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R&S®ATS1000 Antenna Test System

At a glance

The R&S®ATS1000 antenna test chamber is the ideal environment for 5G antenna characterization throughout the entire process from R&D to production for both active and passive devices.

5G is all about data, speed and reliability using high frequency millimeter wave bands. The lack of conventional external RF connectors make 5G antenna characterization challenging. 5G antenna, chipset and UE manufacturers as well as wireless market operators need a viable solution for research, diagnostics and debugging up to type approval.

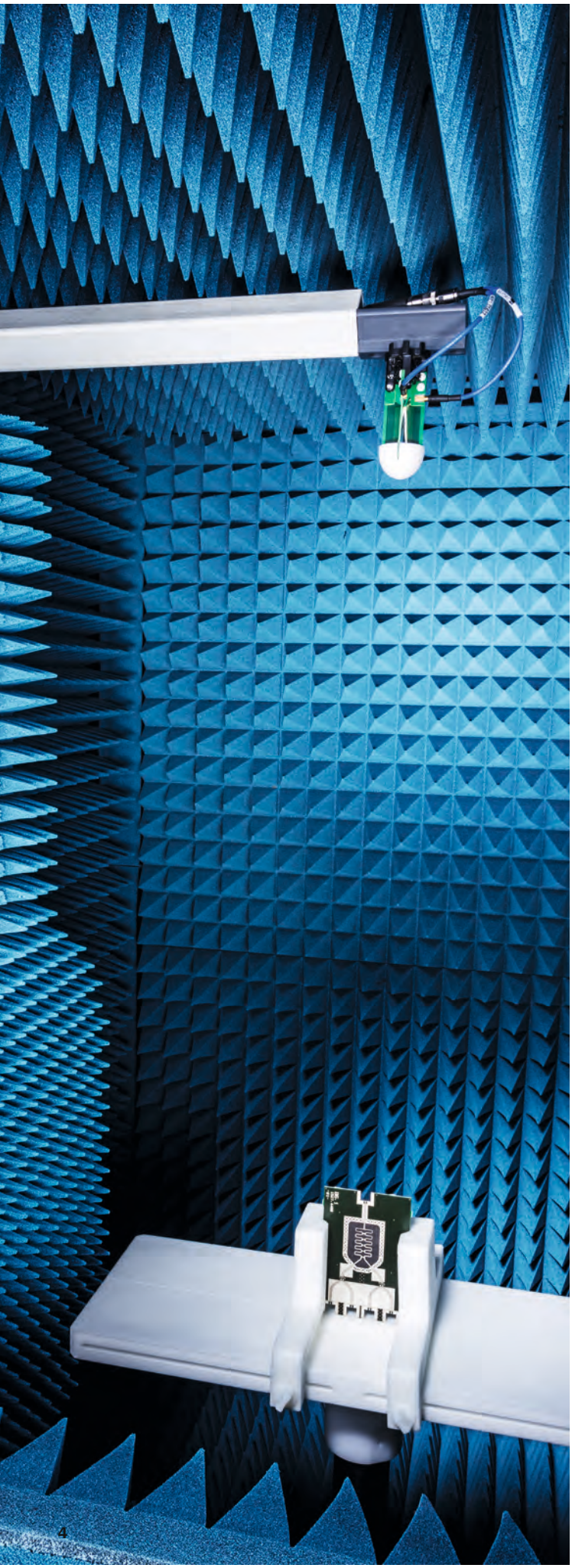
Due to its compact design, the R&S®ATS1000 supports far-field and near-field antenna measurements inside any R&D lab space. The mobile chamber helps to optimize the overall RF performance of antenna modules already in the initial phases of development. This avoids costly and time-consuming modifications for a large number of prototypes at a later stage. Antenna testing during development reduces costs and keeps the product launch on schedule with a faster time to market.

One-stop-shop solutions combining the R&S®ATS1000 with a Rohde&Schwarz test system ensure fast and smooth measurements in the lab and provide optimized capabilities for determining a 5G device's antenna performance and characteristics in the millimeter range.

