Technical Data Sheet

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 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.

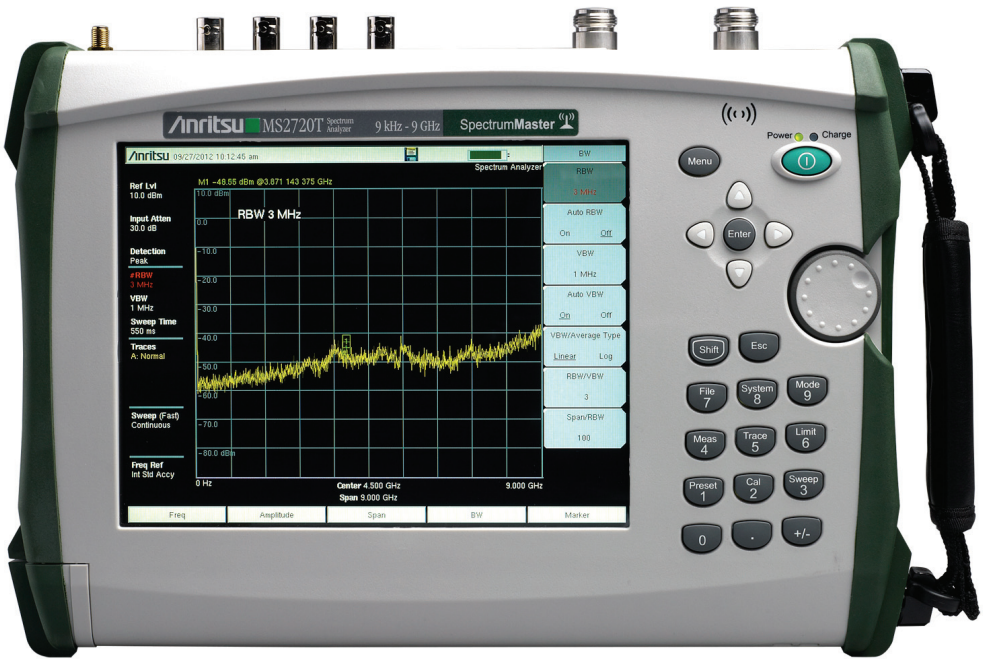
Spectrum and Interference Analyzer Highlights

- 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: –163 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: included at no charge
- 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 ºC: full performance on AC or battery

Capabilities and Functional Highlights

Wireless Measurements

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



Spectrum Master™ MS2720T Spectrum Analyzer

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

Spectrum Analyzer

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

Measurements

Smart Measurements	Field Strength (dBm/m^2, dBW/m^2, V/m, A/m, Watt/m^2, Watt/cm^2, or dBmV/m) Occupied Bandwidth (measures 99 % to 1 % power channel of a signal) Channel Power (measures the total power in a specified bandwidth) ACPR (adjacent channel power ratio) AM/FM/SSB Demodulation (AM, wide/narrow FM, upper/lower SSB), (audio out only) C/I (carrier-to-interference ratio) Emission Mask (recall limit lines as emission mask)

Setup Parameters

Frequency	Center/Start/Stop, Span, Frequency Step, Frequency Offset, Signal Standard, Channel #
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
Bandwidth	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/RBW Ratio

Sweep Functions

Sweep	Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type
Sweep Mode	Fast (100x Performance), Performance, No FFT, Burst Detect (1000x Fast in 15 MHz span)
Detection	Peak, RMS/Avg, Negative, Sample, Quasi-peak
Triggers	Free Run, External, Video, Manual, IF Power
Trigger Position	Delay, Level, Slope, Hysteresis, Holdoff, Force Trigger Once

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

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 (41), Offset, Shape Square/Slope
Limit Line Advanced	Type (Absolute/Relative), Mirror, Save/Recall

Frequency

Frequency Range	(usable to 0 Hz)
MS2720T-0709	9 kHz to 9 GHz
MS2720T-0713	9 kHz to 13 GHz
MS2720T-0720	9 kHz to 20 GHz
MS2720T-0732	9 kHz to 32 GHz
MS2720T-0743	9 kHz to 43 GHz
Tuning Resolution	1 Hz
Frequency Reference	Aging: ± 1.0 x 10^{-6} per 10 years Accuracy: ± 0.3 x 10^{-6} (25 °C ± 25 °C) plus aging (see Options 1 and 31 for improved frequency reference aging and accuracy)
Auto-sensing External Frequency Reference (MHz)	1, 1.2288, 1.544, 2.048, 2.4576, 4.8, 4.9152, 5, 9.8304, 10, 13, 19.6608
Sweep Time	10 µs to 600 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 at 1 GHz

