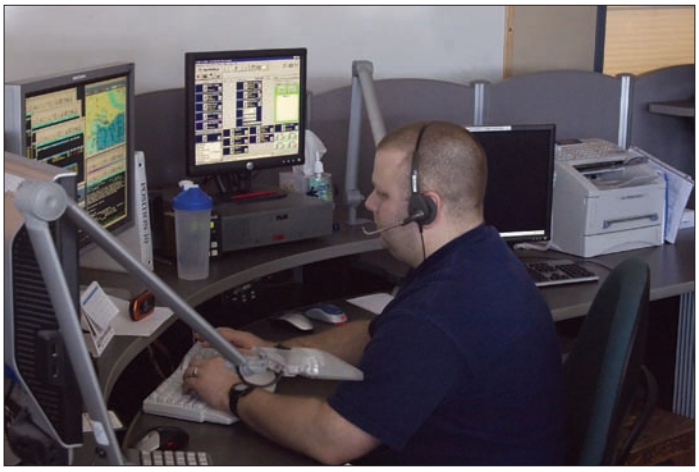
LMR Master™ S412E

Land Mobile Radio Modulation Analyzer, Signal Generator, Cable & Antenna Analyzer, Spectrum Analyzer

Anritsu
envision : ensure

LMR Master™ S412E Features

Overview



S412E LMR Master™

Introduction

The LMR Master S412E is a compact handheld multi-function analyzer that has been specifically developed for technicians and engineers who install and maintain public safety, utility and private mobile communications systems. LMR Master is a highly-integrated rugged handheld instrument that offers unmatched measurement breadth, depth, and precision while reducing the number of different instruments needed to verify operation and diagnose problems. LMR Master is the only truly portable solution for analysis and mapping of P25 TDMA Phase 2, ITC-R Positive Train Control, and FirstNet Public Safety LTE.

Standard features are:

- 2-Port Cable & Antenna and distance domain analysis: 500 kHz to 1.6 GHz (User may also select the more flexible Vector Network Analyzer display)
- Spectrum Analyzer: 9 kHz to 1.6 GHz
- CW/FM/AM Signal Generator: 500 kHz to 1.6 GHz
- Power Meter: 9 kHz to 1.6 GHz
- Narrowband FM Analysis: Received Power, Carrier Frequency, Frequency Error, Deviation, Modulation Rate, SINAD, THD, CTCSS, DCS, and DTMF. Auto Scan locks on to unidentified FM signal sources between 10 MHz and 1.6 GHz. Indoor Coverage Mapping of RSSI and transmitter SINAD is standard on the LMR Master. Outdoor Coverage Mapping is available with the optional GPS Receiver.

LMR Master S412E offers many options, including:

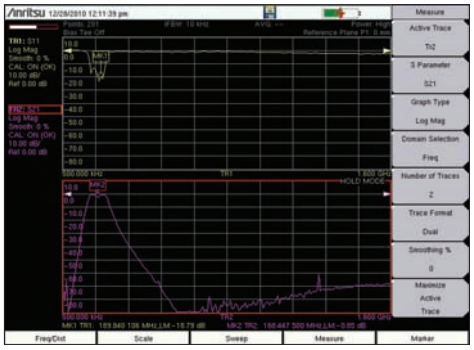
- Extension of Spectrum Analyzer to 6 GHz
- Extension of Vector Network Analyzer to 6 GHz
- Vector Voltmeter
- High Voltage Bias Tee (for both VNA and Spectrum Analyzer applications)
- High Accuracy Power Meter
- Spectrogram Interference Analyzer
- EMF Measurements
- GPS Receiver
- P25 FDMA and Phase 2 TDMA Analyzer & Signal Generator
- NXDN Analyzer & Signal Generator
- ETSI DMR / MotoTRBO* Analyzer & Signal Generator
- ITC-R Positive Train Control Analyzer & Signal Generator
- TETRA Analyzer w/ analysis of Base Station ECC & Signal Generator
- Indoor and Outdoor Coverage Mapping of RSSI, BER, and EVM (Modulation Fidelity) for NBFM, P25 (Phase 1 & Phase 2), NXDN, DMR, MotoTRBO, ITC-R PTC, and TETRA
- LTE Analyzer (FirstNet) including RF, Modulation Quality, and Over-the-Air Measurements
- IEEE 802.16 Fixed WiMAX Analyzer
- IEEE 802.16 Mobile WiMAX Analyzer

LMR site technicians and engineers can use the LMR Master to accurately and quickly test and verify the installation and commissioning of base stations, mobiles, and portables. The LMR Master is equally suited for preventative maintenance and troubleshooting to help ensure the operation of wireless network infrastructures, including broadband and microwave backhaul systems.

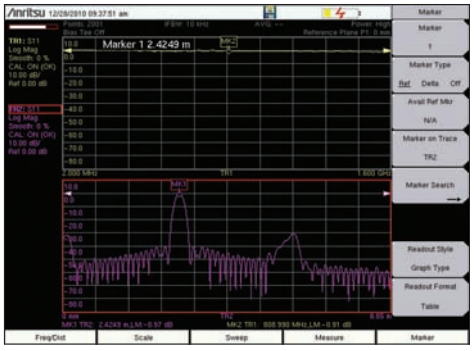
* Supports those features compliant with the ETSI DMR2 standard.

LMR Master™ S412E Features

2 Port Vector Network Analyzer



Cable & Antenna and VNA Mode in the LMR Master both provide simultaneous measurement of insertion loss and return loss.



Distance Domain (DTF) analysis allows simultaneous viewing of cable return loss and distance to fault.

2 Port Cable & Antenna, Vector Network Analyzer, optional Distance to Fault

LMR Master features a 2 Port Cable & Antenna analyzer (which can be reconfigured via menu selection to a full Vector Network Analyzer display) to test and verify the performance of feedline, filtering, and antenna components. This includes:

- Connectors
- Cables/Jumpers
- Antenna Isolators
- Multicouplers/Diplexers/Duplexers
- Tower Mounted Amplifiers

Transmission measurements can help identify poor filter adjustment, antenna isolation, and degraded tower mounted amplifiers. Distance To Fault shows the location of impairments, without the null/masking effects found in traditional TDRs. The goal of these measurements is to maximize the system coverage and capacity with problem-free base stations.

Antenna System Failure Mechanisms

Maintenance is an on going requirement as antenna system performance can degrade at any point in time due to:

- Loose connectors
- Improperly weatherized connectors
- Pinched cables
- Poor grounding
- Corroded connectors
- Lightning strikes
- Strong winds misaligning antennas
- Water intrusion into cables
- Bullet holes, nails, or rodent damage to coax and feedlines

Making Measurements Easier

The LMR Master provides features for making measurements easier to perform and for analyzing test results such as:

- Fast sweep speed, measurement point selection, and flexible display formats make it easy to view and adjust base station RF system performance
- High RF Immunity mode for testing in harsh RF environments
- Trace Overlay compares reference traces to see changes over time
- Limit Lines and Alarming for providing reference standards
- High and Low Power output selection to test tower-top components without climbing the tower
- Internal Bias-Tee on VNA ports to power up TMAs for off-line testing
- Internal Bias-Tee on Spectrum Analyzer port for easy powering of pre-amplifiers
- GPS tagging of data to verify location of tests

Measurements

1-port Measurements
- VSWR, Return Loss, Phase, Linear Polar, Log Polar Smith Chart
- Log/Mag/2 (1-port Cable Loss)
- Distance-to-Fault (DTF) Return Loss
- Distance-to-Fault (DTF) VSWR

Windowing Functions in Distance Domain
- Rectangular
- Normal Side Lobe
- Low Side Lobe
- Minimum Side Lobe

2-port Measurements
- Log Mag Insertion Loss/Gain, Phase, Linear Polar, Log Polar, Group Delay

Calibration

- User-variable Data Points from 2 to 4001
- Full S_{11} (Open, Short, Load)
- 1P2P (Open, Short, Load, Through)
- Response S_{11}
- Response S_{21}

Sweep Functions

- Run/Hold, Single/Continuous
- RF Immunity (High/Low)
- Averaging/Smoothing
- Output Power (High/Low)

Trace Functions

- Save/Recall, Copy to Display Memory
- No Trace Math, Trace ± Memory
- Trace Overlay

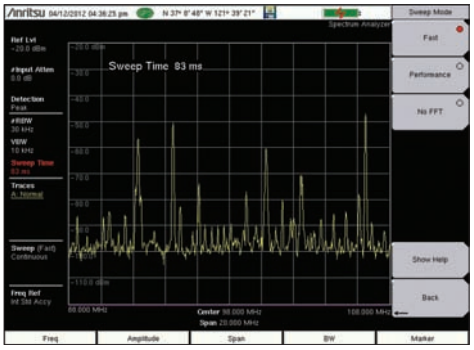
Marker Functions

- Up to 8 Markers, each with a Delta Marker
- Marker to Peak/Valley
- Marker to/Peak Valley between Markers
- Marker Table

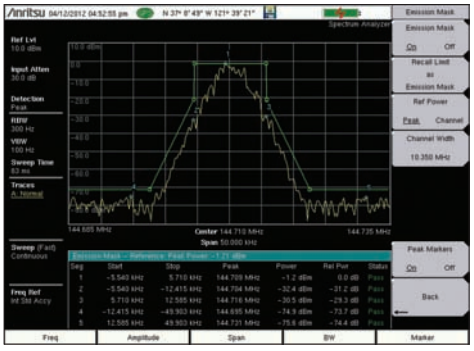
Limit Line Functions

- Limit Lines
  - Single Limit
  - Multi-segment (41)
  - Limit Alarm
- Limit Line Edit
  - Frequency, Amplitude
  - Add/Delete Point
  - Next Point Left/Right
  - Move Limit

Spectrum Analyzer



The spectrum analyzer mode in the LMR Master offers fast sweep speeds for interference hunting intermittent signals.



The Spectrum Analyzer mode in the LMR Master offers automated measurements including occupied bandwidth, adjacent channel power, and emission mask, as shown above. The mask can be quickly created using the standard limit line editor. The emission mask measurement function automatically moves the trace to match the peak of a modulated signal to conform to common mask standards.

Spectrum Analyzer

LMR Master features the most powerful handheld spectrum analyzer in its class with unmatched performance in:

- Sensitivity & Dynamic Range
- Phase Noise & TOI
- DSP-based IF Filtering
- Frequency Accuracy
- Resolution Bandwidth (RBW)

The goal of Spectrum Analyzer measurements is to be able to accurately monitor, measure, and analyze RF signals and their environments. It finds rouge signals, measures carriers and distortion, and verifies base stations' signal performance. It validates carrier frequency and identifies desired and undesired signals.

Simple But Powerful

The LMR Master features dedicated routines for one-button measurements. For more in-depth analysis, the technician has control over settings and features that are not found even on lab-grade benchtop spectrum analyzers. For example, the LMR Master offers:

- Multiple sweep detection methods – Peak, Negative, True RMS, Quasi-Peak, Sample
- Advanced marker functions – noise marker, tracking marker, peak search, sequential peak search, delta markers
- Advanced marker functions – noise marker, tracking marker, peak search, sequential peak search, delta markers
- Advanced limit line functions – automatic envelope creation, relative limits, limit mirror, point/segment/line adjustment
- Save-on-Event – automatically saves a sweep when crossing a limit line

The LMR Master offers full control over bandwidth and sweep settings, or can be set to automatically optimize for best possible trade-off between accuracy and speed.

GPS-Assisted Frequency Accuracy

With GPS Option 31 the frequency accuracy is improved to < 50 ppb (parts per billion). Also all measurements can be GPS tagged for exporting to maps.

Rx Noise Floor Testing

The LMR Master can measure the receive noise floor on a base station's uplink channel using the channel power measurement. An elevated noise floor indicates interference that can lead to call blocking, denial of service, call drops, low data rates, and lowered system capacity.

