

20 GHz High Performance Handheld Spectrum Analyzer

MS2724B Spectrum Master™

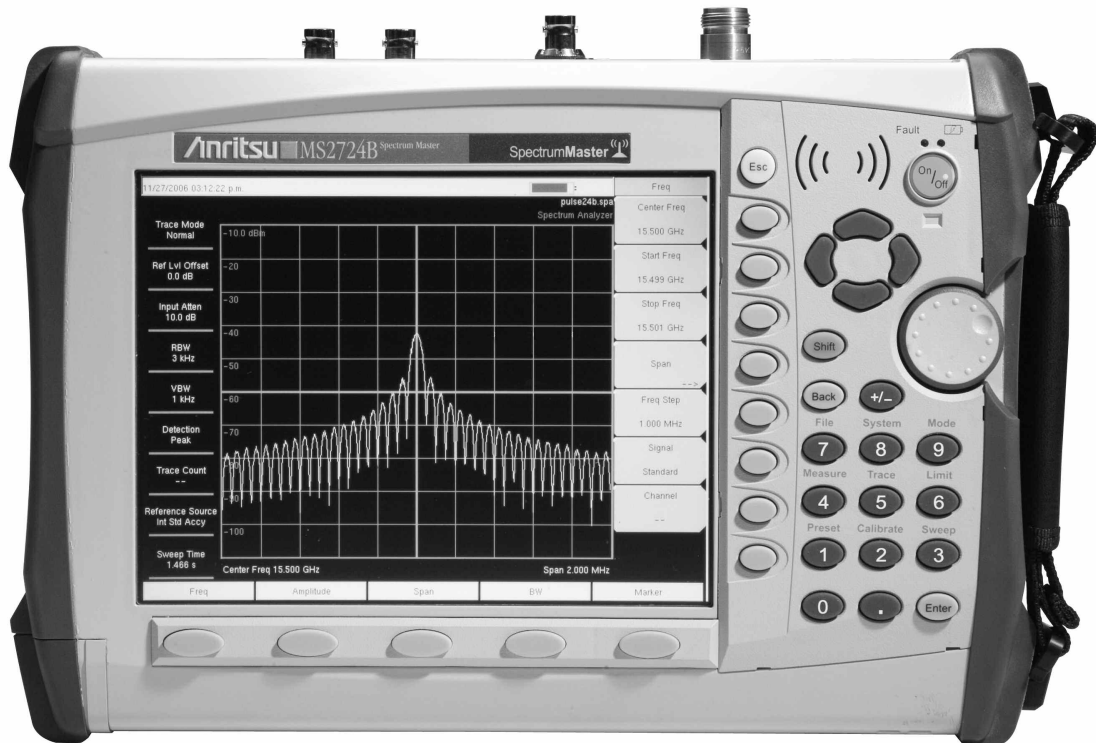
Introduction

Continuous frequency coverage from 9 kHz to 20 GHz gives the wireless professional the performance needed for the most demanding measurements in harsh RF and physical environments.

Whether you need spectrum monitoring, WiFi and WiFi5 installation and testing, RF and microwave signal measurements or cellular signal measurements, the MS2724B Spectrum Master is the tool to make your job easier and more productive.

High Performance Highlights

- 9 kHz to 20 GHz Input
- 1 Hz to 3 MHz RBW Range
- Very Low Phase Noise
(-104 dBc/Hz typical at 10 kHz offset at 2 GHz)
- Built-in AM/FM/SSB Demodulator
- Built-in Preamplifier
- 65 dB Step Attenuator
- True RMS Detection
- 2+ Hours of Battery Life
- 3.4 kg (7.5 lb)
- 3G Modulation options
- GPS Receiver option
- Quasi-peak detector and CISPR bandwidths



The Anritsu MS2724B 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/meter² or dBmV/meter.

