

Anritsu envision : ensure

LMR Master™

Land Mobile Radio Modulation and Signal Analyzer,
Vector Network Analyzer, and Spectrum Analyzer

S412E

9 kHz to 1.6 GHz Spectrum Analyzer
500 kHz to 1.6 GHz Vector Network Analyzer



Introduction

The S412E is Anritsu's second generation solution for installing and maintaining public safety systems. Built on Anritsu's ninth generation handheld platform, the S412E combines a high performance receiver/spectrum analyzer with the world's most advanced handheld vector network analyzer plus a powerful vector signal generator with internally adjustable power from 0 dBm to -130 dBm.

Land Mobile Radio Signal Analyzer Highlights

- Analyzes Narrowband FM analog systems
- Analyzes P25 (TIA-102.CAAA-C), P25 Phase 2 (TIA-102.CCAA), DMR (MOTOTRBO™)^a, NXDN™, dPMR, ITC-R PTC, and TETRA digital systems
- 100 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Internal signal generator: 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm)
- 2.0 dB signal generator accuracy (typical)
- P25/P25p2, NXDN, and ETSI DMR BER test patterns including 1011, 1031, and V.52/O.153
- Duplex test: Simultaneous analysis and generation of analog or digital LMR signals
- Independent control of both receive/transmit frequencies and test patterns
- TETRA Base Station Receiver Sensitivity Measurements

a. Supports those features compliant with the ETSI DMR standard.

Spectrum Analyzer Highlights

- Measurements: Occupied Bandwidth, Channel Power, ACPR, C/I, Coverage Mapping
- Interference Analyzer: Spectrogram, Signal Strength, RSSI, Mapping
- 9 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Dynamic Range: > 95 dB in 10 Hz RBW
- DANL: -152 dBm in 10 Hz RBW
- Phase Noise: -100 dBc/Hz max @ 10 kHz offset at 1 GHz
- Frequency Accuracy: 120 ppb standard (25 °C ± 25 °C); < 50 ppb after 3 minutes with GPS lock

VNA Analyzer Highlights

- 1-path, 2-port Vector Network Analyzer (VNA) w/ quad trace display
- 500 kHz to 1.6 GHz frequency coverage (Optional extension to 6 GHz)
- Intuitive Graphical User Interface (GUI) with convenient touchscreen
- VNA-quality error correction for directivity and source match
- Outstanding calibration stability, up to 16 hours
- Arbitrary data points up to 4001
- IF Bandwidth selections of 10 Hz to 100 kHz
- 100 dB transmission dynamic range
- 850 μs/data point sweep speed

Signal Generator Highlights

- 500 kHz to 1.6 GHz CW/FM/AM Modulation
- FM, 100 Hz to 10 kHz rate, adjustable deviation
- AM, 100 Hz to 10 kHz rate, adjustable depth
- 0.1 dB resolution, 0 dBm to -130 dBm
- CW, FM with CTCSS/DCS/DTMF, FM with CTCSS/DCS/DTMF + Tone Modulation, FM + Tone Modulation

Capabilities and Functional Highlights

- Analog FM and digital LMR analyzer
- High accuracy internal power meter
- On-screen LMR Coverage Mapping (Outdoor and Indoor)
- GPS tagging of saved traces
- USB data transfer
- Complies with MIL-PRF-28800F Class 2 and MIL-STD-810G
- Certified for use in Explosive Atmosphere per MIL-PRF-28800F 8.4 inch daylight-viewable TFT LCD color resistive touchscreen – allows use while wearing gloves
- Touchscreen keyboard
- USB and Ethernet data transfer
- Web Remote Control
- Master Software Tools™
- 3 hour battery operation time



LMR Master™ S412E featuring 8.4 inch Daylight Viewable Touchscreen
Compact Size: 273 mm x 199 mm x 91 mm, (10.7 in x 7.8 in x 3.6 in),
Lightweight: 3.6 kg, (7.9 lb)

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Definitions

All specifications and characteristics apply to Revision 4 instruments under the following conditions, unless otherwise noted:

| | |
|---------------------|--|
| Warm-Up Time | After 15 minutes of warm-up time in VNA mode, where the instrument is left in the ON state. |
| Temperature Range | Over the 23 °C ± 5 °C temperature range, unless otherwise noted. |
| Reference Signal | When using internal reference signal. |
| Typical Performance | Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of characteristic performance. Typical specifications in parenthesis () represent the mean value of measured units and do not include any guard-bands or uncertainties. They are not warranted. |
| Uncertainty | A coverage factor of x1 is applied to the measurement uncertainties to facilitate comparison with other industry handheld analyzers. |
| Calibration Cycle | Calibration is within the recommended 12 month period (residual specifications also require calibration kit calibration cycle adherence.) |

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 (uses antenna calibration tables to measure dBm/m 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 Audio Demodulation (Wide/Narrow FM, AM, Upper/Lower SSB) C/I (carrier-to-interference ratio) Emission Mask Coverage Mapping (requires option 431) |
|--------------------|---|

Setup Parameters

| | |
|----------------------|---|
| Frequency | Center/Start/Stop, Span, Frequency 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 |
| Bandwidth | RBW, Auto RBW, VBW, Auto VBW, RBW/VBW, Span/RBW |
| File | Save, Recall, Delete, Directory Management |
| Save/Recall | Setups, Measurements, Limit Lines, Screen Shots Jpeg (save only), Save-on-Event |
| Save-on-Event | Crossing Limit Line, Sweep Complete, Save-then-Stop, Clear All |
| Delete | Selected File, All Measurements, All Mode Files, All Content |
| Directory Management | Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB |
| Application Options | Bias-Tee On/Off, Impedance (50 Ω, 75 Ω, Other) |

Sweep Functions

| | |
|-----------|---|
| Sweep | Single/Continuous, Manual Trigger, Reset, Detection, Minimum Sweep Time, Trigger Type |
| Detection | Peak, RMS, Negative, Sample, Quasi-peak |
| Triggers | Free Run, External, Video, Change Position, Manual |

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

Frequency

| | |
|------------------------------|---|
| Frequency Range | 9 kHz to 1.6 GHz, (6 GHz with Option 6) |
| Tuning Resolution | 1 Hz |
| Frequency Reference Aging | ± 1.0 ppm/year |
| Frequency Reference Accuracy | ± 120 ppb (25 °C ± 25 °C) + aging, < 50 ppb + aging with GPS lock |
| Frequency Span | 10 Hz to 1.6 GHz including zero span (10 Hz to 6 GHz with Option 6) |
| Sweep Time | 100 ms min, 7 μs to 3600 seconds in zero span |
| Sweep Time Accuracy | ± 2% in zero span |

Bandwidth

| | |
|-------------------------------|---|
| Resolution Bandwidth (RBW) | 10 Hz to 3 MHz in 1-3 sequence ± 10% (1 MHz max in zero-span) (-3 dB bandwidth) |
| Video Bandwidth (VBW) | 1 Hz to 3 MHz in 1-3 sequence (-3 dB bandwidth) (auto or manually selectable) |
| 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 |



Spectrum Analyzer (Continued)

Spectral Purity

SSB Phase Noise @ 1 GHz -100 dBc/Hz, -110 dBc/Hz typical @ 10 kHz offset
 -105 dBc/Hz, -112 dBc/Hz typical @ 100 kHz offset
 -115 dBc/Hz, -121 dBc/Hz typical @ 1 MHz offset

Amplitude Ranges

Dynamic Range > 95 dB (2.4 GHz), 2/3 (TOI-DANL) in 10 Hz RBW
 Measurement Range DANL to +26 dBm (≥ 50 MHz)
 DANL to 0 dBm (< 50 MHz)
 RF In Port Damage Level +33 dBm peak, ± 50 VDC, Maximum Continuous Input (≥ 10 dB attenuation)
 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 55 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

Amplitude Accuracy

(Single sine wave, input power < Ref level and > DANL, Attenuation: Auto, Ambient: -10 °C to 50 °C after 30 minute warm-up)

9 kHz to 100 kHz ± 2.0 dB typical (Preamp Off)
 > 100 kHz to 4.0 GHz ± 1.25 dB, ± 0.5 dB typical
 > 4.0 GHz to 6 GHz ± 1.50 dB, ± 0.5 dB typical

Displayed Average Noise Level (DANL)

| | Preamp Off (Reference Level -20 dBm) | | Preamp On (Reference Level -50 dBm) | |
|---------------------------------|---|----------|--|----------|
| | Maximum | Typical | Maximum | Typical |
| (RBW = 1 Hz, 0 dB attenuation) | | | | |
| 10 MHz to 2.4 GHz | -141 dBm | -146 dBm | -157 dBm | -162 dBm |
| > 2.4 GHz to 4 GHz | -137 dBm | -141 dBm | -154 dBm | -159 dBm |
| > 4 GHz to 5 GHz | -134 dBm | -138 dBm | -150 dBm | -155 dBm |
| > 5 GHz to 6 GHz | -126 dBm | -131 dBm | -143 dBm | -150 dBm |
| (RBW = 10 Hz, 0 dB attenuation) | | | | |
| 10 MHz to 2.4 GHz | -131 dBm | -136 dBm | -147 dBm | -152 dBm |
| > 2.4 GHz to 4 GHz | -127 dBm | -131 dBm | -144 dBm | -149 dBm |
| > 4 GHz to 5 GHz | -124 dBm | -128 dBm | -140 dBm | -145 dBm |
| > 5 GHz to 6 GHz | -116 dBm | -121 dBm | -133 dBm | -140 dBm |

Spurs

Residual Spurious < -90 dBm (RF input terminated, 0 dB input attenuation, > 10 MHz)
 Input-Related Spurious < -75 dBc (0 dB attenuation, -30 dBm input, span < 1.7 GHz, carrier offset > 4.5 MHz)
 Exceptions, typical < -70 dBc @ < 2.5 GHz with 2072.5 MHz Input
 < -68 dBc @ F1 - 280 MHz with F1 Input
 < -70 dBc @ F1 + 190.5 MHz with F1 Input
 < -52 dBc @ 7349 - 2F2 MHz with F2 Input, where F2 < 2437.5 MHz
 < -55 dBc @ 190.5 ± F1/2 MHz, F1 < 1 GHz

Third-Order Intercept (TOI) (Preamp Off, -20 dBm tones, 100 kHz apart, 10 dB attenuation)

800 MHz +16 dBm
 2400 MHz +20 dBm
 200 MHz to 2200 MHz +25 dBm typical
 > 2.2 GHz to 5.0 GHz +28 dBm typical
 > 5.0 GHz to 6.0 GHz +33 dBm typical

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

50 MHz -56 dBc
 > 50 MHz to 200 MHz -60 dBc typical
 > 200 MHz to 3000 MHz -70 dBc typical

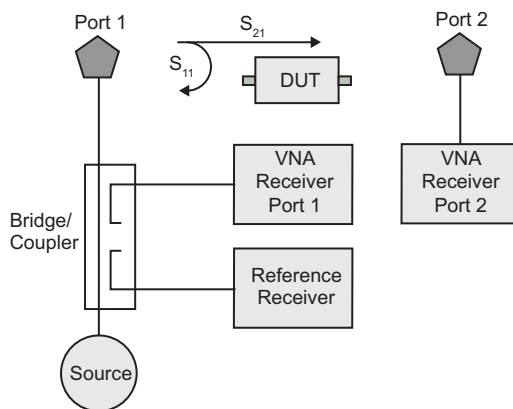
VSWR

2:1 typical

Vector Network Analyzer

Block Diagram

As shown in the following simplified block diagram, the LMR Master has a 2-port, 1-path architecture that automatically measures two S-parameters with error-correction precision inherent to VNA operation. The magnitude and phase information gained from vector network data enables the LMR Master to make significant error corrections and provide improved field measurements.



