# R&S®SGS100A
# SGMA RF Source
# Specifications

ROHDE&SCHWARZ

Data Sheet | Version 04.01

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# Key features

**Dedicated ATE signal generation**

- I/Q-modulated or pure CW source in frequency range from 80 MHz to 12.75 GHz (I/Q) and 1 MHz to 12.75 GHz (CW)
- Very fast settling times via PCIe and Ethernet interface
- Maximum level of typ. > +20 dBm (with electronic attenuator)
- Optional wear-free electronic attenuator
- External software (SGMA GUI) for remote control of multiple instruments
- Field-upgradeable

**Space-saving operation due to small dimensions**

- Smallest signal generator in its class: 1 height unit, ½ × 19"
- Lightweight

**High performance at an attractive price**

- Low SSB phase noise of –133 dBc (meas., 20 kHz carrier offset, f = 1 GHz, 1 Hz measurement bandwidth)
- Wideband noise of < –145 dBc
- Nonharmonics of < –76 dBc (> 10 kHz carrier offset, f ≤ 1500 MHz)
- Very high level accuracy and repeatability
- Optional pulse modulation capability and internal pulse generator
- Optional high-stability reference oscillator
- Optional coherent LO input/output

**Minimized total cost of ownership**

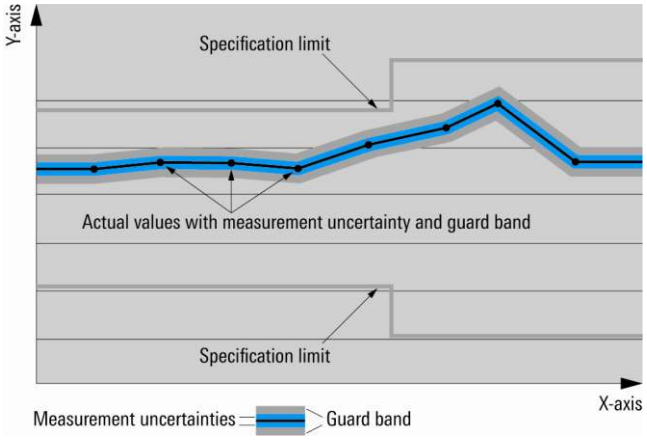
- Attractive initial cost
- Long calibration interval
- Simplified error diagnostics through built-in selftests

# 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 <, ≤, >, ≥, ±, 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.




**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.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

# Specifications

## Frequency

| | | |
|---|---|---|
| Frequency range | with the R&S®SGS-B106 option | 1 MHz to 6 GHz |
| | with the R&S®SGS-B106 and R&S®SGS-B112 options | 1 MHz to 12.75 GHz |
| | with the R&S®SGS-B106V option | 1 MHz to 6 GHz (CW),<br>80 MHz to 6 GHz (I/Q) |
| | with the R&S®SGS-B106V and R&S®SGS-B112V options | 1 MHz to 12.75 GHz (CW),<br>80 MHz to 12.75 GHz (I/Q) |
| Resolution of setting | | 0.001 Hz |
| Resolution of synthesis | f = 1 GHz | 0.174 µHz (nom.) |
| Setting time | to within<br>$< 2 \times 10^{-7}$ for f > 500 MHz or < 100 Hz for f ≤ 500 MHz | |
| | with PCIe or Ethernet (fast socket) remote control | < 500 µs |
| Resolution of phase offset setting | | 0.1° |

