

Anritsu Advancing beyond

Spectrum Master™

High Performance Handheld Spectrum Analyzer

MS2720T

9 kHz to 9 GHz, 13 GHz, 20 GHz



Introduction

From Anritsu, the inventor of the handheld spectrum analyzer first introduced in 1999, we are proud to introduce our 7th 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
- PIM Hunting
- 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 | • LTE/LTE-A FDD/TDD | • EMF Test | • AM/FM/PM Demodulator |
| • W-CDMA/HSPA+ | • NB-IoT | • Zero-span IF Output | • High Accuracy Power Meter up to 26 GHz USB Sensors |
| • TD-SCDMA/HSPA+ | • CDMA/EV-DO | • I/Q Waveform Capture | • Three Hour Battery |
| • PIM Alert Application | • WiMAX Fixed/Mobile | • Gated Sweep | |

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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"> • After 5 minutes of warm-up time, where the instrument is left in the ON state. • Sweep Mode set to Performance. • When using the internal reference signal.
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: www.anritsu.com



Spectrum Analyzer

Measurements

Smart Measurements	Field Strength (dBm/m ² , dBV/m, dBmV/m, dBμV/m, V/m, watt/m ² , dBW/m ² , A/m, dBA/m, or watt/cm ²) 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) PIM Hunting
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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
(usable to 0 Hz)	9 kHz to 9 GHz	9 kHz to 13 GHz	9 kHz to 20 GHz
Tuning Resolution	1 Hz		
Frequency Reference	Aging: ± 0.1 x 10 ⁻⁶ per year; ± 1.0 x 10 ⁻⁶ per 10 years Accuracy: ± 0.3 x 10 ⁻⁶ (25 °C ± 25 °C) plus aging (see Option 31 for improved frequency reference 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 20 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: dBW, dBm, dBμW, dBV, dBmV, dBμV, dBA, dBmA, dBμA 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 (≥ 1.0 dB Attenuation) +23 dBm Peak typical, ± 50 VDC (< 10 dB Attenuation) +13 dBm Peak typical, ± 50 VDC (Preamp = ON Option 713, 720; 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 ^a	± 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

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 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

 **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
	Maximum^a	Typical
Input-Related Spurious (-30 dBm input)	-60 dBc	-70 dBc

a. Instrument centered on single signal, span < 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 (+11 dBm minimum for 9 GHz instruments with firmware V4.60 and higher)
50 MHz to 20 GHz	+20 dBm typical

P1dB

< 4 GHz	+5 dBm nominal
4 GHz to 20 GHz	+12 dBm nominal

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

50 MHz	-68 dBc maximum
< 4 GHz	-60 dBc typical
≥ 4 GHz	-75 dBc typical


VSWR (≥ 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 20 GHz Instruments	
< 20 GHz	1.5:1 typical
20 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 ^a	± 0.16 dB ^b	± 0.18 dB ^c	± 0.17 dB ^d	± 0.17 dB ^e
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	100 kHz to 9 GHz
MS2720T-0809	100 kHz to 13 GHz
MS2720T-0813	100 kHz to 20 GHz
MS2720T-0820	Frequency Accuracy
Frequency Accuracy	Aging: ± 0.1 x 10 ⁻⁶ per year; ± 1.0 x 10 ⁻⁶ per 10 years Accuracy: ± 0.3 x 10 ⁻⁶ (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 72 hours
Signal Strength	Gives visual and aural indication of signal strength
Received Signal Strength Indicator (RSSI)	Collect data up to 168 hours (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 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 ² , dBV/m, dBmV/m, dBuV/m, V/m, W/m ² , dBW/m ² , A/m, dBA/m, W/cm ² LTE OTA, TD-LTE OTA, W-CDMA OTA: dBm/m ² , V/m, W/m ²
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
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Modes where EMF Measurements available

