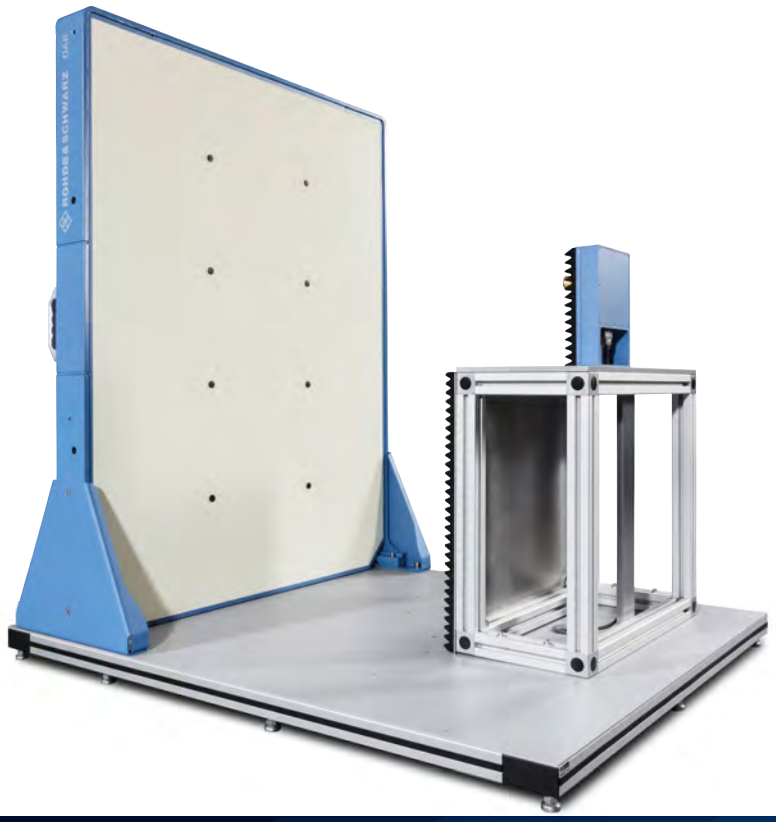
Тестер антенных обтекателей автомобильных радаров QAR



Архангельск (8182)63-90-72
Астана (7172)727-132
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Брянск (4832)59-03-52
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Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
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Тверь (4822)63-31-35
Томск (3822)98-41-53
Тула (4872)74-02-29
Тюмень (3452)66-21-18
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Хабаровск (4212)92-98-04
Челябинск (351)202-03-61
Череповец (8202)49-02-64
Ярославль (4852)69-52-93

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AT A GLANCE

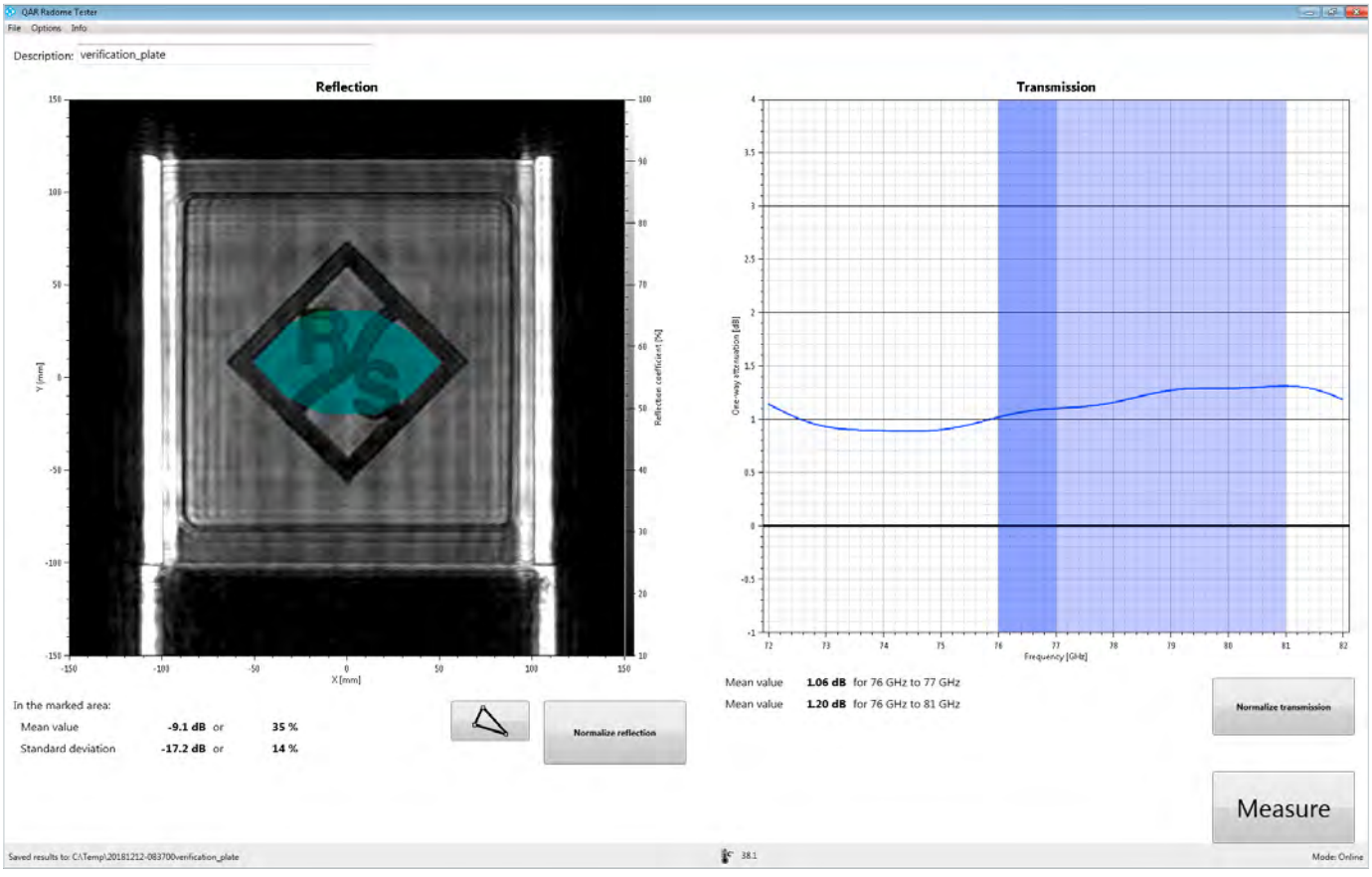
The R&S®QAR is a millimeterwave imaging system for the most demanding radome material and fascia measurements and validations. Thanks to its outstanding performance, speed, quality and intuitive operation, it is the perfect tool for applications ranging from development and production to verification of radome material and integration of 76 GHz to 81 GHz radars.