### Reference frequency

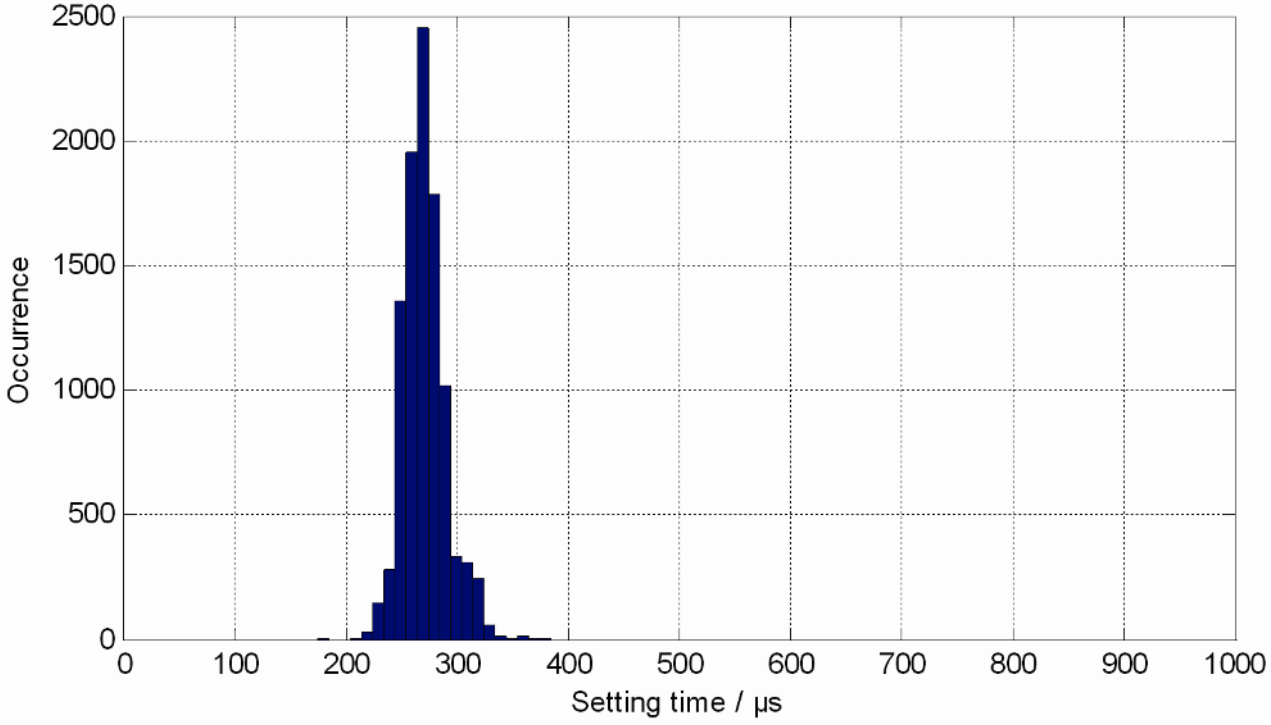
| | | |
|---|---|---|
| Frequency error | at time of calibration in production | $< 1 \times 10^{-7}$ |
| | with the R&S®SGS-B1 option | $< 1 \times 10^{-8}$ |
| Aging<br>(after 30 days of uninterrupted operation) | | $< 1 \times 10^{-6}$/year |
| | with the R&S®SGS-B1 option | $< 1 \times 10^{-9}$/day, $< 1 \times 10^{-7}$/year |
| Temperature effect (0 °C to +50 °C) | | $< 2 \times 10^{-6}$ |
| | with the R&S®SGS-B1 option | $< 1 \times 10^{-7}$ |
| Warm-up time | to nominal thermostat temperature (with R&S®SGS-B1 option only) | ≤ 10 min |
| **Reference frequency output** | | |
| Connector type | REF/LO OUT on rear panel | SMA female |
| Output frequency | sine wave | |
| | instrument set to internal reference | 10 MHz, 1000 MHz |
| | instrument set to external reference | applied external reference input frequency or 1000 MHz |
| Output level | | +6 dBm to +12 dBm, 9 dBm (typ.) |
| Source impedance | | 50 Ω (nom.) |
| **Reference frequency input** | | |
| Connector type | REF/LO IN on rear panel | SMA female |
| Input frequency | | 10 MHz, 13 MHz, 100 MHz, 1000 MHz |
| Frequency locking range | | $\pm 10 \times 10^{-6}$ |
| Input level range | | 0 dBm to +16 dBm |
| Input impedance | | 50 Ω (nom.) |

# Level

**Setting Characteristic: auto** – The step attenuator is switched over automatically. The output level is specified over the full range from –120 dBm to +15 dBm.

