71N50	RF Detector, N(m), 50 ohm, 1 to 3000 MHz
42N50A-30	Attenuator, 30 dB, 50 Watt, bi-directional
15NN50-1.5A	Test Port Cable Armored, 1.5 meter, N(m) to N(m), 3.5 GHz
15NN50-3.0A	Test Port Cable Armored, 3.0 meter, N(m) to N(m), 3.5 GHz
15NN50-5.0A	Test Port Cable Armored, 5.0 meter, N(m) to N(m), 3.5 GHz
15NNF50-1.5A	Test Port Cable Armored, 1.5 meter, N(m) to N(f), 3.5 GHz
15NNF50-5.0A	Test Port Cable Armored, 3.0 meter, N(m) to N(f), 3.5 GHz
15NNF50-3.0A	Test Port Cable Armored, 5.0 meter, N(m) to N(f), 3.5 GHz
15ND50-1.5A	Test Port Cable Armored, 1.5 meter, N(m) to 7/16 DIN(m), 3.5 GHz
15NDF50-1.5A	Test Port Cable Armored, 1.5 meter, N(m) to 7/16 DIN(f), 3.5 GHz
800-109	Detector Extender Cable, 7.6m (25 ft.)
800-110	Detector Extender Cable, 15.2m (50 ft.)
800-111	Detector Extender Cable, 30.5m (100 ft.)
800-112	Detector Extender Cable, 61m (200 ft.)
510-90	Adapter 7-16 (f) to N(m), 3.5 GHz
510-91	Adapter 7-16 (f) to N(f), 3.5 GHz
510-92	Adapter 7-16 (m) to N(m), 3.5 GHz
510-96	Adapter 7-16 DIN (m) to 7/16 DIN (m), 3.5 GHz
510-97	Adapter 7-16 DIN (f) to 7/16 DIN (f), 3.5 GHz
1091-26	Adapter, DC to 18 GHz, 50 Ohm, N(m)-SMA(m)
1091-27	Adapter, DC to 18 GHz, 50 Ohm, N(m)-SMA(f)
1091-172	Adapter, DC to 1.3 GHz, 50 Ohm, N(m)-BNC(f)
34NN50A	Precision Adapter, DC to 18 GHz, 50 Ohm, N(m)-N(m)
34NFNF50	Precision Adapter, DC to 18 GHz, 50 Ohm, N(f)-N(f)
48258	Spare Soft Carrying Case
40-115	Spare AC/DC Adapter
806-62	Spare Automotive Cigarette Lighter/12 Volt DC adapter
800-441	Spare Serial Interface Cable
760-215A	Transit Case for Anritsu Hand Held Spectrum Analyzer
633-27	Rechargeable Battery, NiMH
2300-347	Anritsu Hand Held Spectrum Analyzer Software Tools
10580-00048	Anritsu HHSA User's Guide, Model MS2711A
10580-00049	Anritsu HHSA Programming Manual, Model MS2711A
10580-00050	Anritsu HHSA Maintenance Manual, Model MS2711A
2000-1029	Battery Charger (NiMH), with Universal Power Supply
2000-1030	Portable Antenna, 50 Ohm, SMA (m), 1.71 to 1.88 GHz
2000-1031	Portable Antenna, 50 Ohm, SMA (m), 1.85 to 1.99 GHz
2000-1032	Portable Antenna, SMA (m), 2.4 to 2.5 GHz, 50 Ohm
2000-1034	Portable Antenna, 50 Ohm, SMA (f), 806-960 MHz
2000-1035	Portable Antenna, 50 Ohm, SMA (m), 902-960 MHz
70-28	Headset

Performance Specifications

Performance specifications are provided in Table 1-2. Unless otherwise noted, specified values are obtained after a five minute warmup period at a constant ambient temperature. The typical values are provided for reference, and are not guaranteed.

Table 1-2. Performance Specifications (1 of 2)

Description	Value
Frequency	
Frequency Range	100 kHz to 3.0 GHz
Frequency Reference	
Aging	±1 ppm/yr
Accuracy	±2 ppm
Frequency Span	100 kHz to 3 GHz in 1, 2, 5 step selections in auto mode, plus zero span
Sweep Time	≥ 650 ms full span; 400 ms zero span
SSB Phase Noise	–75 dBc/Hz, 30 kHz offset @ 1 GHz
Spurious Responses	
Input Related	≤–45 dBc
Spurious	
Residual Responses	≤–95 dBm
Resolution Bandwidth	
Selections	10 kHz, 30 kHz, 100 kHz and 1 MHz
Accuracy	± 20% typical
Video Bandwidth	
Selection	100 Hz to 300 kHz in 1-3 sequence
Amplitude	
Measurement Range	+20 dBm to –97 dBm
Displayed Average Noise Level:	≤ –97 dBm (full span) typical
Dynamic Range	> 65 dB
Total Level Accuracy	±2 dB ≥ 200 kHz, typical ±3 dB < 200 kHz, typical
Maximum Safe Input Level	+20 dBm, maximum measurable safe input +27 dBm, maximum damage +27 dBm, peak pulse power +50 Vdc
Amplitude Units	
Log Scale Mode	dBm, dBV, dBmV, dBμV
Display Range	2 to 15 dB/division, in 1 dB steps, 10 divisions displayed
Attenuator	Range: 0 to 50 dB, selected manually or automatically coupled to the reference level. Resolution in 10 dB steps.

Table 1-2. Performance Specifications (2 of 2)

Description	Value
Display	
Type	Monochrome LCD with back light capability
Resolution	640 × 480
Marker Modes	Standard delta marker to peak marker to center
Memory	
Trace Storage	200 traces
Setup Storage	10 setups
Displayed Traces	2 traces
Inputs	
RF Input	50 Ω
Connector	Female, Type N
Maximum Input Level	+ 20 dBm, + 50 Vdc
RF Input VSWR	2.0:1
RS232 Interface	
Type	Null modem
Baud Range	9600 to 56k baud
Printer Interface	
Drivers	Epson ESC/P Epson ESC/P RAST Epson ESC/P2 HP PCL3
General Characteristics	
Dimensions	10 × 7 × 2.25 inches 25.4 × 17.8 × 6.1 centimeters
Weight	4 pounds (1.8 kg) including battery
Power Requirements	NIMH battery: 10.8 volts, 1800 mA maximum External DC input: +11 to +15 Vdc, 1250 mA max.
Temperature	Operating: 0 to +50° C, 85% or less humidity Non-operating: –20 to +75° C
Electromagnetic Compatibility	Meets European community requirements for CE marking
Safety	Conforms to EN 61010-1 for Class 1 portable equipment

Preventive Maintenance

Anritsu HHSA preventive maintenance consists of cleaning the unit and inspecting and cleaning the RF connector on the instrument and all accessories.

Clean the Anritsu HHSA 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 the N (f) connectors and the pins of the N(m) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are 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

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

Annual Verification

Although the Anritsu HHSA does not require daily field calibration, Anritsu recommends an annual calibration and performance verification by local Anritsu service centers. Anritsu service centers are listed in Table 1-3 beginning on the following page.

The Anritsu HHSA itself is “self calibrating”, meaning that there are no field-adjustable components.

Anritsu Service Centers

Table 1-3 provides a listing of the Anritsu Service Centers.

Table 1-3. Anritsu Service Centers

UNITED STATES

ANRITSU COMPANY
685 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 776-8300
FAX: 408-776-1744

ANRITSU COMPANY
10 NewMaple Ave., Suite 305
Pine Brook, NJ 07058
Telephone: 973-227-8999
FAX: 973-575-0092

ANRITSU COMPANY
1155 E. Collins Blvd
Richardson, TX 75081
Telephone: 1-800-ANRITSU
FAX: 972-671-1877

AUSTRALIA

ANRITSU PTY. LTD.
Unit 3, 170 Foster Road
Mt Waverley, VIC 3149
Australia
Telephone: 03-9558-8177
FAX: 03-9558-8255

BRAZIL

ANRITSU ELECTRONICA LTDA.
Praia de Botafogo 440. Sala 2401
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 (SHANGHAI)

ANRITSU ELECTRONICS CO LTD
2F,Rm.B, 52 Section Factory Bldg.
NO 516 Fu Te Road (N)
Waigaoqiao Free Trade Zone
Pudong, Shanghai 200131
PR CHINA
Telephone: 86-21-58680226
FAX: 86-21-58680588

FRANCE

ANRITSU S.A
9 Avenue du Quebec
Zone de Courtaboeuf
91951 Les Ulis Cedex
Telephone: 016-09-21-550
FAX: 016-44-61-065

GERMANY

ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf
Germany
Telephone: 0211-968550
FAX: 0211-9685555

INDIA

MEERA AGENCIES (P) LTD
A-23 Hauz Khas
New Delhi, India 110 016
Telephone: 011-685-3959
FAX: 011-686-6720

ISRAEL

TECH-CENT, LTD
4 Raul Valenberg St.
Tel-Aviv, Israel 69719
Telephone: 972-36-478563
FAX: 972-36-478334

ITALY

ANRITSU Sp.A
Rome Office
Via E. Vittorini, 129
00144 Roma EUR
Telephone: (06) 50-2299-711
FAX: 06-50-22-4252

JAPAN

ANRITSU CUSTOMER SERVICE LTD.
1800 Onna Atsugi—shi
Kanagawa-Prf. 243 Japan
Telephone: 0462-96-6688
FAX: 0462-25-8379

KOREA

ANRITSU SERVICE CENTER
8F Sanwon Bldg.
1329-8 Seocho-Dong
Seocho-Ku
Seoul, Korea 137-070
Telephone: 82-2-581-6603
FAX: 82-2-582-6603

SINGAPORE

ANRITSU (SINGAPORE) PTE LTD
10, Hoe Chiang Road
#07-01/02
Keppel Towers
Singapore 089315
Telephone:65-282-2400
FAX:65-282-2533

SOUTH AFRICA

ETESCSA
12 Surrey Square Office Park
330 Surrey Avenue
Ferndale, Randburt, 2194
South Africa
Telephone: 011-27-11-787-7200
Fax: 011-27-11-787-0446

SWEDEN

ANRITSU AB
Botvid Center
Fittja Backe 13A
145 84
Stockholm, Sweden
Telephone: (08) 534-707-00
FAX: (08)534-707-30

TAIWAN

ANRITSU CO., LTD.
6F, No. 96, Section 3
Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
Telephone: (02) 515-6050
FAX: (02) 509-5519

UNITED KINGDOM

ANRITSU LTD.
200 Capability Green
Luton, Bedfordshire
LU1 3LU, England
Telephone: 015-82-43-3200
FAX: 015-82-73-1303

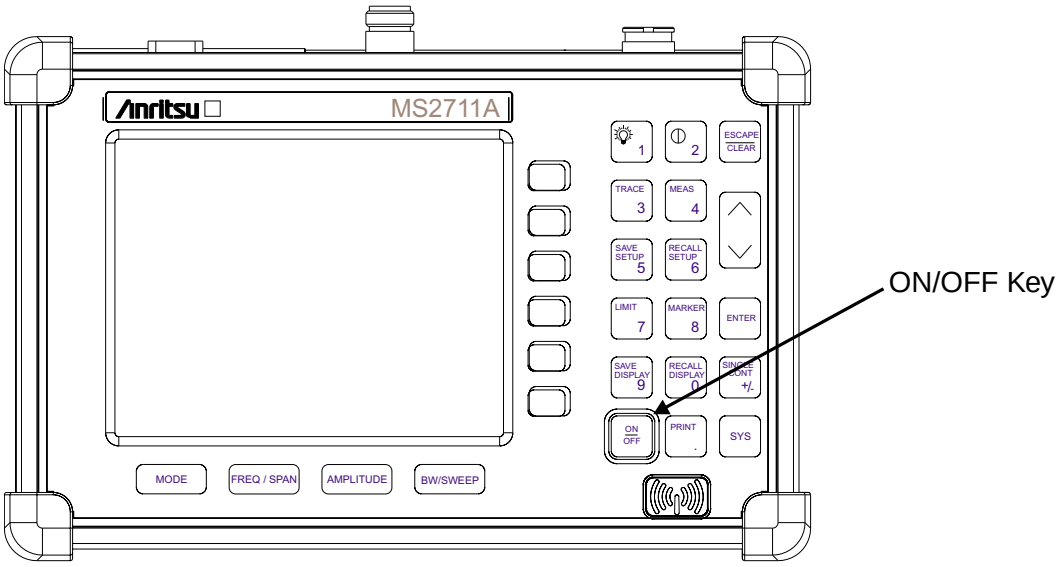

Figure 2-1. MS2711A Power ON/OFF Key

Chapter 2
Quick Start Guide

Introduction

This chapter provides a brief overview of the Anritsu MS2711A HHSA. The intent of this manual is to provide the user with a starting point for making basic measurements. For more detailed information, users may want to consult Chapter 3, *Key Functions* or Chapter 4, *Advanced Measurement Functions*.

Turning the MS2711A On for the First Time

The Anritsu MS2711A HHSA is a lightweight, hand held, battery operated unit designed specifically for field environments and applications requiring mobility. It is capable of up to 2.5 hours of continuous operation from a fully charged, field-replaceable battery. Built-in energy conservation features allow battery life to be extended over an eight-hour workday.

