

Anritsu envision : ensure

# 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+
- PIM Alert Application
- LTE/LTE-A FDD/TDD; MIMO (2x2, 4x4)
- 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

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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
	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: <a href="http://www.anritsu.com">www.anritsu.com</a>

 **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) PIM Alert Application (available for download)
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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	MS2720T-0709	MS2720T-0713	MS2720T-0720	MS2720T-0732	MS2720T-0743
(usable to 0 Hz)	9 kHz to 9 GHz	9 kHz to 13 GHz	9 kHz to 20 GHz	9 kHz to 32 GHz	9 kHz to 40 GHz
Tuning Resolution	1 Hz				
Frequency Reference	Aging: ± 1.0 × 10 <sup>-6</sup> per 10 years Accuracy: ± 0.3 × 10 <sup>-6</sup> (25 °C ± 25 °C) plus aging (see Options 1 and 31 for improved frequency reference aging and accuracy)				
Auto-Sensing External Frequency Reference	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608 (MHz)				
Sweep Time	7 μs to 3600 s in zero span				
Sweep Time Accuracy	± 2 % in zero span				

**Bandwidth**

Resolution Bandwidth (RBW)	1 Hz to 10 MHz in 1-3 sequence ± 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	-136 dBm	-142 dBm	-155 dBm	-161 dBm
32 to 43 GHz Instruments				
> 13 GHz to 20 GHz	-134 dBm	-141 dBm	-152 dBm	-158 dBm
> 20 GHz to 32 GHz	-135 dBm	-140 dBm	-154 dBm	-159 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)	Preamp = Off	Preamp = On
< 13 GHz	-90 dBm, maximum	-100 dBm, maximum
13 to 20 GHz	-85 dBm, maximum	-100 dBm, maximum
> 20 to 32 GHz	-80 dBm, maximum	-100 dBm, maximum
> 32 to 43 GHz	-80 dBm, maximum	-95 dBm, maximum

Input-Related Spurious (-30 dBm input)

Maximum <sup>a</sup>	Typical
-60 dBc	-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, 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 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	MA24105A	MA24106A	MA24108A/18A/26A	MA24208A/18A	MA24330A/40A/50A
Description	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor	Microwave Universal USB Power Sensor	Microwave CW USB Power Sensor
Frequency Range	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz	10 MHz to 8/18 GHz	10 MHz to 33/40/50 GHz
Connector	Type N(f), 50 Ω	Type N(m), 50 Ω	Type N(m), 50 Ω (8/18 GHz) Type K(m), 50 Ω (26 GHz)	Type N(m), 50 Ω	Type K(m), 50 Ω (33/40 GHz) Type V(m), 50 Ω (50 GHz)
Dynamic Range	+3 dBm to +51.76 dBm (2 mW to 150 W)	-40 dBm to +23 dBm (0.1 μW to 200 mW)	-40 dBm to +20 dBm (0.1 μW to 100 mW)	-60 dBm to +20 dBm (1 nW to 100 mW)	-70 dBm to +20 dBm (0.1 nW to 100 mW)
Measurand	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power	True-RMS, Slot Power, Burst Average Power	Average Power
Measurement Uncertainty	± 0.17 dB <sup>a</sup>	± 0.16 dB <sup>b</sup>	± 0.18 dB <sup>c</sup>	± 0.17 dB <sup>d</sup>	± 0.17 dB <sup>e</sup>
Data sheet (for complete specifications)	11410-00621	11410-00424	11410-00504	11410-00841	11410-00906

- Notes:
- a. 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.
  - b. Total RSS measurement uncertainty (0 °C to 50 °C) for power measurements of a CW signal greater than -20 dBm with zero mismatch errors.
  - c. Expanded uncertainty with K=2 for power measurements of a CW signal greater than -20 dBm with zero mismatch errors.
  - d. Power uncertainty expressed with two sigma confidence level for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
  - e. Includes linearity over temperature uncertainties, but not the effects of calibration factor, mismatch, zero set and drift, and noise.


**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**

Frequency Range	Frequency Range
MS2720T-0809	100 kHz to 9 GHz
MS2720T-0813	100 kHz to 13 GHz
MS2720T-0820	100 kHz to 20 GHz
Frequency Accuracy	Aging: ± 1.0 x 10 <sup>-6</sup> per 10 years Accuracy: ± 0.3 x 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 (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**

**Supported Antenna**

2000-1800-R	9 kHz to 300 MHz
2000-1792-R	30 MHz to 3 GHz
2000-1791-R	700 MHz to 6 GHz

**Modes where EMF Measurements available**

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

 **GPS Receiver (Option 31)**


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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) 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

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 **Gated Sweep (Option 90)**


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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

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


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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

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


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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

