

# R&S® FE110SR

## EXTERNAL FRONTEND

### 70 GHz to 110 GHz

#### Specifications



Specifications  
Version 03.00

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# Definitions

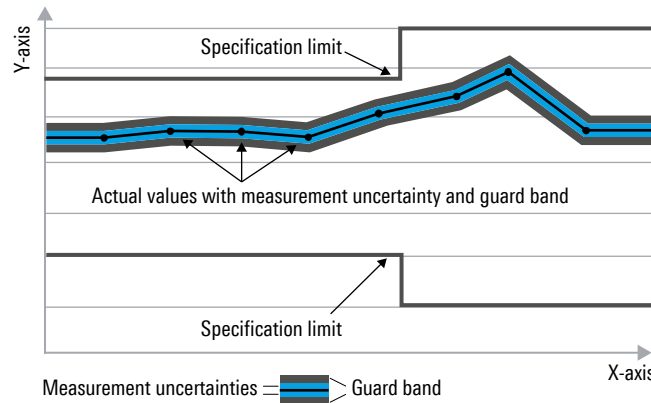
## General

Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 30 minutes of 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®FE110SR, in combination with R&S®FSW base unit (see Options needed for the base unit)
- 640 MHz reference signal from R&S®FSW base unit, LO mode internal
- The corresponding R&S®FE110-Z10, R&S®FE110-Z01, R&S®FE110-Z02, R&S®FE110-Z03 and R&S®FE110-Z04 waveguide filters within the specified frequency range of the waveguide filter (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®FE110SR	70 GHz to 110 GHz
	R&S®FE110SR with R&S®FE110-Z10 waveguide filter (70 GHz to 86 GHz)	70 GHz to 75 GHz
	R&S®FE110SR with R&S®FE110-Z01 waveguide filter (75 GHz to 90 GHz)	75 GHz to 85 GHz
	R&S®FE110SR with R&S®FE110-Z02 waveguide filter (80 GHz to 95 GHz)	85 GHz to 90 GHz
	R&S®FE110SR with R&S®FE110-Z03 waveguide filter (85 GHz to 105 GHz)	90 GHz to 100 GHz
	R&S®FE110SR with R&S®FE110-Z04 waveguide filter (95 GHz to 110 GHz)	100 GHz to 110 GHz

### Reference frequency

This item is specified in the specifications of the base unit which is used as input for the R&S®FE110SR reference frequency.

### LO source

Mode	internal	internal synthesizer
	external	external signal generator or LO output of a further R&S®FE110SR/ R&S®FE110ST with IF mode: shared LO

### Setting times

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

## Analysis bandwidth

### Maximum signal analysis bandwidth (equalized)

With R&S®FSW	The signal analysis bandwidth is equal to the analysis bandwidth of the used R&S®FSW base unit. For details about available options, see the R&S®FSW specifications (PD 5215.6749.22).	
With R&S®RTP	with R&S®RTP-K11 and R&S®RTP-K121	10 GHz

## Level

Setting range of RF attenuator		0 dB to 40 dB, in 1 dB steps
Maximum safe input level	RF attenuation = 0 dB	+5 dBm
	RF attenuation ≥ 25 dB	+20 dBm

### Compression

1 dB compression point	RF attenuation = 10 dB	
	75 GHz ≤ f <sub>in</sub> ≤ 110 GHz	> +10 dBm (meas.)

## Sensitivity

All noise level data in this section not marked as typical (typ.) or nominal (nom.) are specified values whose compliance is ensured by testing.

Displayed average noise level	RF attenuation = 0 dB, termination = 50 $\Omega$ , log. scaling, normalized to 1 Hz RBW, RBW = 1 kHz, trace average = 50, IF cable loss < 3 dB at I/Q analyzer center frequency, analysis bandwidth = 10 MHz	
	70 GHz $\leq f < 75$ GHz	-154 dBm (nom.)
	75 GHz $\leq f \leq 98$ GHz	-154 dBm, -158 dBm (typ.)
	98 GHz $< f \leq 110$ GHz	-152 dBm, -155 dBm (typ.)

