

# R8100 Communications System Analyzer

## The only choice for digital LMR Testing and Analysis

The R8100 comprehensively supports every major LMR protocol. Our test suites for both P25 Phase 1 and 2 are fully compliant with the TIA/EIA specification and employ every modulation and test pattern called out in the specification. And our P25 Phase 1 trunking option allows the test set to emulate a base station and trunking controller.

Our analyzer also leads the way in testing the new 6.25 kHz and 6.25 kHz channel equivalent technologies. Our NXDN™ and DMR test modes fully conform to the applicable specifications. NXDN “Type C” Trunking simulates the functions of an NXDN central controller. Comprehensive TETRA and dPMR test options are also offered.



### General

#### Display Average Noise

- Level (DANL): -140 dBm (50 Ohm input termination)
- Dynamic Range: 80 dB
- Input Related Spurious: -60 dBc max
- Residual Spurious (non-input related): -60 dBm

#### Power

- DC Power Requirements: 15-16 VDC @ 8.0A max
- AC Adapter Specs: 100-240 VAC, 2.5 A max, 50-60 Hz
- Battery Power: Internal Battery
- Battery Operation: 1.5 hour typical easily swappable for extended operation

#### Mechanical/Environmental

- Weight: Dimensions: 13.75lbs including internal battery (6.24 kg)
- Dimension: 9.4" (23.9 cm) H, 12.7" (32.3 cm) W, 7.5" (19.1 cm) D
- Operating Altitude: Up to 15,000 ft (4572 m)

- Humidity: 95% Maximum RH
- Operating Temperature: -20° to 50° C with external DC; 0° to 50° C using supplied AC adapter Without battery: -30° to +80° C; With battery: -20° to +50° C
- Battery Charging Temperature: 0° C to +45° C
- Shock and Vibration Rating: MIL-PRF-28800F, Class 3

#### Warranty

- Standard Warranty: Two years
- Three Year Service Plan: Optional
- Five Year Service Plan: Optional

#### Generator (Receiver Test)

- Port Protection Limit Frequency Range: 5 W for 30 seconds
- Extended Frequency Range (Optional): 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz 1 MHz to 3 GHz (250 kHz to 3 GHz typical)
- Frequency Resolution: 1 Hz

#### OPERATING DISPLAY MODES

- AM/FM Duplex Monitor and Generator
- Audio Synthesizer
- Tracking Generator (Opt.)
- Dual Display (Opt.)
- Cable Fault Locator (Opt.)
- Spectrum Analyzer
- Frequency Counter
- Frequency Error Meter
- Digital Voltmeter
- Power Meter Oscilloscope
- Signal Strength Meter SINAD/Distortion Meter

**Output Level Generate Port**

- Range FM: +5 dBm to -95 dBm below 2 GHz; -5 dBm to -95 dBm above 2 GHz
- Range AM: -1 dBm to -95 dBm below 2 GHz; -11 dBm to -95 dBm above 2 GHz
- Resolution: 0.1 dB
- Accuracy:  $\pm 2$  dB

**Output Level RF I/O Port**

- Range FM: -30 dBm to -130 dBm below 2 GHz; -40 dBm to -130 dBm above 2 GHz
- Range AM: -36 dBm to -130 dBm below 2 GHz; -46 dBm to -130 dBm above 2 GHz
- Resolution: 0.1 dB
- Accuracy:  $\pm 1$  dB to 1 GHz ;  $\pm 2$  dB > 1 GHz

**Spectral Purity**

- Harmonic Spurious: -20 dBc max
- Non-Harmonic Spurious: -35 dBc max; < -25 dBc at mixing product frequencies (3227 MHz - Carrier) (-30 dBc Typ); 10 MHz Harmonics < -124 dBm (RF I/O)
- Residual FM: 4 Hz, 300 Hz to 3 kHz (<1 GHz); 5 Hz, 300 Hz to 3 kHz (> 1 GHz)
- Residual AM: 1.0% max, 300 Hz to 3 kHz
- SSB Phase Noise (20 kHz Offset): -95 dBc/Hz max below 1 GHz (15° to 35° C); -93 dBc/Hz max all frequencies (0° to 50° C)