Measurements

- One Button Measurements
  - Field Strength – in dBm/m² or dBmV/m
  - Occupied Bandwidth - 1% to 99% of power
- Emission Mask
  - Channel Power - in specified bandwidth
  - ACPR - adjacent channel power ratio
  - AM/FM/SSB Demodulation - audio out only
  - C/I - carrier-to-interference ratio

Sweep Functions

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

Trace Functions

- Traces
  - 1-3 Traces (A, B, C), View/Blank, Write/Hold
- Trace A Operations
  - Normal, Max Hold, Min Hold, Average, Number 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

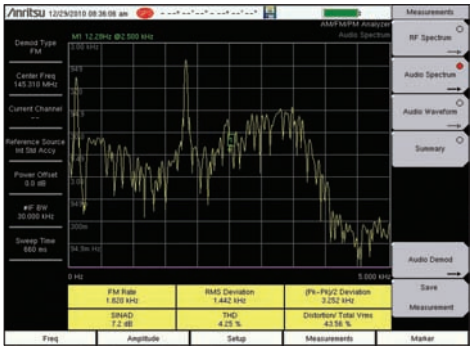
- Markers
  - 1-6 Markers each with a Delta Marker, or Marker 1 Reference with 6 Delta Markers
- Marker Types
  - Fixed, Tracking, Noise, Frequency Counter
- Marker Auto-Position
  - Peak Search, Next Peak (Right/Left), Peak Threshold %, To Channel, To Center,To Reference Level, Delta Marker to Span
- Marker Table
  - 1-6 markers' frequency & amplitude plus delta markers' frequency offset & amplitude

Limit Line Functions

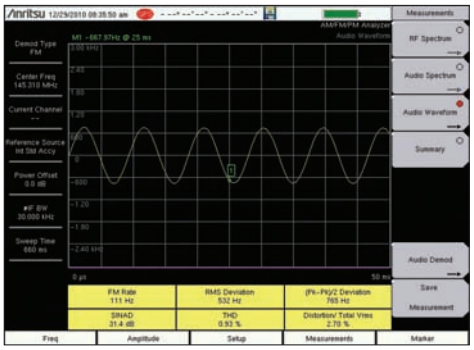
- Limit Lines
  - Upper/Lower, Limit Alarm, Default Limit
- Limit Line Edit
  - Frequency, Amplitude, Add/Delete Point, Add Vertical, Next Point Left/Right
- Limit Line Move
  - To Current Center Frequency, By dB or Hz, To Marker 1, Offset from Marker 1
- Limit Line Envelope
  - Create, Update Amplitude, Number of Points (41), Offset, Shape Square/Slope
- Limit Line Advanced
  - Absolute/Relative, Mirror, Save/Recall

LMR Master™ S412E Features

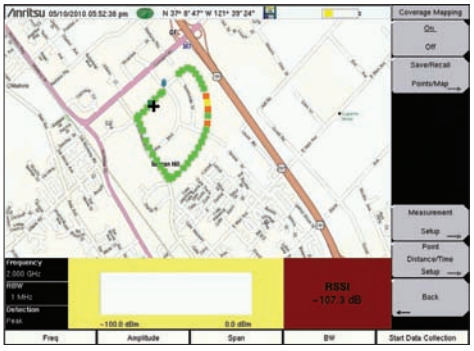
Spectrum Analyzer



The AM/FM/PM option 509 displays the demodulated audio spectrum vs. frequency with AM (%), Deviation (kHz) or Deviation (rad) for AM/FM/PM, respectively.



The AM/FM/PM option 509 displays the demodulated audio spectrum vs. time with AM (%), Deviation (kHz), or Deviation (rad) for AM/FM/PM, respectively.



The Coverage Mapping Option 0431 provides measurement RSSI or ACPR of a single channel along with a user downloaded map and GPS location.

AM/FM/PM Modulation Measurements

Option 509 AM/FM/PM Modulation Analyzer provides analysis and graphical display of common analog modulations. The RF Spectrum View displays the RF spectrum with carrier power (power in dB vs. frequency) along with center frequency, and occupied BW. Audio Spectrum shows the demodulated audio spectrum along with the audio rate, RMS deviation, Pk-Pk deviation (FM/PM) or depth (AM), SINAD, Total Harmonic Distortion (THD), and Total Distortion. Each demodulation also includes an Audio Waveform display that shows the time-domain demodulated waveform. A summary table shows a tabular list of all the RF and Demod measurement results.

AM/FM/PM Coverage Measurements

Coverage Mapping Option 431 provides on screen map displays of RSSI and ACPR.

Users can convert existing map images to a format compatible with the LMR Master using Anritsu's easyMap Tools™ PC software. RSSI and ACPR measurements can then be superimposed on the maps with the LMR Master. Maps with GPS coordinates can take advantage of the optional GPS receiver to place measurements appropriately. For indoor measurements, without GPS, the user just touches the LMR Master display to place measurements at the proper location. The maps with measurements can be exported through the built-in USB port to as JPEG or Google Earth™ KML files.

Measurements

- One Button Measurements
  - Field Strength – in dBm/m² or dBmV/m
  - Occupied Bandwidth - 1% to 99% of power
  - Channel Power - in specified bandwidth
  - ACPR - adjacent channel power ratio
  - AM/FM/SSB Demodulation - audio out only
  - C/I - carrier-to-interference ratio

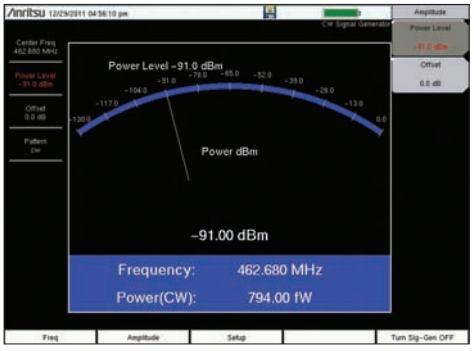
Sweep Functions

- Sweep
  - Single/Continuous, Manual Trigger, Reset, Minimum Sweep Time
- Detection
  - Peak, RMS, Negative, Sample, Quasi-peak

Triggers

- Free Run, External, Video, Change Position, Manual

Signal Generator



The LMR Master includes a standard Signal Generator with coverage from 500 kHz to 1.6 GHz and 120 dB power control range.

Signal Generator

The LMR Master includes a Signal Generator mode for use as a general purpose test signal. The generator can produce CW, modulated AM, and modulated FM signals. Frequency can be adjusted from 500 kHz to 1.6 GHz in 1 Hz steps. Power can be adjusted from 1 to -120 dBm in 0.1 dB steps. The frequency accuracy follows the spectrum analyzer mode and is improved to less than 50 ppb when the GPS is on and locked.

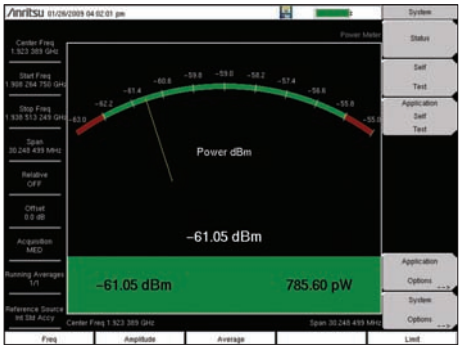
Setup Parameters

- Generator
  - On/Off
- Tx Output Level
  - –130 dBm to 0 dBm
- Tx Pattern

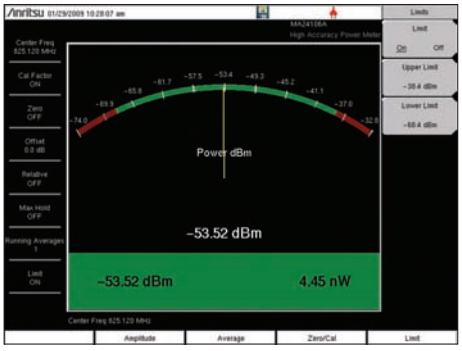
CW **RF Characteristics**

- Power Level Accuracy
  - 2.0 dB (CW Pattern, temperature range 15 °C to 35 °C, –130 dBm to 0 dBm) Typical
- Frequency Range
  - 500 kHz to 1.6 GHz
- Frequency Accuracy
  - Same as Spectrum Analyzer
- Modulation Adjustments
  - AM depth
  - FM deviation

Power Meter — High Accuracy Power Meter (Option 19)

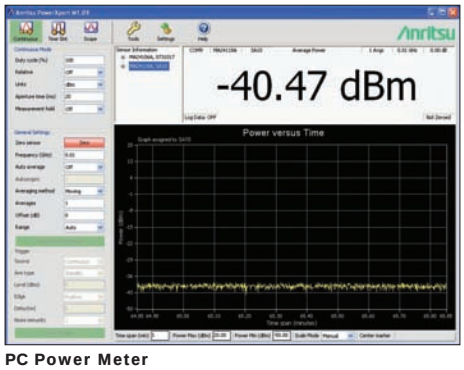


Power Meter Built-in
Power is displayed in an analog type display and, supports both Watts and dBm. RMS averaging can be set to low, medium, or high.



High Accuracy Power Meter
Requires external power sensor with convenient connection via a USB A/mini-B cable. Use upper/lower limit activation during pass/fail measurements.

USB Power Sensor
Anritsu offers a family of Power Sensors for your power measurement requirements. They are compact enough to fit in your shirt pocket.



PC Power Meter
These power sensors can be used with a PC running Microsoft Windows® via USB. A front panel display makes the PC appear like a traditional power meter.

Power Meters

The LMR Master offers a standard built-in Power Meter utilizing the RF In port, and an optional High Accuracy Power Meter when used with optional external power sensors.

Properly setting the transmitter output power of a base station is critical to the overall operation of a wireless network. A 1.5 dB change in power levels indicates a 15% change in coverage area. Too much power means overlapping coverage that translates into cell-to-cell self interference. Too little power, or too little coverage, creates island cells with non-overlapping cell sites and reduced in-building coverage. High or low values will cause dead zones/ dropped calls, lower data rates/reduced capacity near cell edges, and cell loading imbalances/blocked calls.

High Accuracy Power Meter (Option 19)

To address the most accurate power measurement requirements, select the high accuracy measurement option and a choice of sensors with:

- Frequency ranges: 10 MHz to 26 GHz[1]
- Power ranges: –40 dBm to +51.76 dBm[1]
- Measurement uncertainties: ± 0.18 dB[2]

[1]Depending on choice of sensor
[2] Under specific conditions

These sensors enable users to make accurate measurements for CW and digitally modulated signals for LMR and cellular wireless networks.

The power sensor easily connects to the LMR Master via a USB A/Mini-B cable. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed because the necessary power is supplied by the LMR Master's USB host port.

PC Power Meter

These power sensors can be used stand-alone with a PC running Microsoft Windows® via USB. They come with the PowerXpert™ application, an advanced data analysis and control software. The application has abundant features, such as data logging, power vs. time graph, large numerical display, and many more features, that enable quick and accurate measurements.

Remote Power Monitoring via LAN

A USB-to-LAN hub converter enables remote power monitoring via the Internet, if desired.