In summary: The R&S®ATS1000 antenna test system is a convenient and highly accurate solution for testing 5G antenna modules in the new 5G millimeter frequency bands in a mobile shielded chamber.

Key facts

- Extremely fast and accurate 3D antenna characterization
- Designed for maximum compactness and mobility: includes wheels and easily fits next to a 19" rack
- Frequency range from 18 GHz to 87 GHz
- Greater than 50 dB shielding effectiveness up to 87 GHz
- Broadband measurement antenna from 4 GHz to 87 GHz with very low radar cross section
- Passive (magnitude and phase) and active (TRP, EiRP, TIS, EiS, EVM) antenna measurements
- Near-field to far-field transformation with the R&S®AMS32 test measurement and control software
- Device characterization under extreme temperature conditions
- One-stop-shop for 5G devices measurements: R&S®ATS1000 chamber, R&S®AMS32 software, test instruments



R&S®ATS1000 Antenna Test System

Benefits and key features

Extremely fast and accurate 3D antenna characterization

5G is all about speed and reliability. The high precision conical cut positioner integrated in the R&S®ATS1000 makes extremely fast and accurate antenna characterization possible.

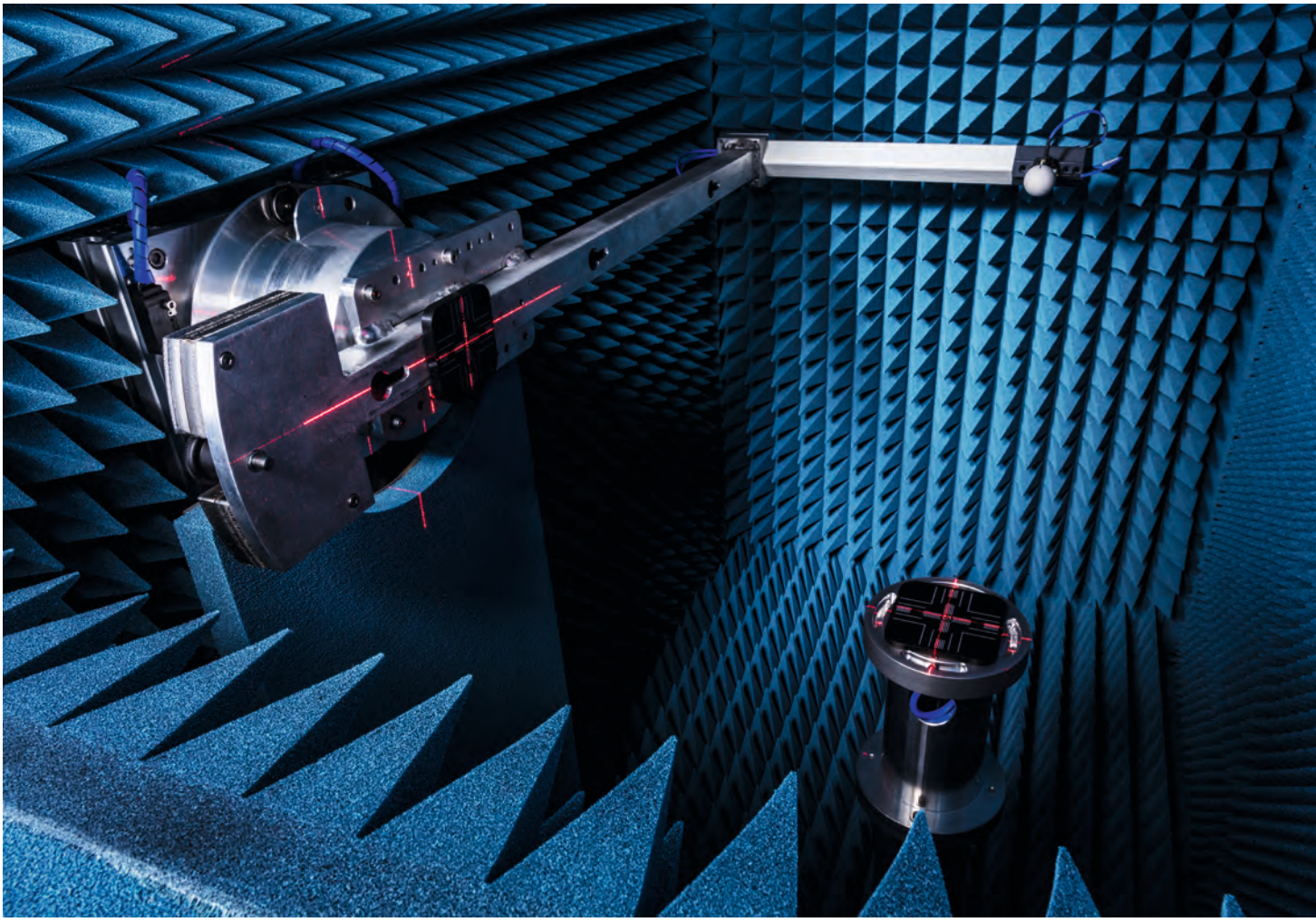
The positioner allows highly precise azimuth and elevation movements with extremely high repeatability and angular resolution, thus assuring accurate 3D antenna measurements.