Operating in the 72 GHz to 82 GHz frequency range, the R&S®QAR is ideal for verifying materials that will cover a radar sensor. With its support of spatially resolved reflection and transmission loss measurements, the R&S®QAR provides an intuitive and powerful way to evaluate the radar performance of a radome. The high resolution of the resulting images allows you to identify even the smallest disturbances in the radome design.

Since the frequency range of the R&S®QAR matches that of automotive radar sensors (76 GHz to 81 GHz), any faults visible in the millimeterwave image directly correlate to the performance of the radome/radar sensor combination.

Key facts

- Combines two measurements
  - Spatially resolved reflectivity
  - Material transmission frequency response (attenuation)
- Frequency range: 72 GHz to 82 GHz
- Spatial resolution: ≤ 3 mm
- Results comparable to vector network analyzers (using R&S®QAR-K50 software)
- Maximum DUT size: 0.3 m × 0.5 m
- Measurement cycle: approx. 7 s
- Easy normalization, data storage and export
- Supports barcode readers and scan protocols



Measurement result of a plastic part with 500 µm thickness mismatch

BENEFITS AND KEY FEATURES

For all your needs
The R&S®QAR heralds a new era in material characterization. When developing and verifying any type of 77 GHz/79 GHz radome material, the R&S®QAR always sees what your radar will see – but with super high resolution.
► page 5

Active array technology
Hundreds of electronically controlled transmit and receive antennas make the R&S®QAR a fast, reliable and high-performance millimeterwave imaging system.
► page 6

Spatially resolved reflectivity measurements
The R&S®QAR measures the spatially resolved reflectivity of a material under test with high resolution. The resulting millimeterwave image allows intuitive evaluation of the reflection behavior.
► page 7

Accurate and robust reflection measurements
Measuring reflectivity with a vector network analyzer can be very challenging. The R&S®QAR-K50 software allows accurate measurements with a relatively low effort.
► page 8

Advanced homogeneity analysis and grid evaluation
Finding smaller deviations in large areas can be challenging. The R&S®QAR-K20 software provides a useful toolset for more detailed analysis of materials.
► page 9

Material transmission frequency response (attenuation)
The R&S®QAR helps you optimize the attenuation and matching properties of your radome. You can test materials at the desired frequency and see the impact of different materials, molding processes, coatings, etc., within seconds.
► page 10

Radar mounting accuracy analysis
The R&S®QAR-K100 option helps verify the mounting accuracy of automotive radars behind bumpers and radomes without having to remove the cover.
► page 11

Seamless integration into automated production lines
Automotive production lines demand automation and high throughput. Thanks to the fast measurement, the R&S®QAR is perfectly suited for end-of-line measurements.
► page 12