Frequency

| | |
|----------------------|--|
| Frequency Range | 500 kHz to 1.6 GHz (500 kHz to 6.0 GHz with Option 16) |
| Frequency Accuracy | 2.5 ppm |
| Frequency Resolution | 1 Hz |

Test Port Power (Typical)

LMR Master supports selection of High, Default, or Low test port power. Changing power after calibration can degrade the calibrated performance. Typical test port power by bands is shown in the following table.

| Frequency Range | High Port Power | Default Port Power | Low Port Power |
|--------------------|-----------------|--------------------|----------------|
| 500 kHz to ≤ 3 GHz | +3 dBm | -5 dBm | -25 dBm |
| 3 GHz to ≤ 6 GHz | 0 dBm | -5 dBm | -25 dBm |

Transmission Dynamic Range

The transmission dynamic range (the difference between test port power and noise floor) using 10 Hz IF Bandwidth and High Port Power:

| | |
|------------------|--------|
| 2 MHz to ≤ 4 GHz | 100 dB |
| 4 GHz to ≤ 6 GHz | 90 dB |

Sweep Speed (Typical)

The two-receiver architecture will simultaneously collect S_{21} and S_{11} in a single sweep. The typical sweep speed for IF Bandwidth of 100 Hz, 1001 data points, and single display is:

| | |
|---------------------|------------------|
| Frequency Range | 500 kHz to 6 GHz |
| Typical Sweep Speed | 850 μs / point |

Noise Floor (Typical)

| Frequency Range | Typical Noise Floor |
|------------------|---------------------|
| 500 kHz to 3 GHz | -100 dBm |
| 3 GHz to 4 GHz | -103 dBm |
| 4 GHz to 6 GHz | -93 dBm |

Temperature Stability (S_{11} or S_{21} , Short, 23 °C ± 5 °C)

| Frequency Range | Magnitude (Typical) | Phase (Typical) |
|------------------|---------------------|-----------------|
| 500 kHz to 6 GHz | 0.020 dB/°C | 0.200 deg/°C |

Interference Immunity

| | |
|--------------|--|
| On-Channel | +17 dBm at > 1.0 MHz from carrier frequency |
| On-Frequency | 0 dBm within ± 10 kHz of the carrier frequency |

 **Vector Network Analyzer** (Continued)

Measurements

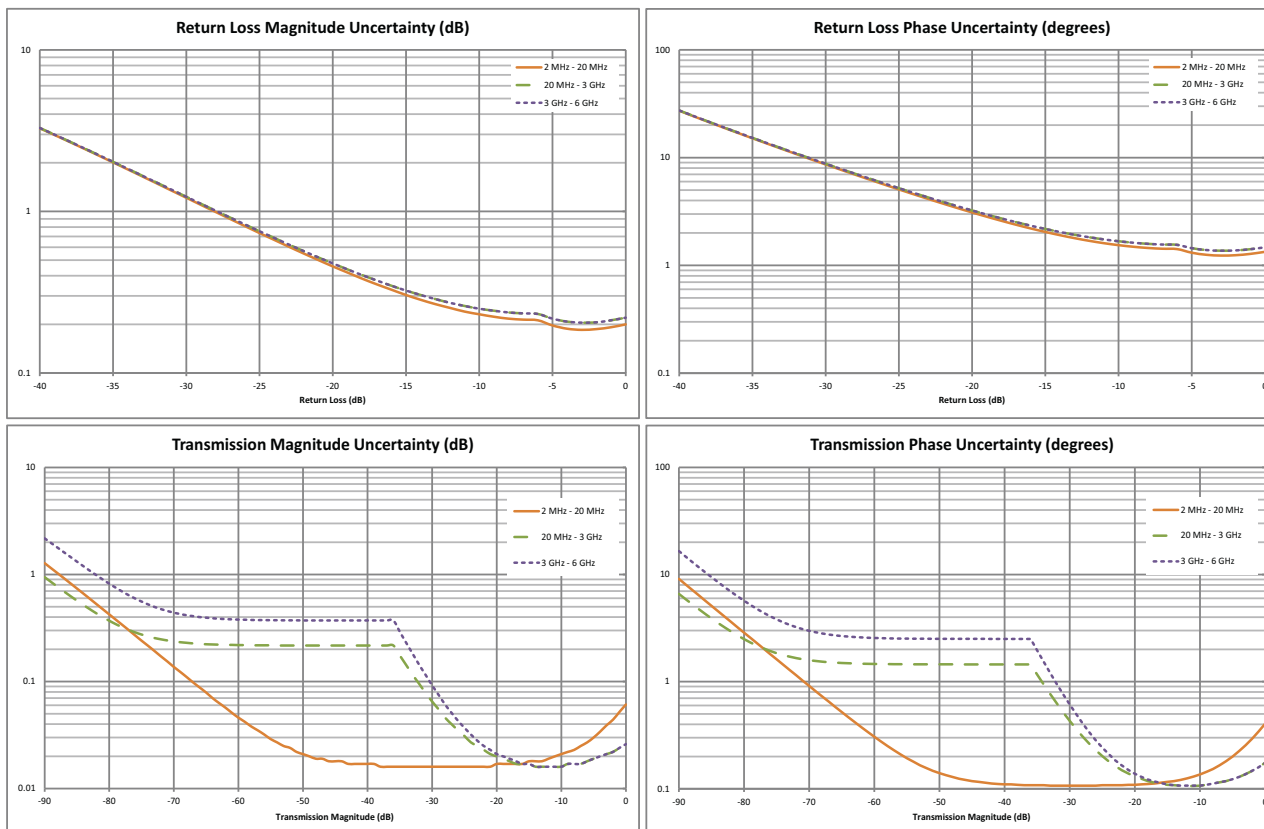
| | |
|-------------------------------------|---|
| Measurement Parameters | S_{11}, S_{21} |
| Number of Traces | Four: TR1, TR2, TR3, TR4 |
| Trace Format | Single, Dual, Tri, Quad. When used with Number of Traces, overlays are possible including a Single Format with Four trace overlays. |
| Graph Types | Log Magnitude, SWR, Phase, Real, Imaginary, Group Delay, Smith Chart, Log Mag/2 (1-Port Cable Loss), Linear Polar, Log Polar, Real Impedance, Imaginary Impedance |
| Domains | Frequency Domain, Distance Domain |
| Frequency | Start Frequency, Stop Frequency, Center Frequency, Span |
| Distance | Start Distance, Stop Distance |
| Frequency Sweep Type: Linear | Single Sweep, Continuous |
| Data Points | 2 to 4001 (arbitrary setting); data points can be reduced without recalibration. |
| Limit Lines | Upper, Lower, 10 segmented Upper, 10 segmented Lower |
| Test Limits | Pass/Fail for Upper, Pass/Fail for Lower, Limit Audible Alarm |
| Data Averaging | Sweep-by-sweep |
| Smoothing | 0 to 20 % |
| IF Bandwidth | 10, 20, 50, 100, 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Hz) |
| Reference Plane | The reference planes of a calibration (or other normalization) can be changed by entering a line length. Assumes no loss, flat magnitude, linear phase, and constant impedance. |
| Auto Reference Plane Extension | Instead of manually entering a line length, this feature automatically adjusts phase shift from the current calibration (or other normalization) to compensate for external cables (or test fixtures). Assumes no loss, flat magnitude, linear phase, and constant impedance. |
| Frequency Range | Frequency range of the measurement can be narrowed (reduces number of data points) within the calibration range without recalibration. When Interpolation is On, narrowed frequency range will retain original number of data points. |
| Group Delay Aperture | Defined as the frequency span over which the phase change is computed at a given frequency point. The aperture can be changed without recalibration. The minimum aperture is the frequency range divided by the number of points in calibration and can be increased to 20% of the frequency range. |
| Group Delay Range | < 180° of phase change within the aperture |
| Trace Memory | A separate memory for each trace can be used to store measurement data for later display. The trace data can be saved and recalled. |
| Trace Math | Complex trace math operations of subtraction, addition, multiplication, or division are provided. |
| Number of Markers | 12, arbitrary assignments to any trace |
| Marker Types | Reference, Delta |
| Marker Readout Styles | Log Mag, Cable Loss (Log Mag/2), Log Mag and Phase, Phase, Real and Imaginary, SWR, Impedance, Admittance, Normalized Impedance, Normalized Admittance, Polar Impedance, and Group Delay |
| Marker Search | Peak Search, Valley Search, Find Marker Value |
| Calibration Type | Full S_{11} , 1-Path, 2-Port (S_{11} and S_{21}), Response S_{11} , Response S_{21} |
| Calibration Methods | Short-Open-Load-Through (SOLT) |
| Calibration Standards' Coefficients | Coax: N-Connector, K-Connector, 7/16, TNC, SMA, and four User Defined |
| Cal Correction Toggle | On/Off |
| Interpolation | On/Off (Interpolation may be activated before or after calibration) |
| Impedance Conversion (Smith Chart) | Support for 50 Ω and 75 Ω are provided. |
| Units | Meters, Feet |
| Bias Tee Settings | Internal, Off |
| Timebase Reference | Internal |
| File Storage Types | Measurement, Setup (with CAL), Setup (without CAL), S2P (Real/Imag), S2P (Lin Mag/Phase), S2P (Log Mag/Phase), JPEG |
| Languages | English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, and Portuguese |

Vector Network Analyzer (Continued)

Corrected System Measurement Accuracy¹ — High Port Power, N-Type (OSLN50A-8 or OSLNF50A-8, TOSLN50A-8 or TOSLNF50A-8)

| Frequency Range | Directivity (dB) | Source Match (dB) | Reflection Tracking (dB) | Transmission Tracking (dB) |
|-------------------|------------------|-------------------|--------------------------|----------------------------|
| < 20 MHz | ≥ 42 | ≥ 30 | ± 0.01 | ± 0.01 |
| 20 MHz to < 3 GHz | ≥ 42 | ≥ 30 | ± 0.05 | ± 0.01 |
| 3 GHz to 6 GHz | ≥ 42 | ≥ 30 | ± 0.05 | ± 0.01 |

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)



