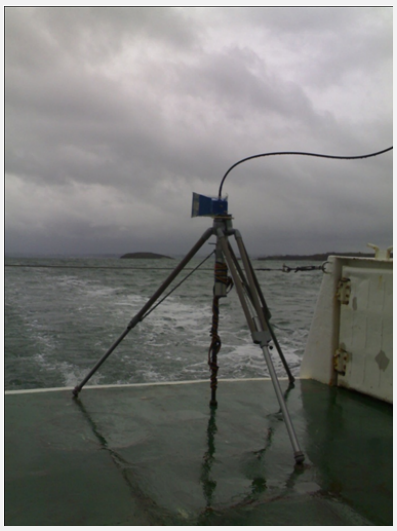
Telecom Bretagne Selects PXI RF Instruments from National Instruments to Prepare for WiMAX Deployment in Coastal Zones



Horn Antenna Used for Signal Transmission on a Boat

"We used the NI PXI platform to build specific integrated equipment, addressing the need for compact field measurements."
- Jacky MÉNARD, Télécom Bretagne

The Challenge:
Assessing the impact of propagation characteristics of transmission channels in specific environments and analyzing their influence on the design and implementation of new communication standards.

The Solution:
Building a compact and powerful NI PXI data acquisition system controlled by an NI LabVIEW software application with timing and synchronization functions, broadband network analysis, and real-time RF recording capabilities.

Author(s):
Jacky MÉNARD - Télécom Bretagne
Jean-Pierre JOLIVET - Télécom Bretagne
Fabien NICOLAS - Télécom Bretagne
Yvon LE ROUX - Télécom Bretagne

Digital communication bandwidths supported by telephone lines, cables, and fiber-optics have greatly increased. This gives rise to new applications and demands. However, for the uncovered areas, new wireless communications systems, such as WiMAX and LTE, must be implemented to deliver more range, speed, and spectral efficiency. In addition, the uncovered areas may have specific properties where the propagation channel may deviate from traditional models and requires more detailed study. Marine port and coastal areas are examples of environments with these deviations, so we chose them as the subjects of this study.

Telecom Bretagne, a prestigious international school, trains future engineers for the telecommunications fields. It is also a major player in research across multiple networks and partnerships and has jointly created several laboratories. Inside the Lab-STICC laboratory (Information and Communication Science and Technology *Laboratory*), the Transmission Channels and Systems (CAST) project team works closely with various academic and industrial laboratories to study the problems posed by deploying WiMAX in coastal areas.

Channel Characterization to Validate the Model

We test our hypothesis on the two-ray channel model in the maritime environment before characterizing the channel. We use the results to validate or supplement the model. We can analyze the influence of channel characteristics on system design, increase reliability, and optimize the spectral efficiency by providing designers with communication functions, such as modulation and coding, relevant information on the signal characteristics, and system recommendations.

Up to 50 MHz of Instantaneous Bandwidth

The device generates a test signal using a calibrated device on the mobile platform and records the remote field level received on two calibrated channels. To correlate the signal level at the receiver with the distance between it and the transmitter, a device to give position and time must be available to both sides.

In the case of the WiMAX channel, frequency bands are located around 3.5 GHz and 5.4 GHz. For other applications, working frequencies can vary between 10 MHz and 6 GHz. The instantaneous bandwidth can be up to 50 MHz, which requires a high data transfer rate, as well as adequate storage capacity. These constraints apply to both the generator and receiver.

3 TB RAID Disks Support Saved Measurement Data

We used the NI PXIe-5673 wideband 6.6 GHz vector signal generator inside an 18-slot chassis with the NI PXIe-8130 controller, the NI PXI-6682 GPS module, and the NI PXI-8262 module to interface with the NI HDD-8264 RAID enclosure. To receive signals, we used the 6.6 GHz NI PXIe-5663 vector signal analyzer inside a second 18-slot chassis with the NI PXIe-8106 controller, the PXI-6682 GPS module, and the PXI-8262 module to interface with the HDD-8264 RAID. These devices are the core elements of the system and are complemented by necessary cables, low-noise filters, and power amplifiers. The opportunity to work on two synchronized and calibrated channels provides access to multiple antennas for space diversity analysis. We can use the capacity of a 3 TB RAID drive to measure several days' worth of data depending on the analysis bandwidth and the time between recordings. For example, to record one hour of a 50 MHz band on two channels at a rate of one second every 6 seconds requires 240 GB.

We chose the NI PXI solution based on several advantages. For example, we could use the NI PXI platform to build specific integrated equipment addressing the need for compact field measurements. Also, we used the modular nature of the devices to increase acquisition by pooling the resources of several successive projects.

Technical Support From NI

The functions performed include human machine interfacing, initiating and driving maps, calibrating equipment, and proofreading and treating delayed data. We used the LabVIEW development environment to build integrated and specific applications. We used examples from the NI support team to develop all these applications and keep them fairly consistent.

Understanding How to Optimize

The system described has been implemented through several cooperative projects accredited by maritime associations. We used the results to understand the performance limitations of communication systems in coastal regions and to provide industrial partners with solutions to increase the range of their communication systems. Also, we used this device to perform remote detection and synchronization based on GNSS signals (specifically GPS signals).

Working Toward an Increase in Frequency – Always With PXI

A new project led us to increase frequency to approximately 12.5 GHz. We used PXI products from Phase Matrix, a National Instruments Alliance Partner, to complement our device and did not have to completely reinvest in new equipment.

Author Information:
Jacky MÉNARD
Télécom Bretagne
Technopole Brest-Iroise CS83818
29238 Brest Cedex 3
France
Tel: +33 (0)2 29 00 15 14
Jacky.Menard@telecom-bretagne.eu