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 **Secure Data (Option 7)**


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

**Setup Parameters**

Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen 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			
RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum	Code Domain Power/Error (QPSK/8 PSK/16 QAM/64 QAM)	Code Scan (32)	View Pass/Fail Limits
Channel Power	Slot Power	Scrambling Code Group	All, RF, Demod
Occupied Bandwidth	DwPTS Power	Tau	Available Measurements
Left Channel Power	Noise Floor	$E_c/I_0$	Occupied Bandwidth
Left Channel Occ B/W	Frequency Error	DwPTS Power	Channel Power
Right Channel Power	Tau	Pilot Dominance	Channel Power RCC
Right Channel Occ B/W	Scrambling Code	Tau Scan (Six)	On/Off Ratio
Power vs. Time	EVM	Sync-DL#	Peak-to-Average Ratio
Six Slot Powers	Peak EVM	Tau	Frequency Error
Channel Power (RRC)	Peak Code Domain Error	$E_c/I_0$	EVM
DL-UL Delta Power	CDP Marker	DwPTS Power	Peak EVM
UpPTS Power	Modulation Summary	Pilot Dominance	Peak Code Domain Error
DwPTS Power		Record	Tau
On/Off Ratio		Run/Hold	Noise Floor
Slot Peak-to-Average Power			
Spectral Emission			
RF Summary			

## 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)	$\pm 1.5$ dB, $\pm 1.0$ dB typical, (slot power $-40$ dBm to $+10$ dBm)
Frequency Error	$\pm 10$ 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 $1 \times 64$ chips
Pilot Power Accuracy	$\pm 1.0$ dB typical
Timing Error (Tau) for Dominant SYNC-DL	$\pm 0.2$ $\mu$ s (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 (2x2, 4x4) 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 - 32, 66A (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	Power vs. Resource Block (RB)	Scanner	View Pass/Fail Limits
Channel Power	RB Power (PDSCH)	Cell ID (Group, Sector)	All, RF, Modulation
Occupied Bandwidth	Active RBs, Utilization %	S-SS, RSRP, RSRQ, SINR	Available Measurements
Power vs. Time	Channel Power, Cell ID	Dominance	Channel Power
Frame View	OSTP, Frame EVM by modulation	Modulation Results - On/Off	Occupied Bandwidth
Sub-Frame View	Constellation	Auto Save - On/Off	ACLR
Total Frame Power	QPSK, 16QAM, 64QAM	Tx Test	Frequency Error
DwPTS Power	Modulation Results	Scanner	Carrier Frequency
Transmit Off Power	Ref Signal Power (RS)	RS Power of MIMO antennas (2x2, 4x4)	Dominance
Cell ID	Sync Signal Power (SS)	Cell ID, Average Power	EVM peak, rms
Timing Error	EVM - rms, peak, max hold	Delta Power (Max-Min)	Frame EVM, rms
ACLR	Frequency Error - Hz, ppm	Graph of Antenna Power	Frame EVM by mod type
Spectral Emission Mask	Carrier Frequency	Modulation Results - On/Off	RS, SS Power
Category A or B (Opt 1)	Cell ID	Mapping	RS EVM
RF Summary	Control Channel Power	On-screen	P-SS, S-SS, Power, EVM
	Bar Graph or Table View	S-SS, RSRP, RSRQ, or SINR	PBCH, PCFICH, PHICH, PDCCH
	RS, P-SS, S-SS	Scanner	Power, EVM
	PBCH, PCFICH, PHICH, PDCCH	Modulation Results - Off	Cell, Group, Sector ID
	Total Power (Table View)	Carrier Aggregation	OSTP
	EVM per Control Channel	Up to 5 component carriers (CC1 to CC5)	Tx Time Alignment
	Tx Time Alignment	CP, MIMO status, RS & SS Power, EVM,	Frame Power
	Modulation Summary	Frequency Error, Time Alignment Error,	DwPTS Power
	Includes EVM by modulation	Cell ID	Transmit Off Power
	Antenna Icons		Timing Error
	Detects active antennas (1/2)		

**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**

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

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

**CDMA Demodulation Measurements**

Frequency Error	± 10 Hz + time base error, 99 % confidence level (in slow mode)
Rho Accuracy	± 0.005, for Rho > 0.9
Residual Rho	> 0.995, typical, > 0.99 maximum, (RF input -50 dBm to +20 dBm)
PN Offset	1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ± 1.0 µs 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 Channel Power Occupied Bandwidth Peak-to-Average Power	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error	Pilot Scanner (Nine) PN $E_c/I_o$ Tau	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power
Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio	Rho Pilot Rho Overall Data Modulation Noise Floor	Pilot Power Channel Power Pilot Dominance	Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error
Spectral Emission Mask Single Carrier ACPR Multi-carrier ACPR RF Summary	MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Multipath Scanner (Six) $E_c/I_o$ Tau Channel Power Multipath Power	Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Multipath Power