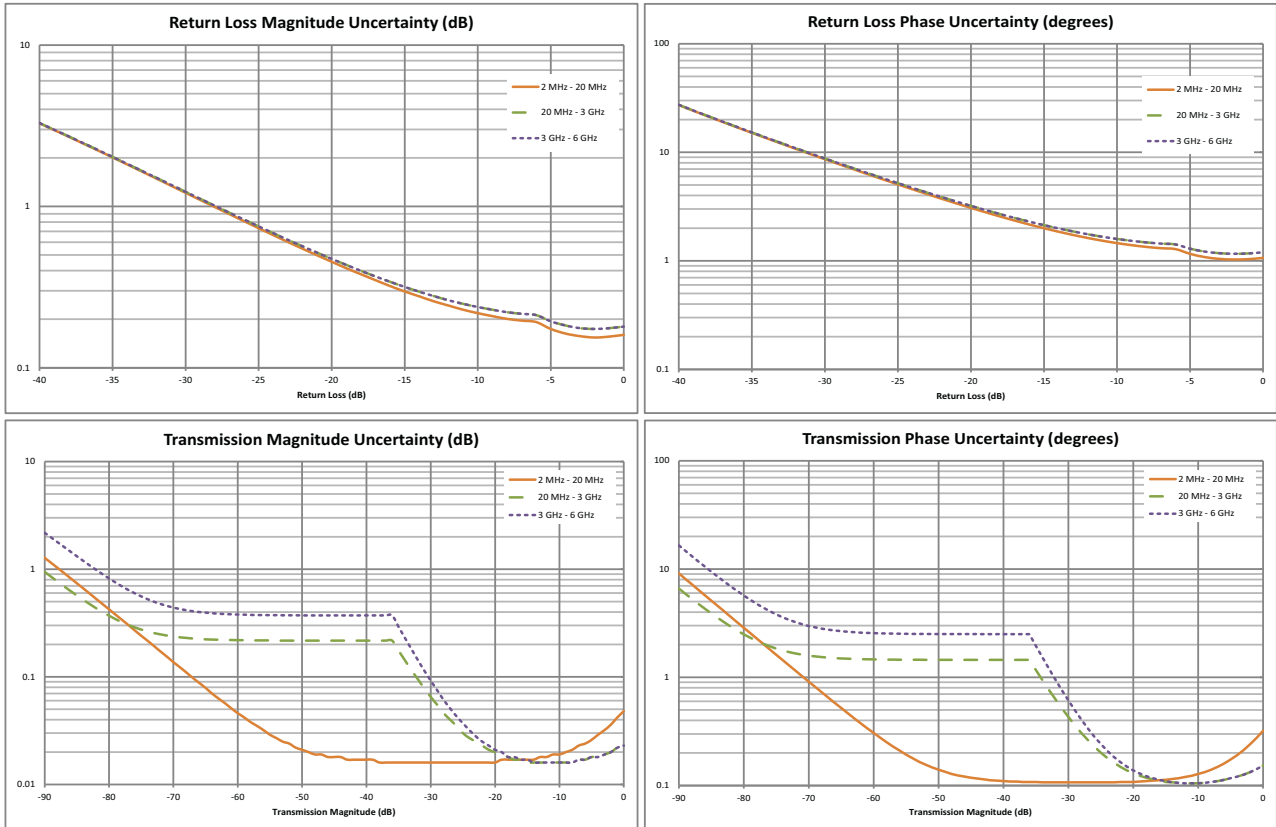
1. Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up. OSLN50A-8, OSLNF50A-8, TOSLN50A-8, or TOSLNF50A-8 calibration kit. Reflection and Transmission Tracking are typical.

 **Vector Network Analyzer** (Continued)

Corrected System Measurement Accuracy¹ — High Port Power, K-Type (OSLK50A-20 or TOSLK50A-20. Compatible with 3.5 mm and SMA connectors)

| Frequency Range | Directivity (dB) | Source Match (dB) | Reflection Tracking (dB) | Transmission Tracking (dB) |
|-------------------|------------------|-------------------|--------------------------|----------------------------|
| < 20 MHz | ≥ 42 | ≥ 33 | ± 0.01 | ± 0.01 |
| 20 MHz to < 3 GHz | ≥ 42 | ≥ 33 | ± 0.05 | ± 0.01 |
| 3 GHz to 6 GHz | ≥ 42 | ≥ 33 | ± 0.05 | ± 0.01 |

Corrected Measurement Uncertainty (Transmission from Port 1 to Port 2)



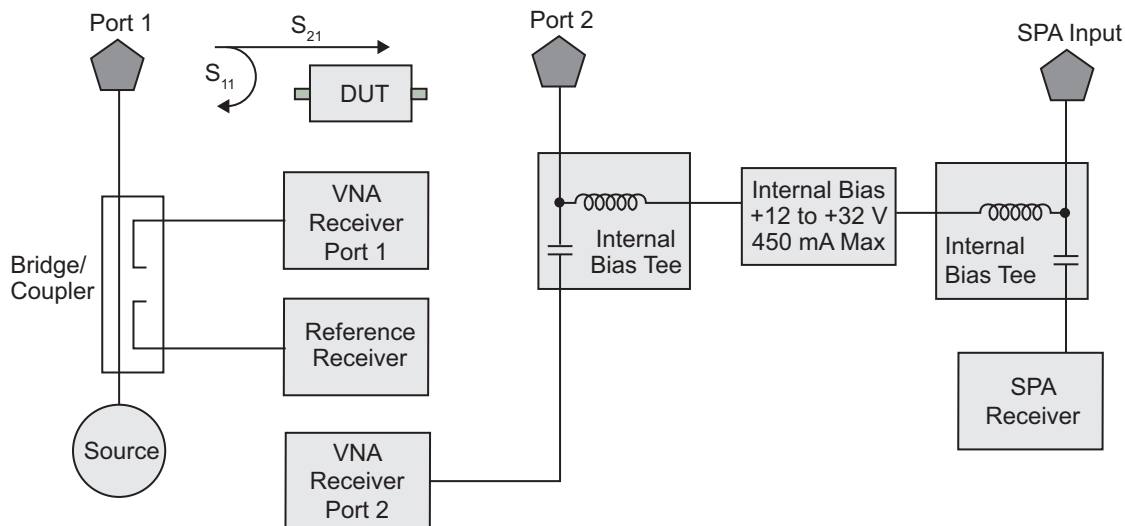
1. Full 1-path, 2-port forward path calibration with isolation, high power, 10 Hz IFBW, no averaging, 10 minute warm-up. TOSLK50A-20, TOSLK50A-20 calibration kit. Reflection and Transmission Tracking are typical.

 **Vector Network Analyzer** (Continued)

Bias Tee (Option 10) For tower mounted amplifier tests, the S412E with optional internal bias tees can supply both DC and RF signals on the center conductor of the cable during measurements. For frequency sweeps in excess of 2 MHz, the LMR Master can supply internal voltage control from +12 to +32 V in 0.1 V steps up to 450 mA. Bias is available on VNA Port 2 and the SPA Input (RF In) for use with antenna pre-amplifiers.

| | |
|--------------------------|---|
| Frequency Range | 2 MHz to 4/6 GHz at VNA Port 2 |
| Internal Voltage/Current | +12 V to +32 V at 450 mA (Steady state) |
| Internal Resolution | 0.1 V |
| Bias Tee Selections | Internal, Off |

The Compact LMR Master offers optional integrated bias tee for supplying DC plus RF to the DUT as shown in this simplified block diagram.



Vector Voltmeter (Option 15)

A phased array system relies on phase matched cables for nominal performance. For this class of application, the LMR Master offers this special software mode to simplify phase matching cables at a single frequency. The similarity between the popular vector voltmeter and this software mode ensures minimal training is required to phase match cables. Operation is as simple as configuring the display for absolute or relative measurements. The easy-to-read large fonts show either reflection or transmission measurements using impedance, magnitude, or VSWR readouts. For instrument landing system (ILS) or VHF Omni-directional Range (VOR) applications, a table view improves operator efficiency when phase matching up to twelve cables. The S412E solution is superior because the signal source is included internally, precluding the need for an external signal generator.

| | |
|---------------------|--|
| CW Frequency Range | 500 kHz to 1.6 GHz (6 GHz with Option 16) |
| Measurement Display | CW, Table (Twelve Entries, Plus Reference) |
| Measurement Types | Return Loss, Insertion |
| Measurement Format | dB/VSWR/Impedance |

Distance Domain

Distance-to-Fault Analysis is a powerful field test tool to analyze cables for faults, including minor discontinuities that may occur due to a loose connection, corrosion, or other aging effects. By using Frequency Domain Reflectometry (FDR), the VNA's DTF mode exploits a user-specified band of full power operational frequencies (instead of DC pulses from TDR approaches) to more precisely identify discontinuities. The VNA converts S-parameters from frequency domain into distance domain on the horizontal display axis, using a mathematical computation called Inverse Fourier Transform. Connect a reflection at the opposite end of the cable and the discontinuities appear versus distance to reveal any potential maintenance issues. When access to both ends of the cable is convenient, a similar distance domain analysis is available on transmission measurements.

Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity). More importantly, you will know precisely where to go to fix the problem and minimize or prevent downtime of the system.

| | |
|--|----------------------|
| Maximum Distance (4001 data points, 1.6 GHz span) | 374.9 m (1,229.9 ft) |
| Maximum Distance (4001 data points, 6.0 GHz span) | 99.9 m (327.75 ft) |
| Minimum Distance Resolution (1.6 GHz span) | 18.7 cm (7.36 in) |
| Minimum Distance Resolution (6.0 GHz span) | 4.99 cm (1.97 in) |
| Measurement Display | Return Loss, VSWR |
| Measurement Format | dB, VSWR |



Interference Analyzer (Option 25) (GPS Option 31 recommended)

Measurements

| | |
|---|--|
| Spectrum | Field Strength Occupied Bandwidth Channel Power Adjacent Channel Power Ratio (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 one week |
| Signal Strength | Gives visual and aural indication of signal strength |
| Received Signal Strength Indicator (RSSI) | Collect data up to one week |
| Signal ID | Up to 12 signals Center Frequency Bandwidth Signal Type: FM, GSM, W-CDMA, CDMA, Wi-Fi Closest Channel Number Number of Carriers |
| Signal-to-Noise Ratio (SNR) | > 10 dB |
| Interference Mapping | Triangulate location of interference with on-display maps |
| Application Option | Bias-Tee On/Off Impedance (50 Ω, 75 Ω, Other) Compatible with the MA2700A InterferenceHunter™ Handheld Direction Finding System |



Channel Scanner (Option 27)

| | |
|---------------------|--|
| Number of Channels | 1 to 20 Channels |
| Measurements | Graph/Table, Max Hold On/5 sec/Off, Freq/Channel, Current/Max, Single/Dual Color |
| Scanner | Scan Channels, Scan Frequencies, Scan Customer List, Scan Script Master™ |
| Amplitude | Reference Level, Scale |
| Custom Scan | Signal Standard, Channel, # of Channels, Channel Step Size, Custom Scan |
| Frequency Accuracy | ± 10 Hz + Frequency Reference |
| Measurement Range | -110 dBm to +26 dBm |
| Application Options | Bias-Tee On/Off, Impedance (50 Ω, 75 Ω, Other) |

GPS Receiver (Option 31)

(Antenna sold separately)

| | |
|---------------------------------|--|
| Setup | On/Off, Antenna Voltage 3.3/5.0 V, GPS Info |
| GPS Time/Location Indicator | Time, Latitude, Longitude and Altitude on display Time, Latitude, Longitude and Altitude with trace storage |
| GPS-Enhanced Frequency Accuracy | < 50 ppb with GPS On, 3 minutes after satellite is locked in selected mode (Applies to Spectrum Analyzer, Interference Analyzer, LMR Signal Analyzers) |
| Connector | SMA, Female |

Ethernet Connectivity

| | |
|--------------------|---|
| Connector | RJ45 |
| LAN Speed | 10 Mbps |
| Mode | Static, DHCP |
| Static IP settings | IP address Subnet Mask IP Gateway |
| Remote Control | Remote capability provided with Web Remote Control and SCPI programming |
| Data Upload | With Line Sweep Tools through Ethernet connection |

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

| | |
|-----------------|------------|
| Indoor Mapping | RSSI, ACPR |
| Outdoor Mapping | RSSI, ACPR |

Setup Parameters

| | |
|-----------------------------|---|
| 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, Span/VBW |
| 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 |

