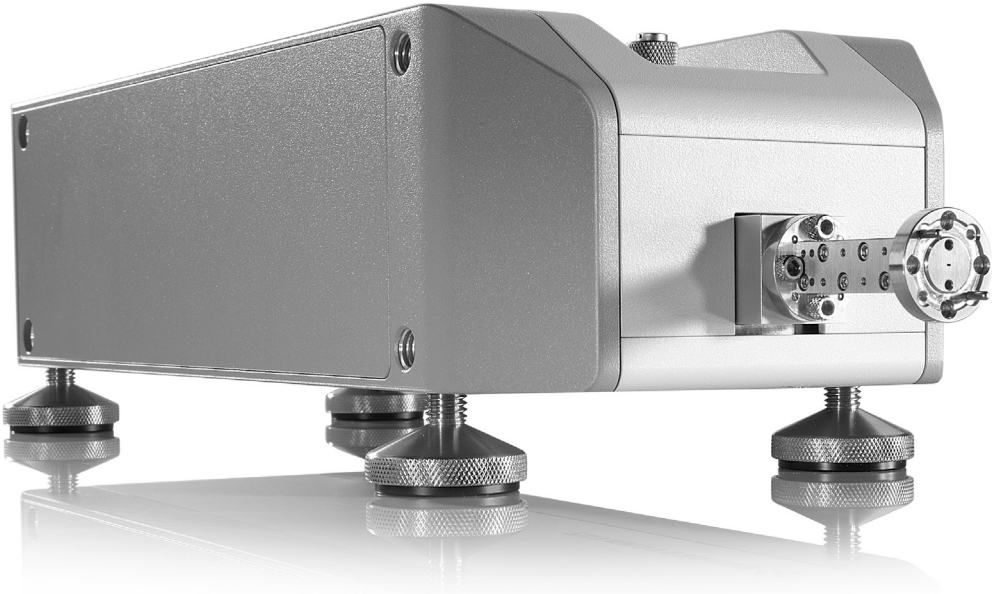



# R&S® ZCxxx

## Millimeter-Wave Converters

### Specifications



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# Definitions

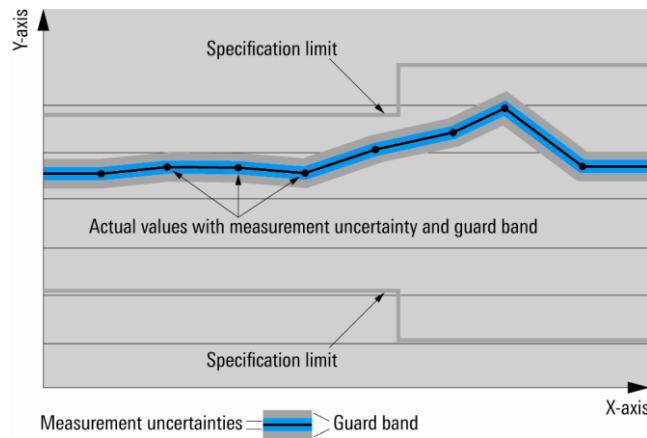
## General

Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 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.

## General information

The R&S®ZCxxx millimeter-wave converters are optional for the following four-port vector network analyzers: R&S®ZVA24, R&S®ZVA40, R&S®ZVA50 or R&S®ZVA67, and R&S®ZVT20 with at least four ports. The converters facilitate measurements in the millimeter-wave frequency range. The R&S®ZCxxx millimeter-wave converters are available for the frequency bands from 110 GHz to 170 GHz (R&S®ZC170), from 140 GHz to 220 GHz (R&S®ZC220), from 220 GHz to 330 GHz (R&S®ZC330) and from 325 GHz to 500 GHz (R&S®ZC500). Other frequency bands are covered by other models from the R&S®ZVA-Zxxx converter series.

The millimeter-wave converters consist of a dedicated reflectometer module containing a directional coupler, a frequency multiplier for generating the source signal, two harmonic mixers as downconverters and a manually adjustable attenuator for output power adjustment. In addition, the R&S®ZCxxx converters allow output power leveling and power sweeps by adjusting the RF input power.

The four-port network analyzer must be equipped with the R&S®ZVAXx-B16 and R&S®ZVA-K8 options.

The R&S®ZCxxx millimeter-wave converters come with the following accessories:

- Hex ball driver
- Two coaxial cables with SMA connectors for the reference and measurement output signals
- Waveguide-to-waveguide adapter (test port adapter, factory mounted)
- DC cable and USB cable
- Waveguide flange screws and dowel pins
- Documentation

The R&S®ZCxxx millimeter-wave converters must be operated with the R&S®ZCPS power supply module (available as an option; one module supplies two converters).

