

Anritsu

# Spectrum Master™ MS2721A

High Performance Handheld Spectrum Analyzer



SpectrumMaster 

100 kHz to 7.1 GHz

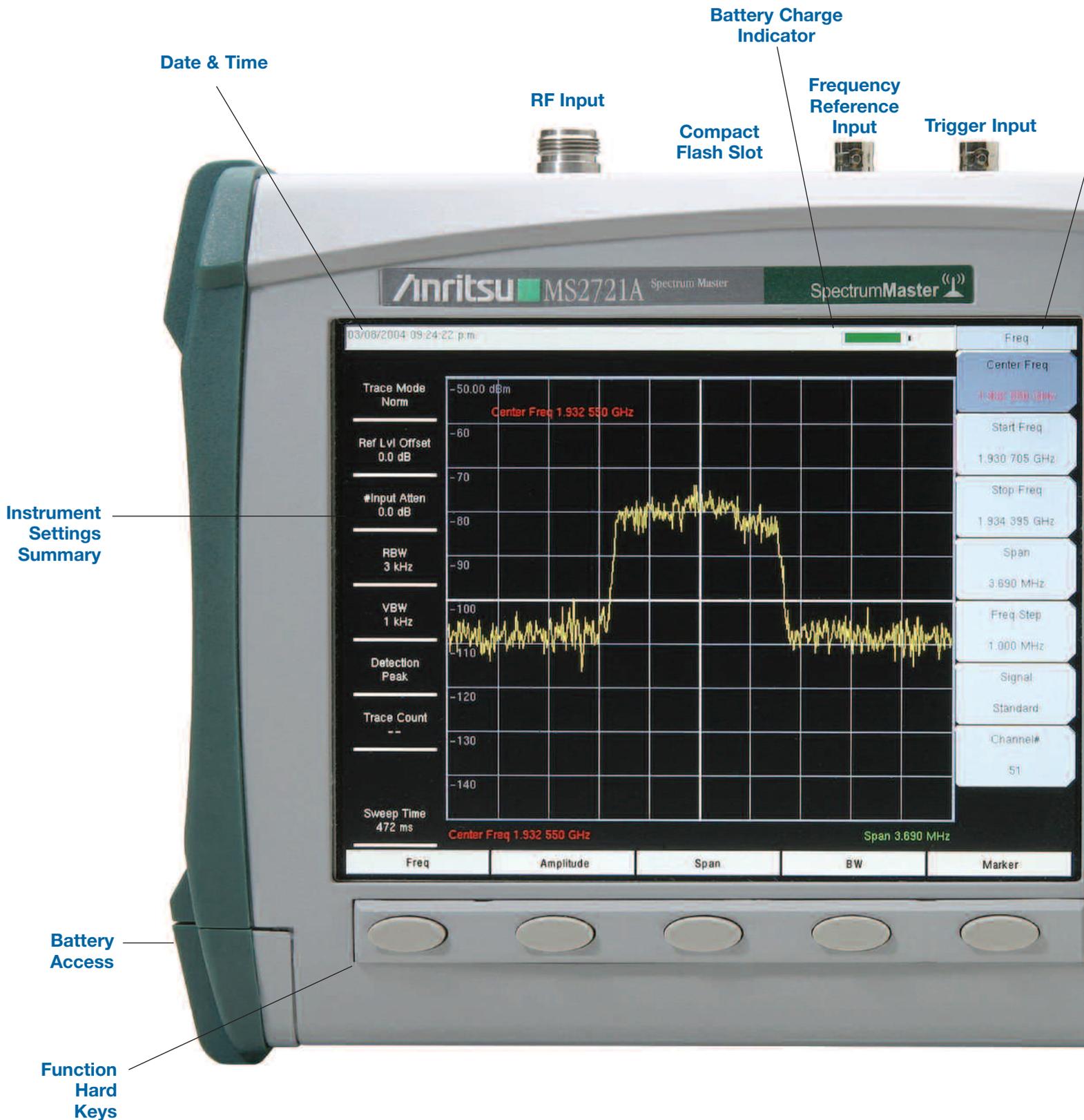
+43 dBm maximum safe input power

Ethernet and USB 2.0 remote control

-100 dBc/Hz @ 10 kHz offset at 7.1 GHz

# High Performance Handheld Spectrum Analyzer

The Anritsu MS2721A is the most advanced ultra-portable spectrum analyzer on the market, featuring unparalleled performance and size at a modest price.