**FM Modulation**

- Deviation Range: 0 to 75 kHz, usable to 100kHz
- Deviation Resolution: 1 Hz
- Deviation Accuracy: 2% of setting
- RF Output Frequency Range: 0 to 40 kHz
- Modulation Output Frequency Range: 0 to 20 kHz
- RF Output Modulation Bandwidth: DC to 100 kHz
- Modulation Output Bandwidth: 5 Hz to 20 kHz
- IF Bandwidth: > 200 kHz
- Pre-emphasis: 750  $\mu$ s (selectable)

**AM Modulation**

- Deviation Range: 0 to 99% (AM Depth)
- Deviation Resolution: 1%
- Deviation Accuracy: 5% of setting
- RF Output Modulation Frequency Range: 0 to 40 kHz
- Modulation Output Frequency Range: 0 to 20 kHz
- RF Output Bandwidth: DC to 100 kHz
- Modulation Output Bandwidth: 5 Hz to 20kHz
- IF Bandwidth: > 200 kHz

**SSB-AM (USB or LSB) Modulation**

- AM Depth Range: 0 to 99%
- Depth Resolution: 1 %
- Modulation Bandwidth: 300 Hz to 20 kHz

**Receiver (Transmitter Test)**

- Frequency Range: 250 kHz - 1 GHz (3 GHz optional)

**Sensitivity**

- Narrowband FM: 2.0  $\mu$ V for 10 dB EIA SINAD
- Wideband FM: 10  $\mu$ V for 10 dB EIA SINAD
- AM: 10  $\mu$ V for 10 dB EIA SINAD

**RF I/O Port**

- VSWR: < 1.2 to 2 GHz, 1.5 to 3 GHz
- Max Power:
  - » 50 W for 5 minutes
  - » 150 W for 30 seconds (30 sec. on, 5 min. off)
- Absolute Max Power: 150 W
- Alarm: Internal temperature alarm

**Antenna Port**

- Maximum Power: 0 dBm
- Alarm: +10 dBm

**IF Filters**

- 6.25 kHz, 8.33 kHz, 10 kHz, 12.5 kHz, 25 kHz, 50 kHz, 100 kHz, 200 kHz

**Frequency Error Measurement**

- Type of Display: Autoranging
- Resolution: 1 Hz

**FM Deviation Measurement**

- Demodulation Range: Up to  $\pm 75$  kHz
- Accuracy: 2 % plus residual FM ( 10 Hz to 15 kHz)
- Frequency Response - Selectable per the following:
  - » Low Pass Filters: 300 Hz, 3 kHz, 20 kHz
  - » High Pass Filters: None, 1 Hz, 300 Hz, 3 kHz

**DEMODO Hardware Characteristics**

- Demodulation Output Level:
  - » 6.25 kHz B/W: 2.56 V / 1 kHz
  - » 12.5 kHz B/W: 1.28 V / 1 kHz
  - » 25 kHz B/W: 0.64 V / 1 kHz
  - » 50 kHz B/W: 0.32 V / 1 kHz
  - » 100 kHz B/W: 1.6 V / 10 kHz
  - » 200 kHz B/W: 0.8 V / 10 kHz
- Demodulation Output Amplitude Flatness:  $\pm 0.2$  dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz
- Demodulation Output Impedance: 100 ohms nominal

**Audio Weighting Filters**

- Filters: none, C-message, CCITT
- De-emphasis (selectable): 750  $\mu$ s

**AM Modulation Measurements**

- Demodulation Range: 0 to 100%
- Accuracy:  $\pm 5$ % levels below 80 % (60 Hz to 15 kHz)
- Frequency Response - Selectable per the following:
  - » Low Pass Filters: 300 Hz, 3 kHz, 20 kHz / High Pass Filters: 1 Hz, 300 Hz, 3 kHz

- » Demodulation Output Level: 0.8 V peak per 10 % AM
- » Demodulation Output Amplitude Flatness:  $\pm 0.2$  dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz
- » Output Impedance: 100 Ohms nominal
- » SSB Sideband Suppression: >70 dB

### Receive Signal Strength Meter

- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Accuracy:  $\pm 2$  dB
- Sensitivity: -120 dBm (Antenna Port; Preamplifier on; 6.25 kHz IF B/W)

