R&S®SGU100A
SGMA Upconverter
Specifications

ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 01.00

CONTENTS

Key features

Modular Frequency extension unit with I/Q upconversion

- I/Q-modulated – or pure LO – frequency extension from 12 GHz to 20 GHz
- External software (SGMA GUI) for remote control
- Vector modulated solution from 10 MHz to 20 GHz with R&S®SGS100A acting as one combined instrument for manual and automated use once connected
- Extends existing analog Rohde & Schwarz signal generators (R&S®SMF100A, R&S®SMB100A) up to 20 GHz with vector modulation capabilities above 12 GHz
- Optional step attenuator with high level range down to –120 dBm

Space-saving operation due to small dimensions

- Only ½ 19", 1 height unit
- Lightweight

High performance at an attractive price

- Maximum level of +20 dBm (typ.) (f = 20 GHz)
- Wideband noise of –145 dBc (typ.) (f = 18 GHz, > 30 MHz carrier offset, 1 Hz measurement bandwidth, CW)
- Subharmonics of < –70 dBc (typ.)
- High modulation bandwidth of 2 GHz
- Very high level accuracy and linearity thanks to closed ALC loop with I/Q modulation

Minimized total cost of ownership

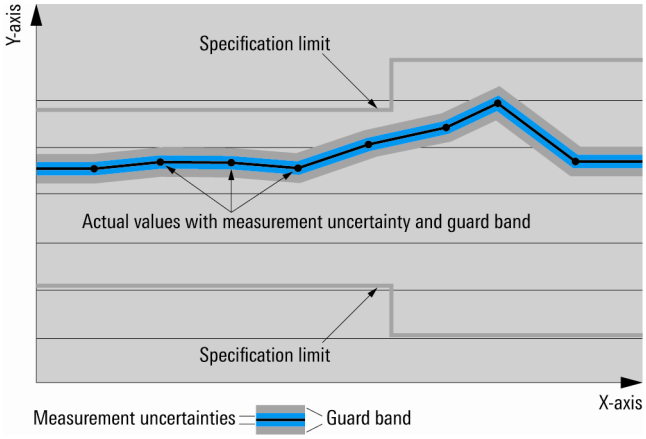
- Attractive initial cost
- Long calibration interval
- Simplified error diagnostics through built-in selftests

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 measured. 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 indicated as follows: “parameter: value”.

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

Specifications

RF performance

Frequency

Output frequency range	with R&S®SGU-B120, R&S®SGU-B120V options	10 MHz to 20 GHz
Input frequency range	For frequency settings below 12 GHz the input signal is sent directly to the output of the instrument or to the optional step attenuator.	10 MHz to 12.75 GHz
Setting time	to within < 2 × 10^{-7} for f > 500 MHz or < 100 Hz for f ≤ 500 MHz, no relay switch over	
	with PCIe remote control [1]	< 2 ms

