

# Spectrum Master™

## High Performance Handheld Spectrum Analyzer

MS2720T

9 kHz to 9 GHz, 13 GHz, 20 GHz, 32 GHz, 43 GHz

### Introduction

From Anritsu, the inventor of the handheld spectrum analyzer first introduced in 1999, we are proud to introduce our 7<sup>th</sup> generation Spectrum Master MS2720T. The MS2720T represents the highest performance handheld spectrum analyzers available in the world as Anritsu pushes the envelope closer to benchtop quality. This generation introduces a touch screen, full-band tracking generators to 20 GHz, and best-in-class performance for dynamic range, DANL, phase noise, and sweep speed.

### Spectrum and Interference Analyzer Highlights

- Measure: Occupied Bandwidth, Channel Power, ACPR, C/I, Field Strength, Spectral Emissions
- Measure Interference: Spectrogram, Signal Strength, RSSI
- Dynamic Range: > 106 dB in 1 Hz RBW
- DANL: -164 dBm in 1 Hz RBW
- Phase Noise: -112 dBc/Hz @ 10 kHz offset at 1 GHz
- Resolution Bandwidth (RBW): 1 Hz to 10 MHz
- Full-band Tracking Generators: 9, 13, 20 GHz
- Full-band Preamplifiers standard
- Channel Scanner: scan up to 20 channels at once
- Burst Detect™ Sweep Mode: Sweep 1000x in 15 MHz span
- Coverage Mapping: plot RSSI on on-screen map
- Interference Mapping: on-screen mapping with triangulation
- Operation to +55 °C: full performance on AC or battery

### Capabilities and Functional Highlights

#### Wireless Measurements

- GSM/GPRS/EDGE
- W-CDMA/HSPA+
- TD-SCDMA/HSPA+
- LTE/LTE-A FDD/TDD
- CDMA/EV-DO
- WiMAX Fixed/Mobile
- EMF Test
- Zero-span IF Output
- I/Q Waveform Capture
- Gated Sweep
- AM/FM/PM Demodulator
- High Accuracy Power Meter up to 26 GHz USB Sensors
- Three Hour Battery



Spectrum Master™ MS2720T Spectrum Analyzer  
 Handheld Size: 315 mm x 211 mm x 77 mm (12.4 in x 8.3 in x 3.0 in), Lightweight: 3.7 kg to 4.4 kg (8.1 lb to 9.8 lb)

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**Definitions**

Specifications	All specifications and characteristics apply to Revision 3 instruments under the following conditions, unless otherwise stated: <ul style="list-style-type: none"> <li>• After 5 minutes of warm-up time, where the instrument is left in the ON state.</li> <li>• Sweep Mode set to Performance.</li> <li>• When using the internal reference signal.</li> </ul>
Typical Specifications	Typical specifications are not tested and not warranted. They are generally representative of characteristic performance.
Nominal	Design parameters are not tested and not warranted.
Calibration Cycle	Recommended calibration cycle is 12 months.
Time Base Error	Input Frequency × Frequency Reference Error


**Spectrum Analyzer**
**Measurements**

Smart Measurements	Field Strength (dBm/m <sup>2</sup> , dBV/m, dBmV/m, dBμV/m, V/m, Watt/m <sup>2</sup> , dBW/m <sup>2</sup> , A/m, dBA/m, or Watt/cm <sup>2</sup> ) Occupied Bandwidth (measures 99 % to 1 % power channel of a signal, or N dB from center of signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) Emission Mask (recall limit lines as emission mask) Spurious Emissions (measures up to 32 segments with independent setups and limits) C/I (carrier-to-interference ratio) AM/FM/SSB Demodulation (AM, wide/narrow FM, upper/lower SSB), (audio only)
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**Setup Parameters**

Frequency	Center/Start/Stop, Span, Freq Step, Freq Offset, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units (dBm, dBV, dBmV, dBμV, Volt, Watt, dBW, A, dBA), Pre-Amp On/Off, Detection (Peak, RMS/Avg, Negative Peak, Sample, Quasi-Peak)
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Avg Type (Linear, Log), RBW/VBW Ratio, Span/RBW Ratio
Impedance	50 Ω, 75 Ω; external pad required for 75 Ω operation

**Sweep Functions**

Sweep	Single/Continuous, Sweep Time, Gated Sweep (see Option 0090)
Sweep Mode	Fast (up to 100x faster than Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
Triggers	Free Run, External, Video, IF Power, Force Trigger Once
Trigger Parameters	Delay, Level, Slope, Hysteresis, Holdoff (availability varies with trigger)

**Trace Functions**

Traces	Up to three Traces (A, B, C), View/Blank, Write/Hold, Trace A/B/C Operations
Trace A Operations	Normal, Max Hold, Min Hold, Average, # of Averages, (always the live trace)
Trace B Operations	A → B, B ← → C, Max Hold, Min Hold
Trace C Operations	A → C, B ← → C, Max Hold, Min Hold, A – B → C, B – A → C, Relative Reference (dB), Scale

**Marker Functions**

Markers	Markers 1-6 each with a Delta Marker, or Marker 1 Reference with Six Delta Markers, Marker Table (On/Off/Large), All Markers Off
Marker Types	Style (Fixed/Tracking), Noise Marker, Frequency Counter Marker
Marker Auto-Position	Peak Search, Next Peak (Right/Left), Peak Threshold %, Set Marker to Channel, Marker Frequency to Center, Delta Marker to Span, Marker to Reference Level
Marker Table	1-6 markers frequency and amplitude, plus delta markers frequency offset and amplitude

**Limit Line Functions**

Available Spans	> 0 Hz
Limit Lines	Upper/Lower, On/Off, Edit, Move, Envelope, Advanced, Limit Alarm, 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 Amplitude, Number of Points (2-41), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall
Save on Event	When Limit Crossed

**Frequency**

Frequency Range	(usable to 0 Hz)
MS2720T-0709	9 kHz to 9 GHz
MS2720T-0713	9 kHz to 13 GHz
MS2720T-0720	9 kHz to 20 GHz
MS2720T-0732	9 kHz to 32 GHz
MS2720T-0743	9 kHz to 43 GHz
Tuning Resolution	1 Hz
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 Options 1 and 31 for improved frequency reference aging and accuracy)
Auto-sensing External Frequency Reference (MHz)	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608
Sweep Time	7 μs to 3600 s in zero span
Sweep Time Accuracy	$\pm 2$ % in zero span

**Bandwidth**

Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1-3 sequence $\pm 10$ % (-3 dB bandwidth)
Video Bandwidth (VBW)	1 Hz to 10 MHz in 1-3 sequence (-3 dB bandwidth)
RBW with Quasi-Peak Detection	200 Hz, 9 kHz, 120 kHz (-6 dB bandwidth)
VBW with Quasi-Peak Detection	Auto VBW is On, RBW/VBW = 1
VBW/Average Type	Linear/Log

 **Spectrum Analyzer** (Continued)
**Spectral Purity – SSB Phase Noise**

Offset from 1 GHz	9 GHz Instrument		13 GHz to 43 GHz Instruments	
	Maximum	Typical	Maximum	Typical
10 kHz	-108 dBc/Hz	-112 dBc/Hz	-102 dBc/Hz	-106 dBc/Hz
100 kHz	-110 dBc/Hz	-115 dBc/Hz	-106 dBc/Hz	-110 dBc/Hz
1 MHz	-118 dBc/Hz	-123 dBc/Hz	-111 dBc/Hz	-116 dBc/Hz
10 MHz	-129 dBc/Hz	-133 dBc/Hz	-123 dBc/Hz	-129 dBc/Hz
Offset from 300 MHz				
1 kHz	-107 dBc/Hz	-111 dBc/Hz		
10 kHz	-112 dBc/Hz	-114 dBc/Hz		
62.5 kHz	-113 dBc/Hz	-115 dBc/Hz		
100 kHz	-114 dBc/Hz	-117 dBc/Hz		
1 MHz	-120 dBc/Hz	-122 dBc/Hz		
10 MHz	-128 dBc/Hz	-131 dBc/Hz		