The Anritsu MS2711A HHSA can also be operated from a 12.5 Vdc source (which will also simultaneously charge the battery). This can be achieved with either the Anritsu AC-DC Adapter (P/N 40-115) or 12.5 Vdc Automotive Cigarette Lighter Adapter (P/N 806-62). Both items are included as standard accessories (see Chapter 1).

Press the **ON/OFF** front panel button (Figure 2-1, facing page).

*The HHSA takes about five seconds to perform a series of self-diagnostic and adjustment routines. At completion, the screen displays the Anritsu logo, the model number, the version of firmware. It also prompts you to press **ENTER** to continue.*

The Anritsu HHSA is now ready for operation. No additional keystrokes or installation are required. For information on making measurements with the Anritsu HHSA, refer to "Making a Basic Measurement," on page 2-9. For advanced applications, refer to Chapter 4, "Advanced Measurement Fundamentals."

Front Panel Overview

The Anritsu HHSA menu-driven user interface is easy to use and requires little training. Hard keys on the front panel are used to initiate function-specific menus. There are four function hard keys located below the display, Mode, Frequency/Span, Amplitude and Bandwidth/Sweep.

There are seventeen keypad hard keys located to the right of the display. Twelve of the keypad hard keys are dual purpose, depending on the current mode of operation. The dual purpose keys are labeled with one function in black, the other in blue.

There are also six soft keys that change function depending upon the current mode 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 illustrated in Figure 2-2, below.

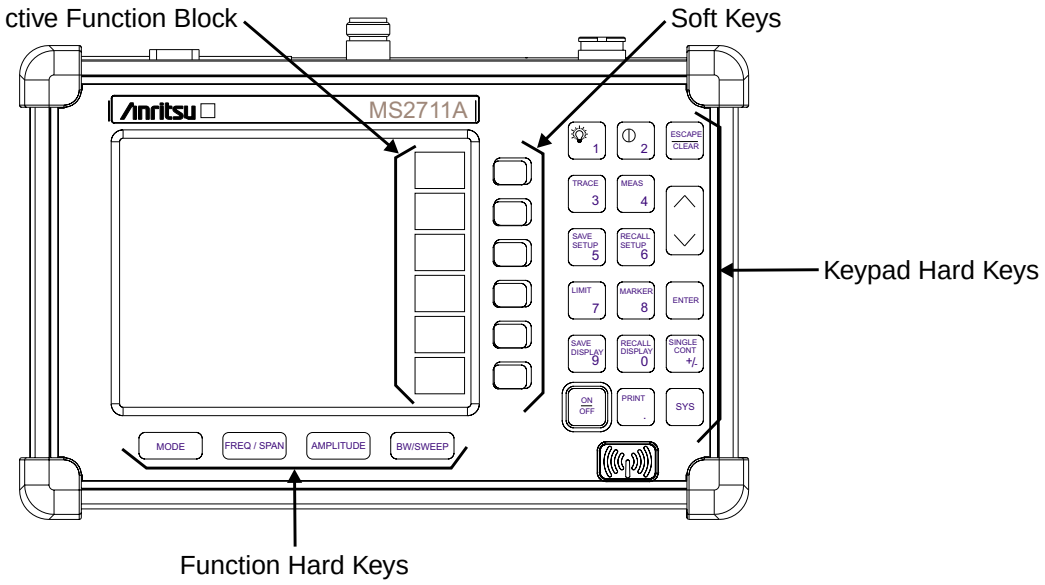

Figure 2-2. MS2711A Soft Keys

Figures 2-3 and 2-4 illustrate the menu structures and soft key labels for each menu selection. Refer to Chapter 3, *Key Functions*, for more detailed hard and soft key descriptions.

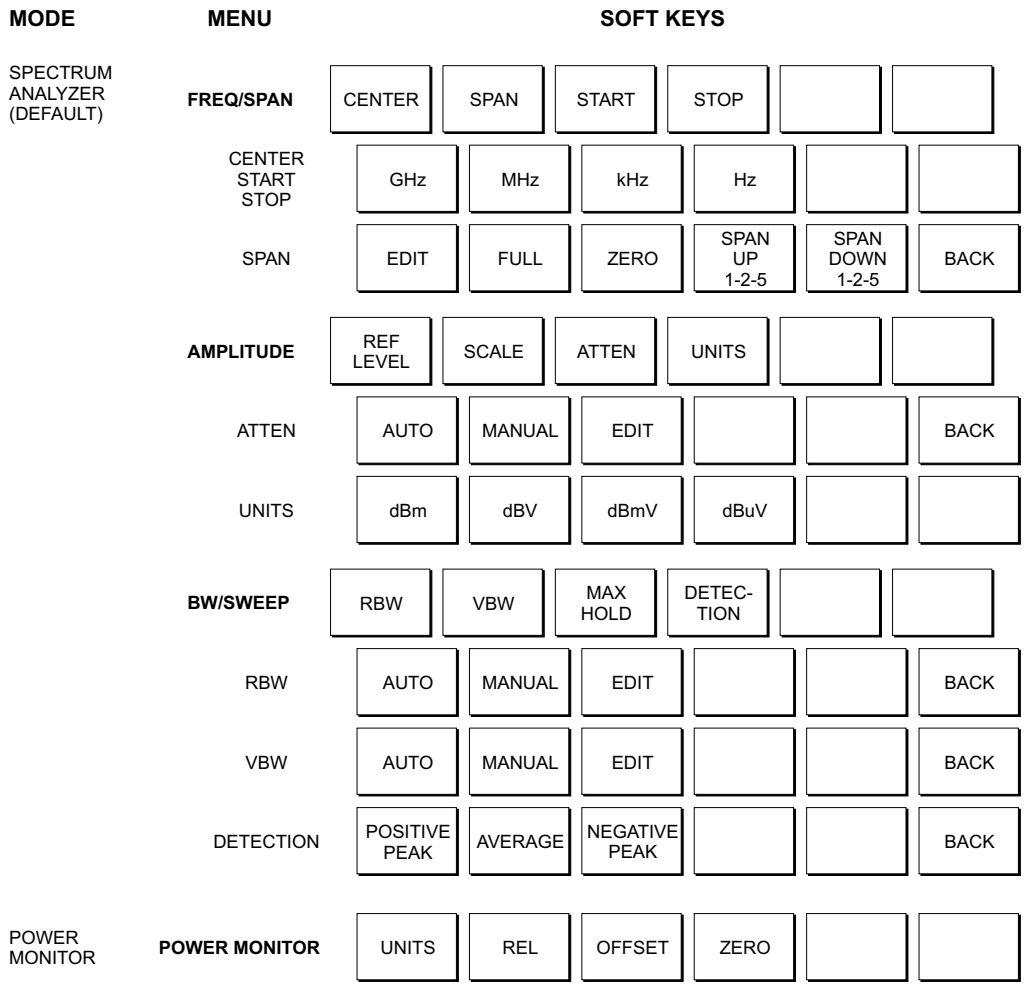

Figure 2-3. Function Hard Keys Menu Structure

MODE	MENU	SOFT KEYS					
SPECTRUM ANALYZER (DEFAULT)	**TRACE**	RESET A	A->B	A - B -> A	A + B -> A	TRACE B	
	TRACE B	VIEW B	CLEAR B	RECALL TRACE ->B			BACK
	MEAS	FIELD STRNGTH	OBW	AM/FM DEMOD	CHANNEL POWER	ACP	
	FIELD STRNGTH	ON/OFF	SELECT ANTENNA				BACK
	OBW	METHOD	%	dBc		MEASURE	BACK
	AM/FM DEMOD	ON/OFF	DEMOD TYPE	VOLUME			BACK
	ACP	CENTER FREQ	MAIN CHANNEL BW	ADJ CHANNEL BW	CHANNEL SPACING	MEASURE	BACK
	LIMIT	SINGLE LIMIT	MULTIPLE UPPER LIMITS	MULTIPLE LOWER LIMITS	LIMIT BEEP		
	SINGLE LIMIT	ON/OFF	EDIT	BEEP AT LEVEL			BACK
	MULTIPLE UPPER LIMITS	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	BACK
	MULTIPLE LOWER LIMITS	SEGMENT 1	SEGMENT 2	SEGMENT 3	SEGMENT 4	SEGMENT 5	BACK
	MARKER	M1	M2	M3	M4		ALL OFF
	M1	ON/OFF	EDIT		MARKER TO PEAK	MARKER FREQ TO CENTER	BACK
	M2 M3 M4	ON/OFF	EDIT	DELTA (Mx - M1)	MARKER TO PEAK	MARKER FREQ TO CENTER	BACK
	SYS	OPTIONS	CLOCK	SELF TEST			
	OPTIONS	PRINTER	CHANGE DATE FORMAT				
	CLOCK	HOUR	MINUTE	MONTH	DAY	YEAR	BACK

Figure 2-4. Keypad Hard Keys Menu Structure

Test Panel Connectors

The connectors and indicators located on the test panel are listed and described below.

12.5-15VDC (1100 mA) DC input to power the unit or for battery charging. Input is 12.5 to 15 Vdc @ 1100 mA.

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.*

Battery Charging Indicator light to show that the battery is being charged. The indicator light automatically shuts off when the battery is fully charged.

External Power Indicator light to show that the Anritsu is being powered by the external charging unit.

Headphone Jack Allows connection of audio headphones for monitoring AM/FM demodulation.

Serial Interface RS232 DB9 interface to a COM port on a personal computer (for use with the Anritsu Software Tools program). Also provides a serial interface to a printer.

RF In 50-Ohm RF input for spectrum analysis and stimulus-response measurements.

RF Det RF detector input for the Power Monitor (Option 5).

Battery Compartment Contains the NiMH battery, part number 633-27. To open, turn the fastener ¼-turn counter-clockwise, pull up and remove the battery compartment door. Remove the battery by pulling straight up on the battery lanyard. Replacement is the opposite of removal.

Making Spectrum Analyzer Measurements

Required Equipment

- MS2711A Hand Held Spectrum Analyzer
- Test Port Extension Cable, Anritsu 15NNF50-1.5A

Procedure

Step 1. Press the **ON/OFF** key.

Step 2. Press the **MODE** key and use the Up/Down arrow key to select Spectrum Analyzer mode. Press **ENTER** to set the mode.

Making a Measurement

Step 1. Connect the input cable to the **RF In** test port.

Step 2. Locate and display the signal(s) of interest by selecting the desired frequency, span, and amplitude value.

Selecting the Frequency

Step 1. Press the **FREQ/SPAN** key to display the Frequency menu.

Step 2. To enter a center frequency, select the CENTER soft key and enter the desired center frequency on the keypad. Select the GHz, MHz, kHz, or Hz softkey to accept the center frequency input.
or
To set a specific frequency band, select the START soft key and enter the desired start frequency on the keypad. Select the GHz, MHz, kHz, or Hz softkey to accept the start frequency input. Then select the STOP soft key and enter the desired stop frequency on the keypad. Select the GHz, MHz, kHz, or Hz softkey to accept the stop frequency input.

Selecting the Span

Step 1. Press the **FREQ/SPAN** key to display the Frequency menu.

Step 2. Press the SPAN soft key to display the Span menu.

Step 3. For a full span, select the FULL soft key.
or
For no span, select the ZERO soft key.
or
To set a specific span, select the EDIT soft key and enter the desired span on the keypad. Select the GHz, MHz, kHz, or Hz soft key to accept the span.

> ***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.*

Selecting the Amplitude

Step 1. Press the **AMPLITUDE** key.

Step 2. Press the REF LEVEL soft key and use the up/down arrow key or directly enter the desired reference level from the keypad. Press **ENTER** to set the amplitude level.

Step 3. Press the SCALE soft key and use the up/down arrow key or directly enter the desired scale from the keypad. Press **ENTER** to set the scale.

Step 4. Press the UNITS soft key and select the desired units from the soft keys presented. Press **ENTER** to set the units selection.

Step 5. Press the ATTEN soft key to set the attenuation. Select either the AUTO or MANUAL soft key. AUTO automatically couples the attenuator setting to the reference level. MANUAL allows editing of the attenuator setting. Press the EDIT soft key and use the up/down arrow key to select the attenuator level. Press **ENTER** to set the attenuator level.

***NOTE**: Select AUTO coupling to help insure that harmonics and spurs are not introduced into the measurements.*

Selecting Bandwidth Parameters

Step 1. Press the **BW/SWEEP** key to display the bandwidth menu.

Step 2. To select the resolution bandwidth, press the RBW soft key.

Step 3. Select AUTO for automatic resolution bandwidth selection, or select EDIT and use the Up/Down arrow key to select the resolution bandwidth. Press **ENTER** to set the resolution bandwidth.

Step 4. To select the video bandwidth, press the VBW soft key.

Step 5. Select AUTO for automatic video bandwidth selection, or select EDIT and use the Up/Down arrow key to select the video bandwidth. Press **ENTER** to set the video bandwidth.

Selecting Sweep Parameters

Step 1. To toggle maximum hold ON or OFF, press the MAX HOLD soft key. Maximum hold displays the maximum response of the input signal.

Step 2. To set the detection method, press the DETECTION soft key and select either POSITIVE PEAK, AVERAGE, or NEGATIVE PEAK detection.

