Agilent Technologies’ Vector Signal Analyzers Open New Windows for Alcatel Space Satellite Communications Business

Case Study

"The advanced time domain analysis of Agilent’s 89610 vector signal analyzer provides unprecedented speed and accuracy in analyzing satellite downlink carriers. Integrating the 89610 into Alcatel Space’s, SpaceCSM gives operators a better window into downlink carrier signal analysis, and the ability to correct problems as they happen."

Christophe Privat, Manager SpaceCSM
Alcatel Space

Challenge
To optimize transponder loading and maximize revenues at any given time, Alcatel Space needed to develop and establish an effective means to monitor, supervise, and analyze communications traffic for the satellite ground stations they design and build. The system they developed shows an outstanding performance in terms of data acquisition speed and measurement accuracy, as well as overall reliability. Although initially designed to work on Spacecraft carriers monitoring, a huge market is also envisioned within broadband spectrum monitoring and analysis, as well as jamming signals detection and identification.

Customer
Alcatel Space
5 rue Noël Pons, 92734 Nanterre Cedex, France

Solution
Alcatel Space uses the Agilent 89610 vector signal analyzer (VSA) with its Telecom Carrier Analyzer (TCA) because of its intuitive, easy-to-use Windows® interface and signal analyzer display facility. Data is analyzable in multiple forms using both frequency domain and time domain formats. With such equipment, Alcatel Space customers are able to maximize transmission carrier usage and revenues. Simple analyzer set-up allows operators to monitor and improve downlink carrier quality for any customer requirement.
Results
Alcatel Space is proud to offer a unique carrier system monitoring that allows up to 50 carriers/sec monitoring rate. Besides the Agilent 89610 VSA, Alcatel Space’s TCA includes a fully calibrated front end which down-converts the incoming satellite band signal into the baseband input of the VSA. On top of the monitoring capabilities, the TCA offers enhanced demodulation features as well as constellation and demodulated signals display functionalities. It works as standalone equipment but can also be connected via LAN interface to a remote management system.

The Space Market
Alcatel Space ranks among the world’s leading space systems prime contractors. With expertise in civil and military applications, Alcatel Space develops satellite technology for telecommunications, navigation, optical and radar observation, meteorology, and science. With partners around the world, subsidiaries throughout Europe, and a strong commitment to R&D, Alcatel Space plays an important role – as prime contractor, operator, investor, or service provider – in a majority of ongoing space programs.

As a prime contractor to numerous satellite ground systems, the company decided to develop a system to upgrade its monitoring and supervision of the new communications carrier format. Maximizing a satellite’s communications capabilities and revenues in today’s market means operators are required to reconfigure transponders to offer on-demand channels as well as an option to work in a flexible, non-dedicated manner to reallocate channels to different subscribers during a given span of time.

Optimizing transponder carrier utilization for this flexible digital channel configuration capability demands a new mode of communications system operations. Alcatel Space identified three functional components to achieve the goals of satellite communications companies.

Looking for Alternatives
Alcatel Space had used another vendor’s frequency analyzer, but was unhappy with its reliability and performance. Since transponder technology continued to push the performance envelope, the company decided to examine all possible solutions to meet changing customer needs. It wanted to develop a reliable system to accurately monitor and measure downlink performance of a customer’s satellite system. A survey of available equipment produced several candidates. With the exception of Agilent’s 89610 VSA, all of the competing equipment worked only in the frequency domain. The ability to display carrier analysis data in the time domain allows operators to perform downlink carrier monitoring in real-time.

Alcatel Space contacted Agilent for a demonstration of the 89610 Series VSA in late 1999. After the demonstration, Alcatel Space’s Christophe Privat said, “It became apparent that no other solutions offered either the range of analysis capabilities or digital storage and playback. Its analysis modes included the ability to monitor carrier quality and power, detect unauthorized carriers, and monitor channel total power.