Most passive antenna modules require wiring of multiple signals such as power supply, USB communications and Ethernet. This is absolutely no problem in the R&S®ATS1000 thanks to the rotary joints and wiring inside the turntable allowing complete 3D measurements of the device under test.

Different DUT holders and fixtures are available to allow convenient measurements for different sizes and weights. These holders are made of an RF transparent material in order to reduce reflections in the chamber.

An accurate DUT positioning and RF calibration is essential in order to get highly precise results. Cross lasers integrated in the chamber ensure maximum precision for proper alignment of the DUT.

Typical testing speed: 9 minutes for full 3D radiation patterns with 4° equidistant steps in azimuth and elevation at 55 frequencies from 26.5 GHz to 40 GHz.



Designed for maximum compactness and mobility

The compact and versatile design of the R&S®ATS1000 fits into any lab ensuring a small footprint of around 1.3 m^2.

Developers no longer depend on large, external antenna chambers installed in a fixed location to test and optimize products in the design phase and can thus avoid measurement bottlenecks, since these chambers are usually booked long in advance. A mobile shielded chamber on wheels can be easily shared among multiple departments, ensuring a greater return of investment.

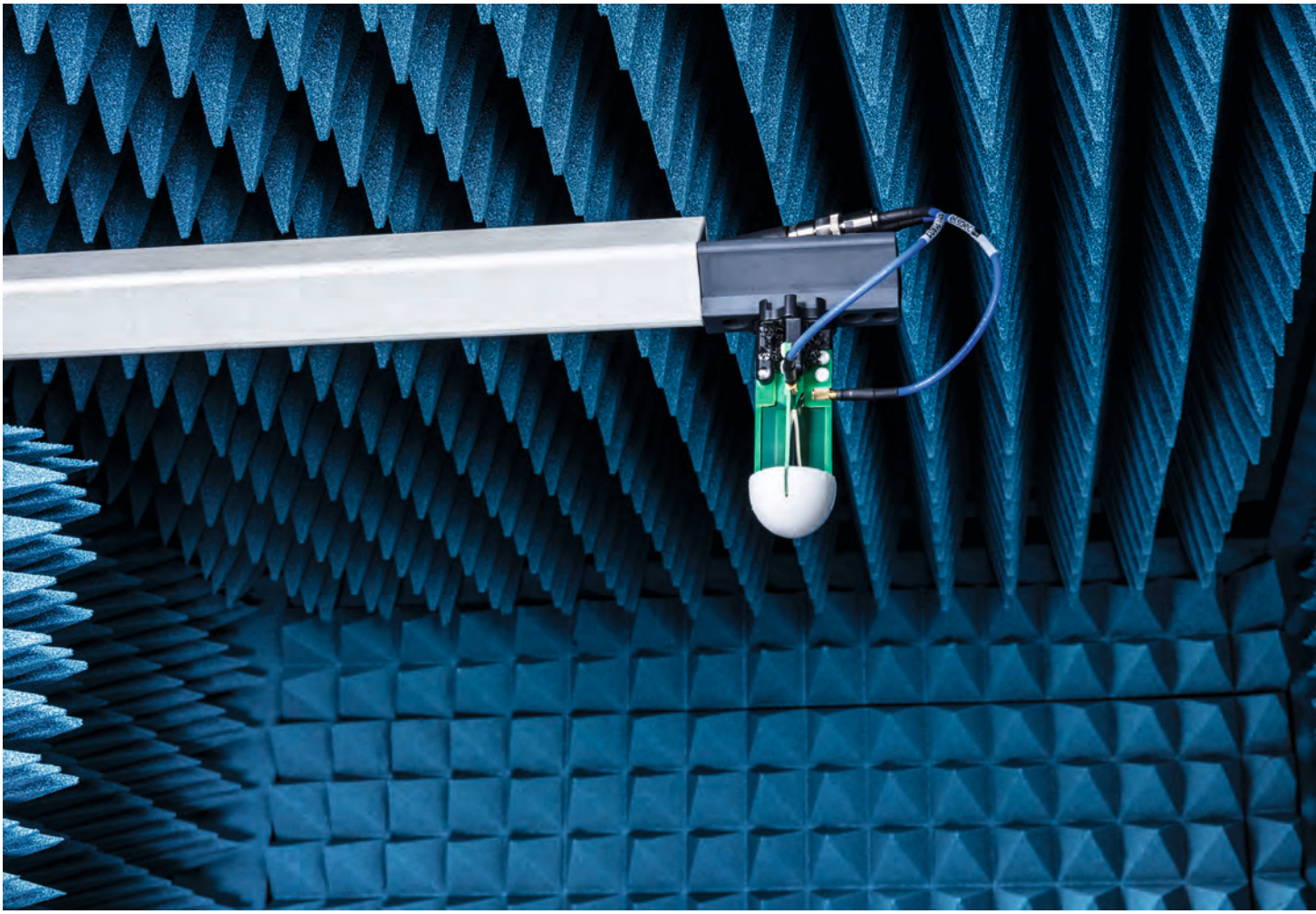
The R&S®ATS1000 provides a high performance shielded environment over a wide frequency range from 18 GHz to 87 GHz.

The decisive advantage of the R&S®ATS1000 is that it offers measurement accuracy as high as that of a three times larger antenna chamber in a more compact shape. The R&S®ATS1000 fits into any lab, which avoids investments for new infrastructure.