# ≤-153 dBm Displayed Average Noise Level Typical @ 1 GHz

Unprecedented in handheld battery powered spectrum analyzers, the sensitivity of the MS2721A delivers the ability to measure very low level signals. Coupled with a wide range of resolution bandwidth choices, you can configure the Spectrum Master to meet your most challenging measurement needs.

As the spectrum becomes more and more congested, the ability to measure low level signals becomes more and more important not only for interference detection but also for wireless system planning.



Soft Key Active Function Block

Headset 2.5 mm

USB Jack

LAN Connector

Battery Charger Input

Speaker

On/Off Button

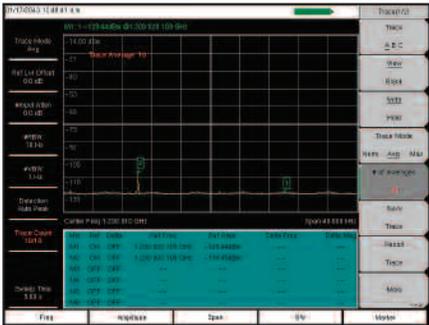
Directional Buttons

Rotary Knob

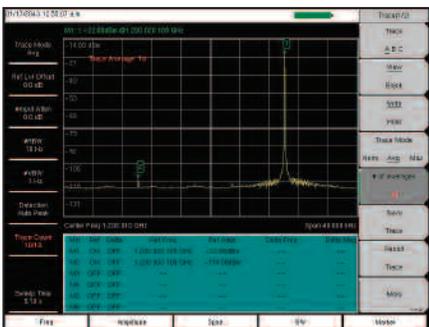
Soft Keys

Dual Function Keypad

# Field Use



Measuring a Small Signal



Wide Dynamic Range — Measuring a small signal in the presence of a very large signal

Operating convenience is of paramount importance when equipment is used in the field.

The input attenuation value can be tied to the reference level, reducing the number of parameters a field technician may have to set. The RBW/VBW and the span/RBW ratios can be set to values that are best for the measurements being made, further easing the technician’s burden and reducing the chances of errors.

Thousands of traces with names up to 15 characters long may be saved in the 64 MB non-volatile compact flash memory. These traces can later be copied into a PC using the built-in USB 2.0 connector or the 10/100 Mbit Ethernet connection.

Commonly needed measurements are built in. These include field strength, occupied bandwidth, channel power, adjacent channel power ratio, AM/FM/SSB demodulation and carrier to interference (C/I) ratio measurements.

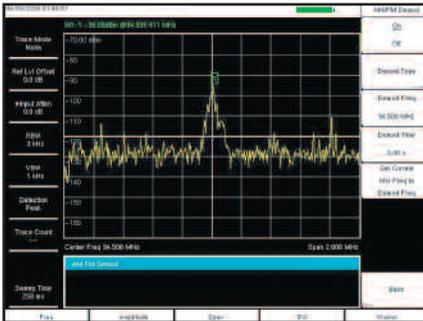
The MS2721A Spectrum Master has a very wide dynamic range, allowing measurement of very small signals in the presence of much larger signals. These pictures show a measurement of a –114 dBm signal with and without the presence of a –22 dBm signal only 20 kHz away.

Measurement Area	Wide RBW & VBW Range	AM/FM Demod	Channel Power	ACPR	OBW	Field Strength	C/I
Cellular Measurements			yes	yes	yes	yes	yes
WiFi Measurements			yes		yes	yes	yes
Spectrum Monitoring	yes	yes					
Interference Detection	yes	yes				yes	





# Features



AM, FM and SSB Demodulation

## Light Weight

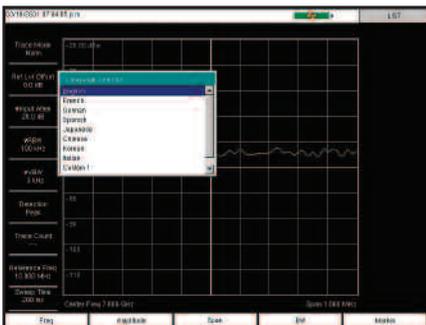
Weighing about six pounds fully loaded, including a Li-Ion battery, this fully functional handheld spectrum analyzer is light enough to take anywhere, including up a tower.