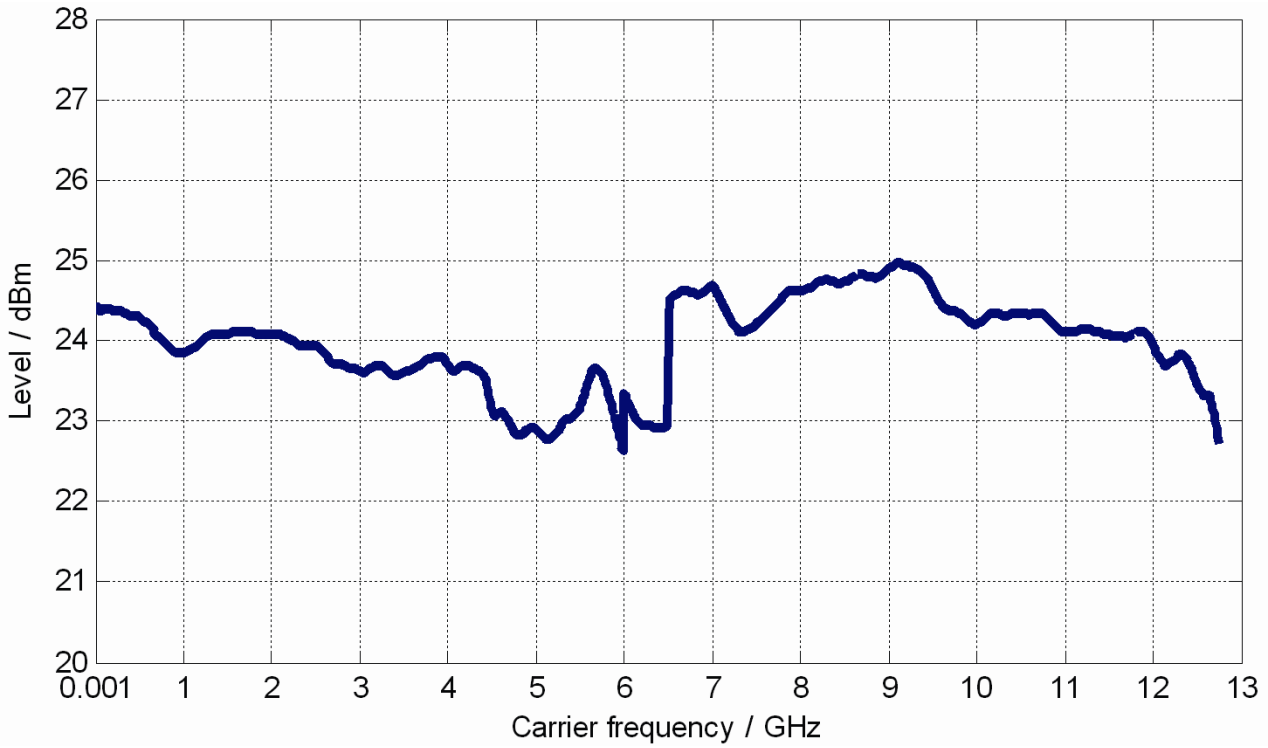
**Setting Characteristic: uninterrupted level setting** – The level is set without changing the step attenuator. The step attenuator is fixed to the current setting. Level changes are performed without interruption. The maximum interruption-free setting range is limited. If this range is exceeded, the spectral purity of the output signal may decrease.