Shortest calibration time, broadband measurements

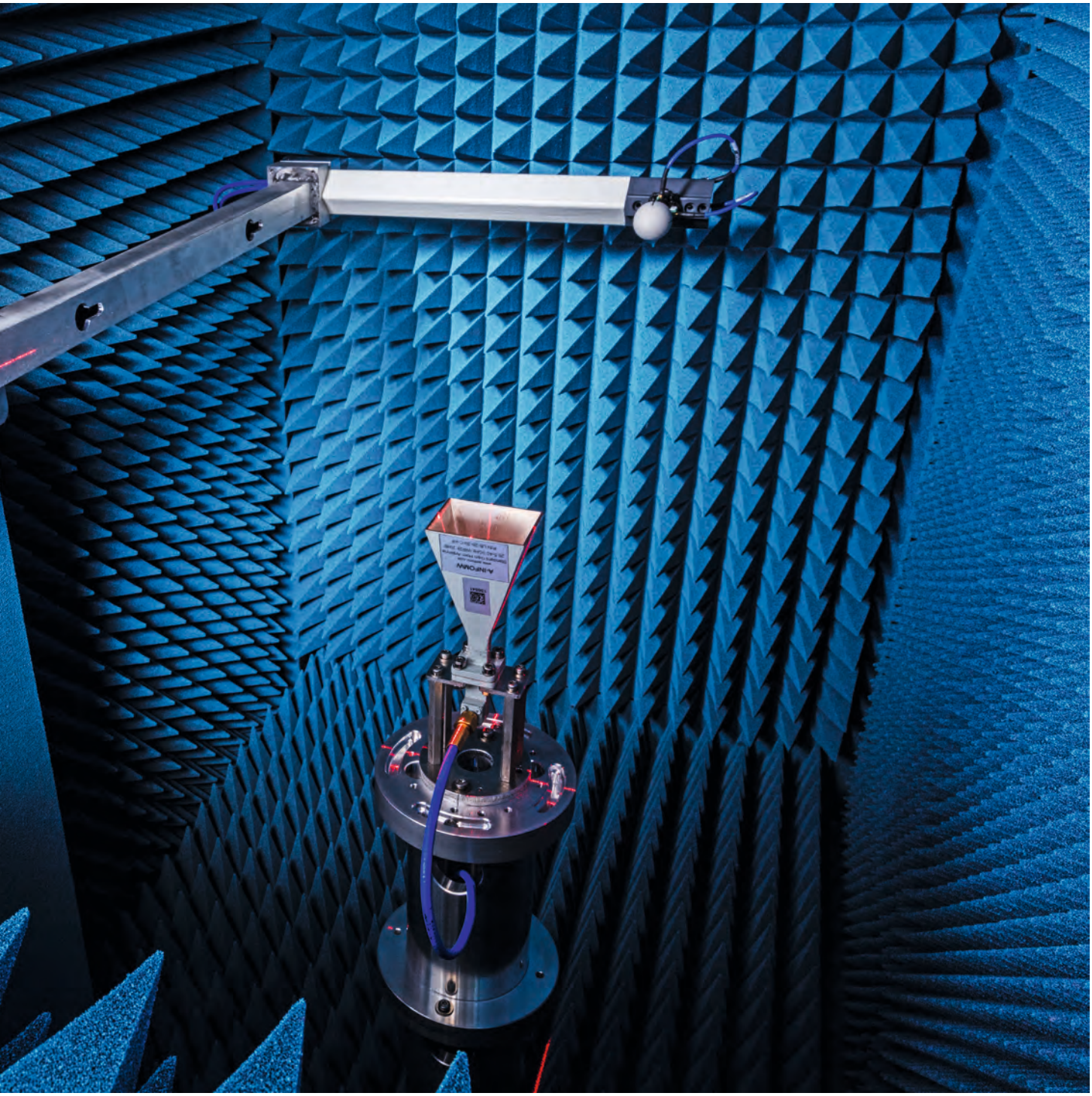
The measurement probe integrated in the R&S®ATS1000 is the R&S®TC-TA85CP cross-polarized Vivaldi antenna, operating from 4 GHz to 87 GHz with high gain (VSWR < 2.5). This antenna features a much lower radar cross section compared to horn antennas, avoiding internal reflections in the chamber. The R&S®TC-TA85CP is cross-polarized, which reduces the measurement time in half by allowing simultaneous vertical and horizontal polarization measurements.

Additionally, the system calibration time decreases significantly due to the broadband characteristic of the measurement antenna to a couple of minutes. Exchanging measurement antennas when calibrating the system for different frequency bands is not necessary anymore using the R&S®TC-TA85CP cross-polarized Vivaldi antenna. This leads to very short calibration times, as short as a couple of minutes.



