

**Anritsu** Advancing beyond

# Remote Spectrum Monitor

For Remote RF Signal Monitoring

## MS27101A

9 kHz to 6 GHz



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## Introduction

The Anritsu platform of spectrum monitors provides high performance real-time monitoring of the radio spectrum. Designed to be stable over time under continuous operation, the MS27101A monitor provides superior sweep speeds, high dynamic range, and low spurious levels for fast and accurate measurements. Applications include monitoring for interference, white space analysis, unlicensed transmission discovery, and signal coverage. The MS27101A is available as a single port RF-IN instrument with USB and Ethernet interfaces.

## Remote Spectrum Monitor Highlights

- Sweep rates up to 24 GHz/s
- Integrated web server to view, control, and conduct measurements via a web browser (Chrome or Firefox)
- Remote firmware updates
- Watchdog timer to insure long-term stability for remotely deployed monitors
- Low spurious signals for accurate signal discovery
- 20 MHz IF bandwidth
- Low power consumption <11 watts
- Integrated GPS receiver for monitoring location and time synchronization applications
- Gigabit Ethernet available for high speed communications
- Measurements: occupied bandwidth, channel power
- Interference analysis: spectrogram and signal strength
- Dynamic range: >106 dB normalized to 1 Hz BW
- Phase noise: -98 dBc/Hz @ 10 kHz offset at 1 GHz
- Frequency accuracy: <  $\pm 1.5$  ppm, <  $\pm 50$  ppb with GPS High Accuracy Mode
- IQ block mode and streaming with time stamping for time difference of arrival (TDOA) applications
- Remote control via SCPI commands
- Vision™ software optional for automated spectrum measurements, setting alarms, and geo-locating signal sources



MS27101A Spectrum Monitor



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## Definitions

|                     |                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | All specifications and characteristics apply under the following conditions, unless otherwise stated:                                                                                                                                                                                                                                           |
| Warm-Up Time        | After 10 minutes of warm-up time, where the instrument is left in the on state.                                                                                                                                                                                                                                                                 |
| Temperature Range   | Over the 23 °C ±5 °C temperature range.                                                                                                                                                                                                                                                                                                         |
| Typical Performance | Typical specifications in parenthesis () describe performance that will be met by a minimum of 80% of all products. They do not include guard bands and are not warranted.<br>Typical specifications that are not in parenthesis are not tested and not warranted. They are generally representative of the nominal characteristic performance. |
| Uncertainty         | A coverage factor of $k = 2$ is applied to the measurement uncertainties to facilitate comparison with other industry monitors.                                                                                                                                                                                                                 |
| Calibration Cycle   | Calibration is within the recommended 12 month period.<br>All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: <a href="http://www.anritsu.com">www.anritsu.com</a>                                                                                                         |



