

# High Performance 9 kHz to 7.1 GHz Handheld Spectrum Analyzer

## MS2721B Spectrum Master™

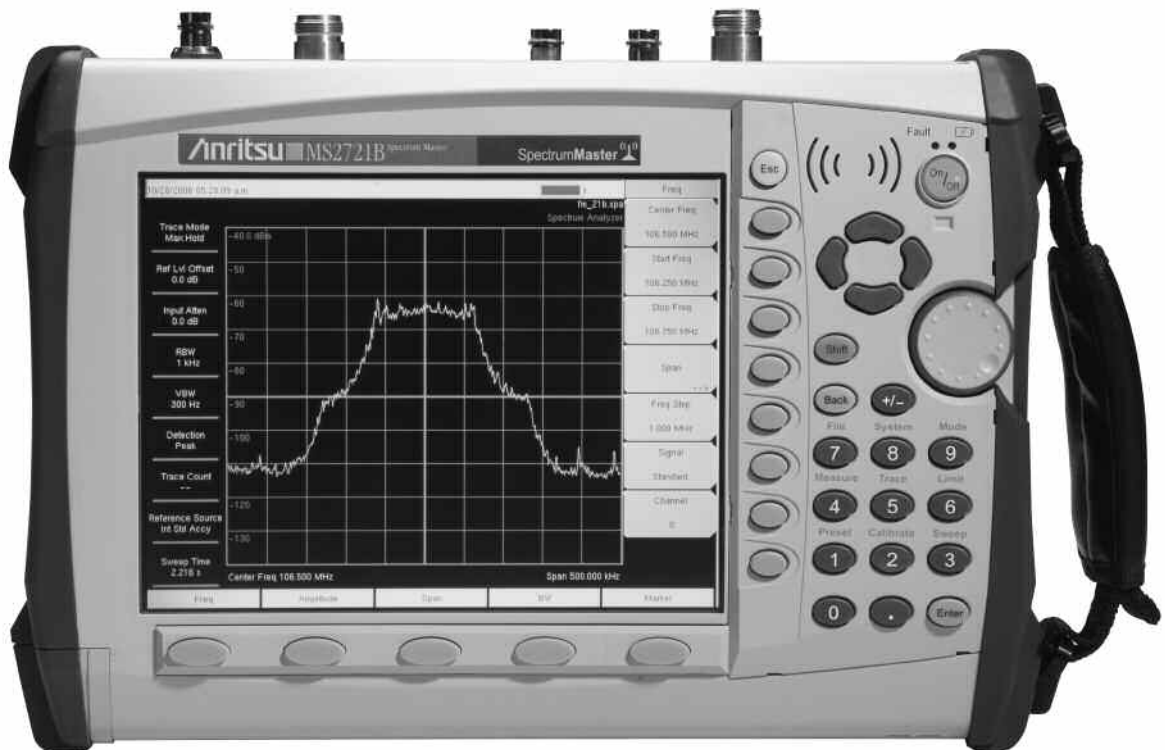
### Introduction

Continuous frequency coverage from 9 kHz to 7.1 GHz gives the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments.

Whether you need spectrum monitoring, AM and FM broadcast proofing, WiFi and WiFi5 installation and testing, RF and microwave signal measurements or cellular signal measurements, the MS2721B Spectrum Master is the tool to make your job easier and more productive.

### High Performance Highlights

- 9 kHz to 7.1 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise  
(-100 dBc/Hz Maximum at 10 kHz offset at 100 kHz to 7.1 GHz)
- Built-in AM/FM/SSB Demodulator
- Built-in Preamplifier
- 65 dB Step Attenuator
- Input Protected to 20 Watts
- True RMS Detection
- 2+ Hours of Battery Life
- 3.1 kg (<6.9 lbs)
- 3G Modulation options
- Tracking Generator option
- GPS Receiver option
- Now includes quasi-peak detector and CISPR bandwidths



The Anritsu MS2721B is the most advanced ultra-portable spectrum analyzer on the market, featuring unparalleled performance at a modest price.

