

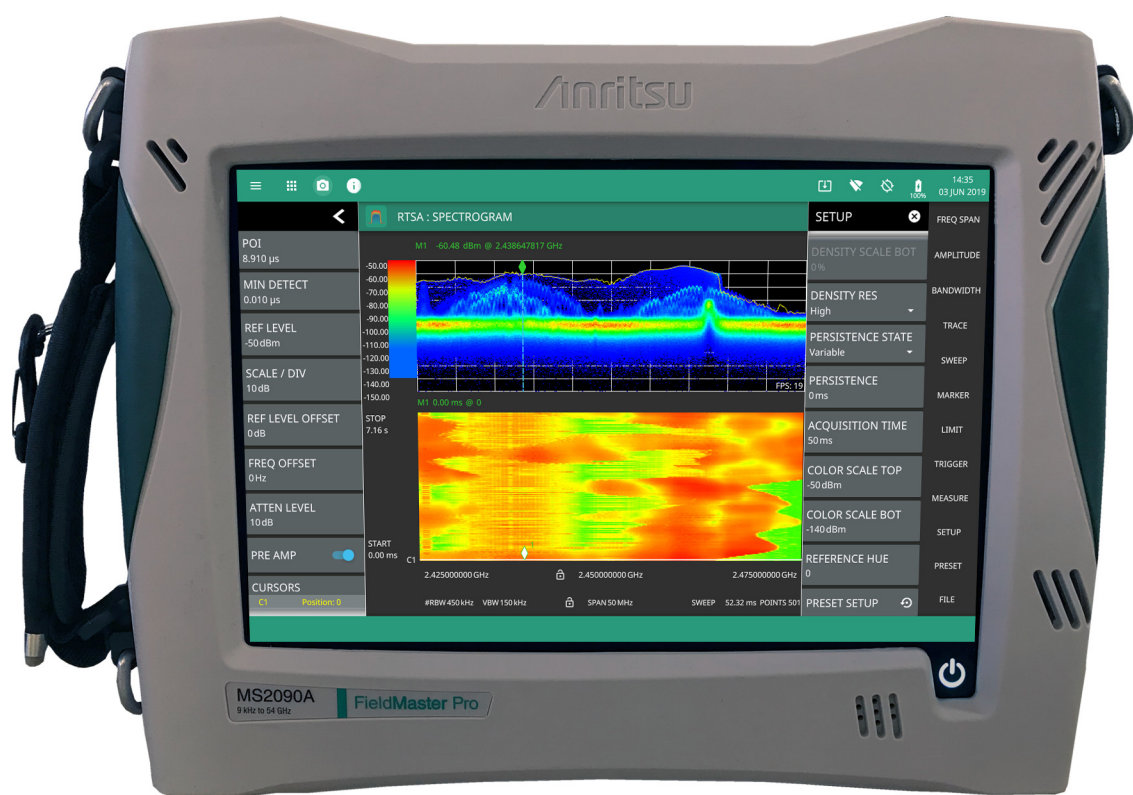
Anritsu envision : ensure

Field Master Pro™

High Performance Handheld
Spectrum Analyzer

MS2090A

9 kHz to 9 GHz, 14 GHz, 20 GHz, 26.5 GHz, 32 GHz, 43.5 GHz, 54 GHz



Introduction

Anritsu is proud to introduce the world's most advanced handheld spectrum analyzer with real-time spectrum analysis capability. With frequency coverage up to 54 GHz, the new Field Master Pro™ MS2090A completely redefines the standards for portable handheld analyzers, setting another new industry benchmark for performance and accuracy. The new MS2090A is the culmination of over 60 years of microwave test and measurement equipment development, using the very latest technologies to deliver accuracy and precision in measurements previously reserved only for benchtop instruments.

Instrument Highlights

- Modulation Bandwidth: up to 100 MHz
- Dynamic Range: > 106 dB in 1 Hz RBW
- DANL: -164 dBm in 1 Hz RBW
- Phase Noise: -106 dBc/Hz @ 10 kHz offset at 1 GHz
- Resolution Bandwidth (RBW): 1 Hz up to 10 MHz
- RTSA with 2.05 μ s POI
- Full-band Preamplifiers
- Operation to +55 °C: Full Performance on AC or Battery
- GNSS (GPS, GLONASS, Galileo, BeiDou)
- USB 3.0
- 10.1" Capacitive Touchscreen
- Two Hour Battery

Capabilities and Functional Highlights

Wireless Measurements

- 5G NR Analyzer - 5G Demodulation
- Real Time Spectrum Analyzer
- LTE FDD
- Spectrogram
- Zero Span IF Output
- Gated Sweep
- EIRP
- Field Strength
- Occupied Bandwidth
- Channel Power
- Adjacent Channel Power
- Spectral Emissions Mask
- Signal Strength and RSSI