**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, 5.0 dB steps
Reference Level Offset	99.9 dB External Loss to 99.9 dB External Gain
Amplitude Units	Log Scale Modes: dBm, dBW, dBV, dBmV, dBμV, dBA Linear Scale Modes: fV, nV, μV, mV, V, fW, pW, nW, μW, mW, W, pA, nA, μA, mA, A
Maximum Continuous Input	+30 dBm Peak typical, ± 50 VDC (≥ 10 dB Attenuation) +23 dBm Peak typical, ± 50 VDC (< 10 dB Attenuation) +13 dBm Peak typical, ± 50 VDC (Preamp = ON Option 713, 720, 732, 743; no extra limit for Option 709)

**Amplitude Accuracy** (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 Instrument				
9 kHz to 100 kHz <sup>a</sup>	± 2.3 dB	± 0.5 dB	± 2.3 dB	± 0.5 dB
100 kHz to 7 GHz	± 1.3 dB	± 0.5 dB	± 2.3 dB	± 0.5 dB
> 7 GHz to 9 GHz	± 1.8 dB	± 0.5 dB	± 2.8 dB	± 0.5 dB
13/20 GHz Instruments				
100 kHz to 13 GHz	± 1.3 dB	± 0.5 dB	± 2.3 dB	± 0.5 dB
> 13 GHz to 18 GHz	± 2.3 dB	± 0.5 dB	± 3.3 dB	± 0.5 dB
> 18 GHz to 20 GHz	-	± 1.0 dB	-	± 1.0 dB
32/43 GHz Instruments				
> 100 kHz to 13 GHz	± 1.3 dB	± 0.5 dB	± 2.3 dB	± 0.5 dB
> 13 GHz to 40 GHz	± 2.3 dB	± 0.5 dB	± 3.3 dB	± 0.5 dB
> 40 GHz to 43 GHz	-	± 1.0 dB	-	± 1.0 dB

a. Values below 100 kHz are with the preamplifier turned off.

**Displayed Average Noise Level (DANL)** (RMS detection, VBW/Avg type = Log, Ref Level = -20 dBm for Preamp Off and -50 dBm for Preamp On, Auto Attenuator On, Performance Sweep Mode)

	Preamp = Off		Preamp = On	
	Maximum	Typical	Maximum	Typical
9 GHz Instrument				
10 MHz to 3 GHz	-146 dBm	-149 dBm	-160 dBm	-163 dBm
> 3 GHz to 8 GHz	-140 dBm	-143 dBm	-152 dBm	-155 dBm
> 8 GHz to 9 GHz	-	-138 dBm	-	-155 dBm
13 to 43 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 13 GHz	-136 dBm	-139 dBm	-156 dBm	-159 dBm
20 GHz Instrument				
> 13 GHz to 20 GHz	-138 dBm	-141 dBm	-157 dBm	-160 dBm
32 to 43 GHz Instruments				
> 13 GHz to 32 GHz	-135 dBm	-138 dBm	-154 dBm	-157 dBm
> 32 GHz to 40 GHz	-127 dBm	-130 dBm	-148 dBm	-151 dBm
> 40 GHz to 43 GHz	-	-130 dBm	-	-151 dBm

 **Spectrum Analyzer** (Continued)
**Spurs** (0 dB input attenuation)

Residual Spurs (RF input terminated)

< 13 GHz
13 to 20 GHz
> 20 to 32 GHz
> 32 to 43 GHz

**Preamp = Off**

-90 dBm, maximum
-85 dBm, maximum
-80 dBm, maximum
-80 dBm, maximum

**Preamp = On**

-100 dBm, maximum
-100 dBm, maximum
-100 dBm, maximum
-95 dBm, maximum

Input-Related Spurious (-30 dBm input)

**Maximum<sup>a</sup>**  
-60 dBc

**Typical**  
-70 dBc

a. Instrument centered on single signal, span &lt; 1.7 GHz

**Third-Order Intercept (TOI)** (-20 dBm tones 100 kHz apart, 0 dB Attenuation Preamp OFF)

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 43 GHz	+20 dBm typical

**P1dB**

< 4 GHz	+5 dBm nominal
4 GHz to 20 GHz	+12 dBm nominal
> 20 GHz to 32 GHz	+7 dBm nominal
> 32 GHz to 43 GHz	+12 dBm nominal

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

50 MHz	-54 dBc maximum
< 4 GHz	-60 dBc typical
> 4 GHz	-75 dBc typical

**VSWR** ( $\geq 10$  dB input attenuation)

9 GHz Instruments	
< 4 GHz	1.5:1 typical
4 GHz to 8 GHz	1.8:1 typical
13 GHz to 43 GHz Instruments	
< 20 GHz	1.5:1 typical
20 GHz to 43 GHz	2.0:1 typical

 **High Accuracy Power Meter (Option 19)** (Requires external USB Power Sensor)

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	MA24105A	MA24106A	MA24108A/18A/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	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz
Connector	Type N(m), 50 $\Omega$	Type N(f), 50 $\Omega$	Type N(m), 50 $\Omega$	Type N(m), 50 $\Omega$ (8/18 GHz) Type K(m), 50 $\Omega$ (26 GHz)
Dynamic Range	-30 dBm to +20 dBm (0.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	-40 dBm to +23 dBm (0.1 $\mu$ W to 200 mW)	-40 dBm to +20 dBm (0.1 $\mu$ W to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS	True-RMS
Measurement Uncertainty	$\pm 0.16$ dB <sup>1</sup>	$\pm 0.17$ dB <sup>2</sup>	$\pm 0.16$ dB <sup>1</sup>	$\pm 0.18$ dB <sup>3</sup>
Data sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

- Notes:
- Total RSS measurement uncertainty (0 °C to 50 °C) for power measurements of a CW signal greater than -20 dBm with zero mismatch errors.
  - 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.
  - Expanded uncertainty with K=2 for power measurements of a CW signal greater than -20 dBm with zero mismatch errors.

