5G channel sounder rolls through the streets

Martin Rowe - May 25, 2017

Since 2010, National Instruments has been providing equipment for 5G physical-layer measurements. "Channel sounding" measurements have and continue to be at the forefront of development at the physical layer. Channel sounding is an activity where engineers attempt to characterize or "sound" a wireless channel. But, there are an endless number of channels, and no two paths between a base station and mobile device are the same. Still, the more we know about how a wireless signal attenuates and reflects as it travels through cities, suburbs, rural areas, and indoors, the better transmitters and receivers can adapt to those conditions.

5G signals will operate both above and below 6 GHz. The **table** below, presented at NI Week 2017, shows the frequency bands and supporting carriers for 3GPP Release 15 (Source: National Instruments).

Frequency range	Supporting companies
3.3 GHz to 4.4 GHz	NTT DOCOMO, KDDI, SBM, CMCC, China Unicom, China Telecom, KT, SK Telecom, LG Uplus, Etisalat, Orange
4.4 GHz to 4.99 GHz	NTT DOCOMO, KDDI, SBM, CMCC, China Unicom, China Telecom, KT, SK Telecom
24.25 GHz to 29.5 GHz	NTT DOCOMO, KDDI, SBM, CMCC, KT,Verizon, T-Mobile, Telecom Italia British Telecom
31.8 GHz to 33.2 GHz	Orange, Telecom Italia, British Telecom
37 GHz to 40 GHz	AT&T, Verizon, T-Mobile

As part of its 5G development, AT&T has developed a channel sounder that consists of a transmitter and receiver racks on wheels. Nicknamed "Porcupine," the channel sounder racks use NI's mmWave transceiver system to generate and receive signals, process the received signals in real time, and store the data. Each rack is motorized and can travel at speeds up to 8 mph (13 km/hr) under remote control. In addition to being showcased at NI Week, the channel sounder was also featured at the most recent Brooklyn 5G Summit.

The transmitter's antenna array consists of eight antennas (**Figure 1**) while the receiver rack's antenna array (**Figure 2**) has 16 antennas, which lets engineers receive signals at different angles.

Figure 1 The AT&T 5G channel sounder's transmitter uses eight antennas.

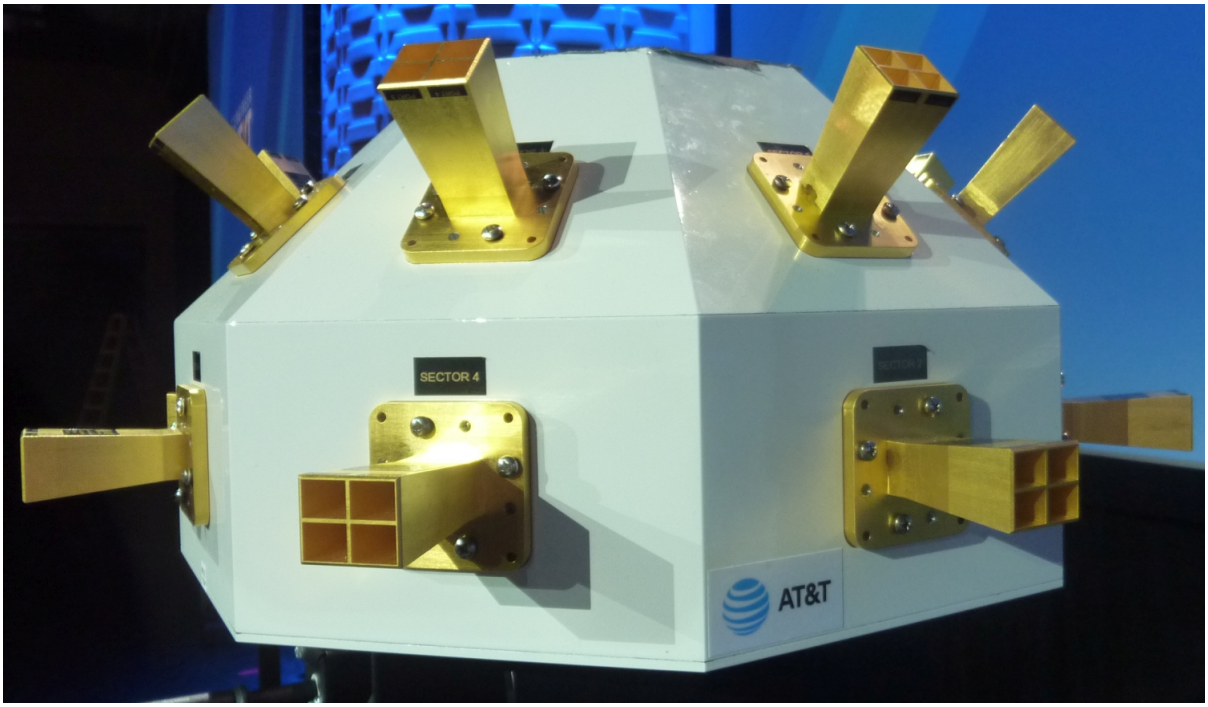

Figure 2 The AT&T channel-sounder receiver has sixteen antennas, which lets it calculate differences in height and receive reflected signals.

In the video below, National Instruments RF engineer Norm Kirchner demonstrated the system on May 23, 2017.

The channel sounder can make 6000 measurements per minute. Its real-time signal processing can generate a tremendous amount of data. Later in the day, after seeing the demonstration, I spoke with AT&T's Arun Ghosh, who was a panelist in a customer-applications panel. Ghosh explained that the Porcupine receiver system can store 5 Tbytes of data, but that's only because the system processes the incoming digitized signals and parses the data, retaining only what engineers need. Without that parsing, the channel sounder would run out of storage capacity in a few minutes.

—*Martin Rowe covers test and measurement for EDN and EE Times. Contact him at martin.rowe@aspencore.com*

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