Product Brochure

Anritsu

LMR Master™ S412D

Cable, Antenna, Spectrum, Interference, and P25 / iDEN Modulation Analyzer

From the Industry Leader in Handheld Field Application Instrumentation – a Multi-Function Land Mobile Radio Tester

The LMR Master from Anritsu is a single instrument that combines all of the tools required to install, maintain, and certify Land Mobile Radio systems.

Easy-to-Use

In a single, lightweight, handheld, battery-operated package, the LMR Master combines the functionality of a cable and antenna analyzer, spectrum analyzer, interference analyzer, power meter, channel scanner, transmitter analyzer (P25 and iDEN), transmission analyzer for 2-port devices (built-in RF source), and GPS receiver.

This optimal combination of network test capabilities eases the job of a technician by eliminating the need for several independent test instruments, reducing the number of tools the technician must carry and learn to operate. The LMR Master is a low-cost, easy-to-use, and rugged solution designed specifically for field based technicians and engineers.

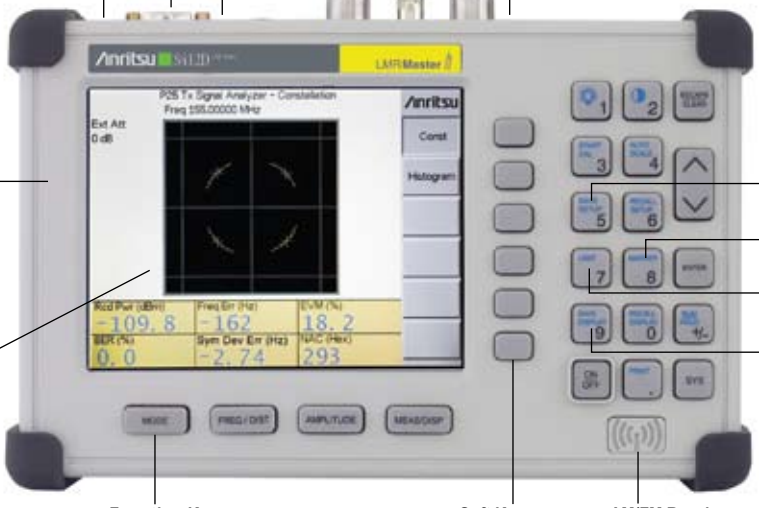
Rugged and Reliable

The Anritsu Handheld S412D is specifically designed for field environments and can easily withstand the day-to-day punishment of field use. The analyzer is almost impervious to the bumps and bangs typically encountered by portable field-based equipment. The battery can be changed without tools in seconds when necessary to help extend measurement time in the field.

Transmissive Color Display

The standard transmissive color display is viewable in direct sunlight and at wide viewing angles.

The LMR Master is the only instrument you need for complete LMR system maintenance and trouble-shooting.



External DC Power Port

Spectrum Analyzer and Power Meter Port

GPS

RS-232 Interface
Transfer stored data to and from a personal computer (PC) via a serial cable for further analysis. Use PC to automatically control and collect data in the field.

Cable and Antenna Analyzer Port

External Trigger and External Frequency Reference In

Snap-in field replaceable battery location

Rugged and Reliable Chassis Design
Ruggedized, lightweight, compact, high-impact housing is designed to withstand repeated drops and rough handling. Weather resistant seals and rubber membrane keypad protect unit from dirt and moisture.

TFT Color Display
Standard TFT (640x480) color display featuring variable brightness control. Viewable in direct sunlight.

Save and Recall Setup
Save 10 to 13 setups for fast repeatable testing (mode dependent).

Marker
Six markers for more comprehensive measurements.

Limit
Create simple pass/fail measurements with a single limit line, upper and/or lower mask limit lines.

Save and Recall Display
Up to 300 memory locations. Alphanumeric data labeling and automatic time/date stamp simplify data management.

Function Keys
Four dedicated function keys simplify measurement tasks.

Soft Keys
Intuitive soft key menu and user interface.

AM/FM Receiver with Internal Speaker
Built-in AM/FM demodulator enables testing and trouble-shooting of wireless communications systems. An internal speaker and headphone jack are included.

Function	Benefits
Cable and Antenna Analyzer	Quickly finds small, hard to identify faults before major failures occur.
Spectrum Analyzer	Easily locate, identify and record various signals with incredible accuracy.
Power Meter	Performs accurate power measurements, reducing holes and interference.
High Accuracy Power Meter	Perform accurate RMS power measurements for both CW and modulated signals.
Channel Scanner	Measures frequency, bandwidth and power of multiple transmitted signals.
Transmission Measurement	Built-in signal source to measure gain or loss of two port devices, as well as tower mounted amplifier antenna isolation measurements and repeater testing.
Interference Analyzer	Identify and locate interfering signals that cause dropped calls and coverage problems. Intermittent problems can be identified using spectrograms.
GPS Receiver	Built-in receiver for location information.
P25 Signal Analyzer	RF measurements, demodulation and BER (1011 Hz pattern) help the technician to quickly check LMR system performance.
P25 Talk-Out Coverage Measurements	Received Power and BER (1011 Hz pattern) along with GPS location and time.
iDEN Signal Analyzer	RF and demodulation measurements to monitor iDEN/WiDEN.
Variable Bias Tee	Eliminates the need for an external power supply when biasing tower mounted amplifier.

Cable and Antenna Analysis – Increase System Uptime

The LMR Master cable and antenna analyzer uses Frequency Domain Reflectometry (FDR) to help technicians and wireless field engineers detect cable, feedline and antenna system problems before they become costly, time-consuming system failures. Superior immunity to ambient RF levels, and excellent directivity and source match ensure accurate and repeatable measurements.