Specifications

Frequency

Frequency Range: 9 kHz to 20 GHz

Preamp: 100 kHz to 4 GHz

Tuning Resolution: 1 Hz

Frequency Reference:

Aging: ± 1 ppm per 10 years

Accuracy: ± 0.3 ppm ($25^{\circ}\text{C} \pm 25^{\circ}\text{C}$) + aging

Frequency Span: 10 Hz to 20 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: $\pm 2\%$ in zero span

Sweep Trigger: Free run, Single, Video, External

Resolution Bandwidth: (-3 dB) 1 Hz to 3 MHz in 1-3 sequence $\pm 10\%$, 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	Max
	9 kHz to 13 GHz 13 GHz to 20 GHz	
10, 20 and 30 kHz	-95 dBc/Hz	-91 dBc/Hz
100 kHz	-97 dBc/Hz	-93 dBc/Hz
1 MHz	-105 dBc/Hz	-102 dBc/Hz
10 MHz	-120 dBc/Hz	-116 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, dB μ V

Linear Scale Modes: nV, μ V, mV, V, kV, nW, μ W, mW, W, kW

Attenuator Range: 0 to 65 dB

Attenuator Resolution: 5 dB steps

Overall Amplitude Accuracy

(20°C to 30°C , 30 minute warmup):

± 1.3 dB

Full Temperature Range: -10 to $+55^{\circ}\text{C}$ add

± 1.2 dB

Frequency Flatness: >4 GHz add

± 1.5 dB

Conditions: 50 Ω source, single sinewave input $\leq$ Reference Level, and $\geq$ DANL, 60 minute warm-up, auto-attenuation

Second Harmonic Distortion

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

50 to 500 MHz -50 dBc

500 to 800 MHz -45 dBc

800 to 3000 MHz -60 dBc

>3 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
2.4 GHz	$+12$ dBm

Frequency	Typical
50 MHz to 500 MHz	>6 dBm
500 MHz to 2 GHz	>8 dBm
2 to 6 GHz	>10 dBm
6 to 20 GHz	>12 dBm

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

2.4 GHz	101 dB min
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Displayed Average Noise Level (DANL) in 1 Hz RBW:

Frequency	Preamplifier On	Equivalent Noise Figure, 23°C
10 MHz to 1 GHz	-159 dBm	15 dB
1 GHz to 3 GHz	-156 dBm	18 dB
3 to 4 GHz	-154 dBm	20 dB

Frequency	Preamplifier Off	Equivalent Noise Figure, 23°C
10 MHz to 4 GHz	-139 dBm	35 dB
4 GHz to 10 GHz	-136 dBm	38 dB
10 GHz to 13 GHz	-130 dBm	44 dB
13 GHz to 20 GHz	-136 dBm	38 dB

(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.

Input-Related Spurious:

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

-70 dBc typical -60 dBc max

except input frequency 3275 MHz, -50 dBc max

Residual Spurious:

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

-90 dBm max

-85 dBm max, >13 GHz

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

-100 dBm max

Options Specifications

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, 50 Ω

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

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

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

cdmaOne and CDMA2000 1xRTT Over The Air (Option 33) and EVDO Over The Air (Option 34)

Over the Air Measurement: Nine strongest pilots with Tau and Ec/Io
Six multipaths relative to strongest pilot

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 deg

Residual Error (GSMK): 1 deg

8PSK Modulation Quality (EVM) Measurement Accuracy: $\pm 1.5\%$

Residual Error (8PSK): 2.5%

CDMA RF Measurements (Option 42) and EVDO RF Measurements (Option 62)

Channel Power Accuracy: ± 1 dB typical for RF Input from +20 dBm to -50 dBm (± 1.5 dB maximum)

cdmaOne and CDMA2000 1xRTT Demodulator (Option 43)

Residual Rho: > 0.995 typical for RF Input from +20 dBm to -50 dBm (> 0.99 dB maximum)

Rho Accuracy: ± 0.01 for Rho > 0.9

Frequency Error: ± 20 Hz + Time base error, 99% confidence level

PN Offset: within 1 x 64 chips

Pilot Power Accuracy: ± 1 dB typical, relative to Channel Power

Tau: ± 0.5 μ s typical (± 1 μ s maximum)

WCDMA/HSDPA OTA (Option 35)

Resolution: 0.1 dB

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: ± 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: ± 0.8 dB typical

Scrambling Code: 3 seconds

EVDO Demodulator (Option 63)

Demodulator Measurements are EVDO Rev A compatible.

