



Spectrum Master™ MS2721B Spectrum Analyzer Specifications



Spectrum Analyzer (continued)

Spectral Purity

SSB Phase Noise -100 dBc/Hz @ 10, 20 and 30 kHz offset from carrier
 -102 dBc/Hz @ 100 kHz offset from carrier

Amplitude Ranges

Dynamic Range > 95 dB at 600 MHz, 2/3 (TOI-DANL) in 1 Hz RBW
 > 96 dB at 3.5 GHz, 2/3 (TOI-DANL) in 1 Hz RBW
 Measurement Range DANL to +30 dBm
 Display Range 1 to 15 dB/div in 1 dB steps, ten divisions displayed
 Reference Level Range -120 dBm to +30 dBm
 Attenuator Resolution 0 to 65 dB, 5.0 dB steps
 Amplitude Units Log Scale Modes: dBm, dBV, dBmV, dBμV
 Linear Scale Modes: nV, μV, mV, V, kV, nW, μW, mW, W, kW

Amplitude Accuracy (Power level > -50 dBm)

(Input attenuation)	Preamp Off (≤ 35 dB)	Preamp Off (40 to 55 dB)	Preamp Off (60 to 65 dB)	Preamp On (0 or 10 dB)
9 kHz to ≤10 MHz	± 1.50 dB	± 1.50 dB	± 1.50 dB	—
100 kHz to 4 GHz	—	—	—	± 1.50 dB
>10 MHz to 4 GHz	± 1.25 dB	± 1.75 dB	± 1.75 dB	—
>4 GHz to 6.5 GHz	—	± 1.75 dB	± 1.75 dB	—
>4 GHz to 7.1 GHz	± 1.75 dB	—	—	± 1.75 dB
>6.5 GHz to 7.1 GHz	—	± 2.00 dB	± 3.00 dB	—

Displayed Average Noise Level (DANL)

(DANL in 1 Hz RBW, 0 dB attenuation)	Preamp Off (Reference level -20 dBm)		Preamp On (Reference level -50 dBm)	
	Maximum	Typical	Maximum	Typical
10 MHz to 1 GHz	-137 dBm	-140 dBm	-161 dBm	-163 dBm
> 1 GHz to 2.2 GHz	-133 dBm	-136 dBm	-159 dBm	-160 dBm
> 2.2 GHz to 2.8 GHz	-126 dBm	-130 dBm	-153 dBm	-156 dBm
> 2.8 GHz to 4 GHz	-136 dBm	-139 dBm	-159 dBm	-160 dBm
> 4 GHz to 7.1 GHz	-127 dBm	-131 dBm	-154 dBm	-158 dBm

Spurs

Residual Spurs Preamp On (RF input terminated, 0 dB input attenuation)
 -100 dBm, 10 MHz to 7.1 GHz
 Preamp Off (RF input terminated, 0 dB input attenuation)
 -90 dBm, 100 kHz to 3.2 GHz
 -84 dBm, > 3.2 GHz to 7.1 GHz

Exceptions -85 dBm @ 250, 300, 350 MHz
 -80 dBm, -90 dBm typical @ ≈ 4010 MHz
 -70 dBm, -83 dBc typical @ ≈ 5084 MHz
 -75 dBm, -87 dBm typical @ ≈ 5894 MHz
 -80 dBm, -92 dBm typical @ ≈ 7028 MHz

Input-Related Spurious (0 dB attenuation, -30 dBm input, span < 1.7 GHz, carrier offset > 4.5 MHz)
 -60 dBc, -70 dBc typical

Exceptions -38 dBc, -48 dBc typical @ 1674 MHz

Third-Order Intercept (TOI) (-20 dBm tones 100 kHz apart, -20 dBm Ref level, 0 dB input attenuation, preamp Off)

Preamp Off

600 MHz	+7 dBm
3.5 GHz	+9.5 dBm
50 MHz to 300 MHz	> +8 dBm typical
> 300 MHz to 2.2 GHz	> +10 dBm typical
> 2.2 GHz to 2.8 GHz	> +15 dBm typical
> 2.8 GHz to 4 GHz	> +10 dBm typical
> 4 GHz to 7.1 GHz	> +13 dBm typical