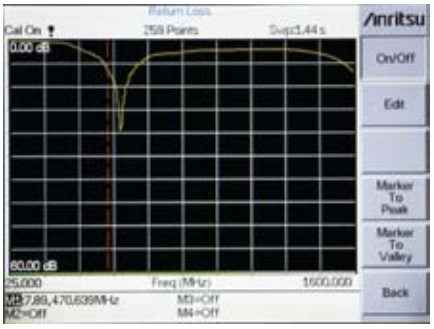
FDR Technique

Frequency Domain Reflectometry (FDR) and Time Domain Reflectometry (TDR) have similar acronyms, and both techniques are used to test transmission lines. But, that's where the similarities end. TDRs are not sensitive to RF problems: the TDR stimulus is a DC pulse, not RF. Thus, TDRs are unable to detect system faults that often lead to system failures. Additionally, FDR techniques save costly, time-consuming trouble shooting efforts by testing cable feedline and antenna systems at their proper operating frequency.

Deficient connectors, lightning arrestors, cables, jumpers or antennas can be replaced before call quality is compromised.

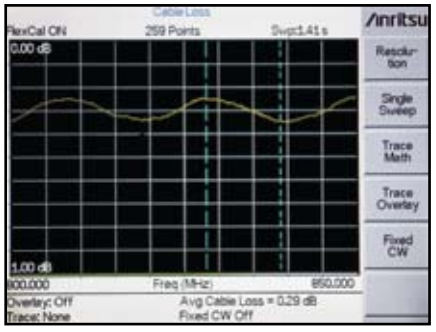
Quick, Simple Measurements

LMR Master performs various RF measurements aimed at simplifying cable feedline and antenna system analysis: Return Loss, SWR, Cable Loss and Distance-to-Fault (DTF). A single softkey selection on the main menu activates the desired measurement mode.



Return Loss, SWR

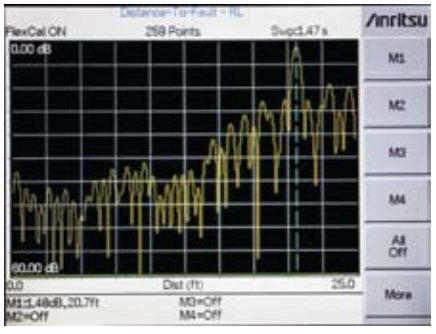
Return Loss measures the signal energy that is "reflected" or returned back to where it came from. VSWR (Voltage Standing Wave Ratio) is another method to measure the reflections. Return Loss and SWR "system" measurements ensure conformance to system performance engineering specifications. Measurements can easily be toggled between the two modes and can be performed without climbing the tower.



Cable Loss

Cable Loss measures the RF energy that is lost to heat and leakage as the signal travels down the cable. Insertion loss can be verified prior to deployment, when you have access to both ends of the cable, or on installed cables with access to the opposite end.

The S412D LMR Master automatically calculates and displays the average cable loss so there's no more guess work or need for complicated calculations in the field.



Distance-to-Fault

Although a Return Loss test can show users the magnitude of signal reflections, it can not show the precise location of a fault within the cable and antenna system. Distance-To-Fault measurements provide the clearest indication of trouble areas as it shows both the magnitude of the signal reflection and the location of the signal anomaly.

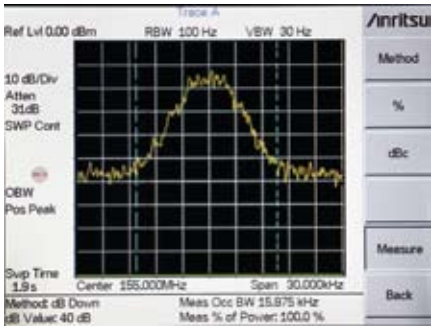
Distance-To-Fault can easily identify connector transitions, jumpers and kinks in the cable and antenna system. Return Loss/SWR measurement data is processed using Fast Fourier Transform and the resulting data indicates Return Loss/SWR versus distance.

Spectrum Analysis – Anywhere, Anytime

The S412D LMR Master integrated spectrum analysis capability provides the “ultimate” in measurement flexibility for field environments and applications requiring mobility. With the S412D you can locate, identify, record and solve communication systems problems quickly and easily, and with incredible accuracy – making it a perfect solution for conducting field measurements in the 100 kHz to 1.6 GHz frequency range.

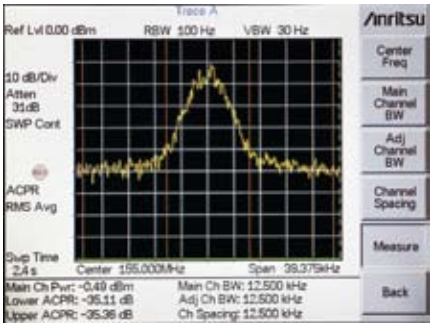
Smart Measurements

The LMR Master has dedicated routines for smart measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR), Carrier-to-Interference and interference analysis. These are increasingly critical measurements for today’s wireless communication systems. The simple interface for these complex measurements significantly reduces test time and increases analyzer usability.



Occupied Bandwidth

This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation depending on the technique used to modulate the carrier. The user can specify percent of power or the “x” dB down point, where “x” can be from 1 dB to 120 dB below the carrier.



Adjacent Channel Power Ratio

A common transmitter measurement is that of adjacent channel leakage power. This is the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel. This measurement is used to replace the traditional two-tone intermodulation distortion (IMD) test for system non-linear behavior.

The result of an ACPR measurement can be expressed either as a power ratio or a power density. In order to calculate the upper and lower adjacent channel values, the LMR Master allows the adjustment of four parameters to meet specific measurement needs: main channel center frequency, measurement channel bandwidth, adjacent channel bandwidth and channel spacing. When an air interface standard and channel are specified in the S412D, all these values are automatically set to the normal values for that standard.