## Remote Spectrum Monitor

|                                             |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
|---------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| <b>Frequency</b>                            |                              | Frequency Range                                                                                                                                                                                                                                       | 9 kHz to 6 GHz (tunable to 0 Hz)                                                                                                               |                                    |
|                                             |                              | Tuning Resolution                                                                                                                                                                                                                                     | 1 Hz                                                                                                                                           |                                    |
|                                             |                              | Frequency Reference                                                                                                                                                                                                                                   | Accuracy: $\pm 1.5$ ppm ( $25\text{ }^{\circ}\text{C} \pm 25\text{ }^{\circ}\text{C}$ ) $\pm 1.0$ ppm/year aging<br>< $\pm 50$ ppb with GPS on |                                    |
|                                             |                              | Frequency Span                                                                                                                                                                                                                                        | 10 Hz to 6 GHz                                                                                                                                 |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Sweep Speed</b>                          | Typical (full span FFT mode) |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
|                                             | 10 kHz RBW                   | 5 GHz/s                                                                                                                                                                                                                                               |                                                                                                                                                |                                    |
|                                             | 30 kHz RBW                   | 12 GHz/s                                                                                                                                                                                                                                              |                                                                                                                                                |                                    |
|                                             | 3 MHz RBW                    | 24 GHz/s                                                                                                                                                                                                                                              |                                                                                                                                                |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Bandwidth</b>                            |                              | Resolution Bandwidth (RBW)                                                                                                                                                                                                                            | 10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth)                                                                                               |                                    |
|                                             |                              | Video Bandwidth (VBW)                                                                                                                                                                                                                                 | 10 Hz to 3 MHz in 1–3 sequence (–3 dB bandwidth) (auto or manually selectable)                                                                 |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Spectral Purity</b>                      |                              | SSB Phase Noise @ 1 GHz                                                                                                                                                                                                                               | (-98 dBc/Hz) @ 10 kHz offset<br>(-98 dBc/Hz) @ 100 kHz offset                                                                                  |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Amplitude Ranges</b>                     |                              | Dynamic Range                                                                                                                                                                                                                                         | > 106 dB at 2.4 GHz, 2/3 (TOI-DANL) in 1 Hz RBW                                                                                                |                                    |
|                                             |                              | Measurement Range                                                                                                                                                                                                                                     | DANL to Maximum Continuous Input                                                                                                               |                                    |
|                                             |                              | Reference Level Range                                                                                                                                                                                                                                 | –150 dBm to +30 dBm                                                                                                                            |                                    |
|                                             |                              | Attenuator Range                                                                                                                                                                                                                                      | 0 dB to 50 dB in 5 dB steps                                                                                                                    |                                    |
|                                             |                              | Amplitude Units                                                                                                                                                                                                                                       | Log Scale Modes: dBm, dB $\mu$ V                                                                                                               |                                    |
|                                             |                              | Maximum Continuous Input                                                                                                                                                                                                                              |                                                                                                                                                |                                    |
|                                             |                              | 100 MHz to 6 GHz, $\geq 10$ dB attenuation                                                                                                                                                                                                            | +30 dBm <sup>a</sup> , $\pm 50$ VDC                                                                                                            |                                    |
|                                             |                              | 300 kHz to 6 GHz, < 10 dB attenuation                                                                                                                                                                                                                 | +10 dBm <sup>a</sup> , $\pm 50$ VDC                                                                                                            |                                    |
|                                             |                              | 9 kHz to 6 GHz, preamp on                                                                                                                                                                                                                             | –10 dBm, $\pm 50$ VDC                                                                                                                          |                                    |
|                                             |                              |                                                                                                                                                                                                                                                       | a. For lower frequencies, derate maximum continuous input by 6 dB per decade                                                                   |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Amplitude Accuracy</b>                   |                              | Attenuation $\leq 40$ dB, preamp off for frequencies less than 100 kHz                                                                                                                                                                                |                                                                                                                                                |                                    |
|                                             |                              | 9 kHz to 6.0 GHz                                                                                                                                                                                                                                      | $\pm 2.5$ dB                                                                                                                                   |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Displayed Average Noise Level (DANL)</b> |                              | RBW normalized to 1 Hz, 0 dB attenuation                                                                                                                                                                                                              |                                                                                                                                                |                                    |
|                                             |                              | Preamp Off, Reference Level –20 dBm                                                                                                                                                                                                                   |                                                                                                                                                | Preamp On, Reference Level –50 dBm |
|                                             |                              | Max (dBm)                                                                                                                                                                                                                                             | Typical (dBm)                                                                                                                                  | Max (dBm)                          |
|                                             |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                | Typical (dBm)                      |
|                                             |                              | 10 MHz to 3.3 GHz                                                                                                                                                                                                                                     | –145                                                                                                                                           | –150                               |
|                                             |                              | > 3.3 GHz to 4.1 GHz                                                                                                                                                                                                                                  | –140                                                                                                                                           | –145                               |
|                                             |                              | > 4.1 GHz to 5 GHz                                                                                                                                                                                                                                    | –138                                                                                                                                           | –143                               |
|                                             |                              | > 5 GHz to 6 GHz                                                                                                                                                                                                                                      | –128                                                                                                                                           | –136                               |
|                                             |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                | –146                               |
|                                             |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                | –154                               |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Spurs</b>                                | Typical                      |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
|                                             | Residual Spurious            | (< –80 dBm) RF input terminated, 0 dB input attenuation, preamp off, > 10 MHz<br>(< –95 dBm) RF input terminated, 0 dB input attenuation, preamp on, > 10 MHz<br>(< –88 dBm) RF input terminated, 0 dB input attenuation, preamp on, 16 MHz to 18 MHz |                                                                                                                                                |                                    |
|                                             | Input-Related Spurious       | < –60 dBc, 0 dB attenuation, –30 dBm input, carrier offset > 5 MHz                                                                                                                                                                                    |                                                                                                                                                |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Second Harmonic Distortion</b>           |                              | Typical; 0 dB attenuation, –30 dBm input                                                                                                                                                                                                              |                                                                                                                                                |                                    |
|                                             |                              | 50 MHz                                                                                                                                                                                                                                                | (–50 dBc)                                                                                                                                      |                                    |
|                                             |                              | > 50 MHz to 200 MHz                                                                                                                                                                                                                                   | < –60 dBc                                                                                                                                      |                                    |
|                                             |                              | > 200 MHz to 3000 MHz                                                                                                                                                                                                                                 | < –60 dBc                                                                                                                                      |                                    |
| <hr/>                                       |                              |                                                                                                                                                                                                                                                       |                                                                                                                                                |                                    |
| <b>Third-Order Intercept (TOI)</b>          |                              | Typical; preamp off, –20 dBm tones 100 kHz apart, 0 dB attenuation, reference level –20 dBm                                                                                                                                                           |                                                                                                                                                |                                    |
|                                             |                              | 800 MHz                                                                                                                                                                                                                                               | (+7 dBm)                                                                                                                                       |                                    |
|                                             |                              | 2400 MHz                                                                                                                                                                                                                                              | (+17 dBm)                                                                                                                                      |                                    |
|                                             |                              | 200 to 2200 MHz                                                                                                                                                                                                                                       | (+10 dBm)                                                                                                                                      |                                    |
|                                             |                              | > 2.2 GHz to 5.0 GHz                                                                                                                                                                                                                                  | (+8 dBm)                                                                                                                                       |                                    |
|                                             |                              | > 5.0 GHz to 6.0 GHz                                                                                                                                                                                                                                  | (+14 dBm)                                                                                                                                      |                                    |



