

Challenges and Approaches to On-chip Millimeter Wave Antenna Measurements

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Abstract:

We present three methods to account for sources of degradation of measured on-chip antenna patterns performed in a probe station environment. Antenna pattern and gain measurements are degraded by parasitic probe tip radiation as well as scattered energy from the metal probe station environment. In this work, we use superposition and S-parameter techniques to de-embed the effects of probe tip radiation. We also use radiation pattern simulations of on-chip antenna layouts, and compare with measured on-chip antenna patterns, to show the impact that surrounding circuitry has on on-chip antenna patterns. This work shows methods that improve the ability to reliably design, predict, and measure on-chip antenna patterns.

Index Terms — On-chip antennas, millimeter-wave antennas, millimeter-wave radios, de-embedding techniques, probe stations, probe radiation, antenna characterization, CMOS, electromagnetic simulations, HFSS.