A Novel Portable Near-field Measurement System for Millimeter-wave Antennas: Construction, Development, and Verification

Timothy Brockett and Yahya Rahmat-Samii

brockett@ee.ucla.edu, rahmat@ee.ucla.edu

Department of Electrical Engineering, University of California, Los Angeles

Los Angeles, CA 90095

Tel: (310) 206-4801 Fax: (310) 206-8495

ABSTRACT - Compact millimeter-wave antenna designs have been the focus of much research in recent years. These compact designs and the expensive RF hardware required for characterization makes many large antenna ranges unsuitable for efficient characterization. Modification for high frequency is difficult as large positional and RF equipment are not easily changed. To mitigate these difficulties, a custom portable and cost-effective millimeter-wave antenna measurement system is introduced. The system development, from the scanner design and implementation, the custom system software, the post-processing options including phase-less measurements, and the measurement of a Ka-Band horn, is presented.

I. SUMMARY

A novel portable and cost-effective millimeter-wave bi-polar planar antenna measurement system was developed at the University of California, Los Angeles. It is designed to accommodate antennas that are 24 inches in diameter and operate at frequencies of 26.5GHz to 67GHz. The bi-polar design allows, despite the compact size of the system, to measure planes up to 5 feet. It also has a portable design, fitting securely on one end of a standard optical table and has the ability to be disassembled easily and quickly for moving, if needed. Components on the design are all conventional, decreasing burden and cost if there is ever a need for replacement parts.

In the goal to make the chamber more cost-effective, the use of phase-less measurements and a phase-retrieval algorithm in post-processing were implemented. This will allow the chamber to eventually measure with only a frequency source and power meter and eliminate any need for expensive vector test equipment.

Custom measurement system software was developed to monitor measurement and post-processing options. The software will control general motion of the bi-polar scanner, conduct data acquisition, provide near-field to far-field transformation options, and phase-retrieval algorithms. A straight-forward graphical user interface will allow effective use of the measurement system.

Finally, a Ka-Band standard gain horn was mounted and then measured inside the measurement system. A measurement with phase was taken and the results processed to the far-field and compared to a simulated result using infinitesimal dipoles. The results show that the system was able to recover an agreeable pattern in comparison to the simulated result.