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Virtual Conference

2021 IEEE Radio & Wireless Week
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Thursday, January 21, 2021
9:45 am – 11:15 am ET

Session C: Traceability in Calibrations and Measurement Uncertainty

Traceability and Uncertainty – What Are They? And Why Do We Need Them?
(Invited Talk) 40 minutes

Nick Ridler (National Physical Laboratory)

Traceability and Uncertainty are two terms that are often encountered when discussing and describing measurements and metrology. But what do these terms actually mean, and why are they important? This talk will provide answers to these two questions.

The talk will begin by exploring the origins of traceability from the early days of commercial trading, and how traceability has evolved to enable trading to be achieved on a global scale. At the same time, an equivalent need for traceability in science, engineering and technology will show how this has led to the development of a quantum-based international system of units.

The talk will also explore the meaning of the term uncertainty, as applied to measurements. It will do this by demonstrating that uncertainty is an integral part of all measurement results. In fact, a more general way to understand and interpret a measurement result is by way of a probability distribution describing the overall state of knowledge concerning the measurand – i.e. the quantity being measured. The uncertainty is then used to help summarise the information contained in the probability distribution.

Throughout the talk, examples will be given to illustrate the concepts that are used. These will be examples drawn from everyday life as well as from various RF and microwave measurement scenarios. The talk will conclude by identifying some of the current challenges involved in applying traceability and uncertainty concepts to contemporary RF and microwave measurement situations.

Improvement of Measurement Uncertainty of THz Waveguide Vector Network Analyzers

*Masahiro Horibe (AIST)**

Even if systematic error terms, i.e. directivity, matching and tracking, in vector network Analyzer (VNA) can be corrected by a calibration process, but it is difficult to ignore the other random error effects, i.e. connection repeatability and flexure effects of cables attached to test ports, etc. In the THz waveguide VNA using frequency extension modules, LO and RF cables making connection from frequency extension modules to microwave VNA produce a large impact on the uncertainty in the transmission phase measurements. This paper proposes minimization of cable flexure effects of RF and LO cables in the THz VNA using frequency extension modules. Then, VNA error model including the LO and RF cable flexure effects are discussed.

Investigation on PIFA and Folded-IFA for TPMS Receiver

Abdellatif Bouyedda (XLIM); Bruno Barelaud (XLIM); Laurent Gineste (EXOTIC-SYSTEMS)*

This paper presents a comparative study between a printed FIFA on PCB and a PIFA integrated in a TPMS Reader. The two antennas are modelled with the enclosure and all metallic parts of the reader, and simulated using a 3D EM simulator. The designed Folded IFA has dimensions of 0.1*λ0x0.1*λ0. Compared with the dimension of the actual PIFA 0.1*λ0x0.1*λ0x0.014*λ0, the proposed miniaturized antenna has better performance than the PIFA and can reduce the volume of the device up to 50%. The simulation results are validated by the measurements performed on the prototyped readers with the two antennas. The performances of the readers are evaluated with a developed test bench based on the ADALM-Pluto SDR platform and a Raspberry PI. The readers are also tested in a vehicle equipped with TPMS sensors.

Classification of Plastic Materials using a Microwave Negative-Order-Resonance Sensor and Support-Vector-Machine

Dania Covarrubias-Martinez (CICESE); Oscar Martinez-Rodriguez (CETYS Universidad); Humberto Lobato-Morales (CICESE); Jose Medina-Monroy (CICESE)*

A method for plastic material classification using a negative-order-resonance (NOR) sensor operating at the 2.5 GHz band and support-vector-machine (SVM) for pattern recognition is presented. The proposal experimentally demonstrates the correct classification of different plastic materials based on their dielectric properties, dealing with large sources of uncertainty introduced by pellet measurements such as air gaps and position/dimension of the pellets. The proposed technique results attractive for the plastic industry as it involves a fast and nondestructive process along with the use of small circuit elements.