Offset	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

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	–120 dBm to +30 dBm
Attenuator Resolution	0 to 65 dB, 5.0 dB steps
Amplitude Units	Log Scale Modes: dBm, dBV, dBmV, dBµV Linear Scale Modes: nV, µV, mV, V, kV, nW, µW, mW, W, kW
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)

Amplitude Accuracy

	20 °C to 30 °C (after 30 minute warm-up)		–10 °C to 55 °C (after 60 minute warm-up)	
9 GHz Instrument	Maximum	Typical	Maximum	Typical
9 kHz to 100 kHz[a]	–	± 1.0 dB	–	± 1.0 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
20 GHz Instruments				
100 kHz to 13 GHz	± 1.3 dB	± 0.5 dB	± 2.3 dB	± 05 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
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, Performance Sweep Mode)

	Preamp = Off		Preamp = On	
9 GHz Instrument	Maximum	Typical	Maximum	Typical
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	–	–142 dBm	–	–155 dBm
13 to 43 GHz Instruments				
10 MHz to 4 GHz	–145 dBm	–148 dBm	–161 dBm	–164 dBm
> 4 GHz to 9 GHz	–142 dBm	–145 dBm	–159 dBm	–162 dBm
> 9 GHz to 13 GHz	–136 dBm	–139 dBm	–156 dBm	–159 dBm
20 GHz Instrument				
> 13 GHz to 20 GHz	–138 dBm	–141 dBm	–157 dBm	–160 dBm
32 to 43 GHz Instruments				
> 13 GHz to 32 GHz	–135 dBm	–138 dBm	–154 dBm	–157 dBm
> 32 GHz to 40 GHz	–127 dBm	–130 dBm	–148 dBm	–151 dBm
> 40 GHz to 43 GHz	–	–130 dBm	–	–151 dBm

Spurs

(RF input terminated, 0 dB input attenuation)

Residual Spurs	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	–60 dBc, –70 dBc typical (0 dB attenuation, –30 dBm input, span < 1.7 GHz)	

Spectrum Analyzer (continued)

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

2.4 GHz	+14 dBm minimum
50 MHz to 20 GHz	+20 dBm typical
> 20 GHz to 32 GHz	+15 dBm typical
> 32 GHz to 43 GHz	+20 dBm typical

P1dB

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

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

50 MHz	–54 dBc maximum

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 43 GHz Instruments	
< 20 GHz	1.5:1 typical
20 GHz to 43 GHz	2.0:1 typical

Internal Atomic Clock (Option 1)

Frequency Accuracy	1 x 10^{-9} + aging
Aging Rate	1 x 10^{-9} per year
Initial Warmup	10 minutes to meet the accuracy specification

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

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

Power Sensor Model	PSN50	MA24105A	MA24106A	MA24108A/18A/26A
Description	High Accuracy RF Power Sensor	Inline High Power Sensor	High Accuracy RF Power Sensor	Microwave USB Power Sensor
Frequency Range	50 MHz to 6 GHz	350 MHz to 4 GHz	50 MHz to 6 GHz	10 MHz to 8/18/26 GHz
Connector	Type N(m), 50 Ω	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)
Dynamic Range	–30 dBm to +20 dBm (0.001 mW to 100 mW)	+3 dBm to +51.76 dBm (2 mW to 150 W)	–40 dBm to +23 dBm (0.1 µW to 200 mW)	–40 dBm to +20 dBm (0.1 µW to 100 mW)
VBW	100 Hz	100 Hz	100 Hz	50 kHz
Measurand	True-RMS	True-RMS	True-RMS	True-RMS, Slot Power, Burst Average Power
Measurement Uncertainty	± 0.16 dB[1]	± 0.17 dB[2]	± 0.16 dB[1]	± 0.18 dB[3]
Data sheet (for complete specifications)	11410-00414	11410-00621	11410-00424	11410-00504

Notes:

1. Total RSS measurement uncertainty (0 ºC to 50 ºC) for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.
2. Expanded uncertainty with K=2 for power measurements of a CW signal greater than +20 dBm with a matched load. Measurement results referenced to the input side of the sensor.
3. Expanded uncertainty with K=2 for power measurements of a CW signal greater than –20 dBm with zero mismatch errors.