FOR ALL YOUR NEEDS

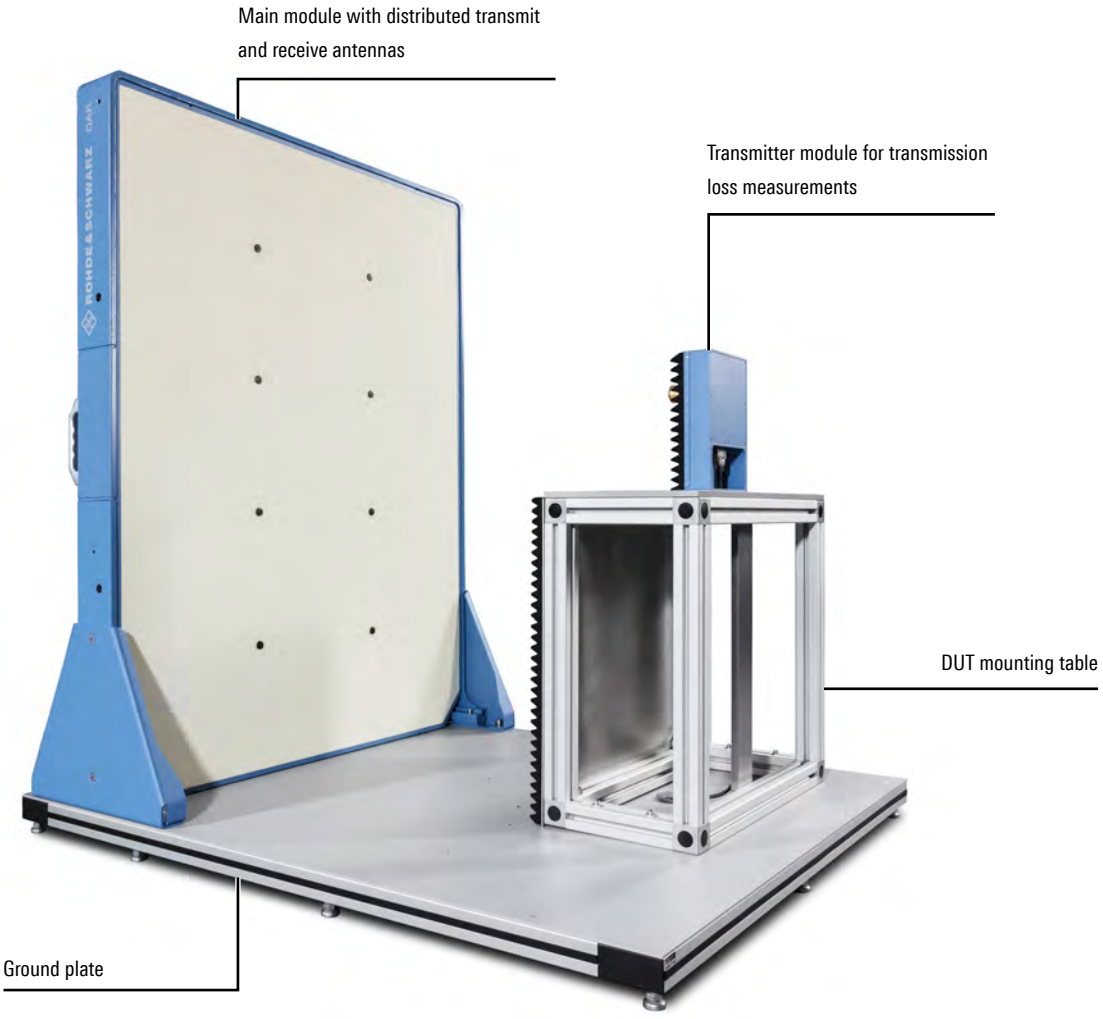
Advanced RF measuring equipment must, above all, be flexible. Performance and functionality requirements vary depending on the test setup and application. The R&S®QAR heralds a new era in material characterization. When developing and verifying any type of 77 GHz/79 GHz radome material, the R&S®QAR always sees what your radar will see – but with super high resolution.

Versatile configuration

The R&S®QAR can be equipped with a main module and transmitter module (R&S®QAR-Z10 option) to meet the requirements for a specific task. The main module performs the reflectivity measurements and the transmitter module is used for the transmission measurement. The main module is mounted directly on the ground plate (R&S®QAR-Z20 option) and the transmitter module (R&S®QAR-Z10 option) is mounted on the mounting table (R&S®QAR-Z50 option) for a device under test (DUT). The mounting table provides several threaded holes for customer-specific DUT fixtures and can accommodate polarization sensitive DUTs as well as complicated incident angle dependent measurement setups.

The R&S®QAR can be integrated into your production line as needed.

Parts of the system



ACTIVE ARRAY TECHNOLOGY

The system's active components are the main module and the optional transmitter module. The main module consists of carefully distributed transmit and receive antenna arrays that enable the main module to create millimeterwave images of DUTs as large as 30 cm × 50 cm.

The technology used in the R&S®QAR does not rely on moving parts, but on hundreds of electronically controlled transmit and receive antennas arranged in 12 clusters. This makes the R&S®QAR a fast, reliable and high-performance millimeterwave imaging system. Used together with the optional transmitter module and the optional DUT mounting table, both the DUT's reflectivity and transmission loss can be evaluated.

