ASTRONICS
TEST SYSTEMS

R8200

Communications System Analyzer

The R8200 from Astronics Test Systems represents a major step in the evolution of Land Mobile Radio Test. The first LMR test instrument to combine comprehensive radio and infrastructure test capability (VNA) with the ability to measure important RF network characteristics, such as Distance to Fault (DTF), Return Loss, and Voltage Standing Wave Ratio (VSWR). The R8200 is also the only service monitor with the ability to display advanced RF Parameters in a Smith Chart for more complicated network analysis.

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): -70 dBm

Power

- DC Power Requirements: 15-16 VDC @ 8.0 A 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: 15 lbs including internal battery (6.80 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 relative humidity
- Operating Temperature: -20 ° to 50 °C (External DC); 0 ° to 50 °C (Using supplied AC adapter)
- Storage Temperature:
  - » Without battery: -30 ° to +80 °C;
  - » With battery: -20 ° to +50 °C
- Battery Charging Temperature: 0 ° 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

VNA (One Port)

- Connector: TNC (F) / SMA-F Optional
- Frequency Range: 1 MHz - 6 GHz
- Frequency Resolution: 20 Hz
- Frequency Accuracy: Same as Timebase
- Measurement Bandwidths: 10 Hz to 100 kHz (1-3-10 sequence)
- Output Power: -3 dBm (High), -30 dBm (Low)
- Accuracy of reflection measurement:
  - » -15 dB to 0 dB, ±0.4 dB / ± 3 deg
  - » -25 dB to -15 dB, ±1.0 dB / ± 6 deg
  - » -35 dB to -25 dB, ± dB / ± 20 deg
- Applications: Return Loss vs Frequency, VSWR vs Frequency, Distance to Fault

OPERATING DISPLAY MODES

- AM/FM Duplex Monitor and Generator
- Audio Synthesizer
- Tracking Generator
- Dual Display
- Cable Fault Locator
- Spectrum Analyzer
- Frequency Counter
- Frequency Error Meter
- Digital Voltmeter
- Power Meter
- Oscilloscope
- Signal Strength Meter
- SINAD/Distortion Meter
- Vector Network Analyzer (VNA
- Return Loss / VSWR vs Frequency
- Distance to Fault (DTF)

Generator (Receiver Test)

- Port Protection Limit: 5 W for 30 seconds
- Frequency Range: 1 MHz to 1 GHz (100 kHz to 1GHz useable); Optional to 3 GHz
- Extended Frequency Range (Optional): 1MHz to 3 GHz (100 kHz to 3 GHz useable)
- Frequency Resolution: 1 Hz

Output Level RF Gen Port

- Range FM: +5 dBm to -125 dBm below 2 GHz; -5 dBm to -125 dBm above 2 GHz
- Range AM: -1 dBm to -125 dBm below 2 GHz; -11 dBm to -125 dBm above 2 GHz
- Resolution: 0.1 dB
- Accuracy: ±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: ±1 dB to 1 GHz ; ±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
- 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 µs (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 20 kHz
- 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: 1 MHz to 1 GHz (100 kHz to 1 GHz useable); Optional to 3 GHz

Sensitivity

- Narrowband FM: 2.0 µV for 10 dB EIA SINAD
- Wideband FM: 10 µV for 10 dB EIA SINAD
- AM: 10 µV 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: 0 to +-75kHZ, usable to 100kHZ
- Accuracy: ±2% plus residual FM
- Flatness: <0.5% for 50kHZ BW filter
- 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

DEMOD 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: ±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 µs

AM Modulation Measurements

- Demodulation Range: 0 to 100%
- Accuracy: ± 5% levels below 80% (60 Hz to 15 kHz)
- Frequency Response: Selectable per the following:
  - » Demodulation Output Level: Low Pass Filters: 300 Hz, 3 kHz, 20 kHz High Pass Filters: 1 Hz, 300 Hz, 3 kHz
  - » Demodulation Output Amplitude Flatness: 0.8 V peak per 10% AM Modulation
- Output Impedance:
  - » ±0.2 dB (300 Hz to 3 kHz),1 dB point @ 20 kHz
  - » 100 ohms nominal
- SSB Sideband Suppression: >70 dB

Receive Signal Strength Level Meter

- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Accuracy: ±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:±10%(2 KHz - 1 GHz); ±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: ±1 dB @ 12 dB SINAD
- Input Level: 0.1 V rms min
- Frequency Range: 300 Hz to 10 kHz
- Reading Range: 0 to 40 dB
- Resolution: 0.01 dB

Distortion Meter

- Reading Range: 0.00% to 100%
- Distortion Accuracy: The greater of ± 0.5% of distortion or ±10% of reading
- Input Level: 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, Avionics

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: ±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

Signal to Noise Ratio (SNR) Meter

- Range: 0 to 100 dB
- Resolution: 0.01 dB
- Accuracy: ±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

Oscilloscope

Vertical Input

- Input Impedance: 1 Meg Ohm / 600 Ohm (Selectable)
- Range: ±48 VDC, ±33 Vrms AC / ±24 VDC, ±15 Vrms AC
- Accuracy: 5% of full scale kHz
- Bandwidth: 0 to 50

Horizontal Sweep

- Range: 20 µSec 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: ±8 V peak (±16/BW V/kHz FM, ±0.08 V/% AM)
- Amplitude Flatness: ±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: ±1V peak reference
- Amplitude Flatness: ±0.2 dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz
- Impedance: 600 Ohms
- Microphone Input Amplitude Flatness: ±0.2 dB (300 Hz to 3 kHz), 1 dB point @ 20 kHz

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, 48 V full scale
- Frequency Range: 50 Hz to 20 kHz
- DC Accuracy: 1% full scale ±1 LSB
- AC Accuracy: 5% full scale ±1 LSB

Timebase

- Input Frequency: 5 MHz, 10 MHz
- Output Frequency: 10MHz
- Stability: Aging: ±0.1 ppm / year Temp.: ±0.01 ppm
- Input Level: -5 dBm to +10 dBm
- Output Level: Minimum 0 dBm into 50 Ohms
- Warm Up: 3 minutes: within ±0.1 ppm

Display Front Panel

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

Display External

- VGA

Remote Front Panel

- Available via Ethernet

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: ±10 Hz
- Resolution: .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%

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

Symbol Deviation
- Range:
  - » 840 to 1260 Hz (4800 bps)
  - » 1920 to 2880 Hz (9600 bps)
  - » 1500 to 2350 Hz (dPMR)
- Accuracy: ±10 Hz
- Resolution: .1 Hz

TETRA

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

Residual Carrier
- Range: 0-10%
- Accuracy: ±0.1%
- Resolution: 0.10%

Frequency Error
- Accuracy: ±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: ± 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 ± 5 Hz
- Accuracy: HCMP ± 10 Hz

Displays: Bar Graph, Eye Diagram, Voice Frame Decode, Constellation Plot, Distribution Plot

ORDERING INFO

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

+1.903.985.8999

ATSsales@astronics.com
Astronics.com/LMR
AstronicsTestSystems.com

Complies With
UL 61010-1
CSA C22.2 No. 61010-1