Tracking Generator (Options 809, 813, and 820)

Setup Parameters

Frequency	Center/Start/Stop, Span, Signal Standard, Channel #, Frequency Step/Offset, Channel Offset
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
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^{-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 72 hours
Signal ID	ID up to 12 FM, GSM, W-CDMA, CDMA or Wi-Fi signals based on RF bandwidth
Interference Mapping	Draw bearing of signal strength from GPS location on on-screen map
Application Options	Impedance (50 Ω, 75 Ω, Other)
	Compatible with the MA2700A InterferenceHunter™ Handheld Direction Finding System

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	Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan
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
Application Options	Impedance (50 Ω, 75 Ω, Other)

Coverage Mapping (Option 431)

Measurements

Indoor Mapping	RSSI, ACPR
Outdoor Mapping	RSSI, ACPR

Setup Parameters

Mode	Spectrum Analyzer
Frequency	Center/Start/Stop, Span, Freq Step, Signal Standard, Channel #, Channel Increment
Amplitude	Reference Level (RL), Scale, Attenuation Auto/Level, RL Offset, Pre-Amp On/Off, Detection
Span	Span, Span Up/Down (1-2-5), Full Span, Zero Span, Last Span
BW	RBW, Auto RBW, VBW, Auto VBW, RBW/VBW Ratio, Span/VBW Ratio
Measurement Setup	ACPR, RSSI
Point Distance / Time Setup	Repeat Type Time Distance
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

GPS Receiver (Option 31)

Setup	On/Off, Antenna Voltage 3.3 V/5.0 V, GPS Info
	Note: Anritsu 2000-1528-R GPS antenna requires +5 VDC Anritsu 2000-1652-R GPS antenna requires +3.3 VDC or +5 VDC
GPS Time/Location Indicator	Time, Latitude, Longitude, and Altitude on display
	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	Full display range of instrument
Setup	Gated Sweep (On/Off)
	Gate Polarity (Rising, Falling)
	Gate Delay (0 ms to 65 ms typical)
	Gate Length (1 µs to 65 ms typical)
	Zero Span Time

Zero Span IF Output (Option 89)

Mode	Spectrum Analyzer/Span/Zero Span
Center Frequency	140 MHz
Output Level	–25 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)
RF Attenuation	Auto
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

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 Bandwidth	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*M Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD* THD* Distortion/Total Vrms*	RMS Depth (AM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*	RMS Deviation (FM/PM) Peak + Depth Peak – Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD* THD* Distortion/Total Vrms*

* Requires sine wave modulation

Setup Parameters

Frequency	Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq
Amplitude Setup	Scale, Power Offset, Adjust Range
Measurements	Demod Type (AM, FM, PM), IFBW, Auto IFBW RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average
Marker	Delta, 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 µs 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) RF Summary	Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error BSIC (NCC, BCC) Modulation Summary	There are no additional OTA Measurements RF and Demodulation Measurements can be made OTA	View Pass/Fail Limits All, RF, Demod 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 Shot (save only), to Internal/External Memory
Measurement Summary Screen	Overall Measurements, RF Measurements, Modulation 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 º
Residual Error (GSMK)	1 º
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_o 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), (-CIPCH) 5 (2 HS), (4 HS), (8 HS)

Setup Parameters

Scrambling Code, Threshold	Auto, Manual
User Selectable	Scrambling Code, S-CCPCH Spread, S-CCPCH Code, PICH Code, Threshold, Max Amp Power, CPICH Power, Frequency Error Average
Maximum Spreading Factor	256, 512
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Marker	Six Markers, Table On/Off
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, 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 % ≤ EVM ≤ 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+ Measurements (Option 882)

Measurements

RF	Demodulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Left Channel Power Left Channel Occ B/W Right Channel Power Right Channel Occ B/W Power vs. Time Six Slot Powers Channel Power (RRC) DL-UL Delta Power UpPTS Power DwPTS Power On/Off Ratio Slot Peak-to-Average Power Spectral Emission RF Summary	Code Domain Power/Error (QPSK/8 PSK/16 QAM/64 QAM) Slot Power DwPTS Power Noise Floor Frequency Error Tau Scrambling Code EVM Peak EVM Peak Code Domain Error CDP Marker Modulation Summary	Code Scan (32) Scrambling Code Group Tau E_C/I_O DwPTS Power Pilot Dominance Tau Scan (Six) Sync-DL# Tau E_C/I_O DwPTS Power Pilot Dominance Record Run/Hold	View Pass/Fail Limits All, RF, Demod Available Measurements Occupied Bandwidth Channel Power Channel Power RCC On/Off Ratio Peak-to-Average Ratio Frequency Error EVM Peak EVM Peak Code Domain Error Tau Noise Floor

