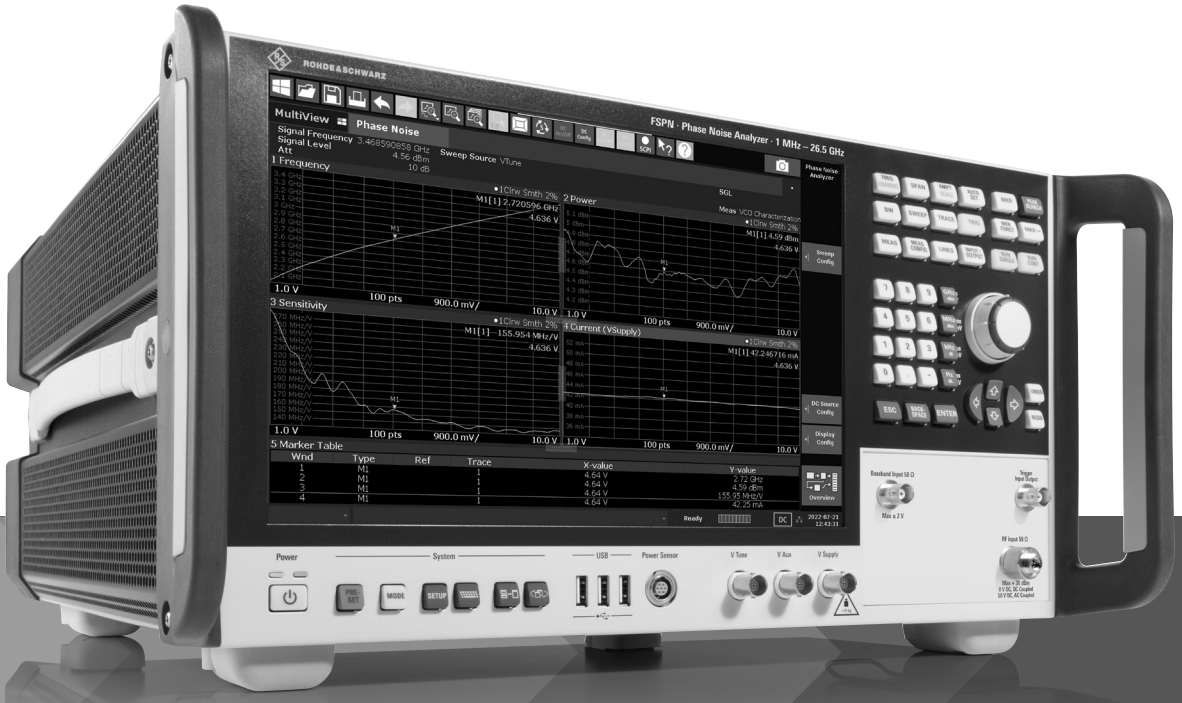
# R&S®FSPN
# PHASE NOISE ANALYZER AND VCO TESTER

## Specifications




Specifications
Version 02.00

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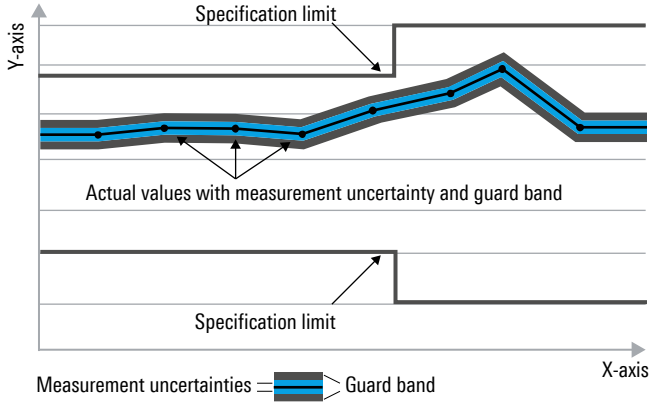
# Definitions

**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 <, ≤, >, ≥, ±, 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

## Frequency

| | | |
|---|---|---|
| **Frequency range, RF input** | | |
| Phase noise, AM noise measurements | R&S®FSPN8 | |
| | AC coupled | 1 MHz to 8 GHz |
| | R&S®FSPN26 | |
| | DC coupled | 1 MHz to 26.5 GHz |
| | AC coupled | 10 MHz to 26.5 GHz |
| | R&S®FSPN50 | |
| | DC coupled | 1 MHz to 50 GHz |
| | AC coupled | 10 MHz to 50 GHz |
| Baseband noise measurement | see “Baseband noise measurement” section | |
| **Frequency resolution** | | 0.01 Hz |
| **Reference frequency, internal** | | |
| Accuracy | | ± (time since last adjustment × aging rate + temperature drift + calibration accuracy) |
| Aging per year | first year of operation | $\pm 5 \times 10^{-8}$ |
| | after first year of operation | $\pm 3 \times 10^{-8}$ |
| Temperature drift | 0 °C to +40 °C | $\pm 1 \times 10^{-9}$ |
| Achievable initial calibration accuracy | | $\pm 5 \times 10^{-9}$ |