## Features and Options

### Functions

**Multiple Marker:** Display up to six markers on screen. Each marker includes a delta marker, effectively allowing up to 12 markers on screen. The user may also set marker 1 to be the reference for 6 delta markers.

**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% to 1% power channel of a signal.

**Channel Power:** Measures the total power in a specified bandwidth.

**C/I:** Measures carrier to interference ratio.

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

**Field Strength:** Uses antenna calibration tables to measure dBm/meter<sup>2</sup> or dBmV/meter.

## Specifications

### Frequency

**Frequency Range:** 9 kHz to 7.1 GHz

**Tuning Resolution:** 1 Hz

**Frequency Reference:**

**Aging:** ±1 ppm per 10 years

**Accuracy:** ±0.3 ppm (25°C ± 25°C) + aging

**Frequency Span:** 10 Hz to 7.1 GHz plus 0 Hz (zero span)

**Span Accuracy:** Same as frequency reference accuracy

**Sweep Time:**

Zero span: 10 μs to 600s

Spans >0 Hz: Sweep time is automatically optimized.

Can be manually increased

**Sweep Time Accuracy:** ±2% in zero span

**Sweep Trigger:** Free run, Single, Video, External

**Resolution Bandwidth:** (-3 dB) 1 Hz to 3 MHz in 1-3 sequence ±10%, 200 Hz, 9 kHz, 120 kHz when quasi-peak detector selected, 10 MHz demodulation bandwidth

**Video Bandwidth:** (-3 dB) 1 Hz to 3 MHz in 1-3 sequence

**SSB Phase Noise:**

Offset from carrier	Max
10, 20 and 30 kHz	-100 dBc/Hz
100 kHz	-102 dBc/Hz

### Amplitude

**Measurement Range:** DANL to +30 dBm

**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

**Absolute Amplitude Accuracy:**

**Power levels:**

≥-50 dBm, ≤35 dB input attenuation

9 kHz to ≤10 MHz ±1.5 dB

>10 MHz to 4 GHz ±1.25 dB

>4 to 7.1 GHz ±1.75 dB

40 to 55 dB input attenuation

9 kHz to ≤10 MHz ±1.5 dB

>10 MHz to 4 GHz ±1.75 dB

>4 to 6.5 GHz ±1.75 dB

>6.5 to 7.1 GHz ±2 dB

60 to 65 dB input attenuation

9 kHz to ≤10 MHz ±1.5 dB

>10 MHz to 6.5 GHz ±1.75 dB

>6.5 to 7.1 GHz ±3 dB

Preamplifier on, 0 or 10 dB input attenuation

9 kHz to 4 GHz ±1.5 dB

>4 to 7.1 GHz ±1.75 dB

### Second Harmonic Distortion

**(0 dB input attenuation, -30 dBm input):**

0.05 to 1.4 GHz -50 dBc

>1.4 to 2 GHz -70 dBc

>2 GHz -80 dBc

### Third Order Intercept (TOI):

**(-20 dBm tones 100 kHz apart, -20 dBm Ref level, 0 dB input attenuation, preamplifier off)**

Frequency	Min
600 MHz	+7 dBm
3.5 GHz	+9 dBm

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

### Dynamic Range 2/3 (TOI-DANL) in 1 Hz RBW:

600 MHz 95 dB min

3.5 GHz 96 dB min

### Displayed Average Noise Level (DANL) in 1 Hz RBW:

Frequency	Preamplifier On		Preamplifier Off	
	Typical	Max	Typical	Max
10 MHz to 1 GHz	-163	-161	-140	-137
>1 GHz to 2.2 GHz	-160	-159	-136	-133
>2.2 to 2.8 GHz	-156	-153	-130	-126
>2.8 to 4.0 GHz	-160	-159	-139	-136
>4.0 to 7.1 GHz	-158	-154	-131	-127

