

# R&S® FE170ST EXTERNAL FRONTEND 110 GHz to 170 GHz

## Specifications



Specifications  
Version 05.00

**ROHDE & SCHWARZ**

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# Definitions

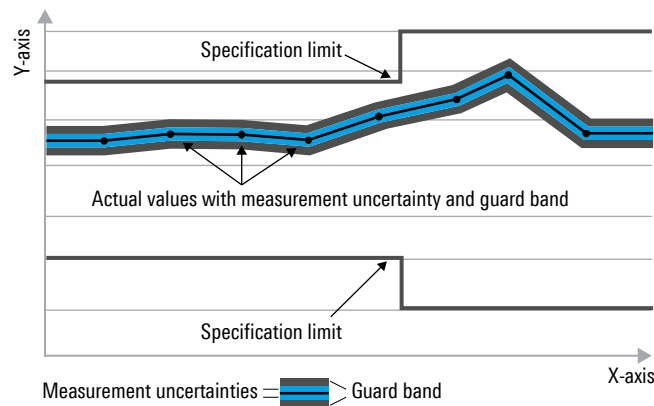
## General

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 designated with the format “parameter: value”.

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

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

## Specifications

Unless otherwise noted, all specifications in this section are valid for:

- R&S®FE170ST, in combination with R&S®SMW200A or R&S®SMM100A base unit (see Options needed for the base unit)
- 1 GHz reference signal from R&S®SMW200A or R&S®SMM100A base unit, LO mode internal
- The corresponding R&S®FE170-Z01, R&S®FE170-Z02 and R&S®FE170-Z03 waveguide filters within the specified frequency range (see Recommended extras)
- +12 V power supply (see Accessories supplied)
- IF cable, 2.92 mm, length: 1 m (see Accessories supplied)
- Temperature range from +20 °C to +30 °C

## Frequency

RF frequency range	R&S®FE170ST	110 GHz to 170 GHz
	overrange	170 GHz to 175 GHz
	R&S®FE170ST with R&S®FE170-Z01 waveguide filter (110 GHz to 136 GHz)	110 GHz to 131 GHz
	R&S®FE170ST with R&S®FE170-Z02 waveguide filter (126 GHz to 153 GHz)	131 GHz to 148 GHz
	R&S®FE170ST with R&S®FE170-Z03 waveguide filter (143 GHz to 170 GHz)	148 GHz to 170 GHz

### Reference frequency

This item is specified in the specifications of the base unit which is used as input for the R&S®FE170ST reference frequency.

### LO source

Mode	internal	internal synthesizer
	external	external signal generator or LO output of a further R&S®FE170SR/ST with IF mode: shared LO

### Setting times

Frequency change	≤ 10 MHz	< 10 ms (nom.)
	> 10 MHz	< 30 ms (nom.)

## Modulation bandwidth

Maximum signal modulation bandwidth (equalized)	with R&S®SMM100A	1 GHz
	with R&S®SMW200A	2 GHz
	with dual-channel R&S®SMW200A and R&S®SMW-K555 options	4 GHz