## AM/FM Demodulation

A built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows a technician to easily identify interfering signals. The demodulated audio can be heard either through the built-in speaker or through a standard headset. A demodulation marker is provided for easy tuning.

## Remote Tools

Imagine sitting at your desk while controlling an MS2721A that is miles away, seeing the screen display and operating with an interface that looks exactly like the instrument itself. That is what Remote Tools lets you do.



Multiple Language Support

## Local Language Support

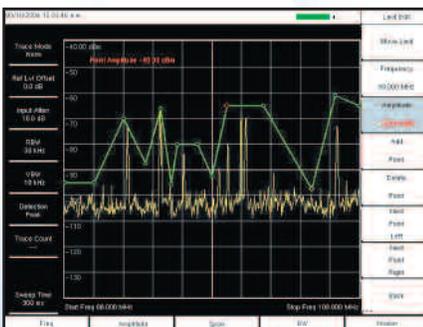
The MS2721A features eight languages English, Spanish, German, French, Japanese, Chinese, Italian and Korean, two custom user-defined languages can be uploaded into the instrument using Master Software Tools, supplied with the instrument.

## Fast Sweep Speed

The MS2721A can do a full span sweep in  $\leq 900$  milliseconds, and sweep speed in zero span can be set from 50 microseconds up to 4294 seconds. This is faster and more flexible than any portable spectrum analyzer on the market today, simplifying the capture of intermittent interference signals.

## +43 dBm Maximum Safe Input Level

Because the MS2721A can survive an input signal of +43 dBm (20 watts) without damage, you can rest assured that the MS2721A can survive in even the toughest RF environments.



Segmented Limit Lines

## Spectrum Monitoring

A critical function of any spectrum analyzer is the ability to accurately view a portion of the RF and microwave spectrum. The MS2721A performs this function admirably thanks to the wide frequency range and excellent dynamic range. A built-in 64 MB compact flash memory module allows thousands of traces to be stored. The external compact flash connector allows additional compact flash memory to expand the trace storage without limit.

## Limit Lines

The MS2721A includes two types of limit lines, lower limit lines and upper limit lines. Limit lines may be used either for visual reference or for pass/fail criteria by implementing limit alarms. Limit alarm failures are reported if a signal is above the upper limit line or below the lower limit line. Each limit line may consist of up to 40 segments.

# Features



Multiple Markers plus Multiple Delta Markers

## Multiple Markers

Display up to six markers on screen, each with delta marker capability. In addition, you may select a marker table that simultaneously shows the status of all markers. In the table you can see the frequency and amplitude measurement value for all markers, along with delta frequency and delta amplitude. Each marker can have not only a measurement reference frequency but also a delta frequency and delta amplitude, effectively giving you up to twelve markers if you need them!

## Noise Markers

The capability to measure noise level in terms of dBm/Hz or dB $\mu$ V/Hz is a standard feature of the MS2721A.

## Frequency Counter Markers

The MS2721A Spectrum Master has frequency counter markers with resolution to 1 Hz. Tie this capability to an external precision time base to get complementary accuracy.

### Functions

Multiple Marker

Display up to six markers on screen, each marker includes a delta marker.

Marker Table

Display a table of up to six marker frequency and amplitude values plus delta marker frequency offset and amplitude.

Upper/Lower Limit Fixed and Segmented

Each upper and lower limit can be made up of between one and 40 segments.

### Smart Measurements

Occupied Bandwidth

Measures 99.99% to 1% power bandwidth of a spectrum.

Channel Power

Measures the total power in a specified bandwidth.

C/I

Measures the carrier to interference ratio in a specified bandwidth.

ACPR

Measures power levels in the channels immediately above and below the center channel.

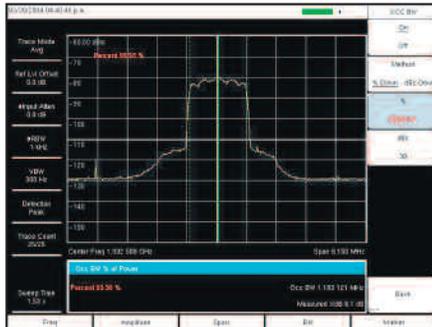
Field Strength

Uses antenna calibration tables to measure dBm/meter or dBmV/meter.

AM/FM/SSB Demodulation

Allows the user to listen to interfering signals. De-emphasis is included for narrow-band FM and wideband FM. Upper Sideband and Lower Sideband demodulation includes a BFO that can be tuned  $\pm 10$  kHz from the center frequency.