(0 dB input attenuation, RMS detection, Reference level = -20 dBm for preamplifier off and -50 dBm for preamplifier on)

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

### Equivalent Noise Figure, 23°C:

**(Preamplifier on, 0 dB input attenuation)**

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

### Input-Related Spurious:

**(-30 dBm input, 0 dB input attenuation, Span <1.7 GHz)**

-70 dBc typical -60 dBc max

### Residual Spurious:

**(Preamplifier on, RF input terminated, 0 dB input attenuation)**

-100 dBm max

**(Preamplifier off, RF input terminated, 0 dB input attenuation)**

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

-84 dBm max\*\*, 3200 to 7100 MHz

### \*\*Exceptions:

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

## Options Specifications

### *IQ Demodulation Hardware (Option 9)*

Hardware needed to run any of the demodulation options

### *PSN50 High Accuracy Power Meter (Option 19)*

#### PSN50 Sensor:

**Measurement Range:** -30 dBm to +20 dBm

**Frequency Range:** 50 MHz to 6 GHz

**Input Connector:** Type N, male, 50Ω

**Max Input Without Damage:** +33 dBm, ±25 VDC

**Input Return Loss:** 50 MHz to 2 GHz: ≥26 dB  
2 GHz to 6 GHz: ≥20 dB

#### PSN50 Accuracy:

**Total RSS Measurement Uncertainty (0°C to 50°C):** ±0.16 dB\*

**Noise:** 20 nW max

**Zero Set:** 20 nW

**Zero Drift:** 10 nW max\*\*

**Sensor Linearity:** ±0.13 dB max

**Instrumentation Accuracy:** 0.00 dB

**Sensor Cal Factor Uncertainty:** ±0.06 dB

**Temperature Compensation:** ±0.06 dB max

**Continuous digital modulation uncertainty:** ±0.06 dB (+17 to +20 dBm)

#### PSN50 System:

**Measurement Resolution:** 0.01 dB

**Offset Range:** ±60 dB

**Power Requirements:**

**Supply Voltage:** 8 to 18 Vdc (supplied by instrument via USB connector)

**Supply Current:** <100 mA

### *Tracking Generator (Option 20)*

**Frequency Range:** 100 kHz to 7.1 GHz

**Frequency Resolution:** 1 Hz

**Frequency Accuracy (25°C ±25 °C):** Same as spectrum analyzer

**Output Power:** 0 dBm to -40 dBm

**Step Size:** 0.1 dB nominal

**Level Accuracy (15°C to 35°C):** ±1.5 dB max, 450 kHz to 7.1 GHz,  
excluding SWR effects

**Zero Span Behavior:** CW Output

**Output Connector:** Type N female, 50Ω

**Damage Levels:** +23 dBm  
±50V DC (limited dv/dt)  
2 kV ESD

### *Interference Analyzer (Option 25)*

**Signal Strength:** Gives visual and aural indication of signal strength

**RSSI:** Collect data up to 72 hours

**Spectrogram:** Collect data up to 72 hours

### *Channel Scanner (Option 27)*

**Number of Channels:** 1 to 20

### *GPS (Option 31)*

**GPS Location Indicator:** Latitude, Longitude and Altitude on display  
Latitude, Longitude and Altitude with trace storage

**GPS High Frequency Accuracy when GPS antenna is connected:**  
±25 ppb with GPS ON, 3 minutes after satellite lock in the selected operating mode

**Internal High Accuracy, when GPS antenna is not connected:**

Better than ±50 ppb for 3 days from a High Accuracy GPS Lock  
and within 0°C to 50°C ambient temperature