Power Sensors

PSN50

- High Accuracy RF Power Sensor
  - 50 MHz to 6 GHz
  - Type N(m), 50 Ω
  - -30 to + 20 dBm (.001 to 100 mW)
  - True-RMS

MA24105A

- Inline Peak Power Sensor
  - 350 MHz to 4 GHz
  - +3 to +51.76 dBm (2 mW to 150 W) – True-RMS (forward and reverse)
  - +33 to +54.77 dBm (2 W to 300 W) – Peak (forward)
  - Other measurements/calculations include: crest factor, CCDF, and return loss/SWR

MA24106A

- High Accuracy RF Power Sensor
  - 50 MHz to 6 GHz
  - -40 to +23 dBm (0.1 µW to 200 mW)
  - True-RMS

MA24108A

- Microwave USB Power Sensor
  - 10 MHz to 8 GHz
  - -40 to +20 dBm (0.1 µW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

MA24118A

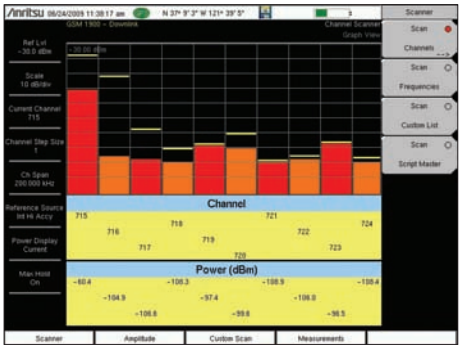
- Microwave USB Power Sensor
  - 10 MHz to 18 GHz
  - -40 to +20 dBm (0.1 µW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

MA24126A

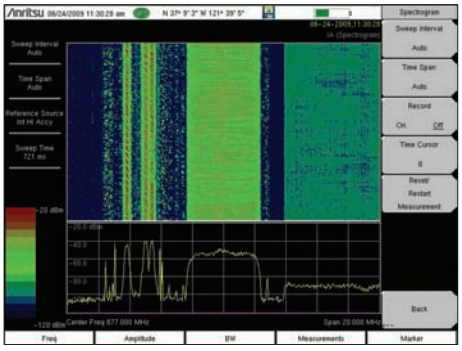
- Microwave USB Power Sensor
  - 10 MHz to 26 GHz
  - -40 to +20 dBm (0.1 µW to 100 mW)
  - True-RMS
  - Slot Power
  - Burst Average Power

LMR Master™ S412E Features

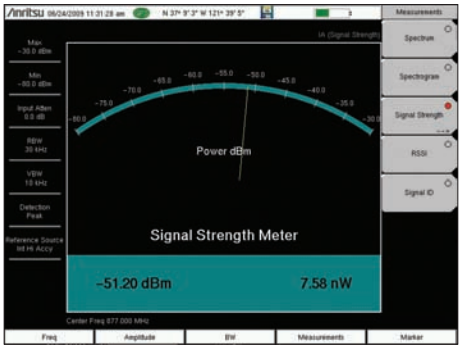
Interference Analyzer (Option 25) Channel Scanner (Option 27)



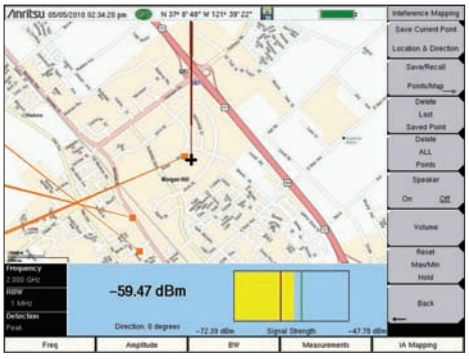
Channel Scanner
Works on any signal and is useful when looking for IM or harmonics. Can help spot signals widely separated in frequency that turn on and off together.



Spectrogram
For identifying intermittent interference and tracking signal levels over time for up to 72 hours with an external USB flash drive.



Signal Strength Meter
Can locate an interfering signal, by using a directional antenna and measuring the signal strength and by an audible beep proportional to its strength.



Interference Mapping
Maps can be downloaded to the LMR Master to help identify sources of interfering signals. Maps can be panned and zoomed to further aid the hunt for interference.

Interference Analyzer (Option 25) Channel Scanner (Option 27)

Interference is a continuously growing problem for wireless network operators. Compounding the problem are the many sources that can generate interference such as:

- Intentional Radiators
- Unintentional Radiators
- Self Interference

Interference causes channel degradation, robbing the network of capacity. In many instances, interference can cause an outage to a sector, a cell, and/or neighboring cells. The goal of these measurements is to resolve interference issues as quickly as possible.

LMR Master supports the MA2700A InterferenceHunter Handheld Direction Finding System (sold separately).

Monitoring Interference

The LMR Master offers many tools for monitoring intermittent interferers over time to determine patterns:

- Spectrogram
- Received Signal Strength Indicator
- Remote Monitoring over the Internet
- Save-on-Event – crossing a limit line

Master Software Tools for your PC features diagnostic tools for efficient analysis of the data collected during interference monitoring. These features include:

- Folder Spectrogram – creates a composite file of multiple traces for quick review
- Movie playback – playback data in the familiar frequency domain view
- Histogram – filter data and search for number of occurrences and time of day
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

Identifying Interference

The LMR Master provides several tools to identify the interference – either from a neighboring wireless operator, illegal repeater or jammer, or self-interference:

- Signal ID (up to 12 signals at once)
- Signal Analyzer Over-the-Air Scanners
- Channel Scanner (up to 1200 channels, 20 at a time)

Interference Mapping

Once interference has been identified, its location can be mapped with the help of the MA2700A Interference Hunter™ (see separate technical data sheet) and suitable directional antenna. Maps can be created with Anritsu's easyMap Tools™ software and downloaded to the LMR Master.

Interference Analyzer Measurements

- Spectrogram
- Signal Strength Meter
- Received Signal Strength Indicator (RSSI)
- Signal ID (up to 12 signals)
  - FM
  - GSM/GPRS/EDGE
  - W-CDMA/HSDPA
  - CDMA/EV-DO
  - Wi-Fi
- Spectrum
  - Field Strength – in dBm/m² or dBmV/m
  - Occupied Bandwidth - 1% to 99% of power
  - Channel Power - in specified bandwidth
  - ACPR - adjacent channel power ratio
  - AM/FM/SSB audio monitor
  - C/I - carrier-to-interference ratio

Channel Scanner

- Scan
  - 20 channels at once, by frequency or channel
  - Noncontiguous channels
  - Different channel bandwidths in one scan
- Display
  - Current plus Max hold display
  - Graph View
  - Table View
- Script Master™
  - Up to 1200 Channels
  - Auto-repeat sets of 20 channels and total
  - Auto-save with GPS tagging

Distance Domain Analysis

Wire Cable Bundle Diagnostics for Aircraft and Shipboard

This innovative new Distance-to-Fault technique finds damaged aircraft wire bundles at bulkheads or other points of vulnerability. It uses the Time Domain option and Frequency Domain Reflectometry with special fixtures to launch high frequency sweep signals into the wiring harnesses. Find out more by downloading Anritsu's Application Note 11410-00565, "Troubleshoot Wire Cable Assemblies with Frequency-Domain-Reflectometry."

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 LMR Master sweeps a user-specified band of full power operational frequencies (instead of fast narrow pulses from TDR-type approaches) to more precisely identify discontinuities.

The LMR Master 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.

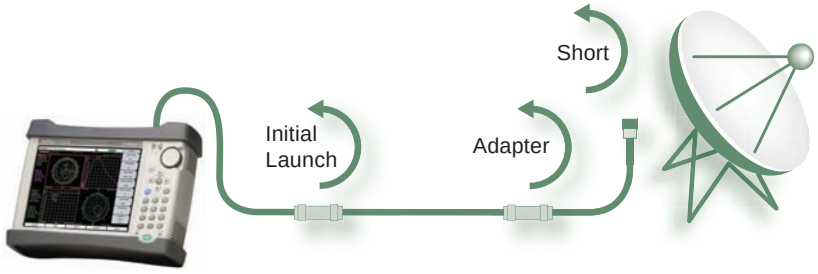
Distance Domain will improve your productivity with displays of the cable in terms of discontinuities versus distance. This readout can then be compared against previous measurements (from stored data) to determine whether any degradations have occurred since installation (or the last maintenance activity).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

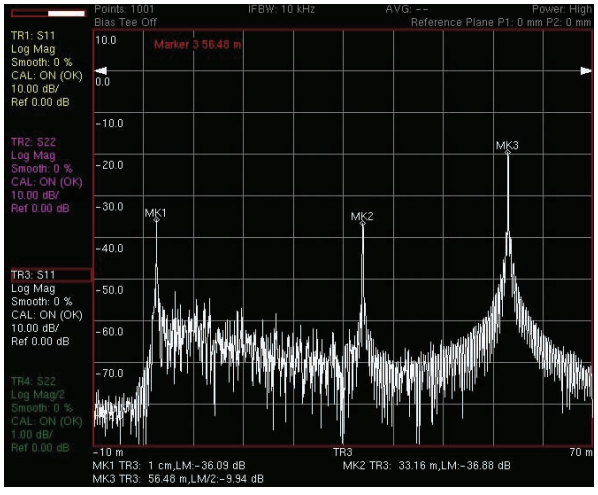
Measurements

- DTF Return Loss
- DTF Insertion Loss
- Full DTF support in VNA modes

Setup Parameters

- Start Distance
- Stop Distance
- Start Frequency (FDR)
- Stop Frequency (FDR)
- Windowing: Rectangular, Nominal Side Lobe, Low Side Lobe, Minimum Side Lobe
- Propagation Velocity
- Cable Loss
- Units: meters or feet
- Distance Info display





Distance-to-Fault Analysis
This illustration shows a typical cable measurement scenario with an adapter between the near and far end of the cable. With a short on the far end, the LMR Master can convert frequency domain results into corresponding distance-domain readout. Moving left to right, we can see the initial launch (MK1), the intermediate adapter (MK2), and the short at the far end of the cable (MK3). It is easy to interpret the discontinuities as normal or faults by simply looking at the location and amplitude of the peaks. Since the short shows as -20 dB, this means that the one-way cable loss must be 10 dB.

Introduction to Signal Analyzers

LMR Master testing from a service vehicle

Signal Analyzers

The LMR Master features Signal Analyzers for the major wireless standards around the world. The Signal Analyzers are designed to test and verify the:

- RF Signal Strength and Quality
- Modulation Quality
- Downlink (Talk-Out) Coverage
- Downlink Channel Capture
- Receiver Sensitivity (excluding TETRA, WiMAX, and LTE)

DSP SDR Receiver enables OTA Coverage Measurements

DSP-powered SDR technology in the LMR Master provides accurate and convenient measurement of the RF modulation quality for LMR systems and improved sensitivity for realistic coverage mapping measurements. DSP IF filtering ensures that adjacent channel signals will not cause errors in on-channel measurements. Optional internal GPS provides location information for coverage mapping, and improves the internal reference accuracy to less than 50 ppb.

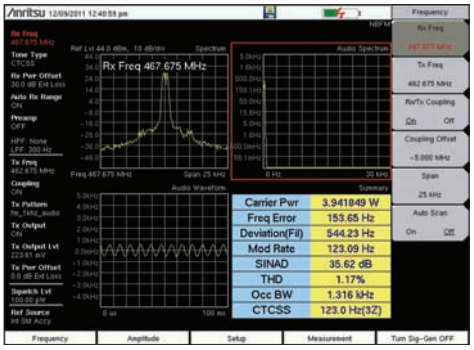
Coverage mapping options are available to support in-service and out-of-service measurements of FM, P25, NXDN, DMR, and PTC systems. LMR Master offers both outdoor (using GPS tagging) and indoor (using on-screen tagging) of critical performance metrics. The signal generator offers a 130 dB power control range to measure receiver sensitivity using CW, modulated FM, modulated AM, and digital LMR modulation test patterns. The signal generator's amplitude, frequency, deviation/depth, and test pattern (digital) are independently adjustable to allow stimulus of a repeater input while observing the transmitter output.

LMR Master's ultra-sensitive receiver combined with FirstNet LTE, WiMAX, and TETRA Analyzer options support testing and mapping the downlink signals over the air, while powerful DSP filtering ensures that on-channel measurements are not skewed by noise or signals in adjacent channels.

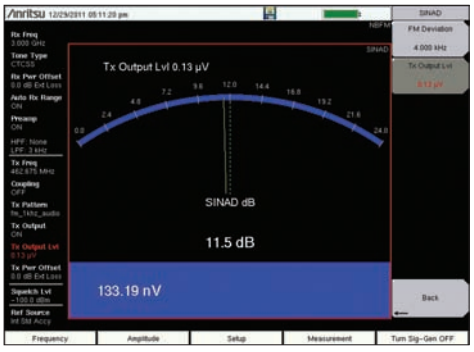
Signal Analyzers

- Narrowband FM
- P25 FDMA Phase 1 and TDMA Phase 2
- NXDN™
- DMR Tier 2 / MotoTRBO™
- ITC-R Positive Train Control (PTC)
- TETRA
- FirstNet Public Safety LTE
- WiMAX (IEEE 802.16, Fixed and Mobile)

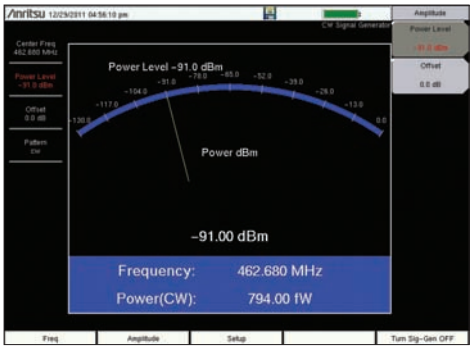
NBFM Analyzer



When cabled to a radio, the NBFM Analyzer features an Auto Scan function that can automatically determine and tune to the carrier frequency of an unknown transmitter.



