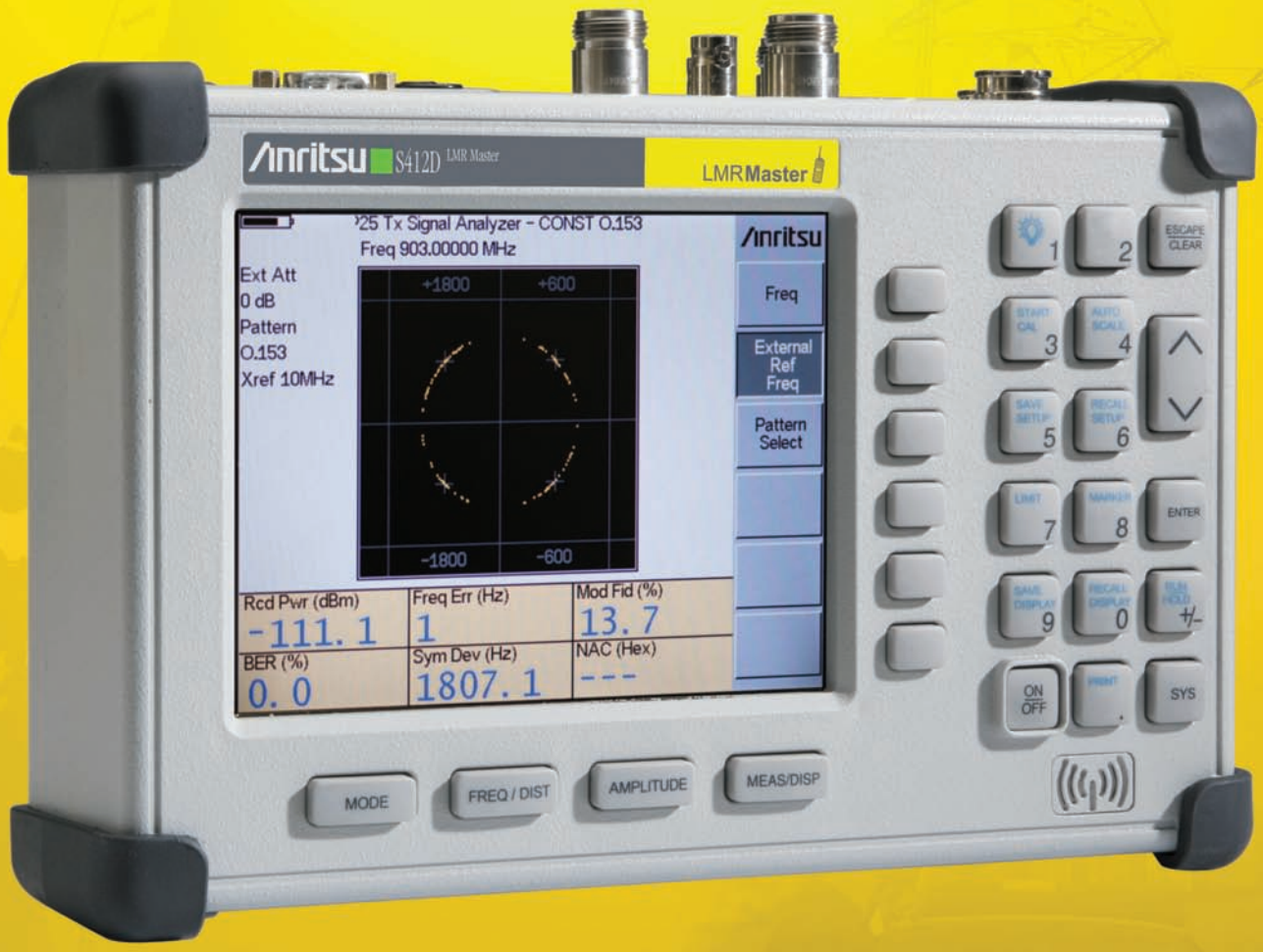
Product Brochure

Anritsu

LMR Master™ S412D

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

Now with NXDN and GPS Enhanced Frequency Accuracy



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, NXDN, 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.