**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 | P-SS, S-SS, and RS are measured and displayed based on each Cell ID received |
| 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: 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 |
| 2000-1792-R | 30 MHz to 1.6 GHz |
| 2000-1791-R | 700 MHz to 1.6 GHz |

Modes where EMF Measurements Available

| |
|----------------------|
| Spectrum Analyzer |
| LTE OTA (Option 546) |

**CW Signal Generator****Setup Parameters**

| | |
|-----------------|---|
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Tx Pattern | CW, AM w/ 1 kHz, FM w/ 1 kHz |

RF Characteristics

| | |
|----------------------|--|
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| Frequency Accuracy | Same as Spectrum Analyzer |



Internal Power Meter

| | |
|--------------------|--|
| Frequency | Center/Start/Stop, Span, Frequency Step, Signal Standard, Channel #, Full Band |
| Amplitude | Maximum, Minimum, Offset, Relative On/Off, Units, Auto Scale |
| Average | Acquisition Fast/Med/Slow, # of Running Averages |
| Limits | Limit On/Off, Limit Upper/Lower |
| Frequency Range | 10 MHz to 1.6 GHz (Standard), 10 MHz to 6 GHz (Option 6) |
| Span | 1 kHz to 100 MHz |
| Display Range | -140 dBm to +30 dBm, ≤ 40 dB span |
| Measurement Range | -120 dBm to +26 dBm |
| Offset Range | 0 dB to +100 dB |
| VSWR | 2:1 typical |
| Maximum Power | Same as RF In Damage Level |
| Accuracy | Same as Spectrum Analyzer |
| Application Option | Impedance (50 Ω, 75 Ω, Other) |



High Accuracy Power Meter (Option 19) (Requires external USB power sensor, sold separately)

| | | | | | |
|--|--|---------------------------------------|--|---|---|
| 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.



NBFM Analyzer and Coverage Mapping

Measurements

| NBFM Analyzer | NBFM Talk-Out Coverage (requires Option 31 GPS and a suitable GPS antenna) |
|--|---|
| Carrier Power | RSSI |
| Carrier Frequency | THD |
| Frequency Error | SINAD |
| FM Deviation (Peak, Average, RMS) | External SINAD |
| Modulation Rate | |
| SINAD | |
| Quieting | |
| THD | |
| Occupied Bandwidth (% Int Pwr or > dBc method) | |
| Decoded CTCSS/DCS/DTMF | |
| Encoded CTCSS/DCS/DTMF | |

Graphs

| NBFM Analyzer | NBFM Talk-Out Coverage |
|----------------------|---|
| Spectrum | Outdoor measured values are overlaid on a geo-tagged map, or displayed on a value vs. time graph. Captured data is exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |
| Audio Spectrum | |
| Audio Waveform/Scope | |
| Summary Display | |

Setup Parameters

| | |
|---|---|
| Frequency | Receive Frequency, Transmit Frequency, Span, Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | Tone Type (CTCSS, DCS, DTMF) |
| Filters | High Pass (300 Hz, 3 kHz, None) and Low Pass (300 Hz, 3 kHz, 15 kHz, None) De-emphasis On/Off |
| Measurement | NBFM Analyzer, NBFM Coverage, Quieting, SINAD |
| Auto Scan | Detection and frequency lock when RF In > +10 dBm, FM or CW signal |
| Tx Patterns | CW, FM w/ CTCSS/DCS/DTMF, FM w/ CTCSS/DCS/DTMF + Tone Modulation, FM + Tone Modulation |
| NBFM Analyzer | Active Graph, Maximize Active Trace, Graph Type, Audio Span, Audio Sweep Time, Occupied Bandwidth, Frequency Display (Carrier or Error) |
| Graph Type | Spectrum, Audio Spectrum, Audio Waveform/Scope, Summary Display |
| NBFM Coverage (requires Option 31 GPS) | Display Type (Map or Time Graph) USB Memory File Format: .nbfm, .kml, both Log data On/Off |

RF Measurements (temperature range 15 °C to 35 °C)

| | |
|---------------------------------|---|
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| SINAD/Quieting | Audio In port conforms to TIA-603-D for input voltage and impedance |
| Additional Summary Measurements | Deviation Modulation Rate THD Occupied Bandwidth |
| Tone Decode | CTCSS/DCS (standard tones per TIA-603-D), DTMF |

Coverage Measurements

RSSI, SINAD, THD



NBFM Signal Generator

Setup Parameters

| | |
|--------------------|---|
| Generator | On/Off |
| TX Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Frequency Accuracy | Same as Spectrum Analyzer |



P25/P25p2 Analyzer and P25/P25p2 Talk-Out Coverage (Options 521 and 522)

| Measurements | |
|--|---|
| P25/P25p2 Analyzer (Option 521) | P25/P25p2 Talk-Out Coverage (Option 522, requires Option 31 GPS) |
| Received Power Frequency Error Modulation Fidelity NAC (hex) Symbol Rate Error BER (1011 for P25, 1031 for P25p2), O.153 (P25), Voice, and Control Channel) Symbol Deviation Hexadecimal Display of Control Channel Traffic | BER RSSI Modulation Fidelity |
| Graphs | |
| P25/P25p2 Analyzer (Option 521) | P25/P25p2 Talk-Out Coverage (Option 522, requires Option 31 GPS) |
| Constellation (P25 only) Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Demodulation Summary Display Base Station Control Channel Summary Displays (Active Control Channel, Band Plan, Backup Control Channel, Adjacent Site Summary) TDMA Power Profile (P25p2 only) | Outdoor measured values are overlaid on a geo-tagged map, or displayed on a value vs time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |
| Standards Compliance | |
| P25 | Relevant sections of TIA-102.CAAA-C |
| P25 Phase 2 | Relevant sections of TIA-102.CCAA |
| Setup Parameters | |
| Frequency | Receive Frequency, Transmit Frequency, Span, Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | P25 Modulation Types: C4FM, CQPSK P25 BER patterns: 1011, O.153 (V.52), Voice, Control Channel P25 Phase 2 Modulation Types: Base Station (H-DQPSK) & Mobile Station (H-CPM) P25 Phase 2 BER patterns: 1031, Silence, Voice, Control Channel Averaging, WACN ID, System ID, Color Code, Descrambling (Off/On) |
| Measurement | P25 Analyzer, P25 Coverage |
| P25/P25p2 Analyzer | Active Graph, Maximize Active Trace, Graph Type, Symbol Span |
| Graph Type | Constellation (P25 only), Linear Constellation, Spectrogram, Histogram, Eye Diagram, Demodulation Summary Display, Base Station Control Channel Summary Displays (Active Control Channel, Band Plan, Backup Control Channel, Adjacent Site Summary) |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| P25/P25p2 Coverage | USB Memory File Format .p25, .kml, both (Option 522, requires Option 31 GPS) |
| Log Data | On/Off |
| RF Measurements (Option 521) | |
| | (temperature range 15 °C to 35 °C) |
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Additional Summary Measurements | Modulation Fidelity (%) BER/MER (%) Symbol Deviation (Hz) Network Access Code (Hex) Symbol Rate Error (Hz) |
| Coverage Measurements (Option 522) | |
| | RSSI, BER, Modulation Fidelity |



P25/P25p2 Signal Generator

Setup Parameters

| | |
|-------------------|---|
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| P25 Tx Patterns | P25: 1011, 1011 Cal, Interference, Silence, Busy, Idle, High Dev, Low Dev, O.153 (v. 52) p25_lsm: 1011, 511 (O.153/v.52), 1011 Cal, Interference, Silence, Busy, Idle, Fidelity CW, AM and FM |
| P25p2 Tx Patterns | Base Station (H-DQPSK): 1031, 1031 Cal, Silence Mobile Station (H-CPM, Selectable timeslot): 1031, 1031 Cal, Silence CW, AM, FM |

RF Characteristics

| | |
|---------------------------|--|
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Accuracy | Same as Spectrum Analyzer |
| Frequency Range | 500 kHz to 1.6 GHz |
| P25 Modulation Fidelity | < 1.25 % max, < 0.75 % typical |
| P25p2 Modulation Fidelity | < 2.0 % max, < 1.75 % typical |



DMR (MOTOTRBO) Analyzer and DMR Talk-Out Coverage (Options 591 and 592)

| Measurements | |
|---|--|
| DMR (MOTOTRBO) Analyzer (Option 591) | DMR Talk-Out Coverage (Option 592, requires Option 31 GPS) |
| Received Power Frequency Error Modulation Fidelity Color Code (decimal) RX Timeslot (Base Station only) Symbol Rate Error Symbol Deviation Base Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence, tsc Mobile Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence Repeater Receiver Sensitivity Test CW, AM, FM | BER RSSI Modulation Fidelity |

| Graphs | |
|---|--|
| DMR (MOTOTRBO) Analyzer (Option 591) | DMR Talk-Out Coverage (Option 592, requires Option 31 GPS) |
| Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display DMR Summary Power Profile | Outdoor measured values are overlaid on a geo-tagged map, or displayed on a value vs. time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |

| Setup Parameters | |
|---|---|
| Frequency | Receive Frequency, Transmit Frequency, Span, Rx/Tx Coupling, Coupling Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | Modulation Type (Base Station, Mobile Station), BER pattern (1031, O.153, Voice, Silence) |
| Measurement | DMR Analyzer, DMR Coverage, DMR Bit Capture |
| DMR Analyzer | Active Graph, Maximize Active Trace, Graph Type, Symbol Span |
| Graph Type | Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary, DMR Summary, Power Profile |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| DMR Coverage (Option 592, requires Option 31 GPS) | USB Memory File Format .dmr2, .kml, both Log data On/Off |

| RF Measurements (Option 591) (temperature range 15 °C to 35 °C) | |
|---|--|
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Summary Measurements | Received Power, Frequency Error, Modulation Fidelity, BER, Symbol Deviation, Color Code, Symbol Rate Error |
| DMR Summary Measurements | MS ID, Target ID, Talk Group ID, FID, Call Type, Base Station ID |


| Coverage Measurements (Option 592) | |
|------------------------------------|--------------------------------|
| | RSSI, BER, Modulation Fidelity |



DMR Signal Generator

| Setup Parameters | |
|------------------|---|
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Tx Pattern | Base Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence, tsc Mobile Station: 1031, 1031-1 % BER, O.153, O.153-1 % BER, Silence CW, AM, FM |

| RF Characteristics | |
|----------------------|--|
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| Mod Fidelity | 1.25 % max, 0.75 % typical |
| Frequency Accuracy | Same as Spectrum Analyzer |

 **dPMR Analyzer (Options 573 and 572)**

Measurements

| dPMR RF Analyzer (Option 573) | dPMR Talk-Out Coverage (Option 572, requires Option 31 GPS) |
|---|--|
| Received Power Frequency Error Modulation Fidelity Symbol Rate Error Symbol Deviation | RSSI Modulation Fidelity |

Graphs

| dPMR RF Analyzer (Option 573) | dPMR Talk-Out Coverage (Option 572, requires Option 31 GPS) |
|---|---|
| Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display | Outdoor measured values are overlaid on a geo-tagged map and exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |

Setup Parameters

| | |
|-------------------------|---|
| Frequency | Receive Frequency, Transmit Frequency, Span, Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | Modulation Bandwidth (6.25 kHz) |
| Measurement | dPMR Analyzer, dPMR Coverage |
| dPMR Analyzer | Active Graph, Maximize Active Trace, Graph Type, Symbol Span |
| Graph Type | Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| dPMR Coverage | USB Memory File Format .dpmr, .kml, both Log data On/Off |