Dedicated 20 dB Quieting and SINAD tools provide quick and accurate measurement of analog receiver performance.



The NBFM Analyzer can generate a CW or FM carrier with adjustable deviation for modulation patterns including 1 kHz, CTCSS/DCS, and DTMF.

NBFM Analyzer

The NBFM Analyzer is a standard feature on all LMR Master instruments and is designed to analyze the performance of both receivers and transmitters according to guidelines in the TIA-603-D Measurement and Performance Standard.

Auto Scan can be used to identify (and automatically tune to) the center frequency of an unknown transmitter. Once locked to the center frequency the Summary display shows Received Power, Frequency Error, Deviation, Modulation Rate, Occupied Bandwidth and THD. Standard values for CTCSS, DCS (both Normal and Inverted), and DTMF are decoded and displayed. 20 dB Quieting and SINAD test screens are provided for receiver alignment. Units are adjustable for dBm, Volts, or Watts as needed.

Filters (high-pass, low-pass, pre-emphasis and de-emphasis) allow selection of audio passband components for precise measurements.

The built-in signal generator can provide everything from pure clean CW to modulated FM with test tone and privacy tone at variable deviations.

NBFM Coverage Mapping is also standard on the S412E LMR Master. When GPS signals are available, the optional GPS receiver (Option 31) allows location tagging of RSSI, THD, and SINAD points which are displayed on the S412E's map viewer. Results are then exportable as tab-delimited data, JPEG image, and industry-standard KML for offline analysis in Google Earth™ or other mapping applications. The LMR Master offers the industry's only self-contained indoor mapping solution for land mobile radio — simply load a building floor plan and begin taking measurements by tapping locations right on the instrument's high-resolution touchscreen display.

RF Measurements

- Received Channel Power
- Carrier Frequency
- Frequency Error
- Occupied Bandwidth (% of Power or > dBc method)

Modulation Measurements

- Deviation
- Modulation Rate
- SINAD from RF Input
- SINAD from Audio Input
- Quieting
- CTCSS / DCS / Inverted DCS / DTMF
- RSSI / THD / SINAD Coverage Mapping

Filter Types

- 750 µs Pre-Emphasis
- 750 µs De-Emphasis
- High Pass: 300 Hz, 3 kHz, None
- Low Pass: 300 Hz, 3 kHz, 15 kHz, None

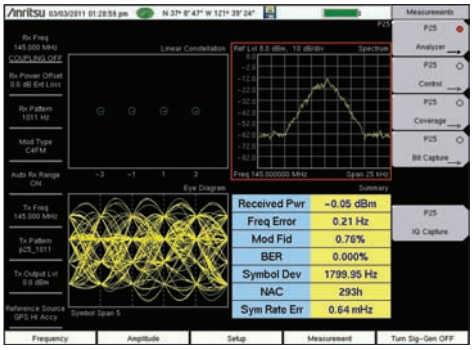
Analyzer Adjustments

- Auto Scan (10 MHz - 1.6 GHz)
- RX Frequency
- TX Frequency
- RX/TX Coupling
- RX/TX Duplex Offset
- Channel Span
- Audio Span
- Audio Sweep Time
- RX Units
- TX Units
- Numerical Squelch Level

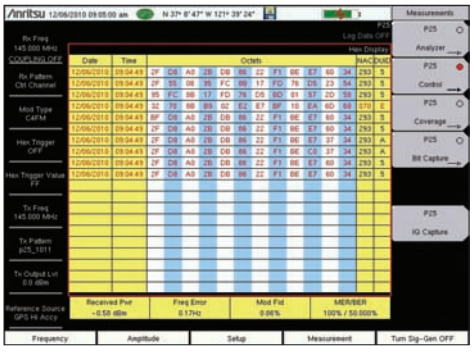
Signal Generator Test Patterns

- CW
- FM + CTCSS
- FM + DCS
- FM + DTMF
- FM + 1 kHz + CTCSS
- FM + 1 kHz + DCS
- AM 10 Hz to 10 kHz, 1 to 100%

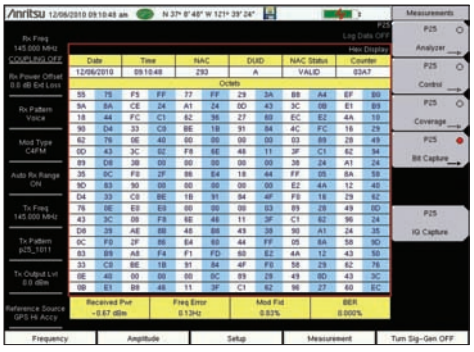
P25 FDMA and P25 Phase 2 TDMA Signal Analyzer (Option 521)



The P25 analyzer display gives a complete summary of the RF Quality.



The P25 Control channel display provides a hex display of the Trunked Downlink data in hex format. Anritsu offers a free software script to convert the hex information to text messages.



The P25 Bit Capture display displays the uplink traffic and exports this to USB memory.

P25 Analyzer

The P25 Signal Analyzer, Option 521, is designed to test and verify the performance of P25 conventional and trunked radio systems. The P25 Analyzer supports measurement of P25 transmitted signals while directly connected to the transmitter (through a power attenuator) or over-the-air with an antenna. The signal analyzer input has the sensitivity to measure P25 signals down to -115 dBm allowing transmitter problems to be analyzed and verified miles away. Separate demodulators are available for C4FM (Phase 1 P25 systems) and π()/4 DQPSK (LSM and Phase 2 P25 systems). Receive test patterns include the P25 standard 1011 Hz BER pattern, the O.153 PN9 BER pattern, a proprietary voice pattern that estimates BER from audio transmissions, and a control channel pattern that measures the control channel message error rate and estimates the control channel BER based on the forward error correction bits.

The P25 signal generator offers several P25 test patterns including the standard 1011 Hz (Phase 1), 1031 Hz (Phase 2), voice-framed BER pattern, and the O.153 PN9 BER pattern. The generator power level can be controlled over a 130 dB range from 0 to −130 dBm to support receiver sensitivity measurements. The 0 dBm signal level supports amplification to higher levels with an external amplifier for use as a temporary BER test transmitter for inbound coverage assessment. The frequency of the signal generator can be either locked to or controlled independently from the receiver frequency.

Control Channel messages on trunked P25 systems can be captured to the instrument display and exported to USB memory for conversion to standard test messages using a Python script available from the Anritsu website at no charge. Control Channel data can be captured in either free-run mode or triggered based on user-definable hexadecimal values to catch specific messages as they occur. Bit Capture captures, displays, and stores the uplink data traffic.

A 12.5 kHz channel I-Q capture function is also available to record a channel's baseband data to USB memory as tab-delimited data for later analysis and replay.

- RF Quality
- Modulation Quality
- Downlink (Talk-Out) Coverage
- Baseband I-Q Channel Capture
- Trunked System Control Channel Messages
- P25 Test Signal Generator for Receiver Sensitivity and Coverage Measurements

RF Measurements

- Received channel power
- Frequency error
- Channel Spectrum
- Eye Diagram
- Constellation

Modulation Measurements

- Modulation Types (P25 Phase 2): Base Station (BS) and Mobile Station (MS)
- Modulation Fidelity
- Symbol Deviation
- Symbol Rate Error
- Symbol Histogram

Protocol Measurements

- BER and ModFid on 1011 Hz, 1031 Hz O.153, Voice, or Control Channel
- NAC
- Color Code (P25 Phase 2)
- TDMA Power Profile (P25 Phase 2)

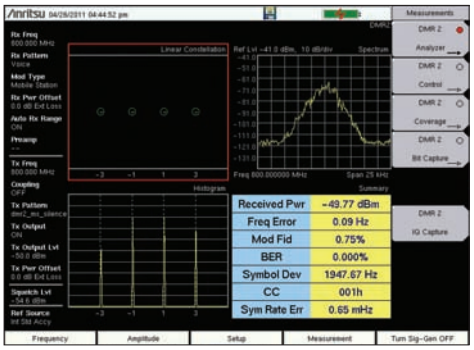
P25 Analyzer Patterns

- 1011 Hz (P25 Phase 1)
- 1031 Hz (P25 Phase 2)
- O.153 (V.52, PN9)
- Voice
- Control Channel

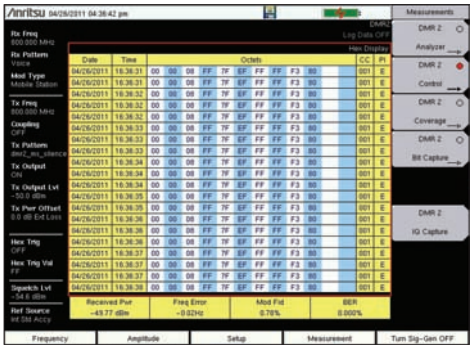
P25 Generator Test Patterns

- p25_1011
- p25_511 (O.153/v.52)
- p25_1011_cal
- p25_intfr
- p25_silence
- p25_busy
- p25_idle
- p25_high_dev
- p25_low_dev
- p25_fidelity
- p25_lsm_1011
- p25_lsm_511 (O.153/v.52)
- p25_lsm_1011_cal
- p25_lsm_intfr
- p25_lsm_silence
- p25_lsm_busy
- p25_lsm_idle
- p25_lsm_fidelity
- p252_bs_1031
- p252_bs_1031_cal
- p252_bs_silence
- p252_ms_1031_0
- p252_ms_1031_1
- p252_ms_1031_2
- p252_ms_1031_cal_0
- p252_ms_1031_cal_1
- p252_ms_silence_0
- p252_ms_silence_1
- cw
- am_1khz_audio
- fm_1khz_audio

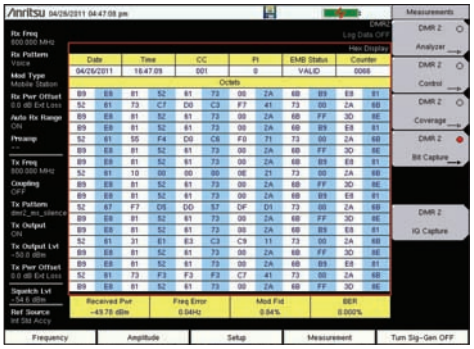
DMR2 Signal Analyzer (Option 591)



The DMR analyzer display gives a complete summary of the RF and Modulation Quality.



The P25 Control channel display provides a hex display of the Trunked Downlink data in hex format. Anritsu offers a free software script to convert the hex information to text messages.



The DMR Bit Capture display displays the uplink traffic and exports this to USB memory.

DMR2 Analyzer

The DMR Analyzer, Option 591, is designed to test and verify the performance of DMR Tier 2 radio systems. The DMR Analyzer supports measurement of time-slotted DMR transmitted signals while directly connected to the transmitter (through a power attenuator) or over-the-air with an antenna. The signal analyzer input has the sensitivity to measure DMR signals down to −115 dBm allowing transmitter problems to be analyzed and verified miles away. Separate demodulators are available for Base Station (BS) and Mobile Station (MS) systems. Receive test patterns include the DMR standard 1031 Hz BER pattern, the O.153 PN9 BER pattern, a proprietary voice pattern that estimates BER from audio transmissions, Silence and Idle patterns, and a control channel pattern that measures the control channel message error rate and estimates the control channel BER based on the forward error correction bits.

The built-in DMR signal generator offers over ten DMR test patterns including the standard 1031 Hz voice-framed BER pattern and the O.153 PN9 BER pattern. The generator power level can be controlled over a 130 dB range from 0 to −130 dBm to support receiver sensitivity measurements. The 0 dBm signal level supports amplification to higher levels with an external amplifier for use as a temporary BER test transmitter for coverage assessment. The frequency of the DMR signal generator can be either locked to or controlled independently from the DMR Analyzer frequency.

Control Channel messages on trunked DMR systems can be captured to the instrument display and exported to USB memory for conversion to standard test messages using a Python script available from the Anritsu website at no charge. Control Channel data can be captured in either free-run mode or triggered based on user-definable hexidecimal values to catch specific messages as they occur. Bit Capture captures, displays, and stores the uplink data traffic.

A 12.5 kHz channel I-Q capture function is also available to record a channel's baseband data to USB memory as tab delimited data for later analysis and replay.