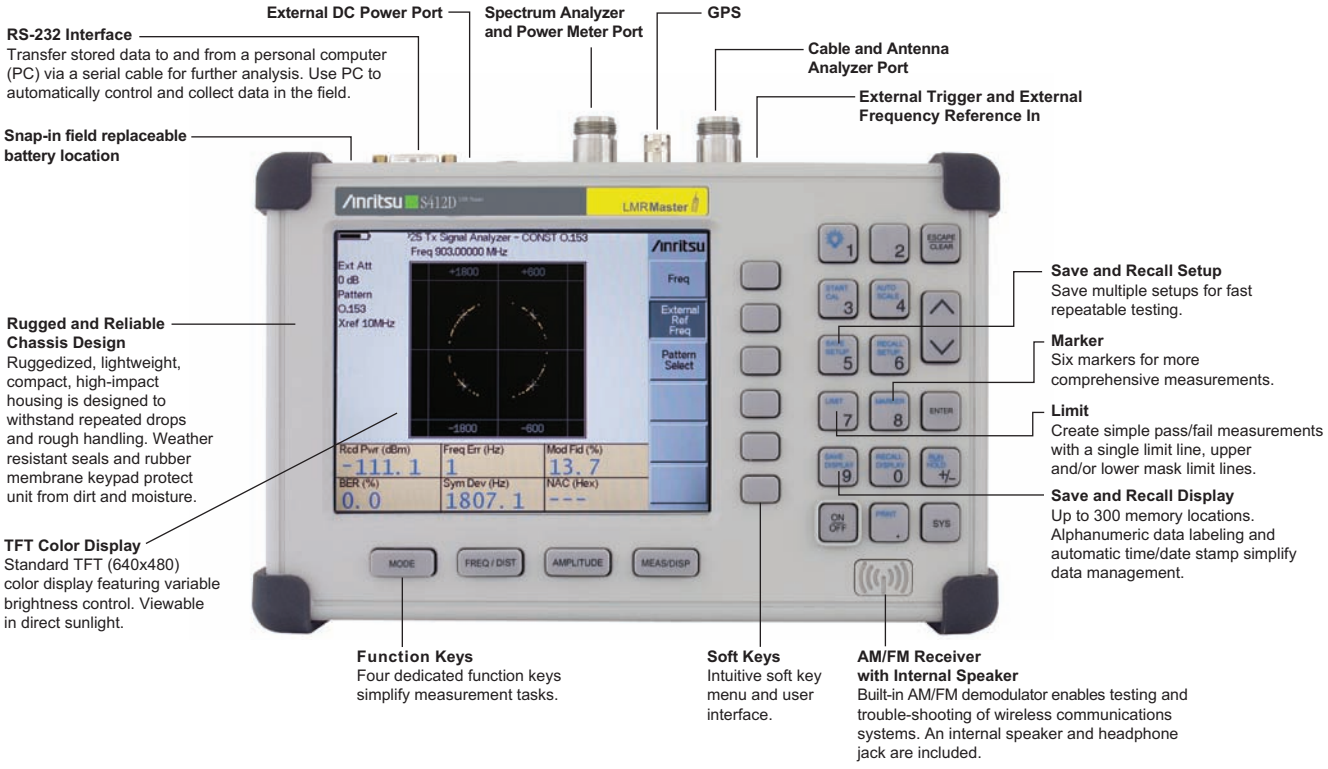
Rugged and Reliable

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 offers the most complete test functionality for LMR system maintenance and trouble-shooting.



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. Improves frequency accuracy to 120 ppb when on and active.
P25 Signal Analyzer	RF measurements, demodulation and BER for 1011 Hz, and 0.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic to help the technician to quickly check LMR system performance.
P25 Talk-Out Coverage Measurements	Received Power and BER for 1011 Hz, and 0.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic) along with GPS location and time.
NXDN Signal Analyzer	RF measurements, demodulation and BER for 0.153 test pattern and BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic to help the technician to quickly check NXDN system performance.
NXDN Talk-Out Coverage Measurements	Received Power and BER for 0.153 test pattern, and BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic) 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.
CW Signal Generator	CW signal generator provides a CW signal source to test low noise amplifiers, repeaters, and for base station receiver sensitivity testing.

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.

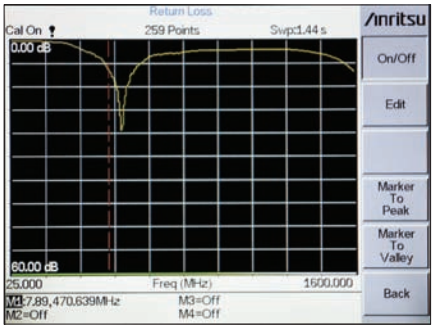
FDR Technique

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.