Front view

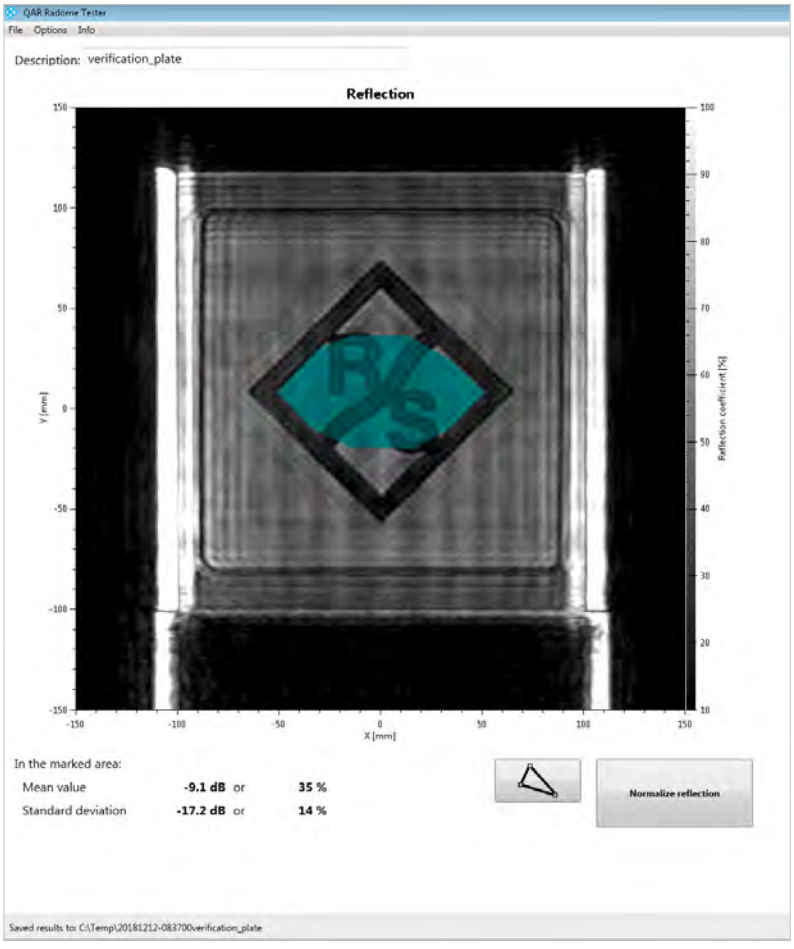
SPATIALLY RESOLVED REFLECTIVITY MEASUREMENTS

The reflectivity measurement determines the amount of energy reflected by the DUT. This energy does not pass through the radome and consequently contributes to performance degradation. Reflected signals decrease the performance of the radar and can even interfere with the received signals. High reflectivity can be caused by e.g. material defects, undesired interaction between several layers of materials, excessive amounts of certain materials (e.g. noncompliant thickness of coating or primer) and foreign objects.

The R&S®QAR measures the spatially resolved reflectivity of a DUT by linking the information collected in the correct sequence by the distributed transmit and receive antennas. The resulting millimeterwave image allows intuitive evaluation of the DUT's reflection behavior.

The R&S®QAR software displays a spatially resolved version of the measured millimeterwave image. The relevant data can be exported for later use in external applications.

The R&S®QAR helps you optimize the reflectivity of your material for optimal radar performance, which your radar customers will appreciate.



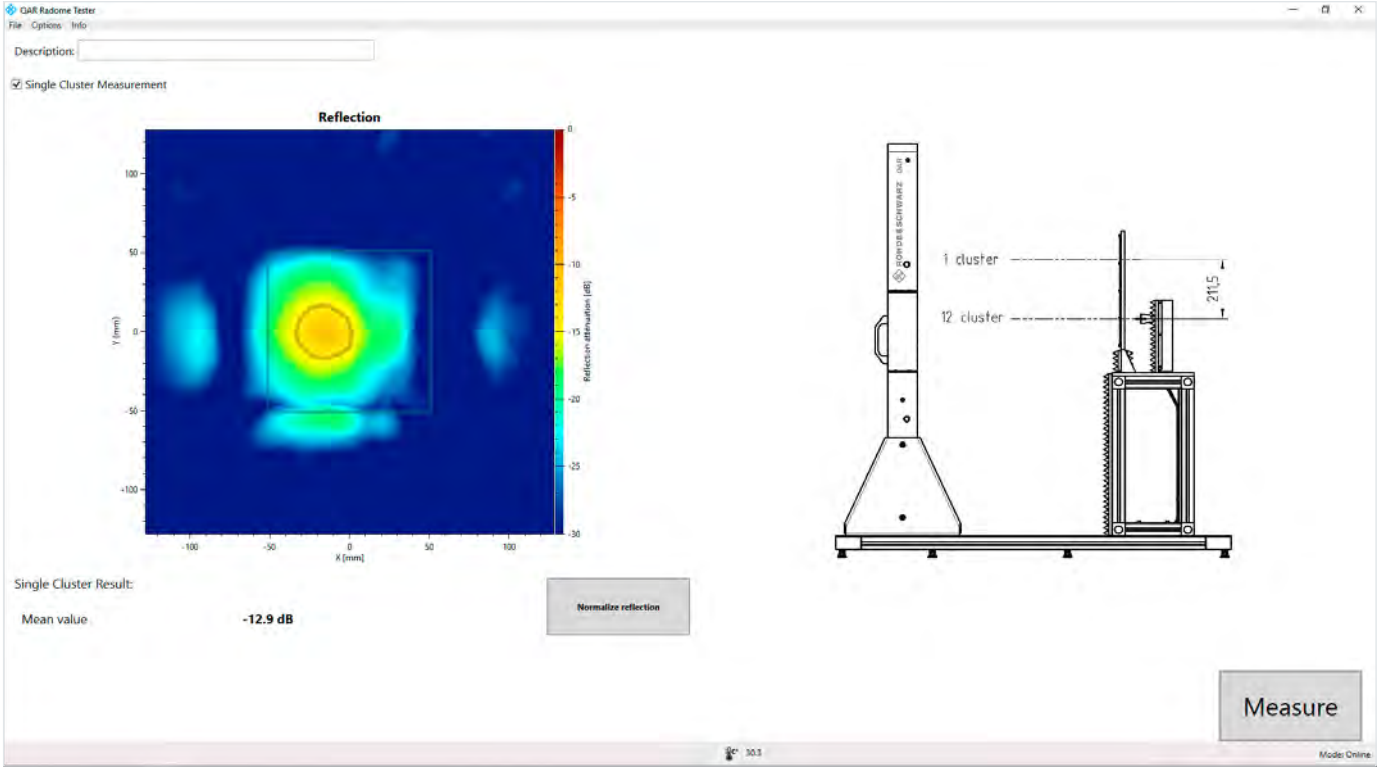
Resulting image of a high-resolution reflectivity measurement of a radome with 500 µm thickness mismatch