Second Harmonic Distortion (0 dB input attenuation, -30 dBm input)

Preamp Off

50 MHz to 1.4 GHz	-50 dBc
> 1.4 GHz to 2 GHz	-70 dBc
> 2 GHz	-80 dBc

VSWR

> 10 dB input attenuation 2.0:1 max, 1.5:1 typical

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GPS Receiver Option (Option 0031) (includes antenna)

Setup	On/Off, GPS Info
GPS Time/Location Indicator	Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage
High Frequency Accuracy when GPS Antenna is connected	Spectrum Analyzer, Interference Analyzer, Signal Analyzer < ± 25 ppb with GPS On, 3 minutes after satellite lock in selected mode
GPS Lock – after antenna is disconnected	< ± 50 ppb for 3 days, 0 °C to 50 °C ambient temperature
Connector	BNC, female, reverse polarity



High Accuracy Power Meter (Option 0019) (Requires external USB Power Sensor(s))

Amplitude	Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale
Average	# of Running Averages, Max Hold
Zero/Cal	Zero On/Off, Cal Factor (Center Frequency, Signal Standard)
Limits	Limit On/Off, Limit Upper/Lower

Power Sensor Model	PSN50	MA24104A	MA24106A	MA24108/18/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	600 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8 GHz (MA24108A) 10 MHz to 18 GHz (MA24118A) 10 MHz to 26 GHz (MA24126A)
Connector	Type N(m), 50 Ω	Type N(m), 50 Ω	Type N(m), 50 Ω	Type N(m), 50 Ω (MA24108/18A) Type K(m), 50 Ω (MA24126A)
Dynamic Range	-30 dBm to +20 dBm (.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	-40 dBm to +23 dBm (0.1 μW to 200 mW)	-40 dBm to +20 dBm (0.1 μW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	± 0.16 dB ¹	± 0.17 dB ²	± 0.16 dB ¹	± 0.18 dB ³
Datasheet (for complete specifications)	11410-00414	11410-00483	11410-00424	11410-00504
Notes:	1) Total RSS measurement uncertainty (0 °C to 50 °C) for power measurements of a CW signal greater than -20 dBm with zero mismatch errors. 2) Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor. 3) Expanded uncertainty with K=2 for power measurements of a CW signal greater than -20 dBm with zero mismatch errors.			

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Interference Analyzer (Option 0025)

Measurements	Spectrum Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power (ACPR) AM/FM/SSB Demodulation (Wide/Narrow FM, Upper/Lower SSB), (audio out only) Carrier-to-Interference ratio (C/I) Spectrogram (Collect data up to one week) Signal Strength (Gives visual and aural indication of signal strength) Received Signal Strength Indicator (RSSI) (collect data up to one week) Gives visual and aural indication of signal strength Signal ID (up to 12 signals) Center Frequency Bandwidth Signal Type (FM, GSM, W-CDMA, CDMA, Wi-Fi) Closest Channel Number Number of Carriers
Application Options	Signal-to-Noise Ratio (SNR) >10 dB Impedance (50 Ω, 75 Ω, Other)



Channel Scanner (Option 0027)

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 sec/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
Application Options	Impedance (50 Ω, 75 Ω, Other)

Gated Sweep (Option 0090)

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 to 65 ms typical) Gate Length (1 μs to 65 ms typical) Zero Span Time

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Tracking Generator Option (Option 0020)

Setup Parameters

Measure Set-up	Off/On, Output Power, Reset Sweep, S21 Insertion loss, Abs Max, Min, Avg (On/Off)
S21 Insertion Loss Set-up	Normalize (Off/On), Rel Reference, Rel Scale, S21 Max, Min, Avg (Off, On), S21 RL Offset
Frequency Range	450 kHz to 7.1 GHz (usable to 100 kHz)
Frequency Resolution	1 Hz
Frequency Accuracy	± 0.3 ppm (25 °C ±25 °C) + aging
Output Power	-40 to 0 dBm
Step Size	0.1 dB nominal
Level Accuracy	± 1.5 dB max (450 kHz to 7.1 GHz, 15 °C to 35 °C)
Zero Span Behavior	CW Output
Output Connector	Type N female, 50 Ω
Damage Level	+ 23 dBm ± 50 VDC (limited dv/dt) 2 kV ESD