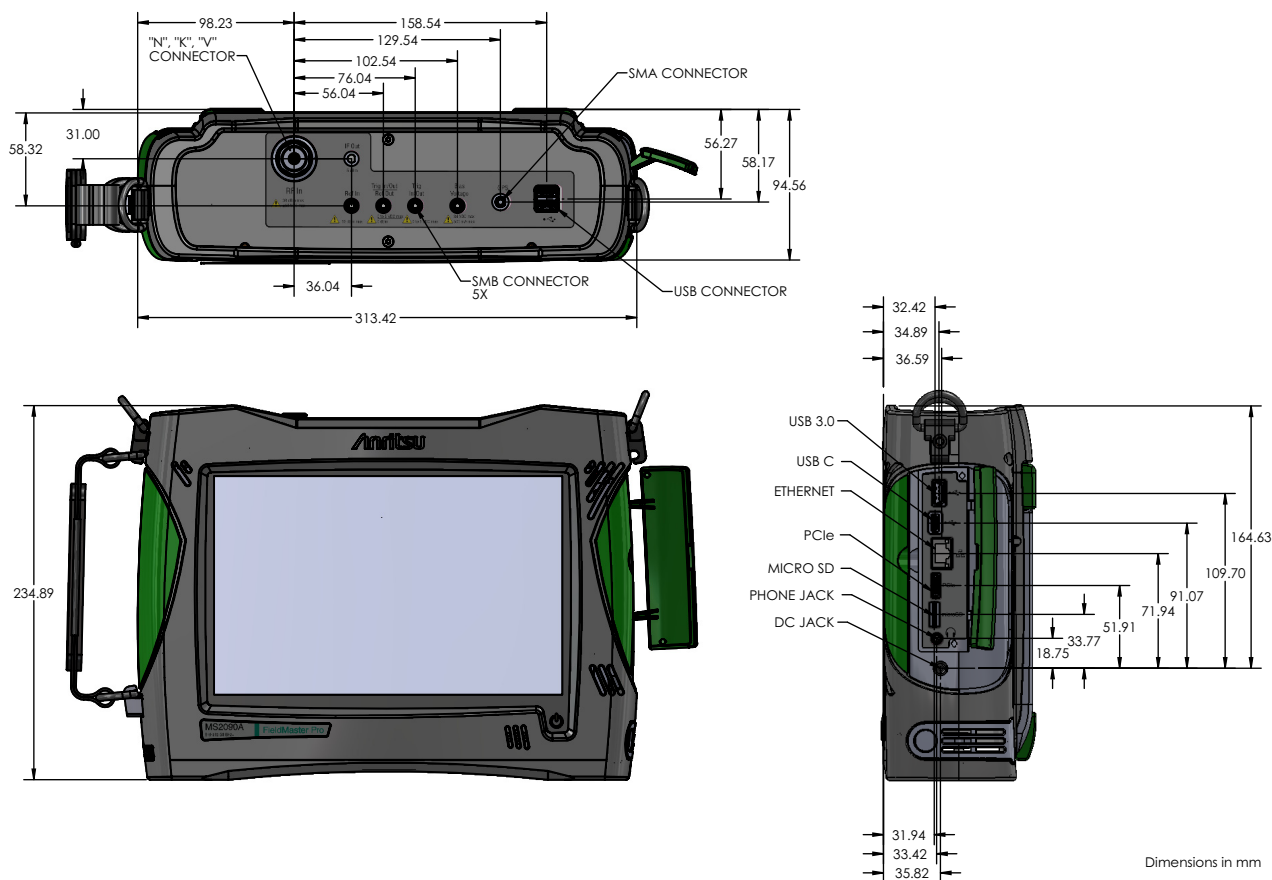


Table of Contents

Definitions.....	3
Standard Spectrum Analyzer Features.....	4
Real-Time Spectrum Analyzer Features.....	5
Spectrum Analyzer Performance.....	6
Interference Finder (Option 24).....	7
GPS Receiver (Option 31).....	7
Zero Span IF Output (Option 89).....	7
Gated Sweep (Option 90).....	8
LTE FDD Signal Analyzer (Option 883).....	8
5G NR Measurements (Option 888).....	9
General Specifications.....	10
Programmable Remote Control.....	11
Ordering Information – Instrument Options.....	12
Standard Accessories.....	12
Optional Accessories.....	13

Definitions

Specifications	All specifications and characteristics apply under the following conditions, unless otherwise stated:
Warm-Up Time	After 10 minutes of warm-up time, where the instrument is left in the ON state.
Reference Signal	When using internal reference signal.
Typical Performance	Typical specifications are not tested and are not warranted. They are generally representative of characteristic performance.
Nominal Performance	Nominal specifications are design parameters; they are not tested and are not warranted.
Uncertainty	A coverage factor of x1 is applied to the measurement uncertainties to facilitate comparison with other industry handheld analyzers.
Time Base Error	Input Frequency × Frequency Reference Error
Calibration Cycle	Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.)
	All specifications in this data sheet are subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com

Standard Spectrum Analyzer Features

Smart Measurements

Field Strength	Measures field strength in dBm/m ² or dBW/m ²
Channel Power	Measures the total power in a specified bandwidth
Occupied Bandwidth	Measures 99 % to 1 % power channel of a signal
Adjacent Channel Power	Measures channel power of the adjacent channel
Spectral Emission Mask	Standards based limits for wireless emissions

Setup Parameters

Frequency	Center/Start/Stop, Frequency Step, Frequency Offset
Span	Span, Full Span, Last Span, Zero Span
Amplitude	Reference Level (Manual/Auto), Scale/Division, Ref Level Offset, Attenuation (Auto, Manual), Units (dBm), Preamp (On/Off)
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/RBW Ratio, Span/RBW Ratio, VBW Log/Lin Averaging

Sweep Functions

Sweep	Single/Continuous, Restart, Sweep Once, Sweep to N, Gated Sweep (see “Gated Sweep (Option 90)” on page 8)
Sweep Points	10 to 4001 (1001 in zero span)
Sweep Time	60 ns to 3600 s in zero span
Sweep Time Accuracy	±2 % in zero span

Trace Functions

Traces	Up to Six Traces
Trace Type	Clear/Write, Average (2 to 1000), Max Hold, Min Hold, Rolling Average, Rolling Max Hold, Rolling Min Hold
Trace Mode	Active, Hold/View, Blank
Detector Type per Trace	Peak, RMS/Avg, Negative

Trigger Functions (zero span only)

Sources	Free Run, Video, External 1, External 2, Periodic
Settings	Level, Holdoff, Slope, Hysteresis

Spectrogram

Trace Time/Position Cursor	Up to Six Cursors (display historical trace data by trace position or time)
Color Setup	Set Color Top/Bottom Range, Set Color Reference Hue

