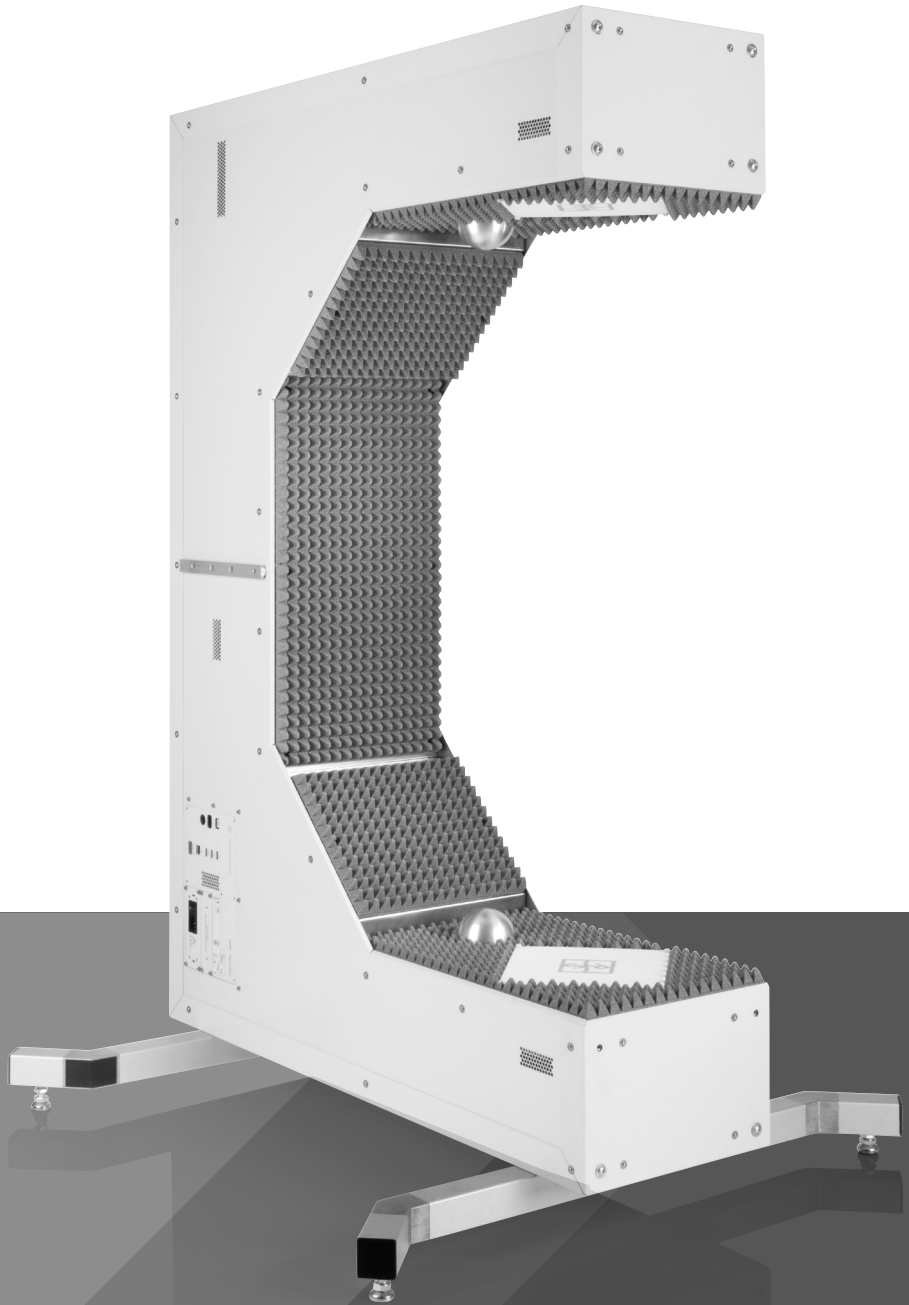


# R&S® QAR50 AUTOMOTIVE RADOME TESTER

## Specifications



Data Sheet  
Version 04.00

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# Definitions

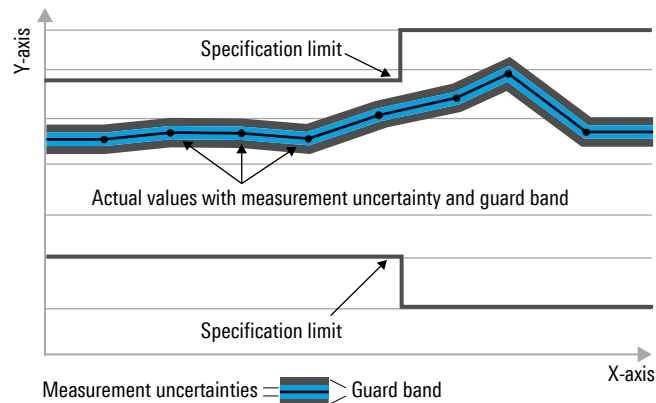
## General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 90 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

## Specifications with limits

Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as  $<$ ,  $\leq$ ,  $>$ ,  $\geq$ ,  $\pm$ , or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



## Non-traceable specifications with limits (n. trc.)

Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

## Specifications without limits

Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

## Typical data (typ.)

Characterizes product performance by means of representative information for the given parameter. When marked with  $<$ ,  $>$  or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

## Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

## Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

## Uncertainties

Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are indicated as follows: “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

# Specifications

Specifications apply under the following conditions: 90 minutes warm-up time at specified environmental conditions and after successfully verified calibration.

## System

Measurement time		< 3 ms
Measurement cycle	from measurement start to results display (data saving time excluded)	< 4 s
Operating system		Windows 10 IoT

## Imaging specifications

Frequency range	start frequency	
	band 1	76 GHz
	band 2	76 GHz
	stop frequency	
	band 1	77 GHz
	band 2	81 GHz
	center frequency	
	band 1	76.5 GHz
	band 2	78.5 GHz
	frequency span	
	band 1	1 GHz
	band 2	5 GHz
Number of frequency steps	band 1	25
	band 2	128
Frequency accuracy		1 MHz
Scan volume	W x H x D	200 mm x 200 mm x 200 mm (7.87 in x 7.87 in x 7.87 in)
