Case Study

Tektronix®

Testing Communications with Nano Satellites Using Tektronix Spectrum Analyzer

Bordeaux INP's National School of Electronics, Computer Science, Telecommunications, Mathematics and Mechanics (ENSEIRB-MATMECA) needed test equipment that could prove how well its base station can communicate with orbiting nanosatellites.

With the support of the France's national space centre (CNES) and the Nouvelle-Aquitaine Academic Space Centre NAASC, ENSEIRB-MATMECA conducted a series of experiments that used the LoRa Internet of Things (IoT) protocol to send and receive signals to and from a stratospheric balloon.

The NAASC is an association of higher education institutions in Nouvelle-Aquitaine, which provide training for the civil and military space field. The CNES JANUS program aims to promote space among students by involving them in the development, launch and operation of standardized nano-satellites of the CubeSats type.

By taking part in the project, the students learn all the aspects of developing and implementing space projects, including project management, development plan, launch, reception of telemetry and transmission of remote controls and data processing. The students thus gain a deeper scientific knowledge with a strong experimental dimension in various fields, such as mechanics, thermodynamics, avionics, attitude control and energy systems.

CHALLENGE

Leading the project at ENSEIRB-MATMECA are Anthony Ghiotto and Guillaume Ferré, both associate professors pursuing their research at the IMS Research Center. The balloon project was designed to prove that the base station and protocol could communicate with the nanosatellites properly and that the signals were being received. This was important as there may be need to reconfigure the satellite and bring data back down to Earth.

Because much of the work is being done by students who are not experts in this field, a spectrum analyzer was needed to check the signals. These signals needed to be measured in real-time which was not possible with conventional spectrums.

SOLUTION

The Tektronix RSA5000B spectrum analyzer was chosen for its ability to provide signals in real-time to discover the location of any issues and which flight direction would be affected. Ghiotto comments, *"Tektronix equipment analyses the strengths of signals, which helps analyze the distance and check the flightpath of the balloon, which could then be correlated with GPS data – other equipment could not offer this"*.

The Tektronix RSA5000B Series Real time Signal Analyzers offers industry leading real-time specification and includes best real time minimum signal duration for 100% probability of intercept and best real-time dynamic range.

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> The first nanosatellite that the project will communicate with was launched in early May.
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> "We are currently finishing our base station in readiness to communicate with it, and the Tektronix analyzer, unlike conventional equipment, that could not be used to analyze such non-periodic signals, will continue to be of great help in this."

Anthony Ghiotto, Associate Professor at ENSEIRB-MATMECA

The RA5000B Series provides the functionality of a high-performance spectrum analyzer, a wide-band vector signal analyzer and the unique trigger-capture-analyze capability of a real-time spectrum analyzer.

The RSA5000B Series helps researchers discover design issues that can be missed when using other signal analyzers. The DPX spectrum display of the unit offers an intuitive live color view of signal transients as they change overtime in the frequency domain, providing confidence in the design of displaying a fault as it occurs.

The project team also used the RSA5000B analyzer to ensure the chosen frequency was free and there would be no interference from other signals that could compromise the project.

The first balloon experiment achieved signals over 200km, while in theory signals can reach over 700km. An updated system is planned that will receive images in real-time that can be put on YouTube. The project team also plan to share information with schools to show pupils what they are doing and help with their studies of metrology.