## Phase noise measurements

| | | |
|---|---|---|
| Measurement results | | SSB phase noise, spurious signals, integrated RMS phase deviation, residual FM, time jitter |
| Offset frequency range | carrier frequency ≤ (maximum input frequency – 1 GHz) | 1 µHz to max. input frequency – carrier frequency |
| | carrier frequency ≥ (maximum input frequency – 1 GHz) | 1 µHz to 1 GHz |
| Signal level range | level setting = high | –20 dBm to +30 dBm |
| | level setting = low | –40 dBm to +30 dBm |
| Number of traces | | 6 |
| Phase noise measurement uncertainty | DUT phase noise ≥ 15 dB above phase noise sensitivity of R&S®FSPN [1] | |
| | 1 µHz ≤ offset < 10 mHz | 1.5 dB (nom.) |
| | 10 mHz ≤ offset < 1 MHz | < 1.5 dB |
| | 1 MHz ≤ offset ≤ 30 MHz | < 2 dB |
| | offset > 30 MHz | < 3 dB |
| Level measurement uncertainty | –20 dBm ≤ signal level ≤ 15 dBm, +20 °C to +30 °C | |
| | 1 MHz ≤ signal frequency < 8 GHz | < 1 dB |
| | 8 GHz ≤ signal frequency < 18 GHz | < 2 dB |
| | 18 GHz ≤ signal frequency | < 3 dB |
| Spurious level [2] | $f_{in}$ < 1 GHz | |
| | 10 Hz ≤ offset from carrier < 1 kHz | < –90 dBc |
| | 1 kHz ≤ offset from carrier ≤ 30 MHz | < –100 dBc |
| | $f_{in}$ ≥ 1 GHz | |
| | 10 Hz ≤ offset from carrier < 1 kHz | < –90 dBc + 20 log($f_{in}$/GHz) |
| | 1 kHz ≤ offset from carrier ≤ 30 MHz | < –100 dBc + 20 log($f_{in}$/GHz) |
| AM suppression | 10 mHz < offset < 1 MHz | 40 dB (nom.) |
| | 1 MHz ≤ offset ≤ 30 MHz, level setting = high, capture range = narrow or wide | 30 dB (nom.) |
| | 1 MHz ≤ offset ≤ 10 MHz, level setting = low, capture range = narrow or wide | 30 dB (nom.) |

[1] The phase noise sensitivity improvement due to the number of cross correlations is included. For DUT phase noise between 6 dB and 15 dB above phase noise sensitivity of the R&S®FSPN, add 1 dB of uncertainty.

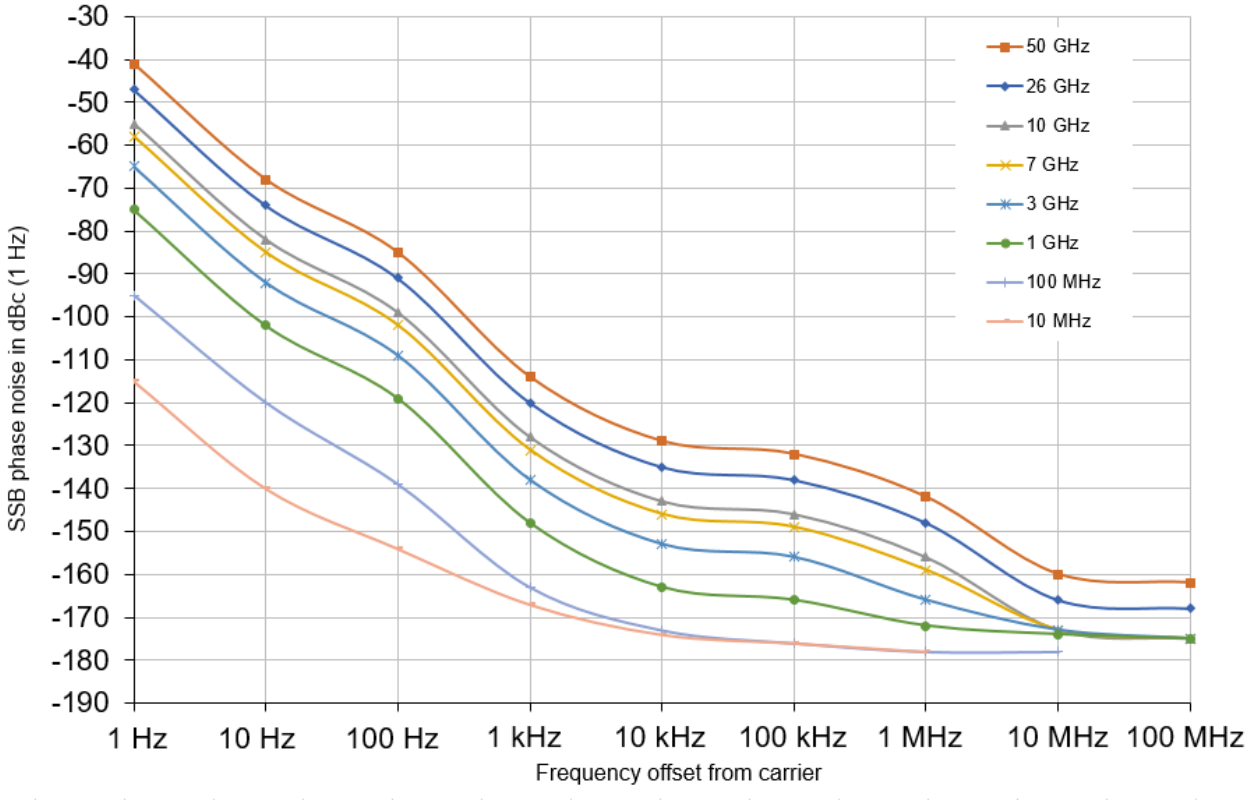
[2] For offset frequencies > 30 MHz spurious levels are not warranted but meet typically the same specification as for 30 MHz offset.