## Level

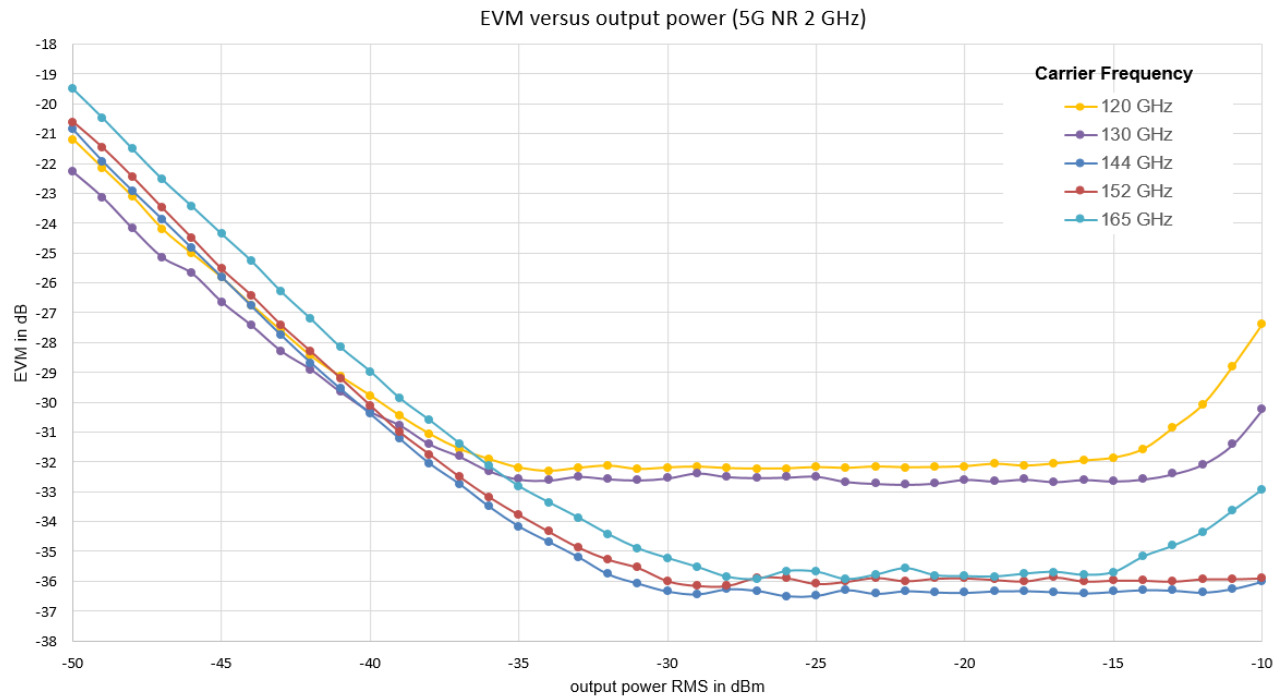
Setting range		-145 dBm to +30 dBm	
Specified level range	CW or I/Q modulated signals		
	$110 \text{ GHz} \leq f_{\text{out}} \leq 170 \text{ GHz}$	-40 dBm to -15 dBm (PEP)	
Resolution of setting		0.1 dB (nom.)	
Setting range of RF attenuator		0 dB to 30 dB, in 1 dB steps	
Level error	CW signal, amplitude settings: auto, level range from -30 dBm to -15 dBm		
	$110 \text{ GHz} \leq f_{\text{out}} \leq 118 \text{ GHz}$	< 3.5 dB <sup>1</sup>	
	$118 \text{ GHz} < f_{\text{out}} \leq 128 \text{ GHz}$	< 3.5 dB	
	$128 \text{ GHz} < f_{\text{out}} \leq 166 \text{ GHz}$	< 3.0 dB	
	$166 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$	< 3.0 dB <sup>1</sup>	
	I/Q modulated signal, level range -30 dBm to -15 dBm		
	$110 \text{ GHz} \leq f_{\text{out}} \leq 170 \text{ GHz}$	add 0.5 dB	
	for any other level setting		
	$110 \text{ GHz} \leq f_{\text{out}} \leq 170 \text{ GHz}$	add 1.0 dB (meas.)	
	Amplitude flatness	with internal baseband I/Q (R&S®SMW-B13XT wideband baseband main module option), optimization mode: high quality	
modulation bandwidth $\leq 500 \text{ MHz}$ <sup>2</sup>			
$110 \text{ GHz} \leq f_{\text{out}} \leq 115 \text{ GHz}$		$\pm 2.7 \text{ dB}$ (meas.)	
$115 \text{ GHz} < f_{\text{out}} \leq 118 \text{ GHz}$		$\pm 2.5 \text{ dB}$ (nom.) <sup>1</sup>	
$118 \text{ GHz} < f_{\text{out}} \leq 128 \text{ GHz}$		$\pm 2.5 \text{ dB}$ (nom.)	
$128 \text{ GHz} < f_{\text{out}} \leq 150 \text{ GHz}$		$\pm 1.5 \text{ dB}$ (nom.)	
$150 \text{ GHz} < f_{\text{out}} \leq 166 \text{ GHz}$		$\pm 2.3 \text{ dB}$ (nom.)	
$166 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$		$\pm 2.3 \text{ dB}$ (nom.) <sup>1</sup>	
modulation bandwidth $\leq 1000 \text{ MHz}$ <sup>2</sup>			
$110 \text{ GHz} \leq f_{\text{out}} \leq 115 \text{ GHz}$		$\pm 3.0 \text{ dB}$ (meas.)	
$115 \text{ GHz} < f_{\text{out}} \leq 118 \text{ GHz}$		$\pm 2.8 \text{ dB}$ (nom.) <sup>1</sup>	
$118 \text{ GHz} < f_{\text{out}} \leq 128 \text{ GHz}$		$\pm 2.8 \text{ dB}$ (nom.)	
$128 \text{ GHz} < f_{\text{out}} \leq 150 \text{ GHz}$		$\pm 2.0 \text{ dB}$ (nom.)	
$150 \text{ GHz} < f_{\text{out}} \leq 166 \text{ GHz}$		$\pm 2.3 \text{ dB}$ (nom.)	
$166 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$		$\pm 2.3 \text{ dB}$ (nom.) <sup>1</sup>	
modulation bandwidth $\leq 2000 \text{ MHz}$ <sup>2</sup>			
$110 \text{ GHz} \leq f_{\text{out}} \leq 115 \text{ GHz}$		$\pm 3.2 \text{ dB}$ (meas.)	
$115 \text{ GHz} < f_{\text{out}} \leq 118 \text{ GHz}$		$\pm 3.0 \text{ dB}$ (nom.) <sup>1</sup>	
$118 \text{ GHz} < f_{\text{out}} \leq 128 \text{ GHz}$		$\pm 3.0 \text{ dB}$ (nom.)	
$128 \text{ GHz} < f_{\text{out}} \leq 150 \text{ GHz}$		$\pm 2.2 \text{ dB}$ (nom.)	
$150 \text{ GHz} < f_{\text{out}} \leq 166 \text{ GHz}$		$\pm 2.5 \text{ dB}$ (nom.)	
$166 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$		$\pm 2.5 \text{ dB}$ (nom.) <sup>1</sup>	
Maximum rated reverse power			0 dBm