ACCURATE AND ROBUST REFLECTION MEASUREMENTS

All radars have a certain field of view, causing a larger range of incident angles on the radome. Therefore, it usually is advantageous that the R&S®QAR creates its spatially resolved image using a larger aperture. This ensures adaption of the radome to a wider field of view. However, certain situations demand a quantitative reflection measurement with a result comparable to a vector network analyzer (VNA): VNA based setups display the results of a single incident angle (usually perpendicular).

Measuring reflectivity with a VNA based setup can be very challenging. Most radome materials have specular reflections, i.e. the angle of incidence and angle of emergence are the same. If sample placement is inaccurate, measurement results are heavily affected by positioning and tilting errors. A VNA based measurement setup is not able to trace this mismatch and feed it back to the user.

Instead of using the full aperture of the R&S®QAR, which consists of 12 clusters, the R&S®QAR-K50 single-cluster software option uses only one cluster, reducing the incident angles for the measurement. Due to the smaller aperture, it not only provides VNA-like results, but also gives feedback on potential positioning inaccuracies.

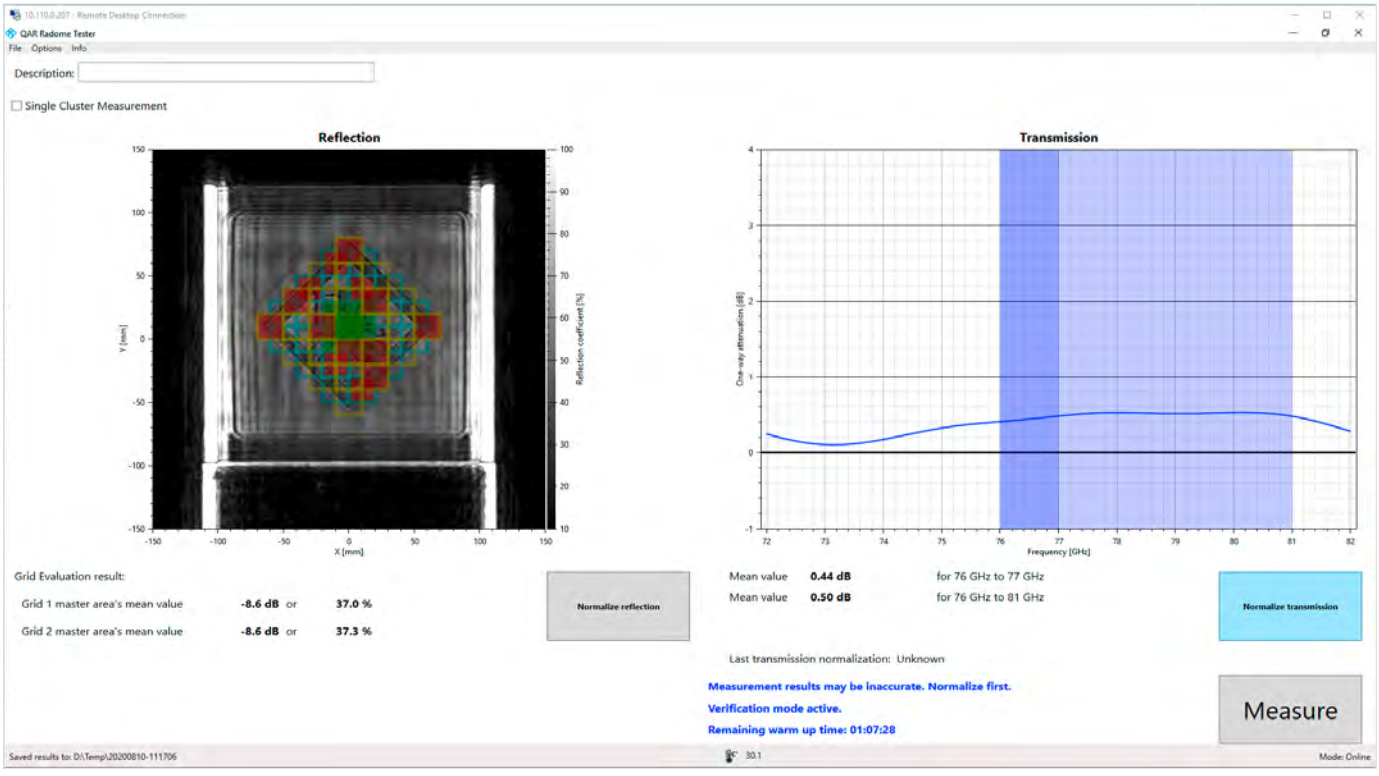