RF Measurements (Option 573) (temperature range 15 °C to 35 °C)

| | |
|---------------------------------|--|
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Additional Summary Measurements | Modulation Fidelity (%) Symbol Deviation (Hz) Symbol Rate Error (Hz) |

Coverage Measurements (Option 572)

RSSI, Modulation Fidelity

 **Signal Generator**

Setup Parameters

| | |
|-----------------|---|
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Tx Patterns | CW, AM, FM, O.153 |

RF Characteristics

| | |
|----------------------|--|
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| Frequency Accuracy | Same as Spectrum Analyzer |



NXDN Analyzer and NXDN Talk-Out Coverage (Options 531 and 532)

| Measurements | |
|---|---|
| NXDN Analyzer (Option 531) | NXDN Talk-Out Coverage (Option 532, requires Option 31 GPS) |
| Received Power Frequency Error Modulation Fidelity RAN (decimal) Symbol Rate Error BER (1031, O.153, Voice, and Control Channel) Symbol Deviation | BER RSSI Modulation Fidelity |
| Graphs | |
| NXDN Analyzer (Option 531) | NXDN Talk-Out Coverage (Option 532, requires Option 31 GPS) |
| Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display | Outdoor measured values are overlaid on a geo-tagged map and exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |
| Setup Parameters | |
| Frequency | Receive Frequency, Transmit Frequency, Span, Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | Modulation Bandwidth (6.25 kHz and 12.5 kHz), BER pattern (1031, O.153, Voice, Control Channel) |
| Measurement | NXDN Analyzer, NXDN Coverage |
| NXDN Analyzer | Active Graph, Maximize Active Trace, Graph Type, Symbol Span |
| Graph Type | Constellation, Linear Constellation, Spectrogram, Histogram, Eye Diagram, Summary |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| NXDN Coverage (Option 532, requires Option 31 GPS) | USB Memory File Format .nxdn, .kml, both Log data On/Off |
| RF Measurements (Option 531) (temperature range 15 °C to 35 °C) | |
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Additional Summary Measurements | Modulation Fidelity (%) BER/MER (%) Symbol Deviation (Hz) Radio Access Number (RAN) Decimal Symbol Rate Error (Hz) |
| Coverage Measurements (Option 532) | |
| | RSSI, BER, Modulation Fidelity |



NXDN Signal Generator

| Setup Parameters | |
|-----------------------------|--|
| Modulation Bandwidth | 6.25 kHz, 12.5 kHz |
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Tx Patterns (9600 and 4800) | 1031, O.153 (v. 52), High Dev, Low Dev, UDCH Pattern 10, CAC, 1031 DTS, FACCH3 DTS, Framed PN9, 1031 Cal, CW, AM, FM |
| RF Characteristics | |
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| Mod Fidelity | 1.25 % max |
| Frequency Accuracy | Same as Spectrum Analyzer |



TETRA Analyzer and TETRA Coverage Mapping (Options 581 and 582)

| Measurements | |
|--|---|
| TETRA Analyzer (Option 581) | TETRA Coverage (Option 582, requires Option 31 GPS) |
| Received Power Frequency Error Error Vector, RMS, and Peak Carrier Magnitude IQ Imbalance Magnitude & Phase Error Base Station Extended Color Code Base Station Receiver Sensitivity Test Symbol Rate Error | RSSI EVM |

| Graphs | |
|---|---|
| TETRA Analyzer (Option 581) | TETRA Coverage (Option 582, requires Option 31 GPS) |
| Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Eye Diagram Summary Display TETRA Summary | Outdoor measured values are overlaid on a geo-tagged map and exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |

Setup Parameters

| | |
|---|--|
| Frequency | Receive Frequency, Tx Frequency, Rx Coupling, Coupling Offset, Span |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range, Tx Output Lvl, Tx Power Offset, Units |
| Setup | Mod Type, Rx Pattern, Tx Pattern, Squelch Lvl, Numeric Averaging |
| Measurements | TETRA Analyzer, TETRA Coverage, TETRA BS Sensitivity |
| TETRA Analyzer | Active Graph, Maximize Active Graph, Graph Type, Symbol Span |
| Graph Type | Constellation, Spectrum, Eye Diagram, Summary, TETRA Summary |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| TETRA Coverage (Option 582, requires Option 31 GPS) | USB Memory File Format .tetra, .kml, or both Log data On/Off |

RF Measurements (Option 581) (temperature range 15 °C to 35 °C)

| | |
|---------------------------------|--|
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Additional Summary Measurements | Vector Error, RMS and Peak (%) Residual Carrier Magnitude (%) IQ Imbalance (dB) Phase Error Degrees Magnitude Error (%) Symbol Rate Error (Hz) |
| TETRA Summary Measurements | Mobile Color Code (Decimal) Mobile Network Code (Decimal) Base Station Color Code (Decimal) Base Station Extended Color Code (Hex) Location Area Code (Decimal) Mobile Station Maximum Transmit Power (dBm) |

Coverage Measurements (Option 582) RSSI, Error Vector Magnitude



TETRA Signal Generator

Setup Parameters

| | |
|----------------------------|--|
| Modulation Type | π/4 (Pi/4) DQPSK |
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Base Station Test Patterns | tetra_bs_idle_unallocPCH tetra_bs_busy_allocPCH T1_TCH_7p2 (Airbus TB3, Hytera, Sepura, Motorola, ETELM NeTIS) |

RF Characteristics

| | |
|----------------------|--|
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| EVM | 3.5 % max |
| Frequency Accuracy | Same as Spectrum Analyzer |



PTC Analyzer and PTC Talk-Out Coverage (Options 721 and 722)

| Measurements | |
|---|---|
| PTC Analyzer (Option 721) | PTC Talk-Out Coverage (Option 722, requires Option 31 GPS) |
| Received Power Burst Power Peak Envelope Power Frequency Error Π/4 DQPSK: Error Vector Magnitude, BER, IQ Offset, Phase Error, Magnitude Error, Symbol Rate Error | BER RSSI Modulation Fidelity |
| Graphs | |
| PTC Analyzer (Option 721) | PTC Talk-Out Coverage (Option 722, requires Option 31 GPS) |
| Constellation Linear Constellation Spectrum [Spans (kHz) = 25, 50, 100, 500, 1000, 5000] Histogram Eye Diagram Summary Display | Outdoor measured values are overlaid on a geo-tagged map, or displayed on a value vs time graph, and are exportable to both KML and CSV text (requires Option 31 GPS and a suitable GPS antenna). Indoor measured values are referenced by creating touchscreen points on a floorplan. |
| Setup Parameters | |
| Frequency | Receive Frequency, Transmit Frequency, Span, Offset |
| Amplitude | Reference level, Scale, Ext Attenuation, Auto Range, Adjust Range |
| Setup | RX Pattern (O.153/V.52, PN9 Normal), Symbol Rate (Half Rate 8 ksps, Full Rate 16 ksps), TX Pattern (O.153 Continuous, PN9 Normal Types 1-4, PN9 Normal Continuous), CW, AM 1 kHz tone, FM 1 kHz tone |
| Measurement | PTC Analyzer, PTC Coverage |
| PTC Analyzer | Active Graph, Maximize Active Trace, Graph Type, Symbol Span |
| Graph Type | Constellation, Linear Constellation, Spectrum, Histogram, Eye Diagram, Summary |
| Eye Diagram Symbol Span | 2, 3, 4, 5 |
| PTC Coverage (Option 722) | USB Memory File Format .ptc, .kml, both (requires Option 31 GPS) |
| Log data | On/Off |
| RF Measurements (Option 721) (temperature range 15 °C to 35 °C) | |
| Received Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Burst Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Peak Envelope Power dBm | ± 1.25 dB, ± 0.5 dB typical |
| Frequency Error Hz | ± 10 Hz + Frequency Reference |
| Additional Summary Measurements | Error Vector Magnitude % BER % IQ Offset dB Phase Error degrees Magnitude Error % Symbol Rate Error (Hz) |
| Coverage Measurements (Option 722) | |
| | RSSI, BER, Modulation Fidelity |



PTC Signal Generator

| Setup Parameters | |
|----------------------|--|
| Modulation Type | Π/4 DQPSK |
| Symbol Rate (ksps) | 8 (Half Rate), 16 (Full Rate) |
| Generator | On/Off |
| Tx Output Level | 0.1 dB resolution, 0 dBm to -130 dBm (spec to -120 dBm) |
| Tx Pattern | PN9 Continuous, PN9 Burst, CW, AM, FM |
| RF Characteristics | |
| Power Level Accuracy | 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, -120 dBm to 0 dBm) typical |
| Frequency Range | 500 kHz to 1.6 GHz |
| EVM | 3.5 % max |
| Frequency Accuracy | Same as Spectrum Analyzer |

 **AM/FM/PM Signal Analyzers (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 ^a THD ^a Distortion/Total Vrms ^a | FM/PM Rate RMS Deviation (Pk-Pk)/2 Deviation SINAD ^a THD ^a Distortion/Total Vrms ^a | AM Rate RMS Depth (Pk-Pk)/2 Depth SINAD ^a THD ^a Distortion/Total Vrms ^a | FM/PM Rate RMS Depth (Pk-Pk)/2 Depth SINAD ^a THD ^a Distortion/Total Vrms ^a | RMS Depth (AM) Peak + Depth Peak - Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD ^a THD ^a Distortion/Total Vrms ^a | RMS Deviation (FM/PM) Peak + Depth Peak - Depth (Pk-Pk)/2 Depth Carrier Power Carrier Frequency Occupied Bandwidth AM Rate SINAD ^a THD ^a Distortion/Total Vrms ^a |

a. Requires Sinewave modulation

Setup Parameters

| | |
|--------------|---|
| Frequency | Center Freq, Span, Freq Step, Signal Standard, Channel, Channel Increment, Set Carrier Freq |
| Amplitude | Scale, Power Offset, Adjust Range |
| Setup | Demod Type (AM, FM, PM), IFBW, Auto IFBW |
| Measurements | RF Spectrum AM/FM/PM, Audio Spectrum (AM/FM/PM), Audio Waveform (AM/FM/PM), Summary (AM/FM/PM), Average |
| Marker | On/Off, Delta, Peak Search, Marker Freq to Center, Marker to Ref Lvl, Marker Table, All Markers Off |

Specifications

| | |
|----------------|---|
| 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, IFBW must be greater than 95 % occupied BW) |
| 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, IFBW must be greater than 95 % occupied BW) |
| 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 |
| RBW/VBW | 30 |
| Span/RBW | 100 |
| Sweep time | 50 µs to 50 ms (Audio Waveform) |

 LTE Signal Analyzers (Options 541, 542, 546, and 886)

| Measurements | | | |
|--|--|--|--|
| RF (Option 541) | Demodulation (Options 542 and 886) | Over-the-Air (OTA) (Option 546) | Pass/Fail (User Editable) |
| 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, Frame EVM by modulation Constellation QPSK, 16QAM, 64QAM 256QAM 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 Modulation Results Tx Time Alignment Modulation Summary Includes EVM by modulation Antenna Icons Detects active antennas (1/2) | Scanner Cell ID (Group, Sector) S-SS Power, RSRP, RSRQ, SINR Dominance Modulation Results - 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 Power, 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 RS EVM SS, P-SS, S-SS Power SS, P-SS, S-SS EVM PBCH Power PBCH EVM PCFICH Power PCFICH EVM PHICH Power, EVM PDCCH Power, EVM Cell, Group, Sector ID OSTP Tx Time Alignment |