## Phase noise sensitivity

Start offset = 1 Hz, cross correlation factor = 1, frequency reference: internal, internal reference loop bandwidth = 30 Hz, signal level ≥ 10 dBm [3], temperature range: +20 °C to +30 °C, specified values in dBc (1 Hz), numbers in brackets are typical values in dBc (1 Hz).

| RF input frequency | Offset frequency from the carrier | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz |
| 10 MHz | (–115) | (–140) | –140 (–156) | –158 (–167) | –170 (–176) | –170 (–176) | –170 (–176) | |
| 100 MHz | (–95) | (–120) | –133 (–139) | –157 (–163) | –167 (–173) | –170 (–176) | –172 (–178) | –172 (–178) |
| 1 GHz | (–75) | (–102) | –113 (–119) | –142 (–148) | –157 (–163) | –160 (–166) | –167 (–173) | –168 (–174) |
| 3 GHz | (–65) | (–92) | –103 (–109) | –132 (–138) | –147 (–153) | –150 (–156) | –160 (–166) | –168 (–174) |
| 7 GHz | (–58) | (–85) | –96 (–102) | –125 (–131) | –140 (–146) | –143 (–149) | –153 (–159) | –168 (–174) |
| 10 GHz | (–55) | (–82) | –93 (–99) | –122 (–128) | –137 (–143) | –140 (–146) | –150 (–156) | –168 (–174) |
| 16 GHz | (–51) | (–78) | –89 (–95) | –118 (–124) | –133 (–139) | –136 (–142) | –146 (–152) | –165 (–171) |
| 26 GHz | (–47) | (–74) | –85 (–91) | –114 (–120) | –129 (–135) | –132 (–138) | –142 (–148) | –161 (–167) |
| 50 GHz | (–41) | (–68) | –79 (–85) | –108 (–114) | –123 (–129) | –126 (–132) | –136 (–142) | –155 (–161) |

| Improvement of phase noise sensitivity by number of cross correlations | | | | |
|---|---|---|---|---|
| Offset frequencies ≥ 1 Hz [4] | | | | |
| Cross correlations | 10 | 100 | 1000 | 10 000 |
| Improvement | 5 dB | 10 dB | 15 dB | 20 dB |




*Typical phase noise sensitivity*
*(start offset = 1 Hz, cross correlation factor = 1, signal level = 10 dBm)*

[3] For signal levels below +10 dBm, the phase noise sensitivity is limited by the thermal noise floor of –177 dBm (1 Hz).

[4] For offset frequencies below 1 Hz, the improvement impact of cross correlation is limited by the coupling between the two R&S®FSPN local oscillators. The improvement achievable in this case ranges from 15 dB (nom.) at 0.1 Hz frequency offset to 3 dB (nom.) at a frequency offset ≤ 30 mHz.

# Measurement speed, nominal values

| Auto freq = off, half decade config = auto, RBW = 10 %, cross correlation factor ≥ 10, measurement times ≥ 2 s, measurement times normalized to cross correlation factor = 1 | | |
|---|---|---|
| Time per cross correlation | span | |
| | 0.1 Hz to 100 MHz | 27 s |
| | 1 Hz to 100 MHz | 6.7 s |
| | 10 Hz to 100 MHz | 0.8 s |
| | 100 Hz to 100 MHz | 0.1 s |
| | 1 kHz to 100 MHz | 0.01 s |
| | 10 kHz to 100 MHz | 0.001 s |

To obtain the measurement time for a given number of cross correlations (without automatic signal frequency search), multiply the above figures by the number of cross correlations.