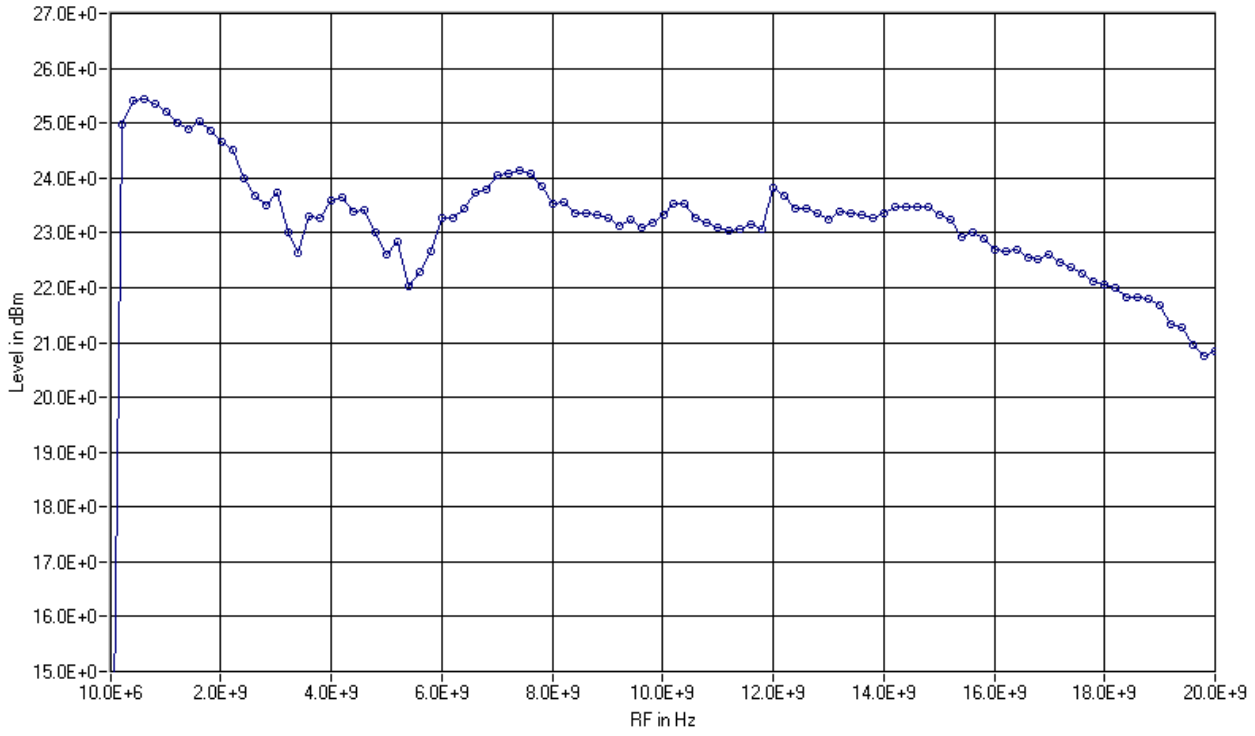
Level

Setting characteristic AUTO: The step attenuator is switched over automatically. This mode maximizes the specified level range.

Setting characteristic uninterrupted level setting: The level is set without switching the step attenuator. The step attenuator is thus fixed to the current setting. Level changes are performed without interruption. The recommended interruption-free setting range is indicated by the instrument depending on the frequency, level and modulation settings. If this range is exceeded, the spectral purity of the output signal may decrease.

Setting range	10 MHz ≤ f < 30 MHz	–20 dBm to +12 dBm
	30 MHz ≤ f < 50 MHz	–20 dBm to +18 dBm
	f ≥ 50 MHz	–20 dBm to +25 dBm
	instruments equipped with R&S®SGU-B26 option	
	10 MHz ≤ f < 30 MHz	–120 dBm to +12 dBm
	30 MHz ≤ f < 50 MHz	–120 dBm to +18 dBm
	f ≥ 50 MHz	–120 dBm to +25 dBm
Specified level range	without option R&S®SGU-B26	
	10 MHz < f ≤ 50 MHz (bypass mode)	–10 dBm to +8 dBm (PEP)
	50 MHz < f ≤ 12 GHz (bypass mode)	–10 dBm to +15 dBm (PEP)
	12 GHz < f ≤ 20 GHz	–10 dBm to +17 dBm (PEP)
	with R&S®SGU-B26 option	
	10 MHz < f ≤ 50 MHz (bypass mode)	–100 dBm to +8 dBm (PEP)
	50 MHz < f ≤ 12 GHz (bypass mode)	–100 dBm to +13 dBm (PEP)
	12 GHz < f ≤ 20 GHz	–100 dBm to +15 dBm (PEP)
Resolution of setting		0.01 dB
Level error [1]	ALC state on, AUTO mode, temperature range from +18 °C to +33 °C, CW or I/Q mode with full scale modulation	
	10 MHz < f ≤ 12 GHz	< 0.9 dB (meas.)
	12 GHz < f ≤ 20 GHz	
	> –30 dBm	< 0.9 dB
	≤ –30 dBm	< 1.1 dB
Additional level error	ALC state off (table)	< 0.5 dB (meas.)
Output impedance VSWR in 50 Ω system	in full frequency range	< 1.7 (meas.)
Setting time [1]	to < 0.2 dB deviation from final value, PCIe remote control	
	no relay switchover	< 2 ms
	with relay switchover	< 25 ms
Reverse power from 50 Ω	maximum permissible RF power in output	0.5 W
Maximum permissible DC voltage		0 V