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

 **GPS Receiver (Option 31)** (requires external GPS antenna, sold separately)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
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 μ 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 ± 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, Wideband 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: ± 1 Hz (< 100 Hz), ± 2 % (> 100 Hz) Depth: ± 5 % for (Modulation rates 10 Hz to 100 kHz)
FM	Modulation Rate: ± 1 Hz (< 100 Hz); ± 2 % (100 Hz to 100 kHz) Deviation Accuracy: ± 5 % (100 Hz to 100 kHz)**
PM	Modulation Rate: ± 1 Hz (< 100 Hz); ± 2 % (100 Hz to 100 kHz) Deviation Accuracy: ± 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 μ s to 50 ms (Audio Waveform)
**	IFBW must be greater than 95 % occupied BW

 **GSM/GPRS/EDGE Signal Analyzer (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)	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™
Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC)			

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+ Signal Analyzer (Option 881)

Measurements

RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
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_0	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	± 1.25 dB, ± 0.7 dB typical, (temperature range 15 °C to 35 °C)
Occupied Bandwidth Accuracy	± 100 kHz
Adjacent Channel Leakage Ratio (ACLR)	-54 dB/-59 dB ± 0.8 dB @ 5 MHz/10 MHz offset, typical, 824 MHz to 894 MHz, 1710 MHz to 2170 MHz -54 dB/-57 dB ± 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	± 10 Hz + time base error, 99 % confidence level
EVM Accuracy	± 2.5 %, $6\% \leq \text{EVM} \leq 25\%$
Residual EVM	2.5 % typical
Code Domain Power	± 0.5 dB for code channel power > -25 dB, 16, 32, 64 DCPH (test model 1), 16, 32 DCPH (test model 2, 3)
CPICH (dBm) Accuracy	± 0.8 dB typical

Over-the-Air (OTA) Measurements

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

 TD-SCDMA/HSPA+ Signal Analyzer (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_o	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_o	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)	± 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 Signal Analyzers (Option 883 and 886)

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 256 QAM Demod (Option 886) 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 eMBMS Test Cell ID, RSRP 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
Evolved Multimedia Broadcast Multicast Services (eMBMS) Test	Reports the Cell ID and measures the Received Signal Received Power (RSRP)

 **LTE/LTE-A FDD/TDD Signal Analyzers (Option 883 and 886)** (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	256 QAM Demod (Option 886)	Scanner	Carrier Frequency
Transmit Off Power	Modulation Results	RS Power of MIMO antennas (2x2, 4x4)	Dominance
Cell ID	Ref Signal Power (RS)	Cell ID, Average Power	EVM peak, rms
Timing Error	Sync Signal Power (SS)	Delta Power (Max-Min)	Frame EVM, rms
ACLR	EVM - rms, peak, max hold	Graph of Antenna Power	Frame EVM by mod type
Spectral Emission Mask	Frequency Error - Hz, ppm	Modulation Results - On/Off	RS, SS Power
Category A or B (Opt 1)	Carrier Frequency	Mapping	RS EVM
RF Summary	Cell ID	On-screen	P-SS, S-SS, Power, EVM
	Control Channel Power	S-SS, RSRP, RSRQ, or SINR	PBCH, PCFICH, PHICH, PDCCH
	Bar Graph or Table View	Scanner	Power, EVM
	RS, P-SS, S-SS	Modulation Results - Off	Cell, Group, Sector ID
	PBCH, PCFICH, PHICH, PDCCH	Carrier Aggregation	OSTP
	Total Power (Table View)	Up to 5 component carriers (CC1 to CC5)	Tx Time Alignment
	EVM per Control Channel	CP, MIMO status, RS & SS Power, EVM,	Frame Power
	Tx Time Alignment	Frequency Error, Time Alignment Error,	DwPTS Power
	Modulation Summary	Cell ID	Transmit Off Power
	Includes EVM by modulation		Timing Error
	Antenna Icons		
	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



NB-IoT Analyzer (Option 887) (requires Option 9)

