Product Brochure

Anritsu envision : ensure

MS27101A

Remote Spectrum Monitor

Introduction

With the rapid expansion of wireless communications, the need for robust networks free of interference continues to grow. Capacity can be degraded by the presence of illegal or unlicensed signals that interfere with legitimate transmissions. These signals can be periodic or present at different frequencies over time, making the discovery and removal of these sources of interference a significant challenge.

Spectrum monitoring can serve to enforce compliance with government regulations. Police, fire fighters, air traffic control, railroads using positive train control (PTC), military and emergency services must all have access to communications free of impediments and distortion. Compliance with spectrum regulations is often enforced by spectrum monitoring.

The MS27101A is designed for such applications as white space monitoring, harm claim threshold detection, in-building interference monitoring, positive train control (see Fig. 1) and research/university applications.

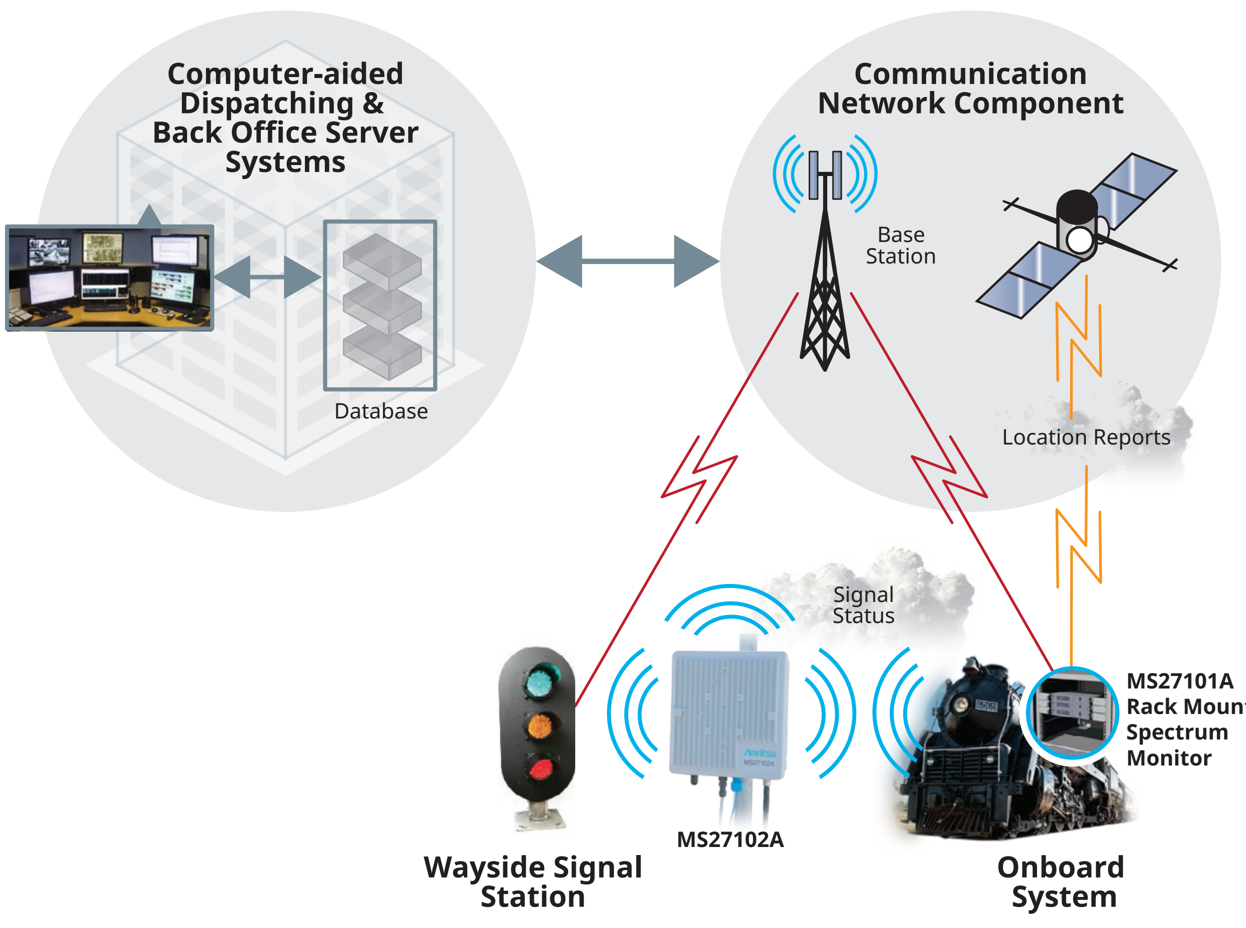