Marker Functions

Markers	Up to 12 Markers
Marker Measurements	Power, Frequency, Time (Spectrogram)
Marker Mode	Normal, Delta, Fixed
Delta Marker	Relative to any Normal or Fixed Marker
Marker Function	None, Noise, Counter Marker
Marker Trace	Assign Marker to any Trace
Peak Search	Peak Search, Next Peak, Next Peak Left, Next Peak Right, Next Point Left, Next Point Right
Peak Search Setup	Peak Threshold, Peak Excursion
Marker →	Mkr → Center, Mkr → Ref Level
Marker Table	Up to 12 Markers Showing Marker Mode, Function, Trace, Frequency, Amplitude, Delta Frequency & Offset

Limit Line Functions

Limit Setup	Upper/Lower, Limit On/Off, Limit Alarm On/Off, Set Default Limit Line, Absolute/Relative, Mirror On/Off, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Envelope, Points (41 max), Offset, Shape Square/Slope

Real-Time Spectrum Analyzer Features

Setup Parameters

Frequency	Center/Start/Stop, Frequency Step, Frequency Offset				
Span	Span, Full Span (max span: 22 MHz standard, 55 MHz with option 103, 110 MHz with option 104)				
Amplitude	Reference Level (Manual/Auto), Scale/Division, Ref Level Offset, Attenuation (Auto, Manual), Units (dBm), Preamp (On/Off)				
Bandwidth	RBW (span dependent), Auto RBW, Span/RBW Ratio				
Probability of Intercept	Analysis Bandwidth	Density Resolution	Span	RBW	POI
	20 MHz (Standard)	Normal High	22 MHz	10 MHz	2.520 μ s 4.420 μ s
	50 MHz (Opt. 103)	Normal High	55 MHz	25 MHz	2.210 μ s 4.110 μ s
	100 MHz (Opt. 104)	Normal High	110 MHz	40 MHz	2.055 μ s 3.950 μ s
Density Color	Set Color Top/Bottom Range, Auto Scale				
Persistence	Infinite or Variable from 0 to 10 s				
Acquisition Time	50 ms to 5 s				
FFT Rate	527,000 FFT/s (normal resolution), 263,000 FFT/s (high resolution)				
Minimum Detectable Signal	5 ns				

Sweep Functions

Sweep	Single/Continuous, Sweep Once
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Trace Functions

Traces	Up to Six Traces
Trace Type	Clear/Write, Average (2 to 1000), Max Hold, Min Hold, Rolling Average, Rolling Max Hold, Rolling Min Hold
Trace Mode	Active, Hold/View, Blank
Detector Type per Trace	Peak, Sample, Negative

Spectrogram

Trace Time/Position Cursor	Up to Six Cursors (display historical trace data by trace position or time)
Color Setup	Set Color Top/Bottom Range, Set Color Reference Hue

Marker Functions

Markers	Up to 12 Markers
Marker Measurements	Power, Frequency, Time (Spectrogram)
Marker Mode	Normal, Delta, Fixed
Delta Marker	Relative to any Normal or Fixed Marker
Marker Function	None, Noise
Marker Trace	Assign Marker to any Trace
Peak Search	Peak Search, Next Peak, Next Peak Left, Next Peak Right, Next Point Left, Next Point Right
Peak Search Setup	Peak Threshold, Peak Excursion
Marker →	Mkr → Center, Mkr → Ref Level
Marker Table	Up to 12 Markers Showing Marker Mode, Function, Trace, Frequency, Amplitude, Delta Frequency & Offset

Limit Line Functions

Limit Setup	Upper/Lower, Limit On/Off, Limit Alarm On/Off, Set Default Limit Line, Absolute/Relative, Mirror On/Off, Default Limit
Limit Line Edit	Frequency, Amplitude, Add Point, Add Vertical, Delete Point, Next Point Left/Right
Limit Line Move	To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
Limit Line Envelope	Create Envelope, Update Envelope, Points (41 max), Offset, Shape Square/Slope

Spectrum Analyzer Performance

Frequency (usable to 0 Hz)

MS2090A-0709	9 kHz to 9 GHz (Option 709)
MS2090A-0714	9 kHz to 14 GHz (Option 714)
MS2090A-0720	9 kHz to 20 GHz (Option 720)
MS2090A-0726	9 kHz to 26.5 GHz (Option 726)
MS2090A-0732	9 kHz to 32 GHz (Option 732)
MS2090A-0743	9 kHz to 43.5 GHz (Option 743)
MS2090A-0754	9 kHz to 54 GHz (Option 754)
Tuning Resolution	1 Hz
Span	10 Hz to max frequency, Zero Span
Frequency Reference	Internal, GPS, External
Internal Frequency Reference	Aging: $\pm 1.0 \times 10^{-6}$ per 10 years Accuracy: $\pm 0.3 \times 10^{-6}$ (25 °C $\pm$ 25 °C) plus aging (see "GPS Receiver (Option 31)" on page 7 for improved accuracy)
External Frequency Reference	10 MHz, 0 dBm to +10 dBm

Bandwidth

Analysis Bandwidth	20 MHz (standard), 50 MHz (Option 103), or 100 MHz (Option 104)
RTSA Bandwidth	22 MHz (standard), 55 MHz (Option 103), 110 MHz (Option 104)
Resolution Bandwidth (RBW)	1 Hz to 10 MHz
Video Bandwidth (VBW)	0.1 Hz to 10 MHz
VBW/Average Type	Linear/Log

Spectral Purity – SSB Phase Noise

Offset from 1 GHz	Maximum	Typical
10 kHz	-102 dBc/Hz	-106 dBc/Hz
100 kHz	-106 dBc/Hz	-110 dBc/Hz
1 MHz	-111 dBc/Hz	-116 dBc/Hz
10 MHz	-123 dBc/Hz	-129 dBc/Hz

Spurs (0 dB input attenuation)

Residual Spurs (RF input terminated)	Preamp = Off	Preamp = On
< 14 GHz	-90 dBm, maximum	-100 dBm, maximum
14 to 20 GHz	-85 dBm, maximum	-100 dBm, maximum
> 20 to 32 GHz	-80 dBm, maximum	-100 dBm, maximum
> 32 to 54 GHz	-80 dBm, maximum	-95 dBm, maximum
Input-Related Spurious (-30 dBm input)	Maximum ^a -60 dBc	Typical -70 dBc

a. Instrument centered on single signal, span < 1.7 GHz, 0 dB input attenuation.