Measurements

NB-IoT Mode Guard Band, Standalone

RF Measurements

Summary Screen	Carrier Frequency Channel Power Occupied Bandwidth NPSS Power NSSS Power NPBCH Power NPDCCH or NPDSCH Power Cell ID RSRP RSRQ SINR Spectral Emission Mask Pass/Fail
Channel Spectrum	Spans supported: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz, 30 MHz
Spectral Emission Mask	Mask Type: NB-IoT Fixed
Save/Recall	Summary Table Off/On (Mask Segment; Start, Stop, Peak Frequencies; Power; Power Margin; RBW; Status) Measurement (.iot), Setup (.stp), Screen Shots (.jpg) to Internal or External Memory

 **CDMA/EV-DO Signal Analyzer (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 Signal Analyzer (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 ± 1.5 dB, ± 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	± 10 Hz + time base error, 99 % confidence level
Rho Accuracy	± 0.01, for Rho > 0.9
Residual Rho	> 0.995 typical, > 0.99, maximum (RF input -50 dBm to +20 dBm)
PN Offset	Within 1 x 64 chips
Pilot Power Accuracy	± 1.0 dB typical, relative to channel power
Tau	± 0.5 µs typical, ± 1.0 µs 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 Signal Analyzer (Option 885)**

WiMAX Fixed Measurements

RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth	Constellation RCE (RMS/Peak) EVM (RMS/Peak)	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 Carrier Frequency EVM RCE Base Station ID
Power vs. Time Channel Power Preamble Power Data Burst Power Crest Factor	Frequency Error Carrier Frequency Base Station ID Spectral Flatness Adjacent Subcarrier Flatness		
ACPR RF Summary	EVM vs. Subcarrier/Symbol RCE EVM Frequency Error Carrier Frequency Base Station ID Sector ID (Mobile) Modulation Summary		

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 10⁻⁸ 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 Signal Analyzer (Option 885)** (Continued)**WiMAX Mobile Measurements¹**

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 10⁻⁸ 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
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
Ethernet	RJ45, 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 61326-1:2013; CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/1; Low Voltage Directive 2014/35/EU; Safety EN 61010-1:2010; RoHS Directive 2011/65/EU + 2015/863
United Kingdom	EMC SI 2016/1091; BS EN 55011 & BS 61000-4-2/3/4/5/6/8/11 Consumer Protection (Safety) SI 2016/1101; BS EN 61010-1:2010 Environmental Protection SI 2012/3032; 2011/65/EU & 2015/863
Australia and New Zealand	RCM AS/NZS 4417:2012
South Korea	KCC-REM-A21+-0004
Canada	ICES-1(A)/NMB-1(A)

Environmental

	MIL-PRF-28800F Class 2
Operating Temperature Range	-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 _n
Altitude	4600 meters, operating and non-operating
Explosive Atmosphere	MIL-PRF-28800F Section 4.5.6.3; MIL-STD-810G, Method 511.5, Procedure 1

Warranty

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

Size	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^1
Interference Analyzer Measurements	Spectrograms, Signal Strength Meter, RSSI ²
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)
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-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-0886	LTE 256 QAM Demodulation (requires Option 883)
 MS2720T-0887	NB-IoT Measurements (requires Option 9)
 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)
MS2720T-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2720T-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.




Standard Accessories (included with instrument)

Accessory	Description
	2000-1685-R Soft Carrying Case
	2000-1691-R Stylus with Coiled Tether
	633-75 Rechargeable Li-Ion Battery, 7500 mAh
	40-187-R AC-DC Adapter with AC power cord (country dependent)
	2000-1797-R Touchscreen Protective Film, 8.4 in (one-factory-installed, one spare)












Accessory	Description
	2000-1371-R Ethernet Cable, 7 ft/213 cm
	3-2000-1498 USB A/5-pin mini-B Cable, 10 ft
	806-141-R Automotive Power Adapter, 12 VDC, 60 W
	Certificate of Calibration and Conformance

USB Power Sensors (for complete ordering information, see the respective data sheets of each sensor)

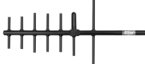






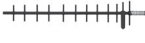

Accessory	Description
	MA24330A Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm
	MA24340A Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm
	MA24350A Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm
	MA24208A Microwave Universal USB Power Sensor, 10 MHz to 8 GHz, +20 dBm to -60 dBm
	MA24218A Microwave Universal USB Power Sensor, 10 MHz to 18 GHz, +20 dBm to -60 dBm
	MA24106A High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm to -40 dBm

