R&S®FE110ST
EXTERNAL FRONTEND
70 GHz to 110 GHz

Specifications

Specifications
Version 04.00

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Make ideas real

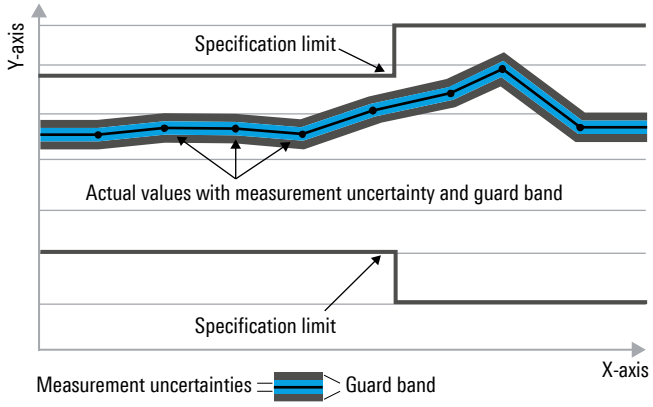
CONTENTS

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 <, ≤, >, ≥, ± 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®FE110ST, 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®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 (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®FE110ST	70 GHz to 110 GHz
	R&S®FE110ST with R&S®FE110-Z10 waveguide filter (70 GHz to 86 GHz)	70 GHz to 75 GHz
	R&S®FE110ST with R&S®FE110-Z01 waveguide filter (75 GHz to 90 GHz)	75 GHz to 85 GHz
	R&S®FE110ST with R&S®FE110-Z02 waveguide filter (80 GHz to 95 GHz)	85 GHz to 90 GHz
	R&S®FE110ST with R&S®FE110-Z03 waveguide filter (85 GHz to 105 GHz)	90 GHz to 100 GHz
	R&S®FE110ST 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®FE110ST 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.)