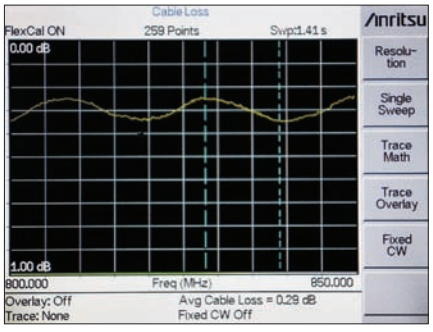
Quick, Simple Measurements

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

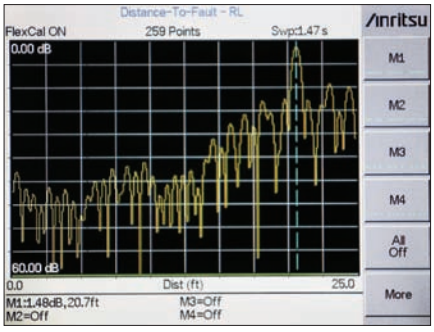
Return Loss measures the signal energy that is "reflected" or returned back to where it came from. VSWR (Voltage Standing Wave Ratio) is another method to measure the reflections. Return Loss and SWR "system" measurements ensure conformance to system performance engineering specifications. Measurements 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.

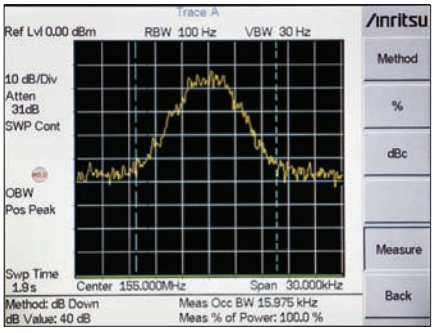
Distance-To-Fault can easily identify connector transitions, jumpers and kinks in the cable and antenna system. Return Loss/SWR measurement data is processed using Fast Fourier Transform and the resulting data indicates Return Loss/SWR versus distance.

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.

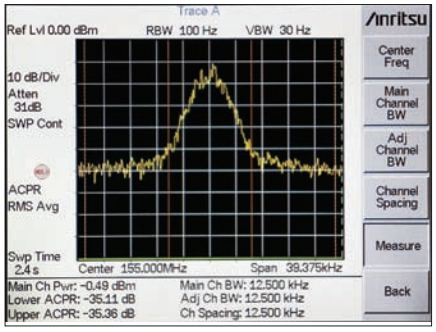
Smart Measurements

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.

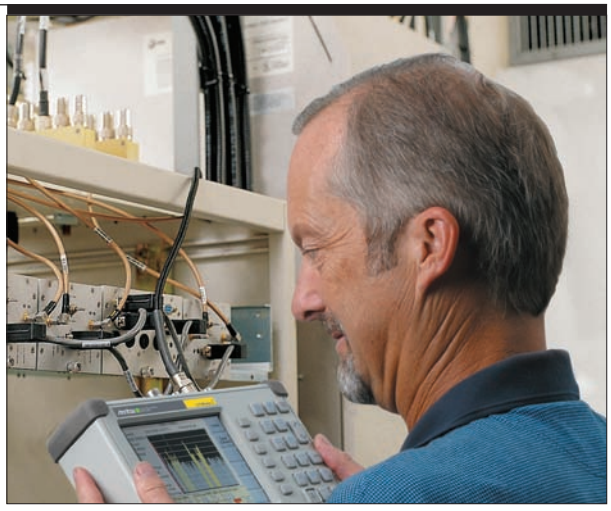
AM/FM Demodulator

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

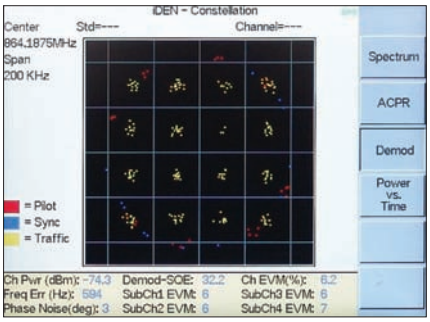
Transmitter Performance Monitoring Made Simple

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, NXDN, 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, NXDN and iDEN signals by connecting to the repeater, or using an over the air antenna.