Voxel size	W x H x D	1.56 mm x 1.56 mm x 6.25 mm (0.06 in x 0.06 in x 0.25 in)
Image size	W x H	200 mm x 200 mm (7.87 in x 7.87 in)
Image pixel size	W x H	1.56 mm x 1.56 mm (0.06 in x 0.06 in)

## Reflection measurements

Image dynamic range	of mean reflection value	> 30 dB
Maximum evaluation area	for the calculation of the mean reflection	100 mm × 100 mm (3.93 in × 3.93 in)
Minimum DUT size <sup>1</sup>	W × H	60 mm × 60 mm (2.36 in × 2.36 in)
Reproducibility <sup>2</sup> of mean reflection <sup>3</sup>	reproducibility of mean reflection values in linear scale <sup>4</sup>	
	static <sup>5</sup>	< 3 %
	dynamic <sup>6</sup>	< 7 %
	with 0 dB mean reflection	
	static	< 0.2 dB
	dynamic	< 0.2 dB
	with –8 dB mean reflection	
	static	< 0.6 dB
	dynamic	< 1.6 dB
	with –15 dB mean reflection	
static	< 0.9 dB	
dynamic	< 3.0 dB	

## Transmission attenuation measurements

Image dynamic range	of mean transmission attenuation value	> 30 dB
Maximum evaluation area	for the calculation of the mean attenuation	100 mm × 100 mm (3.94 in × 3.94 in)
Minimum DUT size <sup>1</sup>	W × H	60 mm × 60 mm (2.36 in × 2.36 in)
Reproducibility <sup>2</sup> of mean attenuation <sup>7</sup>	reproducibility of mean attenuation values in linear scale <sup>8</sup>	
	static <sup>5</sup>	< 2 %
	dynamic <sup>6</sup>	< 5 %
	with 0 dB mean attenuation	
	static	< 0.1 dB
	dynamic	< 0.1 dB
	with 1 dB mean attenuation	
	static	< 0.1 dB
	dynamic	< 0.4 dB

## Transmission phase measurements (using R&S®QAR50-K20 option)

Image lateral resolution <sup>9</sup>		≤ 8 mm (0.31 in)
Minimum DUT size <sup>10</sup>	W × H	60 mm × 60 mm (2.7 in × 2.7 in)
Phase resolution <sup>11</sup>	with 0 dB mean attenuation	±2°

<sup>1</sup> Provided that the evaluation area is set accordingly and fitting to the size of the device under test (DUT). The evaluation window should have at least 10 mm distance to the edge of the DUT. The normalization measurement must be performed using the same window size.