Setup Parameters

| | |
|-----------------------------|---|
| Frequency | E-UTRA bands 1 - 5, 7 - 14, 17 - 21, 23 - 32, 66A (tunable 10 MHz to 6.0 GHz) Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel |
| Bandwidth | 1.4, 3, 5, 10 MHz |
| Span | Auto, 1.4, 3, 5, 10, 15, 20, 30 MHz |
| Amplitude | Scale/Division, Power Offset, Auto Range, Adjust Range |
| Sweep | Single/Continuous, Trigger Sweep |
| EVM Mode | Auto, PBCH only |
| Save/Recall | Setup, Measurement, Screen Shot (save only), to Internal/External Memory |
| Measurement Summary Screens | Overall Measurements, RF Measurements, Modulation Measurements |

RF Measurements (Option 541)

RF Channel Power Accuracy ± 1.5 dB, ± 1.0 dB typical, (RF input -50 dBm to +10 dBm) (Option 541)

Demodulation Measurements (Option 542)

Frequency Error ± 10 Hz + Frequency Reference, 99 % confidence level
Residual EVM (rms) 2.0 % typical (E-UTRA Test Model 3.1, RF Input -50 dBm to +10 dBm) for BW ≤ 10 MHz

Over-the-Air (OTA) Measurements (Option 546)

Scanner Six strongest signals if present
Auto Save — Sync Signal Power and Modulation Results with GPS tagging
Auto Save Scanner — three strongest signals if present
RS Power — strongest signal
Mapping Map On-screen S-SS Power, RSRP, RSRQ, or SINR of Cell ID with strongest signal
Scanner — three strongest signals if present
Save and Export Scanner data: *.kml, *.mtd (tab delimited)



GSM/GPRS/EDGE Measurements (Option 880)

Measurements

| RF | Demodulation | Over-the-Air (OTA) | Pass/Fail |
|---|--|--|---|
| Channel Spectrum Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) Multi-channel Spectrum Power vs. Time (Frame/Slot) Channel Power Occupied Bandwidth Burst Power Average Burst Power Frequency Error Modulation Type BSIC (NCC, BCC) | Phase Error EVM Origin Offset C/I Modulation Type Magnitude Error | 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 Script Master™ |

Setup Parameters

| | |
|----------------------------|--|
| GSM/EDGE Select | Auto, GSM, EDGE |
| Frequency | Center, Signal Standard, Channel #, Closest Channel, Decrement/Increment Channel |
| Amplitude | Power Offset, Auto Range, Adjust Range |
| Sweep | Single/Continuous, Trigger Sweep |
| Save/Recall | Setup, Measurement, Screen Shots (JPEG - save only), to Internal/External Memory |
| Measurement Summary Screen | Overall Measurements |

RF Measurements

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

Demodulation Measurements

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



IEEE 802.16 Fixed WiMAX Signal Analyzers (Options 46 and 47) (Requires Option 6)

| Measurements | | | |
|-----------------------|---------------------------------|--|----------------------------------|
| RF (Option 46) | Demodulation (Option 47) | Over-the-Air (OTA) | Pass/Fail (User Editable) |
| Channel Spectrum | Constellation | There are no additional OTA Measurements. RF Measurements and Demodulation can be made OTA. | Channel Power |
| Channel Power | RCE (RMS/Peak) | | Occupied Bandwidth |
| Occupied Bandwidth | EVM (RMS/Peak) | | Burst Power |
| Power vs. Time | Frequency Error | | Preamble Power |
| Channel Power | Carrier Frequency | | Crest Factor |
| Preamble Power | Base Station ID | | Frequency Error |
| Data Burst Power | Spectral Flatness | | Carrier Frequency |
| Crest Factor | Adjacent Subcarrier Flatness | | EVM |
| ACPR | EVM vs. Subcarrier/Symbol | | RCE |
| | RCE | | Base Station ID |
| | EVM | | |
| | Frequency Error | | |
| | Carrier Frequency | | |
| | Base Station ID | | |

Setup Parameters

| | |
|-----------------------------|--|
| Bandwidth | 1.25, 1.50, 2.50, 3.50, 5.00, 5.50, 6.00, 7.00, 10.00 MHz |
| Cyclic Prefix Ratio (CP) | 1/4, 1/8, 1/16, 1/32 |
| Span | 5, 10, 15, 20 MHz |
| Frame Length | 2.5, 5.0, 10.0 ms |
| 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 |

RF Measurements (Option 46) (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)

Demodulation (Option 47) (temperature range 15 °C to 35 °C)

Frequency Error 0.07 ppm + Frequency Reference, 99 % confidence level
Residual EVM (rms) 3 % typical, 3.5 % max (RF Input -50 dBm to +20 dBm)



IEEE 802.16 Mobile WiMAX Signal Analyzers (Options 66, 67, and 37)

(Requires Option 6, Option 37 requires Option 31 for full functionality)

| Measurements | | | |
|-----------------------|---------------------------------|---------------------------------------|----------------------------------|
| RF (Option 66) | Demodulation (Option 67) | Over-the-Air (OTA) (Option 37) | Pass/Fail (User Editable) |
| Channel Spectrum | Constellation | Channel Power Monitor | Channel Power |
| Channel Power | RCE (RMS/Peak) | Preamble Scanner (Six) | Occupied Bandwidth |
| Occupied Bandwidth | EVM (RMS/Peak) | Preamble | Downlink Burst Power |
| Power vs. Time | Frequency Error | Relative Power | Uplink Burst Power |
| Channel Power | CINR | Cell ID | Preamble Power |
| Preamble Power | Base Station ID | Sector ID | Crest Factor |
| Downlink Burst Power | Sector ID | PCINR | Frequency Error |
| Uplink Burst Power | Spectral Flatness | Dominant Preamble | Carrier Frequency |
| ACPR | Adjacent Subcarrier Flatness | Base Station ID | EVM |
| | EVM vs. Subcarrier/Symbol | | RCE |
| | RCE (RMS/Peak) | | Sector ID |
| | EVM (RMS/Peak) | | |
| | Frequency Error | | |
| | CINR | | |
| | Base Station ID | | |
| | Sector ID | | |
| | DL-MAP (Tree View) | | |

Setup Parameters

| | |
|-----------------------------|--|
| Zone Type | PUSC |
| DL-MAP Auto Decoding | Convolutional Coding (CC), Convolutional Turbo Coding (CTC) |
| Bandwidths | 3.50, 5.00, 7.00, 8.75, 10.00 MHz |
| Cyclic Prefix Ratio (CP) | 1/8 |
| Span | 5, 10, 20, 30 MHz |
| Frame Lengths | 5, 10 ms |
| 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 |

RF Measurements (Option 66) (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)

Demodulation (Option 67) (Temperature range 15 °C to 35 °C)

Frequency Error 0.02 ppm + Frequency Reference, 99 % confidence level
 Residual EVM (rms) 2.5 % typical, 3.0 % max, (RF Input -50 dBm to +20 dBm)

Over-the-Air (OTA) Measurements (Option 37)

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

General Specifications

Setup Parameters

| | |
|-----------------------------|--|
| System | Status (Temperature, Battery Info, Serial Number, Firmware Version, Options Installed) Self Test, Application Self Test, GPS (see Option 31) |
| System Options | Name, Date and Time, Brightness, Volume Language (English, French, German, Spanish, Chinese, Japanese, Korean, Italian, Russian, Portuguese) Reset (Factory Defaults, Master Reset, Update Firmware) |
| File | Save, Recall, Delete, Directory Management |
| Save/Recall | Setups, Measurements, Screen Shots jpeg (save only) |
| Delete | Selected File, All Measurements, All Mode Files, All Content |
| Directory Management | Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy, Format USB |
| Internal Trace/Setup Memory | 2,000 traces, 2,000 setups |
| External Trace/Setup Memory | Limited by size of USB Flash drive |
| Mode Switching | Auto-Stores/Recalls most recently used Setup Parameters in the Mode |

Connectors

| | |
|------------------------------------|---|
| VNA Port 1, VNA Port 2 | Type N, female, 50 Ω |
| VNA Port Damage Level | 23 dBm, ± 50 VDC |
| RF In Port | Type N, female, 50 Ω |
| RF In Port Damage Level | +33 dBm peak, ± 50 VDC, Maximum Continuous Input (≥ 10 dB attenuation) |
| Signal Generator Port | Type N, female, 50 Ω |
| Signal Generator Port Damage Level | +27 dBm, ± 16 VDC |
| GPS | SMA, female |
| External Power | 5.5 mm barrel connector, 12.5 VDC to 15 VDC, < 4.0 A |
| USB Interface (2) | Type A (Connect USB Flash Drive and Power Sensor) |
| USB Interface | 5-pin mini-B, Connect to PC for data transfer |
| Ethernet Interface | RJ45 connector for Ethernet 10-Base T |
| Headset Jack | 3.5 mm mini-phone plug |
| External Reference In | BNC, female, 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz at -10 dBm to +10 dBm |
| Audio In (SINAD/Quieting) | BNC, female, Impedance 50 kΩ, Maximum Voltage > 1.77 Vrms (TIA-603-D compliant) |
| External Trigger/Clock Recovery | BNC, female, Maximum Input ± 5 VDC |

Display

| | |
|---------------|---|
| Type | Resistive TFT Touchscreen |
| Size | 8.4 inch daylight viewable color LCD |
| Resolution | 800 x 600 |
| Pixel Defects | No more than five defective pixels (99.9989% good pixels) |

Power

| | |
|---------------------------|---|
| Field Replaceable Battery | Li-Ion, 7500 mAh rated capacity 40 W on battery power only |
| DC Power | Universal 110/220 V AC/DC Adapter 55 W running with AC/DC adapter while charging battery |
| Life Time Charging Cycles | > 300 (80 % of initial capacity) |
| Battery Operation | 3.6 hours, typical |
| Battery Charging Limits | 0 °C to +45 °C, Relative Humidity ≤ 80 % |

General Specifications (Continued)**Regulatory Compliance**

| | |
|---------------------------|--|
| European Union | EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU applies to instruments with CE marking placed on the market after July 22, 2017 |
| Australia and New Zealand | RCM AS/NZS 4417:2012 |
| South Korea | KCC-REM-A21-0004 |

Environmental

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

ESD

| | |
|--------------------|--------------------------|
| RF Port Center Pin | Withstands up to ± 15 kV |
|--------------------|--------------------------|

Size and Weight

| | |
|--------|---|
| Size | 273 mm x 199 mm x 91 mm (10.7 in x 7.8 in x 3.6 in) |
| Weight | 3.6 kg, (7.9 lb) |

Warranty

| | |
|----------|--|
| Duration | Standard three-year warranty (battery one-year warranty) |
|----------|--|

Master Software Tools (for your PC)

Database Management

| | |
|----------------------|---|
| Full Trace Retrieval | Retrieve spectrum analyzer 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 |
| DAT File Converter | Converts HHST files to MST file format and vice-versa |

Data Analysis

| | |
|--------------------------|---|
| Trace Math and Smoothing | Compare multiple traces |
| Data Converter | Convert from/to Return Loss, VSWR, Cable Loss, DTF and also into Smith Charts |
| Measurement Calculator | Translates 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 |
|------------------------|-------------------|

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 |
| Product Updates | Auto-checks Anritsu website for latest revision firmware |
| Languages | Customize non-English language menus |
| Display | Modify display settings |

Script Master™

| | |
|----------------------|--|
| Channel Scanner Mode | Automate scan up to 1200 channels, repeat for sets of 20 channels, repeat all channels |
|----------------------|--|

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 |
| 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 |

 **easyTest Tools™** (for your PC)

Instrument Modes

| |
|--------------------------|
| Cable & Antenna Analyzer |
| Spectrum 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 |



Line Sweep Tools (for your PC)

Features Line Sweep Tools (LST) is a free PC based program that increases productivity for people who deal with numerous Cable and Antenna traces every day. LST is the next generation of Anritsu's familiar Handheld Software Tools (HHST) and shares its uncomplicated user interface, giving a new face to the term "ease of use."