Residual Rho: > 0.995 typical for RF Input from $+20$ dBm to -50 dBm

(> 0.99 dB maximum)

Rho Accuracy: ± 0.01 for Rho > 0.9

Frequency Error: ± 20 Hz + Time base error, 99% confidence level

PN Offset: within 1×64 chips

Pilot Power Accuracy: ± 1 dB typical relative to Channel Power

Tau: $\pm 0.5 \mu\text{s}$ typical ($\pm 1 \mu\text{s}$ maximum)

Fixed WiMAX RF Measurements (Option 46)

Channel Power Accuracy**:** ± 1 dB Typical for $+20$ dBm to -50 dBm

(± 1.5 dB max)

Fixed WiMAX Demodulator (Option 47)

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

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

Mobile WiMAX Over the Air (OTA) Measurements (Option 37)

Time Interval: 1sec – 60sec

Measurement duration: 72 hours max

Auto Save: Yes

GPS logging: Yes

Mobile WiMAX RF Measurements (Option 66)

Channel Power Accuracy: ± 1 dB Typical (± 1.5 dB max)

for $+20$ dBm to -50 dBm

Mobile WiMAX Demodulator (Option 67)

For $+20$ dBm to -50 dBm, Residual EVM (rms): 2.5% typical (3% max)

Frequency Error: $\pm 0.02\text{ppm}$ + time base error, 99% confidence level

General

RF Input VSWR: (≥ 10 dB input attenuation)

1.5:1 typical < 13 GHz

2:1 typical 13 to 20 GHz

Maximum Continuous Input: (≥ 10 dB input attenuation) $+30$ dBm

Input Damage Level:

≥ 10 dB input attenuation, $> +30$ dBm, ± 50 Vdc

ESD Damage Level: (≥ 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: 2.3 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

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: 3.4 kg (< 7.5 lbs.) typical

Environmental

MIL-PRF-28800F class 2

Operating: -10°C to 55°C , humidity 85% or less

Storage: -51°C to 71°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

MS2724B Handheld Spectrum Analyzer

9 kHz to 20 GHz

Options

Option MS2724B-009	IQ Demodulation Hardware
Option MS2724B-019	High Accuracy Power Meter (PSN50 sensor not included)
Option MS2724B-025	Interference Analysis
Option MS2724B-027	Channel Scanner
Option MS2724B-031	GPS (includes GPS antenna)
Option MS2724B-033	cdmaOne and CDMA2000 1xRTT (OTA) (requires Opt. 009, 031)
Option MS2724B-034	EVDO Over The Air (OTA) Measurement (requires Option 009, 031)
Option MS2724B-035	W-CDMA/HSDPA OTA (requires Opt. 009)
Option MS2724B-037	Mobile WiMAX Over The Air (OTA) Measurement (requires Opt. 009)
Option MS2724B-040	GSM/GPRS/EDGE RF Meas (requires Opt. 009)
Option MS2724B-041	GSM/GPRS/EDGE Demod (requires Opt. 009)
Option MS2724B-042	CDMA RF Measurement (requires Opt. 009)
Option MS2724B-043	cdmaOne and CDMA2000 1xRTT demodulator (requires Opt. 009)
Option MS2724B-044	W-CDMA/HSDPA RF Measurement (requires Opt. 009)
Option MS2724B-045	W-CDMA Demodulation (requires Opt. 009)
Option MS2724B-046	Fixed WiMAX RF Measurement (requires Opt. 009)
Option MS2724B-047	Fixed WiMAX Demodulation (requires Opt. 009)
Option MS2724B-062	EVDO RF Measurement (requires Opt. 009)
Option MS2724B-063	EVDO Demodulator (requires Opt. 009)
Option MS2724B-065	W-CDMA/HSDPA Demodulation (requires Opt. 009)
Option MS2724B-066	Mobile WiMAX RF Measurement (requires Opt. 009)
Option MS2724B-067	Mobile WiMAX Demodulator (requires Opt. 009)