**Connector:** Reverse polarity BNC

### *WCDMA/HSDPA OTA (Option 35)*

**Resolution:** 0.1 dB

### *GSM/GPRS/EDGE RF Measurements (Option 40)*

**Occupied Bandwidth:** Bandwidth within which 99% of the power  
transmitted on a single channel lies

**Burst Power:** ±1 dB typical for -50 dBm to +20 dBm (±1.5 dB max)

**Frequency Error:** ±10 Hz + time base error, 99% confidence level

### *GSM/GPRS/EDGE Demodulator (Option 41)*

**GSMK Modulation Quality**

**(RMS Phase) Measurement Accuracy:** ±1°

**Residual Error (GSMK):** 1°

**8PSK Modulation Quality**

**(EVM) Measurement Accuracy:** ±1.5%

**Residual Error (8PSK):** 2.5%

### *WCDMA/HSDPA RF Measurements (Option 44)*

**Frequency Ranges:** 824 to 894 MHz, 1710 to 2170 MHz, 2300 to 2700 MHz

**RF Channel Power (Temperature range 15°C to 35°C):**

±0.7 dB typical      ±1.25 dB max

**Occupied Bandwidth Accuracy:** ±100 kHz

**Residual Adjacent Channel Leakage Ratio (ACLR)\*\*\***

**(824 to 894 MHz, 1710 to 2170):** -54 dB typical at 5 MHz offset  
-59 dB typical at 10 MHz offset

**Leakage Ratio (ACLR)\*\*\***

**(2300 to 2700 MHz):** -54 dB typical at 5 MHz offset  
-57 dB typical at 10 MHz offset

**ACLR Accuracy (Single Channel Active)**

**(824 to 894 MHz, 1710 to 2170 MHz):**

±0.8 dB for ACLR ≥-45 dB at 5 MHz offset

±0.8 dB for ACLR ≥-50 dB at 10 MHz offset

**ACLR Accuracy (Single Channel Active) (2300 to 2700 MHz):**

±1.0 dB for ACLR ≥-45 dB at 5 MHz offset

±1.0 dB for ACLR ≥-50 dB at 10 MHz offset

**Frequency Error:**

±10 Hz + time base error, 99% confidence level

\* Excludes mismatch errors.

Excludes noise, zero set, zero drift for levels <-20 dBm.

Excludes digital modulation uncertainty between +17 and +20 dBm.

\*\* After 30 min warm-up

\*\*\* Depends on reference level, input signal level and single channel conditions

\*\*\*\* Will vary with amount of data burst traffic

## *WCDMA Demodulation and WCDMA/HSDPA Demodulator (Options 45 and 65)*

### **EVM Accuracy\*\*\* (824 to 894 MHz, 1710 to 2170 MHz):**

(3GPP Test Model 4)  $\pm 2.5\%$ ;  $6 \leq \text{EVM} \leq 25\%$

### **EVM Accuracy\*\*\* (2300 MHz to 2700 MHz):**

(3GPP Test Model 5)  $\pm 2.5\%$ ;  $6 \leq \text{EVM} \leq 20\%$

**Residual EVM:** 2.5% typical

**Code Domain Power:**  $\pm 0.5$  dB for code channel power  $> -25$  dB

16, 32, 64 DCPH (test model 1)

16, 32 DCPH (test model 2, 3)

**CPICH (dBm) Accuracy:**  $\pm 0.8$  dB typical

**Scrambling Code:** 3 seconds

## *Fixed WiMAX RF Measurements (Option 46)*

**Channel Power Accuracy\*\*\*:**  $\pm 1$  dB typical for  $+20$  dBm to  $-50$  dBm

( $\pm 1.5$  dB max)

## *Fixed WiMAX Demodulator (Option 47)*

**Residual EVM (rms):** 3% for  $+20$  dBm to  $-50$  dBm (3.5% max.)

**Frequency Error:**  $\pm 10$  Hz + time base error, 99% confidence level

## **General**

**RF Input VSWR:** ( $\geq 10$  dB input attenuation) 2.0:1 max, 1.5:1 typical

**Maximum Continuous Input:** ( $\geq 10$  dB input attenuation)  $+30$  dBm

**Input Damage Level:**

$\geq 10$  dB input attenuation,  $> +43$  dBm,  $\pm 50$  Vdc

$< 10$  dB input attenuation,  $> +23$  dBm,  $\pm 50$  Vdc<sup>2</sup>

<sup>1</sup>Input protection relay opens at  $> 30$  dBm with  $\geq 10$  dB input attenuation and at approximately 10 to 23 dBm with  $< 10$  dB input attenuation.

