CHRIS DEMARTINO | Technology Editor

# Partnership Propels 5G Development

**NYU WIRELESS and National Instruments (NI) are teaming up to develop the advanced solutions needed to bring 5G to fruition.**

Recently, I had the opportunity to attend the fourth Brooklyn 5G Summit, which took place April 19-21 at the New York University (NYU) Tandon School of Engineering in Brooklyn, N.Y. A wide range of 5G topics were discussed at the event, such as massive multiple-input, multiple-output (MIMO), 5G network architecture, and much more. In addition, the exhibition featured a number of demonstrations.

One company that had a notable presence at the Brooklyn 5G Summit is National Instruments (NI; www.ni.com). NI made headlines in the days prior by announcing a generous donation to the NYU WIRELESS academic research center. The donation is intended to assist research efforts at NYU WIRELESS regarding 5G communications and beyond. Thanks to that donation, NYU WIRELESS labs will be able to take advantage of hardware and software from NI's flexible software-defined-radio (SDR) solutions.

**1. This a photo of a 5G OTA test solution based on Verizon's specification.**

## OVER-THE-AIR DEMONSTRATION

Visitors to the exhibition were able to take in several demonstrations from NI. One of them was the same 5G over-the-air (OTA) test solution that was first shown at the IEEE Wireless Communications and Networking Conference (WCNC) in March.

James Kimery, director of marketing for RF, communications, and software-defined radio (SDR) initiatives at NI, led a walk-through of the demo. "This is one of the first OTA demos based on Verizon's 5G specification," said Kimery. "What's interesting is that it's actually a MIMO setup at 28 GHz—and it's the full spec. You can actually test the full bit rate."

Kimery continued, "We announced the baseband portion of the system last year. And we recently announced our 28-GHz heads, which have both transmit and receive capability. Another key technology is the phased-array antennas. This technology allows for real-time control of the beams in the array, which is really important. What's good about this is that researchers can experiment with the beams to understand how the beams are shaped and then optimize performance that way."

## THE PORCUPINE CHANNEL SOUNDER

Also demonstrated was AT&T's channel sounder, which was created in collaboration with NI. The channel-sounding system, referred to by AT&T as the "Porcupine," uses the same afore-

**2. The "Porcupine" channel sounder can deliver 360-degree channel measurements in real time.**

mentioned 28-GHz heads. However, the difference is that it connects to the Porcupine on the receive side.

"We're using some advanced techniques," noted Kimery. "A typical channel sounder will have two horn antennas—one for transmitting and one for receiving. Those horn antennas are rotated using a servo motor to cover 360 degrees. This system does everything automatically. There are switches inside to go through each of the horns in less than 150 ms."

According to Kimery, the fast measurement speed of the Porcupine is highly beneficial. He explained, "The speed allows you to take measurements faster. You can capture 2 GHz of bandwidth from four streams and have all the measurements done in 150 ms. The normal way is to take a snapshot, move the antenna, take another snapshot, etc. But that process only acquires the data. You then have to take that data and post-process it. This new system takes 4X or more data than a typical channel sounder and processes it an order of magnitude faster."

Kimery added, "The other benefit of this channel sounder is that it allows you to know how a channel really behaves. If you're taking snapshots and moving a servo, there is a time gap between snapshots. This system can quickly take 360-degree measurements, allowing you to get a good picture of what the channel looks like in real-time."

## CHANNEL EMULATION

The NI donation is also spurring channel-emulation development at NYU WIRELESS. Kimery said, "With channel sounding, you get an accurate picture of the channel. But now you want to try some different things without having to go over the air." In essence, channel emulation allows one to test real hardware without even needing to transmit signals over the air.

Aditya Dhananjay, a postdoctoral research fellow at NYU, is driving channel-emulation development efforts. He stated, "If you have to test wireless systems, you need to do testing in various scenarios. This over-the-air testing is very expensive and time-consuming.

"We can connect the transmitter and receiver to a box, known as an emulator, instead of transmitting a signal over the air," added Dhananjay. "The emulator will take the signal from the transmitter and modify it as if it has gone over the programmed wireless channel. The resulting signal is then given to the receiver. So you can test the transmitter and receiver while sitting in the comfort of your lab without having to go outdoors and do measurements."

This article only covers some of the activity taking place at NYU WIRELESS. But it is clear that NYU WIRELESS and NI together are helping to pave the way for 5G communications. While much work still needs to be done before 5G becomes a reality, the partnership of NYU WIRELESS and NI will surely drive the technology to make it finally happen.