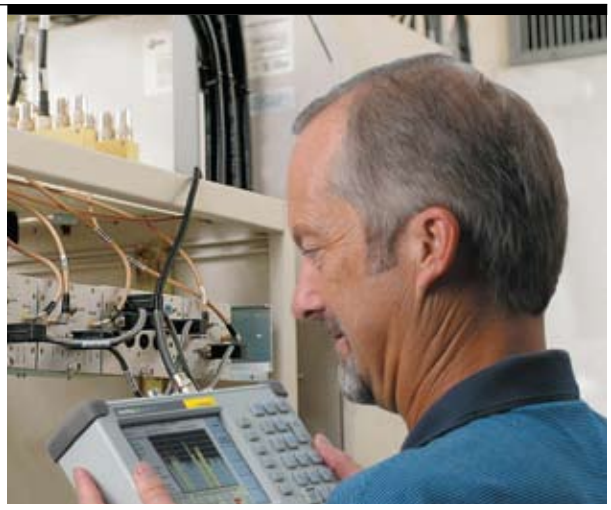
AM/FM Demodulator

A built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows easy identification of interfering signals.

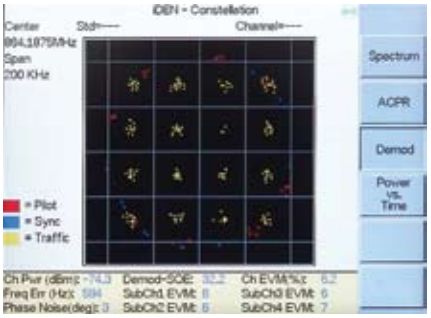
Transmitter Performance Monitoring Made Simple

General purpose test equipment cannot measure all the important parameters of a wireless network. RF technicians and engineers need more sophisticated products to maintain and trouble shoot repeaters. Bench top, fully-featured laboratory design, development and compliance instruments are expensive, big, bulky and very complicated to operate. RF technicians and engineers need an integrated, handheld, multi-function, battery-operated and easy to use product to check repeater performance.

RF measurements (P25 and iDEN) give a general idea of how strong the transmitting signal is and whether the repeater is transmitting at the designated frequency. The LMR Master demodulates the P25 and iDEN signals by connecting to the repeater, or using an over the air antenna.



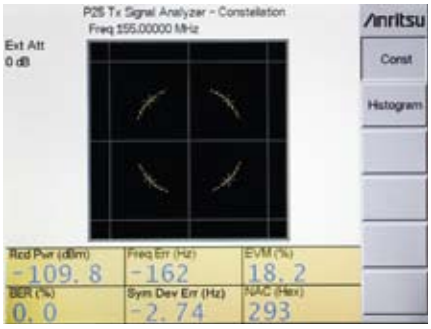
Built-in AM/FM demodulator and internal speaker enhance testing and trouble-shooting of wireless communications systems.



iDEN Signal Analyzer Measurements (Option 0068)

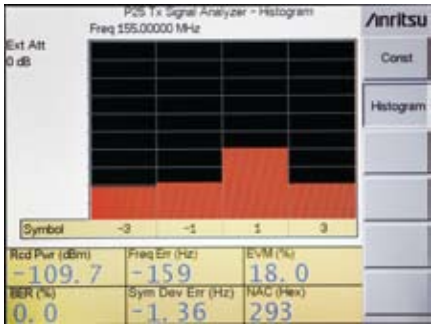
The S412D LMR Master provides a dedicated measurement mode to test performance of iDEN repeaters. This option includes RF and Demodulation measurements of iDEN and WiDEN signals.

– Direct Connect or Over The Air



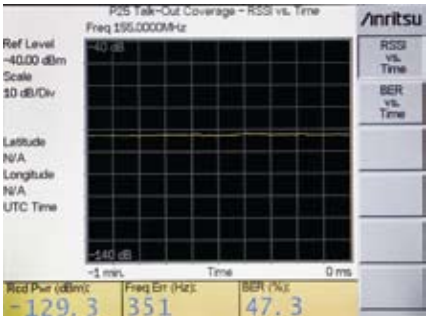
P25 Tx Signal Analyzer (Option 0520)

P25 RF measurements are: frequency error, received power, EVM, Symbol Deviation Error, NAC and BER (1011 Hz pattern). The LMR Master displays Constellation or Histogram.



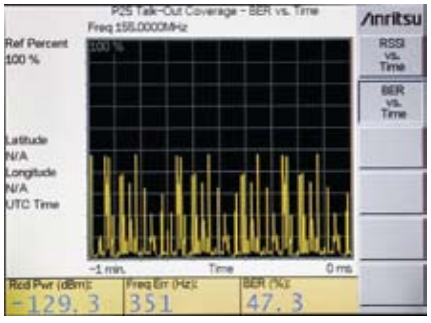
P25 Talk-Out Coverage Measurements (Option 0522)

The LMR Master S412D supports coverage mapping with received power and BER (1011 test pattern) measurements along with GPS location and time. The S412D can accurately measure BER down to realistic –120 dBm signal levels. BER coverage maps provide confidence that communications will be possible even with local interference or multipath. Displays can be automatically stored, providing up to 8 hours of internally stored measurements. Master Software Tools can be used to convert stored traces to comma delimited ASCII files containing GPS location/time, RSSI, and BER.



P25 Talk-Out Coverage RSSI vs. Time Display

A RSSI (Received Signal Strength) Level vs. Time Display is available in the Talk-Out Coverage Mode.

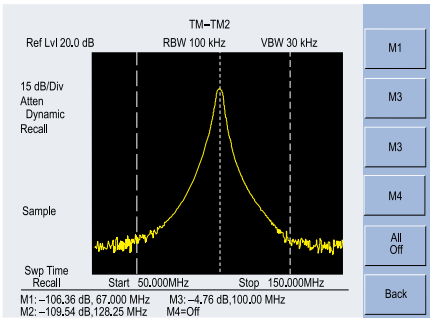


P25 Talk-Out BER vs. Time Display

A BER vs. Time Display is available in the Talk-Out Coverage Mode.

