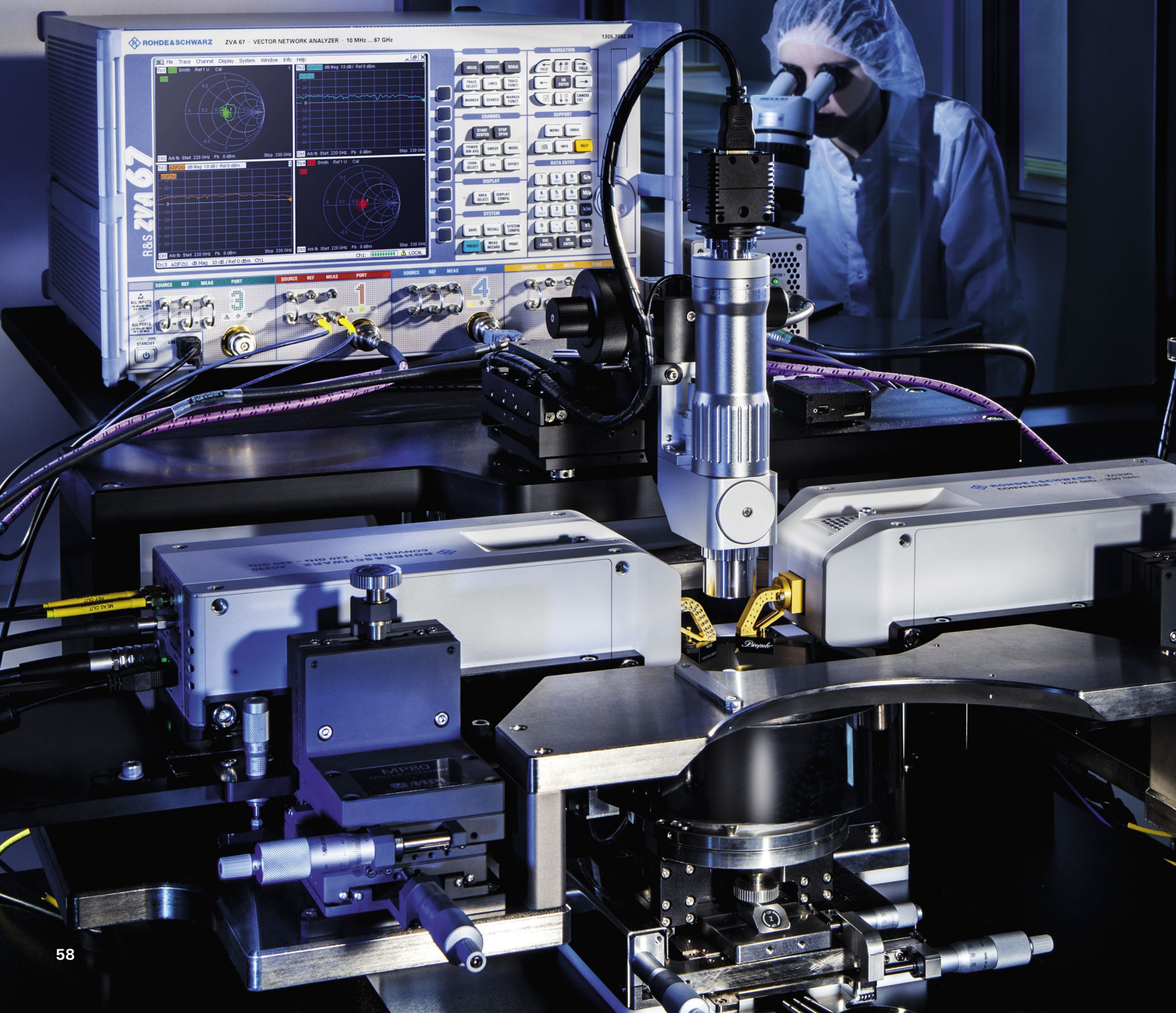# All-in-one solution for on-wafer characterization of millimeterwave components

Fig. 1: On-wafer measurement at 300 GHz with the millimeterwave prober from MPI and the R&S®ZVA network analyzer with frequency converters.

Due to the increasing integration of components, testing them via coaxial ports is less frequently an option, since many of them no longer have coaxial ports. Instead, components are characterized directly on the wafer, a task requiring both a network analyzer and a probe station. An all-in-one solution of this type is now available from Rohde & Schwarz.

On-wafer test solutions in cooperation with MPI Corporation

For a number of years, Rohde & Schwarz has collaborated with the MPI Corporation in Taiwan (www.mpi-corporation.com) to offer turnkey solutions for measurements on semiconductor components in the RF and millimeterwave range. This partnership is now being intensified and extended to provide test stations at various sites in Asia, Europe and the USA where interested parties can perform trial measurements before purchasing a solution.