[1] In combination with R&S®SGS100A.



Maximum available level with options R&S®SGU-B120V, R&S®SGU-B26 (meas.) in combination with R&S®SGS100A.

Spectral purity

Harmonics	f > 12 GHz, level ≤ 8 dBm	< –30 dBc
Subharmonics	f > 12 GHz	< –55 dBc, < –65 dBc (typ.)
Wideband noise [2]	carrier offset > 30 MHz, level > 5 dBm, measurement bandwidth 1 Hz	
	CW, f ≤ 12 GHz	< –140 dBc (meas.)
	CW, f > 12 GHz	< –142 dBc
	vector modulation with full scale DC input, f > 12 GHz	< –135 dBc, < –138 dBc (typ.)

[2] In combination with R&S®SGS100A.

LO input

For frequency settings > 12 GHz, the R&S®SGU100A multiplies and modulates the RF signal fed into the LO input. CW or modulated signals up to 12 GHz can also be amplified and bypassed from LO input to the RF output of the instrument or to the optional step attenuator.

Input frequency range	upconverter operation, f > 12 GHz, CW	6.375 GHz to 12.75 GHz
	bypass operation, f ≤ 12 GHz, CW or modulated	10 MHz to 12 GHz
Connector type	LO IN on rear panel	SMA female
Input impedance		50 Ω (nom.)
Input level range	upconverter operation, f > 12 GHz	+7 dBm to +13 dBm
Input damage level	upconverter operation, f > 12 GHz	+18 dBm
	bypass operation, f ≤ 12 GHz	+25 dBm

Phase coherence output

The R&S®SGU100A provides a phase coherent LO output signal.

Output frequency range	upconverter operation, 12 GHz < f ≤ 20 GHz	12 GHz to 20 GHz
Connector type	LO OUT on rear panel	SMA female
Output impedance		50 Ω (nom.)
Output level range		+7 dBm to +13 dBm

Pulse modulation

The R&S®SGU-B120 and R&S®SGU-B120V options provide an internal pulse modulator for the frequency range from 12 GHz to 20 GHz. For frequencies lower than 12 GHz, pulse modulation on the RF input signal is transferred to the RF output.

Modulation source		external
Connector type	TRIG on rear panel	SMA female
Input impedance		50 Ω (nom.), 10 kΩ (nom.)
On/off ratio		> 80 dB
Rise/fall time	10 %/90 % of RF amplitude	< 20 ns
Pulse repetition frequency		0 Hz to 10 MHz
Video feedthrough	level < 10 dBm with R&S®SGU-B26 option	< 10 % of RF
	level > 3 dBm and < 12 dBm without R&S®SGU-B26 option	< 10 % of RF
Pulse overshoot		< 10 %

I/Q modulation

I/Q modulator

Modulation bandwidth	f > 12 GHz	up to ±1000 MHz
RF frequency response	up to ± 264 MHz	< 2 dB (meas.)
	up to ±1000 MHz	< 6 dB (meas.)
Carrier leakage	without input signal, referenced to full-scale input [3]	< –35 dBc, < –45 dBc (typ.)
Suppression of image sideband	up to ±10 MHz	40 dB (meas.)
Error vector [4]	measured with 16QAM, filter root cosine, α = 0.5, symbol rate 10 MHz	
	f > 12 GHz, RMS	< (2 % + 0.04 % × f/GHz)
	f > 12 GHz, peak value	< (5 % + 0.1 % × f/GHz)
Two tone IMD (2 carriers)	level (PEP) = 0 dBm	
	up to 80 MHz carrier spacing	< –38 dBc
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		0.01 dB
Quadrature offset setting range		–8° to +8°
Quadrature offset setting resolution		0.01°