Adjusting Markers

Step 1. Press the **MARKER** key to call up the Markers menu.

Step 2. Press the M1 soft key to select the M1 marker function.

Step 3. Press the EDIT soft key and enter an appropriate value using the keypad or Up/Down arrow key. Select the GHz, MHz, kHz, or Hz softkey to accept the marker frequency input. Pressing the **ON/OFF** soft key activates or deactivates the M1 marker function.

Step 4. Press the BACK soft key to return to the Markers Menu.

Step 5. Repeat the steps for markers M2, M3, and M4.

Adjusting Limits

Step 1. Press the **LIMIT** key.

Step 2. Enter the desired numerical value using the keypad or Up/Down arrow key.

Step 3. Press **ENTER** when the data entry is complete.

Adjusting Attenuator Settings

Step 1. Press the **AMPLITUDE** key.

Step 2. Press the ATTEN soft key.

Step 3. Select AUTO to automatically couple the attenuator setting to the reference level.

Step 4. Select EDIT to adjust the attenuation setting. Use the Up/Down arrow key to select the attenuation setting and press **ENTER** to set.

> ***NOTE****: AUTO coupling helps insure that harmonics and spurs are not introduced into the measurements.*

Making a Basic Measurement

Making a basic measurement with the Anritsu HHSA is similar to conventional spectrum analyzers. Users need simply to power-on and tune the Anritsu Hand Held Spectrum Analyzer to locate and display a signal on the screen of the hand held spectrum analyzer. Once a signal is displayed the user can measure the signal input in four simple steps to determine the frequency and amplitude of the signal.

These steps include:

- ❒ Setting the center frequency.
- ❒ Setting the frequency span.
- ❒ Setting the amplitude.
- ❒ Activating the marker.

***NOTE**: Frequency, span and amplitude are the fundamental functions for spectrum analyzer measurements. However, by using marker functions, you are able to easily read out frequencies and amplitudes on the spectrum analyzer trace. This lets you make relative measurements, automatically locate the signal of the highest amplitude on a trace, and tune the spectrum analyzer to track a signal automatically. For more information, please refer to Chapter 4, "Advanced Measurement Fundamentals."*

Example – Measuring a 900 MHz signal

Step1. Press the **ON/OFF** key, then the **ENTER** key when prompted.

Step2. Connect a signal generator to the input of the Anritsu HHSA and configure it to provide a –10dBm, 900 MHz signal.

Set the center frequency

Step1. Press the **FREQ/SPAN** key.

Step2. Press the CENTER frequency soft key.

***NOTE**: To set the center frequency to 900 MHz, use the numerical keypad to the right of the display. The data keys allow you to select the exact numeric value of the active function, which in this example is the center frequency. When activating the center frequency function, the hand held spectrum analyzer is set to the center-frequency span mode.*

Step3. Enter 900 on the keypad and select the MHz soft key . Observe that the signal resembles that shown in Figure 2-5.

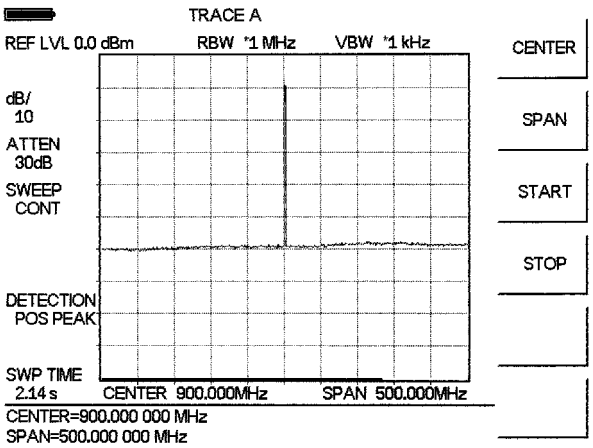

Figure 2-5. Signal at 900 MHz

Set the frequency span

Step 1. Press the **FREQ/SPAN** key.

Step 2. Press SPAN soft key.

The Span menu is now displayed in the active function block. When activating the span function, the hand held spectrum analyzer is set to the center-frequency span mode.

Choices within the span menu include EDIT, ZERO, FULL SPAN, SPAN UP 1-2-5, and SPAN DOWN 1-2-5. The span can be set to 0 Hz using either the data keys or activating ZERO SPAN in the span menu. To reduce the frequency span — for example, to 20 MHz — either press 20 on the keypad and press the MHz soft key, or use the down arrow key to "step down" to the value. (Like data keys, step keys can also be used to change the numeric value of the active function.) A span of 20 MHz is shown in Figure 2-6.

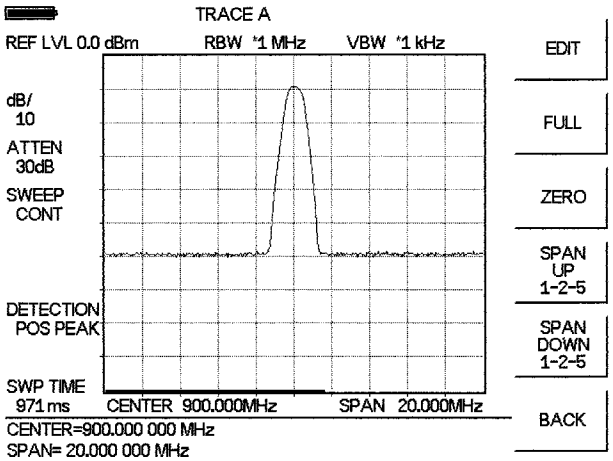

Figure 2-6. 20 MHz Frequency Span

Set the amplitude

Generally, placing the signal peak at the reference level provides the best measurement accuracy. The following steps will adjust the signal peak to the reference level (Figure 2-7).

Step 1. Press the **AMPLITUDE** key.

Step 2. Press the ATTEN soft key and the AUTO soft key to select automatic attenuation.

Step 3. Press BACK soft key and then the REF LEVEL soft key.

Step 4. Press the +/– key and 10 on the keypad and press **ENTER** to set the reference level to –10 dBm. Observe that the display resembles that shown in Figure 2-7.

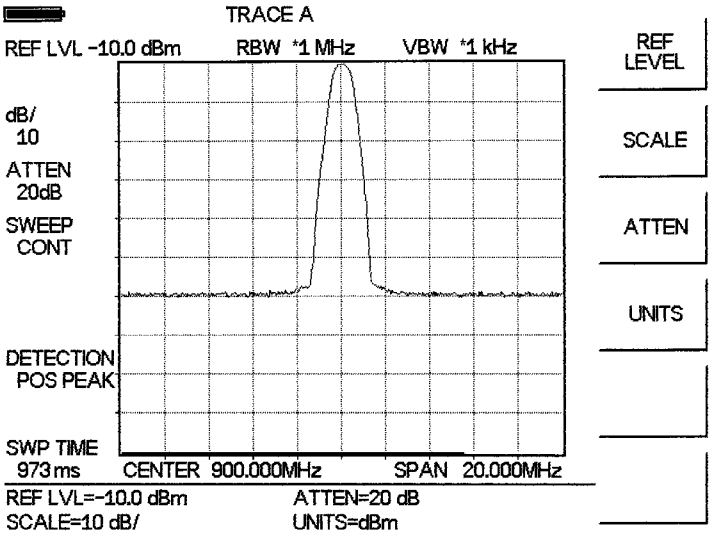

Figure 2-7 Reference Level set at –10 dBm

Step 5. Press the SCALE soft key and use the key pad or up/down arrow key to select a scale of 10 dB/. Press the **ENTER** key to set the scale.

Step 6. Press the UNITS soft key and select dBm as the amplitude units.

Activate the marker

The marker reads both the frequency and the amplitude, and it displays these values in the message area at the bottom of the display. In this case, the marker will read 900 MHz and –10.00 dBm, as shown in Figure 2-8.

Step 1. Press the **MARKER** key.

Step 2. Press the M1 soft key .

Step 3. Press the ON/OFF soft key to activate the selected marker.

Step 4. Press the MARKER TO PEAK soft key to set marker M1 to the highest point on the trace.

Step 5. Read both frequency and the amplitude values identified by the selected marker. These values are displayed in the message area at the bottom of the display (Figure 2-8).

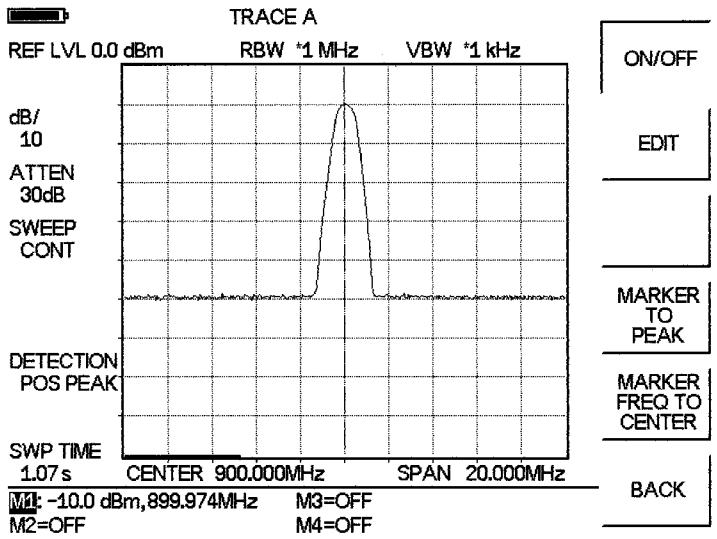

Figure 2-8. Activated Normal Marker

> ***NOTE**: Marker's can be placed the peak of the signal by pressing PEAK, or by using the up/down arrow key to move the marker manually.*
> *When using more than one marker, it may be desirable to use the marker delta function, defined as delta (M1–Mx) in the active function box. The marker delta function reads the difference in amplitude and frequency between two signals and displays the values in the area below the display.*

Save the Display

Step 1. Press the **SAVE DISPLAY** key.

Step 2. To enter a name for the display, press the soft key letter group that contains the desired letter, then select the soft key for that letter. Continue to select letters up to a maximum of 16 characters.

Step 3. Press **ENTER** to set the saved display name.

Recall the Display

Step 1. Press the **RECALL DISPLAY** key.

Step 2. Select the desired display using the Up/Down arrow key.

Step 3. Press **ENTER** to recall the selected display.

Printing

Printing is accomplished using the Seiko DPU-414 thermal printer, the Hewlett Packard DeskJet 340 ink jet printer, or any printer listed in theMS2711A printer selection table . Figure 2-9 shows a setup diagram for two types of printers. Refer to the printer manual for setup details.

Printer Switch Settings

Set the switches on the serial-to-parallel interface cable to the HP Deskjet 340 ink jet printer or other parallel interface printer as follows:

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
OFF	ON	OFF	OFF	OFF	OFF	ON	OFF

Set the switches, SW1, SW2, and SW3, on the Seiko DPU-414 thermal printer as follows:

Switch	1	2	3	4	5	6	7	8
SW1	OFF	ON	ON	ON	ON	OFF	ON	ON
SW2	ON	ON	ON	ON	ON	ON	ON	OFF
SW3	ON	ON	ON	OFF	OFF	ON	ON	ON

Printing a Screen

Step 1. Connect the printer as shown in Figure 2-9.

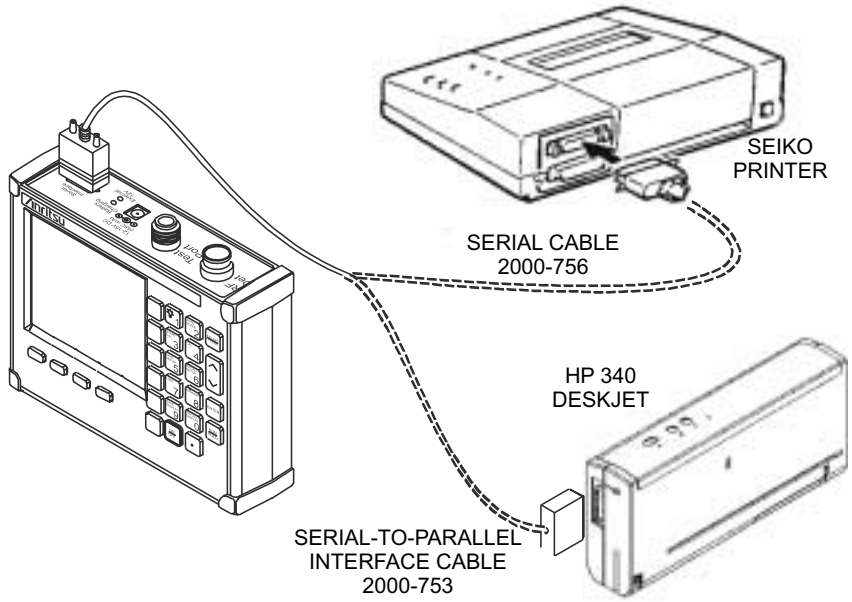

Figure 2-9. Printer Setup

Step 2. Obtain the desired measurement display

Step 3. Press the **SYS** key and the OPTIONS soft key.

Step 4. Press the PRINTER soft key and select from the displayed menu of supported printers..

Step 5. Press the **PRINT** key.

