Investigating Measurement Methods for High-Resolution Electromagnetic Field Side-Channel Analysis

Abstract:
Recent publications have emphasized the power of high-resolution, low-distance EM measurements for side channel analysis. In this paper, we investigate several aspects of such measurements, e.g. different coil-diameters, probe-to-die distances, bandwidths and measurement resolutions. We use an FPGA-based implementation of an AES s-box as device under test and perform measurements of the magnetic near-field. Using the peak amplitude of the magnetic near-field and the Pearson correlation coefficient as quality measures, we show that the probes with smallest diameters lead to the best results. We propose a suitable trade-off between measurement time and measurement quality by using one fourth of the coil diameter as spatial measurement resolution. We show that the correlation is decreasing significantly if a bandwidth below 300 MHz is used and we recommend a bandwidth of 1 GHz. Additionally we confirm that the maximum value of the measured EM amplitude decreases by 1/r², and the correlation of the measurement by 1/r with r being the distance between probe and
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