Amplitude Ranges

Dynamic Range	>106 dB minimum at 2.4 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	-150 dBm to +30 dBm
Attenuator Resolution	0 to 65 dB, 5 dB steps
Reference Level Offset	99.9 dB external loss to 99.9 dB external gain
Amplitude Units	dBm, dBm/m ² , dBW/m ²
Maximum Continuous Input	+30 dBm peak typical, $\pm$ 50 VDC ($\geq$ 10 dB attenuation) +23 dBm peak typical, $\pm$ 50 VDC (< 10 dB attenuation) +10 dBm peak typical, $\pm$ 50 VDC (preamp = On)

Amplitude Accuracy (10 dB attenuation, -50 dBm $\leq$ input signal $\leq$ -10 dBm, 1 kHz RBW, auto-coupled, excluding effects of VSWR, noise, and spurs)

	20 °C to 30 °C (after 30 minute warm-up)		-10 °C to 55 °C (after 60 minute warm-up)	
	Maximum	Typical	Maximum	Typical
9 GHz to 20 GHz Instruments				
9 kHz to 14 GHz	$\pm$ 1.3 dB	$\pm$ 0.5 dB	$\pm$ 2.0 dB	$\pm$ 0.5 dB
> 14 GHz to 18 GHz	$\pm$ 1.3 dB	$\pm$ 0.5 dB	$\pm$ 2.0 dB	$\pm$ 0.5 dB
> 18 GHz to 20 GHz	-	$\pm$ 1.0 dB	-	$\pm$ 1.0 dB
26.5 GHz to 54 GHz Instruments				
9 kHz to 14 GHz	$\pm$ 1.3 dB	$\pm$ 0.5 dB	$\pm$ 2.0 dB	$\pm$ 0.5 dB
> 14 GHz to 20 GHz	$\pm$ 1.3 dB	$\pm$ 0.5 dB	$\pm$ 2.0 dB	$\pm$ 0.5 dB
> 20 GHz to 43.5 GHz	$\pm$ 1.8 dB	$\pm$ 0.5 dB	$\pm$ 2.5 dB	$\pm$ 0.5 dB
> 43.5 GHz to 54 GHz	$\pm$ 1.8 dB	$\pm$ 0.5 dB	$\pm$ 2.5 dB	$\pm$ 0.5 dB

Displayed Average Noise Level (DANL) (RMS detection, VBW/Avg type = Log, reference level = -20 dBm for preamp Off and -50 dBm for preamp On, auto attenuation On)

	Preamp = Off		Preamp = On	
9 GHz to 20 GHz Instruments	Maximum	Typical	Maximum	Typical
10 MHz to 4 GHz	-145 dBm	-148 dBm	-161 dBm	-164 dBm
> 4 GHz to 9 GHz	-142 dBm	-145 dBm	-159 dBm	-162 dBm
> 9 GHz to 14 GHz	-136 dBm	-139 dBm	-156 dBm	-159 dBm
> 14 GHz to 20 GHz	-138 dBm	-144 dBm	-156 dBm	-161 dBm
26.5 GHz to 54 GHz Instruments				
10 MHz to 4 GHz	-145 dBm	-148 dBm	-161 dBm	-164 dBm
> 4 GHz to 9 GHz	-142 dBm	-145 dBm	-159 dBm	-162 dBm
> 9 GHz to 14 GHz	-136 dBm	-139 dBm	-156 dBm	-159 dBm
> 14 GHz to 20 GHz	-138 dBm	-142 dBm	-156 dBm	-159 dBm
> 20 GHz to 32 GHz	-135 dBm	-140 dBm	-154 dBm	-159 dBm
> 32 GHz to 43.5 GHz	-135 dBm	-140 dBm	-152 dBm	-154 dBm
> 43.5 GHz to 54 GHz	-130 dBm	-134 dBm	-147 dBm	-151 dBm

Third-Order Intercept (TOI) (-20 dBm tones 2 MHz apart, 0 dB input attenuation, preamp OFF, reference level -20 dBm)

2.4 GHz	+14 dBm minimum
50 MHz to 20 GHz	+20 dBm typical
> 20 GHz to 32 GHz	+15 dBm typical
> 32 GHz to 54 GHz	+20 dBm typical

P1dB (nominal)

< 4 GHz	+5 dBm
4 GHz to 20 GHz	+12 dBm
> 20 GHz to 32 GHz	+7 dBm
> 32 GHz to 54 GHz	+12 dBm

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

50 MHz	-64 dBc maximum
≤ 4 GHz	-72 dBc typical
> 4 GHz	-75 dBc typical

VSWR (≥ 10 dB input attenuation)

< 20 GHz	1.5:1 typical
20 GHz to 54 GHz	2.0:1 typical

Interference Finder (Option 24) (for use with directional antennas, sold separately)

Setup	Integration Bandwidth, Power Limit, MAX/MIN Level, Volume
Audio Tone	20 Hz to 20 kHz

GPS Receiver (Option 31)