R&S®QAR-K50 single-cluster software interface: measurement results are shown on the left, while the right side reminds the user of the correct positioning of the sample. The option can be enabled directly from the main screen of the standard GUI.

ADVANCED HOMOGENEITY ANALYSIS AND GRID EVALUATION

The R&S®QAR-K20 grid evaluation software option makes it possible to find smaller inhomogeneities within larger areas of a radome. This option enables you to split the evaluation area into several smaller parts. The grid itself is completely customizable within the software.

Using the R&S®QAR-K20 option, homogeneity of the radome can be analyzed more precisely and local deviations in reflection are better detectable. The user defines a reference cell with a certain absolute limit for reflection. A deviation threshold for all other cells is defined in the software. The grid evaluation software allows smaller deviations from the mean reflectivity to be traced.



R&S®QAR-K20 grid evaluation software option for more detailed analysis of the measurement results. The deviation threshold can be set in the software.

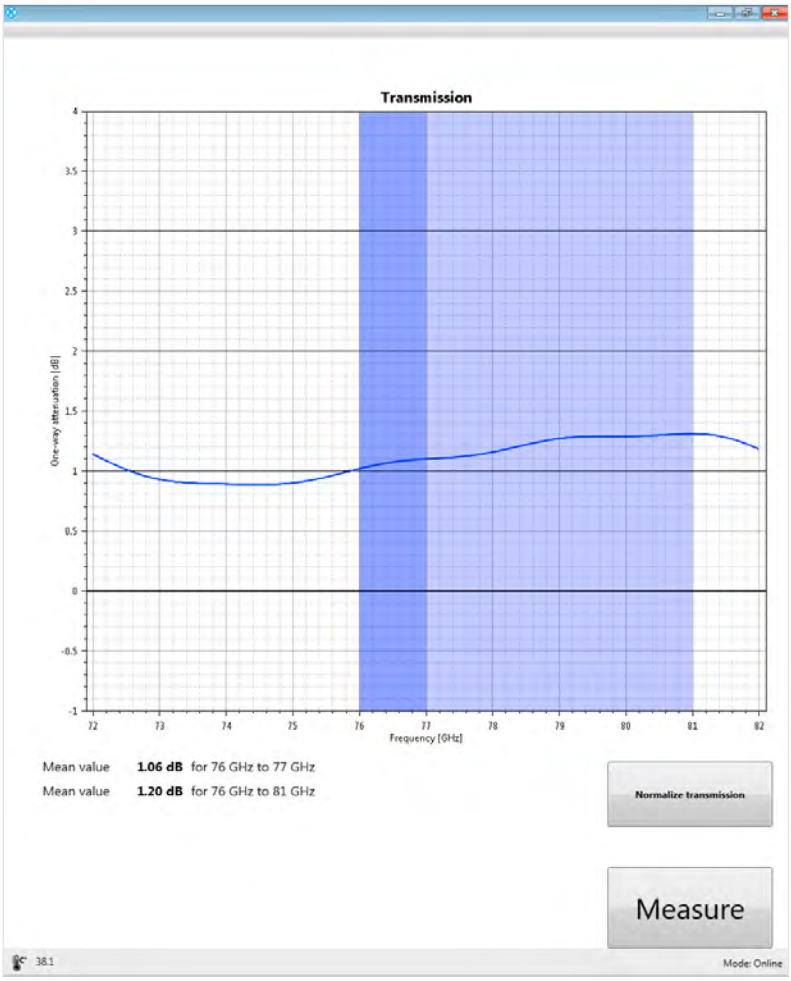
MATERIAL TRANSMISSION FREQUENCY RESPONSE (ATTENUATION)

Any radar signal that penetrates a material is split into a reflected, a transmitted and an absorbed part. It is of interest to measure not only the reflectivity but also the transmission properties.