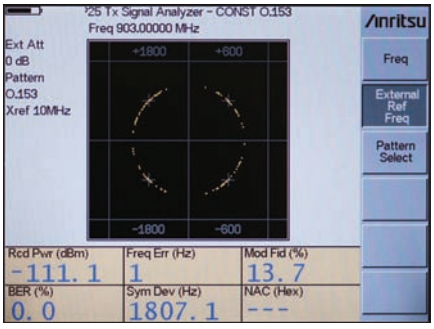
Built-in AM/FM demodulator and internal speaker enhance testing and trouble-shooting of wireless communications systems.



iDEN Signal Analyzer Measurements (Option 68)

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



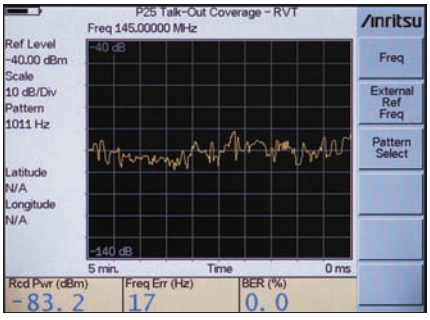
P25 Tx Signal Analyzer (Option 520)

P25 RF measurements are: frequency error, received power, EVM, Symbol Deviation Error, NAC and BER for 1011 Hz, and O.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic.The LMR Master displays Constellation or Histogram, or Control Channel Hex decode. The Control Channel display can be triggered to stop on a specific octet. The Control Channel traffic can also be streamed to the RS232 port to a PC running Microsoft HyperTerminal software.

The Tx Signal Analyzer mode can also decode and display the control channel messages in a P25 trunked system. Snapshots of 17 messages can be displayed directly on the S412D display. Specific message headers can be selected as a trigger point. Control channel messages can be streamed out the RS232 port to a PC using Microsoft HyperTerminal.

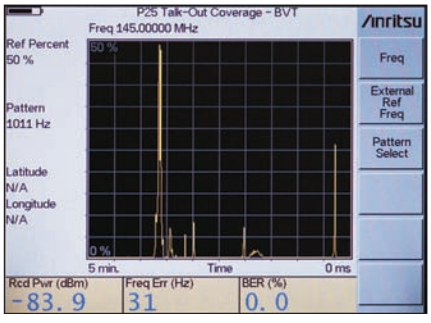
P25 Talk-Out Coverage Measurements (Option 522)

The LMR Master S412D supports coverage mapping with received power and BER/MER measurements along with GPS location and time. The S412D can accurately measure BER/MER down to realistic -110 dBm signal levels. BER/MER 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/MER. A horizontal limit line may be set to give audio indication of RSSI or BER above or below a level.



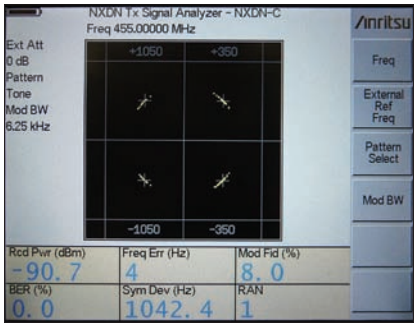
P25 Talk-Out Coverage RSSI vs. Time Display

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

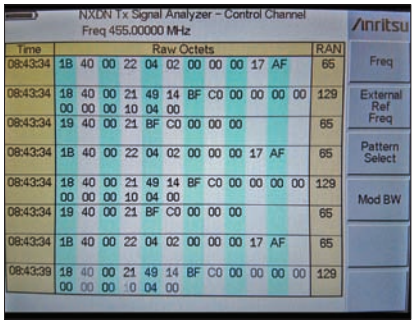


P25 Talk-Out BER/MER vs. Time Display

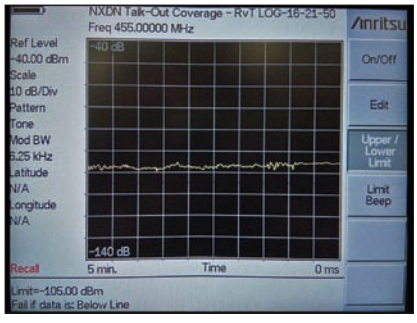
A BER/MER vs. Time Display is available in the Talk-Out Coverage Mode.