# Measurements



Occupied Bandwidth

## Smart Measurements

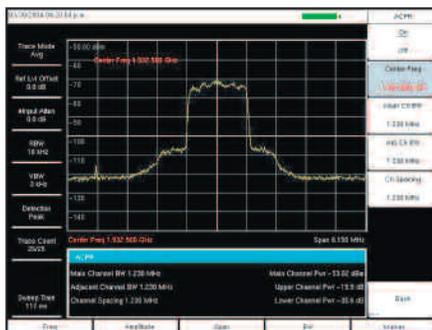
The MS2721A has dedicated routines for one-button measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR) and C/I. These are increasingly critical measurements for today's wireless communication systems. The simple interface for these complex measurements significantly reduces test time and increases analyzer usability.

## Fast Sweep Speed

The MS2721A can do a full span sweep in <900 milliseconds, and sweep speed in zero span can be set from 50 microseconds to 4294 seconds. This is faster and more flexible than any portable spectrum analyzer on the market today, simplifying the capture of intermittent interference signals.

## Carrier to Interference Measurement

As more 802.11 access points are installed, there is an increasing level of interference in the 2.4 GHz and 5.8 GHz bands occupied by this service and other devices such as cordless telephones. This measurement capability makes it simple for an access point installer to determine if the level of interference is sufficient to cause difficulty for users in the intended service area, and can show the need to change to another access channel. The wide frequency coverage of the MS2721A makes this the only spectrum analyzer you need to install and maintain 802.11a, 802.11b and 802.11g wireless networks.



Adjacent Channel Power Ratio

## Occupied Bandwidth

This measurement determines the amount of spectrum used by a modulated signal. You can choose between two different methods of determining bandwidth: the percent of power method or the "x" dB down method, where "x" can be from 3 dB to 100 dB down the skirts of the signal.

## Adjacent Channel Power Ratio

A common transmitter measurement is that of adjacent channel leakage power. This is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel, and is used to replace the traditional two-tone intermodulation distortion (IMD) test for system non-linear behavior.

The result of an ACPR measurement can be expressed either as a power ratio or a power density. In order to calculate the upper and lower adjacent channel values, the MS2721A allows the adjustment of four parameters to meet specific measurement needs: main channel center frequency, measurement channel bandwidth, adjacent channel bandwidth and channel spacing. When an air interface standard is specified in the MS2721A, all these values are automatically set to the normal values for that standard.

# Frequency

Frequency Range	100 kHz to 7.1 GHz
Tuning Resolution	1 Hz
Frequency Reference	Aging $\pm 1$ ppm/year Accuracy $\pm 1$ ppm (25°C $\pm 25$ °C) + long term drift
Frequency Span	10 Hz to 7.1 GHz plus 0 Hz (zero span)
Span Accuracy	Accuracy $\pm 1$ ppm (25°C $\pm 25$ °C) + long term drift
Sweep Time	minimum 100 ms, 50 $\mu$ s in zero span
Sweep Time Accuracy	$\pm 2\%$ in zero span
Sweep Trigger	Free run, Single, Video, External
Resolution Bandwidth	(-3 dB width) 10 Hz to 3 MHz in 1-3 sequence $\pm 10\%$ , 8 MHz demodulation bandwidth
Video Bandwidth	(-3 dB) 1 Hz to 3 MHz in 1-3 sequence
SSB Phase Noise	-100 dBc/Hz max at 10, 20 and 30 kHz offset from carrier -102 dBc/Hz max at 100 kHz offset from carrier

# General

Maximum Continuous Input	$\geq 10$ dB attenuation, +30 dBm
Input Damage Level	$\geq 10$ dB attenuation, $> +43$ dBm, $\pm 50$ Vdc <10 dB attenuation, $> +23$ dBm, $\pm 50$ Vdc Input protection relay opens at $> 30$ dBm with $\geq 10$ dB input attenuation and at approximately 10 to 23 dBm with <10 dB attenuation
RF Input VSWR	2.0:1 maximum, 1.5:1 typical ( $\geq 10$ dB attenuation)
Reference Level	Adjustable over amplitude range
ESD Damage Level	$> 10$ kV $\geq 10$ dB attenuation