Step 6. Press **ENTER**.

Determining Remaining Battery Life

When the AC-DC adapter is disengaged from the Site Master, a battery indicator symbol is continuously displayed at the top-left corner of the display (Figure 2-10). A totally black bar indicates a fully charged battery.

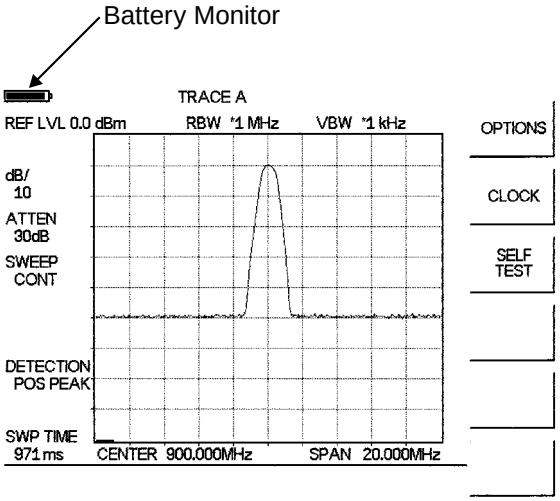

Figure 2-10. Battery Monitor

During operation, the battery condition can be viewed by pressing the **SYS** key and selecting the SELF TEST soft key. The battery condition will be displayed as a percentage of charge remaining.

SELF TEST

VOLTAGE . . . . . BATTERY 11.1V
TEMPERATURE . . . . 24°C

BATTERY CAL . . . . . PASSED
MEMORY . . . . . PASSED
LO . . . . . PASSED

BATTERY CHARGE = 84%

PRESS ENTER TO CONTINUE

Figure 2-11. Self Test Battery Condition Display

Symbols

Table 2-1 provides a listing of the symbols used as condition indicators on the LCD display.

Table 2-1. LCD Icon Symbols

Icon	Symbol
HOLD	Anritsu HHSA is in power conservation mode. To resume sweeping, press the **ENTER** key. After 10 minutes without a key press, the Anritsu HHSA will automatically enter power conservation
	Lock fail indication. Check battery. (If the Anritsu HHSA fails to lock with a fully charged battery, call your Anritsu Service Center.**)**
	Indicates the remaining charge on the battery. The inner white rectangle grows longer as the battery charge depletes.

Self Test

At turn-on, the Anritsu HHSA runs through a series of quick checks to ensure the system is functioning properly. Note that the battery voltage and temperature are displayed in the lower left corner below the self test message. If the battery is low, or if the ambient temperature is not within the specified operational range, Self Test will fail. If Self Test fails AND the battery is fully charged AND the Anritsu HHSA is within the specified operating range, call your Anritsu Service Center.

Error Codes

Self Test Errors

A listing of Self Test Error messages is given in Table 2-2.

Table 2-2. Self Test Error Messages

Error Message	Description
BATTERY LOW	Battery voltage is less than 10 volts. Charge battery. *If condition persists, call your Anritsu Service Center*.
EXTERNAL POWER LOW	External supply voltage is less than 10 volts. *Call your Anritsu Service Center*
PLL FAILED	Phase-locked loops failed to lock. Charge battery. *If condition persists with a fully charged battery, call your Anritsu Service Center*
EEPROM R/W FAILED	Non-volatile memory system has failed. *Call your Anritsu Service Center.*
OUT OF TEMP. RANGE	Ambient temperature is not within the specified operating range. *If the temperature is within the specified operating range and the condition persists, call your Anritsu Service Center.*

NOTE: *A listing of current Anritsu service centers is given in Table 1-3 , page 1-7.*

Range Errors

A listing of Range Error messages is given in Table 2-3.

Table 2-3. Range Error Messages

Error Message	Description
NO STORED SWEEP AT THIS LOCATION	Attempting to recall a display from a location that has not been previously written to. That is, the location does not contain stored sweep.
USE OPTIONS MENU TO SELECT A PRINTER	Attempting to print a display with no printer selected. Select a printer, then retry.
CANNOT ZERO NO DETECTOR INSTALLED	Attempting to perform a Power Monitor zero adjust function with no RF detector connected to the Anritsu HHSA.
CANNOT ZERO INPUT SIGNAL TOO HIGH	Attempting to perform a Power Monitor zero adjust function with an input of greater than –20 dBm.
POWER MONITOR OPTION NOT INSTALLED	Attempting to enter Power Monitor mode with no option 5 installed.

Using the Soft Carrying Case

The soft carrying case has been designed such that the strap can be unsnapped to allow the case to be easily oriented horizontally; thus allowing the Anritsu controls to be more easily accessed (Figure 2-12).

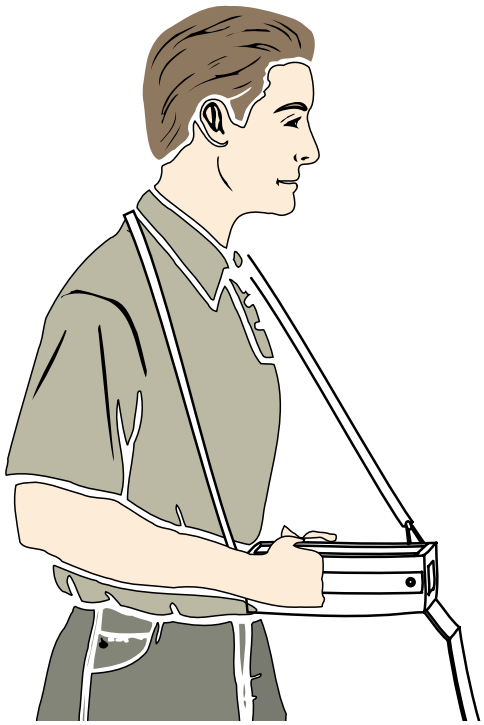

Figure 2-12. Using the Soft Carrying Case

Chapter 3
Key Functions

Introduction

This chapter provides a description of the Anritsu MS2711A Hand Held Spectrum Analyzer keypad controls. There are two kinds of keys available on the MS2711A front panel: Hard Keys and Soft Keys.

Hard Keys

Hard keys are those keys on the front panel that are labeled in black or blue and perform specific functions as explained below. There are four function hard keys, located below the display, and seventeen keypad hard keys located to the right of the display. Twelve of the keypad hard keys are dual purpose, depending on the current mode of operation.

Function Hard Keys

MODE Sets the Anritsu HHSA to a specific mode of operation. Use the Up/Down arrow key to select either spectrum analyzer mode or power monitor mode (if Option 5 is installed). Press the **ENTER** key to implement the selection.

FREQ/SPAN Activates a menu of frequency and span related functions for selection using the soft keys. Available choices from this menu include CENTER, SPAN, START frequency and STOP frequency. Soft key selection of any of these functions brings up a set of choices or selections specific to that procedure.

AMPLITUDE Activates a menu of amplitude related functions including REF LEVEL, SCALE, ATTEN, and UNITS. Soft key selection of any of these functions brings up a set of choices or selections specific to that procedure.

BW/SWEEP Activates a menu of bandwidth and sweep related functions including RBW, VBW, MAX HOLD, and DETECTION. Soft key selection of any of these functions brings up a set of choices or selections specific to that procedure.

Keypad Hard Keys

The following keypad hard key functions are printed in ***black*** on the keypad keys.

0-9 — These keys are used to enter numerical data as required to setup or perform measurements.

+/– — The plus/minus key is used to enter positive or negative values as required to setup or perform measurements.

• — The decimal point is used to enter decimal values as required to setup or perform measurements.

ESCAPE CLEAR — Exits the present operation or clears the display. If a parameter is being edited, pressing this key will clear the value currently being entered and restore the last valid entry. Pressing this key again will close the parameter. During normal sweeping, pressing this key will move up one menu level.

UP/DOWN ARROWS — Increments or decrements a parameter value. The specific parameter value affected typically appears in the message area of the LCD.

ENTER — Implements the current action or parameter selection.

ON OFF — Turns the Anritsu HHSA on or off. When turned on, the system state at the last turn-off is restored. If the **ESCAPE/CLEAR** key is held down while the **ON/OFF** key is pressed, the factory preset state will be restored.

SYS — Allows selection of system setup parameters. Choices are OPTIONS, CLOCK, and SELF TEST.

The following keypad hard key functions are printed in ***blue*** on the keypad keys.

 — Turns the liquid crystal display (LCD) back-lighting ON or OFF. (Leaving back lighting off conserves battery power.)

 — LCD Contrast adjust. Use the Up/Down arrow key and **ENTER** to adjust the display contrast to suit ambient conditions.

TRACE — Activates a menu that allows comparison of a current runtime trace (Trace A) to a saved trace (Trace B).

MEAS — Activates a menu of measurement related functions including field strength, occupied bandwidth (OBW), and AM/FM Demodulation.

SAVE SETUP — Saves the current system setup to 1 of 10 internal non-volatile memory locations. When the key is pressed, a Save Setup selection box appears on the display. Use the Up/Down arrow key to select a setup location and press the **ENTER** key to implement.

RECALL SETUP — Recalls a previously saved setup from memory location 1 through 10. When the key is pressed, a Recall Trace selection box appears on the display. Select a setup using the Up/Down arrow key and press the **ENTER** key to implement. Setup location 0 recalls the factory preset state.

LIMIT Activates a menu of Limit functions including single limit, multiple upper limits, multiple lower limits, and limit beep.

MARKER Activates a menu of marker functions for markers 1 through 4. Each marker, when selected, activates marker to peak and marker frequency to center functions. Markers 2 through 4 also include delta marker functions referenced to M1.

SAVE DISPLAY Saves the displayed trace to non-volatile memory. When the key is pressed, TRACE NAME: appears on the display. Select the alphanumeric characters for that trace name and press **ENTER** key to implement.

RECALL DISPLAY Recalls a previously saved trace from memory. When the key is pressed, a Recall Trace selection box appears on the display. Select a trace using the Up/Down arrow key and press the **ENTER** key to implement.

SINGLE CONT Toggles the units sweep between continuous sweep mode and single sweep mode. The default is continuous sweep. When single sweep is selected, the Anritsu HHSA will sweep once and hold until activated. The currently selected sweep mode appears on the LCD. Single sweep mode can be used to conserve battery power.

PRINT Prints the current display to the selected printer.

Soft Keys

Soft keys are the six unlabeled keys (see Figure 2-2, page 2-2) that perform different functions depending on the currently selected soft key menu. The available selections for the softkeys are displayed in the active function block.

The following paragraphs relate the menus displayed in the active function block when the various function hard keys or keypad hard keys are selected.

Frequency Menu

Pressing the **FREQ/SPAN** key activates a menu of frequency related choices in the active function block. Use the corresponding softkey to select the desired function, explained below. Use the keypad or Up/Down arrow key to change or enter values shown in the message area. Complete the entry by pressing the appropriate softkey frequency designation.

CENTER Activates the center frequency function and sets the Anritsu HHSA to the center frequency. A specific center frequency can be entered by using the keypad or Up/Down arrow key. Select the GHz, MHz, kHz, or Hz softkey to accept the center frequency input.

START Activates the start frequency and sets the Anritsu HHSA in the Start/Stop mode. Select the desired start frequency and complete the entry by pressing the GHz, MHz, kHz, or Hz softkey to accept the start frequency input.

STOP Activates the stop frequency and sets the Anritsu HHSA in the Start/Stop mode. Select the desired stop frequency and complete the entry by pressing the GHz, MHz, kHz, or Hz softkey to accept the stop frequency input.

Span Menu

Pressing the SPAN soft key activates a menu of span related choices in the active function block. Use the corresponding softkey to select the desired function, explained below. Use the keypad or Up/Down arrow key to change or enter values shown in the message area.

EDIT Allows direct entry of a specific frequency span. Use the keypad or Up/Down arrow key to select the span of choice and complete the entry by pressing the GHz, MHz, kHz, or Hz softkey.

FULL Sets the Anritsu HHSA to its maximum frequency span, 2.999 GHz.

ZERO Sets the span to 0 Hz.

SPAN UP 1-2-5 Activates the span function so that the span may be increased quickly in a 1-2-5 sequence.

SPAN DOWN 1-2-5 Activates the span function so that the span may be reduced quickly in a 1-2-5 sequence.

BACK Returns to the previous menu level.

Amplitude Menu

Pressing **AMPLITUDE** activates a menu of amplitude related functions. Use the corresponding softkey to select the desired amplitude function.

REF LEVEL Activates the amplitude reference level function.

SCALE Activates the scale function in a 2 through 15 dB logarithmic amplitude scale.

ATTEN Sets the Anritsu HHSA input attenuator so that it is either coupled automatically to the reference level (AUTO) or manually adjustable (MANUAL).

UNITS Choose from the menu of amplitude related units. Selection of dBm sets absolute decibels relative to 1 mW as the amplitude unit. Selection of dBV, dBmV or dBμV sets absolute decibels relative to 1 volt, 1 millivolt, or 1 microvolt respectively as the amplitude unit.

Bandwidth Menu

Pressing **BW/SWEEP** activates a menu of bandwidth related functions. Use the corresponding softkey to select the desired bandwidth function.