 **Tracking Generator (Options 809, 813, and 820)**
**Setup Parameters**

Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Units, Pre-Amp, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, VBW/Average Type (Linear/Log), RBW/VBW Ratio, Span/RBW Ratio
Generator	On/Off, Output Power, Mode (CW/Tracking), Settings, Transmission Measurement
Tracking Generator Settings	External Gain/Loss, Power Statistics (On/Off)
Transmission Measurement Settings	Normalize (Off/On), Scale, Reference Position and Amplitude, Transmission Statistics and Offset
Maximum Continuous Input	+23 dBm, ± 50 VDC

**Frequency**

MS2720T-0809	Frequency Range 100 kHz to 9 GHz
MS2720T-0813	100 kHz to 13 GHz
MS2720T-0820	100 kHz to 20 GHz
Frequency Accuracy	Aging: ± 1.0 × 10 <sup>-6</sup> per 10 years Accuracy: ± 0.3 × 10 <sup>-6</sup> (25 °C ± 25 °C) plus aging

**Output Power**

100 kHz to 20 GHz	-40 dBm to 0 dBm
Step Size	0.1 dB nominal
Dynamic Range	
9 GHz Instrument	> 110 dB typical 100 kHz to 7 GHz > 100 dB typical > 7 GHz to 9 GHz
13 GHz and 20 GHz Instruments	> 100 dB typical 100 kHz to 12 GHz > 80 dB typical > 12 GHz to 20 GHz

**Level Accuracy** (At least 30 minute warm-up after 1 hour non-operating at 15 to 35 °C ambient, excludes load VSWR effects)

Frequency Range	20 °C to 30 °C (after 30 minute warm-up)		0 °C to 50 °C (after 60 minute warm-up)	
	Maximum	Typical	Maximum	Typical
100 kHz to 9 GHz	± 1.5 dB	± 0.5 dB	± 2.0 dB	± 1.0 dB
> 9 GHz to 13 GHz	± 1.6 dB	± 1.0 dB	± 2.1 dB	± 1.5 dB
> 13 GHz to 18 GHz	± 2.0 dB	± 1.0 dB	± 2.5 dB	± 1.5 dB

**VSWR**

100 kHz to 5 GHz	2:1 typical
> 5 GHz to 20 GHz	4:1 typical

 **Interference Analyzer (Option 25)**
**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 3 days
Signal Strength	Gives visual and aural indication of signal strength
Received Signal Strength Indicator (RSSI)	Collect data up to one week
Interference Mapping	Draw multiple bearings of signal strength from GPS location on on-screen map Pan and Zoom on-screen maps Support for Anritsu MA2700A Handheld Interference Hunter
Impedance	50 Ω, 75 Ω; external pad required for 75 Ω operation

 **Channel Scanner (Option 27)**
**General**

Number of Channels	1 to 20 Channels (Power Levels)
Measurements	Graph/Table, Max Hold (On/5 s/Off), Frequency/Channel, Current/Maximum, Dual Color
Scanner	Scan Channels, Scan Frequencies, Scan Custom List, Scan Script Master™
Amplitude	Reference Level, Scale
Custom Scan	Number of Channels, Signal Standard & Channel, Frequency, Bandwidth
Frequency Range	9 kHz to 9, 13, 20, 32, or 43 GHz
Frequency Accuracy	± 10 Hz + time base error
Measurement Range	-110 dBm to +30 dBm
Impedance	50 Ω, 75 Ω; external pad required for 75 Ω operation

 **Coverage Mapping (Option 431)**
**Measurements**

Indoor Mapping	RSSI, ACPR
Outdoor Mapping	RSSI, ACPR

**Setup Parameters**

Mode	Spectrum Analyzer
Frequency	Center, Span (ACPR only), Freq Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	RSSI Mode: Zero Span ACPR Mode: Span, Span Up/Down (1-2-5), Full Span, Last Span
BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/RBW Ratio
Measurement Setup	RSSI: Mapping color thresholds ACPR: Main Ch BW, Adj Ch BW, Ch Spacing, Adjacent Ch dB Offset, Thresholds for Good and Poor main channel levels
Mapping Colors	RSSI: Dark Green (Excellent), Light Green (Very Good), Yellow (Good), Orange (Fair), Dark Red (Poor) ACPR: Dark Green (Good), Yellow (between Good and Poor), Dark Red (Poor)
Point Distance or Time Setup	Repeat Type: Time (100 ms to 16 s), Distance (1 m to 10,000 m) Distance Units: m, ft
Save Points Map	Save KML, JPEG, Tab Delimited
Recall Points Map	Recall Map, Recall KML Points only, Recall KML Points with Map, Recall Default Grid
Map Types	Outdoor (GPS embedded), Indoor (non-GPS embedded). Import maps using the Anritsu easyMap Tools. Zoomable (.azm) maps are usable, but cannot be zoomed.

 **Electromagnetic Field Test (EMF) (Option 444)**
**Measurements**

Setup	Limit lines, axis dwell time, measurement time, auto-logging, measurement units, trace display
Spectrum Analyzer	Field strength is measured
LTE OTA, TD-LTE OTA	P-SS, S-SS, and RS are measured and displayed based on each Cell ID received
W-CDMA OTA	P-CPICH signals are measured and displayed for each Scrambling Code measured
Units	Spectrum Analyzer: dBm/m <sup>2</sup> , dBV/m, dBmV/m, dBuV/m, V/m, W/m <sup>2</sup> , dBW/m <sup>2</sup> , A/m, dBA/m, W/cm <sup>2</sup> LTE OTA, TD-LTE OTA, W-CDMA OTA: dBm/m <sup>2</sup> , V/m, W/m <sup>2</sup>
Results	Maximum, minimum, and average of all measurements conducted
Display	Measurement status, number of measurements taken, pass/fail indicators

**Frequency Range**

700 MHz to 6 GHz using 2000-1791-R antenna

**Supported Antennas**

700 MHz to 6 GHz, Anritsu 2000-1791-R

**Modes where EMF Measurements available**

Spectrum Analyzer  
 LTE (both FDD and TDD Modes, Option 883)  
 W-CDMA (Option 881)

 **GPS Receiver (Option 31)**

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
	Note: Anritsu 2000-1528-R GPS antenna requires +5 VDC Anritsu 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC Anritsu 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) UTC Time, Latitude, Longitude, and Altitude with trace storage
High Frequency Accuracy	$< \pm 2.5 \times 10^{-8}$ with GPS On, 3 minutes after satellite lock in selected mode (GPS Antenna connected) $< \pm 5.0 \times 10^{-8}$ for 3 days after GPS lock, 0 °C to 50 °C ambient temperature (GPS Antenna disconnected)
Connector	SMA, female

 **Gated Sweep (Option 90)**

Mode	Spectrum Analyzer, Sweep
Trigger	External TTL, IF Level
IF Trigger Level	-80 dBm to +25 dBm typical
Setup	Gated Sweep (On/Off) Gate Polarity (Rising, Falling) Gate Delay (0 ms to 10 ms typical) Gate Length (1 $\mu$ s to 65 ms typical) Gate View Settings: Zero Span Time , Zero Span RBW, Zero Span VBW

 **Zero Span IF Output (Option 89)**

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz nominal (varies up to $\pm 10$ kHz nominal with center frequency and IF bandwidth)
Output Level	-25 dBm typical, for signals at below reference levels, with Auto Attenuation. Maximum -10 dBm typical.
Reference Level	-57 dBm to +30 dBm (Preamp Off) -87 dBm to -40 dBm (Preamp On)
IF Bandwidths	Up to 30 MHz (3 dB bandwidth)
Connector	BNC female

 **I/Q Waveform Capture (Option 24)**

Mode	Spectrum Analyzer
Capture Mode	Single or Continuous
Trigger	Free Run, External (Rising/Falling), Delay
Maximum Capture Length	800 ms
Maximum Sample Rate	40 MHz
Maximum Signal Bandwidth	32 MHz

 **Secure Data (Option 7)**

Set at Factory	Save measurement files on external USB flash drive only Internal memory is permanently disabled
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 **AM/FM/PM Signal Analyzer (Option 509)**
**Measurements**

Display Type	RF Spectrum (AM/FM/PM)	Audio Spectrum (AM)	Audio Spectrum (FM/PM)	Audio Waveform (AM)	Audio Waveform (FM/PM)	Summary (AM)	Summary (FM/PM)
Graphic Display	Power (dBm) vs. Frequency	Depth (%) vs. Modulation Frequency	Deviation (kHz/rad) vs. Modulation Frequency	Depth (%) vs. Time	Deviation (kHz/rad) vs. Time	None	None
Numerical Displays	Carrier Power Carrier Frequency Occupied BW	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD* THD* Distortion/Total Vrms*	RMS Depth Peak + Depth Peak - Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation Peak + Deviation Peak - Deviation (Pk-Pk)/2 Deviation Carrier Power Carrier Frequency Occupied Bandwidth FM/PM Rate SINAD* THD* Distortion/Total Vrms*