I/Q inputs

Connector types	I in, Q in on rear panel	SMA female
Input impedance		50 Ω (nom.)
VSWR	f > 12 GHz	
	up to 100 MHz	< 1.3
	100 MHz up to 1000 MHz	< 1.5
Input voltage for full scale input		$\sqrt{V_i^2 + V_q^2} = 0.5\,V$ (nom.)
Input damage voltage	electronic input protection	± 5 V

I/Q outputs

Allows routing of I and Q baseband signals to R&S®SGS100A

Connector types	I out, Q out on rear panel	SMA female
Output impedance		50 Ω (nom.)
Losses in feedthrough path		< 2 dB (meas.)

[3] Value applies after internal readjustment.

[4] In combination with R&S®SGS100A.

Remote control

Systems		PCIe (single lane)
		Ethernet (TCP/IP) 10/100/1000 BaseT
		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	K female
LO IN	RF/LO input for R&S®SGU100A	SMA female
LO OUT	coherent LO output signal	SMA female
I in, Q in	input connector for I and Q baseband signals	SMA female
I out, Q out	output connector for I and Q baseband signals (to R&S®SGS100A)	SMA female
TRIG	trigger input/output	SMA female
USB IN	remote control of instrument	USB (micro USB, type B)
LAN	remote control of instrument	RJ-45
PCIe	remote control of instrument	single lane

General data

Power supply		
Input voltage range	AC	100 V to 240 V ± 10 %
Supply frequency	AC	50 Hz to 60 Hz, –5 %/+5 %
Max. input current		1.7 A
Power consumption		40 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		40 g shock spectrum, in line with MIL-STD-810E, method no. 516.4, procedure I,
Environmental conditions		
Temperature range	operating	0 °C to +50 °C in line with EN 60068-2-1, EN 60068-2-2
	storage	–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) (nom.)
Calibration interval		
Recommended calibration interval	operation 40 h/week in the full range of the specified environmental conditions	3 years

Ordering information

Designation	Type	Order No.
SGMA Upconverter, base unit [5]	R&S®SGU100A	1418.2005.02
Including power cable, quick start guide and CD-ROM (with operating and service manual)		
Options		
10 MHz to 20 GHz, CW (no modulation)	R&S®SGU-B120	1418.2605.02
10 MHz to 20 GHz, I/Q (with vector modulation)	R&S®SGU-B120V	1418.2657.02
Mechanical Step Attenuator	R&S®SGU-B26	1418.3401.02
Documentation of Calibration Values	R&S®DCV-2	0240.2193.18
Recommended extras		
Hardcopy Manuals (in English)		1418.2070.02
Connection Kit R&S®SGU100A to R&S®SGS100A	R&S®SGU-Z4	1418.3701.02
19” Rack Adapter (for two 1 HU instruments next to each other), suitable for installation of two SGMA instruments	R&S®ZZA-KN20	1175.3191.00
19” Rack Adapter (for one instrument + spacing module)	R&S®ZZA-KN21	1175.3204.00

Service options		
Extended Warranty, one year	R&S®WE1	Please 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 [6]. 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 [6] and calibration at the recommended intervals as well as any calibration carried out during repairs or option upgrades.

[5] The base unit must be ordered together with an R&S®SGU-B120 or R&S®SGU-B120V frequency option.

[6] 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

About Rohde&Schwarz

Rohde&Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established more than 80 years ago, Rohde&Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Quality management and environmental management

Rohde&Schwarz is certified in line with the ISO 9001 and ISO 14001 management systems.

Certified Quality Management ISO 9001

Certified Environmental Management ISO 14001

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