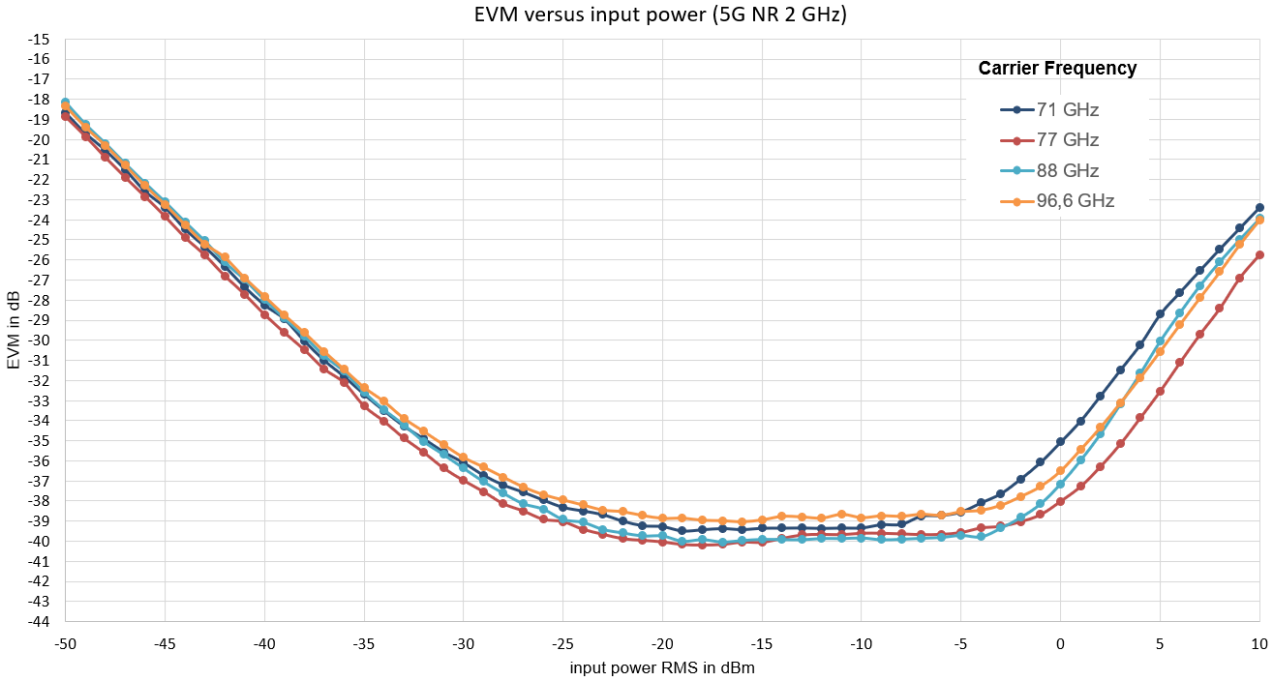
## Level measurement uncertainty

Level measurement uncertainty at center frequency	any RF attenuation, amplitude settings: auto	
	70 GHz $\leq f < 75$ GHz	< 3.0 dB (nom.)
	75 GHz $\leq f \leq 98$ GHz	< 3.0 dB ( $\sigma = 1$ dB)
	98 GHz $< f \leq 110$ GHz	< 3.5 dB ( $\sigma = 1.2$ dB)
RF attenuator switching uncertainty	referenced to 10 dB attenuation, $f_{\text{center}} = 77$ GHz and 96 GHz	
	0 dB to 40 dB	< 0.7 dB (typ.)
Amplitude flatness	RF attenuation = 10 dB, amplitude settings: auto	
	analysis bandwidth $\leq 2000$ MHz <sup>1</sup>	
	70 GHz $\leq f_{\text{center}} \leq 98$ GHz	$\pm 1.5$ dB (nom.)
	98 GHz $< f_{\text{center}} \leq 110$ GHz	$\pm 2.0$ dB (nom.)
	analysis bandwidth $\leq 4400$ MHz <sup>1</sup>	
	70 GHz $\leq f_{\text{center}} \leq 98$ GHz	$\pm 2.0$ dB (nom.)
	98 GHz $< f_{\text{center}} \leq 110$ GHz	$\pm 2.5$ dB (nom.)
	analysis bandwidth $\leq 8312$ MHz <sup>1</sup>	
	70 GHz $\leq f_{\text{center}} \leq 98$ GHz	$\pm 2.5$ dB (nom.)
	98 GHz $< f_{\text{center}} \leq 110$ GHz	$\pm 3.0$ dB (nom.)

<sup>1</sup> Specification is valid for input frequencies in the range from 70 GHz to 110 GHz.

