

Communications هيئة تنظيم Regulatory Authority State of Qatar دولة قطر

•	Name	Mr. AMISH LAD	Advancing beyond				
	Presentation Title	The basis for an innovative solution for Satcom spectrum monitoring and service assurance - MS27201A					
•	Abstract	This Presentation begins with Satellite indus addressing Spectrum Clearing, Satellite grou	try updates followed by a Focus on und station interference monitoring r	MS27201A Anritsu Remote Spectrum Solutions requirements of the Satellite industry.			
•	Bio data	Regional Sales Manager working with Anrits Sales Manager I used to work as Application	u for 10+ years in the Middle East, A n engineer with Anritsu.	Africa & Turkey region. Before working as Regional			



MS27201A

- The basis for an innovative solution for SatCom spectrum monitoring and service assurance -



Amish Lad

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Reflect Orbital is selling sunlight using a constellation of in-space reflectors.



tsu

Advancing beyond



Customer: What can I do with spectrum monitoring?"

- There are five primary use models for remote spectrum monitoring
 - Real-time Remote Monitoring essentially allows a technician to be on-site in multiple locations simultaneously
 - Spectrum Recording allows techs to review any spectrum or interference events that could potentially occur when most responders are off-the-work
 - Alert an Event capabilities enable response to transient or critical interference by sending a notification when conditions meet a predetermined set of parameters
 - Location by Triangulation provides engineers with the ability to estimate the location of interference by coordinating across at least three spectrum monitoring stations
 - Signal Analysis and Demodulation provides users with individual signal parameters for identification of usage and ownership







Designed for long term spectrum monitoring apps.

Compact display free rack mount design

- ▶ MS27201A spectrum analyzers are standard 19" rack wide and 2U tall.
- They are designed to slot directly into test system racks using minimal space. The instruments are powered from a supplied 15 W power block that minimizes rack temperature gain.

24/7 operation: designed for continuous operation

- Recovery features are included to ensure reliable and uninterrupted monitoring. A builtin watchdog timer resets the instrument in the event of a software interruption. Should a break in the power supply occur, when the power is restored, the instrument will resume normal operation in the same state it was in prior to loss of power.
- Ethernet control interface
 - with supplied PC GUI application in familiar MS2090A style
- Compatible to existing LINUX based AI applications
 - RF Spectrum awareness solutions
 - Automatic signal classification
 - Modulation recognition
 - Drone detection and classification



Market Developments in SatCom monitoring

- The global satellite spectrum monitoring market is estimated to have a growth rate of 7.24% during the period Y21 to Y31.
- Growth Drivers
 - Rising signal interference due to SatCom proliferation
 - Rise in spectrum congestion due to increasing technological innovations
- Challenges
 - High cost associated with Spectrum Monitoring and mitigation components
- Opportunities
 - Emerging cloud-based satellite Spectrum Monitoring services
 - NRA's doing SatCom monitoring
 - Interference detection
 - Documentation of signal anomalies



RESEARCH AND MARKETS THE WORLD'S LARGEST MARKET RESEARCH STORE

Global SATCOM on the Move Market

Market forecast to grow at a CAGR of 13.9%





Market segmentation and end users (so called Horizontal Markets)



Teleport



DAS Systems



VSAT Terminals & Hubs



Broadcast DSNG (Digital Satelite News Gathering vehicles)



Government Military



Spot Beam Signal Analysis



Maritime



PPDR Public Protection and Disaster Relief



MilSatCom



Oil and Gas



Short & Long Term EMF



5G NR 5G NR RIM

Spectrum Clearing

- When spectrum is released for the first time or reallocated for a different purpose, the new spectrum owner needs to ensure all legacy users have vacated the frequencies.
- As well as confirming the spectrum is clear, it is advisable to monitor the adjacent channel users in case of overmodulation or spurious and harmonics leaking into the newly licensed spectrum.

MS27201A with

- MX280001A Vision software,
- MX280005A IQ Signal Master is the ideal combination to monitor and analyze activity over a period of days or weeks and log traces.





Broadcast TV Satellite

Operating on C-Band



Shared Spectrum Monitoring

- Demand for scarce spectrum resources is driving a trend towards spectrum sharing. Occasional users may obtain rights to spectrum for short term applications with a contractual priority access agreement. Such shared access cases require system operators to be aware of the typical demand profile from other users.
- MS27201A is the ideal instrument to build up an understanding of how spectrum is currently being utilized over a wide geographic area and what opportunities for spectrum sharing may exist.