- RF Quality
- Modulation Quality
- Downlink (Talk-Out) Coverage
- Baseband I-Q Channel Capture
- DMR Test Signal Generator for Receiver Sensitivity and Coverage Measurements

RF Measurements

- Received channel power
- Frequency error
- Channel Spectrum
- Eye Diagram
- Constellation
- Linear Constellation
- Power Profile

Modulation Measurements

- Modulation Types: Base Station (BS) and Mobile Station (MS)
- Modulation Fidelity
- Symbol Deviation
- Symbol Rate Error
- Symbol Histogram

Protocol Measurements

- BER and EVM on 1031 Hz, O.153, Voice, or Control Channel
- Color Code

DMR Analyzer Patterns

- 1031 Hz
- O.153 (V.52, PN9)
- Voice
- Control Channel
- Silence
- Idle

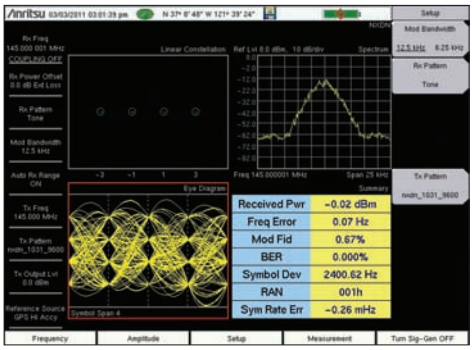
Base Station Test Patterns

- dmr_bs_1031
- dmr_bs_511(O.153)
- dmr_bs_silence
- dmr_bs_1031_1_pcnt_ber
- dmr_bs_511(O.153)_1_pcnt_ber
- dmr_bs_tscc
- cw
- am_1khz_audio
- fm_1khz_audio

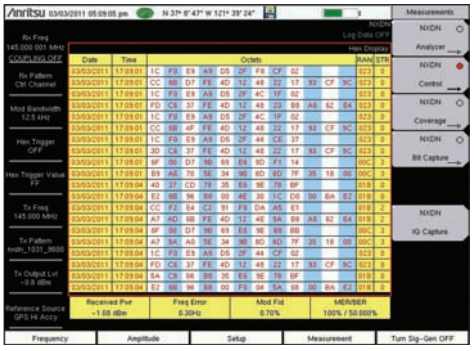
Mobile Station Test Patterns

- dmr_ms_1031
- dmr_ms_511(O.153)
- dmr_ms_silence
- dmr_ms_1031_1_pcnt_ber
- dmr_ms_511(O.153)_1_pcnt_ber
- cw
- am_1khz_audio
- fm_1khz_audio

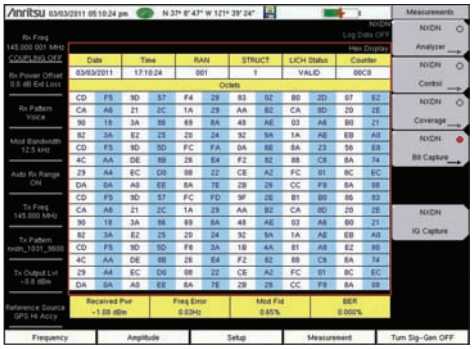
NXDN Signal Analyzer (Option 531)



The NXDN analyzer display gives a complete summary of the RF Quality.



The NXDN Control channel display provides a hex display of the Trunked Downlink data in hex format. Anritsu offers a free software script to convert the hex information to text messages.



The NXDN Bit Capture display displays the uplink traffic and exports this to USB memory.

NXDN Analyzer

The NXDN Analyzer, Option 531, is designed to test and verify the performance of NXDN conventional and trunked radio systems. The NXDN Analyzer supports measurement of NXDN transmitted signals with a direct connection to the transmitter (through a power attenuator) or over-the-air with an antenna. The signal analyzer input has the sensitivity to measure NXDN signals down to −115 dBm, allowing transmitter problems to be analyzed and verified miles away. Separate demodulators are available for 12.5 kHz and 6.25 kHz NXDN systems. Receive BER test patterns include the NXDN standard 1031 "Tone" BER pattern and the O.153 (PN9) BER pattern. For in-service BER testing, Option 0531 offers a proprietary voice pattern that estimates BER from forward error correction bits, and a control channel BER pattern that measures the control channel message error rate, and estimates the control channel BER from the forward error correction bits.

The built-in NXDN signal generator offers over seven NXDN test patterns at both 9600 (12.5 kHz) and 4800 (6.25 kHz) rates including the standard 1031 "Tone" BER pattern and the 511 (O.153) BER pattern.

The generator power level can be controlled over a 130 dB range from 0 to −130 dBm to support receiver sensitivity measurements. The 0 dBm signal level supports amplification to higher levels with an external amplifier for use as a temporary BER test transmitter for coverage assessment. The frequency of the NXDN signal generator is independently settable from the NXDN Analyzer frequency.

Control channel messages on trunked NXDN systems can be captured as hex data to the internal display and exported to USB memory for converting to standard test messages using a Python script available from Anritsu at no charge. Bit Capture captures, displays, and stores the uplink data traffic.

A 12.5 kHz channel I-Q capture is also available to capture channel baseband data to USB memory as tab delimited data for later analysis and replay.

- RF Quality
- Modulation Quality
- Downlink (Talk-Out) Coverage
- Baseband I-Q Channel Capture
- Trunked System Control Channel Messages
- NXDN Test Signal Generator for Receiver Sensitivity Measurements

RF Measurements

- Received channel power
- Frequency error
- Channel Spectrum
- Eye Diagram
- Constellation

Modulation Measurements

- Modulation Fidelity
- Symbol Deviation
- Symbol Rate Error
- Symbol Histogram

Protocol Measurements

- BER on 1031 Hz, O.153, Voice, or Control Channel
- RAN

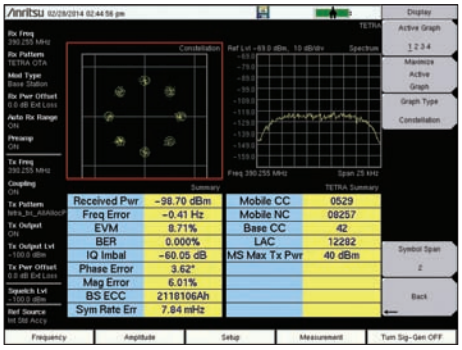
NXDN Analyzer Patterns

- 1031 Hz
- O.153 (V.52, PN9)
- Voice
- Control Channel
- Traffic (DTS)

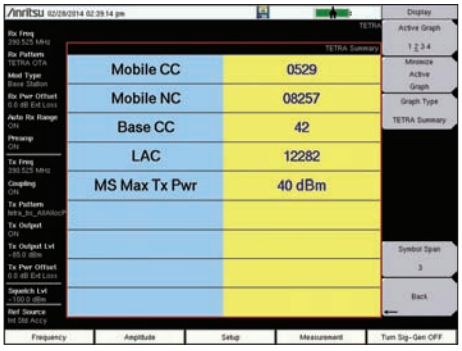
NXDN Generator Test Patterns

- nxdn_1031_4800
- nxdn_1031_9600
- nxdn_511(O.153)_4800
- nxdn_511(O.153)_9600
- nxdn_high_dev_4800
- nxdn_high_dev_9600
- nxdn_low_dev_4800
- nxdn_low_dev_9600
- nxdn_udch_pat_10_4800
- nxdn_udch_pat_10_9600
- nxdn_cac_4800
- nxdn_cac_9600
- nxdn_1031_dts_4800
- nxdn_1031_dts_9600
- nxdn_facch3_dts_4800
- nxdn_facch3_dts_9600
- nxdn_pn9_framed_4800
- nxdn_pn9_framed_9600
- nxdn_1031_cal_4800
- nxdn_1031_cal_9600
- cw
- am_1khz_audio
- fm_1khz_audio

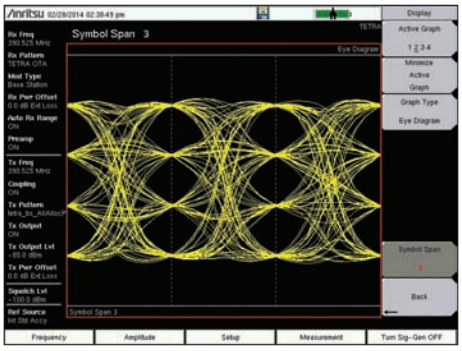
TETRA Analyzer (Option 581)



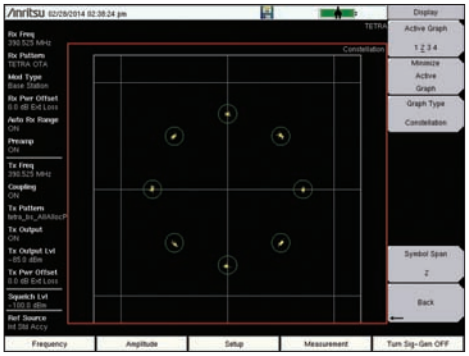
Configurable Quad Display
User-configurable display offers the ability to change screens as needed to suit measurement needs.



TETRA Summary Screen
Provides information on cell configurations and maximum power directives to mobile stations.



Eye Diagram
Distortions in the Eye Diagram will visually indicate variations in amplitude, phase, and inter-symbol timing. Summary screen allow numerical interpretations of error.



Constellation
Distortions in the constellation reveal issues possibly caused by transmitter degradation, multipath, or interference.

TETRA Analyzer

The TETRA Analyzer, Option 581, is designed to test and verify on-the-air performance of Terrestrial Trunked Radio systems. TETRA Analyzer looks at both the physical layer and cell information to give comprehensive insight into real world system performance. Leveraging the LMR Master's high sensitivity receiver, TETRA Analyzer is capable of analyzing PMR system performance at any location. Site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Error Vector Magnitude (EVM)

EVM is the ratio of errors, or distortions, in the actual signal, compared to a perfect signal. EVM faults will result in poor signal quality to all user equipment. High EVM may indicate multipath caused by destructive combining of reflected signals.

IQ Imbalance and Magnitude/Phase Errors

IQ Imbalance shows the ratio difference between the phase states. Magnitude and Phase Errors indicate the cause of IQ errors.

TETRA Summary

Derived from the Base Station control channel, the TETRA Summary screen provides information on the Mobile and Base Color Codes, Network Code, and Location Area Code. It also shows the Mobile Station Maximum Transit Power directive as issued by the base station. Examining these values can help diagnose the causes of user-reported performance issues, and helps ensure that new systems are ready for mission-critical use before wide deployment to users.

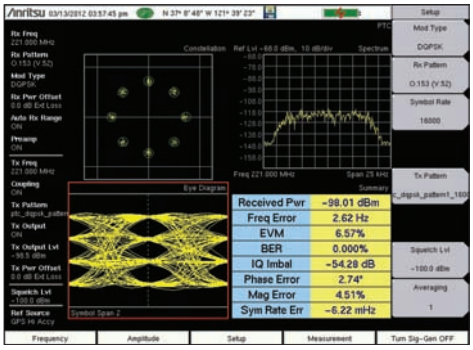
RF Measurements
- Received Power
- Frequency Error
- Channel Spectrum
- Constellation
- Eye Diagram

Modulation Measurements
- Error Vector Magnitude
- Bite Error Rate (BER)
- IQ Imbalance
- Magnitude & Phase Error
- Symbol Rate Error

Protocol Measurements
- Base Station Extended Color Code
- Mobile Color Code
- Mobile Network Code
- Base Station Color Code
- Location Area Code
- Mobile Station Maximum Transmit Power

Base Station Test Patterns
- tetra_bs_idle_unallocPCH
- tetra_bs_busy_allocPCH

PTC Analyzer (Option 721)



PTC Main Screen DQPSK

PTC Signal Analyzer

The PTC Analyzer, Option 721, is designed to test and verify the performance of Positive Train Control radio systems compliant with the ITC-R standard for FRA Class 1 railways. The PTC Analyzer supports measurement of PTC transmitted signals with a direct connection to the transmitter (through a power attenuator) or over-the-air with an antenna. The signal analyzer input has the sensitivity to measure PTC signals down to –115 dBm, allowing transmitter problems to be analyzed and verified miles away. Support for analysis of continuous and burst/packet DQPSK data at Half Rate (8 ksps) and Full Rate (16 ksps) symbol rates is provided.

The built-in PTC signal generator offers three test patterns with various combinations ranging from simple O.153 (PN9) pattern to O.153 patterns with various preambled (as defined by ITCR v1.0 R02).