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

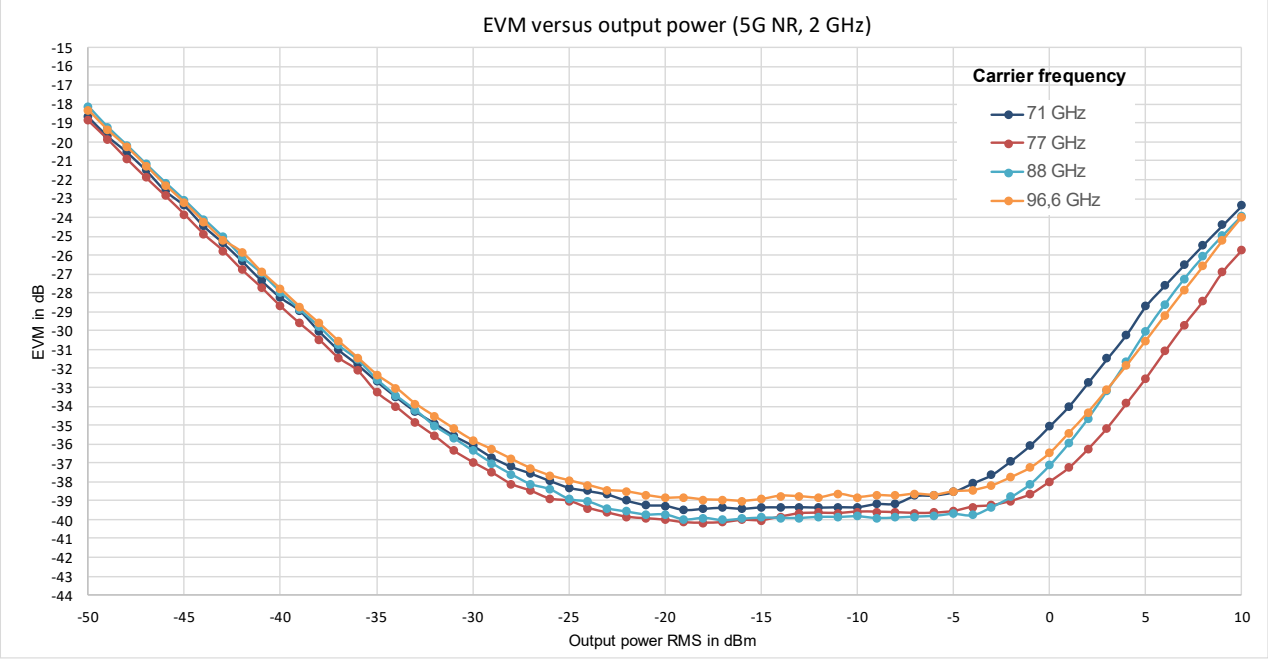
Level

Setting range		–145 dBm to +30 dBm
Specified level range	CW or I/Q modulated signals	
	70 GHz ≤ f_{out} ≤ 110 GHz	–40 dBm to +5 dBm (PEP)
Resolution of setting		0.1 dB (nom.)
Setting range of RF attenuator		0 dB to 40 dB, in 1 dB steps
Level error	CW signal, amplitude settings: auto, level range from –30 dBm to 0 dBm	
	70 GHz ≤ f_{out} < 75 GHz	< 3.0 dB (nom.)
	75 GHz ≤ f_{out} ≤ 80 GHz	< 3.0 dB
	80 GHz < f_{out} ≤ 98 GHz	< 2.5 dB
	98 GHz < f_{out} ≤ 110 GHz	< 3.0 dB
	I/Q modulated signal, level range –30 dBm to 0 dBm	
	70 GHz ≤ f_{out} ≤ 110 GHz	add 0.5 dB
	for any other level setting	
	70 GHz ≤ f_{out} ≤ 110 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 ≤ 500 MHz [1]	
	70 GHz ≤ f_{out} < 75 GHz	±1.5 dB (meas.)
	75 GHz ≤ f_{out} ≤ 98 GHz	±1.5 dB (nom.)
	98 GHz < f_{out} ≤ 110 GHz	±2.3 dB (nom.)
	modulation bandwidth ≤ 1000 MHz [1]	
	70 GHz ≤ f_{out} < 75 GHz	±2.0 dB (meas.)
	75 GHz ≤ f_{out} ≤ 98 GHz	±2.0 dB (nom.)
	98 GHz < f_{out} ≤ 110 GHz	±2.3 dB (nom.)
	modulation bandwidth ≤ 2000 MHz [1]	
	70 GHz ≤ f_{out} < 75 GHz	±2.2 dB (meas.)
	75 GHz ≤ f_{out} ≤ 98 GHz	±2.2 dB (nom.)
	98 GHz < f_{out} ≤ 110 GHz	±2.5 dB (nom.)
Maximum rated reverse power		0 dBm

[1] Specification is valid for output frequencies in the range from 70 GHz to 110 GHz.

Signal performance for digital standards

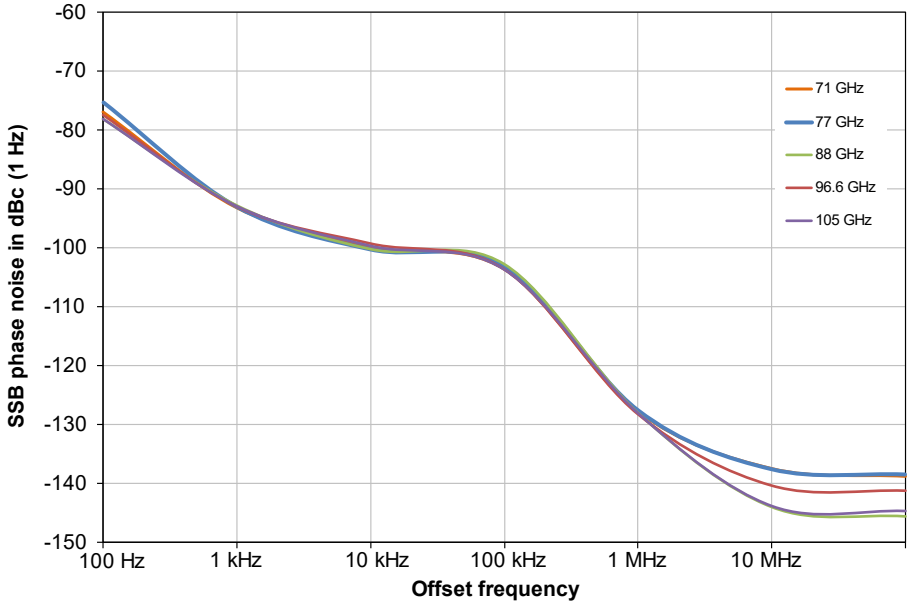
Residual EVM	5G NR signal, channel bandwidth: 2 GHz, full allocation, SCS: 960 kHz, modulation: QPSK, measured with R&S®SMW200A (with R&S®SMW-B711 option) in combination with R&S®FE110SR and R&S®FSW (with R&S®FSW-B4001option), IF mode: EVM optimized	
	77 GHz ≤ f_{out} ≤ 98 GHz	
	–20 dBm ≤ P_{out} (RMS) ≤ –5 dBm	< –38 dB (meas.)
	77 GHz ≤ f_{out} ≤ 98 GHz	
	–30 dBm ≤ P_{out} (RMS) ≤ 0 dBm	< –35 dB (meas.)