Figure 1. Positive Train Control (PTC) Application

In addition to interference detection, spectrum monitoring is also used to characterize spectrum occupancy. Government regulators and operators are often interested in determining the usage rate for various frequency bands. Monitoring these frequencies provides the information needed to optimize spectrum for maximum utilization. Spectrum can be re-purposed for other applications or multiplexed with other signals using cognitive radio techniques. See Figure 2 for an illustration of a spectrum occupancy measurement.

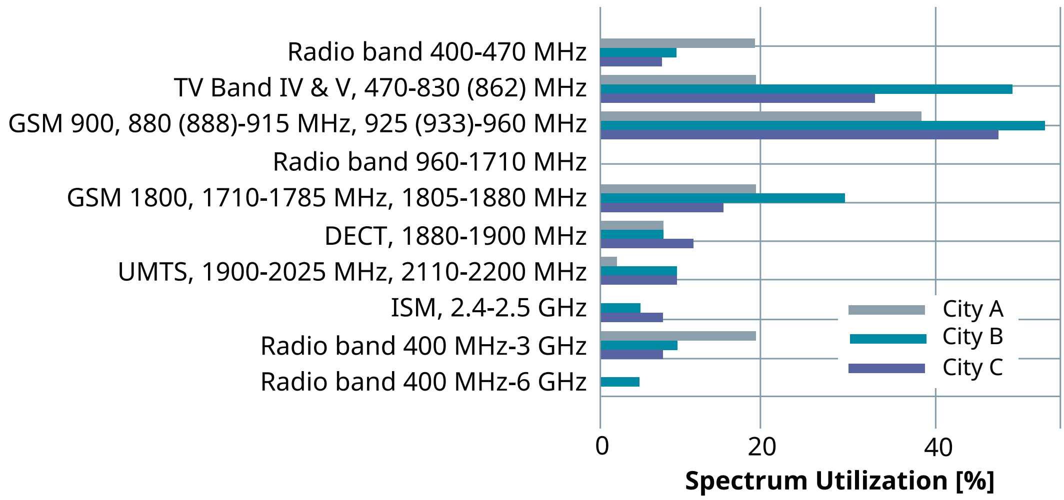

Figure 2. Spectrum Occupancy Measurement

MS27101A Remote Spectrum Monitor

Capable of sweeping at rates up to 24 GHz/s, the MS27101A allows capture of many types of signals. This includes periodic or transient transmissions as well as short “bursty” signals. Also featured is a high dynamic range, high sensitivity and low spurious signals. This enables the MS27101A to reliably distinguish between low-level signals being observed and those signals generated by the monitor itself.