MPI probers feature an exceptionally high level of mechanical stability and a sophisticated design for easy operation and a good reproducibility of measurement results (Fig. 1).

The Rohde & Schwarz R&S®ZVA network analyzer has the dynamic range and stability required for demanding on-wafer measurements. For millimeterwave applications in the automotive, 5G and aerospace and defense fields, converters extend the frequency range of the base unit to various frequency bands up to 500 GHz (Fig. 2). Reproducible measurement results depend on the converters' thermal stability, especially for manual calibrations where the individual calibration steps are performed at a different time than the measurement.
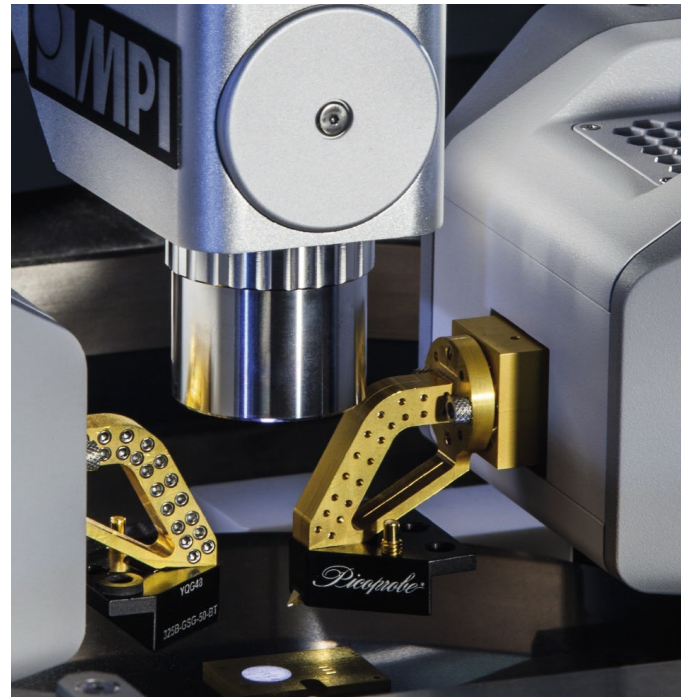

Fig. 3: The probes for wafer contacting are screwed directly onto the converters – a solution that makes designs with waveguide feedthroughs obsolete.

Fig. 2: Frequency converter with waveguide output positioned low. This minimizes the distance to the wafer on the chuck.

Optimized for millimeterwave measurements

In other prober systems on the market, the distance between the converter outputs and the wafer under test can be quite large, with long waveguide bends in them. This can result in mechanical instability and degradation of the RF characteristics, e.g. directivity at the test port at frequencies above 220 GHz. With MPI probers, the wafer chuck and the converters are at the same level. The converters can be placed just a few centimeters from the chip under test so that the mechanically stable probes can be mounted directly on the converter (Figs. 2 and 3). They can be exchanged quickly because they are screwed onto a metal plate that simply slides onto the manipulator from the side and is secured with a dovetail connector. The setup is changed in no time for measurements in a different frequency band.
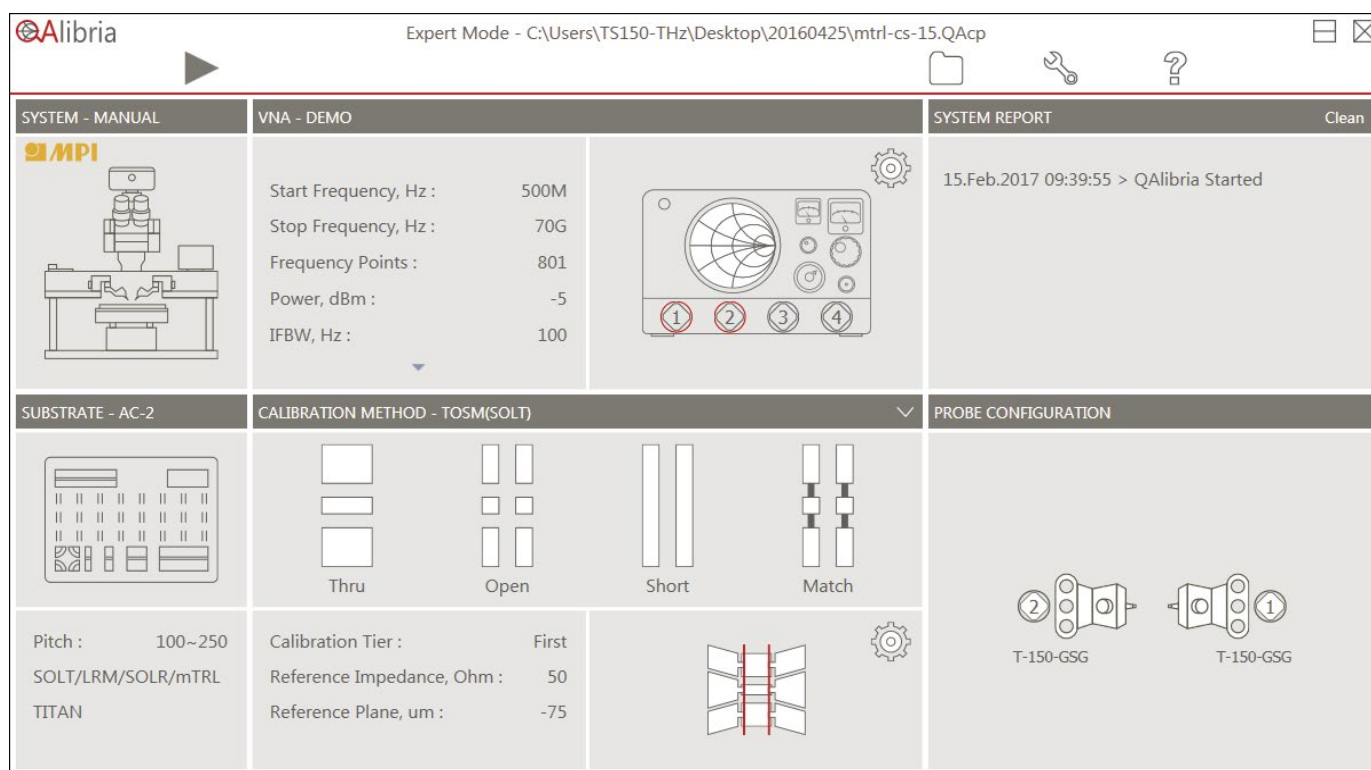
Fig. 4: QAlibria® multitouch calibration software.