Accessory	Description
	MA24108A Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm to -40 dBm
	MA24118A Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm to -40 dBm
	MA24126A Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm to -40 dBm
	MA24105A Inline Dual Directional High Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm
	MA25100A RF Power Indicator


Optional Accessories

Backpack and Transit Case		Accessory	Description
	67135 Anritsu Backpack (for Handheld Instrument and PC)		760-261-R Large Transit Case with Wheels and Handle 63.1 cm x 50 cm x 30 cm (24.83" x 19.69" x 11.88"), space for MA2700A, antennas, filters, instrument inside soft case, and other interference hunting accessories/tools
	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")		760-262-R Transit Case for MA2700A, holds several Yagi antennas and filters/port extender 96.8 x 40.6 x 15.5 cm (38.12" x 16.00" x 6.12")
	760-286-R Compact Transit Case with Wheels and Handle 55.6 cm x 35.5 cm x 22.9 cm (21.89" x 13.98" x 9.01")		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)
Miscellaneous Accessories		Accessory	Description
	2000-1374-R External Dual Charger for Li-Ion Batteries		MA25401A Atomic Clock External 10 MHz Frequency Reference (see MA25401A Technical Data Sheet, PN: 11410-01134 for details)
	MA2700A Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692)		2000-2149-R EMI Near-Field Probe Kit, 100 kHz to 3 GHz Requires 1092-172-R Type N to BNC Adapter and 1 m BNC to BNC Cable (sold separately) (For full specifications, refer to the Near-Field Probe Set User Guide 10580-00347)
GNSS (GPS) Antennas (active)		Accessory	Description
	2000-2185-R Magnet Mount, SMA(m) with 3 m (9.8 ft) cable, requires 2.7 VDC or 5 VDC		2000-1760-R Miniature Antenna, SMA(m), requires 2.5 VDC to 3.7 VDC
	2000-1652-R Magnet Mount, SMA(m) with 0.3 m (1 ft) cable, requires 3.3 VDC or 5 VDC		

Directional Antennas

Accessory	Description
	2000-1411-R 824 MHz to 896 MHz, N(f), 12.3 dBi, Yagi
	2000-1412-R 885 MHz to 975 MHz, N(f), 12.6 dBi, Yagi
	2000-1413-R 1710 MHz to 1880 MHz, N(f), 12.3 dBi, Yagi
	2000-1414-R 1850 MHz to 1990 MHz, N(f), 11.4 dBi, Yagi
	2000-1415-R 2400 MHz to 2500 MHz, N(f), 14.1 dBi, Yagi
	2000-1416-R 1920 MHz to 2170 MHz, N(f), 14.3 dBi, Yagi
	2000-1659-R 698 MHz to 787 MHz, N(f), 10.1 dBi, Yagi
	2000-1660-R 1425 MHz to 1535 MHz, N(f), 14.3 dBi, Yagi
	2000-2107-R Log Periodic, 20 MHz to 8.5 GHz




Multiband Dipole Antenna

Accessory	Description
	2000-2183-R 617 MHz to 5000 MHz, N(m), 0.5 to 3.7 dBi, Dipole Antenna


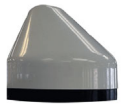
Accessory Description



	2000-1726-R 2500 MHz to 2700 MHz, N(f), 14.1 dBi, Yagi
	2000-1798-R Port Extender, DC to 6 GHz
	2000-1748-R Log Periodic, 1 to 18, N(f), 6 dBi, typical
	2000-1777-R 9 kHz to 20 MHz, N(f) (requires port extender 2000-1798-R when used with MA2700A)
	2000-1778-R 20 MHz to 200 MHz, N(f) (requires port extender 2000-1798-R when used with MA2700A)
	2000-1779-R 200 MHz to 500 MHz, N(f) (requires port extender 2000-1798-R when used with MA2700A)
	2000-1812-R Portable Yagi Antenna, 450 MHz to 512 MHz, N(f), 7.1 dBi
	2000-1825-R Portable Yagi Antenna, 380 MHz to 430 MHz, N(f), 7.1 dBi