Supported Satellite Systems	GPS, GNSS (includes GPS, GLONASS, Galileo, BeiDou)
Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
Anritsu Antennas	2000-1528-R GPS antenna (requires +5 VDC) 2000-1652-R GPS antenna (requires +3.3 VDC or +5 VDC) 2000-1760-R GPS antenna (requires +2.5 VDC to +3.7 VDC)
GPS Time/Location Indicator	UTC Time, Latitude, Longitude, and Altitude on display (UTC Time and Altitude on GPS Info display)
High Frequency Accuracy	< ± 2.5 × 10 ⁻⁸ with GPS On, 3 minutes after satellite lock in selected mode (GPS antenna connected) < ± 5.0 × 10 ⁻⁸ 24 hour holdover accuracy, 0 °C to 50 °C ambient temperature (GPS antenna disconnected)
Connector	SMA, female

Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Zero Span only
Center Frequency	325 MHz (nominal, FFT capture BW ≤ 32 MHz) 300 MHz (nominal, FFT capture BW > 100 MHz, requires Option 103 or 104)
Output Level	-4 dBm (nominal, -20 dBm input level, 0 dB input attenuation, preamp Off, 10 MHz input frequency) Spectrum is inverted in certain input RF bands.
Reference Level	-57 dBm to +30 dBm (Preamp Off) -87 dBm to -40 dBm (Preamp On)
IF Bandwidth	≤ 32 MHz; ≤ 110 MHz with Option 103 or 104
Rise Time	< 20 ns
Connector	SMB(m), 50 Ω

Gated Sweep (Option 90)

Gate Source	GPS
Frame Time	1 s, 20 ms, 10 ms
Gate Delay	up to 200 ms
Gate Length	1 μ s up to 200 ms
Power vs. Time, Display Length	100 μ s to 200 ms

LTE FDD Signal Analyzer (Option 883)

Demodulation Summary

PCI Summary Measurements	Physical Cell ID, Sector ID, Cell Group, Frequency Error, Time Offset, Status of Primary Synchronization Signal (PSS)
Signal Power Measurements (dBm)	Reference Signal (RS), Sync Signal (SS), Physical Broadcast Channel Power (PBCH)
RS Power Accuracy	± 1.0 dB typical, (RF input -50 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error (99 % confidence level)
Error Vector Magnitude Measurements (%)	Physical Broadcast Channel (QPSK), Physical Downlink Shared Channel (QPSK), PDSCH (16 QAM, 64 QAM, 256 QAM)

Channel Power

Measurements	Total Channel Power, Total Power Spectral Density (PSD), Limit Test (Power and PSD)
Setup Parameters	Integration Bandwidth, PSD Units (Hz/MHz), Power Limit (dBm), PSD Limit (dBm/Hz)
RF Channel Power Accuracy	± 1 dB typical (-50 dBm to +10 dBm)

Channel Spectrum

Measurements	Occupied Bandwidth (OBW), Total Power, Occupied Bandwidth, Limit Test (OBW)
Setup Parameters	OBW Power (%/dB), OBW Limit (Hz), Method (%/x dB)

General Setup Parameters

Channel Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
Amplitude	Auto Range, Reference Level, Scale/Division, Reference Level Offset
Sweep	Single/Continuous
MIMO Antenna Setup	Auto, Antenna 1, 2, 3, or 4

5G NR Measurements (Option 888)

5G NR Demod Summary

Measurements	Multi Beam: Physical-layer Cell ID, Beam Index, Sector ID, Cell Group, Frequency Error, Time Offset, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), Sync and Demod Status Indicators, Beam Power (dBm) Single Beam: Physical Cell ID, Sector ID, Cell Group, Frequency Error, Time Offset, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), Sync and Demod Status Indicators, Block Measurements (PSS, SSS, PBCH, PBCH-DMRS), Average EVM, Peak EVM (@ subcarrier/symbol), Beam Power (dBm)
Views	Multi Beam (up to 64), Single Beam
Setup Parameters	SINR Threshold (dB)
Frequency	Band Configuration: Manual or selectable Band #, Absolute Radio Frequency Channel Number (ARFCN), Global Synchronization Raster Channel (GSCN), Channel Bandwidth (5 MHz to 100 MHz in steps of 5 MHz), SSB Offset, Subcarrier Spacing (15, 30, 60, 120, 240 kHz), Mapping Pattern (Auto, P1, P2), Auto SSB Detect
Amplitude	Auto Range, Reference Level, Scale/Division, Reference Level Offset, Attenuation Level (Auto/Manual), Preamp
Sweep	Single/Continuous, Sweep Once

5G NR Multi PCI

Measurements	Multiple Physical-layer Cell IDs, Beam Index, SS-RSRP (dBm), SS-RSRQ (dB), SS-SINR (dB), SS-EVM (%) Beam Power (dBm)
Views	Multi PCI Beam Scanner (up to 64 beams), Table
Setup Parameters	SINR Threshold (dB)

5G NR SSB Detect

Auto SSB Detect	Searches 3GPP defined GSCN raster
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5G NR RF EIRP

Measurements	EIRP (Active, Horizontal/Vertical, Sum), Upper/Lower Limit Test
Views	Normal (RF spectrum), Quick View (summary)
Setup Parameters	Save (Horizontal/Vertical), Reset Sum, RX Antenna Gain, Distance to Antenna, Units (Meters/Feet), Upper/Lower Limit Test, RX Cable Loss

5G NR RF Occupied Bandwidth

Measurements	Occupied Bandwidth, Total Power, x dB Bandwidth, Tx Frequency Error, Limit Test
View	Normal (RF spectrum)
Setup Parameters	Method: OBW Power (% and X dB), OBW Limit Test

5G NR RF Channel Power

Measurements	Total Channel Power, Total PSD, Limit Test
View	Normal (RF spectrum)
Setup Parameters	Integration Bandwidth, PSD Units, Power and PSD Limit Tests

5G NR Modulation Measurements

Frequency Range	10 MHz to 54 GHz (option dependent)
Input Signal Range	-76 dBm to +10 dBm (≤ 20 GHz) -72 dBm to +10 dBm (> 20 GHz)
RSRP Accuracy	± 1.0 dB typical
Residual EVM (rms)	2.0 % typical
Frequency Error	$< \pm 2.0\text{E-}8$ + time base error, typical