The generator power level can be controlled over a 130 dB range from 0 to –130 dBm to support receiver sensitivity measurements. The 0 dBm signal level supports amplification to higher levels with an external amplifier for use as a temporary BER test transmitter for coverage assessment. The frequency of the PTC signal generator is independently settable from the PTC Analyzer frequency.

Features include analysis of:

- RF Quality
- Modulation Quality
- Channel Quality

RF Measurements

- Received channel power
- Frequency error
- Channel Spectrum
- Eye Diagram
- Constellation

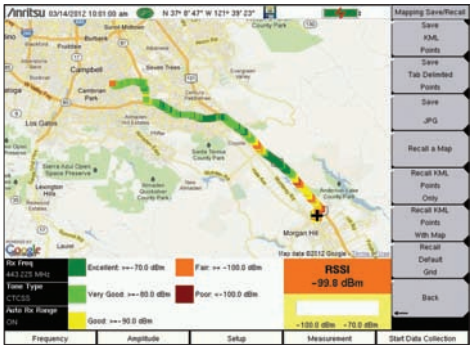
DQPSK Modulation Measurements

- Error Vector Magnitude
- BER
- IQ Imbalance
- Magnitude & Phase Error
- Symbol Rate Error

PTC Analyzer Patterns

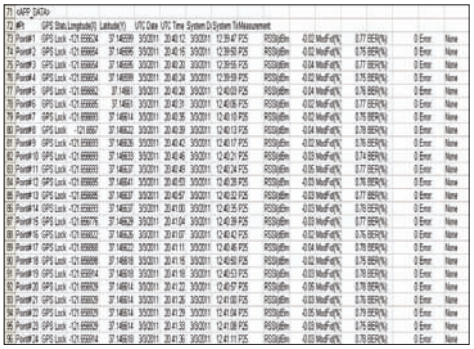
- 0153_cont_1_8000
- 0153_cont_2_8000
- 0153_cont_3_8000
- pn9_normal_1_8000
- pn9_normal_2_8000
- pn9_normal_3_8000
- pn9_normal_4_8000
- pn9_normal_seq_8000
- 0153_cont_1_16000
- 0153_cont_2_16000
- 0153_cont_3_16000
- pn9_normal_1_16000
- pn9_normal_2_16000
- pn9_normal_3_16000
- pn9_normal_4_16000
- pn9_normal_seq_16000
- cw
- am_1khz_audio
- fm_1khz_audio

LMR Coverage Measurements



The LMR Coverage Mapping options provide a map-based view of measurement results along with GPS status. The data points are color-coded according to user-definable level bins for the selected measurement.

The LMR Coverage Mapping options generate a Google Earth KML file with color push pins indicating BER, Modulation Fidelity or EVM, RSSI, THD, or SINAD.



The LMR Coverage Mapping options provide a tab delimited text file for viewing with spreadsheet applications, custom post-processing scripts, or for importing into 3rd-party coverage prediction software.

LMR Coverage Measurements

The LMR Coverage Measurement options, combined with the GPS Option 31, measures and logs key signal quality parameters of land mobile radio systems. For analog FM systems, RSSI, THD and Transmitter SINAD can be mapped. For digital LMR systems BER, Modulation Fidelity (or Error Vector Magnitude), and RSSI can be mapped. All data points are tagged with a GPS location and time and saved to memory approximately once every two seconds. Two files are exportable; a tab-delimited text file for importing to spreadsheet and custom analysis scripts, or an industry-standard KML file for viewing with geo-mapping software such as Google Earth™. In cases where a GPS signal is not available, the LMR Master allows the user to import a floor plan or other map image and use the high-resolution color touchscreen to record data points.

The RSSI value stored into memory is an average of approximately 50,000 separate samples per second taken during the measurement period.

The EVM or Modulation Fidelity values give a good indication of the amount of multipath on the measured signal.

For in-service channel measurements, the Control Channel pattern measures the message error rate and estimates the BER from analysis of the forward error correction on the control channel data.

The Voice pattern estimates the BER on live voice traffic from analysis of the forward error correction data, eliminating the need to take critical systems off the air for analysis and allowing coverage confirmation without operational disruption.

Coverage Mapping Parameters

- Received Channel Frequency
- Receive Signal Pattern
- Auto Receive Range
- Indoor Mapping Repeat Type (Time or Distance)
- Repeat Time
- Repeat Distance
- Distance Units

Coverage Mapping Types

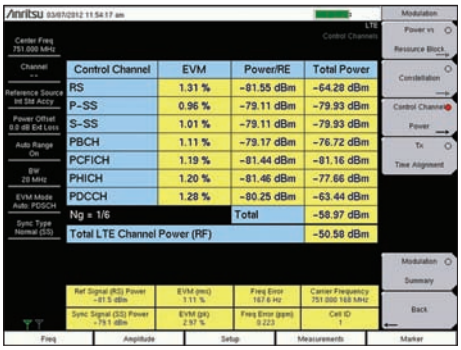
- Analog FM: RSSI, THD, SINAD
- Audio SINAD from External Receiver
- Digital LMR: RSSI, BER, Mod Fid or EVM

Mapping Color Codes

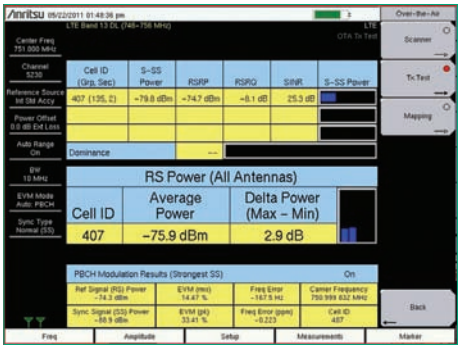
- 5 Levels
- 4 Break Points
- User-adjustable

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

Modulation Quality – Power vs. Resource Block
A high utilization of the Resource Blocks would indicate a cell site in nearing overload and it may be appropriate to start planning for additional capacity.



Modulation Quality – Control Channels
High values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Over-the-Air Measurements – Tx Test
By looking at the reference signals of MIMO antennas one can determine if MIMO is working properly. If the delta power is too large, there is an issue.

LTE Signal Analyzers

The LMR Master features three LTE measurement modes:

- RF Measurements
- Modulation Measurements
- Over-the-Air Measurements (OTA)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous, one can directly connect to the base station to check the signal quality and transmitter power.

Power vs. Resource Block

Determination of system capacity is often best done by analyzing the power by resource blocks. Highly utilized LTE systems may be nearing capacity. Understanding resource block performance allows system planners to anticipate crowding and scale systems for future growth.

Cell ID (Sector ID, Group ID)

Cell ID indicates which base station is being measured OTA. The strongest base station at your current location is selected for measurement. Wrong values for Cell ID lead to inability to register. If the cause is excessive overlapping coverage, it also will lead to poor EVM and low data rates

Frequency Error

Frequency Error is a check to see that the carrier frequency is precisely correct. The LMR Master can accurately measure Carrier Frequency Error OTA if the instrument is GPS enabled or in GPS holdover. Calls will drop when terminals travel at higher speed. In some cases, user equipment cannot hand off into, or out of the cell.

Sync Signal Mapping

Sync Signal Scanner can be used with the GPS to save scan results for later display on a map. The EVM of the strongest synch signal available at that spot is also recorded. The Cell, Sector, and Group ID information is also included so that it's easier to interpret the results. Once the Synch Signals are mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements (Option 541)

- Channel Spectrum
- Channel Power
- Occupied Bandwidth
- ACPR
- RF Summary

Modulation Measurements (Option 542)

- Power vs. Resource Block (RB)
  - RB Power (PDSCH)
  - Active RBs, Utilization %
  - Channel Power, Cell ID
  - OSTP, Frame EVM by modulation
- Constellation
- QPSK, 16 QAM, 64 QAM, 256 QAM (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
- Tx Time Alignment
- Modulation Summary
  - Includes EVM by modulation

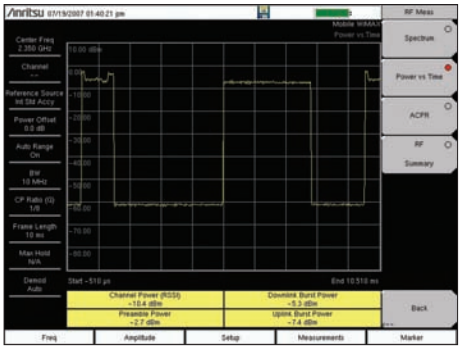
Over-the-Air Scanner (Option 546)

- Scanner
  - Cell ID (Group, Sector)
  - S-SS, RSRP, RSRQ, SINR
  - Dominance
  - Modulation Results – On/Off
  - Auto Save - On/Off
- Tx Test
  - Scanner
  - RS Power of MIMO antennas
  - Cell ID, Average Power
  - Delta Power (Max-Min)
  - Graph of Antenna Power
  - Modulation Results – On/Off
- • Mapping
  - On-screen
    - S-SS, RSRP, RSRQ, or SINR
- Scanner
  - Modulation Results – Off

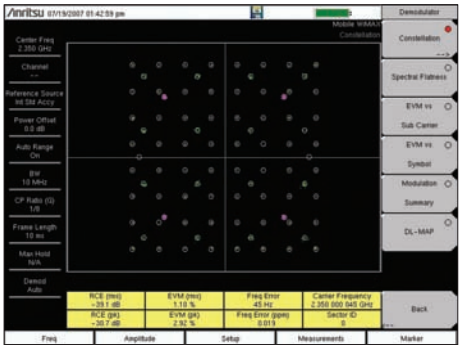
Pass/Fail

- View Pass/Fail Limits
  - All, RF, Modulation
- Available Measurements
  - Channel Power
  - Occupied Bandwidth
  - ACLR
  - Frequency Error
  - Carrier Frequency
  - Dominance
  - EVM peak, rms
  - RS Power
  - SS, P-SS, S-SS Power
  - PBCH Power
  - PCFICH Power
  - Cell, Group, Sector ID
  - OSTP
  - Tx Time Alignment

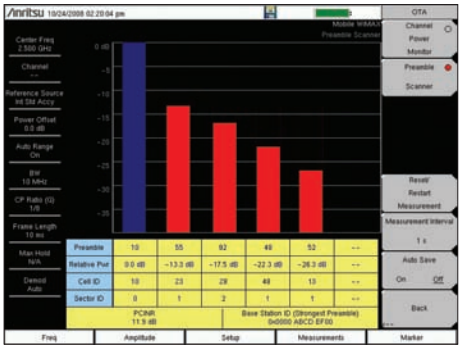
Fixed and Mobile WiMAX Signal Analyzers (Options 46, 47, 66, 67, 37)



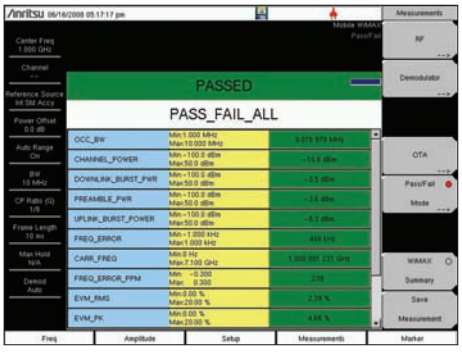
RF Measurement – Preamble Power
High or low values will create larger areas of cell-to-cell interference and create lower data rates near cell edges. Low values affect in-building coverage.



Demodulation – Frequency Error
Calls will drop when user's equipment travels at high speed. In severe cases, hand offs will not be possible at any speed, creating island cells.



Over-the-Air Measurements – PCINR
A low Physical Carrier to Interference plus Noise Ratio (PCINR) indicates poor signal quality, low data rate and reduced sector capacity.



Fixed and Mobile WiMAX Signal Analyzers

The LMR Master features two Fixed WiMAX and three Mobile WiMAX measurement modes:

- RF Measurements
- Demodulation (up to 10 MHz)
- Over-the Air Measurements (OTA) (Mobile only)

The goal of these measurements is to increase data rate and capacity by accurate power settings, ensuring low out-of-channel emissions, and good signal quality. These attributes help to create a low dropped call rate, a low blocked call rate, and a good customer experience.

Cell site technicians or RF engineers can make measurements Over-the-Air (OTA) to spot-check a transmitter's coverage and signal quality without taking the cell site off-line. When the OTA test results are ambiguous one can directly connect to the base station to check the signal quality and transmitter power.