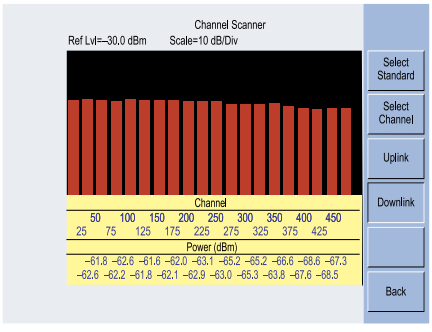
Built-in Multi-Functions to Increase Technician \ Productivity

GPS provides location and UTC time information.



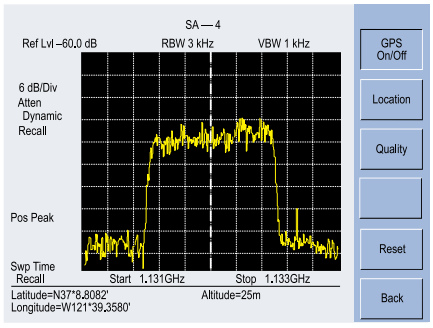
Transmission Measurement (Option 0021)

Transmission Measurement is a two-port measurement covering the 25 MHz to 1.6 GHz frequency range. It is a signal source providing the ability to measure loss or gain of two-port devices such as filters, cables, attenuators, duplexers and tower mounted amplifiers. Transmission measurement can also be used to make antenna-to-antenna isolation measurements and for repeater testing.



Channel Scanner (Option 0027)

The Channel Scanner option measures the power of multiple transmitted signals, and is very useful for measuring channel power in P25 and iDEN systems.

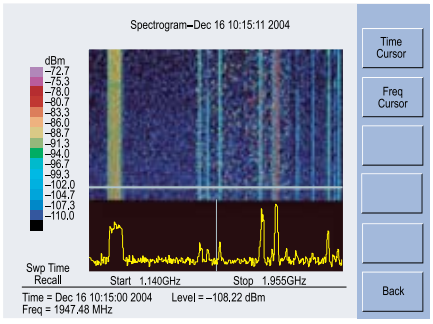


Built-in GPS Provides Location Information (Option 0031)

GPS provides location (latitude, longitude, altitude) and UTC time information. The LMR Master can stamp each trace with location information to check if the measurements were taken at the right location. The LMR Master stores the GPS location information until the unit is turned off, so that the stored location information can be used to stamp traces taken indoors at the same cell site location. The GPS option is offered with a magnet mount antenna with a 15 foot (~ 5m) cable to mount on a car or other handy surface.

Interference Analysis – Critical to Wireless Networks

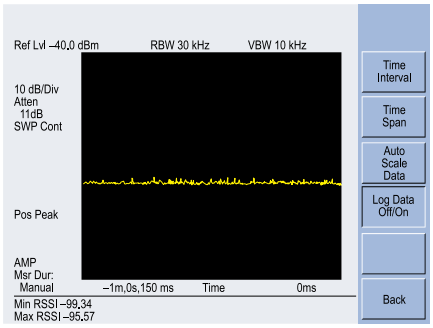
The LMR Master interference analyzer option provides technicians and field engineers the ability to identify and locate interfering signals that affect quality of service. The LMR Master, with built-in preamplifier, can measure signals down to –135 dBm.



Interference Analyzer (Option 0025)

Spectrogram

The LMR Master Spectrogram is a three dimensional display of frequency, power and time of the spectrum activity to identify intermittent interference and track signal levels over time.
The LMR Master can store up to three days worth of measurements.



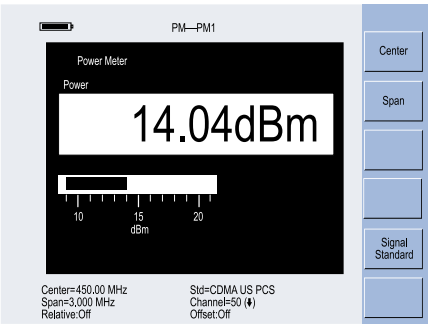
RSSI

RSSI measurement is useful to observe the signal strength of a single frequency over time. The data can be collected for up to seven days.

Locating an Interfering Signal

Connect a directional antenna to the LMR Master and locate the interfering source by measuring the strength of the interfering signal. Signal strength is indicated as an audible beep.

LMR Master Makes High Accuracy Power Measurements

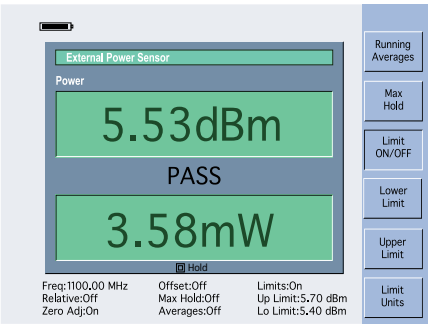


Power Meter (Standard)

The power meter frequency range of 3 MHz to 1.6 GHz performs accurate transmitter power measurements reducing coverage holes and interference. The measured power is the channel based power and the span can be set from 3 MHz to 1.6 GHz. The power can be displayed in dBm or Watts. An external detector is not required for this measurement.

High Accuracy Power Meter (Option 0019)

Anritsu's PSN50 sensor makes high accuracy power measurements from 50 MHz to 6 GHz. The sensor provides true RMS measurements from –30 to +20 dBm, enabling users to make accurate measurements for CW and digitally modulated signals such as CDMA/EV-DO, GSM/EDGE, and WCDMA/HSDPA. The sensor is equipped with an RS-232 interface for fast and easy connection to the LMR Master. Power is displayed in both dBm and Watts. Upper and lower limits can be set for Pass/Fail measurements.



Power Monitor (Option 0005)

The optional Power Monitor features precision, high return loss (low SWR) detectors which can go up to 50 GHz. This excellent impedance match significantly reduces the largest component of power measurement error, mismatch uncertainty. Display formats include absolute power (dBm or Watts) and relative power (dBr or %). Built-in Auto-Averaging automatically reduces the effects of noise while zeroing control allows optimum measurement accuracy at low power levels.