Omni Directional Antennas (requires 1091-27-R SMA(f) to N(m) or 1091-172-R BNC(f) to N(m) adapter)


Accessory	Description
	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
	2000-1361-R 2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
	2000-1487-R Telescoping Whip Antenna, BNC

Mag Mount and Broadband Antennas

Accessory	Description
	2000-2200-R 20 MHz to 21000 MHz, N(f), 50 Ω, Broadband Antenna
	2000-1647-R Cable 1: 698 MHz to 1200 MHz, 2 dBi peak gain, 1700 MHz to 2700 MHz, 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft

Accessory	Description
	2000-1648-R 1700 MHz to 6000 MHz, 3 dBi peak gain, N(m), 50 Ω, 10 ft
	2000-1946-R Cable 1: 617 MHz to 960 MHz, 3 dBi peak gain, 1710 MHz to 3700 MHz, 4 dBi peak gain, N(m), 50 Ω, 10 ft Cable 2: 3000 MHz to 6000 MHz, 5 dBi peak gain, N(m), 50 Ω, 10 ft Cable 3: GPS 26 dB gain, SMA(m), 50 Ω, 10 ft


Isotropic Antennas


Accessory	Description
	2000-1800-R H-Field, 9 kHz to 300 MHz

Bandpass Filters

Accessory	Description
	2000-1734-R 699 MHz to 715 MHz, N(m) and N(f), 50 Ω
	2000-1735-R 776 MHz to 788 MHz, N(m) and N(f), 50 Ω
	2000-1736-R 815 MHz to 850 MHz, N(m) and N(f), 50 Ω
	2000-1737-R 1711 MHz to 1756 MHz, N(m) and N(f), 50 Ω
	2000-1738-R 1850 MHz to 1910 MHz, N(m) and N(f), 50 Ω
	2000-1739-R 880 MHz to 915 MHz, N(m) and N(f), 50 Ω
	2000-1740-R 1710 MHz to 1785 MHz, N(m) and N(f), 50 Ω
	2000-1741-R 1920 MHz to 1980 MHz, N(m) and N(f), 50 Ω
	2000-1742-R 832 MHz to 862 MHz, N(m) and N(f), 50 Ω
	2000-1743-R 2500 MHz to 2570 MHz, N(m) and N(f), 50 Ω
	2000-1799-R 2305 MHz to 2320 MHz, N(m) and N(f), 50 Ω

Precision Adapters

Accessory	Description
	34NN50A N(m) to N(m), DC to 18 GHz, 50 Ω

Accessory	Description
	34NFN50 N(f) to N(f), DC to 18 GHz, 50 Ω

Adapters Accessory	Description
	1091-26-R SMA(m) to N(m), DC to 18 GHz, 50 Ω
	1091-27-R SMA(f) to N(m), DC to 18 GHz, 50 Ω
	1091-80-R SMA(m) to N(f), DC to 18 GHz, 50 Ω
	1091-81-R SMA(f) to N(f), DC to 18 GHz, 50 Ω
	1091-172-R BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
	1091-417-R N(m) to QMA(f), DC to 6 GHz, 50 Ω
	1091-418-R N(m) to QMA(m), DC to 18 GHz, 50 Ω
	71693-R Ruggedized Adapter, K(f) to N(f), DC to 18 GHz, 50 Ω

Accessory	Description
	510-102-R N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle
	510-90-R 7/16 DIN(f) to N(m), DC to 7. 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

Attenuators


Accessory	Description
	1010-128-R 40 dB, 150 W, DC to 3 GHz, N(m) to N(f)
	3-1010-122 20 dB, 5 W, DC to 12.4 GHz, N(m) to N(f)
	3-1010-123 30 dB, 50 W, DC to 8.5 GHz, N(m) to N(f)
	3-1010-124 40 dB, 100 W, DC to 8.5 GHz, N(f) to N(m), Uni-directional