DVB-T/H, SFN, BER (Options 0064, 0078, 0057)

See Technical Data Sheet 11410-00436

ISDB-T, SFN (Options 0030, 0032)

See Technical Data Sheet 11410-00436

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LTE Signal Analyzers (Options 0541, 0542, 0546)

Measurements			
RF (Option 0541)	Modulation (Option 0542)	Over-the-Air (OTA) (Option 0546)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth ACPR RF Summary	Constellation Reference Signal Power Sync Signal Power EVM Frequency Error Carrier Frequency Cell ID Sector ID Group ID Control Channel Power RS P-SS S-SS PBCH PCFICH Modulation Summary	Synch Signal Power (Six Strongest) Power Cell ID Sector ID Group ID Dominance	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM (peak) EVM (rms) RS Power SS Power P-SS Power S-SS Power PBCH Power PCFICH Power Cell ID Group ID Sector ID
Setup Parameters			
	Bandwidth	10 MHz	
	Span	1.4, 3, 5, 10, 15, 20, 30 MHz	
	Frame Length	2.5, 5.0, 10.0 msec	
	Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel	
	Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range	
	Sweep	Single/Continuous, Trigger Sweep	
	Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory	
	Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements	
RF Measurements (Option 0541)			
	RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input -50 dBm to +10 dBm)	
Modulation (Option 0542)			
	Frequency Error	± 10 Hz + time base error, 99% confidence level	
	Residual EVM (rms)	2.5% typical (E-UTRA Test Model 3.1) (RF Input -50 dBm to +10 dBm)	
Over-the-Air (OTA) Measurements (Option 0546)			
	Scanner	Six strongest Sync Signals	
	Auto Save	Yes	
	GPS Tagging and Logging	Yes	

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GSM/GPRS/EDGE Signal Analyzers (Options 0040, 0041)

Measurements

RF (Option 0040)	Demodulation (Option 0041)	Over-the-Air (OTA)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC)	There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA	Measurements Channel Power Occupied Bandwidth Burst Power Average Burst power Frequency Error Phase Error EVM Origin Offset C/I Magnitude Error Script Master™

Setup Parameters

GSM/EDGE Select	Auto, GSM, EDGE
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements

RF Measurements (Option 0040)

Frequency Error	± 10 Hz + time base error, 99% confidence level
Occupied Bandwidth	Bandwidth within which 99% of the power transmitted on a single channel lies
Burst Power Error	± 1.5 dB, ± 1 dB typical, (-50 dBm to +20 dBm)

Demodulation (Option 0041)

GSMK Modulation Quality (RMS Phase) Measurement Accuracy	± 1 deg
Residual Error (GSMK)	1 deg
8 PSK Modulation Quality (EVM) Measurement Accuracy	± 1.5%
Residual Error (8 PSK)	2.5%

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W-CDMA/HSDPA Signal Analyzers (Options 0044, 0045 or 0065, 0035)

Measurements

RF (Option 0044)	Demodulation (Option 0045 or 0065)	Over-the-Air (OTA) (Option 0035)	Pass/Fail (User Editable)
Band Spectrum Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single carrier ACLR Multi-carrier ACLR RF Summary	Code Domain Power Graph P-CPICH Power Channel Power Noise Floor EVM Carrier Feed Through Peak Code Domain Error Carrier Frequency Frequency Error Control Channel Power Abs/Rel/Delta Power CPICH, P-CCPCH S-CCPCH, PICH P-SCH, S-SCH HSDPA Power vs. Time Constellation Code Domain Power Table Code, Status EVM, Modulation Type Power, Code Utilization Power Amplifier Capacity Codogram Modulation Summary	Scrambling Code Scanner (Six) Scrambling Codes CPICH E_c/I_0 Ec Pilot Dominance OTA Total Power Multipath Scanner (Six) Six Multipaths Tau Distance RSCP Relative Power Multipath Power	Measurements Max Output Power Frequency Error EVM CPICH Occupied Bandwidth Spectral Mask ACLR PCDE P-CCPCH S-CCPCH Code Spread 3 PICH Code 128 Script Master™ Test Models 1 (16), (32), (64) 2 3 (16), (32) 4 (+CPICH), (-CPICH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters

Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0044)

RF Channel	± 1.25 dB, ± 0.7 dB typical, (temperature range 15 °C to 35 °C)
Occupied Bandwidth Accuracy	± 100 kHz
Adjacent Channel Leakage Ratio (ACLR)	-54 dB/-59 dB ± 0.8 dB @ 5 MHz/10 MHz offset, typical, Bands I – VI, VIII – XIV, XVII -54 dB/-57 dB ± 1.0 dB @ 5 MHz/10 MHz offset, typical, Band VII

Demodulation (Option 0045 for W-CDMA only or 0065 for W-CDMA and HSDPA)

W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSDPA Modulations	QPSK, 16 QAM, 64 QAM
EVM Accuracy	$\pm 2.5\%$, $6\% \leq \text{EVM} \leq 25\%$
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

Over-the-Air (OTA) Measurements (Option 0035)

Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Six multipaths' power relative to strongest pilot

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cdmaOne/CDMA2000 1X Signal Analyzers (Option 0042, 0043, 0033)

Measurements

RF (Option 0042)	Demodulation (Option 43)	Over-the-Air (OTA) (Option 33)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Multi-carrier ACPR RF Summary	Code Domain Power Graph Pilot Power Channel Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Frequency Error Abs/Rel/ Power Pilot Page Sync Q Page Code Domain Power Table Code Status Power Multiple Codes Code Utilization Modulation Summary	Pilot Scanner (Nine) PN E_c/I_0 Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_0 Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Frequency error Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0042)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input -50 dBm to +20 dBm)
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Demodulation (Option 0043)

Frequency Error	± 10 Hz + time base error, 99% confidence level (in slow mode)
Rho Accuracy	± 0.005 , for Rho > 0.9
Residual Rho	> 0.995, typical, > 0.99 maximum, (RF input -50 dBm to +20 dBm)
PN Offset	1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 μ s typical, ± 1.0 μ s maximum

Over-the-Air (OTA) Measurements (Option 0033)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Six multipaths' power relative to strongest pilot
Limit Test	Average of ten tests compared to limit

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CDMA2000 1xEV-DO Signal Analyzers (Option 0062, 0063, 0034)

Measurements			
RF (Option 0062)	Demodulation (Option 0063)	Over-the-Air (OTA) (Option 0034)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_0 Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) E_c/I_0 Tau Channel Power Multipath Power	Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Multipath Power

Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth	1.23, 1.24, 1.25 MHz
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0062)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input -50 dBm to $+20$ dBm)
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Demodulation (Option 0063)

EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	± 20 Hz + time base error, 99% confidence level
Rho Accuracy	± 0.01 , for Rho > 0.9
Residual Rho	> 0.995 typical, > 0.99 , maximum (RF input -50 dBm to $+20$ dBm)
PN Offset	Within 1×64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 μ s typical, ± 1.0 μ s maximum

Over-the-Air (OTA) Measurements (Option 0034)

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Six multipaths' power relative to strongest pilot

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TD-SCDMA/HSDPA Signal Analyzers (Options 0060, 0061, 0038)

Measurements

RF (Option 0060)	Demodulation (Option 0061)	Over-the-Air (OTA) (Option 0038)	Pass/Fail (User Editable)
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau E _c /I ₀ Pilot Dominance Tau Scan (Six) Sync-DL# Tau E _c /I ₀ DwPTS Power Pilot Dominance Record Run/Hold	Pass Fail All Pass/Fail RF Pass Fail Demod Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Carrier Feedthrough Noise Floor

Setup Parameters

Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0060)

RF Channel Power Accuracy (RRC)	±1.5 dB, ±1.0 dB typical, (slot power -40 to +10 dBm)
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Demodulation (Option 0061)

Supported Modulation	QPSK, 8 PSK, 16 QAM, MBMS
Residual EVM (rms)	3% typical, P-CCPH slot power > -50 dBm
PN Offset	Within 1 x 64 chips
Timing Error (Tau) for Dominant SYNC-DL	± 0.2 μs (external trigger)
Spreading Factor	1, 16

Over-the-Air (OTA) Measurements (Option 0038)