## Remote Spectrum Monitor (continued)

VSWR < 2.5:1 typical

## Signal Processing

|                                |                                                                                       |
|--------------------------------|---------------------------------------------------------------------------------------|
| Data Types                     | I/Q time series: 8, 10, 16 or 24 bit resolution<br>Spectrum trace: 100 to 4000 points |
| Data Transfer Modes            | I/Q time series or spectrum trace in streaming or block mode                          |
| I/Q Data Streaming Rate        | Gapless on 100Base-T network, Up to 2.6 MHz signal bandwidth                          |
| I/Q Data Time Stamp Resolution | 8.7 ns                                                                                |

## I/Q Recording Time Typical

| Signal Bandwidth | Output Data Rate | I/Q Bit Resolution |           |           |           |
|------------------|------------------|--------------------|-----------|-----------|-----------|
|                  | MSPS             | 24 bits            | 16 bits   | 10 bits   | 8 bits    |
| 20 MHz           | 76.25 / 3        | 1.3 s              | 2.5 s     | 3.8 s     | 5 s       |
| 13.3 MHz         | 76.25 / 4        | 1.7 s              | 3.4 s     | 5 s       | 6.7 s     |
| 6.67 MHz         | 76.25 / 8        | 3.4 s              | 6.7 s     | 10.1 s    | 13.4 s    |
| 2.67 MHz         | 76.25 / 20       | 8.4 s              | 16.8 s    | 25.2 s    | 33.6 s    |
| 1.33 MHz         | 76.25 / 40       | 16.8 s             | 33.6 s    | 50.4 s    | 1.12 min  |
| 667 kHz          | 76.25 / 80       | 33.6 s             | 1.12 min  | 1.68 min  | 2.24 min  |
| 267 kHz          | 76.25 / 200      | 1.4 min            | 2.8 min   | 4.2 min   | 5.6 min   |
| 133 kHz          | 76.25 / 400      | 2.8 min            | 5.6 min   | 8.39 min  | 11.19 min |
| 66.7 kHz         | 76.25 / 800      | 5.6 min            | 11.19 min | 16.79 min | 22.38 min |
| 26.7 kHz         | 76.25 / 2000     | 13.99 min          | 27.98 min | 41.97 min | 55.96 min |
| 13.3 kHz         | 76.25 / 4000     | 27.98 min          | 55.96 min | 1.4 h     | 1.87 h    |
| 6.67 kHz         | 76.25 / 8000     | 55.96 min          | 1.87 h    | 2.8 h     | 3.73 h    |
| 2.67 kHz         | 76.25 / 20000    | 2.33 h             | 4.66 h    | 6.99 h    | 9.33 h    |
| 1.33 kHz         | 76.25 / 40000    | 4.66 h             | 9.33 h    | 13.99 h   | 18.65 h   |