Key facts

- 9 kHz to 6 GHz
- Sweep speed up to 24 GHz/s
- Integrated web server to view, control and conduct measurements via a web browser (Chrome and FireFox recommended)
- Remote firmware update capable
- Watchdog timer to insure long-term stability for remotely deployed monitors
- Linux operating system
- Low spurious signals for accurate signal discovery
- 20 MHz instantaneous FFT bandwidth
- Low power consumption < 11 watts
- Integrated GPS receiver for monitoring location and time synchronization applications
- Gigabit Ethernet available for high speed transmissions
- Interference analysis: spectrogram and signal strength
- Dynamic range: > 106 dB normalized to 1 Hz BW
- DANL: < –150 dBm referenced to 1 Hz BW, preamp On
- Phase noise: –99 dBc/Hz @ 10 kHz offset at 1 GHz
- IQ block mode and streaming with time stamping for TDOA applications
- Vision™ software optional for automated spectrum measurements, setting alarms and geo-locating signal sources

Designed For Remote Applications

With monitors potentially being deployed hundreds or thousands of kilometers from the control center, it is preferred that each monitor remain operational under all types of conditions. The MS27101A is designed for robust field deployments, with capabilities for remote power cycling, automated system recovery protocols and firmware updates “pushed” to the monitor remotely.

In the event of an application error or power fluctuation which causes an ongoing interruption in monitor communication, a re-boot policy is implemented to bring the remote monitor back to its previous state. Under these conditions, the current firmware is automatically reloaded and on-line operation is restored. Instrument settings are also restored to their previous state.

A “Golden” firmware image is also placed on each unit in a secure location in memory. If for any reason the firmware in the unit becomes corrupted, a Golden Image is used to bring back full operation of the monitor. This feature is particularly useful for remote firmware updates.

Remote Firmware Updates

There are several stages or “checks” performed when a new firmware package is downloaded remotely into the instrument. Once a new firmware image is downloaded to the monitor, various tests are performed to insure the code was properly transmitted without error. The code is then transferred into probe memory and installed. If there are any issues with this process or the new firmware does not work correctly, the Golden Image automatically replaces the downloaded firmware to keep the remote monitor operational. See Figure 3.

The Golden Image feature provides the user with assurance that the monitor stays in operation when changes are made to the code. Any bug fixes, updates or user requested features can then be remotely sent to the spectrum monitor and safely incorporated.

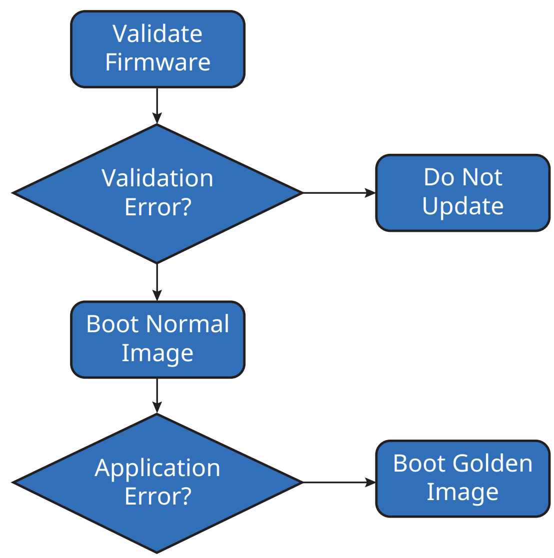

Figure 3. Remote firmware update policy

Integrated Web Server

The MS27101A features an integrated web server. Using an internet browser (Chrome and FireFox are supported), a user from anywhere in the world can log in to the spectrum monitor and control any of its features. This includes such parameters as frequency settings, RBW/VBW control, reference level configuration and many other settings relevant to the user's spectrum monitoring application. Trace data, spectrograms and other measurements can be viewed inside the browser window. A key advantage in using the web server is that it is platform agnostic. Any electronic device capable of rendering a browser will work with the web server.

Users can utilize their PC/laptop, tablet or even smartphone to view the spectrum and change instrument settings. PCs/laptops, tablets or even smart phones can be used to view spectrum and adjust remote instrument settings. Figure 4 shows the measurement data displayed on a smartphone. Figure 5 shows the screen shot displayed on a PC/laptop. The MS27101A features Gbit Ethernet, allowing fast transfers of measurement data and control information.

Figure 4. User interface shown on smartphone browser.