5G NR RF Measurements

RF Channel Power Accuracy	± 1 dB typical (-76 dBm to +10 dBm)
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General Specifications

Setup Parameters

Date and Time	Date and Time settings, Time Zone settings, Time synced to Internet/GPS
Languages	English
Display	Brightness adjustment, Auto screen dimming shutoff timer (on/off), Color schemes (Standard, Inverted)
Screen Shot Settings	Image capture size, Image header/footer
Option Configuration	Enable options using file (USB)
GPS	see "GPS Receiver (Option 31)" on page 7
Ethernet	Ethernet (IP4 & IP6 formats), Type (DHCP, Static)
WLAN (Wi-Fi)	2x2 MIMO, 802.11 a/b/g/n/ac, On/Off, Auto detect wireless networks
Reset	Factory Reset, Delete All User Files, Delete System Files, Master Reset, Diagnostics
Diagnostics	Self Test, Service Tools, exportable event and system error logs
Save/Recall	Measurement Setup, Screenshot Image (.PNG), Export Measurement data (Text, CSV), Location
File Management	Save, Copy, Paste, Delete, Create New Folder, Set File Name and File Type, Rename

Connectors

RF In	MS2090A-0709, -0714, -0720: Type N(f), 50 Ω MS2090A-0726, -0732, -0743: Ruggedized Type K(m), 50 Ω MS2090A-0754: Ruggedized Type V(m), 50 Ω
GPS	SMA(f)
External Power	5.5 mm barrel connector, 13.5 to 17.5 VDC, 5.0 A max
Ethernet Interface	RJ45 connector for Ethernet 10/100/1000 Mbps (connect to PC or LAN for remote access)
USB Interface	USB 3 Type A (connect FAT32 formatted media and power sensors) USB 3 Type C (connect slave devices)
Headset Jack	3.5 mm 3-wire headset jack (functionality supported in future software update)
External Reference In	SMB(m), 50 Ω , maximum input +10 dBm
External Reference Out	SMB(m), 50 Ω , 10 MHz
External Trigger	SMB(m), 50 Ω , TTL-compatible levels, maximum input +5 VDC
IF Out	SMB(m), 50 Ω (see "Zero Span IF Output (Option 89)" on page 7)
DC Bias Voltage	SMB(m), Setup: On/Off, Voltage, Trip Reset Voltage Range: +1 V to +34 V, Resolution: 0.1 V Max Current: 1 A, Max Power: 15 W

Display and Keyboard

Display	10.1 inch capacitive touchscreen, 1280 x 800 resolution
Screen Strength	IK08 (protected against a 5 joule impact)
Keyboard	Common alphanumeric/symbolic keys and customizable EZ keyboard
Touch Gestures	Pinch to zoom x (span), Drag in x (center frequency, markers, limit line points)
Toolbar	System menu, application drawer, shortcuts, screen capture, lock status (touchscreen), notification bar, Wi-Fi status, GPS status, battery status, time and date

Battery

Type	Li-Ion
Battery Operation	Two hour operation, typical
Charging Temperature Limit	0 °C to +45 °C, relative humidity $\leq$ 80 %

Regulatory Compliance

European Union	EMC 2014/30/EU, EN 61326-1:2013, CISPR 11/EN 55011, IEC/EN 61000-4-3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21-0004

Environmental

	MIL-PRF-28800F Class 2
Operating Temperature Range	-10 °C to 55 °C
Storage Temperature Range	-51 °C to 71 °C
Maximum Relative Humidity	95 % RH at 30 °C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 g _n
Altitude	4600 meters, operating and non-operating
Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1

Warranty

Duration	Standard three-year warranty One-year warranty on battery
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Size and Weight

Size	314 mm x 235 mm x 95 mm, (12.4 in x 9.25 in x 3.74 in)
Weight	MS2090A-0709, -0714, -0720: 5.06 kg (11.15 lb) MS2090A-0726, -0732, -0743, -0754: 5.4 kg (11.9 lb)

Programmable Remote Control

Functionality	Full instrument programming control (except power on/off) via Ethernet and WLAN connectivity. See the Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	Ethernet, WLAN

Ordering Information – Instrument Options

Part Number	Description
MS2090A	Field Master Pro (Requires Option 709, 714, 720, 726, 732, 743, or 754)
Options	
MS2090A-0709	Frequency Range 9 kHz to 9 GHz
MS2090A-0714	Frequency Range 9 kHz to 14 GHz
MS2090A-0720	Frequency Range 9 kHz to 20 GHz
MS2090A-0726	Frequency Range 9 kHz to 26.5 GHz
MS2090A-0732	Frequency Range 9 kHz to 32 GHz
MS2090A-0743	Frequency Range 9 kHz to 43.5 GHz
MS2090A-0754	Frequency Range 9 kHz to 54 GHz
MS2090A-0024	Interference Finder (requires directional antenna, sold separately)
MS2090A-0031	GPS Receiver (requires GPS antenna, sold separately)
MS2090A-0089	Zero Span IF Output
MS2090A-0090	Gated Sweep
MS2090A-0103	50 MHz Analysis Bandwidth
MS2090A-0104	100 MHz Analysis Bandwidth
MS2090A-0199	Real Time Spectrum Analyzer
MS2090A-0883	LTE FDD Summary Measurements (requires GPS option MS2090A-0031)
MS2090A-0888	5G NR Downlink Measurements (requires GPS option MS2090A-0031)
MS2090A-0400	Vision Monitor Enabled
MS2090A-0407	Vision High-Speed Port Scanner Enabled
MS2090A-xxxx-0097	Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1 (xxxx is the frequency option number)
MS2090A-xxxx-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1 (xxxx is the frequency option number)
MS2090A-xxxx-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1 plus test data (xxxx is the frequency option number)