**Setup Parameters**

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement	Speed Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Slot Type	Auto, Active, Idle
Number of Carriers	1 to 5
Carrier Bandwidth (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

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

**WiMAX Fixed Measurements**

RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor ACPR RF Summary	Constellation RCE (RMS/Peak) EVM (RMS/Peak) Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Burst Power Preamble Power Crest Factor Frequency Error Carrier Frequency 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 Fixed/Mobile Measurements (Option 885)** (Continued)
**WiMAX Mobile Measurements<sup>1</sup>**

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<sup>®</sup> 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
Pixel Defects	No more than five defective pixels (99.9989% good pixels)
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 %

**Regulatory Compliance**

European Union	EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55022, IEC/EN 61000-4-2/3/4/5/6/58/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010, IEC 60950-1 (when used with Anritsu Company supplied Power Supply) RoHS Directive 2011/65/EU
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21-0004

**Environmental**

Operating Temperature Range	MIL-PRF-28800F Class 2 -10 °C to 55 °C
Storage Temperature Range	-40 °C to 71 °C
Maximum Relative Humidity	95 % RH at 40 °C, non-condensing
Vibration, Sinusoidal	5 Hz to 55 Hz
Vibration, Random	10 Hz to 500 Hz
Half Sine Shock	30 g <sub>n</sub>
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	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 data sheets of each sensor)

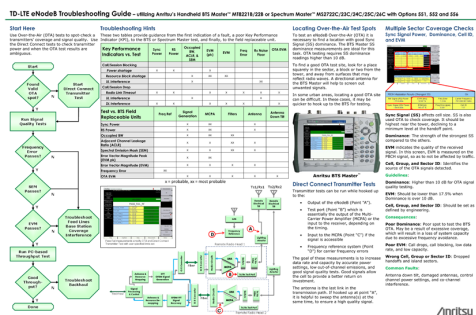


Model Number	Description
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm
MA24106A	RF USB Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm
MA24208A	Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24218A	Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24330A	Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
MA24340A	Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
MA24350A	Microwave CW USB Power Sensor, 10 MHz to 50 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))



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



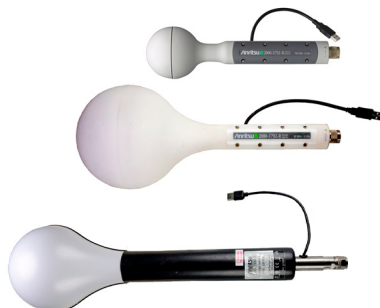
Part Number	Description
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd, Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 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 $\Omega$ , 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 $\Omega$
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 $\Omega$
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 $\Omega$ (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 $\Omega$ (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 $\Omega$ (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 $\Omega$
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 $\Omega$ (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 $\Omega$
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA(m), 2 dB, typical, 50 $\Omega$
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	Isotropic Antenna, 700 MHz to 6000 MHz, N(m)
2000-1792-R	Isotropic Antenna, 30 MHz to 3000 MHz, N(m)
2000-1800-R	Isotropic Antenna, 9 kHz to 300 MHz, N(m)

Optional Accessories (Continued)

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

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



Precision Adapters



Part Number Description

- 34NN50A Precision Adapter, N(m) to N(m), DC to 18 GHz, 50 Ω
- 34NFF50 Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω

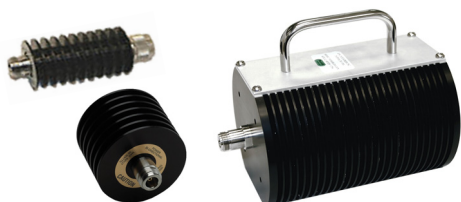
## Optional Accessories (Continued)

## 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

## 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 56 cm x 45.5 cm x 26.5 cm (22.07" x 17.92" x 10.42")
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 52.4 cm x 42.8 cm x 20.6 cm (20.62" x 16.87" x 8.12") (for 2000-1777-R, 2000-1778-R, 2000-1779-R, 2000-1798-R)

## Training at Anritsu

Anritsu has designed courses to help you stay up to date with technologies important to your job. For available training courses, visit: [www.anritsu.com/training](http://www.anritsu.com/training)



### • United States

#### Anritsu Company

1155 East Collins Blvd, Suite 100  
Richardson, TX 75081, U.S.A.  
Toll Free: 1-800-267-4878  
Phone: +1-972-644-1777  
Fax: +1-972-671-1877

### • Canada

#### Anritsu Electronics Ltd.

700 Silver Seven Road, Suite 120  
Kanata, Ontario K2V 1C3, Canada  
Phone: +1-613-591-2003  
Fax: +1-613-591-1006

### • Brazil

#### Anritsu Eletrônica Ltda.

Praça Amadeu Amaral, 27 - 1 Andar  
01327-010 Bela Vista, São Paulo, SP, Brazil  
Phone: +55-11-3283-2511  
Fax: +55-11-3288-6940