| | | |
|---|---|---|
| Setting range | | –20 dBm to +25 dBm |
| | with the R&S®SGS-B26 option | –120 dBm to +25 dBm |
| Specified level range | | –10 dBm to +15 dBm (PEP) [1] |
| | with the R&S®SGS-B26 option | –120 dBm to +15 dBm (PEP) [1] |
| Resolution of setting | | 0.01 dB |
| Level error | Setting Characteristic: auto, temperature range from +18 °C to +33 °C | |
| | 1 MHz ≤ f ≤ 3 GHz | < 0.5 dB |
| | 3 GHz < f ≤ 12.75 GHz | < 0.9 dB |
| Additional level error for pulse modulation | pulse width ≥ 100 ns | < 0.3 dB (meas.) |
| Output impedance VSWR in 50 Ω system | in full frequency range, Setting Characteristic: auto | < 2.0 |
| | in full frequency range, with the R&S®SGS-B26 option | < 1.8 |
| Setting time | to < 0.1 dB deviation from final value, Setting Characteristic: auto, with PCIe or Ethernet (fast socket) remote control | < 500 µs |
| Interruption-free level setting range | Setting Characteristic: uninterrupted level setting | 0 dB to +20 dB |
| Reverse power from 50 Ω | maximum permissible RF power in output | 0.5 W |
| Maximum permissible DC voltage | at RF power connector | 35 V |




*Histogram of level setting times measured via PCIe/Ethernet interface, Setting Characteristic auto.*

[1] PEP = peak envelope power.

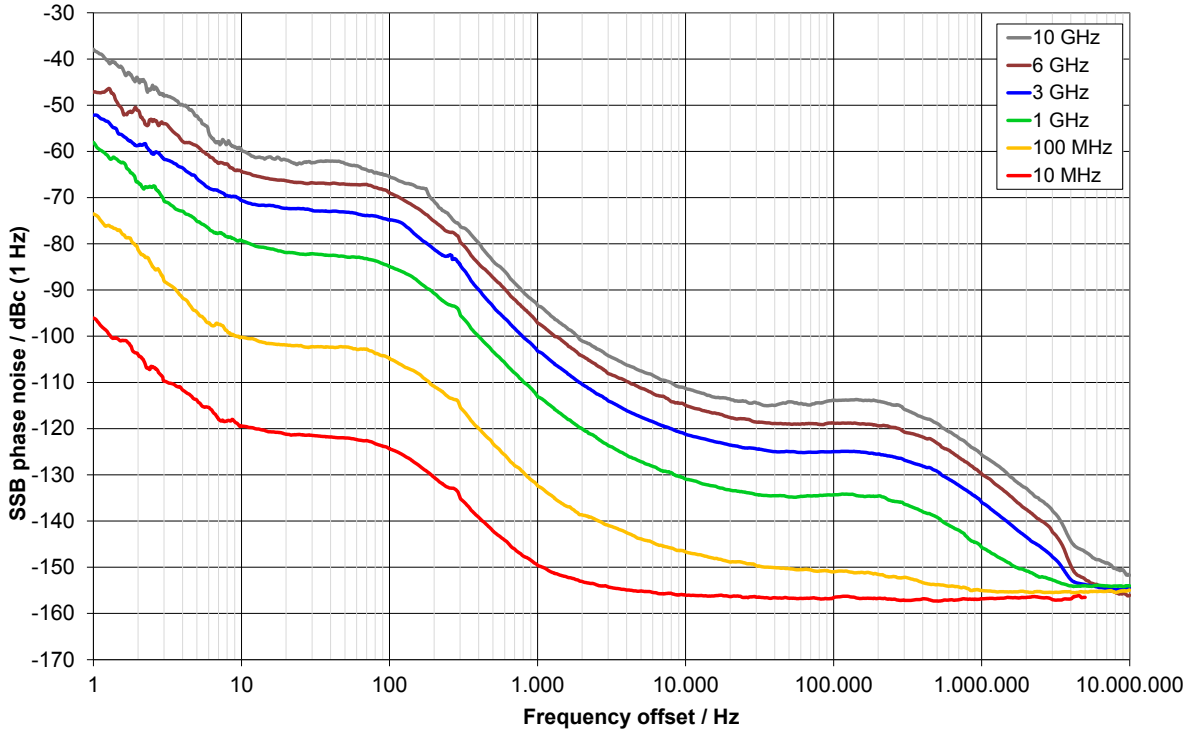



*Maximum available level in CW mode, Setting Characteristic: auto, with the R&S®SGS-B26 electronic step attenuator option (meas.).*