\* Requires sine wave modulation

**Setup Parameters**

Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set (measured) Carrier Freq to Center
Amplitude Setup	Scale, Power Offset, Adjust Range
Measurements	RF Spectrum, Audio Spectrum (demodulated), Audio Waveform (demodulated), Summary, Coverage Mapping (Option 431 required), Audio Demod (AM/FM only)
Measurement Setup	All Measurements: Demod Type (AM, FM, PM), IFBW, Auto IFBW, Squelch Units, Distortion Measurements (Sinewave or Broadcast) RF Spectrum: OBW Method, OBW %, OBW dBC Audio Spectrum: Span, Scale, Squelch Power Audio Waveform: Sweep Time, Scale, Squelch Power Summary: Average count, Squelch Power Coverage Mapping: Measurement (SINAD, Carrier Power, Multiple), Thresholds, Point Distance/Time Audio Demod: Demod Type (AM, USB, LSB, Widband FM, Narrowband FM), Volume, Squelch
Mapping Colors	Dark Green (Excellent), Light Green (Very Good), Orange (Good), Yellow (Fair), Dark Red (Poor)
Marker	Six markers with Delta for each, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table

**RF and Modulation Measurements**

AM	Modulation Rate: $\pm 1$ Hz (< 100 Hz), $\pm 2$ % (> 100 Hz) Depth: $\pm 5$ % for (Modulation rates 10 Hz to 100 kHz)
FM	Modulation Rate: $\pm 1$ Hz (< 100 Hz); $\pm 2$ % (100 Hz to 100 kHz) Deviation Accuracy: $\pm 5$ % (100 Hz to 100 kHz)**
PM	Modulation Rate: $\pm 1$ Hz (< 100 Hz); $\pm 2$ % (100 Hz to 100 kHz) Deviation Accuracy: $\pm 5$ % (deviation 0 to 93 Rad, rate 10 Hz to 5 kHz)**
IF Bandwidth	1 kHz to 300 kHz in 1-3 sequence
Frequency Span	RF Spectrum: 10 kHz to 10 MHz Audio Spectrum: 2 kHz, 5 kHz, 10 kHz, 20 kHz, 70 kHz, 140 kHz
RBW/VBW	30
Span/RBW	100
Sweep Time	50 $\mu$ s to 50 ms (Audio Waveform)
**	IFBW must be greater than 95 % occupied BW

 **GSM/GPRS/EDGE Measurements (Option 880)**
**Measurements**

<b>RF</b>	<b>Demodulation</b>	<b>Over-the-Air (OTA)</b>	<b>Pass/Fail</b>
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 and Demodulation Measurements can be made OTA	View Pass/Fail Limits GSM, EDGE Available 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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements

**RF Measurements**

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

**Demodulation Measurements**

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


**W-CDMA/HSPA+ Measurements (Option 881)**
**Measurements**

<b>RF</b>	<b>Demodulation</b>	<b>Over-the-Air (OTA)</b>	<b>Pass/Fail</b>
Band Spectrum	Code Domain Power Graph	Scrambling Code Scanner (Six)	View Pass/Fail Limits
Channel Spectrum	P-CPICH Power	Scrambling Codes	All, RF, Demod
Channel Power	Channel Power	CPICH	Available Measurements
Occupied Bandwidth	Noise Floor	$E_c/I_o$	Max Output Power
Peak-to-Average Power	EVM	$E_c$	Frequency Error
Spectral Emission Mask	Carrier Feed Through	Pilot Dominance	EVM
Single carrier ACLR	Peak Code Domain Error	OTA Total Power	CPICH
Multi-carrier ACLR	Carrier Frequency	Multipath Scanner (Six)	Occupied Bandwidth
RF Summary	Frequency Error	Six Multipaths	Spectral Mask
	Control Channel Power	Tau	ACLR
	Abs/Rel/Delta Power	Distance	PCDE
	CPICH, P-CCPCH	RSCP	P-CCPCH
	S-CCPCH, PICH	Relative Power	S-CCPCH
	P-SCH, S-SCH	Multipath Power	Code Spread 3
	HSPA+		PICH
	Power vs. Time		Code 128
	Constellation		Test Models
	Code Domain Power Table		1 (16), (32), (64)
	Code, Status		2
	EVM, Modulation Type		3 (16), (32)
	Power, Code Utilization		4 (+CPICH), (-CPICH)
	Power Amplifier Capacity		5 (2 HS), (4 HS), (8 HS)
	Codogram		
	Modulation Summary		

**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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**RF Measurements**

RF Channel Power Accuracy	$\pm 1.25$ dB, $\pm 0.7$ dB typical, (temperature range 15 °C to 35 °C)
Occupied Bandwidth Accuracy	$\pm 100$ kHz
Adjacent Channel Leakage Ratio (ACLR)	-54 dB/-59 dB $\pm 0.8$ dB @ 5 MHz/10 MHz offset, typical, 824 MHz to 894 MHz, 1710 MHz to 2170 MHz -54 dB/-57 dB $\pm 1.0$ dB @ 5 MHz/10 MHz offset, typical, 2300 MHz to 2700 MHz

**Demodulation Measurements**

W-CDMA Modulations	QPSK, QPSK-DTX (Codecs: AMR 4.75, 5.9, 7.4, 12.2 kbps, DTX 7.4, 12.2 kbps)
HSPA+ Modulations	QPSK, 16 QAM, 64 QAM
Frequency Error	$\pm 10$ Hz + time base error, 99 % confidence level
EVM Accuracy	$\pm 2.5$ %, $6\% \leq \text{EVM} \leq 25\%$
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

**Over-the-Air (OTA) Measurements**

Scrambling Code Scanner	Six strongest Scrambling Codes
Multipath Scanner	Multipath power of six signals relative to strongest pilot

 **TD-SCDMA/HSPA+ Measurements (Option 882)**
**Measurements**

<b>RF</b>	<b>Demodulation</b>	<b>Over-the-Air (OTA)</b>	<b>Pass/Fail</b>
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/64 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 <sub>c</sub> /I <sub>0</sub> DwPTS Power Pilot Dominance Tau Scan (Six) Sync-DL# Tau E <sub>c</sub> /I <sub>0</sub> DwPTS Power Pilot Dominance Record Run/Hold	View Pass/Fail Limits All, RF, Demod Available 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 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, 64 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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**RF Measurements**

RF Channel Power Accuracy (RRC)	± 1.5 dB, ± 1.0 dB typical, (slot power -40 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, in the presence of a downlink slot

**Demodulation Measurements**

Supported Modulation	QPSK, 8 PSK, 16 QAM, 64 QAM
Residual EVM (rms)	3 % typical, P-CCPH Slot Power > -50 dBm
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical
Timing Error (Tau) for Dominant SYNC-DL	± 0.2 μs (external trigger)
Spreading Factor	1, 16

**Over-the-Air (OTA) Measurements**

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

**LTE/LTE-A FDD/TDD Measurements (Option 883)****LTE/LTE-A FDD Measurements**

RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization % Channel Power, Cell ID OSTP, Frame EVM by modulation Constellation QPSK, 16 QAM, 64 QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM per Control Channel Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2)	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Auto Save – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off Carrier Aggregation Up to 5 component carriers (CC1 to CC5) CP, MIMO status, RS & SS Power, EVM, Frequency Error, Time Alignment Error, Cell ID	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms Frame EVM, rms Frame EVM by mod type RS, SS Power RS EVM P-SS, S-SS, Power, EVM PBCH, PCFICH, PHICH, PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment

**Setup Parameters**

Frequency	E-UTRA Bands 1 - 14, 17 - 21, 23 - 28 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous
EVM Mode	Auto, PBCH only, Max Hold
Cyclic Prefix (CP)	Auto, Normal, Extended
Sync Type	Normal (SS), RS/Cell ID
Save/Recall	Setup, Measurement, Screen Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**LTE/LTE-A FDD RF Measurements**

RF Channel Power Accuracy ± 1.5 dB, ± 1.0 dB typical, (RF input –50 dBm to +10 dBm)

**LTE/LTE-A FDD Modulation Measurements**

RS Power Accuracy	± 1.0 dB typical, (RF input –50 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, 99 % confidence level
Residual EVM (rms)	2.0 % typical (E-UTRA Test Model 3.1, RF Input –50 dBm to +10 dBm)

**LTE/LTE-A FDD Over-the-Air (OTA) Measurements**

Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: KML, MTD (tab delimited)
Carrier Aggregation	Up to 5 component carriers specified (CC1 to CC5) Automatic detection of CP and MIMO status for each active CC RS Power & RS Delta Power, SS Power, EVM (peak and rms), Freq Error (Hz & ppm), TAE, Cell ID

 **LTE/LTE-A FDD/TDD Measurements (Option 883)** (Continued)
**LTE/LTE-A TDD Measurements**

RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth	Power vs. Resource Block (RB) RB Power (PDSCH) Active RBs, Utilization % Channel Power, Cell ID	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Auto Save - On/Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error
Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error	Constellation QPSK, 16QAM, 64QAM Modulation Results Ref Signal Power (RS) Sync Signal Power (SS) EVM – rms, peak, max hold Frequency Error – Hz, ppm Carrier Frequency Cell ID	Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off	Carrier Frequency Dominance EVM peak, rms Frame EVM, rms Frame EVM by mod type RS, SS Power RS EVM
ACLR Spectral Emission Mask Category A or B (Opt 1) RF Summary	Control Channel Power Bar Graph or Table View RS, P-SS, S-SS PBCH, PCFICH, PHICH, PDCCH Total Power (Table View) EVM per Control Channel Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1/2)	Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off Carrier Aggregation Up to 5 component carriers (CC1 to CC5) CP, MIMO status, RS & SS Power, EVM, Frequency Error, Time Alignment Error, Cell ID	P-SS, S-SS, Power, EVM PBCH, PCFICH, PHICH, PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment Frame Power DwPTS Power Transmit Off Power Timing Error

**Setup Parameters**

Frequency	E-UTRA bands 33 - 44 (tunable 10 MHz to 4.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20
Span (MHz)	Auto, 1.4, 3, 5, 10, 15, 20, 30
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range
Sweep	Single/Continuous, Trigger Sweep
EVM Mode	Auto, PBCH only, Max Hold
Cyclic Prefix (CP)	Auto, Normal, Extended
Trigger	No Trigger/Ext Trigger, Rising/Falling
Uplink/Downlink Configuration	0 to 6
Save/Recall	Setup, Measurement, Screen Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**LTE/LTE-A TDD RF Measurements**

RF Channel Power Accuracy ± 1.5 dB, ± 1.0 dB typical, (RF input –30 dBm to +10 dBm)

**LTE/LTE-A TDD Modulation Measurements**

RS Power Accuracy	± 1.0 dB typical, (RF input –50 dBm to +10 dBm)
Frequency Error	± 10 Hz + time base error, 99 % confidence level
Residual EVM (rms)	2.0 % typical (E-UTRA Test Model 3.1, RF Input –30 dBm to +10 dBm)

**LTE/LTE-A TDD Over-the-Air (OTA) Measurements**

Scanner	Six strongest signals if present Auto Save – Sync Signal power and Modulation Results with GPS information
Tx Test	Scanner – Three strongest signals if present RS Power – Strongest signal
Mapping	Map On-screen S-SS, RSRP, RSRQ, or SINR of Cell ID with strongest signal Scanner – three strongest signals if present Save and Export Mapping data: KML, MTD (tab delimited)
Carrier Aggregation	Up to 5 component carriers specified (CC1 to CC5) Automatic detection of CP and MIMO status for each active CC RS Power & RS Delta Power, SS Power, EVM (peak and rms), Freq Error (Hz & ppm), TAE, Cell ID


**CDMA/EV-DO Measurements (Option 884)**
**CDMA Measurements**

<b>RF</b>	<b>Demodulation</b>	<b>Over-the-Air (OTA)</b>	<b>Pass/Fail</b>
Channel Spectrum Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Emission Mask Single Carrier ACPR 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 $E_c/I_o$ Tau Pilot Power Channel Power Pilot Dominance Multipath Scanner (Six) $E_c/I_o$ Tau Channel Power Multipath Power Limit Test – 10 Tests Averaged Rho Adjusted Rho Multipath Pilot Dominance Pilot Power Pass/Fail Status	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Spectral Mask Test Frequency Error Channel Frequency Pilot Power Noise Floor Rho Carrier Feed Through Tau RMS Phase Error Code Utilization Measured PN Pilot Dominance Multipath Power

**CDMA 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 (MHz)	1.23, 1.24, 1.25
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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**CDMA RF Measurements**

RF Channel Power Accuracy	$\pm 1.5$ dB, $\pm 1.0$ dB typical, (RF input $-50$ dBm to $+20$ dBm)
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**CDMA Demodulation Measurements**

Frequency Error	$\pm 10$ Hz + time base error, 99 % confidence level (in slow mode)
Rho Accuracy	$\pm 0.005$ , 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	$\pm 1.0$ dB typical, relative to channel power
Tau	$\pm 0.5$ $\mu$ s typical, $\pm 1.0$ $\mu$ s maximum

**CDMA Over-the-Air (OTA) Measurements**

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot
Limit Test	Average of ten tests compared to limit


**CDMA/EV-DO Measurements (Option 884)** (Continued)
**EV-DO Measurements**

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

**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 (MHz)	1.23, 1.24, 1.25
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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**EV-DO RF Measurements**

RF Channel Power Accuracy  $\pm 1.5$  dB,  $\pm 1.0$  dB typical, (RF input  $-50$  dBm to  $+20$  dBm)

**EV-DO Demodulation Measurements**

EV-DO Compatibility	Rev 0 and Rev A
Frequency Error	$\pm 10$ Hz + time base error, 99 % confidence level
Rho Accuracy	$\pm 0.01$ , for Rho $> 0.9$
Residual Rho	$> 0.995$ typical, $> 0.99$ , maximum (RF input $-50$ dBm to $+20$ dBm)
PN Offset	Within $1 \times 64$ chips
Pilot Power Accuracy	$\pm 1.0$ dB typical, relative to channel power
Tau	$\pm 0.5$ $\mu$ s typical, $\pm 1.0$ $\mu$ s maximum

**EV-DO Over-the-Air (OTA) Measurements**

Pilot Scanner	Nine strongest pilots
Multipath Scanner	Multipath power of six signals relative to strongest pilot