RBW Sets the resolution bandwidth so that it is either coupled automatically to the span (AUTO) or manually adjustable (MANUAL).

VBW Sets the video bandwidth so that it is either coupled automatically to the span (AUTO) or manually adjustable (MANUAL).

Sweep Menu

Pressing **BW/SWEEP** activates a menu of sweep related functions. Use the corresponding softkey to select the desired sweep function.

MAX HOLD Displays and holds the maximum responses of the input signal.

DETECTION Accesses a menu of detector modes including POSITIVE PEAK detection, AVERAGE detection and NEGATIVE PEAK detection.

BACK Returns to the previous menu level.

Trace Menu

Pressing the **TRACE** key activates a menu of trace related functions. Use the corresponding softkey to select the desired trace function.

> ***NOTE**: For this function, Trace A is always the runtime trace, and Trace B is always a saved trace. Refer to page 3-9 for information on saving and recalling traces.*

RESET A — Clears the current runtime trace.

A → B — Stores the current runtime trace into the Trace B buffer.

A – B → A — Performs a subtraction trace math operation.

A + B → A — Performs an addition trace math operation.

TRACE B — Accesses a menu of saved trace options.
VIEW B - Provides a trace overlay of the saved trace with the current runtime trace.
CLEAR B - Turns off trace overlay.
RECALL TRACE → B - Recalls the saved trace B buffer.
BACK - Returns to the previous menu.

Measurement Menu

Pressing **MEAS** on the data keypad activates a menu of measurement related functions. Use the corresponding softkey to select the measurement function.

FIELD STRENGTH — Accesses a menu of field strength measurement options.
ON/OFF - Turns field strength measurements on or off.
SELECT ANTENNA - Selects an antenna profile to be used for field strength measurements.
BACK - Returns to the previous menu.

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

Selecting % allows entry of the desired % of occupied bandwidth to be measured.

Selecting dBc allows entry of the desired power level (dBc) to be measured.

AM/FM DEMOD — Accesses a menu of AM/FM demodulation options.
ON/OFF - Turns AM/FM demodulation on or off.
DEMOD TYPE - Selects the type of demodulation to perform:
- FM - WIDE BAND
- FM - NARROW BAND
- AM

VOLUME - Adjust the demodulation speaker volume from 0 to 100.
BACK - Returns to the previous menu.

CHANNEL POWER Activates Channel Power measurement. Channel power is measured in dBm. Channel Power density is measured in dBm/Hz.

ACP Accesses a menu of Adjacent Channel Power ratio measurement options:
CENTER FREQ - Activates the center frequency function and sets the Anritsu HHSA to the center frequency. A specific center frequency can be entered using the keypad or Up/Down arrow key. Select the GHz, MHz, kHz, or Hz softkey to accept the center frequency input.
MAIN CHANNEL BW - Sets the bandwidth of the main channel.
ADJACENT CHANNEL BW - Sets the bandwidth of the adjacent channel.
CHANNEL SPACING - Sets the channel spacing.
MEASURE - Begins the ACP measurement.
BACK - Returns to the previous menu.

Save Setup Menu

Pressing **SAVE SETUP** on the data keypad saves the current system setup to 1 of 10 internal non-volatile memory locations. When the key is pressed, a Save Setup selection box appears on the display. Use the Up/Down arrow key to select a setup and press the **ENTER** key to implement.

Recall Setup Menu

Pressing **RECALL SETUP** on the data keypad recalls a previously saved setup from memory location 1 through 10. When the key is pressed, a Recall Trace selection box appears on the display. Select a setup using the Up/Down arrow key and press the **ENTER** key to implement. Setup location 0 recalls the factory preset state.

Limit Menu

Pressing **LIMIT** on the data keypad activates a menu of limit related functions. Use the corresponding softkey to select the desired limit function. Then use the Up/Down arrow key to change its value, which is displayed in the message area at the bottom of the display.

SINGLE LIMIT Sets a single limit value in dBm. Menu choices are:
ON/OFF
EDIT
BEEP AT LEVEL
BACK

MULTIPLE UPPER LIMITS Sets multiple user defined upper limits, and can be used to create an upper limit mask for quick pass/fail measurements. Menu choices are:
SEGMENT 1
SEGMENT 2
SEGMENT 3
SEGMENT 4
SEGMENT 5
BACK

MULTIPLE LOWER LIMITS Set multiple user defined lower limits, and can be used to create a lower limit mask for quick pass/fail measurements. Menu choices are:

SEGMENT 1
SEGMENT 2
SEGMENT 3
SEGMENT 4
SEGMENT 5
BACK

LIMIT BEEP Turns the audible limit beep indicator on or off.

Marker Menu

Pressing **MARKER** on the data keypad activates a menu for the four different markers. Use the corresponding softkey to select the desired marker. Then use the marker second level menu to turn the markers on or off, and to edit marker parameters and values.

M1 Selects the M1 marker parameter, displays both amplitude and frequency, and opens the Markers second level menu.

M2 Selects the M2 marker parameter, displays both amplitude and frequency, and opens the Markers second level menu.

M3 Selects the M3 marker parameter, displays both amplitude and frequency, and opens the Markers second level menu.

M4 Selects the M4 marker parameter, displays both amplitude and frequency, and opens the Markers second level menu.

ALL OFF Turns off all markers.

Marker Menu Second Level Menu

The markers second level menu to turn the markers on or off, and to edit marker parameters and values.

ON/OFF Turns the selected marker on or off.

EDIT Opens the selected marker parameter for data entry. Enter the desired marker frequency using the keypad or Up/Down arrow key. Select the GHz, MHz, kHz, or Hz softkey to accept the marker frequency input.

DELTA Displays delta frequency and amplitude for the selected marker with respect to the M1 marker.

MARKER TO PEAK Places the selected marker at the highest point on a trace.

MARKER FREQ TO CENTER Places the selected marker equal to the center frequency

Save Display Menu

Pressing the **SAVE DISPLAY** key saves the displayed trace to non-volatile memory. When the key is pressed, “Trace Name:” appears on the display. Select the alphanumeric characters for that trace name and press **ENTER** key to implement.

Recall Display Menu

Pressing the **RECALL DISPLAY** key recalls a previously saved trace from memory. When the key is pressed, a Recall Trace selection box appears on the display. Select a trace using the Up/Down arrow key and press the **ENTER** key to implement.

Single Continuous Menu

Toggles the units sweep from continuous sweep mode to single sweep mode, as indicated to the left side of the display. The default is continuous sweep. When single sweep is activated, the Anritsu HHSA will sweep once and hold until activated. Single sweep mode can be used to conserve battery power.

Print Menu

Selecting the **PRINT** key prints the current display to the selected printer.

System Menu

Pressing **SYS** on the data keypad activates a menu of system related functions. Use the corresponding softkey to select the system function.

OPTIONS Displays a second level menu of options functions (see below).

CLOCK Displays a second level menu of clock functions (see below).

SELF TEST Starts an instrument self test featuring battery calibration, memory, and local oscillator testing.

Options Menu Second Level

Provides access to a second level menu of options related functions. Use the corresponding softkey to select the desired function.

PRINTER Displays a menu of supported printers. Use the Up/Down arrow key and **ENTER** key to select the connected printer.

CHANGE DATE FORMAT Pressing this soft key changes the format of the date as displayed in the message area. Choices are DD/MM/YYYY, YYYY/MM/DD, MM/DD/YY, DD/MM/YY, or YY/MM/DD.

Clock Menu Second Level

Provides access to a second level menu of clock related functions. Use the corresponding softkey to select the desired function.

HOUR The hour is displayed in the message area. Enter the desired hour (0-23) using the keypad and press **ENTER** to accept.

MINUTE The minute is displayed in the message area. Enter the desired minute (0-59) using the keypad and press **ENTER** to accept.

MONTH The month is displayed in the message area. Enter the desired month (1-12) using the keypad and press **ENTER** to accept.

DAY The day as displayed in the message area. Enter the desired day (1-31) using the keypad and press **ENTER** to accept.

YEAR The year as displayed in the message area. Enter the desired year (1997-2038) using the keypad and press **ENTER** to accept.

BACK Returns user to the top-level systems menu.

Power Monitor Menu

When the mode of operation is changed to Power Monitor, the power monitor menu provides for setting power monitor parameters.

UNITS Toggles between dBm and Watts.

REL Turns relative mode OFF, if currently ON. If relative mode is currently OFF, turns it ON and causes the power level to be measured and saved as the base level. Subsequent measurements are then displayed relative to this saved value. With units of dBm, relative mode displays dBr; with units of Watts, relative mode displays % (percent).

OFFSET Turns offset OFF, if currently ON. IF Offset is currently OFF, turns it ON and opens the Offset parameter for data entry using the keypad. Press **ENTER** when data entry is complete. Offset is the attenuation (in dB) inserted in the line between the DUT and the RF detector. The attenuation is added to the measured input level prior to display.

ZERO Turns Zero OFF, if currently ON. IF Zero is currently OFF, turns it ON and initiates collection of a series of power level samples, which are averaged and saved. This saved value is then subtracted from subsequent measurements prior to display.

Chapter 4
Advanced Measurement Fundamentals

Introduction

This chapter demonstrates spectrum analyzer measurement techniques using the Anritsu HHSA. Part I will focus on advanced measurement fundamentals. Part II will focus on measurement techniques with examples of typical applications. Each application focuses on different features of the Anritsu HHSA. Measurement applications and procedures covered in this section include:

- Resolving Closely Spaced Signals
- Harmonic Distortion
- AM/FM Modulation
- AM/FM Demodulation
- Segmented Limit Lines
- Trace Overlay

Advanced Measurement Fundamentals

Advanced measurements require the use of additional spectrum analyzer functions beyond frequency, span, amplitude and marker functions. In particular, this section will focus on resolution bandwidth, video bandwidth, sweep, and attenuator functions.

Effect of Resolution Bandwidth

Resolution Bandwidth is determined by the intermediate frequency (IF) filter bandwidth. The spectrum analyzer traces the shape of its IF filter as it tunes past a signal. If more than one IF 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.

The choice of resolution bandwidth will depend on the signal being measured. If two 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 must measure across their entire frequency range at all times.

Therefore, a broadband measurement would include the fundamental frequency, harmonics, spurious responses, and noise in the measurement. On the other hand a narrow-band measurement will filter out all but the desired frequency components, resulting in a measurement that includes only the fundamental. There are advantages to each. The ultimate decision will be dependent 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, is exists at a broad range of frequencies in the frequency domain. If the noise is included in the measurement, the measured value will 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, very little 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 display of the spectrum analyzer. 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.

As a general rule of thumb, most field spectrum analyzer measurements are made at a resolution bandwidth of 30 kHz.

Effect of 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. Thus, changing the video bandwidth (VBW) does not improve sensitivity; however, it does improve discernability and 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. Thus, for a resolution bandwidth of 30 kHz, the typical video bandwidth setting options are either 3 kHz or 300 Hz.

Sweep Limitations

The user normally has control over the SWEEP TIME (the elapsed time of each sweep, sometimes called SCAN TIME), the frequency range over which the analyzer sweeps, and the resolution bandwidth. The analyzer cannot be swept arbitrarily fast while maintaining its specified accuracy, but will have a sweep rate limitation depending on the resolution bandwidth 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 bandwidth filter. If an analyzer is swept very quickly, the filter does 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 Hand Held Spectrum Analyzer has mechanisms designed into it that unburden the user from having to calculate the sweep rate.)

Attenuator Functions

Attenuation adjusts the hand held spectrum analyzer input attenuator. In AUTO mode, the input attenuator is coupled to the reference level. In manual (MANUAL) mode, the input attenuation can be adjusted by using the Up/down arrow key. The attenuator range is 0 to 50 dB, in 10 dB steps.

Attenuation is normally a coupled function and is automatically adjusted when the reference level changes. The reference level will not change however, when the attenuator changes. The attenuator should be adjusted so that the maximum signal amplitude at the input mixer is –30 dBm or less. For example, if the reference level is + 20 dBm, the attenuation is 50 dB for an input signal of –30 dBm at the mixer (20 – 50 = –30). This prevents signal compression.

> ***NOTE**: It is best to begin all measurements in AUTO attenuation mode.*

Example 1: Resolving Closely Spaced Signals

Signal resolution is determined by the intermediate frequency (IF) filter bandwidth. The hand held spectrum analyzer, as do conventional spectrum analyzers, traces the shape of its IF filter as it tunes past a signal. Thus, if two equal-amplitude signals are close enough in frequency, the filter shapes for the two signals can fall on top of one another and appear as a single response. Conversely, if two signals are not equal in amplitude but are still close together, the smaller signal can be hidden under the response of the larger one.

Measurement of Two Signals Having Equal Amplitudes

To resolve two signals of equal amplitude, the resolution bandwidth must be less than or equal to the frequency separation of the two signals. For example, to resolve two signals of equal amplitude with a frequency separation of 30 kHz, a resolution bandwidth of 30 kHz or less should be used. However, most spectrum analyzer IF filter bandwidths are not exact, varying by as much as ± 20%. This should be taken into consideration whenever testing for closely spaced signals. Thus, you may want to select the resolution bandwidth within the lower end of the specification (i.e., –20%, or 24 kHz) to ensure accurate measurements on two signals spaced to within 30 kHz. In this case the next smallest resolution bandwidth would be 10 kHz.