Cell ID, Sector ID, and Preamble

Cell ID, Sector ID, and Preamble show which cell, sector, and segment are being measured OTA. The strongest signal is selected automatically for the additional PCINR and Base Station ID measurement. Wrong values for cell, sector and segment ID lead to dropped hand offs and island cells. If the cause is excessive coverage, it also will lead to large areas of low data rates.

Error Vector Magnitude (EVM) Reletive Constellation Error (RCE)

RCE and EVM measure the difference between the actual and ideal signal. RCE is measured in dB and EVM in percent. A known modulation is required to make these measurements. High RCE and EVM causes low signal quality, low data rate, and low sector capacity. This is the single most important signal quality measurement.

Preamble Mapping (Mobile WiMAX)

Preamble Scanner can be used with the GPS to save scan results for later display on a map. PCINR ratio for the strongest WiMAX preamble available at that spot. The Base Station ID and Sector ID information are also included so that it's easier to interpret the results. Once PCINR data is mapped, it becomes much easier to understand and troubleshoot any interference or coverage issues.

RF Measurements
(Option 46/66, Fixed/Mobile)

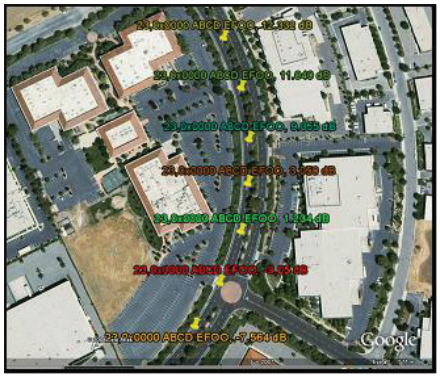
- Channel Spectrum
  - Channel Power
  - Occupied Bandwidth
- Power vs. Time
  - Channel Power
  - Preamble Power
  - Downlink Burst Power (Mobile only)
  - Uplink Burst Power (Mobile only)
  - Data Burst Power (Fixed only)
  - Crest Factor (Fixed only)
- ACPR

Demodulation (10 MHz maximum)
(Option 47/67, Fixed/Mobile)

- Constellation
  - RCE (RMS/Peak)
  - EVM (RMS/Peak)
  - Frequency Error
  - CINR (Mobile only)
  - Base Station ID
  - Carrier Frequency
  - Sector ID
- Spectral Flatness
  - Adjacent Subcarrier Flatness
- EVM vs. Subcarrier/Symbol
  - RCE (RMS/Peak)
  - EVM (RMS/Peak)
  - Frequency Error
  - CINR (Mobile only)
  - Base Station ID
  - Sector ID (Mobile only)
- DL-MAP (Tree View) (Mobile only)

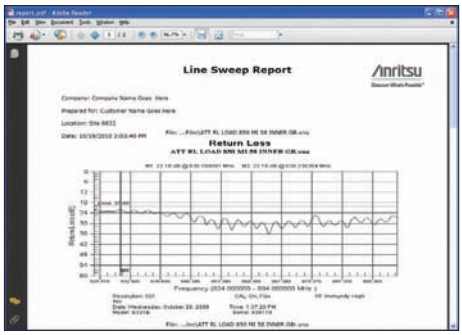
Over-the-Air (OTA)
(Option 37 Mobile only)

- Channel Power Monitor
  - Preamble Scanner (Six)
  - Preamble
  - Relative Power
  - Cell ID
  - Sector ID
  - PCINR
  - Dominant Preamble
    - Base Station ID
- Auto-Save with GPS Tagging and Logging



Line Sweep Tools™ and Master Software Tools™ (for your PC)

Trace Validation
Marker and Limit Line presets allow quick checks of traces for limit violations.



Report Generation
Create reports with company logo, GPS tagging information, calibration status, and serial number of the instrument for complete reporting.

Line Sweep Tools™

Line Sweep Tools increases productivity for people who deal with dozens of Cable and Antenna traces, or Passive Inter-Modulation (PIM) traces, every day.

User Interface

Line Sweep Tools has a user interface that will be familiar to users of Anritsu's Hand Held Software Tools. This will lead to a short learning curve.

Marker and Limit Line Presets

Presets make applying markers and a limit line to similar traces, as well as validating traces, a quick task.

Renaming Grid

A renaming grid makes changing file names, trace titles, and trace subtitles from field values to those required for a report much quicker than manual typing and is less prone to error.

Report Generator

The report generator will generate a professional looking PDF of all open traces with additional information such as contractor logos and contact information.

Line Sweep Features

Presets
7 sets of 6 markers and 1 limit line
Next trace capability

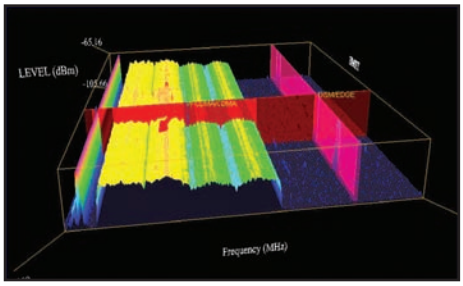
File Types
Input: HHST DAT, MNA and VNA Measurements: Return Loss (VSWR), Cable Loss, DTF-RL, DTF-VSWR, PIM
Output: LS DAT, MNA, VNA, CSV, PNG, BMP, JPG, PDF

Report Generator
Logo, title, company name, customer name, location, date and time, filename, PDF, HTML, all open traces

Tools
Cable Editor
Distance to Fault
Measurement calculator
Signal Standard Editor
Renaming Grid

Interfaces
Serial, Ethernet, USB

Capture Plots to
Screen, Database, DAT files, JPEG, Instrument



3D Spectrogram
For in-depth analysis with 3-axis rotation viewing, threshold, reference level, and marker control. Turn on Signal ID to see the types of signals.

Master Software Tools™

Master Software Tools (MST) is a powerful PC software post-processing tool designed to enhance the productivity of technicians in data analysis and testing automation.

Folder Spectrogram

Folder Spectrogram – creates a composite file of up to 15,000 multiple traces for quick review, also create:

- Peak Power, Total Power, and Peak Frequency plotted over time
- Histogram – filter data and plot number of occurrences over time
- Minimum, Maximum, and Average Power plotted over frequency
- Movie playback – playback data in the familiar frequency domain view
- 3D Spectrogram – for in-depth analysis with 3-axis rotation viewing control

Master Software Tools Features

Database Management
Full Trace Retrieval
Trace Catalog
Group Edit
Trace Editor

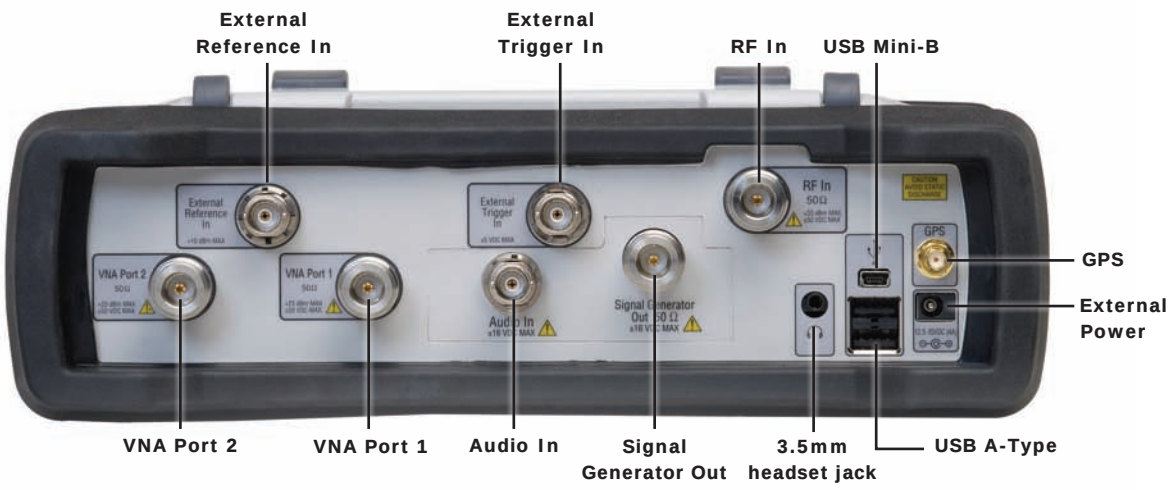
Data Analysis
Trace Math and Smoothing
Data Converter
Measurement Calculator

Mapping (GPS Required)
Spectrum Analyzer Mode
Mobile WiMAX OTA Option
TS-SCDMA OTA Option
LTE, both FDD and TDD Options

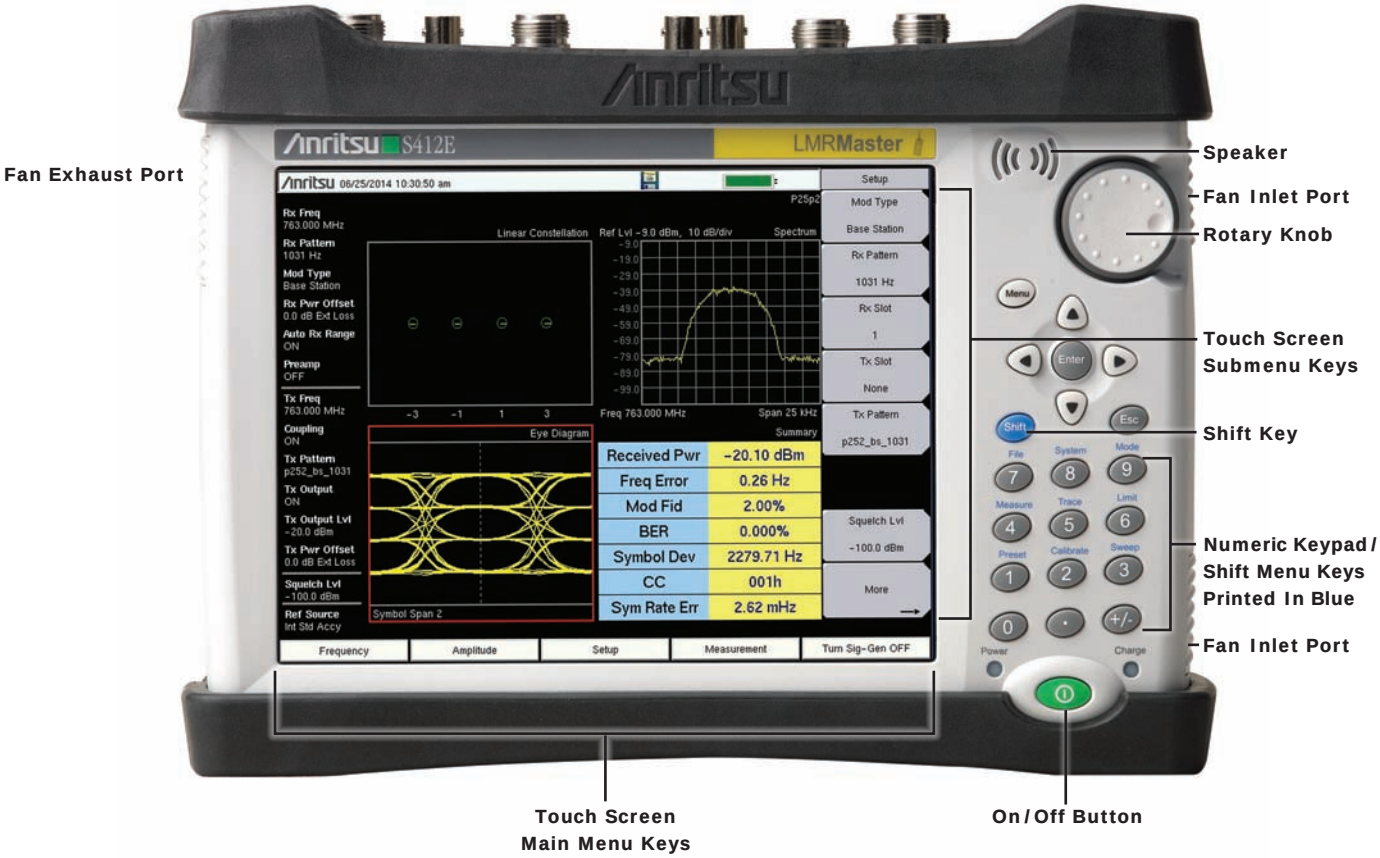
Folder Spectrogram
Folder Spectrogram – 2D View
Video Folder Spectrogram – 2D View
Folder Spectrogram – 3D View

