System-Level Verification Devices and Device Characterization Services

DATA SHEET / 1H-005

Maury Microwave

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What is System Calibration?

Calibration, or error correction, is the process of removing the systematic error terms present in a system through the measurement of known calibration standards.

When thinking about small-signal S-parameters, calibration normally refers to vector calibration. Vector calibration is typically performed by using coaxial, waveguide, or on-wafer calibration substrate standards, to create an error-corrected measurement reference plane at the device under test (DUT). This allows the measurement of incident and reflected waves by the vector network analyzer (VNA) at the DUT reference planes, which enables the determination of the device S-parameters.

For large-signal measurements, a power calibration is performed in addition to vector calibration, which enables absolute power measurements at the calibrated DUT reference planes. This allows the computation of large-signal device parameters such as delivered input power, output power, power added efficiency etc.

In cases where it is impractical or impossible to perform calibration directly at the DUT reference planes, both vector and power calibration may be performed at an alternate common reference plane. Then, through de-embedding, the reference planes can be shifted to the DUT providing accurate, error-corrected device measurement data.

Why Verify a System Calibration?

How do we know that a vector calibration, or power calibration is accurate, and without knowing this, how can we have confidence in our measurements? The best way to gain confidence is to first verify, or validate, our system calibration.

Common S-parameter verification techniques include measuring the combination of low-loss airline and short circuit termination and measuring the peak-to-peak ripple, but it is not obvious how that translates to measurement accuracy on different types of DUTs.

An improved S-parameter verification technique includes measuring passive verification standards, such as 1-port offset shorts and loads, or 2-port airlines or mismatch airlines, and comparing with factory-characterized data. While better than peak-to-peak ripple, these verification standards are optimized for passive device measurements and are not perfect representations of active DUTs (i.e. they have no gain).

Power calibration verification is typically performed on a THRU, where the source power and receiver power calibrated to the DUT reference plane are compared. However, the range over which the verification is performed may not represent the actual power of the DUT.

The ideal vector and power calibration verification technique is one in which a golden device, either similar or identical to the DUT being measured, is used to validate a system calibration. An ideal golden device is one that has been characterized on a traceable measurement system. After vector and power calibration, the golden device is measured, and the results compared to the factory characterization. While similar in principle to using characterized passive verification standards, active golden devices are better representations of active DUTs, especially when having similar match, gain and power.

Verification Device Characterization Services

Maury Microwave offers a verification device (or golden device) characterization service, whereby an active device similar or identical to the customer DUT being measured, is characterized over the desired conditions that will be experienced in the measurement system.

The device can either be supplied by Maury, the customer, or selected by mutual agreement from commercial off-the-shelf devices. A characterization plan is agreed to, which covers all or a subset of:

Type of measurement for characterization

- Small-signal S-parameters
- S-parameters at arbitrary power levels
- 50Ω gain compression power sweep
- Source pull and/or load pull
- Noise parameters

Measurement conditions

- Frequencies
- Signal type (i.e. CW/pulsed-CW single-tone or two-tone, modulated...)
- Biasing
- Power range
- Fundamental and/or harmonic impedance terminations (nonlinear, non-50Ω conditions)
- Etc.

Validated and repeatable measurements are then performed in Maury Microwave's state-of-the-art measurement and modeling facility, after which the resulting measurements and golden device are returned to the customer and used as part of the system validation process before measuring new DUTs.

Increase confidence in your measurements with Maury's system-level verification devices and device characterization services!

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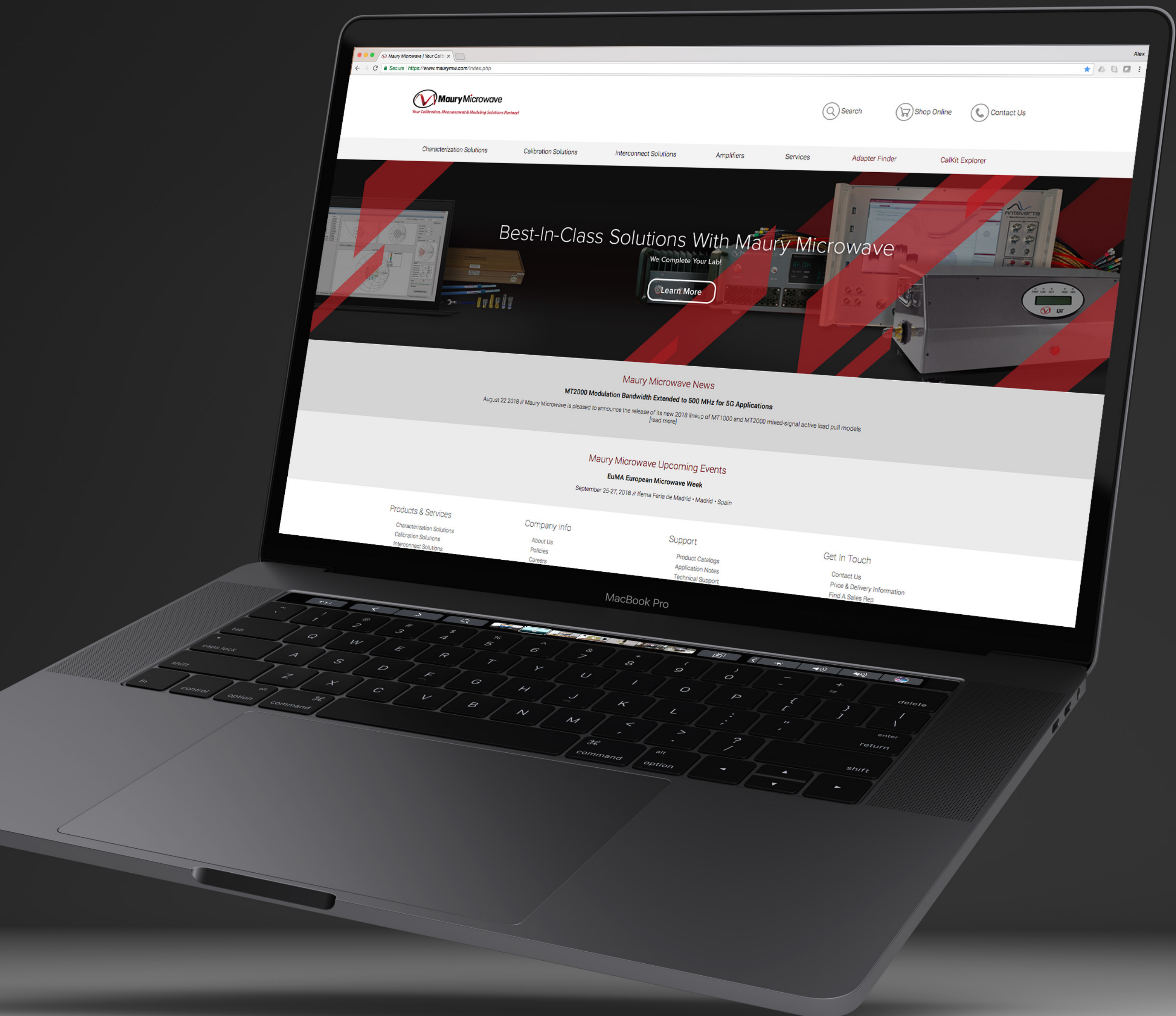

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