Bias Tee (Option 0010)

The optional bias tee is integrated into the LMR Master and is designed for applications where both DC and RF signals must be applied to a device under test, such as a tower mounted amplifier (TMA).

Master Software Tools™

Master Software Tools provides the user with comprehensive data management and post processing tools which augment the capabilities of the LMR Master. This software provides a simple and easy way to manage, archive, analyze, print measurement reports, customize your cable list, antenna list, signal standards list and keep your LMR Master up to date with the latest instrument firmware.

In addition, Master Software Tools can log RSSI or BER measurements and GPS location/time into PC. The user can easily transfer the comma delimited file into their mapping software. For the most current version of Master Software Tools, please visit www.us.anritsu.com.

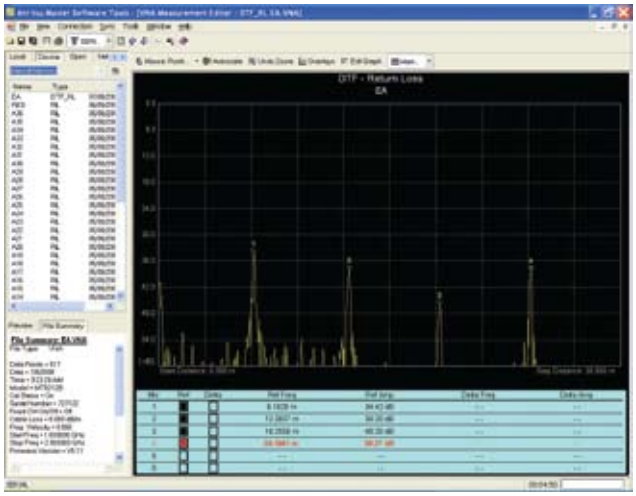


Figure 1, DTF trace transferred to MST

With Master Software Tools™ (Windows® 2000/XP compatible) you can:

- Download and archive all measurements stored in the LMR Master's internal memory with a single menu selection.
- Build historical records with an unlimited number of traces in one document
- Intelligent Trace Renaming features allow you to rename hundreds of traces in minutes instead of hours.
- Edit and create custom signal standards and cable lists
- Create custom reports
- View Spectrogram displays in 3D
- Copy markers and limit lines from one trace to all the traces in a specific folder with easy to use group edit functions.
- Use the Product Update feature to make sure you always use the latest instrument firmware.
- Coordinate cell site locations using Microsoft® MapPoint® and GPS location mapping.
- Export plot data as text files for use in spreadsheets or graphic files (JPG format).

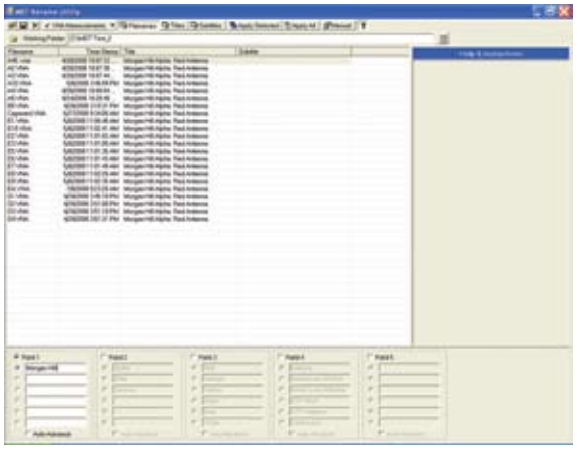


Figure 2, Update file names with the Trace Rename utility

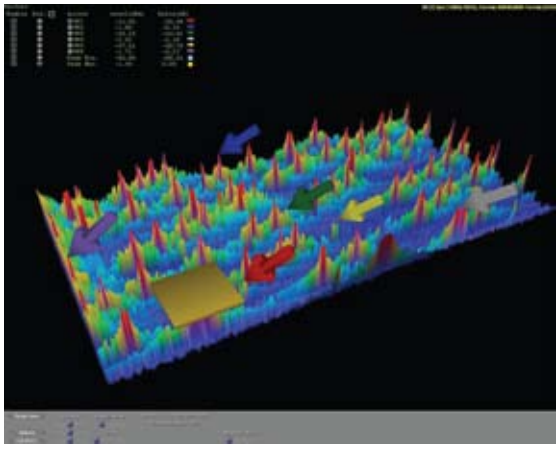


Figure 3, View Spectrogram displays in 3D

Specifications

Cable and Antenna Analyzer

Frequency Range: 25 MHz to 1.6 GHz
Frequency Accuracy: ±50 ppm @ +25 °C
Frequency Resolution: 1 kHz (CW On)
100 kHz (CW Off)
Output Power: < 0 dBm (–10 dBm nominal)
Immunity to Interfering Signals: On-channel +17 dBm
On-frequency –5 dBm
Measurement Speed: ≤2.5 msec / data point (CW ON)
Number of Data Points: 130, 259, 517
Return Loss: Range: 0.00 to 60.00 dB
Resolution: 0.01 dB
VSWR: Range: 1.00 to 65.00
Resolution: 0.01
Cable Loss: Range: 0.00 to 30.00 dB
Resolution: 0.01 dB
Measurement Accuracy: >42 dB corrected directivity after calibration
Distance-To-Fault:
Vertical Range: Return Loss: 0.00 to 60.00 dB
VSWR: 1.00 to 65.00
Horizontal Range: 0 to (# of data pts –1) x
Resolution to a maximum of 1497 m (4912 ft), # of data pts = 130, 259 or 517
Horizontal Resolution
(Rectangular windowing): Resolution (meter) = $(1.5 \times 10^8) \times (V_p)/DF$
Where V_p is the cable's relative propagation velocity and where DF is the stop frequency minus the start frequency (in Hz)