<sup>1</sup> For IF mode: shared LO, specification is only valid as measured (meas.).

<sup>2</sup> Specification is valid for output frequencies in the range from 110 GHz to 170 GHz.

## Signal performance for digital standards

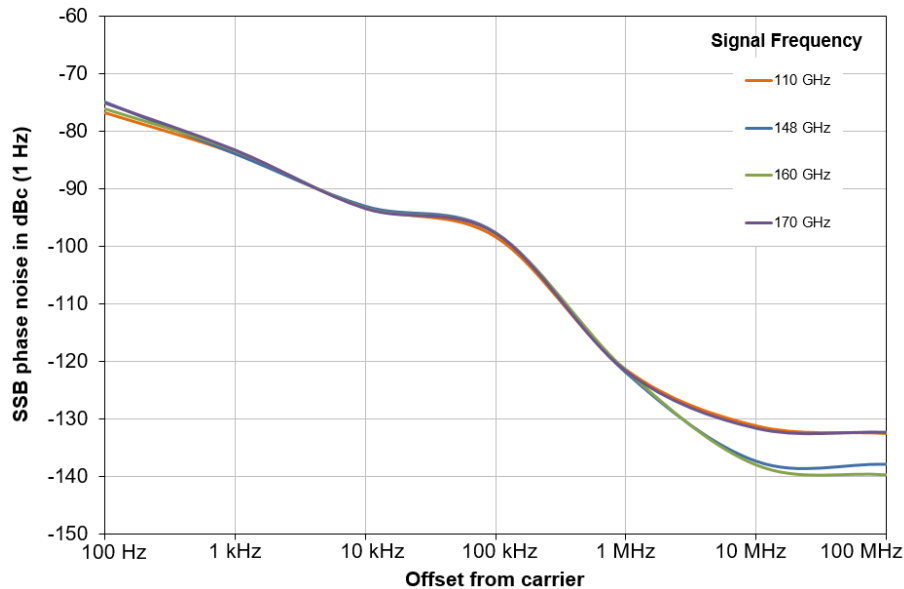
Residual EVM	5G NR signal, channel bandwidth: 2 GHz, full allocation, SCS: 960 kHz, modulation: QPSK, measured with R&S <sup>®</sup> SMW200A (with R&S <sup>®</sup> SMW-B711 option) in combination with R&S <sup>®</sup> FE170SR and R&S <sup>®</sup> FSW (with R&S <sup>®</sup> FSW4001 option), IF mode: EVM optimized	
	120 GHz $\leq f_{out} \leq$ 134 GHz	
	$-35 \text{ dBm} \leq P_{out} \text{ (RMS)} \leq -15 \text{ dBm}$	< -31 dB (meas.)
	134 GHz < $f_{out} \leq$ 167 GHz	
	$-30 \text{ dBm} \leq P_{out} \text{ (RMS)} \leq -15 \text{ dBm}$	< -34 dB (meas.)