Setup Parameters

Slot Selection	Auto, 0-6
Trigger	Trigger Type (No Trigger/GPS/External), External Trigger (Rising/Falling), Tau Offset
SYNC-DL Code	Auto, 0-31
Scrambling/Midamble Code	Auto, 0-127
Maximum Users	Auto, 2, 4, 6, 8, 10, 12, 14, 16
Measurement Speed	Fast, Normal, Slow
User Selectable	Uplink Switch Point, Number of Carriers (1, 3), Tau Offset
Demodulation Type	Auto, QPSK, 8 PSK, 16 QAM, 64 QAM
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Hold/Run, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality 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 FDD/TDD Measurements (Option 883)

LTE FDD Measurements

RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth ACPR 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, EVM 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 Total Power (Table View) Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID

Setup Parameters

Frequency	E-UTRA Bands 1 - 5, 7 - 14, 17 - 21, 24 (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
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

LTE FDD RF Measurements

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

LTE 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 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)

LTE FDD/TDD Measurements (Option 883) (continued)

LTE TDD Measurements

RF	Modulation	Over-the-Air (OTA)	Pass/Fail
Channel Spectrum Channel Power Occupied Bandwidth Power vs. Time Frame View Sub-Frame View Total Frame Power DwPTS Power Transmit Off Power Cell ID Timing Error 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 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 Total Power (Table View) Modulation Results Antenna Icons Detects active antennas (1 or 2) Modulation Summary	Scanner Cell ID (Group, Sector) S-SS, RSRP, RSRQ, SINR Dominance Modulation Results – On/Off Tx Test Scanner RS Power of MIMO antennas Cell ID, Average Power Delta Power (Max-Min) Graph of Antenna Power Modulation Results – On/Off Mapping On-screen S-SS, RSRP, RSRQ, or SINR Scanner Modulation Results – Off	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth ACLR Frequency Error Carrier Frequency Dominance EVM peak, rms RS Power SS, P-SS, S-SS Power PBCH Power PCFICH Power Cell, Group, Sector ID Frame Power DWPTS Power Transmit Off Power Timing Error

Setup Parameters

Frequency	E-UTRA bands 33 - 43 (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
Trigger	No Trigger/Ext Trigger, Rising/Falling
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Modulation Measurements

LTE TDD RF Measurements

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

LTE 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)

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)

CDMA/EV-DO Measurements (Option 884)

CDMA Measurements

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

CDMA Setup Parameters

PN Setup	PN Trigger (No Trigger, GPS, External), PN Search Type (Auto, Manual), PN Offset
Walsh Codes	64, 128
Measurement Speed	Fast, Normal, Slow
External Trigger Polarity	Rising, Falling
Number of Carriers	1 to 5
Carrier Bandwidth (MHz)	1.23, 1.24, 1.25
Frequency	Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel
Amplitude	Scale/Division, Power Offset, Auto Range, Adjust Range, Units (dBm/Watts)
Sweep	Single/Continuous, Trigger Sweep
Save/Recall	Setup, Measurement, Screen Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality 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 Power vs. Time Pilot & MAC Power Channel Power Frequency Error Idle Activity On/Off Ratio Spectral Emission Mask Multi-carrier ACPR RF Summary	MAC Code Domain Power Graph Pilot & MAC Power Channel Power Frequency Error Rho Pilot Rho Overall Data Modulation Noise Floor MAC Code Domain Power Table Code Status Power Code Utilization Data Code Domain Power Active Data Power Data Modulation Rho Pilot Rho Overall Maximum Data CDP Minimum Data CDP Modulation Summary	Pilot Scanner (Nine) PN E_c/I_o Tau Pilot Power Channel Power Pilot Dominance Mulitpath Scanner (Six) E_c/I_o Tau Channel Power Multipath Power	View Pass/Fail Limits All, RF, Modulation Available Measurements Channel Power Occupied Bandwidth Peak-to-Average Power Carrier Frequency Frequency Error Spectral Mask Noise Floor Pilot Power RMS Phase Error Tau Code Utilization Measured PN Pilot Dominance Mulitpath 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 Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality 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 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 Shot (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	0.07×10^{-6} plus time base error, 99 % confidence level
Residual EVM (rms)	3 % typical, 3.5 % maximum (RF Input –50 dBm to +20 dBm)