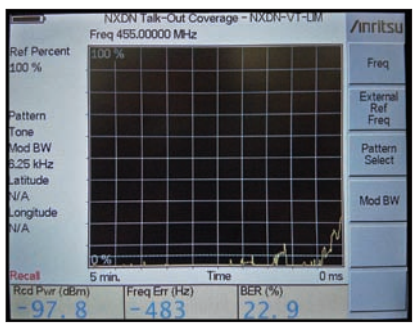


The Constellation display gives a visual indication of the multipath level.



Eight NXDN trunking control channel messages can be displayed in the Tx Signal Analyzer Mode.





NXDN Tx Signal Analyzer (Option 530)

NXDN RF measurements are: frequency error, received power, EVM, Symbol Deviation Error, RAN and BER for O.153 test pattern, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic. The LMR Master displays Constellation or Histogram, or Control Channel Hex decode. The Control Channel display can be triggered to stop on a specific octet. The Control Channel traffic can also be streamed to the RS232 port to a PC running Microsoft HyperTerminal software.

The Tx Signal Analyzer mode can also decode and display the control channel messages in a NXDN trunked system. Snapshots of 8 messages can be displayed directly on the S412D display. Specific message headers can be selected as a trigger point. Control channel messages can selected as a trigger point. Control channel messages can be streamed out the RS232 port to a PC using Microsoft HyperTerminal.

NXDN Talk-Out Coverage Measurements (Option 532)

The LMR Master S412D supports coverage mapping with received power and BER/MER measurements along with GPS location and time. The S412D can accurately measure BER/MER down to realistic -110 dBm signal levels. BER/MER 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/MER. A horizontal limit line may be set to give audio indication of RSSI or BER above or below a level.

NXDN Talk-Out Coverage RSSI vs. Time Display

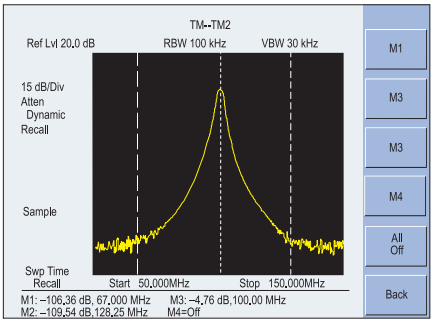
A RSSI (Received Signal Strength) Level vs. Time Display is available in the Talk-Out Coverage Mode.

NXDN Talk-Out BER/MER vs. Time Display

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

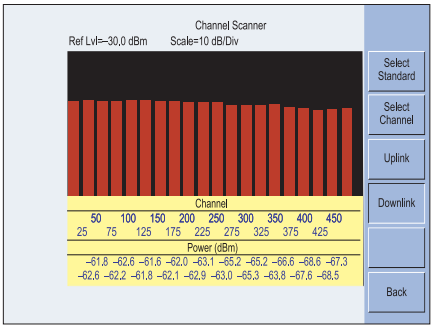
Built-in Multi-Functions to Increase Technician \ Productivity

GPS provides location and UTC time information and enhances the frequency accuracy.



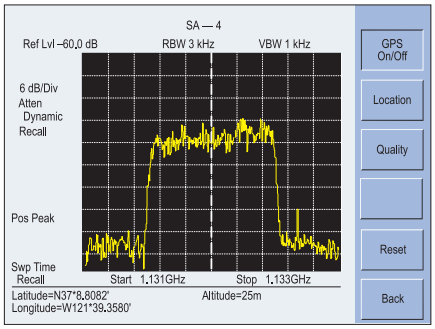
Transmission Measurement (Option 21)

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 27)

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

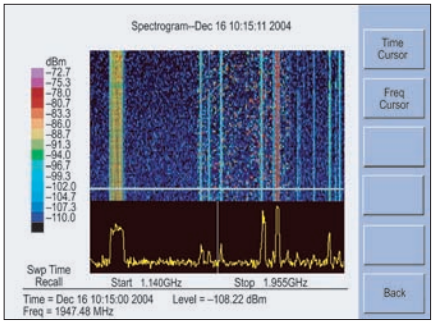


Built-in GPS Provides Location Information (Option 31)