### Broadband Power Meter (RF In/Out Port)

- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Measurement Range: 0.1 W to 150 W
- Input Impedance: 50 Ohms
- Accuracy:  $\pm 10\%$  (1 MHz - 1 GHz);  $\pm 10\%$  (1 GHz - 3 GHz <2.5 W)
- Protection: Over temperature alarms

### Frequency Counter

- Frequency Range: 5 Hz to 100 kHz
- Period Counter Range: 5 Hz to 20 kHz
- Input Level: 0.1 V rms min

### SINAD Meter

- Accuracy:  $\pm 1$  dB @ 12 dB SINAD
- Input Level: 0.1 V rms min
- Frequency Range: 300 Hz to 10 kHz
- Reading Range: 0 to >60 dB
- Resolution: 0.01 dB
- Resolution: 0.01 dB

### Distortion Meter

- Reading Range: 0.00% to 100%
- Distortion Accuracy: The greater of  $\pm 0.5\%$  of distortion or  $\pm 10\%$  of reading
- Input Level:  $\pm 0.1$  V rms min
- Frequency Range: 300 Hz to 10 kHz
- Resolution: 0.01%

### Optional Modes

- DMR (MOTOTRBO™), dPMR, NDXN (Conventional and Type-C Trunking), P25 Phase 1 (Conventional and Trunking), P25 Phase 2, PTC (ITCR), PTC (ACSES), TETRA DMO, TETRA TMO, TETRA Base Station Monitoring, TETRA Base Station T1

## Spectrum Analyzer

### Sweep

- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Frequency Resolution: 1 Hz
- Span Accuracy: 5%
- Update Rate: ~10 times per second (depending on span)

### Amplitude

- Level Accuracy:  $\pm 2$  dB
- Scales (dB/div): 10 (1,2, & 5 w/ESA option)
- Log Linearity Accuracy: <0.1 dB
- Reference Level Resolution: 1 dB
- Reference Level Range: +60 to -70 dB
- T/R Port Dynamic Range: 80 dB
- Typical Noise Floor Performance: -140 dBm
- SSB Phase Noise (20 kHz Offset):
  - » -95 dBc/Hz max below 1 GHz (15° to 35° C)
  - » -93 dBc/Hz max all frequencies (0° to 50° C)
- Resolution Bandwidth: Auto Selected
- Harmonic Spurious (Antenna Port, No Attenuation): -20 dBc max
- Non-Harmonic Spurious (Antenna Porta, No Attenuation): -60 dBc max
- Residual Spurious (Input Terminated): -70 dBm
- Markers: Delta, Absolute, and Frequency
- Modes: Standard, Average, Freeze, Max Hold, and Peak Hold

## Oscilloscope

### Vertical Input

- Input Impedance: 1 Meg Ohm / 600 Ohm (Selectable)
- Range:  $\pm 70$  VDC,  $\pm 33$  Vrms AC /  $\pm 24$  VDC,  $\pm 15$  Vrms AC
- Accuracy: 5% of full scale
- Bandwidth: 0 to 50 kHz

### Horizontal Sweep

- HORIZONTAL SWEEP

- Range: 20 uSec to 1 Sec / div. (Selectable)

### Trigger Selection

- Normal, Auto (Free Running), Single Sweep and Freeze

### Special Functions

- Markers: Absolute Voltage, Delta Voltage, Delta Frequency and Delta Period

## Audio Modulation Synthesizer

- Modulation Types: 1 kHz tone, Standard formats (Private Line, Digital Private Line, DPL Invert, Two-Tone Paging, 5/6 Tone Paging, POCSAG, EURO Tones, or User Defined Tone Sequences), Tone A, Tone B, Tone C (RF Output), DTMF, and external inputs from both a supplied microphone and BNC connector.
- Modulation Output Level:  $\pm 8$  V peak ( $\pm 16$ /BW V/kHz FM,  $\pm 0.08$  V/% AM)
- Amplitude Flatness:  $\pm 0.2$  dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz
- 1 kHz Tone Distortion: Not to exceed 1% THD
- Impedance: 100 Ohms
- Modulation Input Level:  $\pm 1$ V peak reference
- Amplitude Flatness:  $\pm 0.2$  dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz
- Impedance: 600 Ohms
- Microphone Input Amplitude Flatness:  $\pm 0.2$  dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz

## Signal to Noise Ratio (SNR) Meter

- Range: 0 to 100 dB
- Resolution: 0.01 dB
- Accuracy:  $\pm 1$  dB (20 dB to 50 dB)
- Signal Frequency: 300 Hz to 10 kHz
- Audio Input Level: 0.1 to 30 Vrms
- RF Input Level:
  - » RF I/O Port: -10 to +50 dBm
  - » ANT Port: -50 to 0 dBm

## Tracking Generator

- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz

## Digital Voltmeter (DVM)

- Input Impedance: 1 Meg Ohm / 600 Ohm (Selectable)
- Voltage Range: 1 V, 10 V, 70 V full scale
- Frequency Range: 50 Hz to 20 kHz
- DC Accuracy: 1% full scale  $\pm 1$  LSB
- AC Accuracy: 5% full scale  $\pm 1$  LSB

## Timebase

- Output Frequency: 10 MHz
- Stability: Aging:  $\pm 0.1$  ppm / year  
Temp.:  $\pm 0.01$  ppm
- Output Level: Minimum 0 dBm into 50 Ohms
- Warm Up: 3 minutes: within  $\pm 0.1$  ppm

## Display

### Front Panel Display

- Resolution: 800 x 600
- Size: 8.4" (21.3cm) Full Color LCD

### External Display

- External Display: VGA

### Remote Front Panel

- Available over Ethernet

## Supplemental Digital Specifications

### DMR

#### FSK Error

- Range: 0 to 10%
- Accuracy (2% to 10%): <5%
- Resolution: 0.01%

#### Magnitude Error

- Range: 0-5%
- Accuracy: <5% of reading
- Resolution: 0.01%

#### Symbol Deviation

- Range: 1500 to 2350 Hz
- Accuracy:  $\pm 10$  Hz
- Resolution: 0.1 Hz

### BER

- Range: 0 to 20%
- Resolution: 0.00001%

### NXDN/dPMR

#### FSK ERROR

- Range: 0 to 10%
- Accuracy (2% to 10%): <5%
- Resolution: 0.01%

#### Magnitude Error

- Range: 0-5%
- Accuracy: <5% of reading
- Resolution: 0.01%

#### Symbol Deviation

- Range (NXDN):
  - » 840 to 1260 Hz (4800 bps)
  - » 1920 to 2880 Hz (9600 bps)
- Range (dPMR): 1500 to 2350 Hz
- Accuracy:  $\pm 10$  Hz
- Resolution: 0.1 Hz

### BER

- Range: 0 to 20%
- Resolution: 0.00001%

### TETRA

#### EVM (RMS)

- Range: 0 to 20%
- Accuracy (2% to 10%): <10%
- Resolution: 0.10%

### Residual Carrier

- Range: 0-10%
- Accuracy:  $\pm 0.1\%$
- Resolution: 0.10%

### Frequency Error

- Accuracy:  $\pm 500$  Hz
- Resolution: 1 Hz

### P25

- TX/RX BER range: 0-20%
- TX/RX BER resolution: .000001%
- EVM range: 0 to 20%
- EVM resolution: 0.01%
- Symbol Clock Error:  $\pm 20$  ppm
- Symbol Clock Error Accuracy: 1 ppm

### Modulation Fidelity

- Range: 0-10%
- Resolution: 0.01%
- Accuracy: C4FM, HDQPSK <5%
- Accuracy: HCPM <10%

### Symbol Deviation

- Range:
  - » C4FM: 1600 Hz to 2000 Hz
  - » HCPM: 2700 Hz to 3300 Hz
  - » HDQPSK: 2025 Hz to 2475 Hz
- Resolution: .1Hz (all modulations)
- Accuracy: C4FM, HDQPSK  $\pm 5$  Hz
- Accuracy: HCPM  $\pm 10$  Hz

## Remote Front Panel

Available over Ethernet

### ORDERING INFO

2002 Synergy Blvd, Suite 200,  
Kilgore, TX 75662 USA

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[Astronics.com/LMR](http://Astronics.com/LMR)

[AstronicsTestSystems.com](http://AstronicsTestSystems.com)



Complies With  
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