### • Mexico

#### Anritsu Company, S.A. de C.V.

Av. Ejército Nacional No. 579 Piso 9, Col. Granada  
11520 México, D.F., México  
Phone: +52-55-1101-2370  
Fax: +52-55-5254-3147

### • United Kingdom

#### Anritsu EMEA Ltd.

200 Capability Green  
Luton, Bedfordshire LU1 3LU  
United Kingdom  
Phone: +44-1582-433280  
Fax: +44-1582-731303

### • France

#### Anritsu S.A.

12 Avenue du Québec  
Bâtiment Iris 1-Silic 612  
91140 Villebon-sur-Yvette, France  
Phone: +33-1-60-92-15-50  
Fax: +33-1-64-46-10-65

### • Germany

#### Anritsu GmbH

Nemetschek Haus, Konrad-Zuse-Platz 1  
81829 München, Germany  
Phone: +49-89-442308-0  
Fax: +49-89-442308-55

### • Italy

#### Anritsu S.r.l.

Via Elio Vittorini 129  
00144 Roma, Italy  
Phone: +39-06-509-9711  
Fax: +39-06-502-2425

### • Sweden

#### Anritsu AB

Kistagången 20B  
164 40 KISTA, Sweden  
Phone: +46-8-534-707-00  
Fax: +46-8-534-707-30

### • Finland

#### Anritsu AB

Teknobulevardi 3-5  
FI-01530 Vantaa, Finland  
Phone: +358-20-741-8100  
Fax: +358-20-741-8111

### • Denmark

#### Anritsu A/S

Kay Fiskers Plads 9  
2300 Copenhagen S, Denmark  
Phone: +45-7211-2200  
Fax: +45-7211-2210

### • Russia

#### Anritsu EMEA Ltd.

##### Representation Office in Russia

Tverskaya str. 16/2, bld. 1, 7th floor  
Moscow, 125009, Russia  
Phone: +7-495-363-1694  
Fax: +7-495-935-8962

### • Spain

#### Anritsu EMEA Ltd.

Edificio Cuzco IV, Po. de la Castellana, 141, Pta. 8  
28046, Madrid, Spain  
Phone: +34-915-726-761  
Fax: +34-915-726-621

### • United Arab Emirates

#### Anritsu EMEA Ltd.

Dubai Liaison Office  
902, Aurora Tower,  
P O Box: 500311- Dubai Internet City  
Dubai, United Arab Emirates  
Phone: +971-4-3758479  
Fax: +971-4-4249036

### • India

#### Anritsu India Private Limited

2nd & 3rd Floor, #837/1, Binnamangla 1st Stage  
Indiranagar, 100ft Road, Bangalore - 560038, India  
Phone: +91-80-4058-1300  
Fax: +91-80-4058-1301

### • Singapore

#### Anritsu Pte. Ltd.

11 Chang Charn Road, #04-01, Shriro House  
Singapore 159640  
Phone: +65-6282-2400  
Fax: +65-6282-2533

### • P.R. China (Shanghai)

#### Anritsu (China) Co., Ltd.

27th Floor, Tower A  
New Caohejing International Business Center  
No. 391 Gui Ping Road Shanghai, Xu Hui Di District  
Shanghai 200233, P.R. China  
Phone: +86-21-6237-0898  
Fax: +86-21-6237-0899

### • P.R. China (Hong Kong)

#### Anritsu Company Ltd.

Unit 1006-7, 10/F., Greenfield Tower  
Concordia Plaza  
No. 1 Science Museum Road, Tsim Sha Tsui East  
Kowloon, Hong Kong, P. R. China  
Phone: +852-2301-4980  
Fax: +852-2301-3545

### • Japan

#### Anritsu Corporation

8-5, Tamura-cho, Atsugi-shi  
Kanagawa, 243-0016 Japan  
Phone: +81-46-296-1221  
Fax: +81-46-296-1238

### • Korea

#### Anritsu Corporation, Ltd.

5FL, 235 Pangyoyeok-ro, Bundang-gu, Seongnam-si  
Gyeonggi-do, 13494 Korea  
Phone: +82-31-696-7750  
Fax: +82-31-696-7751

### • Australia

#### Anritsu Pty. Ltd.

Unit 20, 21-35 Ricketts Road,  
Mount Waverley, Victoria 3149, Australia  
Phone: +61-3-9558-8177  
Fax: +61-3-9558-8255

### • Taiwan

#### Anritsu Company Inc.

7F, No. 316, Sec. 1, Neihu Rd, Taipei 114, Taiwan  
Phone: +886-2-8751-1816  
Fax: +886-2-8751-1817

List Revision Date: 20160317