GPS provides location (latitude, longitude, altitude) and UTC time information. The GPS receiver can be used to enhance the frequency accuracy to 120 ppb. 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 25)

Spectrogram

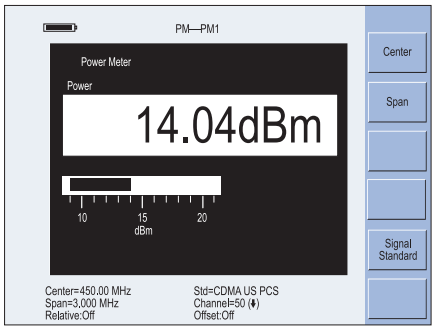
The LMR Master Spectrogram is a three dimensional display of frequency, power and time of the spectrum activity to identify intermittent interference and track signal levels over time. The LMR Master can store up to three days worth of measurements.

CW Signal Generator (Option 28)

The CW Signal Generator provides a CW signal source to test low noise amplifiers, repeaters, and for base station receiver sensitivity testing.

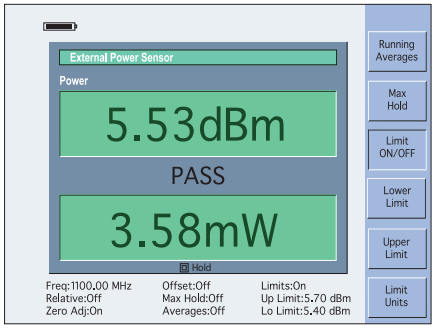
Option 28 requires CW Signal Generator kit (pn. 61534), with cables, external power splitter and 90 dB step attenuator (1 dB steps).

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 19)

Anritsu's High Accuracy Power Meter option enables users to make high accuracy RMS measurements, perfect for both CW and digitally modulated signals such as P25, iDEN, CDMA/EV-DO, GSM/EDGE, and WCDMA/HSDPA. This option requires sensor PSN50 or MA24104A. The PSN50 sensor provides high accuracy measurements from 50 MHz to 6 GHz with a dynamic range from –30 to +20 dBm. The MA24104A is an Inline High Power Sensor with a frequency range from 600 MHz to 4 GHz and can measure signals as high as 150 W. Both of the sensors are 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.

MA24104A Inline High Power Sensor

PSN50 High Accuracy Power Sensor

Power Monitor (Option 5)

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 10)

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/MER 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.

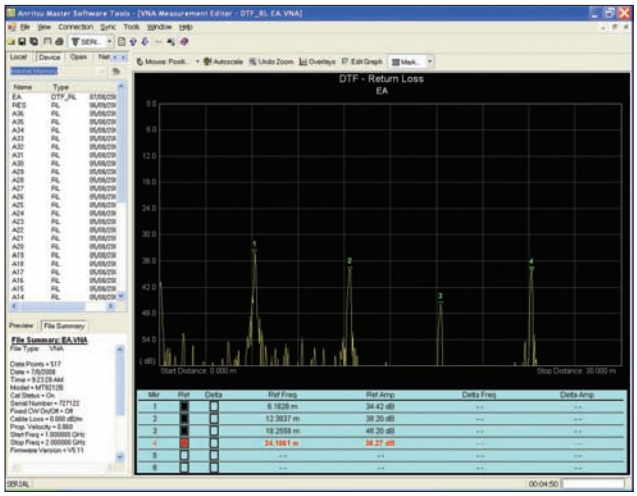


Figure 1, DTF trace transferred to MST

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.
- Convert Talk in and Talk out BER and RSSI coverage measurements to .csv and .kml formats mapping.
- Export plot data as text files for use in spreadsheets or graphic files (JPG format).

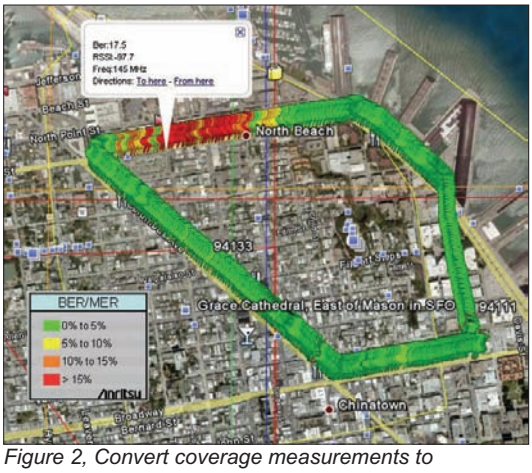


Figure 2, Convert coverage measurements to Google Earth maps.