*EVM values versus output power at different center frequencies with R&S<sup>®</sup>SMW200A (with R&S<sup>®</sup>SMW-B711 option) in combination with R&S<sup>®</sup>FE170SR and R&S<sup>®</sup>FSW (with R&S<sup>®</sup>FSW4001 option), IF mode: EVM optimized*

## Spectral purity

Image suppression	-15 dBm CW output signal, observed frequency range from 110 GHz to 170 GHz, IF mode: spur optimized	
	$110 \text{ GHz} \leq f_{\text{out}} \leq 129 \text{ GHz}$	< -80 dBc (nom.)
	$129 \text{ GHz} < f_{\text{out}} \leq 146 \text{ GHz}$	< -70 dBc (nom.)
	$146 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$	< -70 dBc (meas.)
Wideband noise	-15 dBm CW output signal, carrier offset = 100 MHz, measurement bandwidth = 1 Hz	
	$110 \text{ GHz} \leq f_{\text{out}} \leq 170 \text{ GHz}$	< -132 dBc (meas.)
LO suppression	-15 dBm CW output signal, observed frequency range from 110 GHz to 170 GHz, IF mode: spur optimized	
	$110 \text{ GHz} \leq f_{\text{out}} \leq 131 \text{ GHz}$	< -55 dBc (nom.)
	$131 \text{ GHz} < f_{\text{out}} \leq 148 \text{ GHz}$	< -50 dBc (nom.)
	$148 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$	< -55 dBc (meas.)
Harmonics, subharmonics and other mixing products of the RF and LO signal	-15 dBm CW output signal, within 8.4 GHz bandwidth, observed frequency range from 110 GHz to 170 GHz, IF mode: EVM optimized	
	$110 \text{ GHz} \leq f_{\text{out}} \leq 170 \text{ GHz}$	< -50 dBc (meas.)
	-15 dBm CW output signal, observed frequency range from 110 GHz to 170 GHz, IF mode: spur optimized	
	$110 \text{ GHz} \leq f_{\text{out}} \leq 136 \text{ GHz}$	< -30 dBc (meas.)
	$136 \text{ GHz} < f_{\text{out}} \leq 151 \text{ GHz}$	< -45 dBc (meas.)
	$151 \text{ GHz} < f_{\text{out}} \leq 170 \text{ GHz}$	< -30 dBc (meas.)
SSB phase noise	RF center frequency = 148 GHz, measured in combination with an R&S®SMW200A (with R&S®SMW-B711/-B721 options)	
	100 Hz	-75 dBc (1 Hz) (meas.)
	1 kHz	-84 dBc (1 Hz) (meas.)
	10 kHz	-93 dBc (1 Hz) (meas.)
	100 kHz	-97 dBc (1 Hz) (meas.)
	1 MHz	-122 dBc (1 Hz) (meas.)
	10 MHz	-137 dBc (1 Hz) (meas.)



Measured single sideband phase noise in combination with an R&S®SMW200A (with R&S®SMW-B711/-B721 options)

## Inputs and outputs

<b>RF output</b>		
Connector		WM1651/WR6.5
Impedance		50 $\Omega$

<b>IF input</b>		
Connector		2.92 mm female
Impedance		50 $\Omega$ (nom.)
Input frequency range	IF mode: spur optimized dependent on RF frequency	5 GHz to 31 GHz
	IF mode: EVM optimized dependent on RF frequency	4.8 GHz to 18.9 GHz
Level		-40 dBm to +10 dBm

<b>Reference input 10 MHz, 640 MHz, 1 GHz</b>		
Connector		SMA female
Impedance		50 $\Omega$ (nom.)
Input frequency range		10 MHz, 640 MHz, 1 GHz
Required level		0 dBm to +20 dBm

<b>LO input</b>		
Connector		SMA female
Impedance		50 $\Omega$ (nom.)
Input frequency		8 GHz to 16.4 GHz
Level		+5 dBm to +20 dBm

<b>LO output</b>		
Connector		SMA female
Impedance		50 $\Omega$ (nom.)
Output frequency		8 GHz to 16.4 GHz
Level		+5 dBm to +20 dBm

<b>Power supply</b>		
Connector		2-pin LEMOSA
Supply voltage		+12 V DC, max. 2.5 A (nom.)