## General Specifications

## Setup Parameters

|                             |                                                                                                        |
|-----------------------------|--------------------------------------------------------------------------------------------------------|
| System Status               | Temperature, Serial Number, Firmware Version, Options Installed, Self Test, Application Self Test, GPS |
| System Options              | Name, Date and Time, Reset (Factory Defaults, Master Reset, Update Firmware)                           |
| Directory Management        | Sort Method (Name/Type/Date), Ascend/Descend, Internal/USB, Copy                                       |
| Internal Trace/Setup Memory | 4 GB internal memory available for storing files                                                       |
| Mode Switching              | Automatically stores/recalls most recently used setup parameters in the mode                           |

## Connectors

|                       |                                             |
|-----------------------|---------------------------------------------|
| RF In                 | Type N, female port, 50 $\Omega$            |
| External Power        | 11 W, 5.5 mm barrel connector, 11 to 14 VDC |
| External Reference In | 10 MHz, +10 dBm max, +5 VDC max, BNC(f)     |
| Ethernet              | 1 RJ45 connector                            |
| USB                   | 2 Type A interface connectors               |
| GPS                   | SMA(f)                                      |

## Regulatory Compliance

|                           |                                                                                                                                                                                                                                                            |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| European Union            | EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11<br>Low Voltage Directive 2014/35/EU<br>Safety EN 61010-1:2010<br>RoHS Directive 2011/65/EU applies to instruments with CE marking placed on the market after July 22, 2017 |
| Australia and New Zealand | RCM AS/NZS 4417:2012                                                                                                                                                                                                                                       |
| South Korea               | KCC-REM-A21-0004                                                                                                                                                                                                                                           |
| Canada                    | ICES-1(A)/NMB-1(A)                                                                                                                                                                                                                                         |

## Environmental

|                             |                                          |
|-----------------------------|------------------------------------------|
|                             | MIL-PRF-28800F Class 3                   |
| Operating Temperature Range | 0 °C to 50 °C                            |
| Storage Temperature Range   | -40 °C to 71 °C                          |
| Maximum Relative Humidity   | 95 % RH at 30 °C, non-condensing         |
| Vibration, Sinusoidal       | 5 Hz to 55 Hz                            |
| Vibration, Random           | 10 Hz to 500 Hz                          |
| Half Sine Shock             | 30 g <sub>n</sub>                        |
| Altitude                    | 4600 meters, operating and non-operating |

## ESD

|              |                             |
|--------------|-----------------------------|
| RF Input Pin | Withstands up to $\pm 4$ kV |
|--------------|-----------------------------|

## Size and Weight

|        |                                                      |
|--------|------------------------------------------------------|
| Size   | 216 mm x 45 mm x 368 mm (8.5 in x 1.75 in x 14.5 in) |
| Weight | 2.78 kg (6.2 lb)                                     |

## Warranty

|            |                              |
|------------|------------------------------|
| Instrument | Standard three-year warranty |
|------------|------------------------------|



## Ordering Information

## Options



| Model Number  | Description                                                                                                                   |
|---------------|-------------------------------------------------------------------------------------------------------------------------------|
| MS27101A      | Spectrum Monitor with one RF IN Port<br>(requires frequency option below)                                                     |
| Option Number | Description                                                                                                                   |
| MS27101A-0128 | Vector Signal Analysis Enabled (use with MX280005A)                                                                           |
| MS27101A-0706 | 9 kHz to 6 GHz Frequency Range                                                                                                |
| MS27101A-0001 | Rack Mount Kit                                                                                                                |
| MS27101A-0400 | Vision Monitor Enabled                                                                                                        |
| MS27101A-0401 | Vision Locate Enabled (requires Option 400 above)                                                                             |
| MS27101A-0407 | Vision High-Speed Port Scanner Enabled                                                                                        |
| MS27101A-0486 | Vision Coverage Mapping (requires Option 407)                                                                                 |
| MS27101A-0098 | Standard Calibration to ISO17025 and ANSI/NCSL Z540-1.<br>Includes calibration certificate.                                   |
| MS27101A-0099 | Premium Calibration to ISO17025 and ANSI/NCSL Z540-1.<br>Includes calibration certificate, test report, and uncertainty data. |

## Accessories

| Accessory                                                                         | Description                                                                                                   |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
|  | 40-187-R<br>AC/DC Power Supply, 1 m, 12 VDC Output<br>(included with instrument)                              |
|  | 2000-1528-R<br>Magnet Mount, SMA(m) with 5 m (16.4 ft) cable,<br>requires 5 VDC<br>(included with instrument) |

| Accessory                                                                          | Description                                                                |
|------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|   | 2000-1371-R<br>Ethernet Cable, 2.13 m (7 ft)<br>(included with instrument) |
|  | 760-288-R<br>Transit Case                                                  |



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