Code Scanner	32 Sync Codes and associated Scrambling Code Groups
Tau Scanner	Six strongest Sync Codes
Auto Save	Yes
GPS Tagging and Logging	Yes

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Fixed and Mobile WiMAX Signal Analyzers (Options 0046, 0047, 0066, 0067, 0037)

Measurements			
RF (Option 0046 - Fixed) (Option 0066 - Mobile)	Demodulation (Option 0047 - Fixed) (Option 0067 - Mobile)	Over-the-Air (OTA) (Option 0037 - Mobile)	Pass/Fail (User Editable)
Channel Spectrum	Constellation	Channel Power Monitor	Pass Fail All
Channel Power	RCE (RMS/Peak)	Preamble Scanner (Six)	Pass/Fail RF
Occupied Bandwidth	EVM (RMS/Peak)	Preamble	Pass Fail Demod
Power vs. Time	Frequency Error	Relative Power	Measurements
Channel Power	CINR	Cell ID	Channel Power
Preamble Power	Base Station ID	Sector ID	Occupied Bandwidth
Downlink Burst Power (Mobile)	Sector ID	PCINR	Downlink Bust Power
Uplink Burst Power (Mobile)	Spectral Flatness	Dominant Preamble	Uplink Burst Power
Data Burst Power (Fixed)	Adjacent Subcarrier Flatness	Base Station ID	Preamble Power
Crest Factor (Fixed)	EVM vs. Subcarrier/Symbol		Crest Factor
ACPR	RCE (RMS/Peak)		Frequency Error
RF Summary	EVM (RMS/Peak)		Carrier Frequency
	Frequency Error		EVM
	CINR (Mobile)		RCE
	Base Station ID		Sector ID (Mobile)
	Sector ID (Mobile)		
	DL-MAP (Tree View) (Mobile)		
	Modulation Summary		

Setup Parameters

Fixed WiMAX Bandwidth	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz
Fixed WiMAX Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Fixed WiMAX Span	5, 10, 15, 20 MHz
Fixed WiMAX Frame Length	2.5, 5.0, 10.0 msec
Mobile WiMAX Zone Type	PUSC
Mobile WiMAX DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Mobile WiMAX Bandwidths	3.50, 5.00, 7.00, 8.75, 10.00 MHz
Mobile WiMAX Cyclic Prefix Ratio (CP)	1/8
Mobile WiMAX Span	5, 10, 20, 30 MHz
Mobile WiMAX Frame Lengths	5, 10 msec
Mobile WiMAX Demodulation	Auto, Manual, FCH
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality Measurements

RF Measurements (Option 0046 – Fixed, Option 0066 - Mobile)

RF Channel Power Accuracy	± 1.5 dB, ± 1.0 dB typical, (RF input –50 to +20 dBm)
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Demodulated Signal Analyzer (Option 0047 – Fixed, Option 0067 – Mobile)

Fixed Frequency Error	± 0.1 ppm + timebase error, 99% confidence level
Mobile Frequency Error	± 0.02 ppm + timebase error, 99% confidence level
Fixed WiMAX Residual EVM (rms)	3% typical, 3.5% maximum (RF Input –50 dBm to +20 dBm)
Mobile WiMAX Residual EVM (rms)	2.5% typical, 3.0% maximum, (RF Input –50 dBm to +20 dBm)

Over-the-Air (OTA) Measurements (Option 0037)

Channel Power Monitor	Over time (one week), measurement time interval 1 to 60 sec
Preamble Scanner	Six Strongest Preambles
Auto Save	Yes
GPS Tagging and Logging	Yes

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All specifications and characteristics apply under the following conditions, unless otherwise stated: 1) After 5 minutes of warm-up time, where the instrument is left in the ON state; 2) All specifications apply when using internal reference; 3) All specifications subject to change without notice; 4) Typical performance is the measured performance of an average unit; 5) Recommended calibration cycle is 12 months.

