Analysis of Simulation to Measurement Correlation for PCB Interconnects in HFSS

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At the present time, it is very common for PCB and packaging interconnects to operate at frequencies in the range of 20-40GHz. Designing these interconnects at such high frequencies is a challenging task. It is imperative to obtain a good correlation between measurement and simulation data to establish confidence in our software to accurately model these interconnects at high frequencies.

This paper examines the accuracy in the correlation between the extracted S-parameters in HFSS to the measured Vector Network Analyzer (VNA) results. Measurements are conducted on Wild River Tech`s CMP 28/32 Channel Modeling platform, which contains 27 interconnect structures specifically designed to benchmark the software. From the simulated plots, the regions having an inconsistent correlation with the measurements are studied.

Based on concepts of signal integrity and transmission line theory, potential causes in HFSS leading to these inconsistencies in correlation are identified. Some of these causes include appropriate de-embedding, material properties (dielectric constant, dissipation factor, conductivity and surface roughness), conductor thickness and trace width. Each of these factors is examined individually in HFSS and the impact on the measurement-simulation correlation is considered. This task will enable a recognition of the factors having a major influence on the simulated results. This will help us to understand the limitations of using HFSS for modeling PCB interconnects at frequencies in the range of 20-40 GHz.

In doing the analysis of interconnects in HFSS there will be a need to classify our simulation-measurement correlation results as significant or not. A robust method to quantify such comparisons is an essential requirement. This paper reviews some of the available methods, which can be used for quantitative validation of measurement-simulation correlation data.