**WiMAX Fixed/Mobile Measurements (Option 885)****WiMAX Fixed Measurements**

<b>RF</b>	<b>Demodulation</b>	<b>Over-the-Air (OTA)</b>	<b>Pass/Fail</b>
Channel Spectrum Channel Power Occupied Bandwidth	Constellation RCE (RMS/Peak) EVM (RMS/Peak)	There are no additional OTA Measurements	View Pass/Fail Limits All, RF, Modulation
Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor	Frequency Error Carrier Frequency Base Station ID	RF and Demodulation Measurements can be made OTA	Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor
ACPR	Spectral Flatness Adjacent Subcarrier Flatness		Frequency Error Carrier Frequency
RF Summary	EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary		EVM RCE Base Station ID

**Setup Parameters**

Bandwidth (MHz)	1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00
Cyclic Prefix Ratio (CP)	1/4, 1/8, 1/16, 1/32
Span (MHz)	5, 10, 15, 20
Frame Length (ms)	2.5, 5.0, 10.0
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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**WiMAX Fixed RF Measurements** (temperature range 15 °C to 35 °C)

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

**WiMAX Fixed Demodulation Measurements** (temperature range 15 °C to 35 °C)

Frequency Error 7 x 10<sup>-8</sup> plus time base error, 99 % confidence level  
 Residual EVM (rms) 3 % typical, 3.5 % maximum (RF Input -50 dBm to +20 dBm)


**WiMAX<sup>1</sup> Fixed/Mobile Measurements (Option 885)** (Continued)
**WiMAX Mobile Measurements**

RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum	Constellation	Channel Power Monitor	View Pass/Fail Limits
Channel Power	RCE (RMS/Peak)	Preamble Scanner (Six)	All, RF, Modulation
Occupied Bandwidth	EVM (RMS/Peak)	Preamble	Available Measurements
Power vs. Time	Frequency Error	Relative Power	Channel Power
Channel Power	CINR	Cell ID	Occupied Bandwidth
Preamble Power	Base Station ID	Sector ID	Downlink Burst Power
Downlink Burst Power	Sector ID	PCINR	Uplink Burst Power
Uplink Burst Power	Spectral Flatness	Dominant Preamble	Preamble Power
ACPR	Adjacent Subcarrier Flatness	Base Station ID	Crest Factor
Spectral Emission Mask	EVM vs. Subcarrier/Symbol	Auto Save - On/Off	Frequency Error
RF Summary	RCE (RMS/Peak)		Carrier Frequency
	EVM (RMS/Peak)		EVM
	Frequency Error		RCE
	CINR		Sector ID
	Base Station ID		
	Sector ID		
	DL-MAP (Tree View)		
	Modulation Summary		

**Setup Parameters**

Zone Type	PUSC
DL-MAP Auto Decoding	Convolutional Coding (CC), Convolutional Turbo Coding (CTC)
Bandwidths (MHz)	3.50, 5.00, 7.00, 8.75, 10.00
Cyclic Prefix Ratio (CP)	1/8
Span (MHz)	5, 10, 20, 30
Frame Lengths (ms)	5, 10
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 Shots (JPEG - save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

**WiMAX Mobile RF Measurements** (temperature range 15 °C to 35 °C)

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

**WiMAX Mobile Demodulation Measurements** (temperature range 15 °C to 35 °C)

Frequency Error 2 x 10<sup>-8</sup> plus time base error, 99 % confidence level  
 Residual EVM (rms) 2.5 % typical, 3.0 % maximum (RF Input -50 dBm to +20 dBm)

**WiMAX Mobile Over-the-Air (OTA) Measurements**

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

1. Mobile WiMAX conforms to IEEE Std. 802.16e-2005, WiMAX Forum® Air Interface - Mobile System Profile - Release 1.0 Certified, System Profiles according to WMF-T24-001-R010v07.

## General Specifications

### Setup Parameters

System	Status (Temperature, Battery Info, S/N, Firmware Version, Installed Options) Self Test, Application Self Test, GPS (see Option 31) Name, Date and Time, Ethernet Configuration, Volume
System Options	Display (Brightness, Auto Dim, Blank, Default, Black & White, Night Vision, High Contrast, Invert Black & White) Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese) Reset (Factory Defaults, Master Reset, Update Firmware) Share Center Frequency and Power (All Modes or Not Shared) Power-On (via Power Switch or when DC is Applied)
File Save/Recall	Save As, Save Measurement, Save, Save On Event, Recall Measurement, Recall, Copy, Delete Setups, Measurements, Screen Shots JPEG (save only), Limit Lines, Spurious Emissions Mask, Mapping results (for options with mapping), including KML with or without altitude, tab-delimited
Delete	By File Type, All, Selected
Internal Trace/Setup Memory	> 40,000 single-trace measurements; > 500 Spectrograms, each with 156 traces (with Option 25)
External Trace/Setup Memory	Limited by size of USB Flash Drive

### Connectors

RF In	9 GHz to 20 GHz Instruments: Type N, female, 50 Ω 32 GHz to 43 GHz Instruments: Ruggedized Type K, male
RF Out	9 GHz to 20 GHz Instruments: Type N, female, 50 Ω
GPS	SMA Female
External Power	5.5 mm barrel connector, 12 to 14.5 VDC, < 5.0 A
LAN Connection	RJ48C, 10/100 Mbps, Connect to PC or LAN for Remote Access
USB Interface	Two Type A, Connect FAT32 formatted Flash Drive and Power Sensor; 5-pin mini-B, Connect to PC for data transfer
Headset Jack	3.5 mm 3-wire headset jack
External Reference In	BNC, female, 50 Ω, Maximum Input +10 dBm
External Reference Out	BNC, female, 50 Ω, 10 MHz
External Trigger	BNC, female, 50 Ω, TTL-compatible levels, Maximum Input +5 VDC
IF Out	BNC, female, 50 Ω, 140 MHz (nominal)

### Display and Keyboard

Display	8.4 inch Touchscreen, 800 x 600 Resolution
Keyboard	Backlit (Red for Night Vision, White for all other display modes)

### Battery

Type	Li-Ion
Battery Operation	3 hour operation, typical
Battery Charging Limits	0 °C to +45 °C, Relative Humidity ≤ 80 %

### Electromagnetic Compatibility

European Union	CE Mark, EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC
Australia and New Zealand	C-tick N274
Interference, Emissions, Immunity	EN 61326-1, EN 55011, EN 61000-4-2/3/4/5/11

### Safety

Safety Class	EN 61010-1 Class 1, Pollution Degree 2
Product Safety	IEC 60950-1 when used with Anritsu Company supplied Power Supply

### Warranty

Duration	Standard three-year warranty One-year warranty on battery
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### Environmental

Operating Temperature	-10 °C to 55 °C
Maximum Humidity	85 % RH, non-condensing
Vibration, Shock, Temperature, Humidity	MIL-PRF-28800F Class 2
Storage	-51 °C to 71 °C
Altitude	4600 m, operating and non-operating
Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3 MIL-STD-810G, Method 511.5, Procedure 1

### Size and Weight


Size	315 mm x 211 mm x 77 mm, (12.4 in x 8.3 in x 3.0 in)
Weight	3.7 kg to 4.4 kg (8.1 lb to 9.8 lb) depending on Frequency Option and Tracking Generator

 **easyTest Tools™** (for your PC)**Instrument Modes**

Spectrum Analyzer  
Interference Analyzer  
Channel Scanner  
AM/FM/PM Analyzer

**Commands**

Display Image	Allows putting a custom image on the instrument screen
Recall Setup	Places the instrument into a known state; auto-advance to next command available
Prompt	Displays instructional messages on the instrument screen; timed advance to next command available; instrument users can be allowed or disallowed from making setup adjustments
Save	Allows automatic or manual saving of traces; auto-advance to next command available