General Specifications

Maximum Continuous Input	(≥ 10 dB input attenuation) +30 dBm
Input Damage Level	≥ 10 dB input attenuation, > +43 dBm, ± 50 Vdc. Input protection relay opens at > 30 dBm < 10 dB input attenuation, > +23 dBm, ± 50 Vdc. Limited dV/dt. Input protection relay opens at approximately 10 to 23 dBm
ESD Damage Level	(≥ 10 dB input attenuation) > 10 kV
External Reference Frequencies	1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz and 19.6608 MHz at -10 dBm to +10 dBm

Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Ver, IP Address, Options Installed) Self Test, Application Self Test GPS (see Option 0031)
System Options	Name, Date and Time, Ethernet Configuration, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, User defined) Reset (Factory Defaults, Master Reset, Update Firmware)
File	Save, Recall, Delete, Directory Management
Save/Recall	Setups, Measurements, Screen Shots Jpeg (save only)
Delete	Selected File, All Measurements, All Mode Files, All Content
Directory Management	Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB
Internal Trace/Setup Memory	> 13,000 traces
External Trace/Setup Memory	Limited by size of USB Flash drive or Compact Flash module
Mode Switching	Auto-Stores/Recalls most recently used Setup Parameters in the Mode

Connectors

RF In	Type N, female, 50 Ω, Maximum Input +30 dBm, ± 50 VDC
GPS	BNC, female, reverse polarity
External Power	5.5 mm barrel connector, 12 to 15 VDC, < 5.0 Amps
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
Compact Flash Interface	Type I
USB Interface	Type A, Connect Flash Drive and Power Sensor
USB Interface	5-pin mini-B, Connect to PC for data transfer
Headset	2.5 mm miniature phone plug
External Trigger In	BNC, female, 50 Ω, Maximum Input ± 5 VDC

Display

Size	8.4"
Resolution	800 x 600

Battery

Type	Li-Ion
Battery Operation	2.5 hours, typical

Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 89/336/EEC, 92/31/EEC, 93/68/EEC and Low Voltage Directive 73/23/EEC, 93/68/EEC
Australia and New Zealand	C-tick N274
Interference	EN 61326-1
Emissions	EN 55011
Immunity	EN 61000-4-2/-4-3/-4-4/-4-5/-4-6/-4-11

Safety

Safety Class	EN 61010-1 Class 1
Product Safety	IEC 60950-1 when used with Company supplied Power Supply

Environmental

Operating Temperature	-10 °C to 55 °C
Maximum Humidity	85%
Shock	MIL-PRF-28800F Class 2
Storage	-51 °C to 71 °C
Altitude	4600 meters, operating and non-operating

Size and Weight

Size	315 mm x 211 mm x 94 mm, (12.4 in x 8.3 in x 3.7 in)
Weight	3.1 kg, (6.9 lbs)

Spectrum Master™ MS2721B Spectrum Analyzer Specifications

Master Software Tools (for your PC)

Database Management

Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
Trace Catalog	Index all traces into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files
DAT File Converter	Converts HHST files to MST file format and vice-versa

Data Analysis

Trace Math and Smoothing	Compare multiple traces
Data Converter	Convert from/to Return Loss/ VSWR/ Cable Loss/ DTF and also into Smith Charts
Measurement Calculator	Translates into other units

Report Generation

Report Generator	Includes GPS, power level, and calibration status along with measurements
Edit Graph	Change scale, limit lines, and markers
Report Format	Create reports in HTML for PDF format
Export Measurements	Export measurements to *.s2p, *.jpg or *.csv format
Notes	Annotate measurements

Mapping (GPS Required)

Spectrum Analyzer Mode	MapInfo, MapPoint
Mobile WiMAX OTA Option	Google Earth, Google Maps, MapInfo

Folder Spectrogram (Spectrum Monitoring for Interference Analysis and Spectrum Clearing)

Folder Spectrogram – 2D View	Creates a composite file of multiple traces Peak Power, Total Power, Peak Frequency, Histogram, Average Power (Max/Min) File Filter (Violations over limit lines or deviations from averages) Playback
Video Folder Spectrogram – 2D View	Create AVI file to export for management review/reports
Folder Spectrogram – 3D View	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D View (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)

List/Parameter Editors

Traces	Add, delete, and modify limit lines and markers
Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Product Updates	Auto-checks Anritsu website for latest revision firmware
Firmware Upload	Upload new firmware into the instrument
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
VSG Pattern Converter	Import user-defined patterns (ASCII text or MATLAB file format required)
Languages	Add up to two languages or modify non-English language menus
Mobile WiMAX	DL-MAP Parameters
Display	Modify display settings