Accessory Description


	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)
	1010-127-R 30 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Phase-Stable Test Port Cables, Armored

(recommended for use with tightly spaced connectors and other general purpose applications)


Accessory	Description
	15NNF50-1.5C 1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
	15NN50-1.5C 1.5 m, DC to 6 GHz, N(m) to N(m), 50 Ω
	15NNF50-3.0C 3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
	15NN50-3.0C 3.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω
	15NNF50-5.0C 5.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
	15NN50-5.0C 5.0 m, DC to 6 GHz, N(m) to N(m), 50 Ω

Accessory Description


	15NDF50-1.5C 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
	15ND50-1.5-C 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

Phase-Stable Test Port Cables, Armored w/Reinforced Grip

(recommended for cable & antenna line sweep applications)

Accessory	Description
	15RDN50-1.5-R 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
	15RDFN50-1.5-R 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
	15RDN50-3.0-R 3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
	15RDFN50-3.0-R 3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω

Accessory Description

	15RNFN50-1.5-R 1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
	15RNFN50-3.0-R 3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω

Manuals (soft copy included at www.anritsu.com)

Part Number	Description
10100-00065	Product Information, Compliance, and Safety
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
10580-00235	3GPP2 Signal Analyzer Measurement Guide
10580-00236	WiMAX Signal Analyzer Measurement Guide
10580-00341	Spectrum Master Programming Manual
10580-00342	Spectrum Master Maintenance Manual
10580-00455	EMF Measurement Guide

Troubleshooting Guides (soft copy at www.anritsu.com)

TD-LTE eNodeB Troubleshooting Guide - Utilizing Anritsu's Handheld ETS Master™ MS2720T/20C/20AC or Spectrum Master™ MS2720C/20C/20AC with Option 011, 000 and 006

Start Here
Use this guide for TD-LTE eNodeB troubleshooting. It provides a step-by-step process for troubleshooting eNodeB and signal quality. This document is intended for use by Anritsu-trained personnel and is not to be distributed outside of your organization.

Troubleshooting Steps
1. Verify the eNodeB is powered on.
2. Verify the eNodeB is connected to the network.
3. Verify the eNodeB is configured correctly.
4. Verify the eNodeB is operating within the specified frequency range.
5. Verify the eNodeB is operating within the specified power range.
6. Verify the eNodeB is operating within the specified coverage area.
7. Verify the eNodeB is operating within the specified signal quality range.

Key Performance Indicators (KPIs)

KPI	Unit	Min	Max	Typical	Notes
RSRP	dBm	-140	-44	-100	Reference Signal Received Power
SINR	dB	-10	20	0	Signal to Interference plus Noise Ratio
RSRQ	dB	-14	-1	-8	Reference Signal Received Quality
CRF	dB	-14	-1	-8	Carrier Frequency Offset
CRB	Hz	0	1000	0	Carrier Frequency Bias
CRF Error	Hz	0	1000	0	Carrier Frequency Offset Error
CRB Error	Hz	0	1000	0	Carrier Frequency Bias Error
CRF Error Rate	%	0	100	0	Carrier Frequency Offset Error Rate
CRB Error Rate	%	0	100	0	Carrier Frequency Bias Error Rate

Checklist of Common Troubleshooting Steps

- Verify the eNodeB is powered on.
- Verify the eNodeB is connected to the network.
- Verify the eNodeB is configured correctly.
- Verify the eNodeB is operating within the specified frequency range.
- Verify the eNodeB is operating within the specified power range.
- Verify the eNodeB is operating within the specified coverage area.
- Verify the eNodeB is operating within the specified signal quality range.

Additional Troubleshooting Checks:
 - Verify the eNodeB is connected to the correct antenna.
 - Verify the eNodeB is connected to the correct power source.
 - Verify the eNodeB is connected to the correct network.
 - Verify the eNodeB is connected to the correct configuration file.
 - Verify the eNodeB is connected to the correct software version.

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

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 and search for training and education.



• United States

Anritsu Americas Sales Company

490 Jarvis Drive, Morgan Hill, CA 95037-2809, U.S.A.
Phone: +1-800-Anritsu (1-800-267-4878)

• Canada

Anritsu Electronics Ltd.