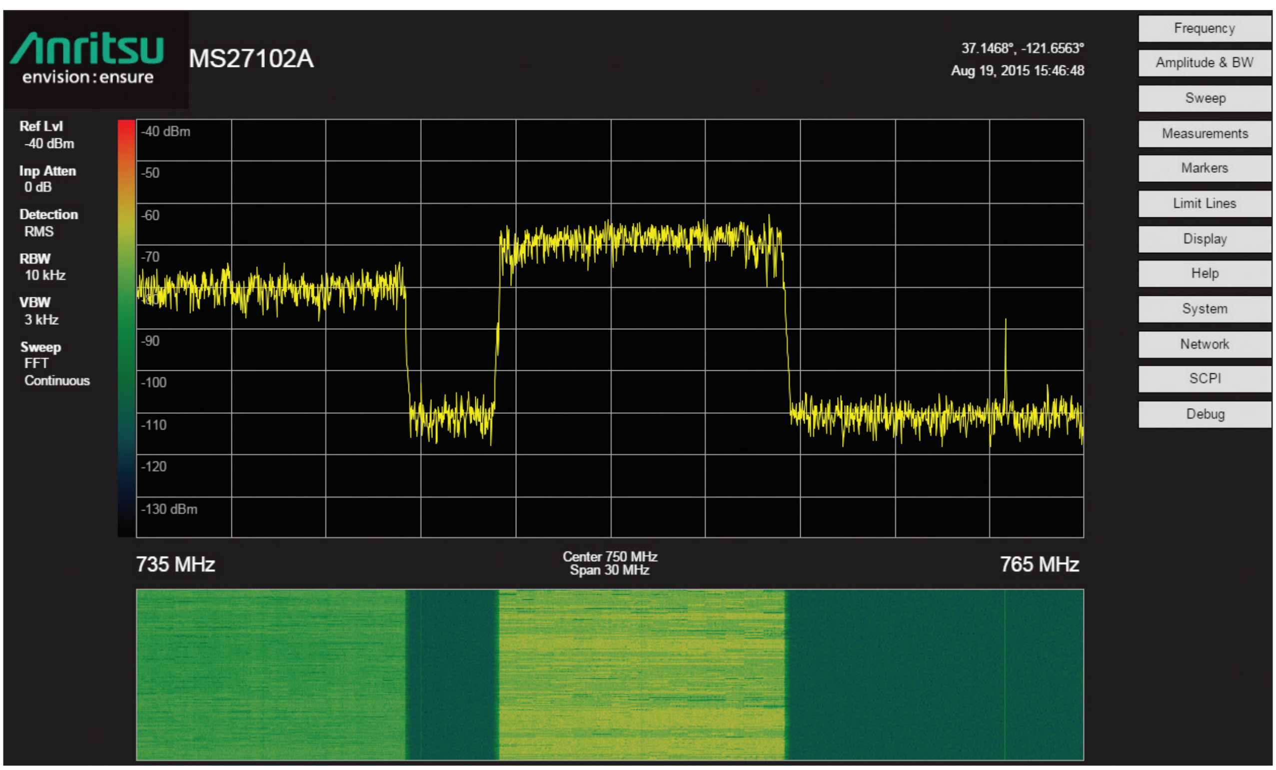

Figure 5. MS27101A Screen Shot

Hardware

The MS27101A is designed for indoor deployment. Ports include power, RF Input, Gbit Ethernet, two USB ports, External Ref In and GPS antenna. The operating temperature ranges from –40 ºC to +55 ºC.

The MS27101A typically consumes less than 11 Watts. The low power used facilitates use of the spectrum monitor powered by solar cells for remote locations.

Optionally available is a bracket kit for the MS27101A. Brackets are provided for placing the MS27101A in a standard rack-mount configuration. Additional brackets are also available in the kit for combining two MS27101A monitors to fit into a standard rack-mount cage. Figure 6 shows the contents of the rack-mount bracket kit. Figure 7 illustrates the combination of of two spectrum monitors using these brackets.