# Specifications

## Test port

Frequency range	R&S®ZC170	110 GHz to 170 GHz	
	R&S®ZC220	140 GHz to 220 GHz	
	R&S®ZC330	220 GHz to 330 GHz	
	R&S®ZC500	325 GHz to 500 GHz	
Waveguide designator	R&S®ZC170	WM-1651	
	R&S®ZC220	WM-1295	
	R&S®ZC330	WM-864	
	R&S®ZC500	WM-570	
Connector type	anti-cocking flange	precision waveguide flange compatible with flange types UG-387/U-M and IEEE 1785.2a	
Output power	at +7 dBm input power from the R&S®ZVA/R&S®ZVT20		
	R&S®ZC170		
	110 GHz to 170 GHz	> +5 dBm (n. trc.), typ. +9 dBm	
	R&S®ZC220		
	140 GHz to 145 GHz	> -4 dBm (n. trc.), typ. 0 dBm	
	145 GHz to 220 GHz	> -2 dBm (n. trc.), typ. +2 dBm	
	R&S®ZC330		
	220 GHz to 320 GHz	> -11 dBm (n. trc.), typ. -8 dBm	
	320 GHz to 330 GHz	> -12 dBm (n. trc.), typ. -9 dBm	
	R&S®ZC500		
325 GHz to 440 GHz	> -17 dBm (n. trc.), typ. -13 dBm		
440 GHz to 500 GHz	> -24 dBm (n. trc.), typ. -18 dBm		
Output power attenuation	R&S®ZC170 manually adjustable	0 dB to 40 dB	
	R&S®ZC220 manually adjustable	0 dB to 40 dB	
	R&S®ZC330 manually adjustable	0 dB to 40 dB	
	R&S®ZC500 manually adjustable	0 dB to 40 dB	
Output power flatness across the waveguide band at minimum attenuation (peak-to-peak)	at 0 dB attenuator setting		
	R&S®ZC170	< 7 dB (n. trc.)	
	R&S®ZC220	< 10 dB (n. trc.)	
	R&S®ZC330	< 7 dB (n. trc.)	
	R&S®ZC500	< 13 dB (n. trc.)	
Damage level	R&S®ZC170	+20 dBm	
	R&S®ZC220	+20 dBm	
	R&S®ZC330	+20 dBm	
	R&S®ZC500	+10 dBm	

## Source input (RF IN)

Connector type	R&S®ZC170	2.92 mm, female	
	R&S®ZC220	2.92 mm, female	
	R&S®ZC330	2.92 mm, female	
	R&S®ZC500	2.92 mm, female	
Frequency range and multiplication factor	R&S®ZC170	9.167 GHz to 14.167 GHz	× 12
	R&S®ZC220	11.667 GHz to 18.333 GHz	× 12
	R&S®ZC330	12.222 GHz to 18.333 GHz	× 18
	R&S®ZC500	9.027 GHz to 13.889 GHz	× 36
Input power range	R&S®ZC170	-15 dBm to +10 dBm	
	R&S®ZC220	-15 dBm to +10 dBm	
	R&S®ZC330	-15 dBm to +10 dBm	
	R&S®ZC500	-15 dBm to +10 dBm	

## Local oscillator input (LO IN)

Connector type	R&S®ZC170	2.92 mm, female	
	R&S®ZC220	2.92 mm, female	
	R&S®ZC330	2.92 mm, female	
	R&S®ZC500	2.92 mm, female	
Frequency range and multiplication factor	R&S®ZC170	10.972 GHz to 16.972 GHz	× 10
	R&S®ZC220	11.643 GHz to 18.310 GHz	× 12
	R&S®ZC330	9.155 GHz to 13.738 GHz	× 24
	R&S®ZC500	13.530 GHz to 20.822 GHz	× 24
Input power range	R&S®ZC170	+5 dBm to +10 dBm	
	R&S®ZC220	+5 dBm to +10 dBm	
	R&S®ZC330	+5 dBm to +10 dBm	
	R&S®ZC500	+5 dBm to +10 dBm	

## Measurement output (MEAS OUT)

Connector type	R&S®ZC170	SMA, female
	R&S®ZC220	SMA, female
	R&S®ZC330	SMA, female
	R&S®ZC500	SMA, female
Frequency range	R&S®ZC170	5 MHz to 2000 MHz
	R&S®ZC220	5 MHz to 2000 MHz
	R&S®ZC330	5 MHz to 2000 MHz
	R&S®ZC500	5 MHz to 2000 MHz

## Reference output (REF OUT)

Connector type	R&S®ZC170	SMA, female
	R&S®ZC220	SMA, female
	R&S®ZC330	SMA, female
	R&S®ZC500	SMA, female
Frequency range	R&S®ZC170	5 MHz to 2000 MHz
	R&S®ZC220	5 MHz to 2000 MHz
	R&S®ZC330	5 MHz to 2000 MHz
	R&S®ZC500	5 MHz to 2000 MHz

## USB connector (USB )

Connector type	R&S®ZC170	universal serial bus (USB), type B
	R&S®ZC220	universal serial bus (USB), type B
	R&S®ZC330	universal serial bus (USB), type B
	R&S®ZC500	universal serial bus (USB), type B

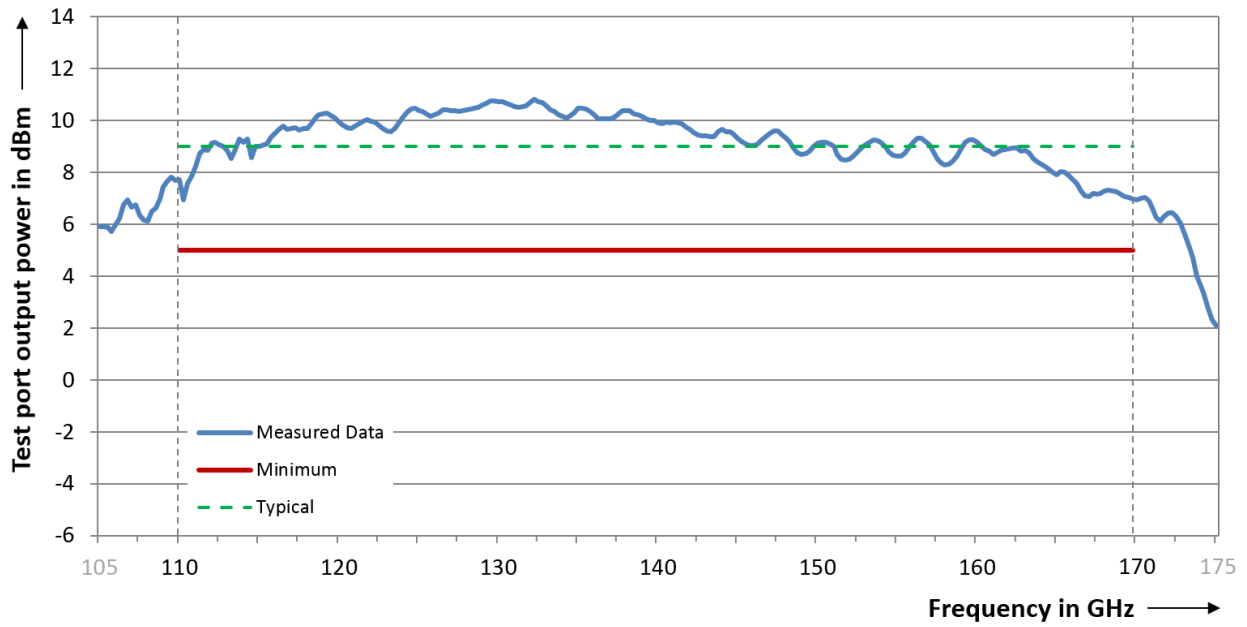
## Power supply input (POWER SUPPLY)