<b>LAN interface</b>		
Connector		10BASE-T/100BASE-T
PoE support		RJ-45 jack PoE++ (max. 52 W)

<b>External modules</b>		
Connector		ix Industrial <sup>®</sup> , type B

<b>USB interface</b>		
	for service use only	1 port, type B plug, version 2.0



## General data

<b>Temperature</b>		
Temperature range	operating	+5 °C to +40 °C
	storage	−40 °C to +70 °C
Climatic loading		+40 °C at 95 % relative humidity, in line with EN 60068-2-30, without condensation

<b>Altitude</b>		
Maximum operating altitude	above sea level	4600 m (approx. 15100 ft)

<b>Mechanical resistance</b>		
Vibration	sinusoidal	5 Hz to 55 Hz, displacement: 0.3 mm, constant amplitude (1.8 g at 55 Hz), in line with EN 60068-2-6
		55 Hz to 150 Hz, acceleration: 0.5 g constant, in line with EN 60068-2-6
	random	8 Hz to 500 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810G, method 516.6, procedure I

<b>EMC</b>		<ul style="list-style-type: none"> <li>• IEC/EN 61326-1<sup>3,4</sup></li> <li>• IEC/EN 61326-2-1</li> <li>• CISPR 11/EN 55011<sup>3</sup></li> <li>• IEC/EN 61000-3-2</li> <li>• IEC/EN 61000-3-3</li> </ul>
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<b>Recommended calibration interval</b>		2 years
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<b>External power supply</b>		
DC output voltage range		+12 V
Maximum output current		5 A
Power consumption		max. 60 W
Safety		in line with IEC/UL/EN 60950-1/62368-1, CE, CB
Test marks		UL, GS, CE, FCC

<b>Dimensions and weight</b>		
Dimensions (nom.)	W x H x D (overall)	150 mm x 57 mm x 190 mm (5.90 in x 2.24 in x 7.48 in)
Net weight (nom.)		1.66 kg (3.66 lb)

<sup>3</sup> Emission limits for class A equipment applied.

<sup>4</sup> Immunity test requirement for industrial environment (EN 61326 table 2).

## Ordering information

Designation	Type	Order No.
External frontend 110 GHz to 170 GHz	R&S®FE170ST	1347.9190.02
<b>Accessories supplied</b>		
+12 V power supply, IF cable (2.92 mm, length: 1 m), reference cable (SMA, length: 2 m)		

## Recommended extras

Designation	Type	Order No.
Torque wrench, for 3.5/2.92/2.4/1.85 mm connectors, 0.9 Nm coupling torque	R&S®ZN-ZTW	1328.8534.35
Angled wrench, 3/32"	R&S®ZCAW	1175.1960.00
Waveguide filter, 110 GHz to 136 GHz	R&S®FE170-Z01	1347.9532.02
Waveguide filter, 126 GHz to 153 GHz	R&S®FE170-Z02	1347.9549.02
Waveguide filter, 143 GHz to 170 GHz	R&S®FE170-Z03	1347.9555.02
WR6.5 waveguide-to-waveguide adapter	R&S®FE170-Z20	1347.9655.02
Height adjustment, for external frontends	R&S®ZZA-FE01	1348.5330.02
Horn antenna, 110 GHz to 170 GHz	R&S®SGH170G20	1537.3327.02
LANCOM PoE++ Injector (compatible with IEEE standard 802.3af/at/bt; up to 100 m distance)		4044144617799 (LANCOM order number)

## Supported base units

Designation	Type	Order No.
Vector signal generator	R&S®SMW200A	1412.0000.02
Vector signal generator	R&S®SMM100A	1440.8002.02

## Options needed for the base unit

Designation	Type	Order No.
Minimum needed frequency option, for R&S®SMW200A	R&S®SMW-B1020	1428.5107.02
Frequency option needed for IF mode: spur optimized, for R&S®SMW200A	R&S®SMW-B1031	1428.5307.02
External frontend control, for R&S®SMW200A	R&S®SMW-K553	1414.6758.02
Minimum needed frequency option, for R&S®SMM100A	R&S®SMM-B1020	1440.9309.02
Frequency option needed for IF mode: spur optimized, for R&S®SMM200A	R&S®SMM-B1031	1440.9409.02
External frontend control, for R&S®SMM100A	R&S®SMM-K553	1441.1147.02

## Service options

<b>Warranty</b>		
Base unit		1 year
Service options		
Extended warranty, one year	R&S®WE1	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>5</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>5</sup> and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

<sup>5</sup> Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.



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- ▶ Energy efficiency and low emissions
- ▶ Longevity and optimized total cost of ownership

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