With the QAlibria® calibration software from MPI, on-wafer measurements are quickly configured and performed (Fig. 4). Its intuitive multitouch user interface (a touchscreen mounted on the station comes with the system) sets the test parameters on the network analyzer, configures probes and the calibration substrate and selects the appropriate calibration method. Besides conventional methods, the software also offers as a special feature the NIST multiline TRL, which makes it possible to perform on-wafer calibrations based on the accuracy requirements from metrology institutes.

Try before you buy

Any test system consisting of a network analyzer and probe station is technologically complex, especially those used for frequencies in the millimeterwave range. Customers can test the MPI / Rohde & Schwarz solution at various sites in Asia (China and Taiwan), Europe (Germany and Russia) and the USA (Texas and California) in order to ensure that their T&M requirements are met before making an investment. Trial measurements on DUTs allow customers to assess the system operation as well as the quality of measurement results. Depending on the site, manual (Fig. 5), semi-automatic or fully automatic probers are available. Interested? Contact your local Rohde & Schwarz representative for more information.
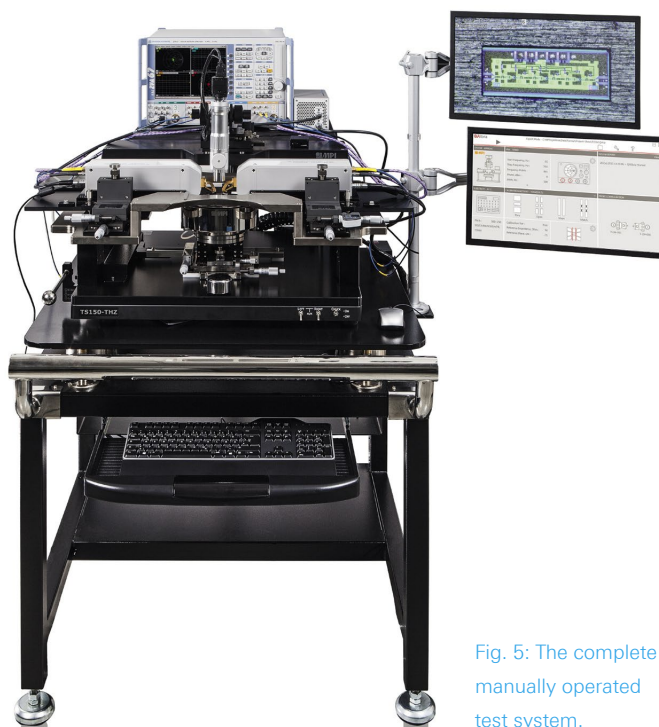
Andreas Henkel

Fig. 5: The complete manually operated test system.