# Amplitude

Measurement Range	DANL to +30 dBm
Absolute amplitude accuracy Power levels $\geq -50$ dBm, $\geq 35$ dB input attenuation, preamp off	100 kHz to $\leq 10$ MHz $\pm 1.5$ dB $> 10$ MHz to 4 GHz $\pm 1.25$ dB $> 4$ GHz to 7.1 GHz $\pm 1.75$ dB
Second Harmonic Distortion (0 dB input attenuation, -30 dBm input)	-50 dBc, 0.05 to 0.75 GHz -40 dBc, $> 0.75$ to 1.05 GHz -50 dBc, $> 1.05$ to 1.4 GHz -70 dBc, $> 1.4$ to 2 GHz -80 dBc, $> 2$ GHz

# Amplitude

## Third Order Intercept (TOI) (preamplifier off)

-20 dBm tones 100 kHz apart  
-20 dBm reference level  
0 dB attenuation

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

## Displayed Average Noise Level

DANL in 10 Hz RBW, 0 dB attenuation  
reference level -50 dBm

Frequency	Preamp On	
	Typical	Max
10 MHz to 1 GHz	-153 dBm	-151 dBm
>1 GHz to 2.2 GHz	-150 dBm	-149 dBm
>2.2 GHz to 2.8 GHz	-146 dBm	-143 dBm
>2.8 GHz to 4.0 GHz	-150 dBm	-149 dBm
>4.0 GHz to 7.1 GHz	-148 dBm	-144 dBm

## Noise Figure (Derived from DANL measurement)

0 dB attenuation, reference level  
-50 dBm, 23°C, preamp on

Frequency	Typical
10 MHz to 1.0 GHz	11 dB
>1 GHz to 2.2 GHz	14 dB
>2.2 GHz to 2.8 GHz	18 dB
>2.8 GHz to 4.0 GHz	14 dB
>4.0 GHz to 7.1 GHz	16 dB

## Display Range

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

## Amplitude Units

Log Scale modes: dBm, dBV, dBmV, dBμV  
Linear Scale modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW

## Attenuator Range

0 to 65 dB

## Attenuator Resolution

5 dB steps

## Input-Related Spurious

-60 dBc max\*, (<-70 dBc typical), -30 dBm input, 0 dB RF attenuation

### \*Exceptions:

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

## Residual Spurious, Preamp Off

(RF input terminated, 0 dB RF attenuation)

-90 dBm max\*\*, 100 kHz to <3200 MHz  
-84 dBm max\*\*, 3200 to 7100 MHz

### \*\*Exceptions:

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

## Residual Spurious, Preamp On:

-100 dBm max  
(RF input terminated, 0 dB RF attenuation)

## Display

Bright Color Transmissive LCD, Full SVGA, 8"

## Languages

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

## Marker Modes

Six Markers, Seven Modes: Standard, Delta, Marker to Peak, Marker to Center, Marker to Reference Level, Next Peak Left, Next Peak Right, All Markers Off, Noise Marker, Frequency Counter Marker (1 Hz resolution)

## Sweeps

Full span, Zero span, Span Up/Span Down

## Detection

Peak, RMS, Negative, Sample

## Memory

Trace and Setup storage is limited only by the capacity of the installed Compact Flash card. For a 256 MB card, storage is greater than 5000 traces and 5000 setups.

## Traces

Displayed Traces: Three traces with trace overlay. One trace is always the live data, two traces can be either stored data or traces which have been mathematically manipulated (such as  $C=A-B$ ).

## Interfaces

Type N female RF Connector  
BNC female connectors for external frequency reference and external trigger  
Mini-B USB 2.0 for data transfer to a PC  
RJ45 connector for Ethernet 10/100-BaseT  
2.5 mm 3-wire headset connector

## Size and Weight

Size: 12 x 7 x 2.4 in. (313 x 211 x 77 mm)  
Weight: <6.4 lbs. (2.9 kg) (typical)

## Environmental

MIL-PRF-28800F Class 2  
Operating:  $-10^{\circ}\text{C}$  to  $55^{\circ}\text{C}$ , humidity 85% or less  
Storage:  $-51^{\circ}\text{C}$  to  $71^{\circ}\text{C}$   
Altitude: 4600 meters, operating and non-operating

## Safety

Conforms to EN 61010-1 for Class 1 portable equipment

## Electromagnetic Compatibility

Meets European Community requirements for CE marking

Specifications are subject to change without notice.