# AM noise measurements

| | | |
|---|---|---|
| Offset frequency range | input signal ≤ 100 MHz | 1 µHz to 40 % of carrier frequency |
| | input signal > 100 MHz | 1 µHz to 40 MHz |
| AM noise measurement uncertainty | DUT AM noise ≥ 15 dB above AM noise sensitivity of R&S®FSWP [5] | |
| | 1 µHz < offset < 10 mHz | 2 dB (nom.) |
| | 10 mHz < offset < 1 MHz | < 2 dB |
| | 1 MHz ≤ offset ≤ 30 MHz | < 2.5 dB |
| Level measurement uncertainty | –20 dBm ≤ signal level ≤ +15 dBm, +20 °C to +30 °C | |
| | 1 MHz ≤ signal frequency < 8 GHz | < 1 dB |
| | 8 GHz ≤ signal frequency < 18 GHz | < 2 dB |
| | 18 GHz ≤ signal frequency | < 3 dB |

## AM noise sensitivity

Start offset = 1 Hz, cross correlation factor = 1, signal level ≥ 10 dBm [6], specified values in dBc (1 Hz), numbers in brackets are typical values in dBc (1 Hz).

| **RF input frequency** | **Offset frequency from the carrier** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz | 30 MHz |
| 100 MHz ≤ f ≤ 1 GHz | –102 (–108) | –117 (–123) | –132 (–138) | –147 (–153) | –155 (–161) | –165 (–171) | –165 (–171) | –165 (–171) | –165 (–171) |
| 1 GHz < f ≤ 12 GHz | –97 (–103) | –112 (–118) | –127 (–133) | –142 (–148) | –152 (–158) | –160 (–166) | –165 (–171) | –165 (–171) | –165 (–171) |
| 12 GHz < f ≤ 18 GHz | –87 (–93) | –102 (–108) | –117 (–123) | –132 (–138) | –147 (–153) | –160 (–166) | –165 (–171) | –165 (–171) | –165 (–171) |
| f > 18 GHz | –77 (–83) | –92 (–98) | –107 (–113) | –122 (–128) | –137 (–143) | –150 (–156) | –160 (–166) | –165 (–171) | –165 (–171) |

| **Improvement of AM noise sensitivity by number of cross correlations** | | | | |
|---|---|---|---|---|
| Cross correlations | 10 | 100 | 1000 | 10 000 |
| Improvement | 5 dB | 10 dB | 15 dB | 20 dB |

[5] Specified values for offset frequencies ≤ 30 % of signal frequency. The AM noise sensitivity improvement due to the number of cross correlations is included. For DUT phase noise from 6 dB to 15 dB above AM noise sensitivity of the R&S®FSPN, add 1 dB of uncertainty.

[6] For signal levels below +10 dBm, the AM noise is limited by the thermal noise floor of –177 dBm (1 Hz).

# Baseband noise measurement

| | | |
|---|---|---|
| Frequency range | R&S®FSPN8 | |
| | RF input | 1 MHz to 8 GHz |
| | baseband input | 10 mHz to 30 MHz |
| | R&S®FSPN26 | |
| | RF input, DC coupled | 10 mHz to 26.5 GHz |
| | RF input, AC coupled | 10 MHz to 26.5 GHz |
| | baseband input | 10 mHz to 30 MHz |
| | R&S®FSPN50 | |
| | RF input, DC coupled | 10 mHz to 50 GHz |
| | RF input, AC coupled | 10 MHz to 50 GHz |
| | baseband input | 10 mHz to 30 MHz |
| Level measurement range | RF input | < +8 dBm |
| | baseband input | < +4 dBm |
| Level measurement uncertainty | +20 °C to +30 °C | |
| | 10 mHz < $f_{in}$ < 1 MHz | < 2 dB (nom.) |
| | 1 MHz ≤ $f_{in}$ ≤ 30 MHz | < 2.5 dB (nom.) |
| Units | | dBm (1 Hz), dBµV (1 Hz), dBV (1 Hz), V ($\sqrt{Hz}$) |

## Baseband noise level

Start offset = 1 Hz, cross correlation factor = 1, input = baseband input, 50 Ω terminated, specified values in dBm (1 Hz), numbers in brackets are typical values in dBc (1 Hz).

| Input frequency | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz | 30 MHz |
|---|---|---|---|---|---|---|---|---|---|
| Noise level | –117 (–123) | –127 (–133) | –142 (–148) | –151 (–157) | –158 (–164) | –160 (–166) | –160 (–170) | –160 (–170) | –160 (–170) |