 **easyMap Tools™** (create instrument-compatible maps on your PC)**Outdoor Maps**

On-Line Sources	Google Maps, Cloud Made Open-Source Maps
Pan & Zoom Mode	AZM map file format allows pan and zoom on-instrument
Legacy Mode	MAP format is compatible with older firmware
Geo-Referenced	Works with instrument based GPS
Map Conversion	Convert scanned maps to geo-referenced

**Indoor Maps**

Sources	Scanned images in JPG, JPEG, JPE, JFIF, GIF, TIF, TIFF, PNG
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**General**

Color Filter	Grayscale, High Contrast
Coverage	Worldwide
Zoom Levels	16 total zoom levels, 7 available in any one map
Map Size	Less than 1 MB to over 1 GB

 **Master Software Tools** (for your PC)**Measurement Viewing**

Display	Modify display settings, including scale
Spectrum Traces	Add, delete, and modify limit lines and markers. Overlay traces.
Spectrum Analyzer Measurements	Field Strength, Occupied Bandwidth, Channel Power, ACPR, Emission Mask, C/I <sup>1</sup>
Interference Analyzer Measurements	Spectrograms, Signal Strength Meter, RSSI <sup>2</sup>
Non-Spectrum Measurements	Hi Accuracy Power Meter, Channel Scanner, GSM, WCDMA/HSPA, LTE, TD-LTE, TD-SCDMA, CDMA, EV-DO, Fixed WiMAX, Mobile WiMAX, Screen captures (JPEGs)

1. Spurious Emissions results viewable in a browser  
2. Coverage Mapping and Interference Mapping files viewable in spreadsheet, Google Earth, or Google Maps

**Database Management**

Full Trace Retrieval	Retrieve all traces from instrument into one PC directory (limited to approximately 15,000 files)
Trace Catalog	Index all traces in selected folder & subfolder on PC into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files

**Data Analysis**

Trace Math and Smoothing	Compare multiple traces
Measurement Calculator	Translate into other units

**Report Generation**

Report Generator	Includes GPS, power level, and measurements
Edit Graph	Change scale, limit lines, and markers
Report Format	Create reports in HTML
Export Measurements	Export measurements or entire folders to *.jpg or *.csv format
Notes	Annotate measurements

**Mapping** (GPS required on instrument)

Spectrum Analyzer Mode	MapInfo
LTE Mode	Google Earth, Google Maps


**Master Software Tools** (Continued)

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

Source	Recorded Spectrogram or multiple spectrum traces
Folder Spectrogram	2D View creates a composite file of multiple traces
Available Displays	Spectrogram, Peak Power vs. Time, Variation in Total Power vs. Time, Peak Frequency vs. Time, Number of Traces Saved vs. Time (useful with Save on Limit Exceeded), Maximum/Average/Minimum Power vs. Time File Filter (Violations over limit lines or deviations from averages) Playback
Display Functions per Trace	Markers, GPS location altitude and time (when recorded), instrument time Filename per trace for Folder Spectrogram
Export to Video	Create AVI file of 2D Spectrogram for management review/reports
Export to 3D Spectrogram	Views (Set Threshold, Markers) - 3D (Rotate X, Y, Z Axis, Level Scale, Signal ID) - 2D (Frequency or Time Domain, Signal ID) - Top Down Playback (Frequency and/or Time Domain)

**List/Parameter Editors**

Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
Script Master	Create Script Master files for GSM/WCDMA or Channel Scanner
Languages	Modify non-English language menus
Mobile WiMAX	DL-MAP Parameters

**Connectivity**

Connections	Connect to PC using USB, LAN, or Direct Ethernet connection
Network Search	Find all Anritsu handheld instruments on local network
Download	Download measurements and live traces to PC for storage and analysis
Upload	Upload measurements and other files from PC to instrument
Remote Access Tool	Remote control and monitoring of instrument (via Ethernet port) over the Internet
Export	Measurements can be saved in various formats, depending on the measurement type, including JPEG, CSV, and Anritsu DAT format
Printing	Print individual or all measurement screens

**Web Remote Control**

Control	Full instrument control through a browser – all instrument functions except power switch and rotary knob
Connections	RJ45 Ethernet jack Third party Wi-Fi router
Protocol	HTTP/TCP/IP
Physical Layer	Cat 5 Cable, Wi-Fi router compatible
Software Required	HTML 5 Compliant Browser – Newer versions of Chrome, Firefox, Internet Explorer and others
Operating System	iOS, Windows, Linux, Android operating systems that can host the HTML 5 Compliant browser
Remote Hardware	PCs, Tablets, and Smart Phones with Ethernet or Wi-Fi connections and a HTML 5 Compliant browser
Download	Individual instrument files downloaded via browser Multiple instrument files and directories zipped and downloaded via browser Screen capture capability
Display Modes	Normal: All modes & displays supported Fast: Spectrum traces update faster (up to 5 updates per second)
Password	The instrument can be password protected Passwords may be used to manage who is controlling the instrument
Users/Instruments	One user/device can view and control many instruments

**Programmable Remote Control**

Functionality	Many instrument functions are programmable. See the Programming Manual for details.
Programming Language	Standard Commands for Programmable Instruments (SCPI)
Interfaces	USB, LAN
Available Drivers	LabView. Visit NI.com for driver.

## Ordering Information – Instrument Options

Part Number	Description
MS2720T	Spectrum Master (Requires Option 709, 713, 720, 732, or 743)
MS2720T-0709	Frequency Range 9 kHz to 9 GHz
MS2720T-0713	Frequency Range 9 kHz to 13 GHz
 MS2720T-0720	Frequency Range 9 kHz to 20 GHz
MS2720T-0732	Frequency Range 9 kHz to 32 GHz
MS2720T-0743	Frequency Range 9 kHz to 43 GHz
MS2720T-0809	9 GHz Tracking Generator (Requires Option 709)
 MS2720T-0813	13 GHz Tracking Generator (Requires Option 713)
MS2720T-0820	20 GHz Tracking Generator(Requires Option 720)
 MS2720T-0025	Interference Analyzer (Option 31 is recommended)
 MS2720T-0027	Channel Scanner
 MS2720T-0431	Coverage Mapping (Requires Option 31 for full functionality)
 MS2720T-0444	EMF Measurements (Requires Anritsu Isotropic Antenna)
 MS2720T-0509	AM/FM/PM Measurements (Option 431 required for full functionality)
MS2720T-0024	I/Q Waveform Capture (Requires Option 9)
MS2720T-0089	Zero-Span IF Output
MS2720T-0090	Gated Sweep
 MS2720T-0019	High Accuracy Power Meter (Requires USB Power Sensor, sold separately)
MS2720T-0009	Demodulation Hardware
 MS2720T-0880	GSM/GPRS/EDGE Measurements (Requires Option 9)
 MS2720T-0881	W-CDMA/HSPA+ Measurements (Requires Option 9, Option 31 recommended)
 MS2720T-0882	TD-SCDMA/HSPA+ Measurements (Requires Option 9, Option 31 required for full functionality)
 MS2720T-0883	LTE/LTE-A FDD/TDD Measurements (Requires Option 9, Option 31 required for full functionality)
 MS2720T-0884	CDMA/EV-DO Measurements (Requires Option 9, Option 31 required for full functionality)
 MS2720T-0885	WiMAX Fixed/Mobile Measurements (Requires Option 9, Option 31 required for full functionality)
MS2720T-0007	Secure Data Operation
MS2720T-0031	GPS Receiver (Requires GPS Antenna, sold separately) - 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) with no cable, 2.5 VDC to 3.7 VDC
MS2720T-0098	Standard Calibration (ANSI Z540-1-1994)
MS2720T-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