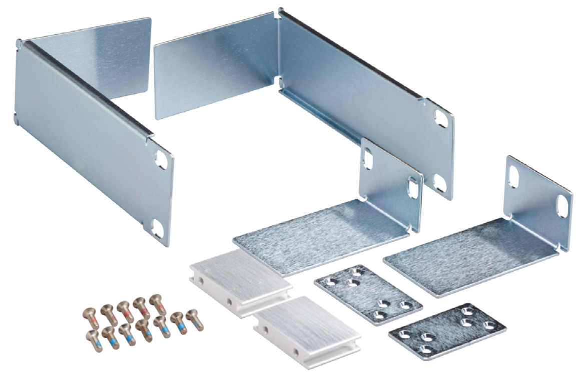

Figure 6. MS27101A-001 Rack-mount bracket kit

Figure 7. Two MS27101A probes joined together with bracket kit

Key Applications

- Spectrum Monitoring usage surveys (white space)
- Harm claim threshold (monitor spectrum for signals “de-sensing” receivers)
- Positive Train Control (PTC)
- Spectrum occupancy and frequency band clearing
- Fast and efficient detection and elimination of interference sources
- Monitor jails/prisons for illegal broadcasts

* Satellite earth station monitoring

- Security at military facilities, national borders, utilities, airports and other sensitive sites where monitors are positioned indoors
- Spectrum monitoring associated with lab RF testing
- Government regulators enforcing spectrum policy
- Geo-location of interference signals
- Maintain history of spectrum activity
- University and lab research
- Generate records of interference events for potential legal action

Signals of Interest

The wide variety of signals to be monitored fall into several categories. Each of these types of signals will be examined in some detail. These include:

- Intentional interference (including illegal or unlicensed broadcasts)
- Accidental interference
- Occupancy

Intentional Interference

Illegal AM/FM and video broadcasts are found in many parts of the world. These signals can be generated by pirated broadcast equipment or over-powered CB radios. Additionally, jammers are sometimes used for applications such as preventing students from cheating on tests, stopping employees from taking phone calls on company time or to prevent prisoners from making illicit calls from prisons. Mitigating this type of interference has become a high priority with government regulators.

Accidental Interference

A wide variety of accidental interference can be seen in the spectrum. A common problem is cable TV leakage. This type of leakage exists both from cable signals leaking into the outside environment as well as from outside signals leaking into the cable system. This problem has been enhanced with the proliferation of cable into frequencies used by broadcasters and cellular operations (such as the 700 MHz LTE band).

DECT phones also cause a problem, particularly when people bring their wireless phones along when moving from one country to another. DECT frequencies vary in different countries, providing the potential for interference when transported. Figure 8 shows the frequency bands for various DECT phones based on country of origin.

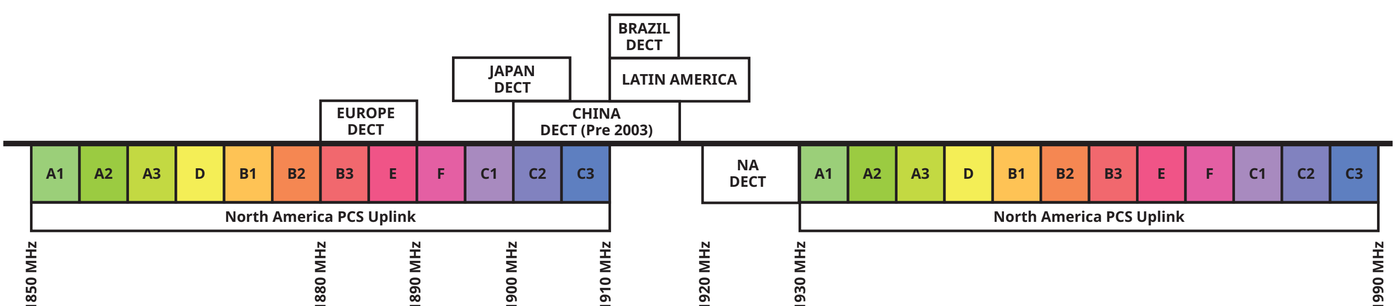

Figure 8. International DECT phone frequencies operate in U.S. cellular bands

Other sources of interference include cellular signals (due to antenna tilt or azimuth errors), repeaters oscillating, wireless microphone problems, power equipment and many others.