Example

Connect two signal sources to the spectrum analyzer input and set the frequency of one source to 900.0 MHz and the other source to 900.030 MHz. Set both sources to the same amplitude, preferably – 20 dBm. On the MS2711A HHSA:

Step 1. Set the span to 100 kHz.

Step 2. Set the resolution bandwidth to 30 kHz and the video bandwidth to 1 kHz.

The two signals should be easily observable on the spectrum analyzer display, spaced 30 kHz apart.

Step 3. Change the resolution bandwidth to a wider value and note that you can no longer see that there are two signals present.

Example

Keeping the same setup as the previous example, change the two source frequencies to 900.0 MHz and 900.020 MHz. Set both sources to the same amplitude, preferably –20 dBm.

Step 1. Set the span to 100 kHz

Step 2. Set the resolution bandwidth to 100 kHz, video bandwidth to 1 kHz.

Step 3. Change the resolution bandwidth from 100 kHz to 30 kHz then to 10 kHz to detect the presence of two signals.

Remember, the resolution bandwidth must be equal to or less than the frequency separation of the signal. Therefore, a 10 kHz resolution bandwidth must be used. The next larger filter, 30 kHz, would exceed the 20 kHz separation and thus would not resolve the two signals. Also, keep in mind that noise side-bands (phase noise) can also affect resolution.

Measurement of Two Signals Having Unequal Amplitudes

Typically, in real world environments, closely spaced signals do not have equal amplitudes. Often, the difference between closely spaced signals can be as much as –90 dBm. To resolve two signals of unequal amplitude, the resolution bandwidth must be less than or equal to the frequency separation of the two signals (the same as resolving two equal amplitude signals). However, in this case the largest resolution bandwidth that will resolve the two unequal signals is determined primarily by the shape factor of the IF filter, rather than by the 3 dB bandwidth. Shape factor is defined as the ratio of the 60 dB bandwidth to the 3 dB bandwidth of the IF filter.

Therefore, to resolve two signals of unequal amplitude, the half-bandwidth of a filter at the point equal to the amplitude separation of the two signals must be less than the frequency separation of the two signals. However, if you do not know the specific shape factor of the IF Filter, not all is lost. Simply perform this measurement as if the signals had equal amplitudes but pay close attention to potential signals having unequal power levels that are closely spaced. This will take some adjusting among the various resolution and video bandwidth and span functions.

Example

Connect two signal sources to the spectrum analyzer input. Set the frequency of one source to 1900.0 MHz and the other source to 1900.100 MHz. Set one source to the + 20 dBm, and the other to – 15 dBm.

Step 1. Set the span to 2 MHz

Step 2. Set the resolution bandwidth to 30 kHz and the video bandwidth to 300 Hz.

The two signals should be easily observable on the spectrum analyzer, each with different amplitudes and spaced 100 kHz apart

Step 3. Change the frequency in the second source from 1900.100 MHz to 1900.050 MHz gradually by turning the knob on the signal source and observe the effect.

Step 4. Change the resolution bandwidth to 10 kHz.

The two signals should still be observable with the 10 kHz resolution bandwidth, but may be difficult to detect with the 30 kHz resolution bandwidth. Narrowing the span may help in detecting the differences in these two signals.

***NOTE**: Spectrum analyzer sweep time is inversely proportional to the square of the resolution bandwidth. So, if the resolution bandwidth is reduced by a factor of ten, the sweep time is increased by a factor of 100. For fastest measurement times, use the widest resolution bandwidth that still permits resolution of all desired signals.*

Example 2: Harmonic Distortion

Most transmitting devices and signal sources contain harmonics. Measuring the harmonic content of such sources is frequently required. In fact, measuring harmonic distortion is one of the most common uses of spectrum analyzers.

The following harmonic distortion measurement applies an important group of spectrum analyzer operating skills: setting the frequency span, using start and stop frequencies; setting the video bandwidth; and making relative measurements using two markers. It also demonstrates setting a signal to center frequency using a marker, and setting the frequency step size to the value for the center frequency.

Example

Step 1. Connect a signal source to the Anritsu HHSA spectrum analyzer.

Step 2. Set the input frequency to 10 MHz and the signal level to + 20 dBm.

Step 3. Set the START frequency at 1 Mhz

Step 4. Set the STOP frequency to 100 MHz

Step 5. Set the resolution bandwidth to improve visibility by smoothing the noise:
a. Press BW/SWEEP
b. Press RBW, then MANUAL and EDIT.

Step 6. Use the step down (down arrow key) to select the desired resolution bandwidth, 100 kHz in this case.

Step 7. Press ENTER once the desired resolution bandwidth has been selected.

Step 8. Set the video bandwidth to improve visibility by smoothing the noise:
a. Press BW/SWEEP
b. Press VBW, then MANUAL and EDIT.

Step 9. Use the step down (down arrow key) to select the desired video bandwidth, 3 kHz in this case.

Step 10. Press ENTER once the desired video bandwidth has been selected.

Step 11. Press AMPLITUDE and then select REF LEVEL

Step 12. Key in the desired REF LEVEL (+20) on the data keypad and press ENTER.

Step 13. Press MARKER and select M1

Step 14. Activate M1 ON and press PEAK

Step 15. Press MARKER and select M2

Step 16. Activate M2 ON and use Up/Down key to place M2 to the center of the first harmonic

Step 17. Select DELTA (M2-M1) marker function. This will provide frequency and amplitude information with respect to marker M1.

Step 18. Press MARKER and select M3

Step 19. Activate M3 ON and use Up/Down key to place M3 to the center of the second harmonic

Step 20. Select DELTA (M3-M1) marker function. This will provide frequency and amplitude information with respect to marker M1.

Example 3: AM/FM Modulation

Modulation is the process of translating some low frequency or baseband signal (voice, music, or data) to a higher frequency. In the modulation process, some characteristic of a carrier signal (usually amplitude or frequency) is changed in direct proportion to the instantaneous amplitude of the baseband signal.

The following procedure describes how to measure signals with AM and FM types of modulation on them. It shows how to tune the signal on the spectrum analyzer display.

Amplitude Modulation

Step 1. Connect the signal source to the spectrum analyzer input.

Step 2. Set the source to a carrier frequency of 100 MHz with an amplitude modulation of about 35 kHz

Step 3. Set the spectrum analyzer center frequency to 100 MHz. Set the span to 500 kHz.

Step 4. To determine the frequency of the carrier, press MARKER, activate M1 and press PEAK, ENTER.

Additional modulation information can be easily determined from the carrier signal and sideband. For example, the difference between the carrier frequency and the sideband frequency can be found by pressing MARKER, activating M2 and pressing DELTA, ENTER.

The markers read the frequency difference between the two signals, which is equal to the modulating frequency. The marker also reads the difference in amplitude. This difference in amplitude between the two signals can be used to determine the percentage of modulation.

***NOTE**: Unequal amplitudes of the lower and upper sidebands indicate incidental FM on the input signal. Incidental FM can reduce the accuracy of percentage-of-modulation measurements.*

Frequency Modulation

This section contains general information about frequency modulation, as well as a procedure for calculating FM deviation using a spectrum analyzer.

For sinusoidal modulation where either the modulation frequency or the FM deviation can be varied, the spectrum analyzer can be used to accurately set up a modulation index corresponding to a Bessel null. The following example illustrates how to verify the FM deviation accuracy of a signal generator with FM capability. We will use a carrier frequency of 100 MHz and test for a FM deviation accuracy at a 25 kHz rate using the modulation index for the first carrier null (2.401).

Step 1. Connect the signal source to the spectrum analyzer input. Set the source to 100 MHz.

Step 2. Change the signal source settings as follows:
a. Set the carrier frequency to 100 MHz
b. Set Span to 100 kHz

c. Set resolution bandwidth to 10 kHz
d. Set video bandwidth to 1 kHz

***NOTE**: Incidental AM from a source signal can cause the frequency null to shift, resulting in errors to the procedure above. Incidental AM is very low for most RF signal generators but can be significant in microwave signal generators. Non-symmetrical side lobes indicate the presence of incidental AM.*

Example 4: AM/FM Demodulation

Amplitude modulation (AM) and frequency modulation (FM) are common modulation techniques used to broadcast information. In the United States and Canada, the AM broadcast band is 535 kHz to 1605 kHz, while the FM broadcast band covers 88 MHz to 108 MHz.

Demodulation of AM and FM signals can be done with any spectrum analyzer with zero span capability and with a wide enough bandwidth to fully encompass the modulated signal, provided that the spectrum analyzer has a speaker or headset jack and AM/FM demodulator. (The Anritsu HHSA comes standard with built-in AM/FM demodulator, internal speaker and headset jack).

Example

Step 1. Provide a signal to the spectrum analyzer by connecting an antenna to the input port of the spectrum analyzer.

Step 2. Tune to the FM band by pressing the MEASURE key.

Step 3. Press DEMOD TYPE

Step 4. Select FM WIDEBAND by using the appropriate softkey

Step 5. Activate FM demodulation ON by using the appropriate softkey.

Step 6. Select the appropriate resolution bandwidth, video bandwidth and reference level to enhance the selection of desired signal. (For wide-band FM, the resolution bandwidth should be 1 MHz. Reference level should be roughly –30 dBm)

Step 7. Position the marker on the signal of interest. If the signal of interest is the highest in amplitude, press MARKER TO PEAK directly.

Step 8. To obtain continuous demodulation of the signal, set the span to zero span.

Step 9. Press FREQ/SPAN

Step 10. Select SPAN by using the appropriate softkey

Step 11. Select ZERO by using the appropriate softkey.

Setting the hand held spectrum analyzer to zero span will ensure continuous demodulation. Otherwise, demodulation will occur only during the spectrum analyzer sweep.

Example 5: Field Strength Measurements

All antennas have losses or gain that can cause errors in measurements. The MS2711A can correct for antenna loss or gain errors using Field Strength Measurements.

The antenna factors must be uploaded to the MS2711A using the Anritsu Software Tools provided with the unit. These antenna factors can then be used to correct for the measurement error.

Step 1. Enter the antenna factor information for the specific antenna into the antenna editor of the SW Tools.

Step 2. Upload the antenna factors to the MS2711A.

Step 3. Press the **MEAS** function key on the MS2711A.

Step 4. Select the FIELD STRENGTH soft key from the measurement menu.

Step 5. Press the SELECT ANTENNA soft key and use the Up/Down arrow key to select the desired antenna factor file. Press the **ENTER** key to select.

The MS2711A will now automatically scale the screen by the antenna factors entered.

Example 6: Creating a Spectral Mask

Quick go/no-go measurements can be performed by establishing test limits. When using test limits, the user is able to quickly identify signals exceeding established limits as failing. To aid users in establishing limits, the Anritsu HHSA features both single limit and multiple limit functions.

Example

Step 1. Connect a signal source to the Anritsu HHSA spectrum analyzer.

Step 2. Set the input frequency to 900 MHz and the signal level to - 20 dBm.

Step 3. Set the center frequency at 900 MHz, resolution bandwidth to 30 kHz, video bandwidth to 300 Hz, and the span to 20 MHz.

Step 4. Press LIMIT and select MULTIPLE UPPER LIMITS using the appropriate softkey.

Step 5. Select SEGMENT 1 using the appropriate softkey, and enter the start frequency, start limit, end frequency, and end limit as prompted in the message area.
(Hint: span is ten divisions wide; therefore divide span by 10 to determine span per division and desired starting point).
Enter start frequency = 890 MHz, start limit = -40, end frequency = 898 MHz, end limit = -40.

Step 6. Select SEGMENT 2 using the appropriate softkey, and enter the start frequency, start limit, end frequency, and end limit as prompted in the message area.
(Hint: start frequency and start limit should be equal to end frequency and end limit of Segment 1).

Enter start frequency = 898 MHz, start limit = -40, end frequency = 899 MHz, end limit = 0.

Step 7. Select SEGMENT 3 using the appropriate softkey, and enter the start frequency, start limit, end frequency, and end limit as prompted in the message area.
(Hint: start frequency and start limit should be equal to end frequency and end limit of Segment 2).
Enter start frequency = 899 MHz, start limit = 0, end frequency = 901 MHz, end limit = 0.

Step 8. Select SEGMENT 4 using the appropriate softkey, and enter the start frequency, start limit, end frequency, and end limit as prompted in the message area.
(Hint: start frequency and start limit should be equal to end frequency and end limit of Segment 3).
Enter start frequency = 901 MHz, start limit = 0, end frequency = 902 MHz, end limit = -40.

Step 9. Select SEGMENT 5 using the appropriate softkey, and enter the start frequency, start limit, end frequency, and end limit as prompted in the message area.
(Hint: start frequency and start limit should be equal to end frequency and end limit of Segment 4).
Enter start frequency = 902 MHz, start limit = -40, end frequency = 910 MHz, end limit = -40.

Example 7: Trace Overlay

The MS2711A HHSA can be used to compare frequency spectrums.

Example:

Step 1. Connect a signal source to the Anritsu HHSA spectrum analyzer.

Step 2. Set the input frequency to 900 MHz and the signal level to –20 dBm.

