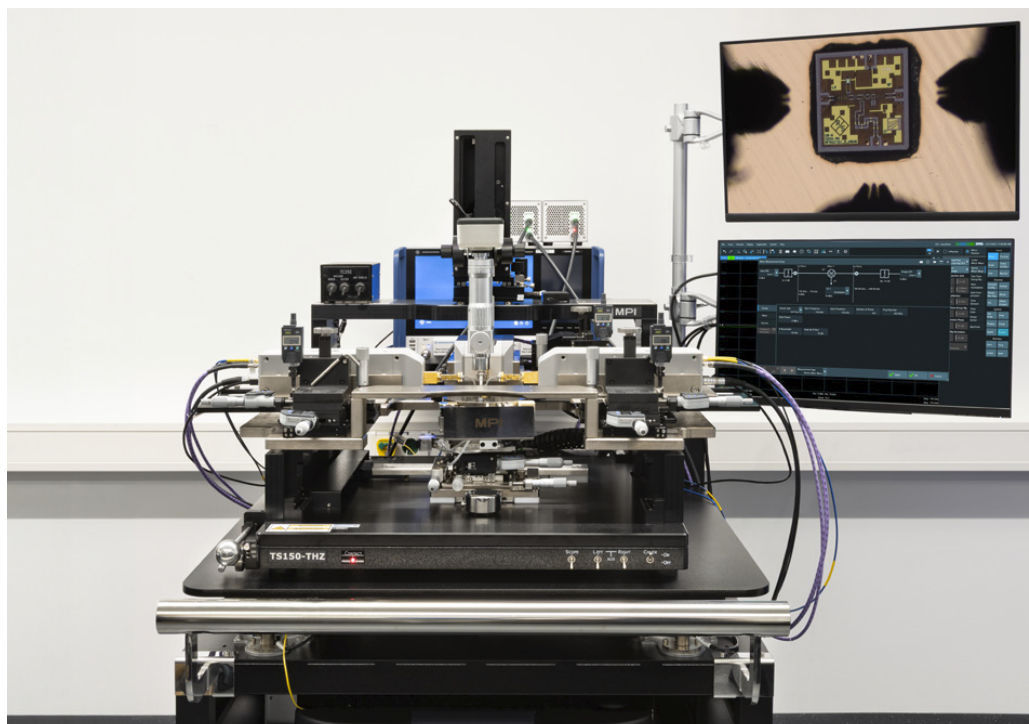


# Three-Port On-Wafer Mixer Measurements Up To The THz Range On MPI Probe Stations



Three-port mmWave integrated characterization system

## YOUR TASK

Accurately characterizing high-frequency mixers and other frequency-converting components on-wafer for design validation is becoming increasingly challenging in the mmWave range.

The R&S®ZNA vector network analyzer (VNA) is a recommended tool to carry out the required mixer measurements, such as conversion loss and matching.

## ROHDE&SCHWARZ SOLUTION

Achieving high-precision three-port mixer measurements directly on wafer, especially at frequencies extending into the THz range, requires a solution that combines performance, flexibility and seamless integration. The four-port R&S®ZNA vector network analyzer is ideally suited to this task.

When combined with external frequency converters, the setup enables measurements across RF, LO and IF paths, which is ideal for characterizing mixers with maximum accuracy in very high frequency ranges.

A standout benefit of this solution is its highly efficient mechanical integration with MPI Corporation's dedicated THz wafer probe system models.

The R&S® mmWave converters can be easily mounted in all the cardinal directions on the MPI probe systems. Rohde & Schwarz provides a complete range of mmWave converters up to 1.1 THz for mixer testing. The mechanical design of the converters leaves enough space for the microscope to be positioned close to the wafer.

The R&S®ZNA advanced architecture, featuring up to four internal phase-coherent sources and eight receivers with a high dynamic range, is a solid foundation for high-performance measurements. The R&S®ZNA also enables the use of two different converter frequency bands, which are required if the RF and LO frequencies of the DUT are in different waveguide bands.

The equipment configuration supports configuration supports key mixer measurements such as conversion loss, compression, isolation and matching – all within a single test environment.



Frequency mmW converters integration on MPI THZ system platform for three-port characterization

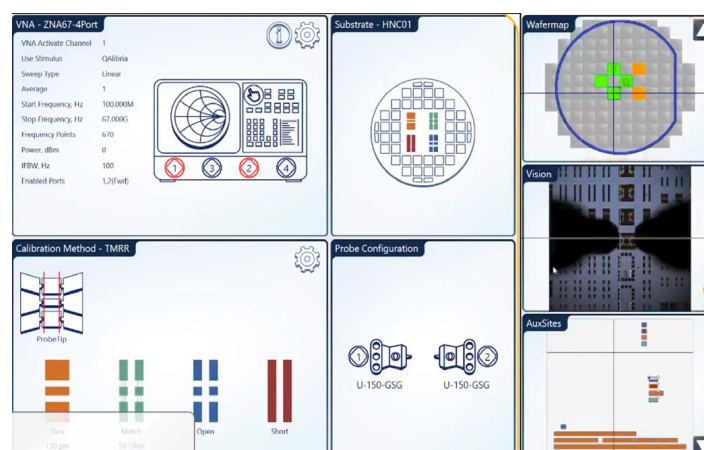
### THREE-PORT FREQUENCY EXTENDER INTEGRATION

MPI is the first in the industry to offer a probe station configuration that supports three frequency extenders mounted simultaneously in the east, west and north positions. MPI's unique prober configuration enables true three-port mmWave and sub-THz measurements directly on the wafer, which is ideal for characterizing frequency-converting devices such as broadband mixers.

The configuration supports a wide range of frequency extenders, including D band (110 GHz to 170 GHz) and G band (140 GHz to 220 GHz), with a direct waveguide probe connection to each extender. Having a direct probe connection minimizes the RF path, which maximizes power delivery, phase stability and directivity while reducing insertion loss and uncertainty in high frequency measurements.

This capability is offered by multiple MPI probe systems, including the TS150-THZ, a 150 mm manual station optimized for mmWave and THz probing. Other manual and automated MPI systems also support this three-port integration with the same mechanical approach. The design provides rigid mounting for the extenders while preserving microscope access and probe positioning flexibility. Stable, repeatable contact is essential for consistent and accurate measurement of results, especially when working across multiple ports and waveguide bands.

Calibration is performed using MPI calibration substrates or on-wafer custom standards managed by QAlibria® software, which drastically simplifies the calibration process, ensuring calibration accuracy and reproducibility.



QAlibria® wafer-level RF calibration software

## SUMMARY

Combining the R&S®ZNA vector network analyzer with MPI Corporation's advanced probing solutions enables highly accurate three-port mixer measurements directly on the wafer up to the THz range. The co-developed solution provides unmatched performance, flexibility and mechanical integration.

Complex characterization tasks can be performed, such as conversion loss, matching and isolation. Together, the versatile R&S®ZNA vector network analyzer and MPI Corporation's innovative probe systems and QAlibria® empower engineers to push the boundaries of mixer characterization and deliver reliable results for next generation THz and high speed RF technologies.

*See MPI Corporation's Terms and Conditions of Sale for more details.*

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