Parametric Study of Probe Positioning Errors in Spherical Near-field Test Systems for mm-Wave Applications

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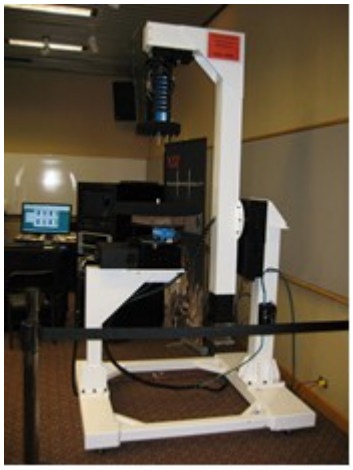
Planar near-field antenna testing at frequencies greater than 100 GHz have become commonplace and many of the RF and mechanical challenges have been addressed in recent years. As the number of applications at these higher frequencies have been growing, so too has the need for antenna test systems and as a result also test systems that are not limited to high gain antennas. Spherical near-field test systems address this need perfectly, but have always been limited by their stringent alignment requirements. This paper describes a parametric study performed to investigate the viability of testing at frequencies above 100 GHz, using positioners implementing a theta/phi scanner. Parameters like probe radial distance, axis intersection and angular positioning are investigated to assess to what extent spherical near-field testing can be performed using commercially available positioners. The results from this study lead to the implementation of a prototype system as depicted below.



Prototype theta/phi spherical near-field test system with integrated mm-wave hardware.

The system consists of a turntable and an overhead gantry containing the probe antenna. RF mm-wave hardware is integrated to minimize path loss and ensure maximum phase stability. The turntable offers phi rotation and the gantry theta rotation while the radial distance of the probe is fixed. The results presented in this paper are based on a combination of measured and simulated data and show that spherical near-field testing is feasible up to a frequency of 500 GHz.