“The most significant feature was the 89610’s ability to display data in both time domain and frequency domain modes. Other analysis equipment presented carrier data only in the frequency domain. The 89610’s ability to present the same data in the time domain allows base station operators to immediately monitor communications operation in real-time. System operators can identify signal problems or unauthorized carriers as they occur and respond almost instantaneously. Satellite operators have the opportunity to improve income.”

Eight months ahead of the effective introduction of the 89610A, Agilent accepted, under Non Disclosure Agreement, to provide Alcatel Space with the appropriate technical engineering assistance to develop the necessary functionality and integrate the 89610 into the company’s TCA software, in order to provide a whole monitoring system with real-time display capabilities, which eventually became SpaceCSM.
Agilent engineers worked with Alcatel Space to integrate the 89610 VSA into the SpaceCSM. The SpaceCSM is comprised of off-the-shelf instruments that include the TCA (composed of the 89610 VSA, a down converter, and a synthesizer for RF chain calibrations) a power meter and the appropriate switching equipment.

SpaceCSM connects to the downlink receiving antenna of the satellite system. Alcatel Space equipment integrates a radio frequency down converter and amplifier, which reduces the satellite frequency to a frequency level compatible with the 89610 VSA inputs. The system then feeds the signal to its TCA.

The 89610 incorporates and utilizes a full range of open and de facto standards from MS Windows to VXIbus and IEEE 1394, which are recognized by virtually all users. This facilitated the integration into the SpaceCSM. The system takes advantages of Windows functionality to simplify setup and stores downlink carrier signals for later analysis and presentation capabilities.

System monitoring capabilities

After integrating the 89610 VSA into its SpaceCSM system, operators would be able to monitor the presence of each carrier and its signal quality. Measurement parameters include carrier downlink Effective Isotropic Radiated Power (EIRP), carrier to noise density ratio (C/No), carrier occupied bandwidth, carrier central frequency, on-demand spectrum trace, unauthorized carrier detection, and channel total power. The SpaceCSM can also monitor both analog and digital TV transmissions, service quality, and MPEG2 normalization checking.

The 89610 unauthorized carrier detection system identifies carriers above a specified threshold over the entire bandwidth of the carrier. It also uses another 89610 function, Error Vector, to identify a carrier hidden within another carrier by using a demodulation process.

The SpaceCSM also provides a carrier editor to enable operators to modify characteristics if a problem occurs during transmission.

The SpaceCSM’s design allows users to choose either a spectrum analyzer to make measurements or the vector analyzer when cycle time and accuracy become critical factors. The system permits users to monitor operations locally or remotely. The system defines the monitoring plan and sets up the SpaceCSM for satellite access modes and frequency plans. It sets up the SpaceCSM to monitor carrier traffic and schedules the monitoring plan.

A complete Telecom Carrier Analyzer system including the Agilent 89610 VSA.
Resulting Benefits

Based on Agilent’s design innovations and the flexibility of the computer-based 89610, Alcatel Space recognized the advantage of the vector signal analyzer’s time domain data presentation and its ability to indicate problems in real-time and allow the earth station operators to solve these problems quickly. This provides a marked advantage compared to any competing system that uses only frequency domain.

Since the 89610 is based on well defined de facto, and open system standards, Alcatel Space recognized the potential in the 89600 Series VSA for making system maintenance and upgrades easier with outside sources and standard upgrades. This will facilitate new system upgrades and enhancements as well as allow Alcatel Space to seamlessly add new services. For instance, Alcatel Space is in the process of developing in-orbit testing of satellites based on the 89610 capabilities.

Alcatel installed its first SpaceCSM system in February 2001, and already secured contracts for the installation of the SpaceCSM with the 89610 VSA in the earth station facilities of four different satellite systems. Also, to further leverage its relationship with Agilent, Alcatel Space has enlisted the company’s global support network to provide maintenance and repair service on a global basis.

![The 89610’s real-time display allows operators to view downlink carrier data and configuration in real time. This enables them to respond to deviations and unauthorized carriers to correct them as soon as they appear.](image1)

![Working with Agilent, Alcatel Space’s SpaceCSM allows operators to monitor multiple downlink channels in real-time.](image2)

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