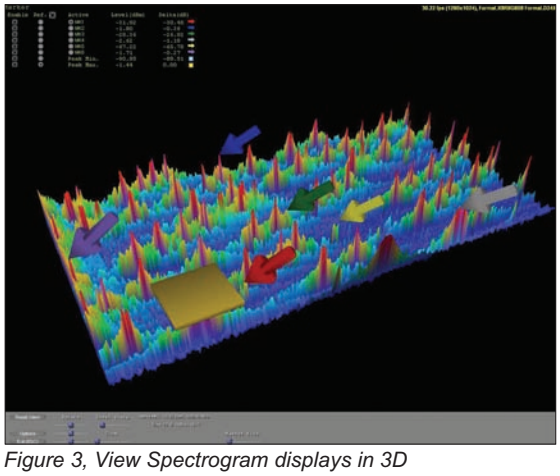


Figure 3, View Spectrogram displays in 3D

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) = $(1.5 \times 10^8) \times (V_p)/\Delta F$ Where V_p is the cable's relative propagation velocity and where ΔF 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, 120 ppb (75 typical) with GPS On and active (GPS Ref indication)
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 (Pin >–30 dBm, >10 MHz to 1.6 GHz)	
Maximum Power	+20 dBm (0.1W) without external attenuator	
**(Excludes Input VSWR)		

Specifications (Continued)

2 MHz Frequency Extension (Option 2)	
Cable and Antenna Analyzer	
Frequency Range	2 MHz to 1600 MHz (All other specs remain the same as standard S412D)
Power Monitor (Option 5)	
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 10)	
Voltage	+12 to +24V
Max Power	6 W (steady state)
Max Current	6 W/Voltage (steady state)
High Accuracy Power Meter (Option 19)	
Compatible Sensors	PSN50 and MA24104A
PSN50 High Accuracy Power Sensor	Frequency Range: 50 MHz to 6 GHz Measurement Range: –30 to +20 dBm Linearity: ± 0.13 dB Connector: Type N, male, 50 Ω Complete Technical Datasheet: p/n 11410-00423
MA24104A Inline High Power Sensor	Frequency Range: 600 MHz to 4 GHz Measurement Range: +3 dBm to +51.76 dBm (2 mW to 150 W) Linearity: ± 0.13 dB Connectors: Type N, female, 50 Ω Complete Technical Datasheet: p/n 11410-00483
Transmission Measurement (Option 21)	
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 25)	
Identify Interference type	
Audible tone - Strength of the Interferer	
RSSI	
Spectrogram	
Channel Scanner (Option 27)	
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
CW Signal Generator (Option 28)	
Frequency Range	25 MHz to 1.6 GHz Requires CW Signal Generator kit (pn. 61534), with cables, external power splitter and 90 dB step attenuator (1 dB steps)
GPS (Option 31)	
GPS Location Indicator	
Latitude, Longitude and Altitude on Display	
Latitude, Longitude and Altitude with trace storage	

Specifications (Continued)

P25 Tx Signal Analyzer (Option 520)	
Modulation	C4FM
Received Power	
Frequency Error	
Symbol Deviation Error	
NAC	
BER for 1011 Hz, and 0.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic	
Modulation Fidelity	
Graphs	Constellation, Histogram
Control Channel Decode	
Display of P25 control channel messages in hex format. A first octet trigger value may be entered to stop display updates. Messages may be streamed to a PC running Microsoft HyperTerminal.	
P25 Talk-Out Coverage Measurements (Option 522)	
Received power or BER for 1011 Hz, and O.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic, along with GPS location and time. A horizontal limit line may be set to give audio indication of RSSI or BER above or below a level.	
NXDN Tx Signal Analyzer (Option 530)	
Modulation	C4FM
Received Power	
Frequency Error	
Symbol Deviation Error	
Mod BW selectable 12.5 kHz or 6.25 kHz	
RAN	
BER for 0.153 test pattern, and BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic	
Modulation Fidelity	
Graphs	Constellation, Histogram
Control Channel Decode	
Display of NXDN control channel messages in hex format. A first octet trigger value may be entered to stop display updates. Messages may be streamed to a PC running Microsoft HyperTerminal.	
NXDN Talk-Out Coverage Measurements (Option 532)	
Received power or BER for O.153 test patterns, BER estimation from Voice traffic, and MER (message error rate) measurement from control channel traffic, along with GPS location and time. A horizontal limit line may be set to give audio indication of RSSI or BER above or below a level.	
iDEN Signal Analyzer (Option 68)	
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 45 setups (VNA-10, SPA/TM-5, Power Meter-5, High Accuracy Power Meter-5, IA-5, Channel Scanner-5, P25-5, NXDN-5)
Display	TFT Color display, viewable in sunlight
Inputs and Outputs Ports	RF Out: Type N, female, 50 Ω Maximum Input without Damage: +23 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 nonoperating storage period.)
Power Supply	External DC Input: +12 to +15 VDC, 1500 mA 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 (Continued)