Connector type	R&S®ZC170	ODU MINI-SNAP® 19-pin miniature circular connector with push-pull locking
	R&S®ZC220	ODU MINI-SNAP® 19-pin miniature circular connector with push-pull locking
	R&S®ZC330	ODU MINI-SNAP® 19-pin miniature circular connector with push-pull locking
	R&S®ZC500	ODU MINI-SNAP® 19-pin miniature circular connector with push-pull locking
Power consumption	R&S®ZC170	12 W
	R&S®ZC220	20 W
	R&S®ZC330	30 W
	R&S®ZC500	48 W

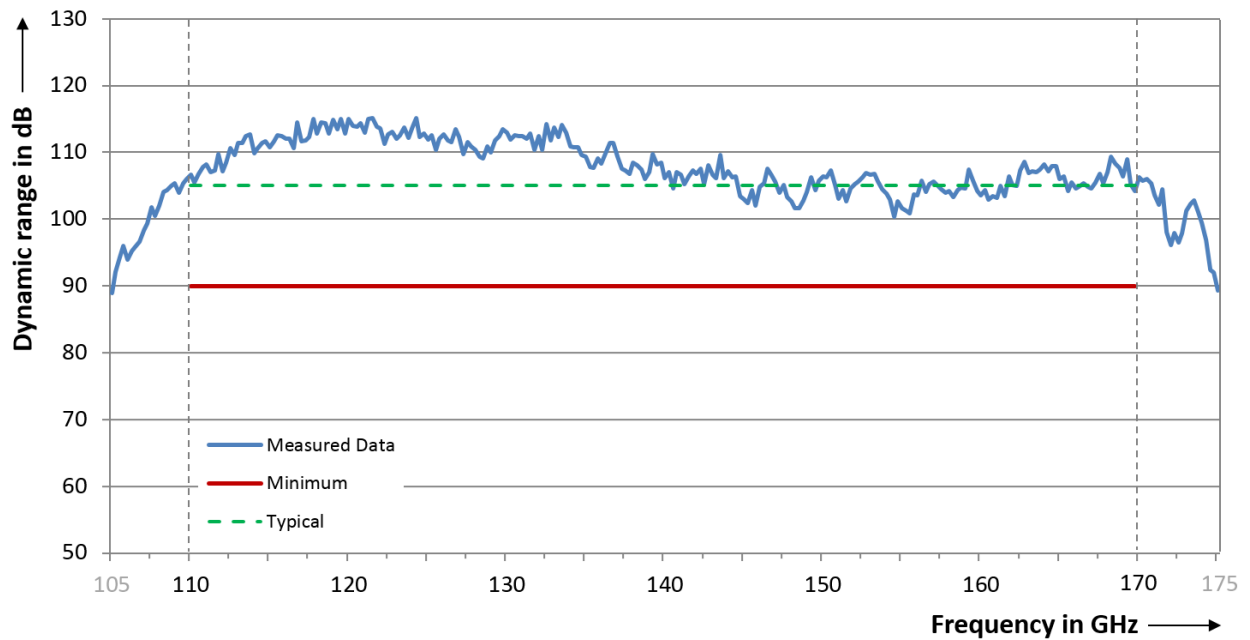
## System characteristics

Trace stability	R&S®ZC170	typ. < 0.3 dB and typ. < 4°
	R&S®ZC220	typ. < 0.3 dB and typ. < 4°
	R&S®ZC330	typ. < 0.4 dB and typ. < 6°
	R&S®ZC500	typ. < 0.5 dB and typ. < 6°
Trace stability is defined as the maximum deviation of the max. or min. hold trace of the reflection factor from its initial (reference) trace when measuring a converter whose waveguide port is terminated with a short. The data is valid if the ambient temperature of the R&S®ZVA/R&S®ZVT20 and the converter has not changed by more than 1 K over 1 hour, the output power of the converter is unattenuated and the measurement bandwidth is set to 100 Hz.		
Source match (without system error correction)	R&S®ZC170	> 25 dB (n. trc.) <sup>1</sup>
	R&S®ZC220	> 25 dB (n. trc.) <sup>1</sup>
	R&S®ZC330	> 20 dB (n. trc.) <sup>1</sup>
	R&S®ZC500	> 20 dB (n. trc.) <sup>1</sup>
