CRYSTAL™

Wherever Content Flows...™

SPECTRUM MONITORING AND RECORDING

An affordable, easy-to-use spectrum monitoring system ideally suited for the Satellite Industry.

WE ARE CRYSTAL

Crystal sits at the core of a dynamic and evolving industry. We thrive in this split-second, round-the-clock environment of news alerts, live events, program content, commercial messages and evolving distribution paths. Our depth of experience is legendary and our knowledge-base know-how is unparalleled.

Crystal technology is built to support complex, mission-critical environments with robust resiliency. We are the architects of optimization and the delivery mechanism of quality control. We connect the world's greatest brands to the ever-changing consumer on a global scale.

Wherever content flows, you will find Crystal.

Crystal architects solutions for optimization and creates delivery mechanisms that ensure quality control. Crystal know-how and technology is the solution to connect complex, mission-critical environments on a global scale.

CONTRIBUTION

Everyone's a content creator now—and effectively managing a myriad of incoming feeds is imperative for competitive success. From media companies and sports leagues to enterprises and individuals, contributors produce a flood of content that demands rapid and precise configuration, analysis, tagging, routing, storage, and access.

DISTRIBUTION

In a world of steadily growing content complexity, content distribution needs to remain agile, dependable, and flexible. Crystal is the leader in simplifying the flow of content across your network.

OPERATIONAL RESILIENCY

The more complex multi-format content distribution evolves, the more opportunities for transmission interruptions. Crystal works with you to create a plan and build systems that anticipate and prepare for these eventualities before they happen.

BUSINESS INTELLIGENCE

Building on knowledge of how your network is constructed and architected to run, Crystal puts all the information you care about in one place. This knowledge helps you understand how content is flowing across your network and determine how to maximize your investment.

Whatever their role, Crystal's end-users are big fans.

Operators love Crystal because, day to day and moment to moment, they have precisely the information they need to control their complex real-time systems. Despite their technical sophistication, Crystal's solutions are so intuitive and purpose-built that hiring and training issues are greatly diminished.

Engineers love Crystal because its library of device drivers is unparalleled. Crystal's interfaces enable designers to incorporate all relevant equipment, both legacy and cutting edge. When there's a problem, maintenance engineers can run down its history and extent from within the system, directly from the operator's console.

Executives love Crystal because its business-intelligence dashboard documents the key performance indicators (KPIs) that content and advertising clients demand. Clear historical reporting enables better strategic decision-making.

"The more complex multi-format content distribution evolves, the more opportunities for transmission interruptions. Crystal works with you to create a plan and build systems that anticipate and prepare for these eventualities before they happen."

SMR: EXAMINE. MONITOR. LEVERAGE

Crystal Spectrum Monitoring & Recording (SMR) is an affordable, easy-to-use spectrum monitoring system ideally suited for the Satellite Industry. Crystal Spectrum Monitoring & Recording uses single spectrum analyzer to monitor multiple RF sources.

It can work as a stand-alone solution or, when easily integrated with Crystal Solutions' leading Network Management System plus automation (NMS+), SMR can react to detected anomalies and automatically route affected signals to advanced analysis devices for further investigation or even reconfigure earth station equipment to activate an alternate path to restore services.

Crystal Solutions SMR works with virtually all-commercial spectrum analyzers to provide:

- Auto-anomaly detection and notification (audible, visual, via email) for immediate attention and resolution of serious problems.
- A common interface overlay to multiple spectrum analyzer types (the user sees the same easy-to-use interface regardless of the specific type of spectrum analyzer under control).
- A flexible, affordable approach to spectrum monitoring while still providing the user a full set of monitoring tools. In addition, SMR is vendor agnostic: Advantest®, Agilent®, Anritsu®, AVCOM®, Dominion Test Instruments® ("DTI"), LP Technologies®, Narda®, Rohde and Schwarz®, and Tektronix® are all supported.

What are the implications of satellite interference and what solutions does Crystal have for addressing the problem?Roger Franklin, President and CEO, Crystal, explains.

SMR KEY FEATURES

Interactive Spectrum Analyzer control – one or more users may view, monitor and control local or remote spectrum analyzers. Users working with a common spectrum analyzer can simultaneously view different measurements on different segments of a spectrum or different switch ports.

Background Monitoring – measures transponders and carriers behind the scenes.

- Monitoring for alarm conditions, logging and trending for later analysis takes place, even when the monitored spectrum is not being viewed.

Historical trending and spectral playback – users can graph and view historical measurements for a transponder/carrier. Users can also play back recorded spectrums to view them as they change. The recorded spectrums can also be exported to AVI files—capturing irrefutable evidence of interference.

