Publishable Summary for 19SIP02 PlanarMeT
Knowledge transfer of planar calibration and measurement techniques at millimetre-wave frequencies

Overview

This project aims to maximise uptake by the industrial end-user community of outputs from the EMPIR 14IND02 PlanarCal project, related to planar on-wafer calibration and measurement techniques at millimetre-wave frequencies. On-wafer measurement is important for the precise characterisation of integrated circuits operating at millimetre-wave frequencies that benefit sectors such as telecommunications, automotive, and space. Knowledge about high frequency on-wafer measurement, developed in 14IND02 PlanarCal, will be transferred through a practical industrial User Guide, a training course, and, a workshop at European Microwave Week.

Need

Millimetre-wave on-wafer calibration and measurement are underpinning technologies for the development of integrated planar circuits, which are in widespread use for a large variety of applications. Notable examples include high capacity mobile backhaul links, automotive radar sensors, and space deployed radiometers for remote sensing of atmospheric constituents which are related to climate change. Precise on-wafer measurement is critical to the production of high quality, cost effective, and assured integrated circuits for these applications.

Previously, the 14IND02 PlanarCal project sought to establish measurement traceability for the characterisation of S-parameters of integrated planar circuits from radio frequencies to submillimetre-wave frequencies. The key output from 14IND02 PlanarCal was the establishment of traceability for on-wafer S-parameter measurements. 14IND02 PlanarCal also developed a Best Practice Guide (BPG) on how to perform precise on-wafer S-parameter measurements. However, this BPG is aimed primarily at top tier metrology laboratories, such as National Metrology Institutes (NMIs), rather than more general end-users working in industry.

The Primary Supporter for this project is Filtronic Broadband Ltd. Like many electronics companies, Filtronic are developing millimetre-wave technology to support the above-mentioned applications. This technology relies on electronic circuits that are realised on-wafer. Their characterisation can only be achieved using accurate and reliable on-wafer measurements. These needs will be addressed by adapting and implementing the Best Practice Guide developed in 14IND02 PlanarCal for industrial applications, which will in turn benefit other companies involved in this sector (i.e. in high-frequency electronics for communications).

Objectives

The overall aim of the project is to provide detailed practical guidance and design philosophy to the Primary Supporter, Filtronic, and to enable take-up of the knowledge gained and raise the profile of the outputs from 14IND02 PlanarCal work with industrial end users.

The specific objectives of this project are:

1. To provide an industrial User Guide to end users, that demonstrates industry-level methods to perform reliable and precise on-wafer calibration and measurement at millimetre-wave frequencies;
2. To work with the user community so they are aware of, and able to use, the User Guide and to promote its uptake. Dissemination will be done through training courses, the On-Wafer Users Forum, and, a workshop.

Results

This project will produce the following outputs related to the objectives:

Objective 1

1. User Guide giving industry-level methods for validating planar calibrations and measurements at millimetre-wave frequencies;

Objective 2

2. Training courses for end users (including the project's Primary Supporter) to demonstrate the use and implementation of the User Guide;
3. A workshop to further disseminate the activities undertaken in this project to industrial end users, including members of the IEEE On-wafer Users Forum.

Impact

Direct impact will be achieved by working with the Primary Supporter, who manufactures millimetre-wave transceiver modules for mobile backhaul systems, to transfer knowledge so that industrial end users (including the Primary Supporter) will be able to perform precise on-wafer measurements at high frequencies. This will be done via the User Guide which will demonstrate practical methods developed in 14IND02 PlanarCal on typical measurement requirements provided by key industrial stakeholders (e.g. members of the IEEE On-Wafer Users Forum). Work undertaken within this project will be communicated to the end users in industry and academia via training courses, a workshop, and interaction with the on-wafer measurement Users Forum that is sponsored by the IEEE Automatic RF Techniques Group (ARFTG). This will ensure the widest possible uptake of the outputs from 14IND02 PlanarCal via this project.

The impact will spread beyond the Primary Supporter to the wider community by the delivery of a training course, a workshop at an international scientific conference, and, papers/articles published in a scientific journal, a trade journal and at conference. In addition, the industrial User Guide produced in this project will be communicated to the IEEE on-wafer Users Forum which has recently been launched to foster advancements in the standardisation of on-wafer measurements.

With the User Guide, training activities and workshop, manufacturers will be able to provide their customers with confidence in measurements and specifications of their products. This is very important for customer/supplier relationships and where products need to demonstrate compliance with specifications or directives, regardless of who is doing the testing or where the test is being done. All sectors of the electronics industries involved in characterisation and modelling of high-frequency integrated circuits will benefit from this project.

Economic impact will be achieved through support for the digitisation of products and services across Europe. Social impact will include retaining a competitive advantage in Europe over foreign competition on technology and thereby retaining and growing expertise and much needed highly skilled electronic engineering and support staff jobs. Environmental impact will be achieved through more accurate and traceable measurements for sensor networks comprised of ground-based millimetre-wave cloud radars and passive multi-channel millimetre-wave space deployed radiometers. Such sensor networks play a key role in weather forecasting and earth observation which provides essential information concerning global climate change.

Project start date and duration:	01 June 2020, 18 months	
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