Directivity (without system error correction)	R&S®ZC170	> 25 dB (n. trc.) <sup>1</sup>
	R&S®ZC220	> 25 dB (n. trc.) <sup>1</sup>
	R&S®ZC330	> 20 dB (n. trc.) <sup>1</sup>
	R&S®ZC500	> 20 dB (n. trc.) <sup>1</sup>
Effective source match (with system error correction)	R&S®ZC170	> 30 dB (meas.)
	R&S®ZC220	> 30 dB (meas.)
	R&S®ZC330	> 30 dB (meas.)
	R&S®ZC500	> 30 dB (meas.)
Effective directivity (with system error correction)	R&S®ZC170	> 30 dB (meas.)
	R&S®ZC220	> 30 dB (meas.)
	R&S®ZC330	> 30 dB (meas.)
	R&S®ZC500	> 30 dB (meas.)
Dynamic range	R&S®ZC170	> 90 dB, typ. 105 dB
	R&S®ZC220	> 100 dB, typ. 115 dB
	R&S®ZC330	> 100 dB, typ. 115 dB
	R&S®ZC500	> 85 dB, typ. 100 dB
Dynamic range is defined as the difference between the data trace of the transmission magnitude with maximum test port output power and both test ports through-connected on the one hand and the RMS value of the data trace of the transmission magnitude produced by noise and crosstalk with the test ports short-circuited on the other hand. The specification is valid without system error correction and at 10 Hz measurement bandwidth. The dynamic range can be increased by using a measurement bandwidth of 1 Hz.		

<sup>1</sup> Measurement uncertainty not considered.

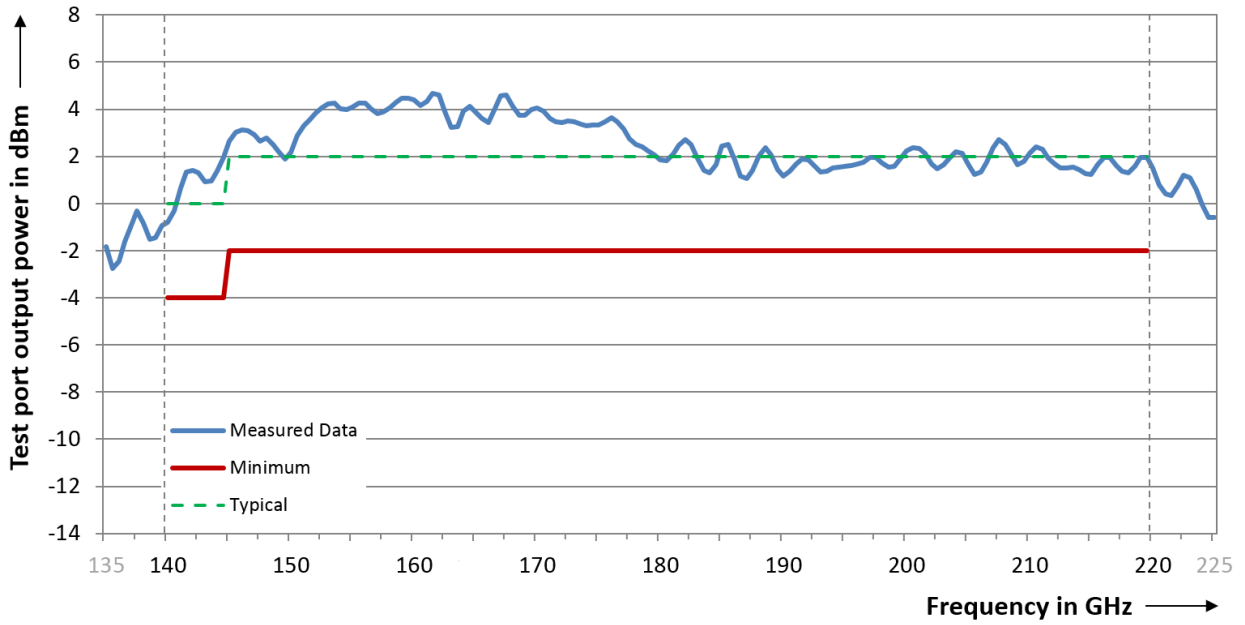


Test port output power versus frequency of the R&S®ZC170.