<sup>2</sup> Reproducibility values are valid, after proper normalization and for temperature changes less than 4K. The DUT has to be positioned within the test fixture.

<sup>3</sup> The mean reflection value is defined as the arithmetic mean of the individually measured reflection values within the range [maxVal – 3 dB; maxVal]. maxVal is the maximum reflection value within the evaluation area.

<sup>4</sup> Calculating measurement tolerances in dB from the specification in linear scale can be done as follows: For example, a DUT has a mean reflectivity of 50 % and the specified static reproducibility is 3 %, the measurement result can vary between 47 % and 53 %. To translate the tolerances into logarithmic scale, perform the following calculations: Minimum measured reflectivity is  $20 \cdot \log_{10}(0.47) = -6.56$  dB, mean measured reflectivity is  $20 \cdot \log_{10}(0.50) = -6.02$  dB and maximum measured reflectivity is  $20 \cdot \log_{10}(0.53) = -5.51$  dB. The logarithmic tolerance at –6 dB reflectivity therefore is (+0.51 dB/–0.54 dB).

<sup>5</sup> For stationary DUT.

<sup>6</sup> Evaluated with repositioning of the DUT.

<sup>7</sup> The mean transmission attenuation value is defined as the arithmetic mean of the individually measured transmission attenuation values within the range [minVal; minVal + 3 dB]. minVal is the minimum transmission attenuation value within the evaluation area.

<sup>8</sup> Calculating measurement tolerances in dB from the specification in linear scale can be done as follows. For example, a DUT has a mean transmission attenuation of 20 % and the specified static reproducibility is 2 %, the measurement result can vary between 18 % and 22 %. To translate the tolerances into logarithmic scale, perform the following calculations: Minimum measured transmission attenuation is  $-20 \cdot \log_{10}(1-0.18) = 1.72$  dB, average measured transmission attenuation is  $-20 \cdot \log_{10}(1-0.20) = 1.94$  dB and maximum measured transmission attenuation is  $-20 \cdot \log_{10}(1-0.22) = 2.16$  dB. The logarithmic tolerance at 1.94 dB attenuation is therefore (+0.22 dB/–0.21 dB).

<sup>9</sup> Lateral image resolution defines the minimum distance of two phase steps to be resolved.

<sup>10</sup> Provided that the evaluation area is fitting to the size of the device under test (DUT). The evaluation area should have at least 15 mm distance to the edge of the DUT.

<sup>11</sup> Phase resolution defines the minimum phase difference in a DUT, that can be resolved inside the calculated image.

**High resolution reflection measurements (using R&S®QAR50-K30 option)**

Image lateral resolution		≤ 8 mm (0.31 in)
Frequency range	band 2	
	start frequency	76 GHz
	stop frequency	81 GHz
	center frequency	78.5 GHz
	frequency span	5 GHz
Number of frequency steps	band 2	128

**Frequency resolved measurements (using R&S®QAR50-K10 option)**

Frequency range (measurement range)	start frequency	72 GHz
	stop frequency	82 GHz
	center frequency	77 GHz
	frequency span	10 GHz
Number of frequency steps		256
Frequency accuracy		1 MHz
Frequency range (analysis range after time gating)	start frequency	73 GHz
	stop frequency	81 GHz
	center frequency	77 GHz
	frequency span	8 GHz