The R&S®QAR can be equipped with an optional transmitter module that is placed behind the DUT on the table. The transmitter uses discrete frequency points to cover a selected frequency span. This allows precise analysis of the transmission frequency response.

The frequency response delivers detailed information on the RF matching of the DUT at the exact frequency band intended for radar operation. This is independent of the actual signal waveform utilized by the radar unit, which facilitates the testability and optimization of the radome.

R&S®QAR helps you optimize your radome material at the desired frequency and test different materials to find the material with the lowest attenuation within seconds.



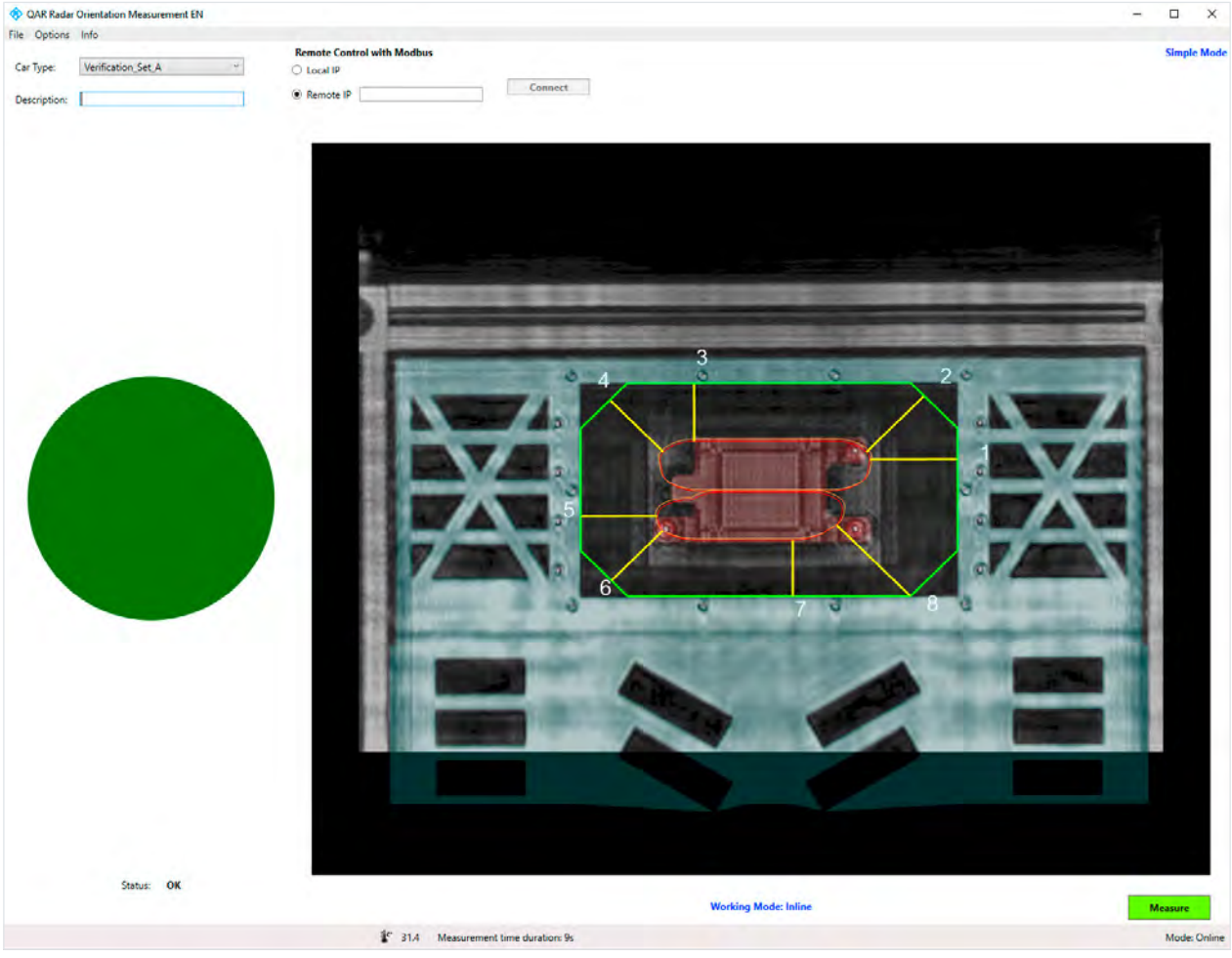
Measurement on a standard industry radome. Transmission measurement on a commercial multi-layer radome that is optimized in the 73 GHz to 75 GHz range, but not in the 76 GHz to 79 GHz range.

RADAR MOUNTING ACCURACY ANALYSIS

There are different ways to mount a radar in a car. The current possibilities are to either hide the radar behind a design radome, use a simple radome integrated in the air intake or mount it behind the bumper. Usually, the bumper is just clipped onto the car's frame, and one or both of the clips might not be properly tightened. In addition, the radar might not be properly mounted to the frame and is tilted a couple of degrees.

The R&S®QAR can verify the mounting accuracy of automotive radars behind bumpers and radomes without having to remove the cover.