Signal performance for digital standards

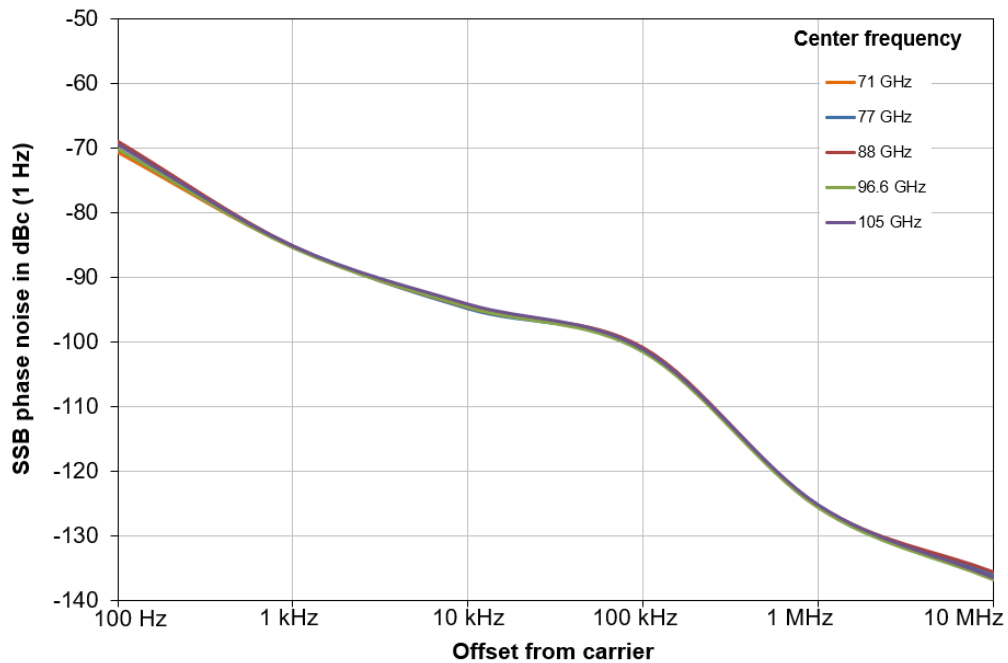
Residual EVM	5G NR signal, channel bandwidth: 2 GHz, full allocation, SCS: 960 kHz, modulation: QPSK, measured with R&S®FSW (with R&S®FSW-B4001 option) in combination with R&S®SMW200A (with R&S®SMW-B711 option) and R&S®FE110ST, IF mode: EVM optimized	
	77 GHz ≤ f <sub>in</sub> ≤ 98 GHz	
	-20 dBm ≤ P <sub>in</sub> (RMS) ≤ -5 dBm	< -38 dB (meas.)
	77 GHz ≤ f <sub>in</sub> ≤ 98 GHz	
	-30 dBm ≤ P <sub>in</sub> (RMS) ≤ 0 dBm	< -35 dB (meas.)



EVM values versus input power at different center frequencies in combination with R&S®SMW200A (with R&S®SMW-B711/-B721 options) and R&S®FE110ST, IF mode: EVM optimized

## Spectral purity

Image response	$f_{in} = f - 2 \times (\text{first IF}), 75 \text{ GHz} \leq f_{in} \leq 110 \text{ GHz}, \text{ input level} \leq -15 \text{ dBm}$	
	$70 \text{ GHz} \leq f \leq 73 \text{ GHz}$	$< -40 \text{ dBc (meas.)}$
	$73 \text{ GHz} < f < 75 \text{ GHz}$	$< -65 \text{ dBc (meas.)}$
	$75 \text{ GHz} \leq f \leq 76 \text{ GHz}$	$< -55 \text{ dBc}$
	$76 \text{ GHz} < f \leq 110 \text{ GHz}$	$< -65 \text{ dBc}$
$f = \text{receive frequency}$		
Residual spurious response	RF attenuation = 0 dB, RF input termination = 50 $\Omega$ , analysis bandwidth $\leq 8.312 \text{ GHz}$	
	$70 \text{ GHz} \leq f \leq 110 \text{ GHz}$	$< -90 \text{ dBm (nom.)}$
$f = \text{receive frequency}$		
SSB phase noise	RF center frequency = 96.6 GHz, measured with an R&S®FE110ST as signal source on the used IF frequency of the R&S®FE110SR	
	100 Hz	-70 dBc (1 Hz) (meas.)
	1 kHz	-85 dBc (1 Hz) (meas.)
	10 kHz	-94 dBc (1 Hz) (meas.)
	100 kHz	-101 dBc (1 Hz) (meas.)
	1 MHz	-125 dBc (1 Hz) (meas.)
	10 MHz	-136 dBc (1 Hz) (meas.)



Measured single sideband phase noise in combination with an R&S®FE110ST

## Inputs and outputs

<b>RF input</b>		
Connector		WM-2540/WR10
Impedance		50 $\Omega$

<b>IF output</b>		
Connector		SMA female
Impedance		50 $\Omega$ (nom.)
Output frequency		5 GHz to 15 GHz
Level		-40 dBm to +10 dBm

<b>Reference input</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		RJ-45 jack
PoE support		PoE++ (max. 52 W)

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

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

Temperature		
Temperature range	operating	+5 °C to +40 °C
	storage	−40 °C to +70 °C

Altitude		
Maximum operating altitude	above sea level	4600 m (approx. 15100 ft)

Mechanical resistance		
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
	random	55 Hz to 150 Hz, acceleration: 0.5 g constant, in line with EN 60068-2-6
Shock		8 Hz to 500 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
		40 g shock spectrum, in line with MIL-STD-810G, method 516.6, procedure I

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

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

<sup>2</sup> Emission limits for class A equipment applied.