Spectrum Analyzer

Frequency:
Frequency Range: 100 kHz to 1.6 GHz (tuneable to 9 kHz)
Frequency Reference (Internal Timebase):
Aging: ±1 ppm/yr
Accuracy: ±2 ppm
Frequency Span: 10 Hz to 1.59 GHz in 1, 2, 5 step selections in auto mode, plus zero span
Sweep Time: ≤1.3 sec full span; ≤50 µsec to 20 sec zero span
Resolution Bandwidth (–3 dB): 100 Hz to 1 MHz in 1-3 sequence ±5% Accuracy
Video Bandwidth (–3 dB): 3 Hz to 1 MHz in 1-3 sequence
SSB Phase Noise (1 GHz) @ 30 kHz Offset: ≤–75 dBc/Hz
Spurious Responses Input Related: ≤–45 dBc
Spurious Residual Responses: ≤–90 dBm, ≥10 MHz
≤–80 dBm, <10 MHz
(10 kHz RBW, pre-amp on)
Amplitude:
Total Level Accuracy: ±1 dB typical (±1.5 dB max), ≥10 MHz to 1.6 GHz
±2 dB typical <10 MHz for input signal levels –60 dBm, excluding input VSWR mismatch
Measurement Range: +20 dBm to –135 dBm
Input Attenuator Range: 0 to 51 dB, selected manually or automatically coupled to the reference level. Resolution in 1 dB steps.
Displayed Average Noise Level:
≤–135 dBm, ≥10 MHz (preamp on)
≤–115 dBm, <10 MHz (preamp on) for input terminated, 0 dB attenuation, RMS detection, 100 Hz RBW
Dynamic Range: >65 dB, typical
Display Range: 1 to 15 dB/division, in 1 dB steps, 10 divisions displayed
Scale Units: dBm, dBV, dBmV, dBµV, V, W
RF Input VSWR: (with ≥20 dB atten.) 1.5:1 typical, (10 MHz to 1.6 GHz)

AM/FM Demodulator

Standard Speaker and Headphone Jack

Power Meter

Frequency Range: 4.5 MHz to 1.6 GHz
Display Range: –80 dBm to +80 dBm
Measurement Range: –80 dBm to +20 dBm (+80 dBm with external attenuator)
Offset Range: 0 to +60 dB
Accuracy**: ±1 dB typical (±1.5 dB max), ≥10 MHz to 1.6 GHz
±2 dB typical <10 MHz
VSWR: 1.5:1 typical (P_{in} > –30 dBm, >10 MHz to 1.6 GHz)
Maximum Power: +20 dBm (0.1W) without external attenuator

**(Excludes Input VSWR)

Power Monitor (Option 0005)

Display Range: –80 to +80 dBm (10 pW to 100 kW)
Measurement Range: –50 to +16 dBm (10 nW to 40 nW)
Offset Range: 0 to +60 dB
Resolution: 0.1 dB, 0.1 xW
Measurement Accuracy: ±1 dB maximum for >–40 dBm and <18 GHz

Bias Tee (Option 0010)

Voltage: +12 to +24V
Max Power: 6 W (steady state)
Max Current: 6/Voltage (steady state)

High Accuracy Power Meter PSN50 (Option 0019)

Sensor:
Measurement Range: –30 to +20 dBm
Frequency Range: 50 MHz to 6 GHz
Input Connector: Type N, male, 50 Ω
Max Input Without Damage: +33 dBm, ±25 VDC
Input Return Loss: 50 MHz to 2 GHz: ≥26 dB
2 GHz to 6 GHz: ≥20 dB
Accuracy:
Total RSS Measurement Uncertainty (0 to 50 °C): ±0.16 dB*
Noise: 20 nW max
Zero Set: 20 nW
Zero Drift: 10 nW max**
Sensor Linearity: ±0.13 dB max
Instrumentation Accuracy: 0.00 dB
Sensor Cal Factor Uncertainty: ±0.06 dB
Temperature Compensation: ±0.06 dB max
Continuous Digital Modulation Uncertainty: +0.06 dB (+17 to +20 dBm)
System:
Measurement Resolution: 0.01 dB
Offset Range: ±60 dB
Power Requirements:
Supply Voltage: 8 to 18 Vdc
Supply Current: <100 mA

* Excludes mismatch errors.
Excludes noise, zero set, zero drift for levels <–20 dBm.
Excludes digital modulation uncertainty between +17 and +20 dBm.
** After 30 min warm-up

Transmission Measurement (Option 0021)

RF Source:
Frequency Range: 25 MHz to 1.6 GHz
Frequency Resolution: 10 Hz
Output Power Level: –10 dBm typical
Dynamic Range: 80 dB
Output Impedance: 50 Ω

Interference Analyzer (Option 0025)

Identify Interference type
Audible tone - Strength of the Interferer
RSSI
Spectrogram

Channel Scanner (Option 0027)

Frequency Range: 100 kHz to 1.6 GHz
Frequency Accuracy: ±10 Hz + Time base error, 99% Confidence level
Measurement Range: +20 dBm to –110 dBm
Channel Power: ±1 dB typical (±1.5 dB max)
Adjacent Channel Power Accuracy: ±0.75 dBc

Specifications (Continued)

GPS (Option 0031)

GPS Location Indicator
Latitude, Longitude and Altitude on Display
Latitude, Longitude and Altitude with trace storage

P25 Tx Signal Analyzer (Option 0520)

Modulation: C4FM
Received Power
Frequency Error
Symbol Deviation Error
NAC
BER (1011 Hz pattern)
EVM
Graphs: Constellation, Histogram

P25 Talk-Out Coverage Measurements (Option 0522)

Received power or BER (1011 test pattern), along with GPS location and time

iDEN Signal Analyzer (Option 0068)

Modulation Type: 16 QAM
Frequency Error: ±0.05 ppm+time, Base Error: 99% confidence level
Channel Power: ±1.5 dB