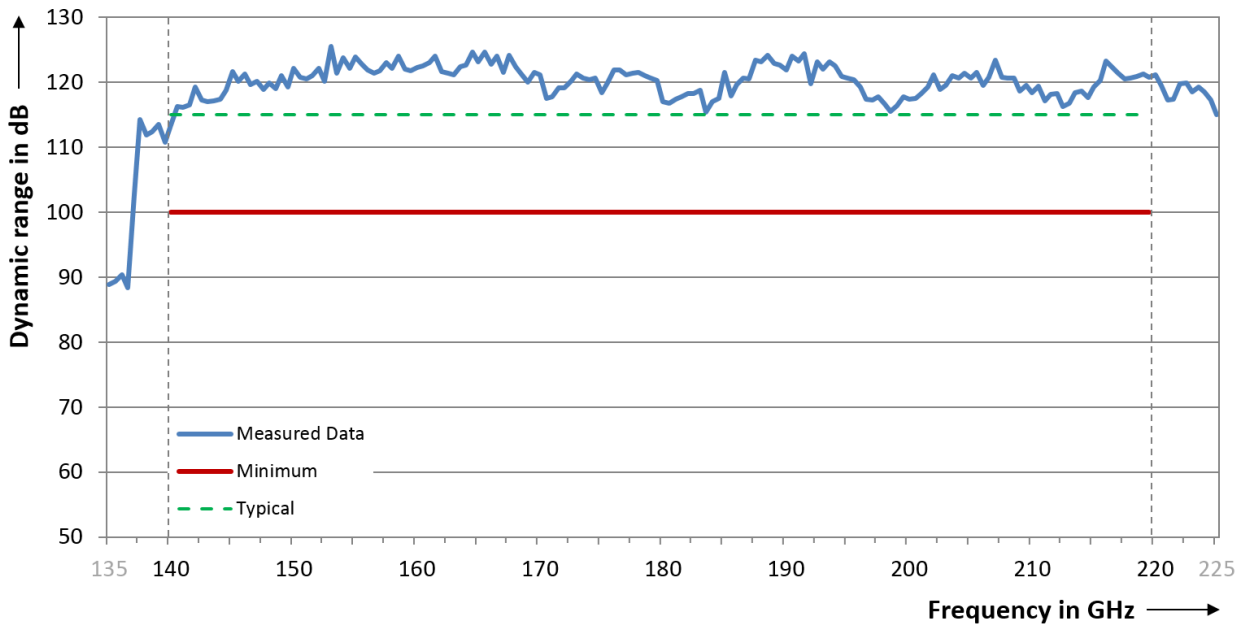


Dynamic range versus frequency of the R&S®ZC170.

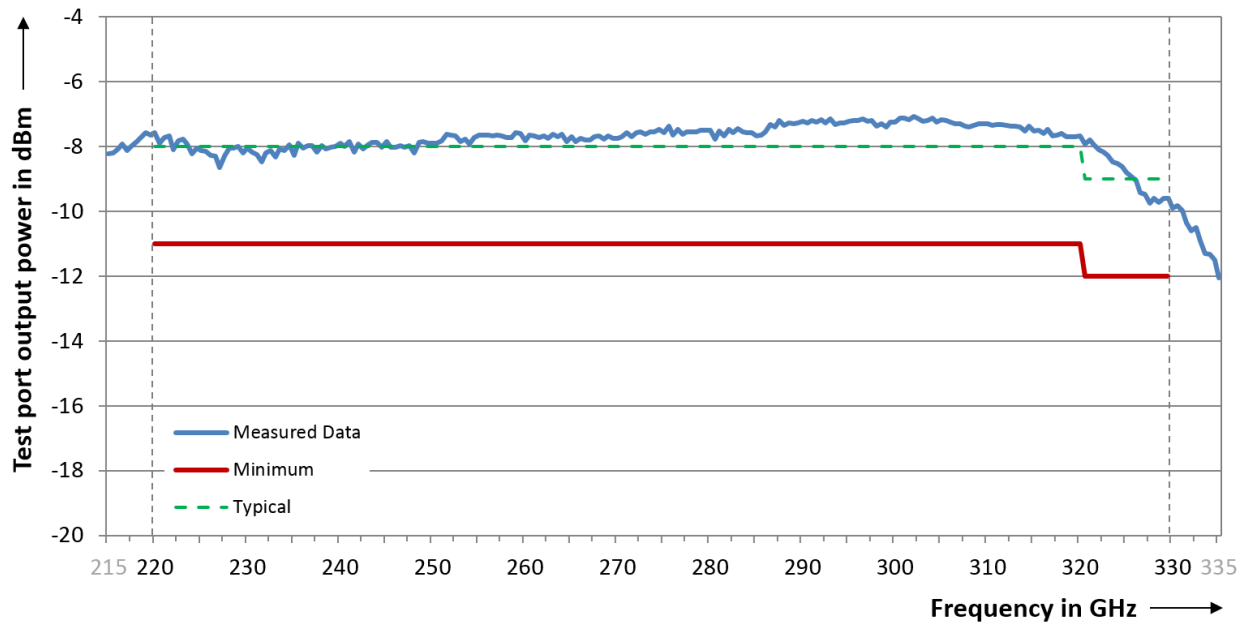




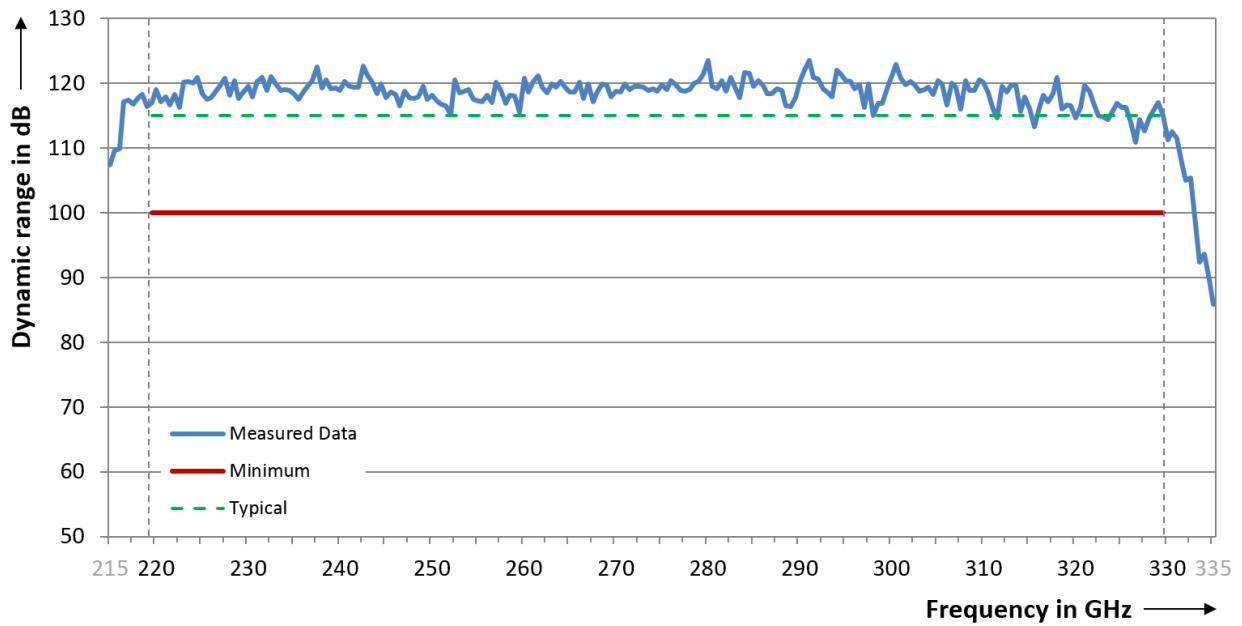
Test port output power versus frequency of the R&S®ZC220.