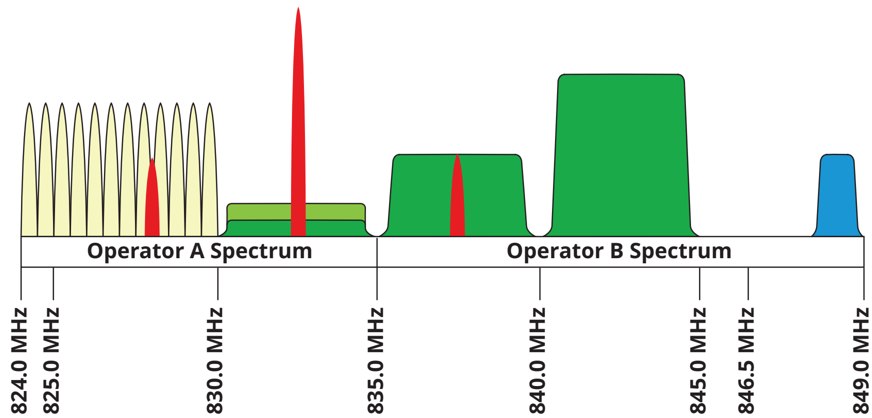

Figure 9. Malfunctioning repeaters may block licensed transmission

Occupancy

With the rapid demand for available spectrum from both public and private sectors, new ways are being investigated for making more efficient use of various frequency bands. A lot of the spectrum is potentially underutilized, providing the opportunity to re-purpose existing spectrum with additional applications.

Spectrum occupancy measurements quantify the amount of use of frequency bands over a given period of time. Remote spectrum probes are used to monitor a band of frequencies, recording spectral history as a function of time.

Performance

The MS27101A is able to sweep the frequency spectrum at rates up to 24 GHz/s. This enables the user to capture intermittent or pulsed signals. Additionally, the spectrum monitors has an instantaneous FFT bandwidth of 20 MHz.

A typical use case for this feature is the real-time capture of the entire FM radio band (88 MHz to 108 MHz in most countries). The user can perform multiple FFT captures of FM signals, storing the data for later playback and analysis. Unlicensed signals can then be identified using this information.

Multiple spectrum sensors can also be deployed to extend the RF monitoring capabilities and for geo-location of signals of interest. Using three or more probes, Anritsu's optional Vision™ software can be used to position an interferer signal or illegal broadcast. Additionally, IQ measurements are time stamped using the probe's GPS receiver. This enables the user to employ their own software using Time Distance of Arrival (TDOA) capabilities to find interferers, given each monitor IQ measurement is precisely time stamped.

Communications

Communications with the MS27101A are conducted via wired Ethernet. Each monitor is shipped with a pre-programmed static IP address. See Anritsu's Ethernet Configuration Guide for further details. Alternatively, a USB cellular modem can be used for communicating with the MS27101A. Although 3G modems can be used, a 4G modem is recommended for its high throughput rates.

All commands and inquiries with the MS27101A are done with SCPI commands. Anritsu provides a user manual listing each SCPI command along with its corresponding description and command syntax.