List / Parameter Editors
Traces
Antennas, Cables, Signal Standards
Product Updates
Firmware Upload
Pass/Fail
VSG Pattern Converter
Languages
Mobile WiMAX
Display

LMR Master™ S412E Features

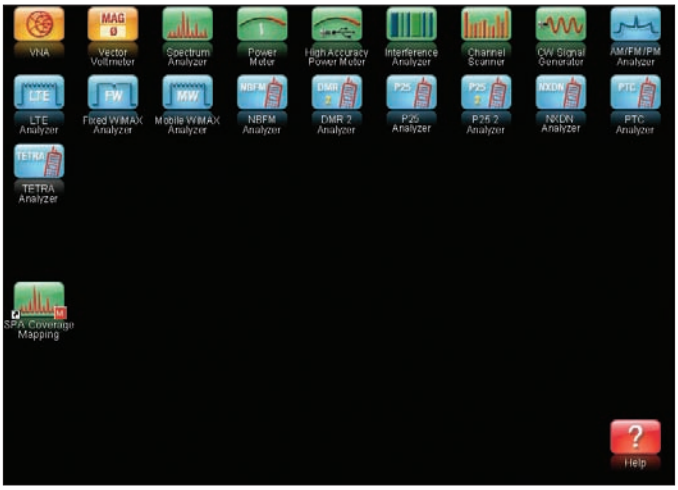


All Connectors are conveniently located on the top panel, leaving the sides clear for handheld use



Handheld Size: 273 x 199 x 91 mm, (10.7 x 7.8 x 3.6 in), Lightweight: 3.6 kg, (7.9 lbs)

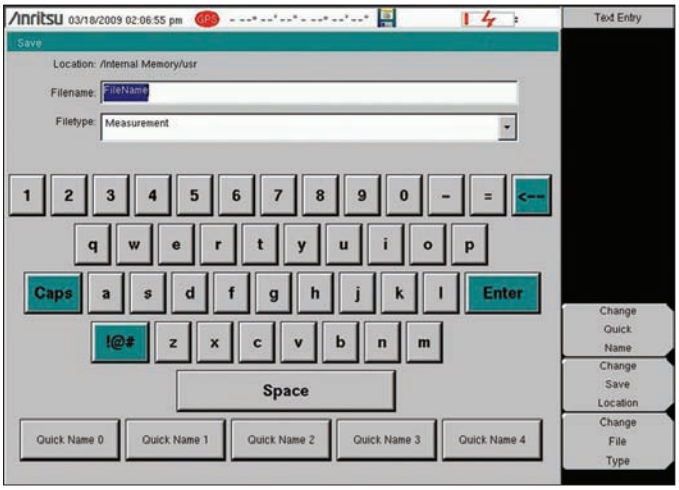
LMR Master™ S412E Features



Touchscreen Menu

The Menu Key activates the touchscreen menu for one button access to all of the Analyzers.

User defined shortcuts can be created for one-button access to commonly used functions.



Touchscreen Keyboard

A built-in touchscreen keyboard saves valuable time in the field when entering trace names.

For Cable and Antenna Analysis, a Quick Name Matrix can be customized for quickly naming your line sweeps.

Tilt bails are integrated into the case and soft case for better screen viewing.

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 0031 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 0031)
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 0031 and 0521)
S412E-0531	NXDN Analyzer Measurements
S412E-0532	NXDN Coverage Measurements (requires Options 0031 and 0531)
S412E-0581	TETRA Analyzer Measurements
S412E-0582	TETRA Coverage Measurements (requires Options 0031 and 0581)
S412E-0591	DMR2 Analyzer Measurements
S412E-0592	DMR2 Coverage Measurements (requires Options 0031 and 0591)
S412E-0721	PTC Analyzer Measurements
S412E-0722	PTC Coverage Measurements (requires Options 0031 and 0721)
S412E-0541	LTE RF Measurements (requires Option 0031)
S412E-0542	LTE Modulation Quality (requires Option 0031)
S412E-0546	LTE Over-the-Air Measurements (requires Option 0031)
S412E-0866	LTE 256 QAM Demodulation (requires Option 00542)
S412E-0046	IEEE 802.16 Fixed WiMAX RF Measurements (requires Option 0031)
S412E-0047	IEEE 802.16 Fixed WiMAX Demodulation (requires Option 0031)
S412E-0066	IEEE 802.16 Mobile WiMAX RF Measurements (requires Option 0031)
S412E-0067	IEEE 802.16 Mobile WiMAX Demodulation (requires Option 0031)
S412E-0037	IEEE 802.16 Mobile WiMAX Over-the-Air Measurements (requires Option 0031)
S412E-0098	Standard Calibration (ANSI 2540-1-1994)
S412E-0099	Premium Calibration (ANSI Z540-1-1994) plus printed test data

LMR Master™ S412E Ordering Information

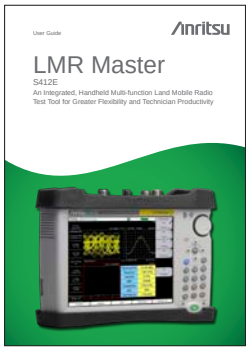
Standard Accessories (Included with instrument)

Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
2000-1691-R	Stylus with Coiled Tether
2000-1654-R	Soft Carrying Case
2300-577	Anritsu Software Tool Box
633-75	Rechargeable 7500 mAh Li-Ion Bat
40-187-R	AC-DC Adapter
806-141-R	Automotive Power Adapter, 12 VDC, 60 Watts
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

Power Sensors (For complete ordering information see the respective data sheets of each sensor)

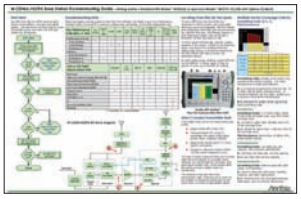
Part Number	Description
PSN50	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, -30 dBM to +20 dBm
MA24105A	Inline Peak Power Sensor, 350 MHz to 4 GHz, +3 dBm to +51.76 dBm (RMS), +33 dBm to +54.77 dBm (Peak)
MA24106A	High Accuracy RF Power Sensor, 50 MHz to 6 GHz, -40 dBm to +23 dBm
MA24108A	Microwave USB Power Sensor, 10 MHz to 8 GHz, -40 dBm to +20 dBm
MA24118A	Microwave USB Power Sensor, 10 MHz to 18 GHz, -40 dBm to +20 dBm
MA24126A	Microwave USB Power Sensor, 10 MHz to 26 GHz, -40 dBm to +20 dBm

Manuals (Soft copy included on Handheld Document Disc and at www.anritsu.com)



Part Number	Description
10920-00060	Handheld Instruments Documentation Disc
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
10580-00244	Spectrum Analyzer Measurement Guide - Interference Analyzer, Channel Scanner, Gated Sweep, CW Signal Generator, AM/FM/PM Analyzer, Interference Mapping, Coverage Mapping
10580-00240	Power Meter Measurement Guide - High Accuracy Power Meter
10580-00234	3GPP Signal Analyzer Measurement Guide - GSM/EDGE, W-CDMA/HSDPA, TD-SCDMA/HSDPA, LTE
10580-00236	WiMAX Signal Analyzer Measurement Guide - Fixed WiMAX, Mobile WiMAX
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
11410-00473	Cable, Antenna, and Component Troubleshooting Guide
11410-00427	Understanding Cable & Antenna Analysis White Paper

Optional Accessories

Directional Antennas

Part Number	Description
MA2700A	InterferenceHunter™
2000-1812-R	450 MHz to 512 MHz, N(f), 5 dBd, Yagi
2000-1411-R	822 MHz to 900 MHz, N(f), 10 dBd, Yagi
2000-1412-R	885 MHz to 975 MHz, N(f), 10 dBd, Yagi
2000-1413-R	1710 MHz to 1880 MHz, N(f), 10 dBd. Yagi
2000-1414-R	1850 MHz to 1990 MHz, N(f), 9.3 dBd, Yagi
2000-1415-R	2400 MHz to 2500 MHz, N(f), 10 dBd, Yagi
2000-1416-R	1920 MHz to 2170 MHz, N(f), 10 dBd, Yagi
2000-1747-R	Portable Log Periodic Antenna, 5.1 dBi, typical, N(f), 0.30 to 5 GHz
2000-1748-R	Portable Log Periodic Antenna, 6 dBi, typical, N(f), 1 to 18 GHz

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)
2000-1487	Telescoping Whip Antenna, BNC **

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

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, N(m) to N(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, N(m) to N(f), 50 Ω
1030-107-R	1910 MHz to 1990 MHz, N(m) to N(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 w/ Reinforced Grip (Recommended for cable & antenna line sweep applications)

Part Number	Description
15RNFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-1.5-R	1.5 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω
15RNFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to N(f), 50 Ω
15RDFN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(f), 50 Ω
15RDN50-3.0-R	3.0 m, DC to 6 GHz, N(m) to 7/16 DIN(m), 50 Ω

Optional Accessories (Continued)

Phase-Stable Test Port Cables, Armored (recommended for use with tightly spaced connectors and other general purpose applications)

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

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-R	BNC(f) to N(m), DC to 1.3 GHz, 50 Ω
510-90-R	7/16 DIN(f) to N(m), DC to 7.5 GHz, 50 Ω
510-91-R	7/16 DIN(f) to N(f), DC to 7.5 GHz, 50 Ω
510-92-R	7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 Ω
510-93-R	7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 Ω
510-96-R	7/16 DIN(m) to 7/16 DIN (m), DC to 7.5 GHz, 50 Ω
510-97-R	7/16 DIN(f) to 7/16 DIN (f), DC to 7.5 GHz, 50 Ω
510-102-R	N(m) to N(m), DC to 11 GHz, 50 Ω, 90 degrees right angle

Precision Adapters

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

Calibration Components, 50 Ω

Part Number	Description
OSLN50-1	Precision Open/Short/Load, N(m), 42 dB, 6.0 GHz, 50 Ω
OSLNF50-1	Precision Open/Short/Load, N(f), 42 dB, 6.0 GHz, 50 Ω
OSLN50A-08	Precision Open/Short/Load, N(m), 42 dB, 8.0 GHz, 50 Ω
OSLNF50-08	Precision Open/Short/Load, N(f), 42 dB, 8.0 GHz, 50 Ω
22N50	Open/Short, N(m), DC to 18 GHz, 50 Ω
22NF50	Open/Short, N(f), DC to 18 GHz, 50 Ω
SM/PL-1	Precision Load, N(m), 42 dB, 6.0 GHz, 50 Ω
SM/PLNF-1	Precision Load, N(f), 42 dB, 6.0 GHz, 50 Ω

Miscellaneous Accessories

Part Number	Description
MA25200A	High Power Tx/Rx Input Protection Module
2000-1528-R	GPS Antenna, SMA(m) with 15 ft cable
2000-1652-R	GPS Antenna, SMA(m) with 1 ft cable
633-75	Extra Extended Capacity Rechargeable 7500 mAh Battery Pack
2000-1374	External Charger for Li-Ion Battery
2000-1797-R	Screen Protector Film
66864	Rack Mount Kit, Master Platform
2000-1689	EMI Near Field Probe Kit

Optional Accessories (Continued)

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

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

High Power Adapter Kits (recommended for cable-attached transmitter analysis, benchtop and mobile installation applications)

50 Watt Adapter Kit

Part Number	Description
1091-420-R	40 dB Dual Directional Coupler
3-1010-123	50 W, 30 dB Attentuator
SM/PL-1	50 Ω Load
15NN50-1.5C	Phase Stable Cable (kit requires Qty 2)

150 Watt Adapter Kit

Part Number	Description
1091-420-R	40 dB Dual Directional Coupler
1010-127-R	150 W, 30 dB Attentuator
SM/PL-1	50 Ω Load
15NN50-1.5C	Phase Stable Cable, N(m) to N(m), 1.5 m
15NNF50-1.5C	Phase Stable Cable, N(m) to N(f), 1.5 m
15NN50-1.0B	Phase Stable Cable, N(m) to N(m), 1.0 m

Notes

Anritsu envision : ensure

Specifications are subject to change without notice.

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