# VCO characterization measurements (frequency, RF power, DC supply current)

| | | |
|---|---|---|
| Sweep parameters | | • DC tune voltage ($V_{tune}$)<br>• DC auxiliary voltage ($V_{aux}$)<br>• DC supply voltage ($V_{supply}$)<br>• DC supply current ($I_{supply}$) |
| Measurement parameters | | • frequency<br>• RF power<br>• DC supply current<br>• tuning sensitivity |
| Frequency resolution | | 100 mHz to 100 kHz in steps of 1, 10, … |
| RF power measurement range | 1 MHz ≤ signal frequency ≤ 100 MHz | –15 dBm to +27 dBm |
| | signal frequency > 100 MHz | –20 dBm to +27 dBm |
| Level measurement uncertainty | –20 dBm ≤ signal level ≤ 15 dBm, +20 °C to +30 °C | |
| | 1 MHz ≤ signal frequency < 8 GHz | < 1 dB |
| | 8 GHz ≤ signal frequency < 18 GHz | < 2 dB |
| | signal frequency ≥ 18 GHz | < 3 dB |
| $V_{tune}$ | setting range | –10 V to +28 V |
| | setting resolution | 1 mV |
| | setting uncertainty | ±(0.2 % of reading + 8 mV) (meas.) |
| | reading uncertainty | ±(0.5 % of reading + 25 mV) (meas.) |
| | output resistance | 50 Ω |
| | output settling time | 7 ms/V |
| | noise level | < 1 nV (RMS) at 10 kHz (meas.) |
| $V_{aux}$ | setting range | –10 V to +10 V |
| | setting resolution | 1 mV |
| | setting uncertainty | ±(0.1 % of reading + 2 mV) (meas.) |
| | reading uncertainty | ±(0.5 % of reading + 25 mV) (meas.) |
| | output resistance | 5 Ω |
| | output settling time | 1 ms/V |
| | noise level | < 10 nV (RMS) at 10 kHz (meas.) |
| $V_{supply}$ | setting range | 0 to 16 V |
| | setting resolution | 1 mV |
| | setting uncertainty | ±(0.1 % of reading + 1 mV) (meas.) |
| | reading uncertainty | ±(0.5 % of reading + 25 mV) (meas.) |
| | output resistance | 0.5 Ω |
| | output settling time | 50 ms/V |
| | noise level | < 10 nV (RMS) at 10 kHz (meas.) |
| $I_{supply}$ | setting range | 10 mA to 2000 mA |
| | setting resolution | 1 mA |
| | setting uncertainty | ±(0.5 % of reading + 0.5 mA) (meas.) |
| | reading uncertainty | ±(0.5 % of reading + 1.5 mA) (meas.) |

# Transient analysis

| | | |
|---|---|---|
| Frequency range | R&S®FSPN8 | |
| | AC coupled | 1 MHz to 8 GHz |
| | R&S®FSPN26 | |
| | DC coupled | 1 MHz to 26.5 GHz |
| | AC coupled | 10 MHz to 26.5 GHz |
| | R&S®FSPN50 | |
| | DC coupled | 1 MHz to 50 GHz |
| | AC coupled | 10 MHz to 50 GHz |
| Measurement parameters | narrow mode/wide mode | frequency |
| | narrow mode additionally | phase |
| Frequency transient bandwidth | narrow mode | 40 MHz |
| | wide mode | 256 MHz to 8 GHz |
| Frequency uncertainty | | ±(resolution + reference frequency accuracy) |
| Phase uncertainty | DUT signal locked to target frequency | 0.05° + 0.1° × $f_{in}$/GHz |
| RF input level range | narrow mode | −20 dBm to +20 dBm |
| | wide mode | |
| | 256 MHz to 6 GHz | −15 dBm to +20 dBm |
| | 6 GHz to 7 GHz | −10 dBm to +20 dBm |
| | 7 GHz to 8 GHz | 0 dBm to +20 dBm |
| Time span | | 1 µs to 16 s |
| Time resolution | | > 20 ns |
| Measurement trigger | trigger mode | free run, external, frequency |
| | external trigger polarity | positive, negative (3.3 V TTL level) |
| | pretrigger delay | (–1) × time span to 16 s |

### Frequency resolution, narrow mode

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Observation time | 1 µs | 10 µs | 100 µs | 1 ms | 10 ms | 100 ms | 1 s | 10 s | 16 s |
| Minimum VBW | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz |
| Maximum VBW | 5 MHz | 5 MHz | 5 MHz | 5 MHz | 625 kHz | 96 kHz | 10 kHz | 1 kHz | 625 Hz |
| Measurement points | 51 | 501 | 5001 | 50001 | 62501 | 100001 | 100001 | 100001 | 100001 |
| Time resolution at maximum VBW | 20 ns | 20 ns | 20 ns | 20 ns | 160 ns | 1 µs | 10 µs | 100 µs | 160 µs |
| Frequency resolution at mininimum VBW for span > 1 MHz | 20 Hz | 20 Hz | 20 Hz | 20 Hz | 20 Hz | 20 Hz | 20 Hz | 20 Hz | 20 Hz |
| Frequency resolution at mininimum VBW for span ≤ 1 MHz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz |
| Frequency resolution at maximum VBW | 57 kHz | 57 kHz | 57 kHz | 57 kHz | 1.2 kHz | 500 Hz | 30 Hz | 30 Hz | 30 Hz |