Step 3. Set the center frequency at 900 MHz, resolution bandwidth to 30 kHz, video bandwidth to 300 Hz, and the span to 20 MHz.

Step 4. Press the **TRACE** key.

Step 5. Select the A → B soft key to save the current runtime trace to the Trace B buffer.

Step 6. Set the input frequency to 901 MHz and the signal level to –20 dB.

Step 7. Press the TRACE B soft key to go to the Trace B menu.

Step 8. Select the VIEW B soft key to view the traces simultaneously.

Example 8: Power Monitor Measurements

A RF Wattmeter/Power meter option is also available on the Anritsu HHSA. Power meter measurement is accomplished using a broadband (1 MHz to 3000 MHz) RF detector. Measured power can be displayed in dBm or Watts.

Example

To use the power monitor, use must first set the Anritsu HHSA to the power monitor mode and zero the power monitor.

Step 1. Press the MODE key

Step 2. With no applied power to the DUT, press ZERO soft key from the power menu. Wait a few seconds while the Anritsu HHSA accumulates samples of the quiescent power level. When complete, ZERO ADJ: ON is displayed in the message area.

Step 3. Insert an attenuator between the DUT and the RF detector, sufficient to insure that the power to the Anritsu HHSA is no greater than 20 dBm.

Step 4. Press the OFFSET soft key.

Step 5. Enter the attenuation in dB using the keypad. Press ENTER to complete the entry. The message area will show OFFSET in ON along with the entered value in dB.

Step 6. Press the UNITS soft key to display power in Watts.

Step 7. With the desired base power level input to the Anritsu HHSA, press the REL soft key. The message area will show REL: ON and the power reading will indicate 100%.

Step 8. Press the UNITS soft key to display power in dBm. Since REL is ON, the power reading will be in dBr (relative to base power).

Chapter 5
Field Measurements

Introduction

This chapter provides examples of various field measurements:

- ❒ Occupied Bandwidth
- ❒ Power Monitor
- ❒ Adjacent Channel Power
- ❒ Out-of-Band Spurious Emissions
- ❒ In-Band Spurious Emissions
- ❒ Field Strength
- ❒ AM/FM Demodulation

Occupied Bandwidth

A common measurement performed on radio transmitters is that of occupied bandwidth (OBW). 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 to modulate the carrier.

XdB Down Method

The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is XdB below the peak carrier level.

N% Method

The occupied frequency bandwidth is calculated as the bandwidth containing N% of the power transmitted where N can be between 1% and 99%.

Occupied Bandwidth Measurement with the MS2711A

To make an occupied bandwidth measurement with the MS2711A hand held spectrum analyzer, perform the steps below.

Required Equipment

- ❒ MS2711A Hand Held Spectrum Analyzer
- ❒ 30 dB, 50 watt, Bi-Directional, DC – 18 GHz, N(m) – N(f), Attenuator
- ❒ Test Port extension cable, Anritsu 15NNF50 – 1.5A

Procedure

Step 1. Using the test port extension cable and 30 dB, 50 watt, Bi-directional attenuator, connect the MS2711A to appropriate transmit test port.

Step 2. Press the **ON/OFF** key on the MS2711A.

Step 3. Press the **MODE** key.

Step 4. Use the Up/Down arrow key to scroll to Spectrum Analyzer mode and press **ENTER**.

Step 5. Enter the center frequency of interest.

Step 6. Select the appropriate span, amplitude level, resolution and video bandwidths.

Step 7. Press the **MEAS** key.

Step 8. Once in the Measurement menu, press the OBW soft key in the active function block.

Step 9. Select measurement method (dB Down or % of Power) in the active function block by pressing the METHOD soft key.

Step 10. Adjust the dBc or % by pressing the appropriate key.

Step 11. Press MEASURE to initiate the measurement.

Adjacent Channel Power Leakage

Another common transmitter measurement is that of 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. Therefore, this test measures the amount of integrated power within adjacent channel bandwidths. The resulting signal level is determined by this amount of isolation between channels. In order to calculate the upper and lower adjacent channel values, the spectrum analyzer needs five parameters to be specified:

- ❒ Channels separation
- ❒ Measurement channel bandwidth
- ❒ Adjacent channel bandwidth (if different from the measurement channel bandwidth), and the center frequency of the reference channel
- ❒ Power level of the primary channel as well as the lower and upper adjacent channels.
- ❒ The adjacent channel power leakage measurement is applicable to both modulated and unmodulated signals and provides a means of assessing the transmitters selectivity.

Adjacent Channel Power Measurement with the MS2711A

To make a channel power measurement with the MS2711A hand held spectrum analyzer, simply execute the following steps.

Required Equipment

- ❒ MS2711A Hand Held Spectrum Analyzer
- ❒ 30 dB, 50 watt, Bi-Directional, DC – 18 GHz, N(m) – N(f), Attenuator
- ❒ Test Port extension cable, Anritsu 15NNF50 – 1.5A

Procedure

Step 1. Using the test port extension cable and 30 dB, 50 watt, Bi-directional attenuator, connect the MS2711A to appropriate transmit test port.

Step 2. Press the ON/OFF key on the MS2711A.

Step 3. Press the MODE key.

Step 4. Use the Up/Down arrow key to scroll to Spectrum Analyzer mode and press ENTER.

Step 5. Enter the center frequency for the channel of interest.

Step 6. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 7. Select the appropriate amplitude level, resolution and video bandwidths.

Step 8. Use markers to read and compare to the specified power level for adjacent channel power compliance.

Out-of-Band Spurious Emission Measurements

Out-of-band spurious measurements are made on signals outside the system band. These signals, which can interfere with other communication systems, can be categorized into harmonics and unknown spurious emissions. Real time monitoring of spurious emissions from a transmitter can uncover unwanted signals before they interfere with other users of the radio spectrum, rendering the transmitting system non-compliant. In order to determine compliance with the allowable level of spurious emissions, the spectrum analyzer needs three parameters to be specified:

- ❒ Measurement channel bandwidth (in band, Figure 5-1)
- ❒ Measurement channel bandwidth (out of band, Figure 5-1)
- ❒ Allowable level of spurious emissions

Out-of-band Spurious Measurement with the MS2711A

To make an out-of-band spurious measurement with the MS2711A hand held spectrum analyzer, simply execute the following steps.

Required Equipment

- ❒ MS2711A Hand Held Spectrum Analyzer
- ❒ 30 dB, 50 watt, Bi-Directional, DC – 18 GHz, N(m) – N(f), Attenuator
- ❒ Test Port extension cable, Anritsu 15NNF50 – 1.5A

Procedure

Step 1. Using the test port extension cable and 30 dB, 50 watt, Bi-directional attenuator, connect the MS2711A to appropriate transmit test port.

Step 2. Press the ON/OFF key on the MS2711A.

Step 3. Press the MODE key.

Step 4. Use the Up/Down arrow key to scroll to Spectrum Analyzer mode and press ENTER.

Step 5. Enter the center frequency for the channel of interest.

Step 6. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 7. Select the appropriate amplitude level, resolution and video bandwidths.

Step 8. Use limit line and markers to read and compare observed signals to the specified allowable level of out-of-band spurious emissions for the corresponding channel transmit frequency.

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 (1) in-band spurious emissions and (2) adjacent channel power ratio (also called spectral regrowth). There are stringent regulatory controls on the amount of interference that a transmitter can cause to neighboring channels. The standards specify the amount of interference allowed by the system. In order to determine compliance with the allowable level of spurious emissions, the spectrum analyzer needs two parameters to be specified:

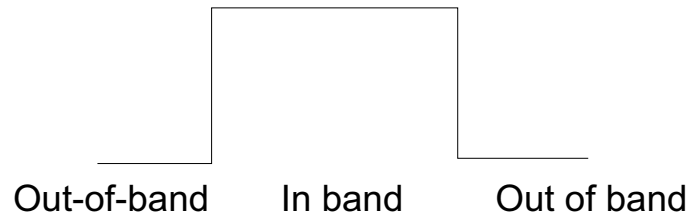

Figure 5-1. Example of In- and Out-of Bandwidth Signals

- ❒ Measurement channel bandwidth
- ❒ Allowable level of spurious emissions

In-band Spurious Measurement with the MS2711A

To make an out-of-band spurious measurement with the MS2711A hand held spectrum analyzer, simply execute the following steps.

Required Equipment

- ❒ MS2711A Hand Held Spectrum Analyzer
- ❒ 30 dB, 50 watt, Bi-Directional, DC – 18 GHz, N(m) – N(f), Attenuator
- ❒ Test Port extension cable, Anritsu 15NNF50 – 1.5A

Procedure

Step 1. Using the test port extension cable and 30 dB, 50 watt, Bi-directional attenuator, connect the MS2711A to appropriate receive test port.

Step 2. Press the ON/OFF key on the MS2711A.

Step 3. Press the MODE key.

Step 4. Use the Up/Down arrow key to scroll to Spectrum Analyzer mode and press ENTER.

Step 5. Enter the center frequency for the channel of interest.

Step 6. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

Step 7. Select the appropriate amplitude level, resolution and video bandwidths.

Use limit line and markers to read and compare observed signals to the specified allowable level of in-band spurious emissions for the corresponding channel transmit/receive frequency.

Signal resolution is determined by the intermediate frequency (IF) filter bandwidth. The hand held spectrum analyzer, as does conventional spectrum analyzers, traces the shape of its IF filter as it tunes past a signal. Thus, if two equal-amplitude signals are close enough in frequency, the filter shapes for the two signals can fall on top of one another and appear as a single response. Conversely, if two signals are not equal in amplitude but are still close together, the smaller signal can be hidden under the response of the larger one.

Field Strength

The procedure below details how to make field strength measurements.

Required Equipment

- ❒ MS2711A Hand Held Spectrum Analyzer
- ❒ 30 dB, 50 watt, Bi-Directional, DC – 18 GHz, N(m) – N(f), Attenuator
- ❒ Test Port extension cable, Anritsu 15NNF50 – 1.5A

Procedure

Step 1. Use the antenna editor feature of the Software Tools to define an antenna (see page 6-5).

Step 2. Upload the antenna information to the MS2711A HHSA (see page 6-5).

Step 3. Press the MEAS key.

Step 4. Select the FIELD STRENGTH soft key.

Step 5. Press the SELECT ANTENNA soft key.

Step 6. Use the Up/Down arrow key to choose the desired antenna and select by pressing the ENTER key.

Step 7. To change the unit of measurement, press the AMPLITUDE hard key, then press the UNITS soft key and select dB, dBV, dBmV or dBμV using the designated soft key.

The MS2711A HHSA will automatically scale the display by the antenna factors selected.

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 mW to μV in a 50-ohm system:

$$P = \frac{V^2}{R}$$

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

For power in milliwatts (10^{-3}W), and voltage in microvolts 10^{-6}V:

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

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

$$Pd = \frac{E^2}{120\pi}$$

where: E = field strength in V/m
P = Power density in W/m^2

Power density at a point:

$$P_d = \frac{P_t G_t}{4\pi r^2}$$

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

P_d = power density in W/m^2
P_t = power transmitted in Watts
G_t = gain of transmitting antenna
r = distance from the antenna in meters

Making Power Measurements with the Power Meter

Power measurement is accomplished using a broadband (1 MHz to 3000 MHz) RF detector, P/N 5400-71N50. The power monitor displays the measured power in dBm or Watts.

Entering Power Monitor Mode

Step 1. Press the MODE key.

Zeroing the Power Monitor

Step 2. With no power applied to the DUT, press the ZERO soft key from the Power menu. Wait a few seconds while the Anritsu HHSA accumulates samples of the quiescent power level. When complete, ZERO ADJ: ON is displayed in the message area.

Measuring High Input Power Levels

Step 3. Insert an attenuator between the DUT and the RF detector, sufficient to insure that the input power to the Anritsu is no greater the 20 dBm.

Step 4. Press the OFFSET soft key.

Step 5. Enter the attenuation in dB using the keypad. Press ENTER to complete the entry. The message area will show OFFSET is ON along with the entered value in dB.

Displaying Power in dBm and Watts

Step 6. Press the UNITS soft key to display power in Watts.

Displaying Relative Power

Step 7. With the desired base power level input to the Anritsu HHSA, press the REL soft key. The message area will show REL: ON and the power reading will indicate 100%.

Step 8. Press the UNITS soft key to display power in dBm. Since REL is ON, the power reading will be in dBr, relative to the base power level.

AM/FM Demodulation

Amplitude modulation (AM) and frequency modulation (FM) are common modulation techniques used to broadcast information. In the United States and Canada, the AM broadcast band is 535 kHz to 1605 kHz, while the FM broadcats band covers 88 MHz to 108 MHz.

Demodulation of AM and FM signals can be accomplished with the MS2711A hand held spectrum analyzer using zero span and a wide enough bandwidth to fully encompass the modulated signal. An alternative, and possibly easier, method of examining a demodulated signal with the MS2711A is to use the built-in AM/FM demodulator and speaker or optional external headset.

The following example illustrates the use of the MS2711A built-in AM/FM demodulator and speaker. The example includes tunning the hand held spectrum analyzer to the band of interest, activating and moving a marker to the signal that is to be demodulated, selecting the appropriate zero span, and demodulating and listening to the signal of interest with the built-in demodulator and speaker. To find the signal of interest for demodulation:

Step 1. Connect an antenna to the input port of the MS2711A.