Using the imaging capabilities of the R&S®QAR, you can locate the position and orientation of the radar and the bumper and thus ensure that the radar is mounted correctly on the car and is able to look through the specified zone in the radome. The geometrical position of the radar sensor and the bumper is presented to the user in a 3D image and as numerical values.



Measurement result of the R&S®QAR-K100 option showing the R&S®QAR-Z42 verification set for mounting accuracy

SEAMLESS INTEGRATION INTO AUTOMATED PRODUCTION LINES

Conventional test solutions for production lines are based on measuring only a few points using a radar reference sensor and with reflectors attached to the ceiling. It is not possible to measure the uniformity of the entire surface with this approach. Thanks to the R&S®QAR, radomes and radome testing can meet higher requirements, since a quick and reliable end-of-line (EOL) homogeneity check is now feasible.

Preconfigured solutions from our integration partners are available for EOL integration of the R&S®QAR measurement system. In order to maximize production throughput, the system allows automated normalization directly on the line without losing much time. Measurement accuracy and function can also be verified directly on the line without reconfiguration. The test bench can easily be adapted to new radomes and specifications.

Exemplary EOL integration of an R&S®QAR radome measurement system by our partner Löhnert Elektronik. EOL setups for bumper evaluation are also available from our partners.

SPECIFICATIONS IN BRIEF

Specifications in brief		
System		
Measurement time	for reflection only	< 1 s
	for reflection and transmission	< 2 s
Measurement cycle	from start of measurement to display of results (time to save data excluded)	< 7 s
Operating system		Windows 10 IoT
Reflection measurements		
Frequency range	start frequency	74 GHz
	stop frequency	79 GHz
	center frequency	76.5 GHz
	frequency span	5 GHz
Frequency accuracy		1 MHz
Scan volume	W × H × D	352 mm × 512 mm × 550 mm (14 in × 20 in × 22 in)
Polarization angle		45°
Image lateral resolution		≤ 3 mm
Image pixel size		0.5 mm × 0.5 mm
Transmission measurements (using the R&S®QAR-Z10 option)		
Frequency range		72 GHz to 81 GHz (typ. 82 GHz)
Time-gated frequency range	in verification mode	73 GHz to 81 GHz
Frequency accuracy		1 MHz
Number of frequency steps		64
Connectors and switches	AC inlet and mains power switch	▶ ground terminal ▶ external transmitter control and RF out ▶ monitor power ▶ LAN ▶ digital visual interface (DVI) ▶ 4 × USB ▶ power button
General data		
Environmental conditions	operating temperature range	+10 °C to +38 °C
	storage temperature range	–10 °C to +60 °C
	humidity	+38 °C at 95 % rel. humidity, in line with IEC 60068-2-78
	protection class	IP20
Power rating	rated voltage	
	without additional protective grounding	200 V to 230 V AC (± 10 %)
	with additional protective grounding	200 V to 240 V AC (± 10 %)
	rated current	max. 6 A
	power consumption	
	average	800 W
	standby	11 W
	rated frequency	
	without additional protective grounding	50 Hz (± 5 %)
	with additional protective grounding [1)]	50 Hz to 60 Hz (± 5 %)

[1)] For additional protective grounding (earthing), a green/yellow ground wire with a cross section of at least 4 mm² is to be used.

ORDERING INFORMATION

Designation	Type	Order No.
Quality automotive radome tester	R&S®QAR	1336.6008.02
Hardware options		
Transmitter module, copolar polarization	R&S®QAR-Z10	1336.5401.02
Transmitter module, horizontal polarization	R&S®QAR-Z10	1336.5401.03
Ground plate	R&S®QAR-Z20	1336.5418.02
Reduced ground plate	R&S®QAR-Z21	1336.5524.02
Calibration set	R&S®QAR-Z30	1336.5430.02
Verification objects for radome measurements	R&S®QAR-Z40	1336.5447.02
Verification objects for bumper measurements	R&S®QAR-Z41	1336.5499.02
Verification kit for radar positioning	R&S®QAR-Z42	1336.5530.02
Verification set reflection	R&S®QAR-Z43	1343.0230.02
Mounting table	R&S®QAR-Z50	1336.5424.02
Reference reflector	R&S®QAR-Z60	1336.5453.02
Stand reference reflector	R&S®QAR-Z61	1336.5476.02
Absorber wall	R&S®QAR-Z70	1336.5460.02
Software options		
Software for radome measurement	R&S®QAR-K10	1336.5501.02
Software OPC client for radome measurement	R&S®QAR-K11	1340.5219.02
Grid evaluation software option	R&S®QAR-K20	1343.0030.02
Single-cluster software option	R&S®QAR-K50	1343.0018.02
Software for bumper measurement	R&S®QAR-K60	1336.5482.02
Software OPC client for bumper measurement	R&S®QAR-K61	1340.5225.02
Software for radar positioning	R&S®QAR-K100	1336.5518.02
Software OPC client for radar positioning	R&S®QAR-K101	1340.5231.02
Software update		
Upgrade of the R&S®QAR to Windows 10 IoT	R&S®QAR-U1	1343.0501.02