Nick commentary

Talk more about NIST secondment!

* Invited secondment
* From Dylan – MTT president during (IEEE Xplore bio.)!

P5 nist acronym

Using resources available at a National Metrology Institute, attempt to

apply best practices to higher frequencies (with the potential for future communications

use) and observe if they are applicable

Similar waveguide is being used in

5G backbone development at 28 GHz and above, so reliable metrology in this transmission

medium is important. HIGHER PLS

2.2.1.1 They are

physical and measurable via slotted line experiments or \thru-reect-line" calibrations (explained

later in this Chapter).

FIG 2.4 acronyms

Fig 2.5 receiver names

Vna if not all such to rf and microwave meas.

sources has falled – fallen

extreme stimulus powers – clarify

internals and and external – internal components and

collier book editors

This is especially true for the phase calibration where

the coefficients calculated from the measurements of the reference it's characterisation have a

linear relationship with the calibrated DUT waves

The covariances between these quantities are not

included, however, which can signi\_cantly a\_ect the combined uncertainty of some nonlinear

DUT measurements, including those involving cross-frequency terms such as behavioural models

described later in Chapter 5. CLARIFY QUANTITIES

Therefore, for this project two phase references were taken to NIST and re-characterised – COMMENT ON RESULT COMPARED TO KS

This \_gure is used with permission from a report produced by Gustavo Avolio MENTION HIS HERITAGE

Figure shows a screenshot of the MUF software VNA Uncertainty Calculator with the

LSNA tab open.

We shall \_rst introduce a generic frequency-domain model of the nonlinear device, illustrated in

Figure X

(via network and tested across the Atlantic!) – MAKE A PROFESSIONAL POINT

The evaluation board used 2.92 mm precision connectors, REMOVE 2.92 MM!

The two phase references used for both calibration and synchronisation of the mixer-based

NVNA were Keysight 67 GHz comb generators[134]. The phase uncertainties for the calibration

phase reference are given in Table 5.3 and were obtained through characterization with a sampling

oscilloscope at NIST, which is traceable to national measurement standards via electro-optic – REFERENCE NIST TRIP

In this example we used Monte Carlo with 1000 samples to propagate uncertainty to the Xparameters

of the DUT. – MC METHOD

Figure ?? shows

A world-first, rigorous evaluation of combined standard uncertainty – REMOVE COMB STD

MENTION CH 1 AND 2 IN CONC

Future wireless communications are planned to use frequencies of 26 GHz and above (mention E-band)

The NIST Microwave Uncertainty Framework was introduced as an established and proven base – ADD SECONDMENT INFO AGAIN

This is expected as the uncertainty of the phase reference characterisation increased with

Frequency – AS WELL AS OTHER SOURCES

The ripple technique work – WAVEGUIDE UNC EVAL

repeat the evaluation of the ripple technique SEE ABOVE

The Cardiff model – REFERENCE

On-wafer DUTs can also be included, using both calibration de-embedding techniques or the developing on-wafer absolute calibration standards – REFERENCE

The repeatability of behavioural model extraction, comparing the uncertainties in model

parameters extracted from the same DUT at different labs – REPRODUCABILITY, MENTION ISO-5725

Repeatability studies are commonly used by NMIs to measure the variation in measurements across laboratories – AND INDUSTRY!

Finally, an evaluation of behavioural model uncertainty using analytical propagation should be straightforward to develop, which can provide further veri\_cation against the numerical method presented here. RELATIVELY STRAIGHTFORWARD

Ginleyt ref error

Add closing statement?