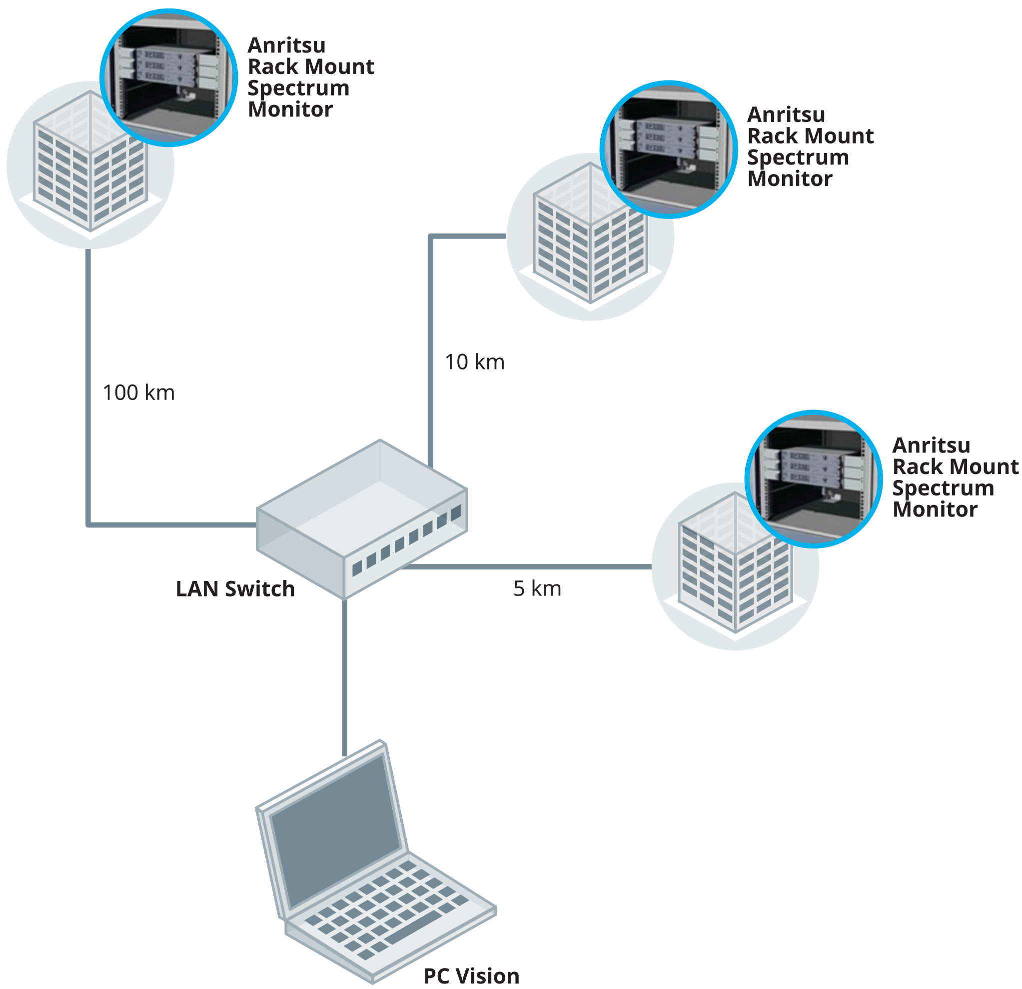

Figure 10. MS27101A Indoor Spectrum Monitoring System.

Anritsu envision : ensure

• **United States**
Anritsu Company
1155 East Collins Boulevard, Suite 100,
Richardson, TX, 75081 U.S.A.
Toll Free: 1-800-267-4878
Phone: +1-972-644-1777
Fax: +1-972-671-1877

• **Canada**
Anritsu Electronics Ltd.
700 Silver Seven Road, Suite 120,
Kanata, Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

• **Brazil**
Anritsu Electrônica Ltda.
Praça Amadeu Amaral, 27 - 1 Andar
01327-010 - Bela Vista - São Paulo - SP - Brazil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

• **Mexico**
Anritsu Company, S.A. de C.V.
Av. Ejército Nacional No. 579 Piso 9, Col. Granada
11520 México, D.F., México
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