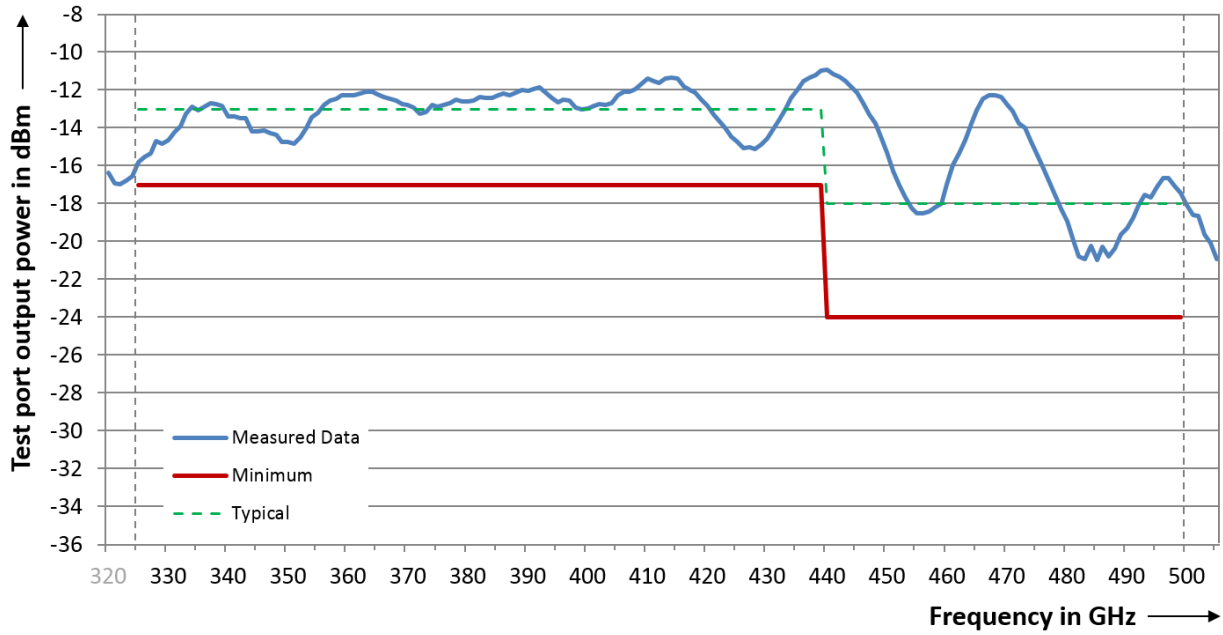
Dynamic range versus frequency of the R&S®ZC220.



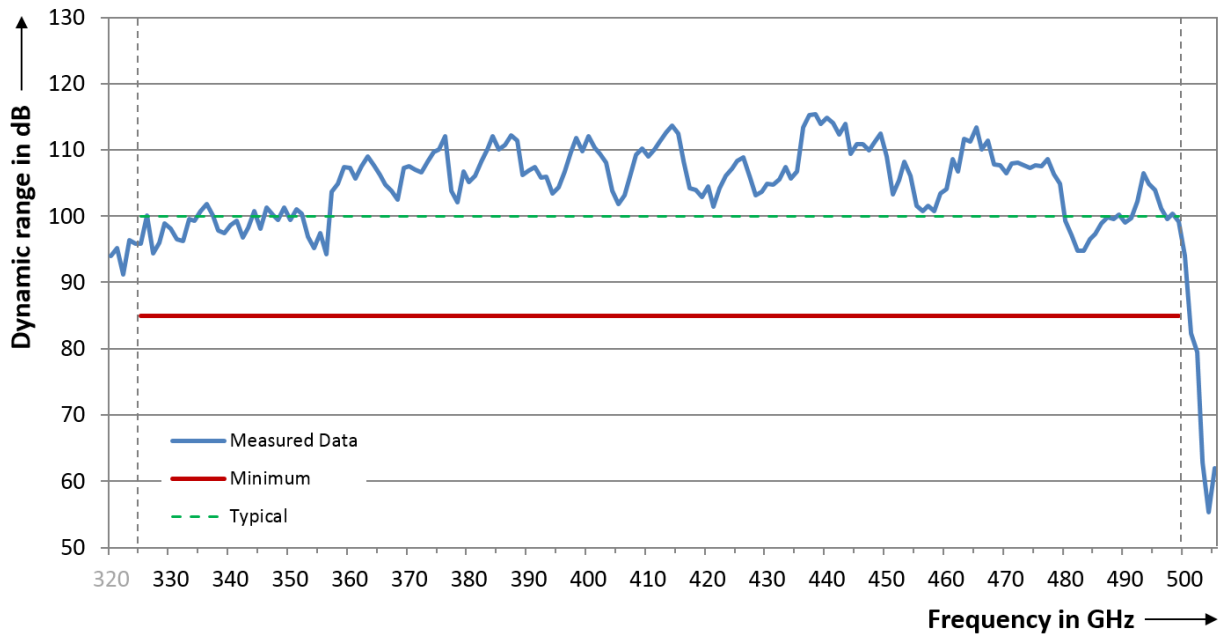
Test port output power versus frequency of the R&S®ZC330.