EVM values versus output power at different center frequencies with R&S®SMW200A (with R&S®SMW-B711 option) in combination with R&S®FE110SR and R&S®FSW (with R&S®FSW-B4001 option), IF mode: EVM optimized

Spectral purity

Image suppression	–15 dBm CW output signal, observed frequency range from 75 GHz to 110 GHz	
	70 GHz ≤ f_{out} < 75 GHz	< –80 dBc (meas.)
	75 GHz ≤ f_{out} ≤ 110 GHz	< –90 dBc (nom.)
Wideband noise	–15 dBm CW output signal, carrier offset 100 MHz, measurement bandwidth = 1 Hz	
	75 GHz ≤ f_{out} ≤ 110 GHz	< –139 dBc (meas.)
LO suppression	–15 dBm CW output signal, observed frequency range from 75 GHz to 110 GHz, IF mode: spur optimized	
	71 GHz ≤ f_{out} ≤ 73 GHz	< –35 dBc (meas.)
	73 GHz < f_{out} < 75 GHz	< –50 dBc (meas.)
	75 GHz ≤ f_{out} ≤ 76 GHz	< –40 dBc (nom.)
	76 GHz < f_{out} ≤ 94 GHz	< –55 dBc (nom.)
	94 GHz < f_{out} ≤ 110 GHz	< –50 dBc (nom.)
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 75 GHz to 110 GHz, IF mode: spur optimized	
	70 GHz ≤ f_{out} ≤ 110 GHz	< –55 dBc (meas.)
	–15 dBm CW output signal, observed frequency range from 75 GHz to 110 GHz, IF mode: spur optimized	
	70 GHz ≤ f_{out} ≤ 89 GHz	< –45 dBc (meas.)
	89 GHz < f_{out} ≤ 110 GHz	< –40 dBc (meas.)
SSB phase noise	RF center frequency = 96.6 GHz, measured in combination with an R&S®SMW200A (with R&S®SMW-B711/-B721 options)	
	100 Hz	–77 dBc (1 Hz) (meas.)
	1 kHz	–93 dBc (1 Hz) (meas.)
	10 kHz	–99 dBc (1 Hz) (meas.)
	100 kHz	–103 dBc (1 Hz) (meas.)
	1 MHz	–128 dBc (1 Hz) (meas.)
	10 MHz	–140 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

RF output		
Connector		WM-2540/WR10
Impedance		50 Ω

IF input		
Connector		2.92 mm female
Impedance		50 Ω (nom.)
Input frequency range	IF mode: spur optimized	
	dependent on RF frequency	10 GHz to 19 GHz
	IF mode: EVM optimized	
	dependent on RF frequency	8 GHz to 19 GHz
	IF mode: shared LO	9.93 GHz fixed
Level		–40 dBm to +10 dBm

Reference input		
Connector		SMA female
Impedance		50 Ω (nom.)
Input frequency range		10 MHz, 640 MHz, 1 GHz
Required level		0 dBm to +20 dBm

LO input		
Connector		SMA female
Impedance		50 Ω (nom.)
Input frequency		8 GHz to 16.4 GHz
Level		+5 dBm to +20 dBm

LO output		
Connector		SMA female
Impedance		50 Ω (nom.)
Output frequency		8 GHz to 16.4 GHz
Level		+5 dBm to +20 dBm

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

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

External modules		
Connector		ix Industrial®, type B

USB interface	for service use only	1 port, type B plug, version 2.0

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
		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

EMC		• IEC/EN 61326-1 [2, 3] • IEC/EN 61326-2-1 • CISPR 11/EN 55011 [2] • IEC/EN 61000-3-2 • IEC/EN 61000-3-3

Recommended calibration interval		2 years

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)

[2] Emission limits for class A equipment applied.

[3] 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®FE110ST	1348.4870.02
Accessories supplied		
+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, 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
Waveguide filter, 70 GHz to 86 GHz	R&S®FE110-Z10	1348.5230.02
Waveguide filter, 76 GHz to 92 GHz	R&S®FE110-Z11	1348.5247.02
Waveguide filter, 82 GHz to 98 GHz	R&S®FE110-Z12	1348.5253.02
Waveguide filter, 88 GHz to 104 GHz	R&S®FE110-Z13	1348.5260.02
Waveguide filter, 100 GHz to 115 GHz	R&S®FE110-Z14	1348.5276.02
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.
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
External frontend control, for R&S®SMW200A	R&S®SMW-K553	1414.6758.02
1 GHz REF IN/OUT, for R&S®SMW200A (recommended)	R&S®SMW-K703	1413.7380.02
Minimum needed frequency option, for R&S®SMM100A	R&S®SMM-B1020	1440.9309.02
External frontend control, for R&S®SMM100A	R&S®SMM-K553	1441.1147.02
1 GHz REF IN/OUT, for R&S®SMM100A (recommended)	R&S®SMM-K703	1441.1301.02

Warranty and service

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

[4] For extended periods, contact your Rohde & Schwarz sales office.

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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

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