## Spectral purity

| | | |
|---|---|---|
| Harmonics | level ≤ 8 dBm, CW, I/Q wideband off | < –30 dBc |
| Nonharmonics | level > –10 dBm [2], offset > 10 kHz from carrier | |
| | f ≤ 1500 MHz | < –76 dBc |
| | 1500 MHz < f ≤ 3000 MHz | < –70 dBc |
| | 3000 MHz < f ≤ 6000 MHz | < –64 dBc |
| | 6000 MHz < f ≤ 12750 MHz | < –58 dBc |
| Subharmonics | level > –10 dBm [2] | |
| | f ≤ 3000 MHz | < –76 dBc |
| | 3000 MHz < f ≤ 6500 MHz | < –68 dBc |
| | 6500 MHz ≤ f ≤ 12750 MHz | < –60 dBc |
| Wideband noise | 1 MHz ≤ f ≤ 6 GHz and carrier offset 10 MHz, 6 GHz < f ≤ 12.75 GHz and carrier offset 30 MHz, level > 5 dBm, Setting Characteristic: auto, 1 Hz measurement bandwidth, CW | < –145 dBc |
| | 200 MHz ≤ f ≤ 6 GHz and carrier offset 10 MHz, 6 GHz < f ≤ 12.75 GHz and carrier offset 30 MHz, level > 5 dBm, Setting Characteristic: auto, 1 Hz measurement bandwidth, I/Q | < –135 dBc |
| SSB phase noise | 20 kHz carrier offset, 1 Hz measurement bandwidth | |
| | f = 1 GHz | < –126 dBc, –133 dBc (meas.) |
| | f = 2 GHz | < –120 dBc, –127 dBc (meas.) |
| | f = 10 GHz | < –106 dBc, –113 dBc (meas.) |

[2] > 0 dBm for instruments without the R&S®SGS-B26 electronic step attenuator.




*SSB phase noise with the R&S®SGS-B1 internal OCXO option (meas.).*

## Phase coherence (R&S®SGS-K90 option)

The R&S®SGS-K90 option provides phase-coherent RF outputs for two or more instruments. For frequencies above 6.5 GHz (instruments equipped with the R&S®SGS-B112 or R&S®SGS-B112V frequency extension), the LO output and input frequency are set to half the output frequency.

| | | |
|---|---|---|
| LO coupling modes | this mode corresponds to internal LO operation; the REF/LO OUT connector can provide the internal LO oscillator signal to enable phase-coherent coupling on other instruments | internal |
| | this mode corresponds to external LO operation at the REF/LO IN connector; the REF/LO OUT connector can provide the external LO oscillator signal to enable phase-coherent coupling on additional instruments. | external |
| REF/LO OUT states | active local oscillator signal can be routed to the REF/LO OUT connector (in order to couple two or more instruments) | REF/LO/OFF |
| Phase drift over temperature | drift of RF signal phase difference between two LO coupled instruments R&S®SGS100A when changing ambient temperature by +1 °C, f = 6 GHz, level = +10 dBm | 0.4° (meas.) |

| | | |
|---|---|---|
| **Input of phase coherence signal** | | |
| Connector type | REF/LO IN on rear panel | SMA female |
| Input impedance | | 50 Ω (nom.) |
| Input level range of external local oscillator signal | | 7 dBm to 13 dBm |
| Frequency range of external local oscillator signal | for RF setting 80 MHz to 6.5 GHz | 80 MHz to 6.5 GHz |
| | for RF setting > 6.5 GHz to 12.75 GHz | 3.25 GHz to 6.375 GHz |
| **Output of phase coherence signal** | | |
| Connector type | REF/LO OUT on rear panel | SMA female |
| Output impedance | | 50 Ω (nom.) |
| Output level range of internal local oscillator signal | | 7 dBm to 13 dBm |
| Frequency range of internal local oscillator signal | for RF setting 80 MHz to 6.5 GHz | 80 MHz to 6.5 GHz |
| | for RF setting > 6.5 GHz to 12.75 GHz | 3.25 GHz to 6.375 GHz |