Dynamic range versus frequency of the R&S®ZC330.



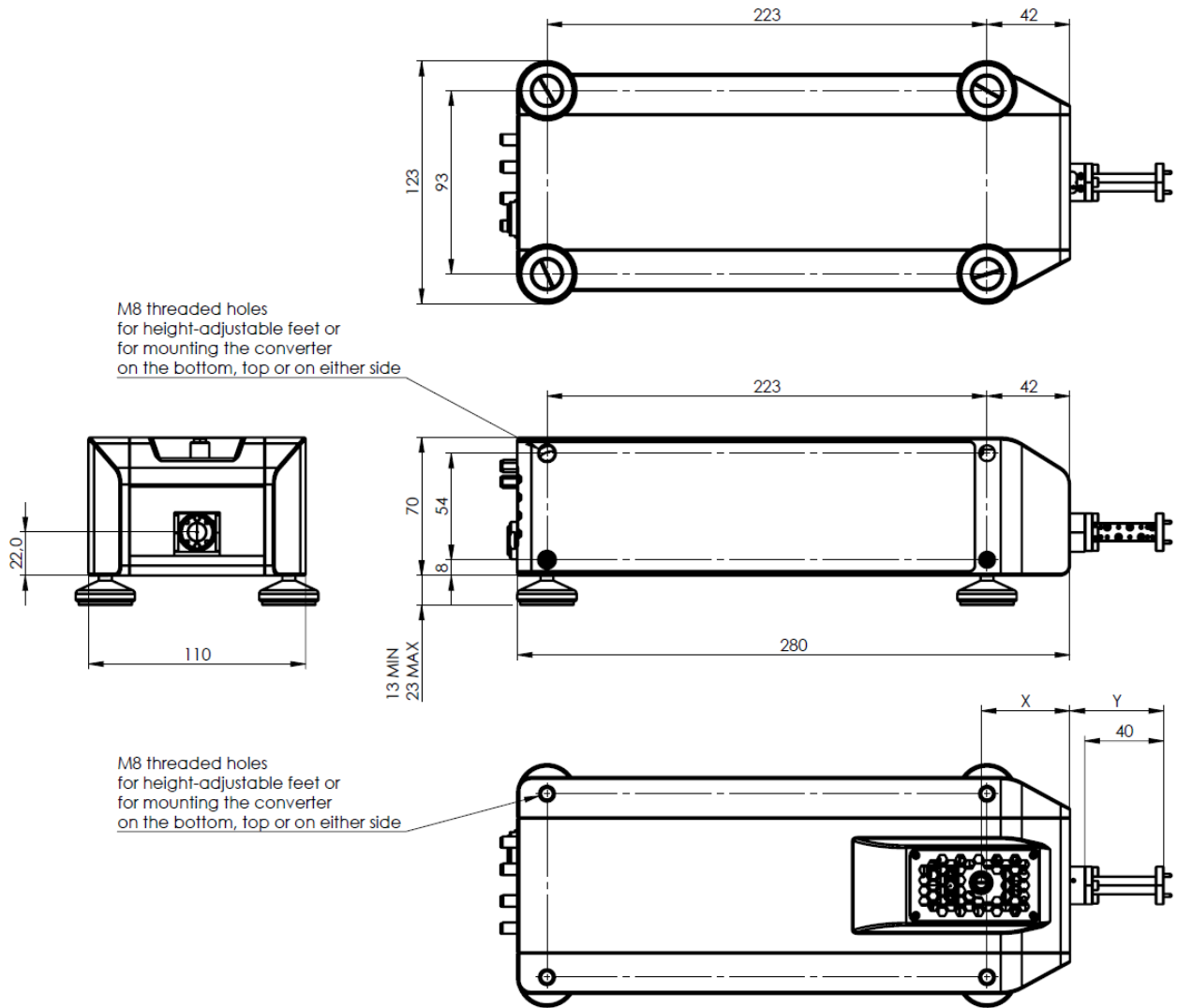
Test port output power versus frequency of the R&S®ZC500.



Dynamic range versus frequency of the R&S®ZC500.

## General data

Temperature loading	operating temperature range	+18 °C to +28 °C
	permissible temperature range	+5 °C to +40 °C
	storage temperature range	-40 °C to +70 °C
		in line with IEC 60068-2-1 and IEC 60068-2-2
Damp heat		+40 °C at 80 % rel. humidity, in line with IEC 60068-2-30
Mechanical resistance	vibration, sinusoidal	5 Hz to 150 Hz, in line with IEC 60068-2-6
	vibration, random	10 Hz to 300 Hz, in line with IEC 60068-2-64
	shock	40 g shock spectrum, in line with MIL-STD-810, method 516, procedure I
Operation	permissible altitude	3000 m above sea level
Dimensions (W x H x D)	with feet height adjusted to 12.1 mm (0.5 in)	123 mm x 88.38 mm x 322.5 mm (4.84 in x 3.48 in x 12.70 in)
Number of feet	alternatively	3 or 4
Feet height	user-adjustable	12.1 mm to 29.1 mm (0.5 in to 1.1 in)
Weight		3 kg (7 lb)
Shipping weight		5 kg (11 lb)



