A Prescription for THz Transistor Characterization: An Overview

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PROGRESS in high-frequency transistors characterization has accelerated over the last few years with the introduction of transistor technologies with gain at THz frequencies. However, overmoding and other parasitics make it difficult to control errors in coplanar waveguide (CPW) calibrations at sub-millimeter wavelengths [1;2]. Figure 1 illustrates this with an example of a measurement of the reverse transmission through a transistor from [3] with calibrations based on commercially available impedance-standard substrates (ISS).

An alternative strategy for accurately characterizing high-frequency transistors operating at sub-millimeter and THz wavelengths based on thru-reflect-line (TRL) calibrations addresses this problem. These TRL calibrations locate the measurement reference plane directly in small, single-mode microstrip lines fabricated next to the transistors. Figure 1 shows the clear advantages of the TRL approach.

The presentation will focus on the TRL approach, and how to achieve measurements such as that shown in Fig. 2, which shows the current gain of two transistors measured to 750 GHz, and to estimate the uncertainties of these measurements. A narrated Power-Point[1] presentation with greater detail and embedded references can be found at www.nist.gov/pml/electromagnetics/upload/APrescriptionForTHzTransistorCharacterization_compressed.pptx.

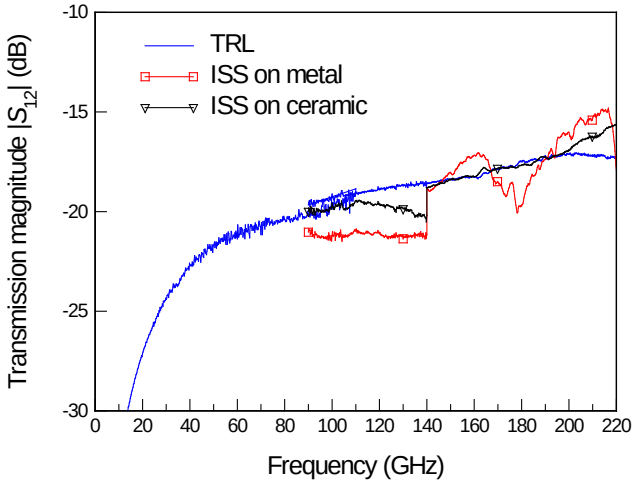

Fig. 1. Comparison of TRL measurements to measurements corrected with an impedance standard substrate (ISS) placed on a metal chuck and on a thick ceramic substrate. From [3].

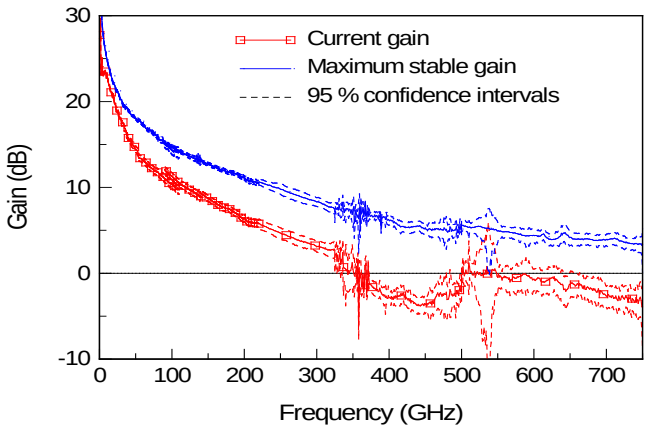

Fig. 2. Measured results and their uncertainties after de-embedding the access via holes. From [3].

REFERENCES

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[3] D. F. Williams, A. C. Young, and M. Urteaga, "A Prescription for Sub-Millimeter-Wave Transistor Characterization," *IEEE Trans. THz Sci. Technol.*, pp. 433-439, Mar.2013.

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