Trace Capture

| | |
|----------------------|--|
| Browse to Instrument | View and copy traces from the test equipment to your PC using Windows Explorer |
| Open Legacy Files | Open DAT files captured with Handheld Software Tools v6.61 |
| Open Current Files | Open VNA or DAT files |
| Capture Plots To | The Line Sweep Tools screen, DAT files, Database, or JPEG |

Traces

| | |
|---------------|---|
| Trace Types | Return Loss, VSWR, DTF-RL, DTF-VSWR, Cable Loss, Smith Chart, and PIM |
| Trace Formats | DAT, VNA, CSV, PNG, BMP, JPG, HTML, Data Base, and PDF |

Report Generation

| | |
|------------------|---|
| Report Generator | Includes GPS location along with measurements |
| Report Format | Create reports in HTML or PDF format |
| Report Setup | Report Title, Company, Prepared for, Location, Date and Time, Filename, Company logo ¹ |
| Trace Setup | One Trace Portrait Mode, Two Trace Portrait Modes, One Trace Landscape Mode |

Trace Validation

| | |
|-------------------|--|
| Presets | 7 presets allow "one click" setting of up to 6 markers and one limit line |
| Marker Controls | 6 regular Markers, Marker Peak, Marker Valley, Marker between, and frequency entry |
| Delta Markers | 6 Delta markers |
| Limit Line | Enable and drag or value entry. Also works with presets |
| Next Trace Button | Next Trace and Previous Trace arrow keys allow quick switching between traces |

Tools

| | |
|-------------------------------------|---|
| Cable Editor ² | Allows creation of custom cable parameters |
| Distance to Fault ³ | Converts a Return Loss trace to a Distance to Fault trace |
| Measurement Calculator | Converts Real, Imaginary, Magnitude, Phase, RL, VSWR, Rho, and Transmit power |
| Signal Standard Editor ² | Creates new band and channel tables |
| Renaming Grid | 36 user definable phrases for creation of file names, trace titles, and trace subtitles |

Connectivity

| | |
|-------------|---|
| Connections | Ethernet, USB cable, and USB memory stick |
|-------------|---|

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 – Google Chrome, Mozilla Firefox |
| 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 connection and an HTML 5-compliant browser |
| Download | Individual instrument files downloaded via browser Multiple instrument files and directories zipped and downloaded via browser File downloads are not supported by iOS Screen capture capability |
| Display Modes | Normal: All modes and 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 | Ethernet, USB |
| Available Drivers | LabView. Visit NI.com for driver |

1. Optionally set by user

2. Instrument type/model must match original

3. Only *.dat and *.vna file types supported

Ordering Information – Options

| | S412E | Description |
|---|--------------------|--|
|  | 500 kHz to 1.6 GHz | Vector Network Analyzer |
|  | 9 kHz to 1.6 GHz | Spectrum Analyzer |
|  | 10 MHz to 1.6 GHz | Power Meter |
|  | 500 kHz to 1.6 GHz | CW Signal Generator |
|  | 10 MHz to 1.6 GHz | NBFM Analyzer |
| | Options | |
| | S412E-0010 | High Voltage Variable Bias Tee |
| | S412E-0031 | GPS Receiver (requires suitable GPS antenna) |
|  | S412E-0019 | High-Accuracy Power Meter (requires External Power Sensor) |
|  | S412E-0025 | Interference Analyzer (Option 31 recommended) |
|  | S412E-0027 | Channel Scanner |
| | S412E-0006 | 6 GHz Coverage on Spectrum Analyzer |
| | S412E-0016 | 6 GHz Coverage on Vector Network Analyzer |
|  | S412E-0015 | Vector Voltmeter |
| | S412E-0431 | Coverage Mapping (requires Option 31) |
|  | S412E-0444 | EMF Measurements (requires Anritsu Isotropic Antenna) |
|  | S412E-0509 | AM/FM/PM Analyzer |
|  | S412E-0521 | P25/P25p2 Analyzer Measurements |
| | S412E-0522 | P25/P25p2 Coverage Measurements (requires Options 31 and 521) |
|  | S412E-0531 | NXDN Analyzer Measurements |
| | S412E-0532 | NXDN Coverage Measurements (requires Options 31 and 531) |
|  | S412E-0573 | dPMR RF Analyzer Measurements |
| | S412E-0572 | dPMR Coverage Measurements (requires Options 31 and 573) |
|  | S412E-0581 | TETRA Analyzer Measurements |
| | S412E-0582 | TETRA Coverage Measurements (requires Options 31 and 581) |
|  | S412E-0591 | DMR (MOTOTRBO) Analyzer Measurements |
| | S412E-0592 | DMR (MOTOTRBO) Coverage Measurements (requires Options 31 and 591) |
|  | S412E-0721 | PTC Analyzer |
| | S412E-0722 | PTC Coverage Measurements (requires Options 31 and 721) |
|  | S412E-0541 | LTE RF Measurements |
| | S412E-0542 | LTE Modulation Quality |
| | S412E-0886 | LTE 256QAM Demodulation (Requires Option 542) |
| | S412E-0546 | LTE Over-the-Air Measurements (requires Option 31) |
| | S412E-0880 | GSM/GPRS/EDGE Measurements |
|  | | |
|  | S412E-0046 | IEEE 802.16 Fixed WiMAX RF Measurements (requires Option 6) |
| | S412E-0047 | IEEE 802.16 Fixed WiMAX Demodulation (requires Option 6) |
|  | S412E-0066 | IEEE 802.16 Mobile WiMAX RF Measurements (requires Option 6) |
| | S412E-0067 | IEEE 802.16 Mobile WiMAX Demodulation (requires Option 6) |
| | S412E-0037 | IEEE 802.16 Mobile WiMAX Over-the-Air Measurements (requires Option 6; Option 31 required for full functionality) |
| | S412E-0098 | Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate. |
| | S412E-0099 | Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data. |

Standard Accessories (Included with instrument)

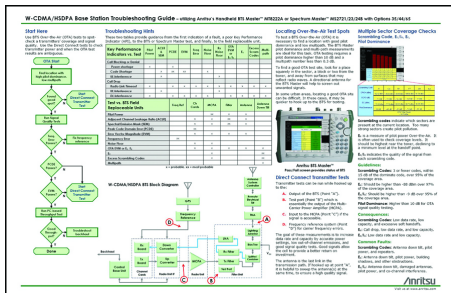


| Part Number | Description |
|-------------|---|
| 2000-1691-R | Stylus with Coiled Tether |
| 2000-1797-R | Screen Protector Film, 8.4 inch (2, one installed) |
| 2000-1654-R | Soft Carrying Case |
| 633-75 | Rechargeable 7500 mAh Li-Ion Battery |
| 40-187-R | AC-DC Adapter |
| 806-141-R | Automotive Power Adapter, 12 VDC, 60 W |
| 3-2000-1498 | USB A-type to Mini USB B-type cable, 3.05 m (10 ft) |
| | Standard Three Year Warranty (one year on battery) |
| | Certificate of Conformance |

Manuals, Related Literature (Soft copy at www.anritsu.com)

| Part Number | Description |
|-------------|--|
| 10100-00065 | Product Information, Compliance, and Safety |
| 10580-00318 | LMR Master User Guide |
| 10580-00289 | Vector Network Analyzer Measurement Guide |
| 10580-00243 | Land Mobile Radio Measurement Guide |
| 10580-00241 | Cable and Antenna Analyzer Measurement Guide |
| 10580-00349 | Spectrum Analyzer Measurement Guide |
| 10580-00240 | Power Meter Measurement Guide |
| 10580-00234 | 3GPP Signal Analyzer Measurement Guide |
| 10580-00236 | WiMAX Signal Analyzer Measurement Guide |
| 10580-00319 | Programming Manual |

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



| Part Number | Description |
|-------------|---|
| 11410-00551 | Spectrum Analyzers |
| 11410-00472 | Interference |
| 11410-00566 | LTE eNode Testing |
| 11410-00466 | GSM/GPRS/EDGE Base Stations |
| 11410-00473 | Cable, Antenna, and Component Troubleshooting Guide |
| 11410-00427 | Understanding Cable & Antenna Analysis White Paper |

Optional Accessories

Backpack and Transit Case



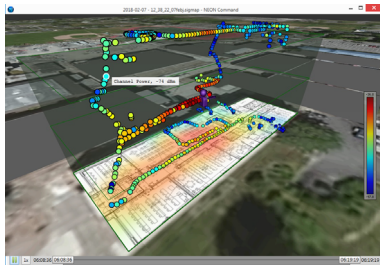
| Part Number | Description |
|-------------|---|
| 67135 | Anritsu Backpack (For Handheld Instrument and PC) |
| 760-243-R | Large Transit Case with Wheels and Handle 56 cm x 45.5 cm x 26.5 cm (22.07" x 17.92" x 10.42") |
| 760-271-R | Transit Case for Portable Directional Antennas and Port Extender 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) |

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



| Model Number | Description |
|--------------|---|
| MA24105A | Inline Dual Directional High Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm |
| MA24106A | High Accuracy RF Power Sensor, 50 MHz to 6 GHz, +23 dBm to -40 dBm |
| 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 |
| 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 |
| MA24330A | Microwave CW USB Power Sensor, 10 MHz to 33 GHz, +20 dBm |
| MA24340A | Microwave CW USB Power Sensor, 10 MHz to 40 GHz, +20 dBm |
| MA24350A | Microwave CW USB Power Sensor, 10 MHz to 50 GHz, +20 dBm |
| MA25100A | RF Power Indicator |

MA8100A TRX NEON Signal Mapper



| Model Number | Description |
|--------------|---|
| MA8100A-001 | TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service. |
| MA8100A-003 | TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 3 year TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. |
| MA8100A-005 | TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes 5 year TRX NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service. |
| MA8100A-100 | TRX NEON® Signal Mapper with Anritsu Integration and Tracking Unit. Includes Perpetual TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. |
| 2300-574 | 1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service. Cannot be ordered separately from P/N MA8100A-001. See P/N 2300-612 for renewals. |
| 2300-575 | 3 year TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. Cannot be ordered separately from P/N MA8100A-003. See P/N 2300-613 for renewals. |
| 2300-576 | 5 year TRX NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service. Cannot be ordered separately from P/N MA8100A-005. See P/N 2300-614 for renewals. |
| 2300-606 | Perpetual TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. Part number can also be used to order a perpetual license after a limited term license has expired. |
| 2300-612 | Renewal of 1 year TRX NEON Software License with 1 year of maintenance and support and 1 year of Cloud Service. |
| 2300-613 | Renewal of 3 year TRX NEON Software License with 3 years of maintenance and support and 3 years of Cloud Service. |
| 2300-614 | Renewal of 5 year TRX NEON Software License with 5 years of maintenance and support and 5 years of Cloud Service. |