Step 2. Press the **FREQ/SPAN** key

Step 3. Press the START soft key and enter 88 MHz

Step 4. Press the STOP soft key and enter 108 MHz

To demodulat an FM signal, you must first locate the signal you are trying to demodulate. Using a marker will facilitate this process:

Step 5. Press the **MARKER** key.

Step 6. Select the M1 soft key and then the ON/OFF soft key to activate marker 1.

Step 7. Select the EDIT soft key and set marker M1 to the signal of interest (if the signal of interest is the highest in amplitude, press the MARKER TO PEAK key).

The marker frequency should correspond to the desired signal of interest, and now becomes the center frequency which must be entered. To improve chances of receiving the desired signal, the attenuation setting should be set to zero and the resolution bandwidth should bet wide enough to encompass the entire demodulated signal, i.e., 1 MHz.

Step 8. Press the MEAS key and select AM/FM DEMOD to activate the demodulation function.

Step 9. Press the ON/OFF soft key to turn AM/FM demodulation on.

Step 10. Press the DEMOD TYPE soft key and select WIDE BAND FM.

Step 11. Press the VOLUME soft key, use the Up/down arrow key to adjust the volume setting and press **ENTER**

Step 12. Press the **FREQ/SPAN** key and the SPAN soft key.

Step 13. Select the ZERO soft key to select zero span.

Chapter 6
Software Tools Program

Description

The Anritsu Software Tools program provides the means for transferring the measured trace, along with any applied markers and/or limit line, to the screen of a personal computer (PC) running Windows 95/98/NT/2000.

Requirements

The Anritsu Software Tools program will run on any computer that runs Windows 95/98/NT/2000. Typically, this means having a PC with the following characteristics:

- Pentium or better microprocessor running enhanced mode (100 MHz or better, recommended).
- 32 MBytes of memory, minimum.
- Hard Disk Drive, with approximately 15 MBytes of available space.

Communication Port Setting

The Anritsu Software Tools communicates with the Anritsu through a standard COM port on the PC. It is important that your Windows COM port settings conform to the actual hardware settings. Since various add-in devices such as sound cards, modems, and network cards use IRQ (interrupts), it is possible that your computer has non-standard COM port settings. Please consult your computer vendor for COM port address and IRQ information.

Changing COM Port Settings–Windows 95/98/NT/2000

Refer to Figure 5-1 while performing the following procedure.

Step 1. Open the **Windows Control Panel**.

Step 2. Double click on the **SYSTEM** icon. The System Properties window appears.

Step 3. Select **Device Manager**. The Device List appears.

Step 4. Double click on the item **Ports (COM & LPT)** in the device list.

Step 5. Double click on the **Communications Port** you want to set. The Communications Port Properties window appears.

> ***NOTE**:*
> *If Windows doesn't show any available COM Ports, consult your computer manufacturer.*

Step 6. Choose **Port Settings**, then change to the following settings if necessary.
Baud Rate: 9600

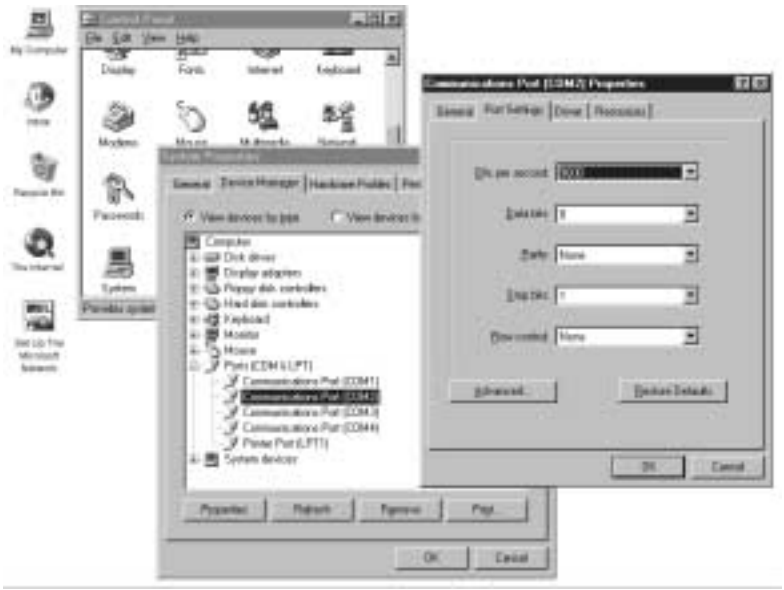

Figure 6-1. Windows 95 COM Port Setting Dialog Boxes

Data Bits: 8
Parity: None
Stop Bits: 1
Flow Control: None

Step 7. Choose **Resource** and verify the COM Port Base Address and IRQ. Click **OK** when done.

Step 8. Click **OK** again to close the System Properties window.

> ***NOTE**:*
> *If you changed the COM Port Base Address and/or IRQ, you will need to restart Windows.*

Software Installation

The Anritsu Software Tools program is a conventional Microsoft Windows program. Installation is similar to all other such programs. For users new to Windows, a detailed procedure is given below.

Step 1. Insert the Anritsu Anritsu Software Tools CD For Windows disk into the CD drive.

Step 2. Select Run under the Start menu.

Step 3. Type D: \SETUP.EXE, when the dialog box appears (Assumes CD ROM is drive D:).

Step 4. Press the Enter key to select the default directory, C:\PROGRAM FILES\SITEMASTER SOFTWARE TOOLS, and begin the Setup routine.

Step 5. When the Setup program prompts for the Program Group, select “Site Master Software Tools” and select CONTINUE.

***NOTE**: The Setup routine will create a new Program Manager Group named* "Site Master Software Tools".

Step 6. When the installation is complete, click OK.

Step 7. Double-click on the "Anritsu Software Tools " icon to open the Software Tools program.

Step 8. Click on Settings, in the top menu bar, and select Communications. Select the appropriate COM port number for the serial interface cable (null modem type).

Plot Capture

Plots (traces) can be captured either individually from the Anritsu HHSA display or in multiples from one or more stored-display locations. Both methods are described below.

The recommended method is the **Capture Multiple Traces** option in the **Capture** pull-down menu. Using this method, you can download to the Software Tools program in one operation all of the data residing in the up-to-70 Stored Display memory locations. The downloaded traces can be stored in a database or appear in cascade on the PC screen.

***NOTE**: Trace scale can be captured as per* Anritsu HHSA *or as autoscale by the capture program. To select per* Anritsu HHSA *or autoscaling, click on **Settings** and **Default Plot Settings** from the top menu bar and pull-down menu.*

Capture multiple to database

Step 1. Connect the supplied cable.

Step 2. Open the "Anritsu Software Tools" group, in the Windows Program Manager. (*Select the* **Windows** *pull-down menu from the Program Manager menu bar, and select* **Anritsu Software Tools**.)

Step 3. Double-click on the "**Anritsu Software Tools**" icon to open the program.

Step 4. Click on **Capture**, in the top menu bar, and select **Capture Multiple to Database** from the drop-down menu.

Step 5. Follow the database instructions to download the plot(s) to either a new database or an existing database.

Step 6. Enter the number(s) of the stored-display memory location(s) (1 to 50) from which you wish to store to the database, and click "OK".

Step 7. Observe that the "Acquiring Control" box appears on the screen, then disappears as traces are automatically acquired. The "Database" box appears when the plot(s) has been completely captured into the database.

Capture multiple traces to PC screen

Step1. Perform steps 1, 2, and 3 of the capture-multiple-to-database procedure.

Step2. Click on "**Capture Multiple Traces"** icon or click on **Capture**, in the top menu bar, and select **Capture Multiple Traces** from the drop-down menu.

Step3. Enter the number (or numbers) of the stored-display memory location(s) (1 to 50) from which you wish to display traces in Anritsu Software Tools or select from the drop-down list.

Step4. Select "OK."

Step5. Observe that the "Acquiring Control" box appears on the screen, then disappears as the traces are automatically acquired.

Single trace capture

Step1. Perform steps 1, 2, and 3 of the capture-multiple-to-database procedure.

Step2. Click on "**Start a Plot Capture**" icon or click on **Capture**, in the top menu bar, and select **Start Capture** from the drop-down menu.

Step3. Observe that a "Waiting for Data" box appears on the screen.

Step4. On the Anritsu HHSA,

Step5. Capture a new trace and store it to a memory location.

Step6. Recall the stored plot to the screen.

Step7. Press the ENTER key (on the Anritsu HHSA) to start the screen capture.

> ***NOTE**: The* ENTER *key on the Anritsu HHSA must be pressed while the PC screen shows "Waiting for Data" for the transfer of information to be complete.*

Step 8. On the PC, observe that the "Waiting for Data" box disappears and the trace capture process begins. Within a short time, the Anritsu HHSA trace will appear.

Program Operation

The captured trace on the PC can be scaled and have its limit line, markers, and properties changed. (Select **Plot Properties** under the **View** menu to make these changes.) The operation of the various menus that allow these operations to be accomplished is straightforward. To read about the operation of the menus, refer to the on-line help screens. They can be accessed from the **Help** menu, in the top menu bar.

Entering Antenna Factors

The antenna factor is a parameter of an antenna that is used in the calculation of field strength during radiated emissions measurement. It relates the voltage output of the measurement antenna to the value of the incident field producing that voltage. The units are volts output per volt/meter incident field or reciprocal meters. Antennas used for radiated emissions testing are individually calibrated (the antenna factor is directly measured) at all appropriate distances. The calibrations produce values that are defined as the "equivalent free space antenna factor." The calibration procedure corrects for the presence of the reflection of the antenna in the ground plane, giving the value that would be measured if the antenna were in "free space."

Step 1. Once the Site Master Software Tools has been opened, select Antenna Editor from the Tools menu on the tool bar. A pop-up box will appear on the screen of the PC.

Step 2. Click on "Edit Antenna" to enter an antenna name, description, frequencies, and antenna factors. Enter the frequencies in ascending order, starting with lowest frequency first. A maximum of 60 antenna factors may be entered. Use the arrow keys on the keyboard to move between entries.

NOTES: Only one input of frequency and antenna factor is allowed per row. Multiple antenna factors for a single antenna must be entered individually. For example, an antenna having an antenna factor of 5 from 2.0 to 2.25 GHz and an antenna factor of 4 from 2.25 to 2.5 GHz should be entered as follows:

Frequency (MHz)	Antenna Factor
2000	5
2251	4
2500	4

If necessary, an antenna factor of zero (0) may be entered.

Step 3. Select Save from the File menu to save the antenna factors to the hard disk.

Uploading Antenna Factors

To upload antenna information from Software Tools to the MS2711A:

Step 1. Connect the RS232 cable between the PC and the MS2711A.

Step 2. Click on the "Upload" button on the tool bar (or select Upload from the Tools menu). It is important to note that the MS2711A should sweep very quickly during the data transfer, at least at 5 seconds, otherwise the Software Tools program will default to a "time-out" condition (to improve chances of successful upload, increase RBW and VBW settings to the maximum position).

Step 3. To determine if the antenna information has been successfully uploaded to the MS2711A, press the measure function key (#4 key) and activate the field strength measurement by pressing the ON/OFF soft key.

Saving a Plot as a Windows Metafile

Plots can be saved as Windows Metafiles (.WMF). The metafile may be imported into other graphic programs, but cannot be reloaded into the Anritsu Software Tools program.

To save a plot as a Windows Metafile, click on **File**, in the top menu bar, and select **Save as Metafile** from the drop down menu.

Saving Data to a Spreadsheet

The data points from a plot can be exported to a spreadsheet via the clipboard. To transfer data to a Windows spreadsheet program:

Step 1. Select **Settings** and **Clipboard Format** from the top menu bar and pull-down menu and choose **Formatted Text**.

Step 2. Capture or load the desired plot.

Step 3. Copy the data to the clipboard by selecting the "**Copy to Clipboard**" icon or **Copy** from the Edit menu.

Step 4. Open the spreadsheet program and place the cursor where the first data point should appear.

Step 5. Select **Paste** from the spreadsheet program's Edit menu.

Saving Data as a Data File

The data points from a plot can be saved as a data file (.dat).

Step 1. Select the File menu.

Step 2. Select Save.

Step 3. Enter a file name and location.

Step 4. Click OK.

Saving Data to a Database

Plots can be saved to a database. Comments can be added to the plot data saved. Queries of the database provide a means of comparing plots in the database. Refer to the on-line help screens for operating instructions.

To save a plot to a database, click on **File**, in the top menu bar, and select **Save Plot to Database** from the drop-down menu.

“Drag-n-Drop”

Anritsu Software Tools is Windows based. Graphs can “Drag-n-Drop” onto each other. **Anritsu** Software Tools allows quick comparison of “before” and “after” measurements. Recent data is compared to a historical PC database record, which is usually recorded during site installation/commissioning.

Printing

Captured traces may be printed from a PC using Anritsu Software Tools. Once a captured trace has been downloaded choose **Print** under the **File** menu for printing options. The printer setup can be altered, plots can be scaled, and multiple plots can be printed from the Print dialog box.

Anritsu