**Standard Accessories** (included with instrument)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
2300-577	Anritsu Software Tool Box for Handheld RF Instruments Disc
2000-1371-R	Ethernet Cable, 7 ft/213 cm
2000-1685-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
2000-1797-R	Touchscreen Protective Film, 8.4 in (one factory-installed, one spare)
633-75	High Capacity Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Power Adapter, 12 VDC, 60 W
3-2000-1498	USB A-mini B Cable, 10 ft/305 cm
	Certificate of Calibration and Conformance

**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
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
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
MA25100A	RF Power Indicator

**Manuals** (soft copy included on Handheld Instruments Documentation Disc and at [www.anritsu.com](http://www.anritsu.com))



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
10580-00340	Spectrum Master User Guide
10580-00349	Spectrum Analyzer Measurement Guide
10580-00339	Tracking Generator Measurement Guide
10580-00240	Power Meter Measurement Guide
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSPA+, TD-SCDMA/HSPA+, LTE, TD-LTE
10580-00235	3GPP2 Signal Analyzer Measurement Guide - CDMA, EV-DO
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual

**Troubleshooting Guides** (soft copy at [www.anritsu.com](http://www.anritsu.com))

**TD-LTE eNodeB Troubleshooting Guide - Utilizing Anritsu's Handheld 915 Master™ MS2720T/23C/24C/25C with Options 951, 952 and 954**

**Start Here**  
 One function of the TD-LTE eNodeB is to perform a self-check at the beginning of each power-on. The Error Counter table in the Troubleshooting Guide provides information on the error counter.

**Troubleshooting Hints**  
 Please refer to the Troubleshooting Hints section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**Key Performance Indicators (KPI) Table**

Item	Unit	Max. Value	Min. Value	Normal Range	Unit	Max. Value	Min. Value	Normal Range
Cellular Frequency	Hz	1920	1920	1920	Hz	1920	1920	1920
Cellular Frequency Error	Hz	100	100	100	Hz	100	100	100
Cellular Frequency Error Rate	Hz/Hz	100	100	100	Hz/Hz	100	100	100
Cellular Frequency Error Rate	Hz/Hz	100	100	100	Hz/Hz	100	100	100
Cellular Frequency Error Rate	Hz/Hz	100	100	100	Hz/Hz	100	100	100
Cellular Frequency Error Rate	Hz/Hz	100	100	100	Hz/Hz	100	100	100

**Locating Over-the-Air Test Spots**  
 To locate test spots, please refer to the first chapter of a log, a log Key Performance Indicators (KPI) table.

**Multiple Sector Coverage Checks**  
 Please refer to the Troubleshooting Hints section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**Power Meter Measurement Guide**  
 Please refer to the Power Meter Measurement Guide section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**3GPP Signal Analyzer Measurement Guide**  
 Please refer to the 3GPP Signal Analyzer Measurement Guide section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**3GPP2 Signal Analyzer Measurement Guide**  
 Please refer to the 3GPP2 Signal Analyzer Measurement Guide section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**WiMAX Signal Analyzer Measurement Guide**  
 Please refer to the WiMAX Signal Analyzer Measurement Guide section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**Spectrum Master Programming Manual**  
 Please refer to the Spectrum Master Programming Manual section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

**Spectrum Master Maintenance Manual**  
 Please refer to the Spectrum Master Maintenance Manual section in the first chapter of a log, a log Key Performance Indicators (KPI) table.

Part Number	Description
11410-00551	Spectrum Analyzers
11410-00472	Interference
11410-00466	GSM/GPRS/EDGE Base Stations
11410-00566	LTE eNodeB
11410-00615	TD-LTE eNodeB
11410-00463	W-CDMA/HSPA+ Base Stations
11410-00465	TD-SCDMA/HSPA+ Base Stations
11410-00467	cdmaOne/CDMA2000 1X Base Stations
11410-00468	CDMA2000 1xEV-DO Base Stations
11410-00469	Mobile WiMAX Base Stations
11410-00470	Fixed WiMAX Base Stations

Optional Accessories

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

Directional Antennas



Part Number	Description
2000-1411-R	822 MHz to 900 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
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12.2 dBd, Yagi
2000-1677-R	300 MHz to 3000 MHz, SMA(m), 50 Ω, 3 m cable (9.8 ft), 0 to 6 dBi gain @ 950 MHz, Log Periodic
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), 12 dBd, Yagi
2000-1747-R	Antenna, Log Periodic, 300 MHz to 5000 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)

Portable Antennas



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)

Isotropic Antenna



Part Number	Description
2000-1791-R	700 MHz to 6000 MHz, N(m) Isotropic Antenna

Mag Mount Broadband Antennas



2000-1647-R	Cable 1: 698–1200 MHz 2 dBi peak gain, 1700–2700 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000–6000 MHz 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft
2000-1645-R	694-894 MHz 3 dBi peak gain 1700-2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1646-R	750-1250 MHz 3 dBi peak gain, 1650-2000 MHz 5 dBi peak gain, 2100-2700 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft
2000-1648-R	1700-6000 MHz 3 dBi peak gain, N(m), 50 Ω, 10 ft



**Optional Accessories** (Continued)**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

**Adapters**

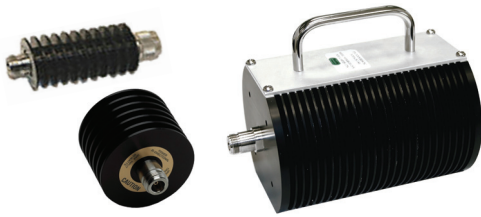
Part Number	Description
1091-26-R	SMA(m) to N(m), DC to 18 GHz, 50 Ω
1091-27-R	SMA(f) to N(m), DC to 18 GHz, 50 Ω
1091-80-R	SMA(m) to N(f), DC to 18 GHz, 50 Ω
1091-81-R	SMA(f) to N(f), DC to 18 GHz, 50 Ω
1091-417-R	N(m) to QMA(f), DC to 6 GHz, 50 Ω
1091-418-R	N(m) to QMA(m), DC to 18 GHz, 50 Ω
1091-172-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
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
71693-R	Ruggedized K(f) to Type N(f)
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

**Precision Adapters**

Part Number	Description
34NN50A	Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

**Optional Accessories** (Continued)

**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)

**Miscellaneous Accessories**



Part Number	Description
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	Rechargeable Li-Ion Battery, 7500 mAh
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
2000-1797-R	Touchscreen Protective Film, 8.4 in
MA2700A	Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)
2000-1691-R	Stylus with Coiled Tether
2000-1798-R	Port Extender, DC to 6 GHz, N(m) to N(f)

**Backpack and Transit Case**



Part Number	Description
67135	Anritsu Backpack (For Handheld Instrument and PC)
760-243-R	Large Transit Case with Wheels and Handle
760-261-R	Transit Case, space for MA2700A, antennas, filters, instrument inside softcase, and other interference hunting accessories/tools
760-271-R	Transit Case for Portable Directional Antennas and Port Extender (2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)





The Master Users Group is an organization dedicated to providing training, technical support, networking opportunities and links to Master product development teams. As a member, you will receive the Insite Quarterly Newsletter with user stories, measurement tips, new product news and more. Visit us to register today: [www.anritsu.com/mug](http://www.anritsu.com/mug)



Customers in the United States can receive a quote to purchase a product or order accessories by visiting our online ordering site: [www.ShopAnritsu.com](http://www.ShopAnritsu.com)

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