General

Language Support: English
Internal Trace Memory: Up to 300 traces
Setup Configurations:
S412D: 15 to 40 setups (VNA-10, SPA/TM-5, Power Meter-5, High Accuracy Power Meter-5, IA-5, Channel Scanner-5, P25-5)
Display: TFT Color display, viewable in sunlight
Inputs and Outputs Ports:
RF Out: Type N, female, 50 Ω
Maximum Input without Damage: +20 dBm, ±50 VDC
RF In: Type N, female, 50 Ω
Maximum Input without Damage: +43 dBm (Peak), ±50 VDC
Ext. Trig In: BNC, female (5V TTL)
Ext. Freq Ref In (2 to 20 MHz): Shared BNC, female, 50 Ω, (–15 dBm to +10 dBm)
GPS Antenna: reverse BNC
Serial Interface: RS-232 9 pin D-sub, three wire serial
Electromagnetic Compatibility: Meets European Community requirements for CE marking
Safety: Conforms to EN 61010-1 for Class 1 portable equipment
Temperature:
Operating: –10 °C to 55 °C, humidity 85% or less
Non-operating: –51 °C to +71 °C (Recommend the battery be stored separately between 0 °C and +40 °C for any prolonged non-operating storage period.)
Power Supply:
External DC Input: +12.5 to +15 VDC, 1500mA
Internal: NiMH battery: 10.8 volts, 1800 mA maximum
Dimensions:
Size (w x h x d): 254 mm x 178 mm x 61 mm (10.0 in x 7.0 in x 2.4 in)
Weight: <2.28 kg (<5 lbs) includes battery

Ordering Information

Base Model

S412D	Cable and Antenna Analyzer (25 MHz to 1.6 GHz), Spectrum Analyzer (100 kHz to 1.6 GHz), and Power Meter (4.5 MHz to 1.6 GHz)

Options

S412D-0005	Power Monitor (requires external detector)
S412D-0010	Bias Tee
S412D-0019	High Accuracy Power Meter (PSN50 sensor not included)
S412D-0021	Transmission Measurement
S412D-0025	Interference Analyzer (requires directional antenna)
S412D-0027	Channel Scanner
S412D-0031	GPS (includes GPS antenna)
S412D-0520	P25 Tx Signal Analyzer
S412D-0522	P25 Talk-Out Coverage Measurements (requires Option 0031)
S412D-0068	iDEN Signal Analyzer

Standard Accessories Include:

10580-00260	LMR Master User Guide (for Model S412D)
2300-498	Anritsu Master Software Tools CDROM
65717	Soft Carrying Case
633-27	Rechargeable Battery, NiMH
40-168-R	AC-DC Adapter with Power Cord
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
800-441	Serial Interface Cable
551-1691-R	USB to RS232 adapter cable
	One Year Warranty

Optional Accessories

1N50C	Limiter, N(m) to N(f), 50 Ω, 10 MHz to 18 GHz
42N50-20	Attenuator, 20 dB, 5 watt, DC to 18 GHz, N(m)-N(f)
42N50A-30	Attenuator, 30 dB, 50 watt, DC to 18 GHz, N(m)-N(f)
1010-127-R	Attenuator, 40 dB, 150 watt, DC to 3 GHz, N(m)-N(f)

Calibration Components

ICN50B	InstaCal™ Calibration Module, 2 MHz to 6.0 GHz, N(m), 50 Ω
22N50	Open/Short, DC to 18 GHz, N(m), 50 Ω
22NF50	Open/Short, DC to 18 GHz, N(f), 50 Ω
SM/PL-1	Precision Load, DC to 6 GHz, 42 dB, N(m), 50 Ω
SM/PLNF-1	Precision Load, DC to 6 GHz, 42 dB, N(f), 50 Ω
OSLN50-1	Precision Open/Short/Load, DC to 6 GHz, 42 dB, 50 Ω, N(m)
OSLNF50-1	Precision Open/Short/Load, DC to 6 GHz, 42 dB, 50 Ω, N(f)
2000-767	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN(m), 50 Ω
2000-768	Precision Open/Short/Load, DC to 4 GHz, 7/16 DIN(f), 50 Ω

Test Port Cables

806-186-R	Cable, 0.91 meters, N(m)-N(f), 4 GHz, 50 Ω
806-187-R	Cable, 0.91 meters, N(m)-N(m), 4 GHz, 50 Ω

Phase Stable Test Port Cables Armored

15NN50-1.5C	Test Port Cable Armored, 1.5 meters, N(m)-N(m), 6 GHz, 50 Ω
15NN50-3.0C	Test Port Cable Armored, 3.0 meters, N(m)-N(m), 6 GHz, 50 Ω
15NN50-5.0C	Test Port Cable Armored, 5.0 meters, N(m)-N(m), 6 GHz, 50 Ω
15NNF50-1.5C	Test Port Cable Armored, 1.5 meters, N(m)-N(f), 6 GHz, 50 Ω
15NNF50-3.0C	Test Port Cable Armored, 3.0 meters, N(m)-N(f), 6 GHz, 50 Ω
15NNF50-5.0C	Test Port Cable Armored, 5.0 meters, N(m)-N(f), 6 GHz, 50 Ω
15ND50-1.5C	Test Port Cable Armored, 1.5 meters, N(m)-7/16 DIN(m), 6 GHz, 50 Ω
15NDF50-1.5C	Test Port Cable Armored, 1.5 meters, N(m)-7/16 DIN(f), 6 GHz, 50 Ω
15RNFN50-1.5-R	Test Port Cable Armored with Reinforced Grip, 1.5 meters, N(m)-N(f), 6 GHz 50 Ω