Type	Waveguide	Dimension X (Distance between converter front panel and center of attenuator screw)	Dimension Y (Distance between converter front panel and waveguide flange surface)
R&S®ZC170	WM-1651	68.1 mm	64.4 mm
R&S®ZC220	WM-1295	61.9 mm	59.5 mm
R&S®ZC330	WM-864	45.0 mm	47.5 mm
R&S®ZC500	WM-570	34.0 mm	46.5 mm

*Dimensions (in mm) of the R&S®ZCxxx millimeter-wave converters.*

## Ordering information

Designation	Type	Order No.
Converter WM-1651	R&S®ZC170	1323.7630.02
Converter WM-1295	R&S®ZC220	1323.7646.02
Converter WM-864	R&S®ZC330	1323.7669.02
Converter WM-570	R&S®ZC500	1323.7681.02
Converter Set Transport Case	R&S®ZCSTC	1323.7730.00
Converter Power Supply (supplies two converters)	R&S®ZCPS	1325.6101.02
DC Connection Cable (40 cm longer than the standard DC connection cable delivered with each converter)	R&S®ZCPSC	1323.7952.00
Test Cable, 3.5 mm (f) to 3.5 mm (m), length: 910 mm (two cables per converter required)	R&S®ZV-Z193	1306.4520.36
Test Cable, 2.92 mm (f) to 2.92 mm (m), length: 910 mm (two cables per converter required)	R&S®ZV-Z195	1306.4536.36
Waveguide Calibration Kit WR06 (without sliding match), compatible with converter WM-1651	R&S®ZV-WR06	1311.8807.10
Waveguide Calibration Kit WR06 (with sliding match), compatible with converter WM-1651	R&S®ZV-WR06	1311.8807.11
Waveguide Calibration Kit WR05 (without sliding match), compatible with converter WM-1295	R&S®ZV-WR05	1307.8106.10
Waveguide Calibration Kit WR05 (with sliding match), compatible with converter WM-1295	R&S®ZV-WR05	1307.8106.11
Waveguide Calibration Kit WR03 (without sliding match), compatible with converter WM-864	R&S®ZV-WR03	1307.7300.30
Waveguide Calibration Kit WR03 (with sliding match), compatible with converter WM-864	R&S®ZV-WR03	1307.7300.31
Waveguide Calibration Kit WM-570 (without sliding match)	R&S®ZCWM-570	1322.3099.10
Converter Control Software	R&S®ZVA-K8	1307.7022.02
Adapter Kit, including a power divider and two right angle SMA (m/m) adapters (required if R&S®ZVA24 var. 28 or R&S®ZVA40 var. 48 (VNAs with four sources) is used)	R&S®ZCAK	1323.7746.24
Adapter Kit, including four 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters (required if R&S®ZVA50 is used)	R&S®ZCAK	1323.7746.50
Adapter Kit, including a power divider, two right angle SMA (m/m) adapters, three 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters (required if R&S®ZVA67 is used)	R&S®ZCAK	1323.7746.67
Torque Wrench, for waveguide flange screws	R&S®ZV-Z1000	1314.5467.02
Angled Wrench, for waveguide flange screws	R&S®ZCAW	1175.1960.00
Angled Torque Wrench, for waveguide flange screws	R&S®ZCTW	1175.2014.02

<b>Service options</b>		
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty, three years	R&S®WE3	
Extended Warranty, four years	R&S®WE4	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	
Extended Warranty with Calibration Coverage, three years	R&S®CW3	
Extended Warranty with Calibration Coverage, four years	R&S®CW4	

**Extended warranty with a term of one to four years (WE1 to WE4)**

Repairs carried out during the contract term are free of charge <sup>2</sup>. Necessary calibration and adjustments carried out during repairs are also covered.

**Extended warranty with calibration (CW1 to CW4)**

Enhance your extended warranty by adding calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated, inspected and maintained during the term of the contract. It includes all repairs <sup>2</sup> and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

For product brochure, see PD 3607.1471.12 and [www.rohde-schwarz.com](http://www.rohde-schwarz.com)

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<sup>2</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

## Service that adds value

- | Worldwide
- | Local and personalized
- | Customized and flexible
- | Uncompromising quality
- | Long-term dependability

## About Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, the independent company which is headquartered in Munich, Germany, has an extensive sales and service network with locations in more than 70 countries.

## Sustainable product design

- | Environmental compatibility and eco-footprint
- | Energy efficiency and low emissions
- | Longevity and optimized total cost of ownership

Certified Quality Management

ISO 9001

Certified Environmental Management

ISO 14001

## Rohde & Schwarz GmbH & Co. KG

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## Rohde & Schwarz training

[www.training.rohde-schwarz.com](http://www.training.rohde-schwarz.com)

## Regional contact

- | Europe, Africa, Middle East | +49 89 4129 12345  
[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)
- | North America | 1 888 TEST RSA (1 888 837 87 72)  
[customer.support@rsa.rohde-schwarz.com](mailto:customer.support@rsa.rohde-schwarz.com)
- | Latin America | +1 410 910 79 88  
[customersupport.la@rohde-schwarz.com](mailto:customersupport.la@rohde-schwarz.com)
- | Asia Pacific | +65 65 13 04 88  
[customersupport.asia@rohde-schwarz.com](mailto:customersupport.asia@rohde-schwarz.com)
- | China | +86 800 810 82 28 | +86 400 650 58 96  
[customersupport.china@rohde-schwarz.com](mailto:customersupport.china@rohde-schwarz.com)

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R&S®ZCxxx Millimeter-Wave Converters

Data without tolerance limits is not binding | Subject to change

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