Far-field measurements in a small footprint

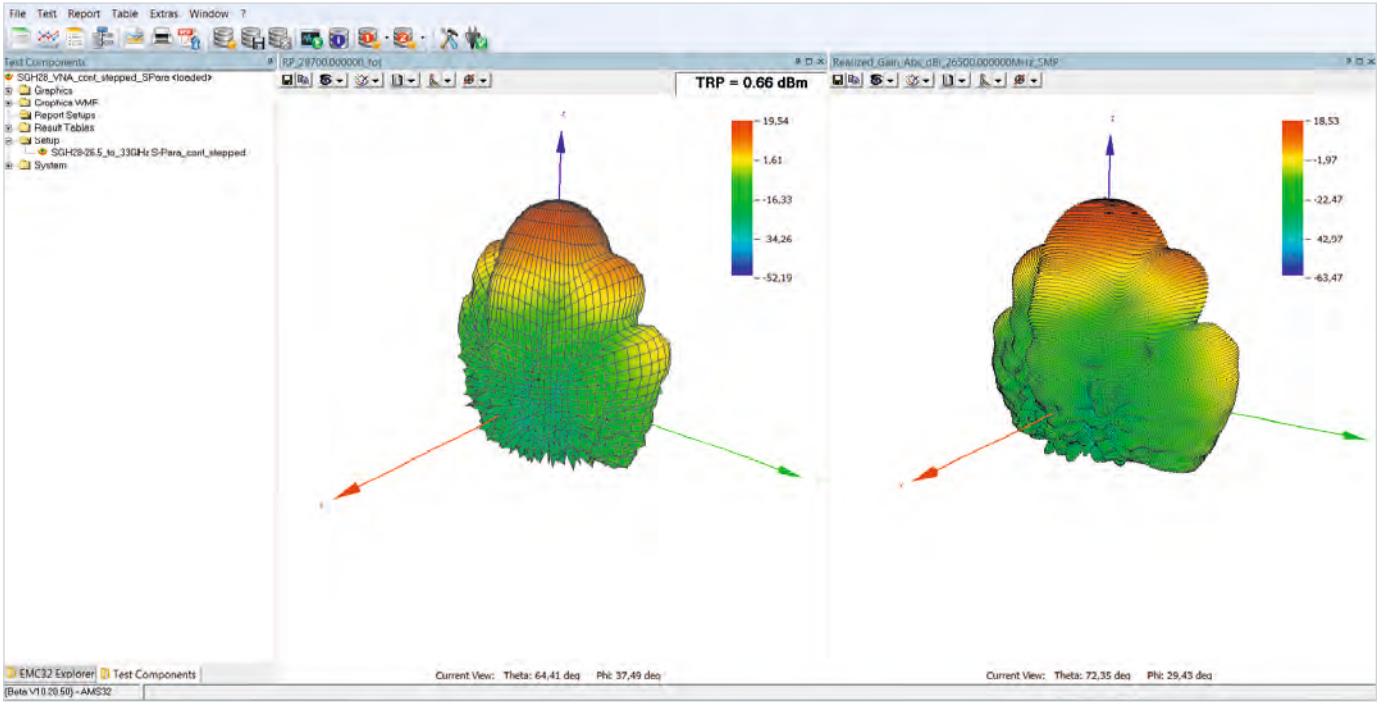
Most of the future 5G test cases will be happening in far field conditions, particularly for transceiver measurements such as channel power, EVM and ACLR. The flexibility of the R&S®ATS1000 and the variable height of the elevation arm results in a customizable range length, allowing far-field measurements in a compact setup. This can be useful when measurements at a closer distance are required due to high atmospheric path loss.



Near-field to far field transformation

When the device under test exceeds the maximum size for far-field conditions, a near-field to far-field transformation is necessary for increased measurement accuracy.

The R&S®AMS32 software not only controls the measurement equipment, positioner and automates the 3D measurements; but also contains new features and options to perform fast near field to far field transformations with arbitrary or uniform grid sampling.



Device characterization under extreme temperature conditions

Thermal effects diagnostics on DUTs is becoming a requirement for 5G since device heating can affect the RF components and consequently the radiation pattern of the antennas. Engineers no longer need to depend on separate testing in an RF OTA chamber and a climatic chamber because the R&S®ATS1000 thermal solution combines both into a single chamber. The R&S®ATS-TEMP option is a compact solution that allows RF measurements on devices in a temperature range from –20 °C to +85 °C. The option consists of a RF transparent material which minimizes the influence to the radiated measurements (< 0.2 dB). Thanks to its compact design, the R&S®ATS-TEMP option can be used to perform fast and precise 3D thermal measurements with excellent repeatability and angular resolution.