WiMAX[1] Fixed/Mobile Measurements (Option 885) (continued)

WiMAX Mobile Measurements

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

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 Shot (save only), to Internal/External Memory
Measurement Summary Screens	Overall Measurements, RF Measurements, Signal Quality 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	0.02×10^{-6} 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, Blank, Default, Black & White, Night Vision, High Contrast, Invert Black & White)
	Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, User Defined)
	Reset (Factory Defaults, Master Reset, Update Firmware)
	Share Center Frequency and Power (All Modes are Not Shared)
	Power-On (via Power Switch or when DC is Applied)
File	Save As, Save Meas, Save, Save On Event, Recall Meas, Recall, Copy, Delete
Save/Recall	Setups, Measurements, Screen Shots JPEG (save only)
Delete	By File Type, All, Selected
Internal Trace/Setup Memory	> 13,000 traces
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 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, Maximum Input +5 VDC
IF Out	BNC, female, 50 Ω, 140 MHz

Display and Keyboard

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

Battery

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

Electromagnetic Compatibility

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

Safety

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

Warranty

Duration	Standard three-year warranty

Environmental

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

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

Master Software Tools (for your PC)

Database Management

Full Trace Retrieval	Retrieve all traces from instrument into one PC directory
Trace Catalog	Index all traces into one catalog
Trace Rename Utility	Rename measurement traces
Group Edit	Titles, subtitles, plot scaling, markers and limit lines, simultaneously on similar files

Data Analysis

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

Report Generation

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

Mapping (GPS Required)

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

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

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

List/Parameter Editors

Traces	Add, delete, and modify limit lines and markers
Antennas, Cables, Signal Standards	Modify instrument's Antenna, Cable, and Signal Standard List
Pass/Fail	Create, download, or edit Signal Analysis Pass/Fail Limits
Languages	Add one language or modify non-English language menus
Mobile WiMAX	DL-MAP Parameters
Display	Modify display settings

Connectivity

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

Ordering Information – Instrument Options

Part Number	Description
MS2720T	Spectrum Master (Requires Option 709, 713, 720, 732, or 743)
	Freqeuncy Options
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
	Tracking Generator Options
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)
	Spectrum Analyzer Options
MS2720T-0025	Interference Analyzer (Option 31 is recommended)
MS2720T-0027	Channel Scanner
MS2720T-0431	Coverage Mapping (Requires Option 31 for full functionality)
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
	Power Meter Option
MS2720T-0019	High Accuracy Power Meter (Requires USB Power Sensor, sold separately)
	Wireless Measurement Options
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 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)
	General Options
MS2720T-0001	Internal Atomic Clock (Cannot be combined with Options 732, 743, 809, 813, 820, or 884)
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
MS2720T-0098	Standard Calibration (ANSI Z540-1-1994)
MS2720T-0099	Premium Calibration (ANSI Z540-1-1994 plus test data)

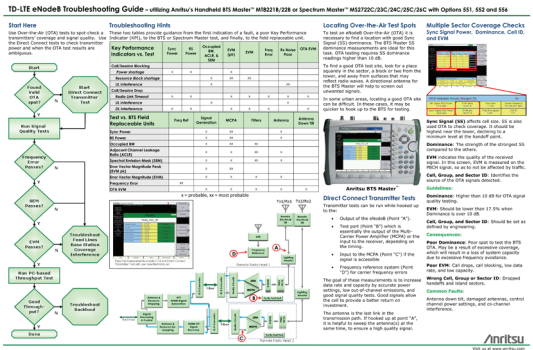
Power Sensors (for complete ordering information see the respective datasheets of each sensor)

Part Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +51.76 dBm
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, +20 dBm

Manuals (soft copy included on Handheld Instruments Documentation Disc and at 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)



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

Standard Accessories (included with instrument)