<sup>3</sup> Immunity test requirement for industrial environment (EN 61326 table 2).

## Ordering information

Designation	Type	Order No.
External frontend 70 GHz to 110 GHz	R&S®FE110SR	1348.4870.02
Step attenuator, 70 GHz to 110 GHz (included in R&S®FE110SR)	R&S®FE110-B221	1348.7791.02
<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
Torque wrench for waveguide flanges, 0.58 Nm	R&S®ZCTW	1175.2014.02
Waveguide filter, 70 GHz to 86 GHz	R&S®FE110-Z10	1348.5230.02
Waveguide filter, 75 GHz to 90 GHz	R&S®FE110-Z01	1348.5147.02
Waveguide filter, 80 GHz to 95 GHz	R&S®FE110-Z02	1348.5153.02
Waveguide filter, 85 GHz to 105 GHz	R&S®FE110-Z03	1348.5160.02
Waveguide filter, 95 GHz to 110 GHz	R&S®FE110-Z04	1348.5199.02
WR10 waveguide-to-waveguide adapter	R&S®FE110-Z20	1705.9180.04
Waveguide coax adapter WR10 to 1 mm (f)	R&S®WCA110	3626.1067.02
Waveguide coax adapter WR10 to 1 mm (m)	R&S®WCA110	3626.1067.03
Height adjustment, for external frontends	R&S®ZZA-FE01	1348.5330.02
Horn antenna, 75 GHz to 110 GHz, 20 dBi	R&S®SGH110G20	1537.3262.02
Horn antenna, 75 GHz to 110 GHz, 25 dBi	R&S®SGH110G25	1538.5852.03
LANCOM PoE++ injector (compatible with IEEE 802.3af/at/bt, up to 100 m distance)		4044144617799 (LANCOM order number)

## Supported base units

Designation	Type	Order No.
<b>Signal and spectrum analyzers</b>		
Signal and spectrum analyzer, 2 Hz to 13.6 GHz	R&S®FSW13	1331.5003.13
Signal and spectrum analyzer, 2 Hz to 26.5 GHz	R&S®FSW26	1331.5003.26
Signal and spectrum analyzer, 2 Hz to 43.5 GHz	R&S®FSW43	1331.5003.43
Signal and spectrum analyzer, 2 Hz to 50 GHz	R&S®FSW50	1331.5003.50
Signal and spectrum analyzer, 2 Hz to 67 GHz	R&S®FSW67	1331.5003.67
Signal and spectrum analyzer, 2 Hz to 85 GHz	R&S®FSW85	1331.5003.85
<b>Oscilloscope</b>		
Oscilloscope 16 GHz, 100 Mpoints memory	R&S®RTP164B	1803.7000.16

## Options needed for the base unit

Designation	Type	Order No.
<b>Signal and spectrum analyzers</b>		
External frontend control, for R&S®FSW	R&S®FSW-K553	1350.6118.02
<b>Oscilloscopes</b>		
External frontend control	R&S®RTP-K553	1803.6890.02
I/Q software interface	R&S®RTP-K11	1800.6683.02
Deembedding	R&S®RTP-K121	1326.3064.02

## Supported applications

Designation	Type	Order No.
Pulse measurements	R&S®FSW-K6	1313.1322.02
Amplifier measurements	R&S®FSW-K18	1325.2170.02
Noise figure measurements	R&S®FSW-K30	1313.1380.02
Transient measurement application	R&S®FSW-K60	1313.7495.02
Vector signal analysis	R&S®FSW-K70	1313.1416.02
WLAN 802.11ad measurements	R&S®FSW-K95	1313.1639.02
OFDM signal analysis	R&S®FSW-K96	1313.1539.02
WLAN 802.11ay measurements	R&S®FSW-K97	1338.4902.02
5G NR Rel. 15 downlink measurements	R&S®FSW-K144	1338.3606.02
5G NR Rel. 15 uplink measurements	R&S®FSW-K145	1338.3612.02

## Warranty and service

Warranty		
Base unit		1 year
All other items		1 year
Service options		
	Service plans	On demand
Calibration	up to five years <sup>4</sup>	pay per calibration
Warranty and repair	up to five years <sup>4</sup>	standard price repair
Contact your Rohde & Schwarz sales office for further details.		

<sup>4</sup> For extended periods, contact your Rohde & Schwarz sales office.

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