NIST antenna calibrations extended to 60-110 GHz

May 25 2007

The National Institute of Standards and Technology (NIST) has developed a new "tabletop" sized facility to improve characterization of antennas operating in the 60 to 110 gigahertz (GHz) frequency range. This extended frequency capability serves needs for advanced civilian and military communication and radar systems.

Many electronic systems are moving to higher frequencies to attain higher channel capacity, better spatial resolution and other advantages. The new measurement facility will help accelerate development of technologies such as automobile collision-prevention radars, which operate at 94 GHz and require antennas small enough to be integrated into car bumpers. Improved NIST antenna calibration capability also helps to assure the accuracy of many systems. "NIST is the start of the measurement traceability chain," says Perry Wilson, leader of the Radio Frequency Fields Group. "For instance, we calibrate the probes used by aerospace companies to calibrate instruments launched on satellites and other critical systems. Weather satellites are an example; improvements in antenna accuracy mean better data for weather models, resulting in better weather predictions."

The new facility continues NIST's history of innovation in antenna measurements, building on the "extrapolated gain" technique developed several decades ago. The original extrapolation range and techniques made it practical for researchers to accurately compute an antenna's far-field characteristics based on near-field measurements. By making the range compact, costs are significantly reduced. In addition, the

extrapolation technique uses over-sampling and averaging techniques to minimize the effects of scattering and range imperfections.

The tabletop extrapolation range is used to measure the gain (increase in signal power) and polarization (orientation of the electric field) of high-performance antennas. To make measurements, one antenna is fixed on the table and a second is moved along a rail. A laser tracker is used for alignment and positioning. The laser tracker is capable of following a moving target with less than 20 micrometer uncertainty at 1,000 points per second. The range is arranged on an optical table to provide the mechanical isolation and stability necessary to achieve low uncertainties at short wavelengths of radiation. Typical measurement uncertainty for certain types of antennas in the 60 – 110 GHz range approaches that of NIST's existing calibration facilities for antennas operating at lower frequencies (less that 60 GHz).

Source: National Institute of Standards and Technology (NIST)