Standard Accessories (included with instrument)

Part Number	Description
2000-1371-R	Ethernet Cable, 7 ft/213 cm
2000-1931-R	Stylus
3-2000-1928	Shoulder Strap
633-75	Li-Ion Battery
40-204-R	AC/DC Power Supply (Field Master Series)
2000-1859-R	USB Cable, USB 3.0 Type-A to Type-C, 1 m
2000-1938-R	SMB Plug to BNC Jack Adapter (qty 3)
806-366-R	BNC to SMB Cable, 1 m
	Certificate of Calibration and Conformance

Optional Accessories

Miscellaneous Accessories



Part Number	Description
2000-1945-R	MS2090A Soft Case
67135	Anritsu Backpack (for Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle 56 cm x 45.5 cm x 26.5 cm (22.07" x 17.92" x 10.42")
40-207-R	Automotive DC/DC Power Adapter (Field Master™ series)
2000-1374	External Dual Charger for Li-Ion Batteries
MA25401A	Atomic Clock External 10 MHz Frequency Reference (see MA25401A Technical Data Sheet, PN: 11410-01134 for details)

GPS Antennas



Part Number	Description
2000-1528-R	GPS Antenna, SMA(m) with 5 m (15 ft) cable, requires 5 VDC
2000-1652-R	GPS Antenna, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC
2000-1760-R	GPS Antenna, SMA(m), 25 dB gain, 2.5 VDC to 3.7 VDC

Mag Mount and Broadband Antennas



Part Number	Description
2000-1616-R	20 MHz to 21000 MHz, N(f), 50 Ω
2000-1645-R	694 MHz to 894 MHz, 3 dBi peak gain 1700 MHz to 2700 MHz, 3 dBi peak gain, N(m), 50 Ω , 10 ft
2000-1646-R	750 MHz to 1250 MHz, 3 dBi peak gain, 1650 MHz to 2000 MHz, 5 dBi peak gain, 2100 MHz to 2700 MHz, 5 dBi peak gain, N(m), 50 Ω , 10 ft
2000-1647-R	Cable 1: 698 MHz to 1200 MHz, 2 dBi peak gain, 1700 MHz to 2700 MHz, 5 dBi peak gain, N(m), 50 Ω , 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω , 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω , 10 ft
2000-1648-R	1700 MHz to 6000 MHz, 3 dBi peak gain, N(m), 50 Ω , 10 ft
2000-1946-R	Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N(m), 50 Ω , 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω , 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω , 10 ft
2000-1940-R	Ka Band 26.5 GHz to 40 GHz, K(f) (2.92 mm), 3 dBi gain

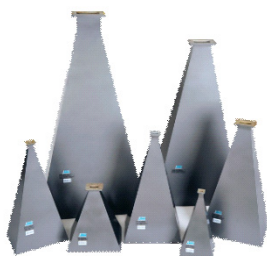
Directional Antennas



Part Number	Description
2000-1411-R	824 MHz to 896 MHz, N(f), 12.3 dBi, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 12.6 dBi, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 12.3 dBi, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 11.4 dBi, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 14.1 dBi, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 14.3 dBi, Yagi
2000-1659-R	698 MHz to 787 MHz, N(f), 10.1 dBi, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 14.3 dBi, Yagi
2000-1715-R	Directional Antenna, 698 MHz to 2500 MHz, N(f), gain of 2 dBi to 10 dBi, typical
2000-1726-R	Antenna, 2500 MHz to 2700 MHz, N(f), 14.1 dBi, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 7000 MHz, N(f), 5.1 dBi, typical
2000-1748-R	Antenna, Log Periodic, 1 GHz to 18 GHz, N(f), 6 dBi, typical
2000-1777-R	Portable Directional Antenna, 9 kHz to 20 MHz, N(f)
2000-1778-R	Portable Directional Antenna, 20 MHz to 200 MHz, N(f)
2000-1779-R	Portable Directional Antenna, 200 MHz to 500 MHz, N(f)
2000-1812-R	Portable Yagi Antenna, 450 MHz to 512 MHz, N(f), 7.1 dBi
2000-1825-R	Portable Yagi Antenna, 380 MHz to 430 MHz, N(f), 7.1 dBi

Portable Antennas**Part Number Description**

2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA(m), 2 dB, typical, 50 Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

Directional Horn Antennas**Part Number Description**

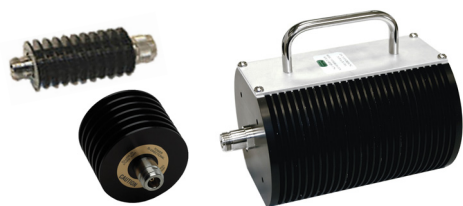
2000-1867-R	17.6 GHz to 26.7 GHz, WR42, 25 dBi gain
2000-1868-R	26.4 GHz to 40.1 GHz, WR28, 25 dBi gain
2000-1869-R	33.0 GHz to 50.1 GHz, WR22, 25 dB gain
2000-1870-R	39.3 GHz to 59.7 GHz, WR19, 25 dBi gain