<sup>2</sup>with limited dV/dt.

**ESD Damage Level:** ( $\geq 10$  dB input attenuation)  $> 10$  kV

**External Reference Frequencies:** 1, 1.2288, 1.544, 2.048, 2.4576, 4.8,

4.9152, 5, 9.8304, 10, 13 and 19.6608 MHz at  $-10$  dBm to  $+10$  dBm

**Battery Life:** 2.5 hours typical

## *Display*

**Bright daylight-viewable color transmissive LCD:** Full SVGA, 8 in.

## *Languages*

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

## *Marker Modes*

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

## *Sweeps*

Full span, Zero span, Span Up/Span Down

## *Detection*

Peak, Negative peak, Sample, RMS, Quasi-peak

## *Memory*

Trace and Setup storage is limited only by the capacity of the installed Compact Flash card or USB Flash drive. For a 256 MB card, storage is greater than 13000 spectrum analyzer traces and over 10000 setups.

## *Traces*

**Displayed Traces:** Three Traces with trace overlay. Trace A is always the live data; Traces B and C can be either stored data or traces which have been mathematically manipulated. Also Trace C can show max hold or min hold.

## *Interfaces*

Type N female RF connector for Spectrum Analyzer input

Type N female RF connector for optional Tracking Generator

Reverse polarity BNC jack for optional GPS antenna connector

BNC female connectors for ext. reference and ext. trigger

5-pin Mini-B USB 2.0 for data transfer to a PC

USB 2.0 Host connector used with PSN50 High Accuracy Power Meter and USB Flash Drives

RJ45 connector for Ethernet 10/100 Base T

2.5 mm 3-wire headset connector

## *Size and Weight*

**Size:** 313W x 211H x 77D mm (12W x 8H x 3D in.)

**Weight:** 3.1 kg (<6.9 lbs.) 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.

\* Excludes mismatch errors.

Excludes noise, zero set, zero drift for levels  $< -20$  dBm.

Excludes digital modulation uncertainty between  $+17$  and  $+20$  dBm.

\*\* After 30 min warm-up

\*\*\* Depends on reference level, input signal level and single channel conditions

\*\*\*\* Will vary with amount of data burst traffic

## Ordering Information

### Model

#### MS2721B Handheld Spectrum Analyzer

9 kHz to 7.1 GHz

### Options

Option MS2721B-009	IQ Demodulation Hardware
Option MS2721B-019	High Accuracy Power Meter (PSN50 sensor not included)
Option MS2721B-020	Tracking Generator
Option MS2721B-025	Interference Analysis
Option MS2721B-027	Channel Scanner
Option MS2721B-031	GPS (includes GPS antenna)
Option MS2721B-035	WCDMA/HSDPA OTA (requires Opt. 009)
Option MS2721B-040	GSM/GPRS/EDGE RF Meas
Option MS2721B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
Option MS2721B-044	WCDMA/HSDPA RF Meas
Option MS2721B-045	WCDMA Demod (requires Opt. 009)
Option MS2721B-046	Fixed WiMAX RF Meas
Option MS2721B-047	Fixed WiMAX Demod
Option MS2721B-065	WCDMA/HSDPA Demod (requires Opt. 009)

### Standard Accessories Include:

10580-00175	User's Guide
61382	Soft Carrying Case
40-168	AC – DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
2300-498	CD ROM containing Master Software Tools
2000-1371	Ethernet Cable
2000-1209	Cross-over Ethernet Cable
633-44	Rechargeable battery, Li-Ion
1091-27	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
64343	Tilt Bail Stand Accessory
2000-1501	256 MB USB Flash Drive
3-2000-1360	USB Type A to Mini-B Cable
	One Year Warranty