### Frequency resolution, wide mode (256 MHz to 8 GHz)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Observation time | 1 µs | 10 µs | 100 µs | 1 ms | 10 ms | 100 ms | 1 s | 10 s | 16 s |
| Minimum VBW | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz |
| Maximum VBW | 100 kHz | 100 kHz | 100 kHz | 100 kHz | 100 kHz | 96 kHz | 10 kHz | 1 kHz | 625 Hz |
| Measurement points | 51 | 501 | 5001 | 50001 | 62501 | 100001 | 100001 | 100001 | 100001 |
| Time resolution at maximum VBW | 20 ns | 20 ns | 20 ns | 20 ns | 160 ns | 1 µs | 10 µs | 100 µs | 160 µs |
| Frequency resolution at minimum VBW | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz | 1 Hz |
| Frequency resolution at maximum VBW | 15 MHz | 15 MHz | 1 MHz | 20 kHz | 20 kHz | 5 kHz | 250 Hz | 20 Hz | 20 Hz |

# Allan deviation, Allan variance

| | | |
|---|---|---|
| Frequency range | R&S®FSPN8 | 1 MHz to 8 GHz |
| | R&S®FSPN26 | 1 MHz to 26.5 GHz |
| | R&S®FSPN50 | 1 MHz to 50 GHz |
| Measurement range | measurement time τ | 100 ns to 1 000 000 s |
| Allan deviation | reference frequency with highly stable external reference, reference loop bandwidth = 100 Hz | $8.8 \times 10^{-14}$ at τ = 1 s (meas.) |
| | | $7.0 \times 10^{-15}$ at τ = 1000 s (meas.) |

# Inputs and outputs

| **RF input** | | |
|---|---|---|
| Impedance | | 50 Ω |
| Connector | R&S®FSPN8 | N female |
| | R&S®FSPN26 | APC 3.5 mm male (compatible with SMA) |
| | R&S®FSPN50 | 1.85 mm male (compatible with 2.4 mm) |
| VSWR | R&S®FSPN8 | |
| | 10 MHz ≤ f < 3 GHz | < 1.5 (nom.) |
| | 3 GHz ≤ f ≤ 8 GHz | < 2.0 (nom.) |
| | R&S®FSPN26, R&S®FSPN50 | |
| | RF attenuation = 0 dB | |
| | 10 MHz ≤ f ≤ 26.5 GHz | < 2.0 (nom.) |
| | RF attenuation = 5 dB | |
| | 10 MHz ≤ f ≤ 3.5 GHz | < 1.5 (nom.) |
| | 3.5 GHz < f ≤ 18 GHz | < 1.8 (nom.) |
| | 18 GHz < f ≤ 50 GHz | < 2.0 (nom.) |
| | RF attenuation ≥ 10 dB | |
| | 10 MHz ≤ f ≤ 3.5 GHz | < 1.2 (nom.) |
| | 3.5 GHz < f ≤ 18 GHz | < 1.5 (nom.) |
| | 18 GHz < f ≤ 50 GHz | < 2.0 (nom.) |
| Setting range of attenuator | R&S®FSPN8 | no user accessible attenuator |
| | R&S®FSPN26, R&S®FSPN50 | 0 dB to 75 dB, in 5 dB steps |

| **Maximum RF input level** | | |
|---|---|---|
| DC voltage | AC coupled | 50 V |
| | DC coupled | 0 V |
| CW RF power | R&S®FSPN8 | |
| | input frequency < 5 MHz | 20 dBm (= 0.1 W) |
| | input frequency ≥ 5 MHz | 30 dBm (= 1 W) |
| | R&S®FSPN26, R&S®FSPN50 | |
| | RF attenuation < 10 dB | 20 dBm (= 0.1 W) |
| | RF attenuation ≥ 10 dB | 30 dBm (= 1 W) |
| Maximum pulse voltage | R&S®FSPN26, R&S®FSPN50,<br>RF attenuation ≥ 10 dB | 50 V |
| Maximum pulse power | R&S®FSPN26, R&S®FSPN50,<br>RF attenuation ≥ 10 dB,<br>pulse duration τ = 3 µs | 100 W |

| **$V_{supply}$** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Output voltage | | 0 V to 16 V |
| Output current | | 0 mA to 2000 mA |

| **$V_{aux}$** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Output voltage | | –10 V to +10 V |
| Output current | | ±100 mA |

| **$V_{tune}$** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Output voltage | | –10 V to +28 V |
| Output current | | ±20 mA |

| **Baseband input** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Input frequency range | | DC to 30 MHz |
| Maximum input level | | ±2 V |

| **Probe power supply** | | |
|---|---|---|
| Supply voltages | | +15 V DC,<br>–12.6 V DC and ground,<br>max. 150 mA (nom.) |

| **Trigger in/out** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |

| **Power sensor** | | |
|---|---|---|
| Connector | | 6-pin LEMOSA female for R&S®NRP-Zxx power sensors |

| **Reference input 1 MHz to 50 MHz** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Input frequency range | | 1 MHz ≤ $f_{in}$ ≤ 50 MHz, in 1 Hz steps |
| Required level | | > 0 dBm |

| **Reference input 100 MHz/1 GHz** | | |
|---|---|---|
| Connector | | SMA female |
| Impedance | | 50 Ω (nom.) |
| Input frequency range | | 100 MHz, 1 GHz |
| Required level | | 0 dBm to 10 dBm |