## Pulse modulation (R&S®SGS-K22 option)

The R&S®SGS-K22 option provides pulse modulation capabilities. The pulse modulator can be controlled by an internal pulse generator (delivered with the R&S®SGS-K22) or by an external pulse signal.

| | | |
|---|---|---|
| Modulation source | | external, internal |
| On/off ratio | | > 80 dB |
| Rise/fall time | 10 % to 90 % of RF amplitude | < 20 ns |
| External pulse modulation delay | | 45 ns (meas.) |
| Pulse repetition frequency | | 0 Hz to 10 MHz |
| Video feedthrough | level < 10 dBm,<br>with the R&S®SGS-B26 option | < 10 % of RF |
| Pulse overshoot | f ≥ 500 MHz | < 10 % |

## Input for external pulse modulation and pulse generator trigger

| | | |
|---|---|---|
| Connector type | TRIG on rear panel | SMA female |
| Input impedance | selectable | 10 kΩ or 50 Ω (nom.) |
| Threshold voltage | | 1 V (nom.) |
| Input damage voltage | | ±5 V |
| Input polarity | selectable | normal, inverse |

## Internal pulse generator

| | | |
|---|---|---|
| Pulse mode | | single pulse, double pulse |
| Trigger mode | free run, internally triggered | auto |
| | | externally triggered |
| | | externally gated |
| Active trigger edge | | positive or negative |
| Pulse period | | |
| Setting range | | 100 ns to 100 s |
| Setting resolution | | 10 ns |
| Pulse width | | |
| Setting range | the pulse widths of double pulses can be set independently | 20 ns to 100 s |
| Setting resolution | | 10 ns |
| Pulse delay | | |
| Setting range | with external trigger | 0 s to 100 s |
| Setting resolution | with external trigger | 10 ns |
| Double pulse delay | | |
| Setting range | | 40 ns to 100 s |
| Setting resolution | | 10 ns |
| External trigger delay jitter | | < 20 ns |
| Pulse/video output | available on TRIG connector on rear panel in auto trigger mode | LVTTL signal, 3.3 V (nom.) |

# I/Q modulation

## I/Q modulator

| | | |
|---|---|---|
| Modulation bandwidth | 80 MHz < f ≤ 1 GHz | ±5 % of carrier frequency |
| | 1 GHz < f ≤ 12.7 GHz | ±50 MHz |
| | 100 MHz < f ≤ 2.5 GHz, I/Q wideband | ±20 % of carrier frequency |
| | 2.5 GHz < f ≤ 12.25 GHz, I/Q wideband | ±500 MHz |
| RF frequency response | 80 MHz < f ≤ 1 GHz,<br>up to ±5 % of carrier frequency | < 3 dB (meas.) |
| | 1 GHz < f ≤ 12.7 GHz, up to ±50 MHz | < 3 dB (meas.) |
| | 100 MHz < f ≤ 2.5 GHz,<br>up to ±20 % of carrier frequency,<br>I/Q wideband | < 6 dB (meas.) |
| | 2.5 GHz < f ≤ 12.25 GHz,<br>up to ±500 MHz, I/Q wideband | < 9 dB (meas.) |
| Carrier leakage | without input signal, referenced to full-scale input [3] | < –45 dBc, < –55 dBc (meas.) |
| Suppression of image sideband | up to ±10 MHz | 40 dB (meas.) |
| Error vector | measured with 16QAM, filter root cosine α = 0.5, 10 kHz symbol rate | |
| | f > 80 MHz, RMS | < (0.4 % + 0.2 % × f/GHz) |
| | f > 80 MHz, peak value | < (0.8 % + 0.4 % × f/GHz) |
| 3GPP FDD digital standard, adjacent-channel leakage ratio (ACLR) | test model 1, 64 DPCHs,<br>level ≤ 10 dBm [4] PEP,<br>frequency range from 1800 MHz to 2200 MHz | |
| | 5 MHz offset | > 67 dB, 70 dB (meas.) |
| | 10 MHz offset | > 69 dB, 71 dB (meas.) |
| **I/Q impairment settings** | | |
| Offset setting range | | –5 % to +5 % |
| Offset setting resolution | | 0.01 % |
| Gain imbalance setting range | | –1.0 dB to +1.0 dB |
| Gain imbalance setting resolution | | 0.001 dB |
| Quadrature offset setting range | | –8° to +8° |
| Quadrature offset setting resolution | | 0.01° |

## Baseband bypass mode

The baseband bypass mode allows generation of modulated signals below the I/Q modulator's specified frequency range. Externally generated signals applied to the I or Q baseband input connector can be leveled and amplified by the instrument and are provided at the RF output connector.