Script Master™


























Channel Scanner Mode	Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels
GSM/GPRS/EDGE or W-CDMA/HSDPA Mode	Automate Signal Analysis testing requirements with annotated how-to pictures

Connectivity

Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
Download	Download measurements and live traces to PC for storage and analysis
Upload	Upload measurements from PC to instrument
Firmware Updates	Product Update: download latest firmware version
Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet

Spectrum Master™ MS2721B Spectrum Analyzer Specifications

Ordering Information

	MS2721B	Description
	9 kHz to 7.1 GHz	Spectrum Analyzer
	Options	
	MS2721B-0031	GPS Receiver (includes antenna)
	MS2721B-0019	High-Accuracy Power Meter
	MS2721B-0025	Interference Analyzer
	MS2721B-0027	Channel Scanner
	MS2721B-0090	Gated Sweep
	MS2521B-0020	Tracking Generator
	MS2721B-0009	I/Q Demodulation Hardware*
	MS2721B-0040	GSM/GPRS/EDGE RF Measurements*
	MS2721B-0041	GSM/GPRS/EDGE Demodulation*
	MS2721B-0044	W-CDMA/HSDPA RF Measurements*
	MS2721B-0045	W-CDMA Demodulation*
	MS2721B-0065	W-CDMA/HSDPA Demodulation*
	MS2721B-0035	W-CDMA/HSDPA Over-the-Air Measurements**
	MS2721B-0060	TD-SCDMA/HSDPA Measurements*
	MS2721B-0061	TD-SCDMA/HSDPA Demodulation*
	MS2721B-0038	TD-SCDMA/HSDPA Over-the-Air Measurements*
	MS2721B-0541	LTE RF Measurements*
	MS2721B-0542	LTE Modulation Measurements*
	MS2721B-0546	LTE Over-the-Air Measurements*
	MS2721B-0042	cdmaOne/CDMA2000 1X RF Measurements*
	MS2721B-0043	cdmaOne/CDMA2000 1X Demodulation*
	MS2721B-0033	cdmaOne/CDMA2000 1X Over-the-Air Measurements**
	MS2721B-0062	CDMA2000 1xEV-DO RF Measurements*
	MS2721B-0063	CDMA2000 1xEV-DO Demodulation*
	MS2721B-0034	CDMA2000 1xEV-DO Over-the-Air Measurements**
	MS2721B-0046	IEEE 802.16 Fixed WiMAX RF Measurements*
	MS2721B-0047	IEEE 802.16 Fixed WiMAX Demodulation*
	MS2721B-0066	IEEE 802.16 Mobile WiMAX RF Measurements*
	MS2721B-0067	IEEE 802.16 Mobile WiMAX Demodulation*
	MS2721B-0037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements
	MS2721B-0064	DVB-T/H Measurements*
	MS2721B-0078	DVB-T/H SFN Field Measurements*
	MS2721B-0057	DVB-T/H BER Unit (requires Option 0064)*
	MS2721B-0030	ISDB-T Measurements*
	MS2721B-0032	ISDB-T SFN Field Measurements*
	MS2721B-0098	Standard Calibration to Z540
	MS2721B-0099	Premium Calibration to Z540 plus test data *Requires Option 0009, **Requires Option 0009, and Option 0031

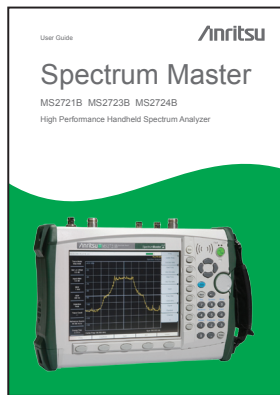
Power Sensors (For complete ordering information see the respective datasheets of each sensor)



Part Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24104A	Inline High Power Sensor, 600 MHz to 4 GHz, 150 W
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

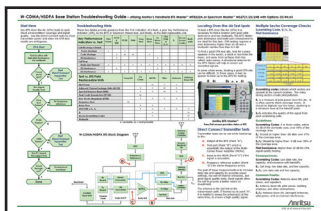
Spectrum Master™ MS2721B Spectrum Analyzer Specifications