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-0002	2 MHz frequency extension for cable and antenna measurements
S412D-0005	Power Monitor (requires external detector)
S412D-0010	Bias Tee
S412D-0019	High Accuracy Power Meter (sensor not included)
S412D-0021	Transmission Measurement
S412D-0025	Interference Analyzer (requires directional antenna)
S412D-0027	Channel Scanner
S412D-0028	CW Signal Generator (requires CW Signal Generator Kit, 61534)
S412D-0031	GPS (includes GPS antenna)
S412D-0068	iDEN Signal Analyzer
S412D-0520	P25 Tx Signal Analyzer
S412D-0522	P25 Talk-Out Coverage Measurements (requires Option 0031)
S412D-0530	NXDN Tx Signal Analyzer
S412D-0532	NXDN Talk-Out Coverage Measurements
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, 30 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

Ordering Information (Continued)

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-R	Adapter, N(m)-SMA(m), DC to 18 GHz, 50 Ω
1091-27-R	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
513-62-R	Adapter, TNC(f)-N(f), 18 GHz, 50 Ω
510-90-R	Adapter, 7/16 DIN(f)-N(m), DC to 7.5 GHz, 50 Ω
510-91-R	Adapter, 7/16 DIN(f)-N(f), DC to 7.5 GHz, 50 Ω
510-92-R	Adapter, 7/16 DIN(m)-N(m), DC to 7.5 GHz, 50 Ω
510-93-R	Adapter, 7/16 DIN(m)-N(f), DC to 7.5 GHz, 50 Ω
510-96-R	Adapter, 7/16 DIN(m)-7/16 DIN(m), DC to 7.5 GHz, 50 Ω
510-97-R	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
1091-315-R	Adapter, TNC(m)-N(f), 18 GHz, 50 Ω
1091-324-R	Adapter, TNC(f)-N(m), 18 GHz, 50 Ω
1091-325-R	Adapter, TNC(m)-N(m), 18 GHz, 50 Ω
1091-317-R	Adapter, TNC(m)-SMA(f), 18 GHz, 50 Ω
1091-318-R	Adapter, TNC(m)-SMA(m), 18 GHz, 50 Ω
1091-323-R	Adapter, TNC(f)-TNC(f), 18 GHz, 50 Ω
1091-326-R	Adapter, TNC(m)-TNC(m), 18 GHz, 50 Ω
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
1030-149-R	Filter, Hi-Pass, 150 MHz, N(m) to N(f), 50 Ω
1030-150-R	Filter, Hi-Pass, 400 MHz, N(m) to N(f), 50 Ω
1030-151-R	Filter, Hi-Pass, 700 MHz, N(m) to N(f), 50 Ω
1030-152-R	Filter, Lo-Pass, 200 MHz N(m)-N(f), 50 Ω
1030-153-R	Filter, Lo-Pass, 550 MHz N(m)-N(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-R	Portable Yagi Antenna, 10 dBd, N(f), 822 to 900 MHz
2000-1412-R	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
61534	CW Signal Generator Kit (required for use with Opt. 28, CW Signal Generator) includes, cables, external power splitter and 90 dB step attenuator (1 dB steps)
High Accuracy Power Meter Accessories	
PSN50	High Accuracy Power Sensor, 50 MHz to 6 GHz
MA24104A	Inline High Power Sensor, 600 MHz to 4 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

Ordering Information (Continued)

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 100 feet (30.5 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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