Robotic Spherical Near-Field Measurements at 183 GHz[+]

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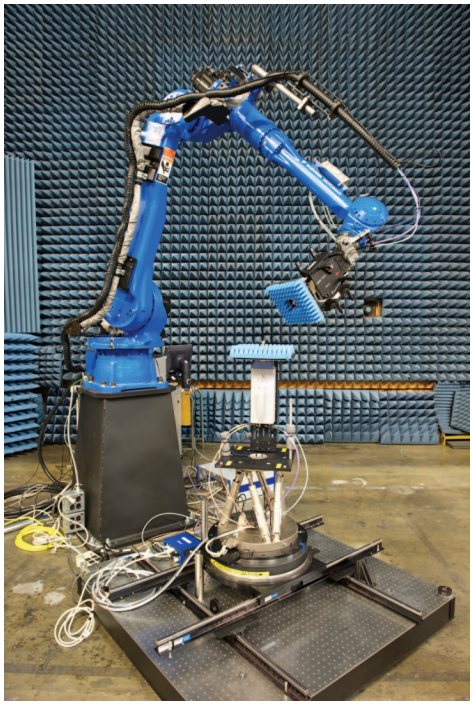
The National Institute of Standards and Technology (NIST) is developing a new robotic scanning system, the CROMMA (**C**onfigurable **RO**botic **M**illi**M**eter-wave **A**ntenna) Facility, for performing near-field measurements at frequencies above 100 GHz. This cost-effective system is designed for high-frequency applications, is based on an industrial robot (pictured), is capable of scanning in multiple configurations, and is able to track measurement geometry at every point in a scan. The RF measurements are made with a vector network analyzer. At every measurement point, relative position and orientation are also recorded with a laser tracker system. The system has been used to achieve a positioning accuracy of about 22 μm RMS, which should be sufficient to allow near-field measurements up to about 500 GHz. We are currently qualifying the CROMMA Facility and evaluating its limitations. The system is capable of planar, spherical, cylindrical, or mixed-geometry scanning. Position and orientation information allow us to assess the quality of the alignment and will eventually allow implementation of position and orientation correction algorithms for canonical geometries and mixtures of them. This system is described in more detail in (M.H. Francis et al., Proc. AMTA 2014, pp. 231 – 234).

We measured the radiation pattern, in the forward hemisphere, of a WR-5 pyramidal standard gain horn (with an aperture of 9.67 cm by 12.62 cm and a nominal gain of 24 dB) at 183 GHz using the spherical near-field method at a radius of 10 cm. A spherical near-to-far-field transform was used to obtain the far-field. The dimensions of the horn were used to calculate a theoretical far-field pattern for comparison. We also measured the pattern at a radius of 100 cm, which is nominally in the far field.



The results of theory, near field and far field agree qualitatively. A quantitative evaluation of the agreement is in progress.