Satellite ground station interference monitoring

- Satellite downlinks are moving into higher frequency bands C-band → Ka-band
- Orbital congestion is causing difficulties
- Highly sensitive satellite earth stations are susceptible to interference and spurious from adjacent communication systems. Continuous monitoring of the downlink to quickly identify sources of interference is typically deployed to maintain continuous communications







Satellite RF band utilization



MS2720xA RSM applications



SatCom RF Bands and Operation Modes

- Main operation frequency bands
 - UHF
 - UL: 291 317, DL: 244 270 MHz
 - L-band 1,53 2.7 GHz (monitoring)
 - S-band 2 4 GHz
 - ⊕ UL: 1980 2010, DL: 2170 2200 MHz
 - **X-band 8 12 GHz**
 - ⊕ UL: 7.9 8.4 GHz, DL: 7.25 GHz 7.75 GHz
 - **Ku-band downlink 12 18 GHz**
 - **+** 11.7 12.7 GHz (FSS)
 - 12.2 12.7 GHz (DBS)
 - Ka- band downlink 26.5 40 GHz
 - High Throughput Satellites (HTS)
 - Polarizations: LHCP, LHRP, LPV, LPH

1 2	4	8	12	18	26	40
LS	С	Х	KU	К	KA	A Contraction of the second seco
Lower (Throughput)						Higher
Larger				(Antenna Size)	Smaller	
Lower				(Spectrum Band)		Larger
Less				(Susceptibility to rain fading)		More
Less				(Susceptibility to rain fading)		More



MSS Mobile Satellite Service FSS Fixed Satellite Service





SatCom RF Bands and Operation Modes – Example: INTELSAT



Satellite link power budget illustration





Satellite ground station interference monitoring

- Besides signal monitoring, the received signal power is an important criterion for SatCom
- Ground station is equipped with a so called pilot-path in parallel to the actual receive path
 - Measure the frequency dependent gain of the entire receive path ("station gain")
- Based on the results, additional carrier parameters can be calculated:
 - Spectral power density at RX antenna
 - EIRP of power density at the satellite
 - EIRP of carrier at satellite antenna (DL)
 - Signal attenuation based on beacon signal
 - due to free-space propagation Ð
 - **Rain attenuation**
 - Atmospheric attenuation
- Based on regular measurements, it is possible to detect aging effects and take mitigations during live operation



Spectrum Monitoring solutions

Spectrum monitoring solutions

Hardware families

- Automatic spectrum monitoring can be performed essentially on spectrum analyzer models that offer option 400 VISION enabled
- 1st generation Remote Spectrum Monitors (RSM)
 - MS27101A, MS27102A, MS27100A, MS27103A
 - 9 kHz to 6 GHz; ASCII based 20 MHz IQ block capability
- Field Master product MS2090A platform
 - 9 kHz up to 54 GHz in several frequency variants
 - binary IQ data 20, 55 and 110 MHz block and streaming capa
- 2nd generation Remote Spectrum Monitors (RSM)
 - MS27201A; MS27200A
 - 9 kHz up to 54 GHz in several frequency variants
 - Φ binary IQ data 20, 55 and 110 MHz block and streaming capability
 - MS2080A 4,8 GHz
 - 9 kHz up to 4 / 6 GHz
 - MS2070A 3 GHz



Spectrum Monitoring Hardware Solutions



OEM Board – ideal solution for system integration solutions

- The boards are backed by Anritsu's support and warranty.
- Allow for complex systems build on OEM board base without revealing the Anritsu name through white labeling
- Option 17 Secure communications is ideal for communication via unsecure networks (e.g. public internet)
- Ability to write custom programs using SCPI commands. Being selfsufficient when it comes to integration because all available measurements are also available through SCPI.



Spectrum Monitoring Hardware Solutions



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Direct access via PC Tools or VISION

- The most simple method is to be within the customers' network, but that is not always the case.
- To access RSM in those situations, customers must have a public-facing IP. There are a few options, but it is up to the customer's IT department.
 - Port Forwarding
 - VPN
 - Separate Network



Spectrum Monitoring solutions



Remote Spectrum Monitor Vision[™] Software MX280001A

♦ Vision[™] software application

- Toolbox for various monitoring tasks
- runs on a Windows 7/8/10/11 PC/Laptop
- Works with Field Master platform and 1st and 2nd generation of RSMs
- Monitoring large frequency spans or several frequency blocks one after the other
- locating signals by either using
 - PDOA (location within sensor area)
 - or
 - TDOA (location in and outside of sensor area)
- Automated e-mail initiated alarming
- Frequency occupancy reports



Spectrum Monitoring solutions



Remote Spectrum Monitor Vision – feature overview

- MX280001A VISION software allows for
 - Option 407 High Speed port scanner application
 - Option 400 Spectrum Monitoring
 - Option 401 emitter localization
 - Power Difference on Arrival aka PDOA and
 - Time Difference on Arrival aka TDoA
- MX280001A VISION software is free of charge

GNSS

Interference location

> Monitoring Stations

 Option 400, 401 and 407 or 482 are paid option of the relevant hardware



MS2720xA RSM family

Summary

MS27201A

- Premium RF performance
- Microwave frequency range
- Sophisticated IQ features
- Remote RTSA
- VISION based monitoring
- Channel Scanner based monitoring
- 100% remote control via free of charge remote PC Tool
- MX280001A VISION allows for the best long term monitoring solution over a wide area to gain the maximum insight into RF activity at satellite ground stations, sites of critical infrastructure and at major spirting events and festivals.
- For regulators and spectrum licensees, MS27201A monitors all RF activity over a wide region to confirm conformance to local or international requirements by all transmitter operators.







Driving Technology

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