Manuals (soft copy included on MST CD and at www.us.anritsu.com)



MS2721B	Description
10580-00175	Spectrum Master User Guide (Hard copy included) - Bias-Tee, GPS Receiver
10580-00231	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, IF Output, Gated Sweep
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00232	Signal Generator Measurement Guide - Tracking, and Vector Signal Generator
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00237	Digital TV Measurement Guide - DVB-T/H, ISDB-T
10580-00176	Programming Manual
10580-00177	Maintenance Manual

Troubleshooting Guides (soft copy included on MST CD and at www.us.anritsu.com)



11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00463	W-CDMA/HSDPA Base Stations
11410-00465	TD-SCDMA/HSDPA Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00470	Fixed WiMAX Base Stations
11410-00469	Mobile WiMAX Base Stations

Standard Accessories (included with instrument)



10580-00207	Spectrum Master User Guide (includes Bias-Tee and GPS Receiver)
2300-498	MST CD: Master Software Tools, User/Measurement Guides, Programming Manual, Troubleshooting Guides, Application Notes
65729	Soft Carrying Case
633-44	Rechargeable Li-Ion Battery
40-168-R	AC/DC Power Supply
806-141-R	Automotive Cigarette Lighter 12 Volt DC Adapter
3-806-152	Cat 5e Crossover Patch Cable, 7 feet/213 cm
2000-1371-R	Ethernet Cable, 7 feet/213 cm
3-2000-1498	USB A-mini B Cable, 10 feet/305 cm
2000-1520-R	USB Memory Drive
1091-27-R	Type-N male to SMA female adapter
1091-172	Type-N male to BNC female adapter
11410-00405	Spectrum Master™ MS2721B Technical Data Sheet One Year Warranty (Including battery, firmware, and software) Certificate of Calibration and Conformance

Spectrum Master™ MS2721B Spectrum Analyzer Specifications

Optional Accessories

Directional Antennas



Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1519-R	500 MHz to 3000 MHz, log periodic
2000-1617	600 MHz to 2100 MHz, N(f), 5-8 dBi to 12 GHz, 0-6 dBi to 21 GHz, log periodic

Portable Antennas



2000-1200	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035	896 MHz to 941 MHz, SMA (m), 50 Ω (1/4 wave)
2000-1030	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1616	20 MHz to 21000 MHz, N(f), 50 Ω
61532	Antenna Kit (Consists of: 2000-1030, 2000-1031, 2000-1032-R, 2000-1200, 2000-1035, 2000-1361, and carrying pouch)

Bandpass Filters



1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA (f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA (f), 50 Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) - SMA (f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz Band, 0.34 dB loss, N(m) to SMA(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA (f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω

Attenuators



3-1010-122	20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
42N50-20	20 dB, 5 W, DC to 18 GHz, N(m) to N(f)
42N50A-30	30 dB, 5 W, DC to 18 GHz, N(m) to N(f)
3-1010-123	30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
1010-127-R	30 dB, 150 W, DC to 3 GHz, N(m) to N(f)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Spectrum Master™ MS2721B Spectrum Analyzer Specifications

Optional Accessories (continued)

Adapters



1091-26-R	SMA(m) - N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) - N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) - N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) - N(f), DC to 18 GHz, 50 Ω
1091-172	BNC(f) - N(m), DC to 1.3 GHz, 50 Ω
1091-379-R	7/16 DIN(f) - 7/16 DIN(f), DC to 6 GHz, 50 Ω, w/ Reinforced Grip
510-102-R	N(m) - N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters



34NN50A	Precision Adapter, N(m) - N(m), DC to 18 GHz, 50 Ω
34NFN50	Precision Adapter, N(f) - N(f), DC to 18 GHz, 50 Ω

Miscellaneous Accessories



2000-1410	GPS Antenna, RP-BNC
69793	CW Signal Generator Kit
2000-1520-R	USB Flash Drive
3-200-1567	512 MB Compact Flash Card
2000-1374	External Charger for Li-Ion Batteries

Backpack and Transit Case



67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle

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