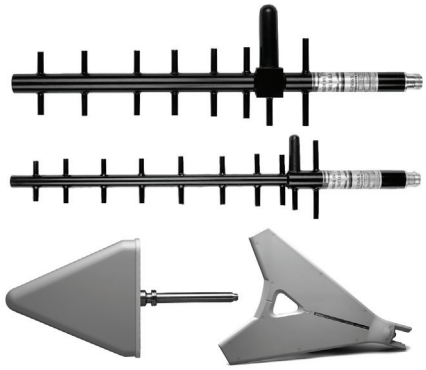
Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
2300-577	Anritsu Software Tool Box for Handheld RF Instruments Disc
2000-1685-R	Soft Carrying Case
2000-1691-R	Stylus with Coiled Tether
633-75	High Capacity Li-Ion Battery
40-187-R	AC/DC Power Supply
806-141-R	Automotive Power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

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

Directional Antennas



Part Number	Description
2000-1659-R	698 MHz to 787 MHz, N(f), 8 dBd, Yagi
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
2000-1660-R	1425 MHz to 1535 MHz, N(f), 12 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
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1726-R	2500 MHz to 2700 MHz, N(f), 12 dBd, Yagi
2000-1677-R	300 MHz to 3000 MHz, SMA(m), 50 ohm, 3 m cable (9.8 ft) 0 to 6 dBi gain @ 950 MHz, Log Periodic
2000-1747-R	300 MHz to 5000 MHz, N(f), Log Periodic
2000-1617	600 MHz to 21 GHz, N(f), 5 to 8 dBi gain to 12 GHz, 0 to 6 dBi gain to 21 GHz, Log Periodic
2000-1748-R	1 GHz to 18 GHz, N(f), Log Periodic
2000-1715-R	698 MHz to 2.5 GHz Bi-blade

Portable Antennas

2000-1200-R	806 MHz to 866 MHz, SMA(m), 50 Ω
2000-1473-R	870 MHz to 960 MHz, SMA(m), 50 Ω
2000-1035-R	896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1030-R	1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1474-R	1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)
2000-1031-R	1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1475-R	1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω
2000-1032-R	2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)
2000-1361-R	2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω
2000-1751-R	698 MHz to 960 MHz, 1710 MHz to 2100 MHz, 2500 MHz to 2700 MHz, SMA(m), 2 dB, typical, 50 Ω
2000-1487	VHF/UHF, Telescopic Whip antenna, straight or 90°, BNC(m), 50 Ω
2000-1636-R	Antenna Kit (Consists of: 2000-1030-R, 2000-1031-R, 2000-1032-R, 2000-1200-R, 2000-1035-R, 2000-1361-R, and carrying pouch)

Mag Mount Broadband Antenna

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

Optional Accessories (continued)

Bandpass Filters

1030-114-R	806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω
1030-105-R	890 MHz to 915 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω
1030-111-R	1850 MHz to 1910 MHz, N(m) to SMA(f), 50 Ω
1030-106-R	1710 MHz to 1790 MHz Band, N(m) to SMA(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz Band, N(m) to SMA(f), 50 Ω
1030-112-R	2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω
1030-155-R	2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω
1030-178-R	1920 MHz to 1980 MHz, N(m) to N(f), 50 Ω
1030-179-R	777 MHz to 787 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

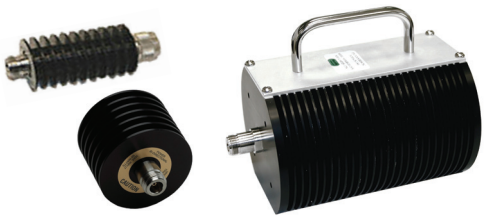
Adapters

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
1091-379-R	7/16 DIN(f) to 7/16 DIN(f), DC to 6 GHz, 50 Ω, w/ Reinforced Grip
71693-R	Ruggedized K(f) to Type N(f)
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

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

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)
3-1010-124	40 dB, 100 W, DC to 8.5 GHz, N(m) to N(f), Uni-directional
1010-121	40 dB, 100 W, DC to 18 GHz, N(m) to N(f), Uni-directional
1010-128-R	40 dB, 150 W, DC to 3 GHz, N(m) to N(f)

Optional Accessories (continued)

Miscellaneous Accessories

Part Number	Description
2000-1374	External Dual Charger for Li-Ion Batteries
633-75	High Capacity Battery Pack, 7500 mAh
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit
2000-1653	Anti-glare Screen Cover (package of 2)
MA2700A	InterferenceHunter™ Handheld Direction Finding System

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

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List Revision Date: 20130905

This Technical Data Sheet applies to Revision 2 of the MS2720T Spectrum Master. Refer to the sticker on the back of the instrument. Instruments not indicating a revision level on the sticker are Revision 1 instruments.

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