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PROBE COMPENSATION CHARACTERIZATION AND ERROR ANALYSIS IN CYLINDRICAL NEAR-FIELD SCANNING

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Abstract

Recent evolution of spaceborne scatteromer are demanding very high quality performance from antennas. For example a recently designed JPL/NASA spaceborne scatterometer for global mapping of dynamic change of ocean circulation requires the knowledge of wide angle antenna patterns with demanding accuracy. The antennas arc to be calibrated to within 0.25dB over the main beam with pointing accuracy of 0.05 degrees. The antennas assembled on this instrument are long stick slotted waveguide array type operating at Ku-Band.

In order to accurately characterize the radiation performance of these antennas at JPL, a cylindrical near-field measurement facility has been developed. It is the objective of this paper to critically assess the importance of different error mechanisms in evaluating the achievable accuracy in gain and patterns measurements. This assessment has been performed by utilizing a novel simulation algorithm. In particular, special attention has been given in properly characterizing the role of probe patterns in the implementation of probe compensation technique.

The near-field systematic errors include probe position, data truncation in both azimuthal and elevation direction, near-field signal to noise ratio, probe antenna interaction, and amplitude phase/drift etc. It has been demonstrated, for an example, that a probe position alignment better than 1/16λ is needed for pointing accuracy better than 0.05 degrees. A probe model is used (with directivity of 5.5dB, 9.9dB and 15.9dB) to determine the sensitivity of probe in the implementation of probe correction at wide angles for both the co and cross polarized field components. A probe with low directivity requires little, if any, probe correction near the antenna main beam and necessitate probe compensation at wider angles. The role of the probe null, for high directivity probe, may not cause a problem in the implementation of probe correction as in the planar near-field scanning. Computer simulated near-field and far-field results as well as experimental verification with a probe gain of 9.5dB are given.