Adapters

34NN50A	Precision Adapter, N(m)-N(m), DC to 18 GHz, 50 Ω
34NFNF50	Precision Adapter, N(f)-N(f), DC to 18 GHz, 50 Ω
1091-26	Adapter, N(m)-SMA(m), DC to 18 GHz, 50 Ω
1091-27	Adapter, N(m)-SMA(f), DC to 18 GHz, 50 Ω
1091-80-R	Adapter, N(f)-SMA(m), DC to 18 GHz, 50 Ω
1091-81-R	Adapter, N(f)-SMA(f), DC to 18 GHz, 50 Ω
1091-172	Adapter, N(m)-BNC(f), DC to 1.3 GHz, 50 Ω
510-90	Adapter, 7/16 DIN(f)-N(m), DC to 7.5 GHz, 50 Ω
510-91	Adapter, 7/16 DIN(f)-N(f), DC to 7.5 GHz, 50 Ω
510-92	Adapter, 7/16 DIN(m)-N(m), DC to 7.5 GHz, 50 Ω
510-93	Adapter, 7/16 DIN(m)-N(f), DC to 7.5 GHz, 50 Ω
510-96	Adapter, 7/16 DIN(m)-7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97	Adapter, 7/16 DIN(f)-7/16 DIN(f), DC to 7.5 GHz, 50 Ω
510-102	Adapter, N(m)-N(m) 90° right angle, DC to 11 GHz, 50 Ω
513-62	Adapter, TNC(f)-N(f), 18 GHz, 50 Ω
1091-315	Adapter, TNC(m)-N(f), 18 GHz, 50 Ω
1091-324	Adapter, TNC(f)-N(m), 18 GHz, 50 Ω
1091-325	Adapter, TNC(m)-N(m), 18 GHz, 50 Ω
1091-317	Adapter, TNC(m)-SMA(f), 18 GHz, 50 Ω
1091-318	Adapter, TNC(m)-SMA(m), 18 GHz, 50 Ω

Bandpass Filters

1030-105-R	Filter, Bandpass, 890 to 915 MHz, N(m) to SMA(f), 50 Ω
1030-109-R	Filter, Bandpass, 824 to 849 MHz, N(m) to SMA(f), 50 Ω
1030-110-R	Filter, Bandpass, 880 to 915 MHz, N(m) to SMA(f), 50 Ω

Portable Antennas

2000-1035	SMA(m), 846 to 941 MHz, 50 Ω
2000-1200	SMA(m), 806 to 869 MHz, 50 Ω
2000-1473	SMA(m), 870 to 960 MHz, 50 Ω

Directional Antennas

2000-1411	Portable Yagi Antenna, 10 dBd, N(f), 822 to 900 MHz
2000-1412	Portable Yagi Antenna, 10 dBd, N(f), 885 to 975 MHz

Ordering Information (Continued)

Miscellaneous Accessories

2000-1410	Magnet Mount GPS Antenna with 15 ft. (4.57 m) cable
551-1691-R	USB to RS-232 adapter cable
67135	Backpack, 25 lb. max weight limit
65717	Soft Carrying Case
760-243-R	Transit Case
633-27	Rechargeable Battery, NiMH
2000-1029	Battery Charger, NiMH, w/ Universal Power Supply
40-168-R	AC/DC Adapter
806-141	Automotive Cigarette Lighter/12 Volt DC Adapter
800-441	Serial Interface Cable
2300-498	Master Software Tools CDROM

High Accuracy Power Meter Accessories

PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
40-168-R	AC-DC Adapter
800-441	Serial Interface Cable
3-1010-122	Attenuator, 20 dB, 5 Watt, DC to 12.4 GHz, N(m)-N(f)
3-1010-123	Attenuator (Bi-directional), 30 dB, 50 Watt, DC to 8.5 GHz, N(m)-N(f)
3-1010-124	Attenuator (Uni-directional), 40 dB, 100 Watt, DC to 8.5 GHz, N(m)-N(f)
1010-127-R	Attenuator, 30 dB, 150W, DC to 3 GHz, N(m)-N(f)
1010-128-R	Attenuator, 40 dB, 150W, DC to 3 GHz, N(m)-N(f)
65701	3 GHz Offset Cal Kit consisting of one each: 3-1010-119, 10 dB Attenuator, DC to 6 GHz, 2W 3-806-151, 4 GHz Cable, 18” (46 cm)

Manuals

10580-00260	LMR Master User Guide (for Model S412D)
10580-00261	LMR Master Programming Manual (for Model S412D)

Training Course

10580-00263	Interference Analysis for Land Mobile Radio

Power Monitor - Detectors

The 5400 and 560 Series Detectors use zero-biased Schottky diodes. Measurement range is –55 dBm to +16 dBm using single cycle per sweep AC detection, auto-zeroing with DC detection during the frequency sweep. Extender cables of over 3000 feet (914.4 meters) can be used with the S412D LMR Master.

Model	Frequency Range	Impedance	Return Loss	Input Connector	Frequency Response
5400-71N50	0.001 to 3 GHz	50 Ω	26 dB	N(m)	±0.2 dB, <1 GHz ±0.3 dB, <3 GHz
5400-71N75	0.001 to 3 GHz	75 Ω	26 dB, <2 GHz 20 dB, <3 GHz	N(m)	±0.2 dB, <1 GHz ±0.5 dB, <3 GHz
560-7N50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	N(m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7S50B	0.01 to 20 GHz	50 Ω	15 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 14 dB, <20 GHz	WSMA(m)	±0.5 dB, <18 GHz ±1.25 dB, <20 GHz
560-7K50	0.01 to 40 GHz	50 Ω	12 dB, <0.04 GHz 22 dB, <8 GHz 17 dB, <18 GHz 15 dB, <26.5 GHz 14 dB, <32 GHz 13 dB, <40 GHz	K(m)	±0.5 dB, <18 GHz ±1.25 dB, <26.5 GHz ±2.2 dB, <32 GHz ±2.5 dB, <40 GHz
560-7VA50	0.01 to 50 GHz	50 Ω	12 dB, <0.04 GHz 19 dB, <20 GHz 15 dB, <40 GHz 10 dB, <50 GHz	V(m)	±0.8 dB, <20 GHz ±2.5 dB, <40 GHz ±3.0 dB, <50 GHz

Detector Extension Cables

800-109	7.6 m (25 ft.)
800-111	30.5 m (100 ft.)

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Catalog No. 11410-00482, Rev. A Printed in United States 2008-12