Americas Sales and Support

490 Jarvis Drive, Morgan Hill, CA 95037-2809, U.S.A.
Phone: +1-800-Anritsu (1-800-267-4878)

• Brazil

Anritsu Eletronica Ltda.

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

• Mexico

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

Blvd Miguel de Cervantes Saavedra #169 Piso 1,
Col. Granada, Mexico, Ciudad de Mexico,
11520, MEXICO
Phone: +52-55-4169-7104

• United Kingdom

Anritsu EMEA Limited

900 Capability Green,
Luton, Bedfordshire, LU1 3LU, U.K.
Phone: +44-1582-433200
Fax: +44-1582-731303

• France

Anritsu SA

12 avenue du Québec, Immeuble Goyave,
91140 VILLEBON SUR YVETTE, France
Phone: +33-1-60-92-15-50

• 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.

Spaces Eur Arte, Viale dell'Arte 25, 00144 Roma, Italy
Phone: +39-6-509-9711

• Sweden

Anritsu AB

Kistagången 20 B, 2 tr, 164 40 Kista, Sweden
Phone: +46-8-534-707-00

• Finland

Anritsu AB

Technopolis Aviapolis, Teknobulevardi 3-5 (D208.5.),
FI-01530 Vantaa, Finland
Phone: +358-20-741-8100

• Denmark

Anritsu A/S

c/o Regus Winghouse, Ørestads Boulevard 73, 4th
floor,
2300 Copenhagen S, Denmark
Phone: +45-7211-2200

• Spain

Anritsu EMEA Ltd.

Representation Office in Spain
Calle Manzanares 4, Primera planta, 28005
Madrid, Spain
Phone: +34-91-572-6761

• Austria

Anritsu Pty Ltd

Am Belvedere 10, A-1100 Vienna, Austria
Phone: +43-(0)1-717-28-710

• United Arab Emirates

Anritsu EMEA Ltd.

Anritsu A/S

Office No. 164, Building 17, Dubai Internet City
P. O. Box - 501901, Dubai, United Arab Emirates
Phone: +971-4-3758479

• India

ANRITSU INDIA PRIVATE LIMITED

6th Floor, Indiqube ETA, No.38/4, Adjacent to EMC2,
Doddanekundi, Outer Ring Road,
Bengaluru - 560048, India
Phone: +91-80-6728-1300
Fax: +91-80-6728-1301

• Singapore

ANRITSU PTE LTD

1 Jalan Kilang Timor, #07-04/06 Pacific Tech Centre
Singapore 159303
Phone: +65-6282-2400
Fax: +65-6282-2533

• Vietnam

ANRITSU COMPANY LIMITED

16th Floor, Peakview Tower, 36 Hoang Cau Street,
O Cho Dua Ward, Dong Da District, Hanoi, Vietnam
Phone: +84-24-3201-2730
Fax: +84-24-3201-2740

• P.R. China (Shanghai)

Anritsu (China) Co., Ltd.

Room 2701-2705, Tower A, New Caohejing
International Business Center No. 391 Gui Ping Road
Shanghai, 200233, P.R. China
Phone: +86-21-6237-0898
Fax: +86-21-6237-0899

• P.R. China (Hong Kong)

ANRITSU COMPANY LIMITED

Unit 1302, 13th Floor, New East Ocean Center,
No.9 Science Museum Road, TsimShaTsui East,
Kowloon, Hong Kong
Phone: +852-2301-4980
Fax: +852-2301-3545

• Japan

Anritsu Corporation

8-5, Tamura-cho, Atsugi-shi, Kanagawa, 243-0016
Japan
Phone: +81-46-296-6509
Fax: +81-46-225-8352

• South Korea

Anritsu Corporation, Limited

8F, A TOWER, 20, Gwacheondaero 7-gil, Gwacheon-si,
Gyeonggi-do, 13840, Republic of Korea
Phone: +82-2-6259-7300
Fax: +82-2-6259-7301

• 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

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