• **United Kingdom**
Anritsu EMEA Ltd.
200 Capability Green, Luton, Bedfordshire LU1 3LU, U.K.
Phone: +44-1582-433280
Fax: +44-1582-731303

• **France**
Anritsu S.A.
12 avenue du Québec, Batiment Iris 1-Silic 612,
91140 Villebon-sur-Yvette, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

• **Germany**
Anritsu GmbH
Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49-89-442308-0
Fax: +49-89-442308-55

• **Italy**
Anritsu S.r.l.
Via Elio Vittorini 129, 00144 Roma Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

• **Sweden**
Anritsu AB
Kistagången 20B, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

• **Finland**
Anritsu AB
Teknobulevardi 3-5, FI-01530 Vantaa, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

• **Denmark**
Anritsu A/S
Kay Fiskers Plads 9, 2300 Copenhagen S, Denmark
Phone: +45-7211-2200
Fax: +45-7211-2210

• **Russia**
Anritsu EMEA Ltd.
Representation Office in Russia
Tverskaya str. 16/2, bld. 1, 7th floor
Moscow, 125009, Russia
Phone: +7-495-363-1694
Fax: +7-495-935-8962

• **Spain**
Anritsu EMEA Ltd.
Representation Office in Spain
Edificio Cuzco IV, Po. de la Castellana, 141, Pta. 8
28046, Madrid, Spain
Phone: +34-915-726-761
Fax: +34-915-726-621

• **United Arab Emirates**
Anritsu EMEA Ltd.
Dubai Liaison Office
P O Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suite 701, 7th floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

• **India**
Anritsu India Pvt Ltd.
2nd & 3rd Floor, #837/1, Binnamangla 1st Stage,
Indiranagar, 100ft Road, Bangalore - 560038, India
Phone: +91-80-4058-1300
Fax: +91-80-4058-1301

• **Singapore**
Anritsu Pte. Ltd.
11 Chang Charn Road, #04-01, Shriro House
Singapore 159640
Phone: +65-6282-2400
Fax: +65-6282-2533

• **P. R. China (Shanghai)**
Anritsu (China) Co., Ltd.
2701-2705, Tower A,
New Caohejing International Business Center
No. 391 Gui Ping Road Shanghai, Xu Hui Di District,
Shanghai 200233, P.R. China
Phone: +86-21-6237-0898
Fax: +86-21-6237-0899

• **P. R. China (Hong Kong)**
Anritsu Company Ltd.
Unit 1006-7, 10/F., Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong, P. R. China
Phone: +852-2301-4980
Fax: +852-2301-3545

• **Japan**
Anritsu Corporation
8-5, Tamura-cho, Atsugi-shi,
Kanagawa, 243-0016 Japan
Phone: +81-46-296-6509
Fax: +81-46-225-8359

• **Korea**
Anritsu Corporation, Ltd.
5FL, 235 Pangyoyeok-ro, Bundang-gu, Seongnam-si,
Gyeonggi-do, 463-400 Korea
Phone: +82-31-696-7750
Fax: +82-31-696-7751

• **Australia**
Anritsu Pty Ltd.
Unit 21/270 Ferntree Gully Road,
Notting Hill, Victoria 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

• **Taiwan**
Anritsu Company Inc.
7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

MASTER USERS GROUP

The Master Users Group is an organization dedicated to providing training, technical support, networking opportunities and links to Master product development teams. As a member you will receive the Insite Quarterly Newsletter with user stories, measurement tips, new product news and more.

Visit us to register today: **www.anritsu.com/MUG**

Training at Anritsu
Anritsu has designed courses to help you stay up to date with technologies important to your job.

For available training courses visit: www.anritsu.com/training

Please Contact:

Anritsu utilizes recycled paper and environmentally conscious inks and toner.

11410-00902, Rev. A Printed in United States 2015-12