94th Session B: On-Wafer and mm-Wave Measurements- Chair

Session Chair: Joel Dunsmore

P1

An Interferometric Characterization Technique for Extreme Impedance Microwave Devices

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This paper presents a microwave impedance characterization technique for extreme impedance devices. The method is based on active interferometry and uses a 2-source 4-port vector network analyzer, which allows for a compact and straight-forward implementation. A new calibration algorithm is described that incorporates error terms from two separate three-known-load calibrations. Based on simulated and measured data, the proposed technique shows substantial improvement in obtaining the impedance of two offset-short devices when compared with conventional measurements.

P2

Inter-laboratory comparison of S parameter measurements with dynamic uncertainty evaluation

Dilbagh *Singh (National Physical Laboratory)*; Martin Salter (National Physical Laboratory); Haris Vosti (University of Surrey); Nick Ridler (National Physical Laboratory)*

This paper presents results from an interlaboratory comparison of S-parameter measurements where the measurement uncertainty has been evaluated using the dynamic uncertainty option within the PNA vector network analyzer (VNA) from Keysight Technologies. The same devices were measured at two different laboratories (NPL, UK, and the University of Surrey, UK), both using a VNA with the dynamic uncertainty option. Several one- and two-port devices were chosen with a range of different values of reflection and transmission coefficients. The uncertainty of the S-parameter measurements has been evaluated for two different calibration methods (short-open-load-reciprocal and electronic calibration) and these are also reported. The investigation was carried out over the frequency range 100 MHz to 26 GHz which covers many of today's RF and microwave applications.

P3

A Method to Remove the Effects of LO Drift from Vector Network Analyzer Measurements

Alexander Arsenovic *(810 Labs LLC)**

This paper describes the effects of LO-drift in VNA scattering parameter measurements and demonstrates an analytical technique to correct for this error. It is shown that LO drift has a limited effect on the process of error correction. Specifically, for calibration algorithms employing a single transmissive standard, such as SOLT, only the phase of corrected measurements are affected. A technique to remove the LO-drift from reciprocal devices is presented, and its application to measurements in the 75-110GHz band is demonstrated. This technique, which we refer to as undrifting, can be applied in post processing if sufficient data is recorded during the measurement process. Thus, measurements that have been previously made can have the errors of LO drift removed. Eight Ten Labs LLC has patent on this technique.

P4

A Novel True-Mode Balanced Measurement using Mixed-mode Power waves

XIN CHEN *(Keysight)*, Joel Dunsmore (Keysight)*

Mixed-mode (Combined differential-mode and common-mode) s-parameters are well adapted to accurate measurements of linear networks. Most of current measurements are using standard s-parameters to compute the mixed-mode S parameters. In this paper, a new measurement system is introduced for measurement of the mixed-mode power waves. And with the mixed-mode power waves, the mixed-mode S parameters are calculated by the mixed-mode scattering matrix..

P5

Vector Network Analyzer Calibration Standards with Precision SMPS connectors for Electro-Optical Modulators

Masahiro Horibe *(AIST)**

The paper demonstrates establishing calibration standard for vector network analyzers (VNA) evaluating electro-optical modulators (EO modulators). The latest EM modulators can operate over 60 GHz frequency. Connectors attached to EM modulators are small push on type connector, SMPS. For the specification of EM modules, return loss and insertion loss shall be evaluated by VNA, however, there is no calibration standards with SMPS connectors in VNA measurement. Therefore, users use conversion adapter/cable to attach to the modules, then the modules are measured at the connector end of 1.85 mm or 1.0 mm coaxial connectors. In the case, conversion adapter/cable makes large phase difference and transmission loss. Calibration standard shall be demonstrated In this study, we have developed and demonstrated SMPS calibration standard devices to adopt VNA calibration. In the calibration standard evaluation, calibration values are traced back to calibration standard s in 1.0 mm coaxial line. After calibration of SMPS standard devices, VNA calibration has been demonstrated under the overdetermined calibration scheme. As the results, VNA calibration uncertainties were less than 0.112, 0.062 and 0.061 at 30 GHz, 67 GHz and 80 GHz, respectively.

P6

Analysis and Performance Evaluation of Novel Microstrip Patch Antenna Based on Two Parasitic Ring Resonators and Partial Ground Plane for Multiband Applications

*Bishoy Halim Elgndi (Alexandria Unversity)**

In this paper, a novel planar monopole antenna for multi-band applications is proposed. The simulated results show that the proposed antenna operates at multiband resonance frequencies, which covers different wireless communication applications. The proposed antenna consists of a quasi-modified rectangular radiating patch with a partial ground plane and two parasitic elements (open-loop-ring resonators) to serve as coupling-bridges. A stepped cut at the partial ground plane is used, to achieve the multi-band features. The proposed antenna is simulated and optimized using High-Frequency Simulation System (HFSS). The antenna topology possesses an area of 30×30 ×1.27 mm3. The measured results demonstrate that the proposed antenna has impedance bandwidths for -10 dB return loss which meet the requirements of worldwide interoperability for microwave access (Wi-MAX), C- (Uplink), X (Uplink) and Ku- (Uplink) band applications. An Acceptable agreement is obtained between measurement and simulation results. Experimental results show that the antenna is successfully simulated and measured.

P7

Design of a WR10 Rotary Joint with two 3D-printed TE01 Mode Transducers

Marian Marschner *(Fraunhofer HHI)*; Wilhelm Keusgen (Fraunhofer HHI); Felix Baum (AKKA EMC GmbH)*

This paper describes the design and construction of a rotary joint based on two 3D-printed TE01 mode transducers. The achieved operating bandwidth of the rotary joint is 25 GHz from 82 GHz to 107 GHz. The attenuation over the whole achieved bandwidth never falls below -4 dB at an amplitude variation of 1.25 dB over a whole rotation. The phase variation is less than 14.8° over a whole rotation, which makes this rotary joint suitable for channel-sounding and measurement purposes.