The combination of the R&S®ATS1000 and R&S®ATS-TEMP provides the ideal environment for device characterization under extreme temperature conditions.

The MPI ThermalAir TA-5000A temperature test system is used to generate the heated/cooled airflow in line with customer requirements.

Upgradeability made easy

The thermal solution can be easily retrofitted, even in an existing R&S®ATS1000. To upgrade your system, please contact our Rohde&Schwarz service team.

Applications

A wide range of different antenna characterization and parameterization measurements are possible within the R&S®ATS1000. Either passive modules such as an antenna array or 5G active devices need to be qualified. The R&S®ATS1000 is the perfect combination with other Rohde&Schwarz measurement instruments to perform this analysis.

5G antenna module tests: passive and active measurements using CW signals

In the early stages of antenna module development, a fast check using continuous wave (CW) signals assists the R&D design team in achieving improvements in the module design. An four-port Rohde&Schwarz vector network analyzer is all needed to be able to perform passive measurements (magnitude and phase) using CW signals for both polarizations. Combined with the conical cut positioner and hardware triggering, near-field measurements are almost as fast as direct far-field measurements. In order to get a complete 3D characterization of the device with an accurate angular step resolution requires only a couple of minutes.

Active measurement such as EiRP and TRP are also available making use of the same setup.

Following measurements are possible with such scenario:

- Directivity, gain, realized gain
- Efficiency
- Beamwidth
- EiRP, TRP
- 2D and 3D patterns
- Phase measurements for near-field to far-field transformation

All measurements are implemented in the R&S®AMS32 control and measurement software.

5G transceiver module tests: passive and active measurements using modulated signals

In both the advanced stages of the development and debugging phases of 5G devices, measurements using modulated signals are necessary in order to achieve high first-time pass rates during final type approval, saving time and money.

These tests required in R&D and quality assurance are fast and easy with the combination of the R&S®ATS1000 and Rohde&Schwarz vector signal generators and spectrum analyzer (e.g. R&S®SMW200A and R&S®FSW).

The following parameters can be measured using modulated signals:

- EVM (error vector magnitude)
- ACLR (adjacent-channel leakage ratio)
- SEM (spectrum emission mask)
- Directivity, gain, realized gain
- Efficiency
- Beamwidth
- EiRP, TRP, channel power
- 2D and 3D beamforming pattern

Specifications in brief

Specifications in brief		
R&S®ATS1000 shielded chamber		
Frequency range		18 GHz to 87 GHz [1]
Shielding effectiveness	18 GHz to 87 GHz	> 50 dB
Dimensions (W × H × D)	outside dimensions including handles	0.90 m × 1.99 m × 1.53 m [2] (2.95 ft × 6.53 ft × 5.02 ft)
	inside width	0.47 m × 1.25 m × 0.92 m (1.54 ft × 4.10 ft × 3.02 ft)
Wheels		4
Weight	without positioner	300 kg (661.4 lb)
	with positioner	350 kg (771.6 lb)
	with positioner and wooden transportation box	540 kg (1190.5 lb)
Door operation		manually operated, electrical closing mechanism
Conical cut positioning system		
Angular resolution	azimuth/elevation	0.03°
Positioning repeatability	azimuth/elevation	0.1°
Load capability	weight	20 kg (44.1 lb), centered
	maximum dimensions of the DUT	20 cm × 20 cm (7.9 in × 7.9 in)
Measurement antenna (R&S®TC-TA85CP)		
Frequency range	nominal	6 GHz to 85 GHz
	extended	4 GHz to 87 GHz
Polarization	dual polarized	

[1] Measurement antenna up to 87 GHz. Direct RF measurements up to 50 GHz. Frequency extension on customer request.
[2] Outer dimensions including the R&S®ATS-LASER option: 0.984 m × 2.1 m × 1.53 m.