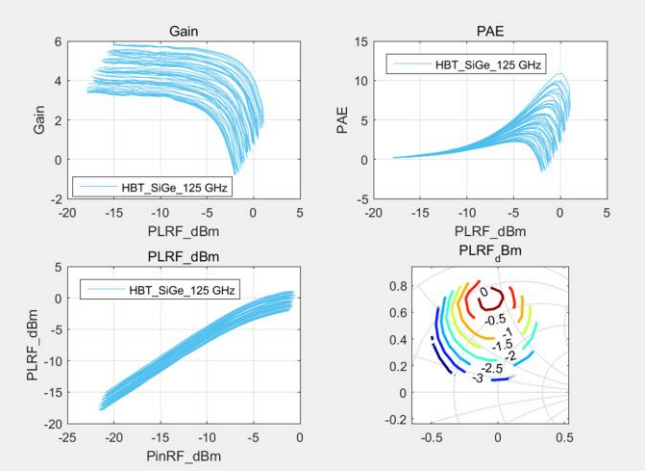
Active Load Pull for 6G and Sub-THz Frequencies

Conventional VNA test benches for frequencies over 70 GHz rely on frequency extenders, which provide little to no control over the power and/or phase delivered to the DUT. The lack of control makes it challenging to ensure small-signal driving to active devices during S-parameter measurements, especially when measuring small transistors using state-of-the-art high-power extenders.

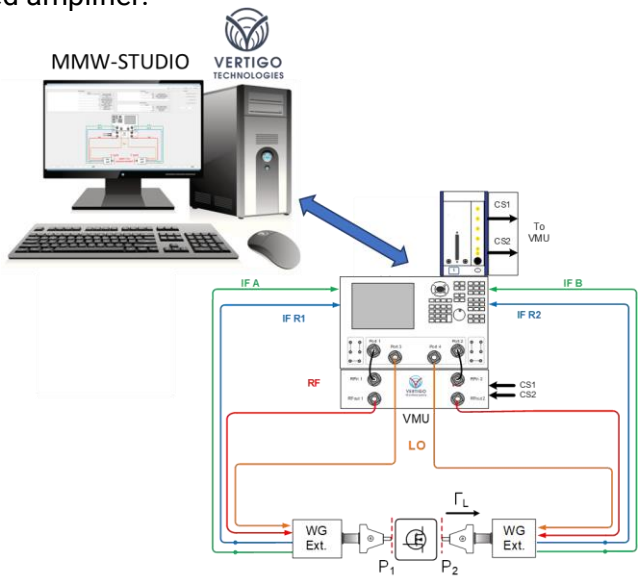
This challenge also makes it impractical to perform vector-corrected large-signal measurements. VNAs cannot be used during power sweeps, so such measurements are typically performed using scalar-based methods, which limit the amount of extracted information during device characterization. Additionally, conventional scalar-based large-signal measurement techniques become extremely time-consuming when large power sweeps are needed.



Gain vs power out (top left), power-added efficiency vs power out (top right), power out vs power for each gamma load in (bottom left), and power out contour (bottom right)

This demonstration shows the measurement capabilities of the MMW-STUDIO – a software suite provided by Vertigo Technologies that enables power and phase control at the DUT reference plane through the extenders – as it performs a power-controlled S-parameter measurement and an active load pull in the WR6.5 waveguide band (110 GHz – 170 GHz) on a waveguide connectorized amplifier.

Demo Setup



Target Users

Target users include professors, design engineers, technicians, and researchers who are involved in mmWave/RF analog design, device modeling, and device characterization.

Product Overview

MMW-STUDIO – mmWave and Sub-THz Characterization Software

Provided by Vertigo Technologies, the MMW-STUDIO (MT920A) is a software suite designed to work with waveguide-banded mmWave VNA systems and add accurate and repeatable high-resolution power control. The software enables the direct measurement of vector-corrected power at the DUT reference plane, as well as control over the power delivered to the DUT. Doing so allows engineers to perform gain compression power sweep measurements over the available levels of power, and S-parameter measurements at any arbitrary power level.

MMW-STUDIO LP (MT920B) is a software addon, which when used in conjunction with a Vector Modulation Unit (VMU), enables control over the magnitude and phase of the signals delivered to the input and output of the DUT. This enables an engineer to set arbitrary impedances, or perform active load pull measurements, where the magnitude of reflection presented to the DUT is achieved by controlling the reflected a_2 wave and fulfilling $\Gamma = a_2/b_2$.

MMW-STUDIO and MMW-STUDIO LP empower conventional waveguide-banded mmWave VNA systems to perform power measurements, large-signal testing, and active load pull without using power meters, passive impedance tuners, or additional test-sets, thereby taking advantage of the large dynamic range and high speeds of the VNA's receivers while maintaining a seamless setup configuration and user experience.

KEY SPECIFICATIONS AND FEATURES:

- Fast, accurate power control and measurements using standard VNA-based setups at virtually any frequency covered by mmWave extenders
- Fully frequency-scalable fundamental active load pull system across all commercial waveguide frequency extenders (currently up to 1.1 THz) using off-the-shelf lab equipment
- The active load pull approach allows full Smith chart coverage, depending on the DUT
- Fully autonomous high-speed load pull measurement on different bias, frequency, and power conditions
- Accurate small- and large-signal device measurements in mmWave
- Easy calibration/measurement procedure for large-signal characterization at the press of a button

More Resources

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