| **Reference output 10 MHz** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Connector | | | | | BNC female | | | |
| Impedance | | | | | 50 Ω (nom.) | | | |
| Output frequency | | | | | 10 MHz | | | |
| Level | | | | | 10 dBm (nom.) | | | |
| **Measured phase noise, internal reference loop bandwidth 30 Hz** | | | | | | | | |
| Offset frequency from the carrier | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 3 MHz |
| Phase noise in dBc (1 Hz) | –110 | –134 | –146 | –157 | –165 | –166 | –167 | –168 |

| **Reference output 1 MHz to 50 MHz** | | |
|---|---|---|
| Connector | | BNC female |
| Impedance | | 50 Ω (nom.) |
| Output frequency | internal reference | not active |
| | external reference | same as reference input signal |
| Level | | same as reference input signal |

| **Reference output 100 MHz** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Connector | | | | | SMA female | | | |
| Impedance | | | | | 50 Ω (nom.) | | | |
| Output frequency | | | | | 100 MHz | | | |
| Level | | | | | 6 dBm (nom.) | | | |
| **Measured phase noise internal reference loop bandwidth 30 Hz** | | | | | | | | |
| Offset frequency from the carrier | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz |
| Phase noise in dBc (1 Hz) | –90 | –114 | –126 | –154 | –162 | –163 | –164 | –164 |

| **Reference output 640 MHz** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Connector | | | | | SMA female | | | |
| Impedance | | | | | 50 Ω (nom.) | | | |
| Output frequency | | | | | 640 MHz | | | |
| Level | | | | | 16 dBm (nom.) | | | |
| **Measured phase noise with internal reference loop bandwidth 30 Hz** | | | | | | | | |
| Offset frequency from the carrier | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | 10 MHz |
| Phase noise in dBc (1 Hz) | –75 | –98 | –112 | –142 | –156 | –158 | –165 | –165 |

| | | |
|---|---|---|
| **IEC/IEEE bus control** | | interface in line with<br>IEC 625-2 (IEEE-488.2) |
| Command set | | SCPI 1997.0 |
| Connector | | 24-pin Amphenol female |
| Interface functions | | SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0 |

| | | |
|---|---|---|
| **LAN interface** | | 10/100/1000BASE-T |
| Connector | | RJ-45 |

| | | |
|---|---|---|
| **External monitor** | | |
| Connector | | DVI-D, DisplayPort Rev 1.1 |

| | | |
|---|---|---|
| **USB interface** | | 7 ports, type A plug, version 2.0 |
| | | 1 port, type B plug, version 2.0 |

# General data

| | | |
|---|---|---|
| **Display** | | 30.7 cm (12.1"), WXGA color touchscreen |
| Resolution | | 1280 × 800 pixel (WXGA resolution) |
| Pixel failure rate | | < 1 × $10^{-5}$ |

| **Data storage** | | |
|---|---|---|
| Internal | standard | solid state disk ≥ 128 Gbyte |
| External | | supports USB 2.0 compatible memory devices |

| **Temperature** | | |
|---|---|---|
| Operating temperature range | | +5 °C to +40 °C |
| Permissible temperature range | | 0 °C to +55 °C |
| Storage temperature range | | –40 °C to +70 °C |
| Climatic loading | without condensation | +40 °C at 90 % rel. humidity,<br>in line with EN 60068-2-30 |

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

| **Mechanical resistance** | | |
|---|---|---|
| Vibration | sinusoidal | 5 Hz to 55 Hz,<br>displacement: 0.15 mm constant,<br>amplitude (1.8 g at 55 Hz),<br>55 Hz to 150 Hz,<br>acceleration: 0.5 g constant,<br>in line with EN 60068-2-6 |
| | random | 8 Hz to 500 Hz,<br>acceleration: 1.2 g (RMS),<br>in line with EN 60068-2-64 |
| Shock | | 40 g shock spectrum,<br>in line with MIL-STD-810E,<br>method no. 516.4, procedure I,<br>MIL-PRF-28800F, class 3 |

| **EMC** | | |
|---|---|---|
| | | • IEC/EN 61326-1 [7, 8]<br>• CISPR 11/EN 55011 [7] |

| **Recommended calibration interval** | | 1 year |
|---|---|---|

| **Power supply** | | |
|---|---|---|
| Input voltage range | AC | (100 V to 240 V) ± 10 % |
| Supply frequency | AC | (50 Hz to 60 Hz/400 Hz) ± 5 % |
| Maximum input current | | 7.3 A to 4.6 A (100 V to 240 V) |
| Power consumption | R&S®FSPN8 | 210 W |
| | R&S®FSPN26, R&S®FSPN50 | 235 W |
| Safety | | in line with:<br>IEC 61010-1, EN 61010-1, UL 61010-1,<br>CAN/CSA-C22.2 No. 61010-1 |
| Test marks | | VDE, CE, $_{C}$CSA$_{US}$, KCC |

| **Dimensions and weight** | | |
|---|---|---|
| Dimensions (nom.) | W × H × D,<br>including front handles and rear feet | 462 mm × 240 mm × 504 mm<br>(18.15 in × 9.44 in × 19.81 in) |
| Net weight (nom.) | R&S®FSPN8 | 20.5 kg (45.2 lb) |
| | R&S®FSPN26, R&S®FSPN50 | 22 kg (48.5 lb) |

[7] Emission limits for class A equipment.