For the baseband bypass mode, only the data specified in this section is valid.

| | | |
|---|---|---|
| Level setting range | | –10 dBm to +25 dBm |
| | with the R&S®SGS-B26 option | –120 dBm to +25 dBm |
| Specified level range | | –5 dBm to +15 dBm |
| | with the R&S®SGS-B26 option | –120 dBm to +15 dBm |
| Frequency response | 1 MHz ≤ f ≤ 80 MHz, level = 10 dBm | < 3 dB, < 1 dB (meas.) |
| Level error | auto attenuator mode, temperature range from +18 °C to +33 °C, referenced to full-scale input at I or Q connector,<br>1 MHz ≤ f ≤ 80 MHz | < 3 dB |
| Level linearity | fixed attenuator mode,<br>for setting range of 0 dB to +20 dB | < 2 dB, < 0.5 dB (meas.) |

[3] Value applies after internal readjustment.

[4] 5 dBm for instruments without the R&S®SGS-B26 electronic step attenuator.

### I/Q inputs

| | | |
|---|---|---|
| Connector types | I, Q on rear panel | SMA female |
| Input impedance | | 50 Ω (nom.) |
| VSWR | up to 100 MHz | < 1.2 |
| | 100 MHz to 500 MHz | < 1.5 |
| Input voltage for full-scale input | | $\sqrt{V_i^2 + V_q^2} = 0.5\ V$ (nom.) |
| Input damage voltage | | ±1 V |

## Remote control

| | | |
|---|---|---|
| Systems | | PCIe (single lane) |
| | | Ethernet (TCP/IP) 10/100/1000BaseT |
| | | USB 2.0 |
| Command set | remote control via Ethernet, USB | SCPI 1999.5 or compatible command sets |
| | remote control via PCIe | Rohde & Schwarz instrument driver |

## Connectors

### Rear panel connectors

| | | |
|---|---|---|
| RF 50 Ω | RF output | SMA female |
| REF/LO IN | reference frequency input or<br>external LO signal input | SMA female |
| REF/LO OUT | reference frequency output or<br>internal LO signal output | SMA female |
| I, Q | input connector for I and Q baseband signals,<br>input for I/Q vector-modulated IF signals up to 80 MHz | SMA female |
| TRIG | trigger input/output, pulse input/output | SMA female |
| USB IN | remote control of instrument | USB (micro USB) |
| LAN | remote control of instrument | RJ-45 |
| PCI Express | remote control of instrument | single lane, according to PCI Express external cabling specification |

# General data

| | | |
|---|---|---|
| **Power supply** | | |
| AC input voltage range | | 100 V to 240 V ± 10 % |
| AC supply frequency | | 50 Hz to 60 Hz, –5 %/+5 % |
| Max. input current | | 1.7 A |
| Power consumption | | 70 W (meas.) |
| Power factor correction | | in line with EN 61000-3-2 |
| **Electrical safety** | | |
| Compliance | | in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1-04, UL 61010-1 |
| Test mark | | VDE-GS, $_{C}$CSA$_{US}$ |
| **EMC** | | |
| Electromagnetic compatibility | | in line with EN 55011 class B, EN 61326-1 (industrial environment), EN 61326-2-1 |
| **Mechanical resistance** | | |
| Vibration | sinusoidal | 5 Hz to 150 Hz, max. 2 g at 55 Hz, const. 0.5 g at 55 Hz to 150 Hz, in line with EN 60068-2-6 |
| | random | 10 Hz to 300 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64 |
| Shock | | in line with MIL-STD-810E, method no. 516.4, procedure I, 40 g shock spectrum |
| **Environmental conditions** | | |
| Temperature range | operating temperature range | 0 °C to +50 °C, in line with EN 60068-2-1, EN 60068-2-2 |
| | storage temperature range | –40 °C to +71 °C |
| Climatic resistance | | +40 °C/95 % rel. humidity, in line with EN 60068-2-30 |
| Altitude | operating | up to 4600 m |
| | storage | up to 4600 m |
| **Dimensions** | W × H × D | 250 mm × 52.5 mm × 401 mm (9.84 in × 2.07 in × 15.79 in) 1 HU, ½ 19" rack width |
| **Weight** | when fully equipped | 4.0 kg (8.82 lb) |
| **Calibration interval** | | |
| Recommended calibration interval | 40 h/week operation in the full range of the specified environmental conditions | 3 years |