**Frequency resolved reflection measurements (using R&S®QAR50-K10 option)**

Dynamic range		> 30 dB
Minimum DUT size <sup>1</sup>	W × H	60 mm × 60 mm (2.36 in × 2.36 in)
Reproducibility of reflection <sup>12</sup> per frequency point <sup>13</sup>	reproducibility of reflection values in linear scale	
	static	< 7 %
	dynamic	< 12 %
	with 0 dB reflection	
	static	< 0.4 dB
	dynamic	< 0.4 dB
	with –8 dB reflection	
	static	< 1.6 dB
	dynamic	< 3.0 dB
	with –15 dB reflection	
	static	< 3.0 dB
	dynamic	< 6.0 dB

**Frequency resolved attenuation measurements (using R&S®QAR50-K10 option)**

Dynamic range		> 30 dB
Minimum DUT size <sup>1</sup>	W × H	60 mm × 60 mm (2.36 in × 2.36 in)
Reproducibility of attenuation <sup>14</sup> per frequency point <sup>13</sup>	reproducibility of transmission attenuation values in linear scale	
	static	< 3 %
	dynamic	< 5 %
	with 0 dB mean attenuation	
	static	< 0.2 dB
	dynamic	< 0.2 dB
	with 1 dB mean attenuation	
	static	< 0.2 dB
	dynamic	< 0.4 dB

<sup>12</sup> Automatic processing detects the pixel with the highest reflectivity inside the recovered image and calculates the frequency response of this specific point of the DUT.

<sup>13</sup> Time gating is used to reduce standing waves. Measurement values are valid for frequencies between 73 and 81 GHz.

<sup>14</sup> Automatic processing detects the pixel with the lowest transmission attenuation inside the recovered image and calculates the frequency response of this specific point of the DUT.

## Connectors and switches

4 × USB 3.0	(1) and (3), see Fig. 1	for keyboard, mouse and general use
Power button	(2), see Fig. 1	for switching on and off
LAN	(5), see Fig. 1	1 Gbit
Display port	(6), see Fig. 1	display connector for monitor
AC inlet and mains power switch	(7), see Fig. 1	for mains power supply

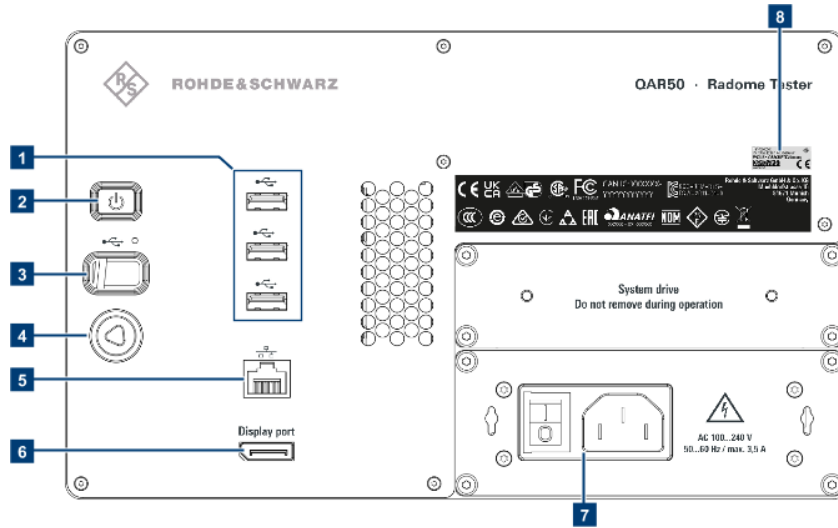


Fig. 1: Connector board of the R&amp;S®QAR50

## General data

Environmental conditions		
Temperature	operating temperature range	+5 °C to +40 °C
	storage temperature range	−10 °C to +60 °C
Humidity		+25 °C/+40 °C, 95 % rel. humidity, cyclic, in line with EN 60068-2-30; +40 °C, 95 % rel. humidity, steady state
Installation altitude		max. 2000 m above sea level
Vibration		8 Hz to 500 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		in line with EN 60068-2-27
Transport		in line with: <ul style="list-style-type: none"> <li>EN 60068-2-27</li> <li>EN 60068-2-31</li> <li>EN 60068-2-64</li> </ul>
Surroundings	<ul style="list-style-type: none"> <li>installation to be maintained in low-reflection environment</li> <li>metal walls or strong reflectors in the proximity of the imaging zone to be avoided</li> </ul>	