# Ordering Information

Model: MS2721A - Handheld Spectrum Analyzer  
100 kHz to 7.1 GHz

## Standard Accessories

10580-00103	User's Guide
61382	Soft Carrying Case
40-168	AC – DC Adapter
806-62	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	Master Software Tools CD ROM
2000-1360	USB A-mini B cable
2000-1371	Ethernet Cable
633-44	Rechargeable battery, Li-Ion
2000-1358	64 MB Compact Flash Memory Module
1091-172	Adapter, N(m) to BNC, 50Ω
1091-27	Adapter, N(m) to SMA(f), 50Ω
64343	Tilt Bale Stand Accessory

One Year Warranty

Certificate of Calibration and Conformance

## Optional Accessories

42N50A-30	30 dB, 50 Watt, Bi-directional, DC to 18 GHz, N(m) to N(f) Attenuator
34NN50A	Precision Adapter, DC to 18 GHz, 50Ω, N(m) to N(m)
34NFN50	Precision Adapter, DC to 18 GHz, 50Ω, N(f) to N(f)
15NNF50-1.5B	Test port cable, armored, 1.5 meter N(m) to N(f) 18 GHz
15ND50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(m), 6.0 GHz
15NDF50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(f), 6.0 GHz
510-90	Adapter, 7/16 DIN(f) to N(m), DC to 7.5 GHz, 50Ω
510-91	Adapter, 7/16 DIN(f) to N(f), DC to 7.5 GHz, 50Ω
510-92	Adapter, 7/16 DIN(m) to N(m), DC to 7.5 GHz, 50Ω
510-93	Adapter, 7/16 DIN(m) to N(f), DC to 7.5 GHz, 50Ω
510-96	Adapter 7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50Ω
1030-86	Band Pass Filter, 800 MHz band, 806-869 MHz, Loss = 1.7 dB, N(m) to SMA(f)

1030-87	Band Pass Filter, 900 MHz band, 902-960 MHz, Loss = 1.7 dB, N(m) to SMA(f)
1030-88	Band Pass Filter, 1900 MHz band, 1.85-1.99 GHz, Loss = 1.8 dB, N(m) to SMA(f)
1030-89	Band Pass Filter, 2400 MHz band, 2.4-2.5 GHz, Loss = 1.9 dB, N(m) to SMA(f)
510-97	Adapter 7/16 DIN(f) to 7/16 DIN(f), 7.5 GHz
61382	Soft carrying case
64343	Tilt Bale Stand Accessory
40-168	AC/DC adapter
806-62	Automotive Cigarette Lighter/12 Volt DC Adapter
760-235	Transit Case for Anritsu MS2721A Handheld Spectrum Analyzer
2300-498	Anritsu Master Software Tools CD ROM
10580-00103	Anritsu HHSA User's Guide, Model MS2721A
10580-00104	Anritsu HHSA Programming Manual, Model MS2721A
10580-00105	Anritsu HHSA Maintenance Manual, Model MS2721A
633-44	Rechargeable battery, Li-Ion
2000-1374	Dual External, Li-Ion charger with universal power supply
2000-1030	Portable antenna, 50Ω, SMA(m) 1.71-1.88 GHz
2000-1031	Portable antenna, 50Ω, SMA(m) 1.85-1.99 GHz
2000-1032	Portable antenna, 50Ω, SMA(m) 2.4-2.5 GHz
2000-1035	Portable antenna, 50Ω, SMA(m) 896-941 MHz
2000-1200	Portable antenna, 50Ω, SMA(m) 806-869 MHz
2000-1361	Portable antenna, 50Ω, SMA(m) 5725-5825 MHz
2000-1358	64 MB Compact Flash Memory Module

## Directional Antennas

2000-1411	Portable Yagi antenna, 10 dBd, N(f) 822-900 MHz
2000-1412	Portable Yagi antenna, 10 dBd, N(f) 885-975 MHz
2000-1413	Portable Yagi antenna, 10 dBd, N(f) 1.71-1.88 GHz
2000-1414	Portable Yagi antenna, 9.3 dBd, N(f) 1.85-1.99 GHz
2000-1415	Portable Yagi antenna, 10 dBd, N(f) 2.4-2.5 GHz
2000-1416	Portable Yagi antenna, 10 dBd, N(f) 1.92-2.23 GHz



## SALES CENTERS:

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