Standard Accessories Include:

10580-00175	User's Guide
65729	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
3-806-152	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-R	256 MB USB Flash Drive
3-2000-1498	USB Type A to Mini-B Cable
	One Year Warranty

Optional Accessories:

3-2000-1500	256 MB Compact Flash
2000-1501-R	256 MB USB Flash Drive
2000-1520-R	2 GB 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, 50 Ω , N(m) to N(m)
34NFnF50C	Precision Adapter, DC to 18 GHz, 50 Ω , 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, 50 Ω
510-91	Adapter, 7/16 DIN (f) to N(f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96	Adapter 7/16 DIN(m) to 7/16 DIN(m), DC to 7.5 GHz, 50 Ω
1030-105-R	Band Pass Filters, 890-915 MHz, N(m) to N(f), 50 Ω
1030-106-R	Band Pass Filters, 1710-1790 MHz, N(m) to N(f), 50 Ω
1030-107-R	Band Pass Filters, 1910-1990 MHz, N(m) to N(f), 50 Ω
1030-109-R	Band Pass Filters, 824-849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	Band Pass Filters, 880-915 MHz, N(m) to SMA(f), 50 Ω
1030-111-R	Band Pass Filters, 1850-1910 MHz, N(m) to SMA(f), 50 Ω
1030-112-R	Band Pass Filters, 2400-2484 MHz, N(m) to SMA(f), 50 Ω
1030-114-R	Band Pass Filters, 806-869 MHz, N(m) to SMA(f), 50 Ω
510-97	Adapter 7/16 DIN(f) to 7/16 DIN(f), 7.5 GHz
65729	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
760-243-R	Transit case with wheels and retractable handle for Anritsu MS2724B Handheld Spectrum Analyzer

Optional Accessories (Continued):

2300-498	Anritsu Master Software Tools	2000-1030	Portable antenna, SMA(m) 1.71 to 1.88 GHz, 50 Ω
10580-00175	Anritsu HHSA User's Guide, Model MS2724B (spare)	2000-1031	Portable antenna, SMA(m) 1.85 to 1.99 GHz, 50 Ω
10580-00176	Anritsu HHSA Programming Manual, Model MS2724B	2000-1032	Portable antenna, SMA(m) 2.4 to 2.5 GHz, 50 Ω
10580-00177	Anritsu HHSA Maintenance Manual, Model MS2724B	2000-1035	Portable antenna, SMA(m) 896 to 941 MHz, 50 Ω
633-44	Rechargeable battery, Li-Ion	2000-1200	Portable antenna, SMA(m) 806 to 869 MHz, 50 Ω
2000-1374	Dual battery charger, Li-Ion with universal power supply	2000-1361	Portable Antenna, SMA(m) 5725 to 5825 MHz, 50 Ω
2000-1411	Portable Yagi Antenna, 10 dBd, N(f) 822 to 900 MHz	2000-1473	Portable Antenna, SMA(m) 870 to 960 MHz, 50 Ω
2000-1412	Portable Yagi Antenna, 10 dBd, N(f) 885 to 975 MHz	2000-1474	Portable Antenna, SMA(m) 2.4 to 2.5 GHz, 50 Ω
2000-1413	Portable Yagi Antenna, 10 dBd, N(f) 1.71 to 1.88 GHz	2000-1475	Portable Antenna, SMA(m) 2.11 to 2.17 GHz, 50 Ω
2000-1414	Portable Yagi Antenna, 9.3 dBd, N(f) 1.85 to 1.99 GHz	61532	Antenna Kit: 2000-1030, 2000-1031, 2000-1032,
2000-1415	Portable Yagi Antenna, 10 dBd, N(f) 2.4 to 2.5 GHz		2000-1035, 2000-1200, and 2000-1361
2000-1416	Portable Yagi Antenna, 10 dBd, N(f) 1.92 to 2.17 GHz		



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