Power rating		
Rated voltage		100 V to 240 V AC (± 10 %)
Rated current		max. 3.5 A
Power consumption	average	150 W
	standby	3 W
Rated frequency		50 Hz to 60 Hz (± 5 %)

Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU	
	emission tests	in line with EN 55011
	immunity tests	in line with EN 61326-1
Electrical safety	EU: in line with Low Voltage Directive 2014/35/EU	applied standards: <ul style="list-style-type: none"> <li>EN 61010-1</li> <li>IEC 61010-1</li> </ul>
	USA	UL 61010-1
Hazardous substances	EU: in line with Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 2011/65/EU	applied standard: EN IEC 63000

Dimensions		
Base unit	W x H x D	325.8 mm x 1002.4 mm x 1428.6 mm (12.83 in x 39.46 in x 56.24 in)
Incl. mounting		see figs 2 and 3 <sup>15</sup>
Shipping dimensions		
Base unit		800 mm x 1280 mm x 1560 mm (31.5 in x 50.4 in x 61.4 in)
R&S®QAR50-Z44 verification set		980 mm x 750 mm x 270 mm (38.6 in x 29.6 in x 10.7 in)

Weight		
Base unit		78 kg (172 lb)
Shipping weight		
Base unit		135 kg (298 lb)
R&S®QAR50-Z44 verification set		19 kg (42 lb)

<sup>15</sup> Note, that dimensions can vary slightly depending on setup orientation due to cover screws filling the mounting points of the R&S®QAR50.



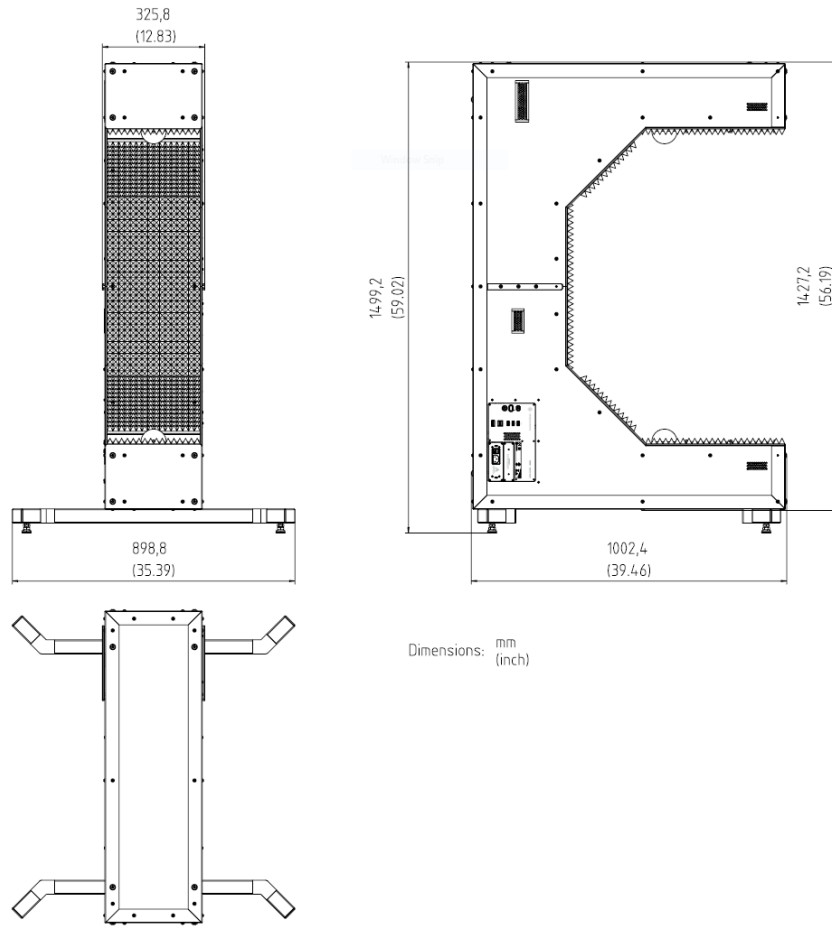


Fig. 2: Dimensions of the R&S®QAR50 including mounting base in a standing position