User Configurable Spectrum Cache – allows the user to define the number of traces to cache in memory ensuring that all necessary pre-anomaly traces are recorded.

- Spectrum Recording – records the spectral trace for transponders and/or carriers fulltime or "On Anomaly". When "On Anomaly", SMR caches a user configurable number of spectrum snapshots for each record.
- Event Alarms and Notifications – upon breach of a user defined limit, SMR can generate multiple notifications in any combination of audible, visual or email messages.
- User Configurable Limits– a set of 8 distinct limits can be adjusted in frequency and power to detect anomalous conditions relative to a user-captured spectral baseline or reference trace.

For example, a user may define a number limit of 6 dB and a lower power limit of 3 dB and SMR will generate an alarm when a limit is breached.

In addition, conventional limits such as frequency, power, bandwidth and noise floor may be configured for each monitored carrier.

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SPECTRUM MONITORING AND RECORDING A REAL WORLD EXAMPLE

The global nature of SMR is key to such a widely used system, since (as opposed to many other carrier monitoring systems) SMR is not tied to particular data formats as delivered by specific vendor's equipment. The figure below illustrates SMR system architecture.

The following real world example shows how an Operations Manager at one of the world's largest satellite bandwidth providers uses SMR to quickly resolve what could have been a very costly problem.

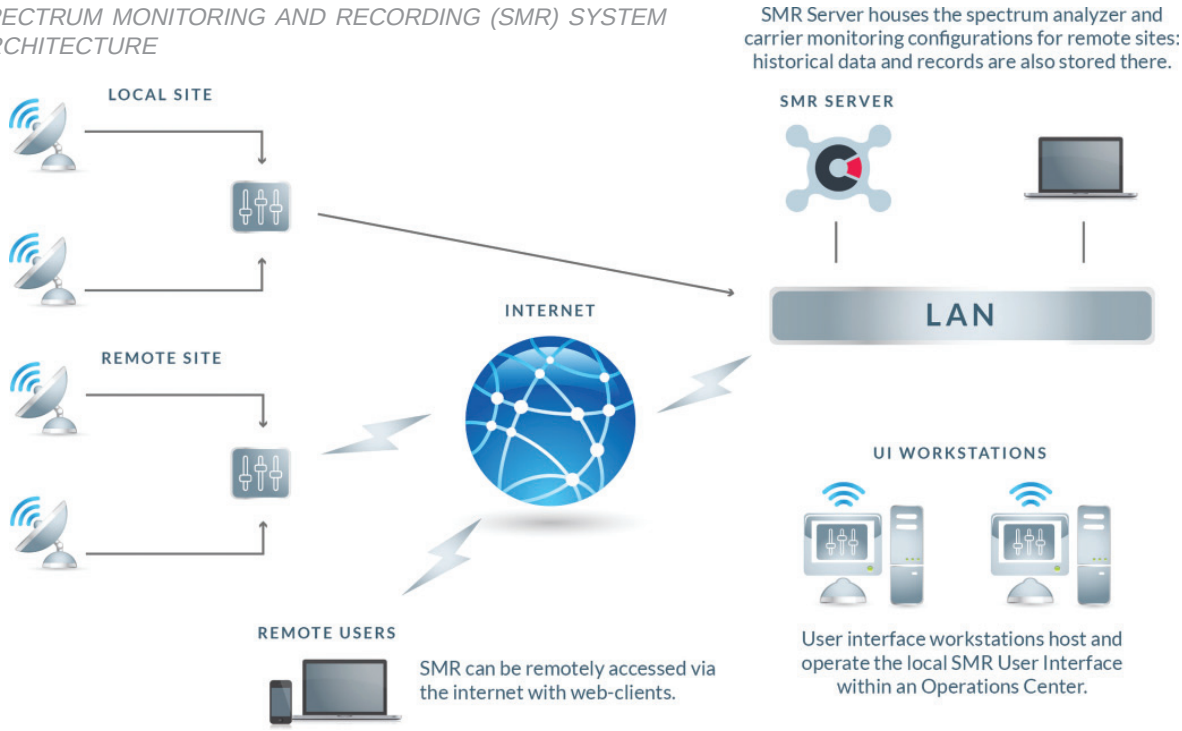
A large government maritime company uses SMR to control 30 physical spectrum analyzers located around the world. SMR continually monitors carriers on 120 RF feeds and 200 transponders in total.

The company routinely uses various segments of bandwidth on a variable basis. Transmission to a segment often starts from one location (in this case a ship) and follows just on the heels of transmission from another location.