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| SGMA RF source [5] | R&S®SGS100A | 1416.0505.02 |
| Including power cable and quick start guide | | |
| **Options** | | |
| 1 MHz to 6 GHz, CW (no modulation) | R&S®SGS-B106 | 1416.2308.02 |
| 1 MHz to 6 GHz, I/Q (with vector modulation) | R&S®SGS-B106V | 1416.2350.02 |
| Frequency extension to 12.75 GHz, CW [6] | R&S®SGS-B112 | 1416.1553.02 |
| Frequency extension to 12.75 GHz, I/Q[7] | R&S®SGS-B112V | 1416.1576.02 |
| Electronic step attenuator | R&S®SGS-B26 | 1416.1353.02 |
| Reference oscillator OCXO | R&S®SGS-B1 | 1416.2408.02 |
| Pulse modulation | R&S®SGS-K22 | 1416.2650.02 |
| Phase coherent input/output | R&S®SGS-K90 | 1416.2608.02 |
| **Recommended extras** | | |
| 19" rack adapter<br>(for two 1 HU instruments next to each other), suitable for installation of two R&S®SGMA instruments | R&S®ZZA-KN20 | 1175.3191.00 |
| 19" rack adapter<br>(for one instrument and spacing module) | R&S®ZZA-KN21 | 1175.3204.00 |
| Cable kit R&S®SGU100A to R&S®SGS100A (side-by-side) | R&S®SGU-Z3 | 1418.3801.02 |
| Connection kit R&S®SGU100A to R&S®SGS100A | R&S®SGU-Z4 | 1418.3701.02 |
| R&S®SGMA adapter | R&S®SGS-Z8 | 1416.2914.02 |
| **Accessories** | | |
| Documentation of calibration values | R&S®DCV-2 | 0240.2193.18 |

| **Service options** | | |
|---|---|---|
| Extended warranty, one year | R&S®WE1SGS100A | Please contact your local Rohde & Schwarz sales office. |
| Extended warranty, two years | R&S®WE2SGS100A | |
| Extended warranty, three years | R&S®WE3SGS100A | |
| Extended warranty, four years | R&S®WE4SGS100A | |
| Extended warranty with calibration coverage, one year | R&S®CW1SGS100A | |
| Extended warranty with calibration coverage, two years | R&S®CW2SGS100A | |
| Extended warranty with calibration coverage, three years | R&S®CW3SGS100A | |
| Extended warranty with calibration coverage, four years | R&S®CW4SGS100A | |

**Extended warranty with a term of one to four years (WE1 to WE4)**
Repairs carried out during the contract term are free of charge [8]. Necessary calibration and adjustments carried out during repairs are also covered. Simply contact the forwarding agent we name; your product will be picked up free of charge and returned to you in top condition a couple of days later.

**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 [8] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

**For product brochure, see PD 5214.5703.12 and www.rohde-schwarz.com**

[5] The base unit must be ordered together with an R&S®SGS-B106 or R&S®SGS-B106V frequency option.

[6] Requires R&S®SGS-B106.

[7] Requires R&S®SGS-B106V.

[8] 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

**Rohde&Schwarz**

The Rohde&Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, monitoring and network testing. 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.

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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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