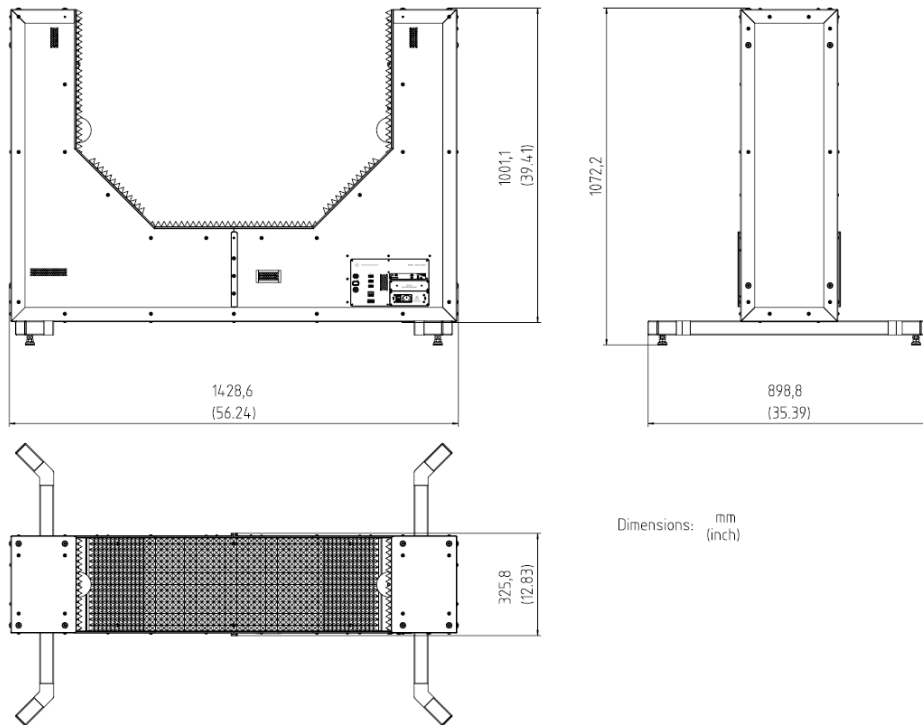


Fig. 3: Dimensions of the R&S®QAR50 including mounting base in a lying position

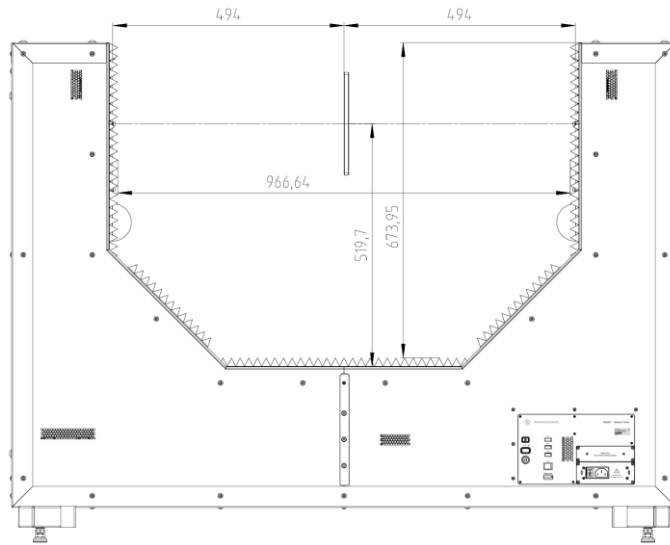


Fig. 4: Inner dimensions of the R&S®QAR50

## Ordering information

Designation	Type	Order No.
Radome tester, vertical polarization	R&S®QAR50	1343.0099K02
Radome tester, horizontal polarization	R&S®QAR50	1343.0099K03
<b>Options</b>		
Verification set	R&S®QAR50-Z44	1343.0082.02
Polarization change to vertical	R&S®QAR50-U02	1343.0060.02
Polarization change to horizontal	R&S®QAR50-U03	1343.0076.02
<b>Software options</b>		
Frequency response measurement	R&S®QAR50-K10	1343.2091.02
Homogeneity analysis	R&S®QAR50-K20	1343.2110.02
High resolution image	R&S®QAR50-K30	1343.2133.02

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