[8] Immunity test requirement for industrial environment (EN 61326 table 2).

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| Phase noise analyzer and VCO tester, 1 MHz to 8 GHz | R&S®FSPN8 | 1322.8003.07 |
| Phase noise analyzer and VCO tester, 1 MHz to 26.5 GHz | R&S®FSPN26 | 1322.8003.25 |
| Phase noise analyzer and VCO tester, 1 MHz to 50 GHz | R&S®FSPN50 | 1322.8003.49 |
| Accessories supplied: power cable, quick start guide;<br>additionally for R&S®FSPN26: adapter 3.5 mm (APC3.5-compatible), female/female;<br>additionally for R&S®FSPN50: adapter 1.85 mm, female/female | | |

## Recommended extras

| Designation | Type | Order No. |
|---|---|---|
| IEC/IEEE bus cable, length: 1 m | R&S®PCK | 0292.2013.10 |
| IEC/IEEE bus cable, length: 2 m | R&S®PCK | 0292.2013.20 |
| Front cover | R&S®ZZF-511 | 1174.8825.00 |
| 19" rack adapter | R&S®ZZA-KN5B | 1703.1352.00 |
| **Matching pads, 50/75 Ω** | | |
| L section, matching at both ends | R&S®RAM | 0358.5414.02 |
| Series resistor, 25 Ω, matching at one end<br>(taken into account in instrument function RF INPUT 75 Ω) | R&S®RAZ | 0358.5714.02 |
| **High-power attenuators** | | |
| 100 W, 3 dB, 1 GHz | R&S®RBU100 | 1073.8495.03 |
| 100 W, 6 dB, 1 GHz | R&S®RBU100 | 1073.8495.06 |
| 100 W, 10 dB, 1 GHz | R&S®RBU100 | 1073.8495.10 |
| 100 W, 20 dB, 1 GHz | R&S®RBU100 | 1073.8495.20 |
| 100 W, 30 dB, 1 GHz | R&S®RBU100 | 1073.8495.30 |
| 50 W, 3 dB, 2 GHz | R&S®RBU50 | 1073.8695.03 |
| 50 W, 6 dB, 2 GHz | R&S®RBU50 | 1073.8695.06 |
| 50 W, 10 dB, 2 GHz | R&S®RBU50 | 1073.8695.10 |
| 50 W, 20 dB, 2 GHz | R&S®RBU50 | 1073.8695.20 |
| 50 W, 30 dB, 2 GHz | R&S®RBU50 | 1073.8695.30 |
| 50 W, 20 dB, 6 GHz | R&S®RDL50 | 1035.1700.52 |
| **Connectors and cables** | | |
| Coaxial adapter, N (f)/3.5 mm (f), APC3.5-compatible,<br>for R&S®FSPN8 | | 3587.7829.00 |
| Coaxial adapter, 3.5 mm (f/f), APC3.5-compatible,<br>for R&S®FSPN26 | | 3689.9442.00 |
| Coaxial adapter, 1.85 mm (f/f), APC2.4-compatible,<br>for R&S®FSPN50 | | 3588.9654.00 |
| Probe power connector, 3-pin | | 1065.9480.00 |
| Type N adapter, for R&S®RT-Zxx oscilloscope probes | R&S®RT-ZA9 | 1417.0909.02 |
| **DC block** | | |
| DC block, 10 kHz to 18 GHz (type N) | R&S®FSE-Z4 | 1084.7443.02 |

# Service options

| 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 with calibration coverage, one year | R&S®CW1 | |
| Extended warranty with calibration coverage, two years | R&S®CW2 | |
| Extended warranty with accredited calibration coverage, one year | R&S®AW1 | |
| Extended warranty with accredited calibration coverage, two years | R&S®AW2 | |

**Extended warranty with a term of one and two years (WE1 and WE2)**
Repairs carried out during the contract term are free of charge [9]. Necessary calibration and adjustments carried out during repairs are also covered.

**Extended warranty with calibration coverage (CW1 and CW2)**
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 [9] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

**Extended warranty with accredited calibration (AW1 and AW2)**
Enhance your extended warranty by adding accredited calibration coverage at a package price. This package ensures that your Rohde & Schwarz product is regularly calibrated under accreditation, inspected and maintained during the term of the contract. It includes all repairs [9] and accredited calibration at the recommended intervals as well as any accredited calibration carried out during repairs or option upgrades.

[9] Excluding defects caused by incorrect operation or handling and force majeure. Wear-and-tear parts are not included.

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PD 3683.7925.22 | Version 02.00 | December 2023 (jr)
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