### Optional Accessories:

3-2000-1500	256 MB Compact Flash
2000-1501	256 MB USB Flash Drive
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)
34N50C	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
15NN50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(m), 6 GHz
15NN50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(m), 6 GHz
15NN50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(m), 6 GHz
15NNF50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(f), 6 GHz
15NNF50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(f), 6 GHz
15NNF50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(f), 6 GHz
15ND50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(m), 6.0 GHz
15NDF50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(f), 6.0 GHz
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
1030-105	Band Pass Filters, 890-915 MHz, N(m) to N(f), 50Ω
1030-106	Band Pass Filters, 1710-1790 MHz, N(m) to N(f), 50Ω
1030-107	Band Pass Filters, 1910-1990 MHz, N(m) to N(f), 50Ω
1030-109	Band Pass Filters, 824-849 MHz, N(m) to SMA(f), 50Ω
1030-110	Band Pass Filters, 880-915 MHz, N(m) to SMA(f), 50Ω
1030-111	Band Pass Filters, 1850-1910 MHz, N(m) to SMA(f), 50Ω
1030-112	Band Pass Filters, 2400-2484 MHz, N(m) to SMA(f), 50Ω
1030-114	Band Pass Filters, 806-869 MHz, N(m) to SMA(f), 50Ω
510-97	Adapter 7/16 DIN(f) to 7/16 DIN(f), 7.5 GHz
61382	Spare soft carrying case
64343	Spare Tilt Bail Stand Accessory
40-168	Spare AC/DC adapter
806-141	Spare automotive cigarette lighter/12 Volt DC adapter
760-235	Transit case for Anritsu Handheld Master products

## Optional Accessories (Continued):

2300-498	Anritsu Master Software Tools	2000-1415	Portable Yagi Antenna, 10 dBd, N(f) 2.4 to 2.5 GHz
10580-00175	Anritsu HHSA User's Guide, Model MS2721B (spare)	2000-1416	Portable Yagi Antenna, 10 dBd, N(f) 1.92 to 2.23 GHz
10580-00176	Anritsu HHSA Programming Manual, Model MS2721B	2000-1030	Portable antenna, SMA(m) 1.71 to 1.88 GHz, 50Ω
10580-00177	Anritsu HHSA Maintenance Manual, Model MS2721B	2000-1031	Portable antenna, SMA(m) 1.85 to 1.99 GHz, 50Ω
633-44	Rechargeable battery, Li-Ion	2000-1032	Portable antenna, SMA(m) 2.4 to 2.5 GHz, 50Ω
3-2000-1500	256 MB Compact Flash Memory Module	2000-1035	Portable antenna, SMA(m) 896 to 941 MHz, 50Ω
2000-1374	Dual battery charger, Li-Ion with universal power supply	2000-1200	Portable antenna, SMA(m) 806 to 869 MHz, 50Ω
2000-1411	Portable Yagi Antenna, 10 dBd, N(f) 822 to 900 MHz	2000-1361	Portable Antenna, SMA(m) 5725 to 5825 MHz, 50Ω
2000-1412	Portable Yagi Antenna, 10 dBd, N(f) 885 to 975 MHz	2000-1473	Portable Antenna, SMA(m) 870 to 960 MHz, 50Ω
2000-1413	Portable Yagi Antenna, 10 dBd, N(f) 1.71 to 1.88 GHz	2000-1474	Portable Antenna, SMA(m) 2.4 to 2.5 GHz, 50Ω
2000-1414	Portable Yagi Antenna, 9.3 dBd, N(f) 1.85 to 1.99 GHz	2000-1475	Portable Antenna, SMA(m) 2.11 to 2.17 GHz, 50Ω
		61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032, 2000-1035, 2000-1200, and 2000-1361

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