The company began experiencing episodes of false interference on a particular carrier. The transmission started normally from one ship, but was interrupted by interference from another, unknown source. When the bandwidth provider asked all entities to suspend transmissions, the problematic carrier was still present. Instead of spending days or weeks to troubleshoot this issue, the company used Crystal's SMR package to quickly isolate the problem.

"That carrier might still be an issue today… had this not been resolved so quickly"

SPECTRUM MONITORING AND RECORDING (SMR) SYSTEM ARCHITECTURE



In addition to global carrier support, SMR prioritizes physical resources (in this example Spectrum Analyzers) for an operator to support detailed, dedicated examination of a carrier.

This is known as the Priority VSA (Virtual Spectrum Analyzer) feature. When Priority VSA is used, the operator has complete control over the settings of the spectrum analyzer and can focus on a segment of the spectrum for closer examination. Priority VSA also causes the SMR system to assign more, or all, 'cycles' of the normal round-robin cycling to the Priority session instead of the normal monitoring functions.

In this case, the Operations Manager used two additional SMR features – the rapid cycling time of SMR amongst carriers (in this installation, around one minute for all monitored carriers) and the ability to examine stored traces down to 10ths of MHz and dB. Examining sessions in this way retains more fidelity of the actual events, both in time and data, than competing solutions.

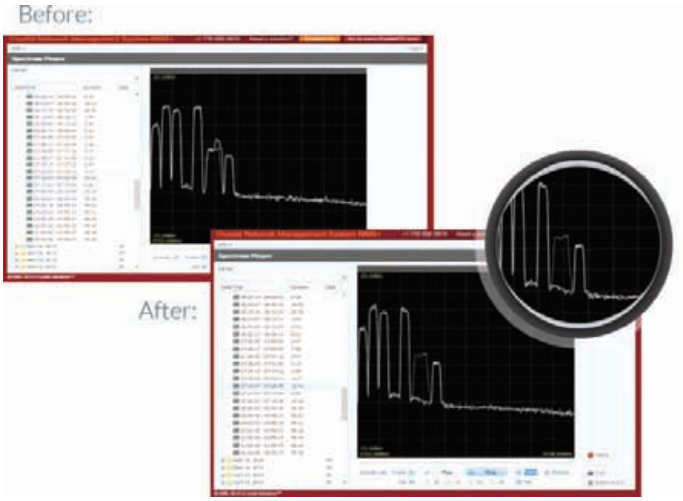
In addition, SMR's password protected web access feature allowed the customer to access the SMR system remotely and securely. The bandwidth provider's customer reviewed the exact same documentary evidence as was available to the engineer. The SMR feature of turning successive spectrum trace captures into an AVI file made it easy for the customer to witness the sequence of events, and the critical timing of events strongly suggested cause and effect.

The 'Jump to Anomaly' feature of the spectrum recording playback made it easy for the engineer (and end customer) to zero in on the exact problem scenario, as shown in the next figure.

"In other words, when solid convincing evidence can be immediately shown to an end customer, without them even having to step away from their desk, problem resolution can remain at an 'engineer to engineer' level, in effect making a molehill out of a potential mountain. Sometimes it's really nice to have the right 'hammer' in your toolbox."

The extra 'hump' on the right hand edge of the 2nd carrier from the right has an obviously interfering carrier. The high fidelity (resolution) of the spectral scan makes this type of anomaly stand out.

When the customer was advised to move their carrier to another available frequency, SMR observed (and recorded) the fact that the interfering carrier went away at the precise instant that the 'legitimate' transmitting equipment was reconfigured, as displayed on the next screen shot.



SMR recorded the offending carrier in high temporal fidelity. This evidence very strongly suggested the correct source of the interference to the customer and allowed them to determine the cause of interference. This evidence was enough to convince the customer to examine their other transmit chains (especially redundant chains) and the problem has not recurred.

When asked how long this problem may have lasted without the use of SMR, the engineer replied, "That carrier might still be an issue today [roughly 2 months later]. I am sure we would have been paying outage credits for the transponder had this not been resolved so quickly."

Crystal's SMR solution allowed the company to retain high customer confidence and saved the company several hundreds of thousands of dollars in lost revenue. SMR provided solid, easy to view evidence to facilitate resolving the problem quickly.

ABOUT CRYSTAL

Founded in 1986, Crystal designs and delivers network monitoring and management solutions that improve operational efficiency, analyze errors, and enhance system resiliency, particularly for businesses that deal with complex and dispersed distribution pathways.

Every day, program and advertising content worth billions of dollars flows through equipment managed by Crystal for leading media, enterprise, and satellite customers including Fox, CNN, Disney, and Intelsat.

Crystal, a privately held company, is headquartered in Greater Atlanta, GA.

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