Wednesday, January 20, 2021
9:45 am – 11:15 am ET

Session B: Over-the-Air and On-Wafer Characterization

Uncertainty in mmWave Over-the-Air Test (Panel Session) 60 minutes

Moderated by Dylan Williams (NIST) and Kate Remley (NIST)

This panel session will address the many difficulties in evaluating the uncertainty of Over-the-Air tests. Our panel of experts will address measurement uncertainty in OTA test, how important it is, where we can cut corners, and where the current practice will have to be modified. Questions will start with whether specifications on reflection coefficients are adequate or if measurement-based mismatch corrections must be performed and progress all the way to capturing correlations in errors, treatment of systematic bias and the practicality of performing Monte Carlo analyses in complex free-field measurements.

Anomalies in Multiline-TRL-Corrected Measurements of Short CPW Lines

Gia Ngoc Phung (Physikalische Technische Bundesanstalt); Uwe Arz (Physikalisch-Technische Bundesanstalt (PTB))*

Microwave probes in on-wafer measurements contribute to a number of parasitic effects deteriorating the accuracy of multiline Thru Reflect Line (mTRL) calibrations. The accuracy of mTRL calibration is especially sensitive in Devices under Test (DUTs) of shorter line length. It has been demonstrated in previous experimental studies that the calibrated results are often only reliable as long as the length of the line is at least 2 mm. However, the reasons behind this phenomenon have not yet been clarified. Therefore, this paper reports on a systematic analysis of the dependency of the mTRL calibration accuracy on probe effects with a focus on coplanar waveguides (CPW) of shorter line length. For the first time, investigations with regard to the probe effects in shorter CPWs are presented.

Electromagnetic Field Measurements Above On-Wafer Calibration Standards

Haris Votsi (University of Cyprus); Jonas Urbonas (Maury Microwave); Stavros Iezekiel (University of Cyprus); Peter Aaen (Colorado School of Mines)*

This paper presents electromagnetic field measurements obtained above on-wafer calibration standards. The results show the complexity of calibrating in an on-wafer environment, especially at high frequencies as the fields couple to adjacent devices, resulting in the standards behaving different than expected. A vector network analyzer and an electro-optic measurement system are integrated to enable the measurement of the electric-field components above a calibration wafer between 2–26 GHz. The measured tangential electric-field component is compared to electromagnetic simulations, verifying the validity of the measurements. Both the tangential and normal electric field components capture the electromagnetic fields present within an on-wafer environment, when a coplanar-waveguide offset short structure is excited.

RF-dc Converter Optimization using MIMO Antennas and OTA Multi-Sine Calibration Method

Marina Jordao (Instituto de Telecomunicacoes, University of Aveiro); Daniel Belo (Instituto de Telecomunicacoes); Rafael F. S. (University of South Wales, Cardiff, UK, Instituto de Telecomunicações (IT), Delegação de Leiria, ESTG, Polytechnic Institute of Leiria, Portugal); Arnaldo Oliveira (Instituto de Telecomunicações, Universidade de Aveiro); Nuno Borges Carvalho (Instituto de Telecomunicacoes)*

In this paper, the optimization of the power transmitted from several non-collocated antennas to an RF-dc converter circuit is performed using an Over-The-Air (OTA) multi-sine feedback method. An experimental system is tested in an indoor environment and the OTA multi-sine calibration method is applied to produce constructive interference at the RF-dc converter location. It is shown that its overall performance is improved for different indoor positions. Experimental results demonstrate the effectiveness of using the proposed method for Wireless Power Transfer (WPT) applications since the RF-dc converter presents higher efficiency when the method is applied even in worst scenarios, such as low input power or larger distance.

Automatic Probing System with Machine Learning Algorithm

Ryo Sakamaki (National institute of Advanced Industrial Science and Technology); Masahiro Horibe (AIST)*

This paper presents a novel probe alignment system that implements machine learning methods. The developed measurement system is demonstrated at frequencies ranging from 100 MHz to 125 GHz. The measurement system measures the S-parameter with slightly shifting the probe. The S-parameter is expressed by ten trigonometric function orders using the linear least mean square method. The coefficient of each function order is used to calculate the local outlier factor (LOF). Then, the calculated LOFs are used to detect the probe touchdown, and the LOF threshold is preliminarily determined using training data. The accuracy of probe positioning was compared with that of a conventional automatic probing technique, and the difference in the probe position between the two techniques was determined to be approximately 1 μm.

Numerically Stable Digital Predistortion Model for Over-the-Air MIMO transmission

Shipra (IIT Roorkee); Meenakshi Rawat (Indian Institute of Technology, Roorkee, India)*

Digital Predistortion technique is the most economical and reliable technique among all the linearization techniques available. This paper adduces the idea of linearization based on piecewise polynomial or essential spline functions as an integral solution to the MIMO nonlinearity and compares with the Crossover Memory polynomial model. MIMO nonlinearity is strongly coupled together due to the combined effect of PA nonlinearity and crosstalk. For the proof of concept, the method is implemented over the air on 2X2 MIMO, and simulation is performed for 4X4, 8X8, 16X16 MIMO System. Numerical evaluation of the technique is exhibited in terms of NMSE, BER, and EVM., while numerical stability is presented in terms of Condition number and Dispersion coefficient.