Baseband Audio Generator and Oscilloscope



| Model Number | Description |
|--------------|---|
| 2000-1897-R | USB Baseband Audio generator and 2-Channel oscilloscope 10 MHz bandwidth, 8 kS buffer memory, 16 protocol serial decoder, USB connected and powered |
| 2000-1898-R | USB Low Distortion Baseband Audio generator and 2-Channel oscilloscope 16-bit resolution, low distortion (96 dB SFDR), low noise (8.5 μ V RMS), 5 MHz bandwidth, 16 MS buffer memory, low-distortion signal generator, arbitrary waveform generator, USB powered |

Miscellaneous Accessories



| Part Number | Description |
|-------------|--|
| MA2700A | Handheld Interference Hunter (For full specifications, refer to the MA2700A Technical Data Sheet 11410-00692) |
| MA25200A | High Power Tx/Rx Input Protection Module |
| 633-75 | Rechargeable Li-Ion Battery, 7500 mAh |
| 2000-1374 | External Dual Charger for Li-Ion Batteries |
| 2000-1797-R | Screen Protector Film |
| 66864 | Rack Mount Kit, Master Platform |
| 2000-1689 | EMI Near Field Probe Kit |

Full Temperature N-Type Coaxial Calibration Kits -10 °C to +55 °C (see individual data sheets on www.anritsu.com)



| Part Number | Description |
|-------------|--|
| OSLN50A-8 | High Performance Type N(m), DC to 8 GHz, 50 Ω |
| OSLNF50A-8 | High Performance Type N(f), DC to 8 GHz, 50 Ω |
| TOSLN50A-8 | High Performance with Through, Type N(m), DC to 8 GHz, 50 Ω |
| TOSLNF50A-8 | High Performance with Through, Type N(f), DC to 8 GHz, 50 Ω |

Full Temperature K-Type Coaxial Calibration Kits K-type connectors are compatible with 3.5 mm and SMA connectors. -10 °C to +55 °C



| Part Number | Description |
|--------------|---|
| TOSLK50A-20 | High Performance with Through, Type K(m), DC to 20 GHz, 50 Ω |
| TOSLKF50A-20 | High Performance with Through, Type K(f), DC to 20 GHz, 50 Ω |

Coaxial Calibration Components, Other 50 Ω , 75 Ω



| Part Number | Description |
|-------------|--|
| 22N50 | Precision N(m) Short/Open, 18 GHz |
| 22NF50 | Precision N(f) Short/Open, 18 GHz |
| 28N50-2 | Precision Termination, DC to 18 GHz, 50 Ω , N(m) |
| 28NF50-2 | Precision Termination, DC to 18 GHz, 50 Ω , N(f) |
| SM/PL-1 | Precision N(m) Load, 42 dB, 6 GHz |
| SM/PLNF-1 | Precision N(f) Load, 42 dB, 6 GHz |
| 2000-1914-R | Precision Open/Short/Load, 4.3-10(f), DC to 6 GHz, 50 Ω |
| 2000-1915-R | Precision Open/Short/Load, 4.3-10(m), DC to 6 GHz, 50 Ω |
| 2000-1618-R | Open/Short/Load, 7/16 DIN(m), DC to 6.0 GHz 50 Ω |
| 2000-1619-R | Open/Short/Load, 7/16 DIN(f), DC to 6.0 GHz 50 Ω |
| 12N50-75B | Matching Pad, DC to 3 GHz, 50 Ω to 75 Ω |
| 22N75 | Open/Short, N(m), DC to 3 GHz, 75 Ω |
| 22NF75 | Open/Short, N(f), DC to 3 GHz, 75 Ω |
| 26N75A | Precision Termination, N(m), DC to 3 GHz, 75 Ω |
| 26NF75A | Precision Termination, N(f), DC to 3 GHz, 75 Ω |
| 1091-55-R | Open, TNC(f), DC to 18 GHz |
| 1091-53-R | Open, TNC(m), DC to 18 GHz |
| 1091-56-R | Short, TNC(f), DC to 18 GHz |
| 1091-54-R | Short, TNC(m), DC to 18 GHz |
| 1015-54-R | Termination, TNC(f), DC to 18 GHz |
| 1015-55-R | Termination, TNC(m), DC to 18 GHz |

Adapters



| Part Number | Description |
|-------------|--|
| 1091-26-R | SMA(m) to N(m), DC to 18 GHz, 50 Ω |
| 1091-27-R | SMA(f) to N(m), DC to 18 GHz, 50 Ω |
| 1091-80-R | SMA(m) to N(f), DC to 18 GHz, 50 Ω |
| 1091-81-R | SMA(f) to N(f), DC to 18 GHz, 50 Ω |
| 1091-172 | BNC(f) to N(m), DC to 1.3 GHz, 50 Ω |
| 1091-465-R | Adapter, DC to 6 GHz, 4.3-10(f) to N(f), 50 Ω |
| 1091-467-R | Adapter, DC to 6 GHz, 4.3-10(m) to N(f), 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 |
| 513-62 | Adapter, DC to 18 GHz, TNC(f) to N(f), 50 Ω |
| 1091-315 | Adapter, DC to 18 GHz, TNC(m) to N(f), 50 Ω |
| 1091-324 | Adapter, DC to 18 GHz, TNC(f) to N(m), 50 Ω |
| 1091-325 | Adapter, DC to 18 GHz, TNC(m) to N(m), 50 Ω |
| 1091-317 | Adapter, DC to 18 GHz, TNC(m) to SMA(f), 50 Ω |
| 1091-318 | Adapter, DC to 18 GHz, TNC(m) to SMA(m), 50 Ω |
| 1091-323 | Adapter, DC to 18 GHz, TNC(m) to TNC(f), 50 Ω |
| 1091-326 | Adapter, DC to 18 GHz, TNC(m) to TNC(m), 50 Ω |
| 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 |
| 34NFF50 | Precision Adapter, N(f) to N(f), DC to 18 GHz, 50 Ω |

Filters



| Part Number | Description |
|-------------|---|
| 1030-114-R | 806 MHz to 869 MHz, N(m) to SMA(f), 50 Ω |
| 1030-109-R | 824 MHz to 849 MHz, N(m) to SMA(f), 50 Ω |
| 1030-110-R | 880 MHz to 915 MHz, N(m) to SMA(f), 50 Ω |
| 1030-105-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, 0.34 dB loss, N(m) to SMA(f), 50 Ω |
| 1030-107-R | 1910 MHz to 1990 MHz Band, 0.41 dB loss, N(m) to SMA(f), 50 Ω |
| 1030-112-R | 2400 MHz to 2484 MHz, N(m) to SMA(f), 50 Ω |
| 1030-149-R | High Pass, 150 MHz, N(m) to N(f), 50 Ω |
| 1030-150-R | High Pass, 400 MHz, N(m) to N(f), 50 Ω |
| 1030-151-R | High Pass, 700 MHz, N(m) to N(f), 50 Ω |
| 1030-152-R | Low Pass, 200 MHz, N(m) to N(f), 50 Ω |
| 1030-153-R | Low Pass, 550 MHz, N(m) to N(f), 50 Ω |
| 1030-155-R | 2500 MHz to 2700 MHz, N(m) to N(f), 50 Ω |

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) |

Phase-Stable Test Port Cables, Armored



| Part Number | 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 |
| 15NDF50-1.5C | 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω |
| 15ND50-1.5C | 1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(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 |
| 15N43M50-1.5C | Test Port Extension Cable, Armored, 1.5 meters, DC to 6GHz, N(m) to 4.3-10(m) |
| 15N43F50-1.5C | Test Port Extension Cable, Armored, 1.5 meter, DC to 6GHz, N(m) to 4.3-10(f) |
| 15N43M50-3.0C | Test Port Extension Cable, Armored, 3 meters, DC to 6 GHz, N(m) to 4.3-10(m) |
| 15N43F50-3.0C | Test Port Extension Cable, Armored, 3 meters, DC to 6 GHz, N(m) to 4.3-10(f) |
| 15NF43M50-1.5C | Test Port Extension Cable, Armored, 1.5 meters, DC to 6 GHz, N(f) to 4.3-10(m) |
| 15NF43F50-1.5C | Test Port Extension Cable, Armored, 1.5 meters, DC to 6 GHz, N(f) to 4.3-10(f) |
| 15NF43M50-3.0C | Test Port Extension Cable, Armored, 3 meters, DC to 6 GHz, N(f) to 4.3-10(m) |
| 15NF43F50-3.0C | Test Port Extension Cable, Armored, 3 meters, DC to 6 GHz, N(f) to 4.3-10(f) |

InterChangeable Adaptor Phase Stable Test Port Cables, Armored w/Reinforced Grip (Recommended for cable and antenna line sweep applications. It uses the same ruggedized grip as the Reinforced Grip series cables. Now you can also change the adaptor interface on the grip to four different connector types)



| Part Number | Description |
|---------------|--|
| 15RCN50-1.5-R | 1.5 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω |
| 15RCN50-3.0-R | 3.0 m, DC to 6 GHz, N(m), N(f), 7/16 DIN(m), 7/16 DIN(f), 50 Ω |

Directional Antennas



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

Isotropic Antennas



| Part Number | Description |
|-------------|--|
| 2000-1791-R | Isotropic Antenna, 700 MHz to 6000 MHz, N(m) |
| 2000-1792-R | Isotropic Antenna, 30 MHz to 3000 MHz, N(m) |
| 2000-1800-R | Isotropic Antenna, 9 kHz to 300 MHz, N(m) |

Portable Antennas



| Part Number | Description |
|-------------|---|
| 2000-1200-R | 806 MHz to 866 MHz, SMA(m), 50 Ω* |
| 2000-1473-R | 870 MHz to 960 MHz, SMA(m), 50 Ω* |
| 2000-1035-R | 896 MHz to 941 MHz, SMA(m), 50 Ω (1/2 wave)* |
| 2000-1030-R | 1710 MHz to 1880 MHz, SMA(m), 50 Ω (1/2 wave)* |
| 2000-1474-R | 1710 MHz to 1880 MHz with knuckle elbow (1/2 wave)* |
| 2000-1031-R | 1850 MHz to 1990 MHz, SMA(m), 50 Ω (1/2 wave)* |
| 2000-1475-R | 1920 MHz to 1980 MHz and 2110 MHz to 2170 MHz, SMA(m), 50 Ω* |
| 2000-1032-R | 2400 MHz to 2500 MHz, SMA(m), 50 Ω (1/2 wave)* |
| 2000-1361-R | 2400 MHz to 2500 MHz, 5000 MHz to 6000 MHz, SMA(m), 50 Ω* |
| 2000-1636-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) |
| 2000-1616 | 20 MHz to 21000 MHz, N(f), 50 Ω |
| 2000-1487 | Telescoping Whip Antenna, BNC ** |

* Requires 1091-27-R SMA(f) to N(m) adapter
 ** Requires 1091-172-R BNC(f) to N(m) adapter

GPS Antennas (active)



| Part Number | Description |
|-------------|---|
| 2000-1652-R | Magnet Mount, SMA(m), 3 VDC to 5 VDC with 1 ft cable |
| 2000-1528-R | Magnet Mount, SMA(m), 3 VDC to 5 VDC with 4.6 m (15 ft) extension cable |
| 2000-1760-R | Mini GPS Antenna, SMA(m), 25 dB gain, 2.5 VDC to 3.7 VDC |

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