Bandpass Filters



Part Number	Description
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
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz, N(m) to N(f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz, N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(f), 50 Ω
1030-149-R	High Pass, 150 MHz, N(m) to N(f), 50 Ω
1030-150-R	High Pass, 400 MHz, N(m) to N(f), 50 Ω
1030-151-R	High Pass, 700 MHz, N(m) to N(f), 50 Ω
1030-152-R	Low Pass, 200 MHz, N(m) to N(f), 50 Ω
1030-153-R	Low Pass, 550 MHz, N(m) to N(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50 Ω
1030-179-R	777 MHz to 798 MHz, N(m) to N(f), 50 Ω
1030-180-R	2500 MHz to 2570 MHz, N(m) to N(f), 50 Ω
2000-1684-R	791 MHz to 821 MHz, N(m) to N(f), 50 Ω
2000-1734-R	Bandpass Filter, 699 MHz to 715 MHz, N(m) and N(f), 50 Ω
2000-1735-R	Bandpass Filter, 776 MHz to 788 MHz, N(m) and N(f), 50 Ω
2000-1736-R	Bandpass Filter, 815 MHz to 850 MHz, N(m) and N(f), 50 Ω
2000-1737-R	Bandpass Filter, 1711 MHz to 1756 MHz, N(m) and N(f), 50 Ω
2000-1738-R	Bandpass Filter, 1850 MHz to 1910 MHz, N(m) and N(f), 50 Ω
2000-1739-R	Bandpass Filter, 880 MHz to 915 MHz, N(m) and N(f), 50 Ω
2000-1740-R	Bandpass Filter, 1710 MHz to 1785 MHz, N(m) and N(f), 50 Ω
2000-1741-R	Bandpass Filter, 1920 MHz to 1980 MHz, N(m) and N(f), 50 Ω
2000-1742-R	Bandpass Filter, 832 MHz to 862 MHz, N(m) and N(f), 50 Ω
2000-1743-R	Bandpass Filter, 2500 MHz to 2570 MHz, N(m) and N(f), 50 Ω
2000-1799-R	Bandpass Filter, 2305 MHz to 2320 MHz, N(m) and N(f), 50 Ω

Attenuators



Part Number	Description
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, 50 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)
1010-121	Attenuator, 40 dB, 100 W, DC-18 GHz, N(f) input - N(m) output, UniDirectional
3-1010-124	Attenuator, 40 dB, 100 W, DC-8.5 GHz, N(f) input - N(m) output, Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Precision Fixed Attenuators



Part Number	Description
41KB-3	DC to 26.5 GHz, 1W, 3 dB, K(m) to K(f)
41KB-6	DC to 26.5 GHz, 1W, 6 dB, K(m) to K(f)
41KB-10	DC to 26.5 GHz, 1W, 10 dB, K(m) to K(f)
41KB-20	DC to 26.5 GHz, 1W, 20 dB, K(m) to K(f)
41KC-3	DC to 40 GHz, 1W, 3 dB, K(m) to K(f)
41KC-6	DC to 40 GHz, 1W, 6 dB, K(m) to K(f)
41KC-10	DC to 40 GHz, 1W, 10 dB, K(m) to K(f)
41KC-20	DC to 40 GHz, 1W, 20 dB, K(m) to K(f)
41V-3	DC to 65 GHz, 1W, 3 dB, V(m) to V(f)
41V-6	DC to 65 GHz, 1W, 6 dB, V(m) to V(f)
41V-10	DC to 65 GHz, 1W, 10 dB, V(m) to V(f)
41V-20	DC to 65 GHz, 1W, 20 dB, V(m) to V(f)

Precision Adapters



Part Number	Description
34NN50A	Precision Adapter, DC to 18 GHz, N(m) to N(m), 50 Ω
34NFN50	Precision Adapter, DC to 18 GHz, N(f) to N(f), 50 Ω
34NMDVFN50	Precision NMD Adapter, DC to 18 GHz, V(f) to N(f), 50 Ω
71693-R	Ruggedized K(f) to N(f), DC to 18 GHz, 50 Ω

Adapters



Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50 Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50 Ω
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96-R	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510-97-R	7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50 Ω
2000-1938-R	SMB Plug to BNC Jack Adapter

Coaxial Adapters



Part Number	Description
2000-1880-R	DC to 18 GHz, N(m) to V(f), 50 Ω
2000-1881-R	DC to 18 GHz, N(f) to V(f), 50 Ω
K222B	DC to 40 GHz, K(f) to K(f), 50 Ω
34VFK50	DC to 40 GHz, V(f) to K(m), 50 Ω
34VFKF50	DC to 40 GHz, V(f) to K(f), 50 Ω
34VV50	DC to 65 GHz, V(m) to V(m), 50 Ω
34VVF50	DC to 65 GHz, V(f) to V(m), 50 Ω
34VVF50	DC to 65 GHz, V(f) to V(f), 50 Ω

Precision Waveguide Coaxial Adapters (right angle)



Part Number	Description
35WR42KF	18 GHz to 26.5 GHz, WR42 to K(f)
35WR28KF	26.5 GHz to 40 GHz, WR28 to K(f)
35WR22VF	33 GHz to 50 GHz, WR22 to V(f)
35WR19VF	40 GHz to 60 GHz, WR19 to V(f)
35WR15VF	50 GHz to 65 GHz, WR15 to V(f)

Waveguide to Coaxial End Launch Adapters (straight through)



Part Number	Description
2000-1889-R	17.6 GHz to 26.7 GHz, WR42 to K(f)
2000-1890-R	26.4 GHz to 40.1 GHz, WR28 to K(f)
1091-460-R	17.6 GHz to 26.7 GHz, WR42 to V(f)
1091-459-R	26.4 GHz to 40.1 GHz, WR28 to V(f)
1091-458-R	33.0 GHz to 50.1 GHz, WR22 to V(f)
1091-457-R	39.3 GHz to 59.7 GHz, WR19 to V(f)
1091-456-R	49.9 GHz to 67.0 GHz, WR15 to V(f)

Test Port Cables (Armored, Semi-rigid)



Part Number	Description
3670K50-1	DC to 40 GHz, K(f) to K(m), 30.5 cm (1 ft)
3670K50-2	DC to 40 GHz, K(f) to K(m), 61.0 cm (2 ft)
3670V50A-1	DC to 70 GHz, V(f) to V(m), 30.5 cm (1 ft)
3670V50A-2	DC to 70 GHz, V(f) to V(m), 61.0 cm (2 ft)

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