Signal Generators SMGU, SMHU

SMGU: 100 kHz to 2160 MHz

SMHU: 100 kHz to 4320 MHz

High-performance generators with excellent features over a wide frequency range

SMHU (photo 37926)

Brief description

SMGU and SMHU are ideal for applications which the majority of signal generators cannot handle. In addition to out-of-channel measurements, they are for instance able to determine the spurious rejection of radiotelephone equipment up to 4 GHz as laid down by CEPT.

Main features

- Extremely high spectral purity
- Frequency setting time <1 ms
- Frequency resolution 0.1 Hz
- RF, AF, level and memory sweeps
- Broadband FM from DC to 1 MHz
- Frequency-accurate and drift-free FM DC for FSK applications
- OCXO as a reference
- Pulse modulator

Characteristics

Frequency

The frequency can be set with a resolution of 0.1 Hz over the entire range, and this is sufficient even for measurements on extremely narrowband DUTs. Both instruments supply frequencies down to 1 kHz.

The frequency setting time is below 10 ms. In the fast mode up to 200 user-defined frequencies can be handled by means of a trigger signal or by memory sweep in less than 1 ms per setting.

Spectral purity

SMGU/SMHU fulfill requirements for selectivity measurements on top-class receivers. Signals of extremely high spectral purity afford critical adjacent-channel, in-channel and out-of-channel measurements with a wide tolerance margin.

Phase noise remains low right up to the carrier. SMGU and SMHU are therefore ideal for LO applications or as a low-noise reference in noise measurement systems.

Frequency modulation

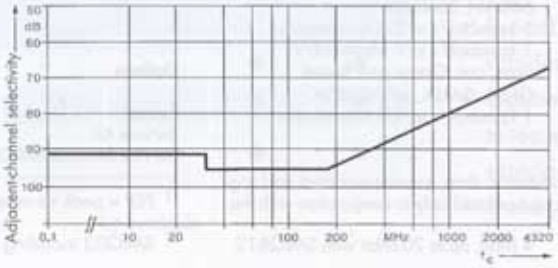
The FM modulation frequency range extends from DC to 1 MHz. In FM DC mode a high carrier-frequency accuracy is attained. The frequency offset occurring with FM DC selected is extremely small.

Amplitude modulation

The whole of the modulation frequency range can be used down to carrier frequencies of less than 100 kHz. The minimal phase shift at 30 Hz (AM DC) and a flat frequency response make for the precision amplitude modulation that is required for testing VOR/ILS navigation receivers.

Pulse modulation

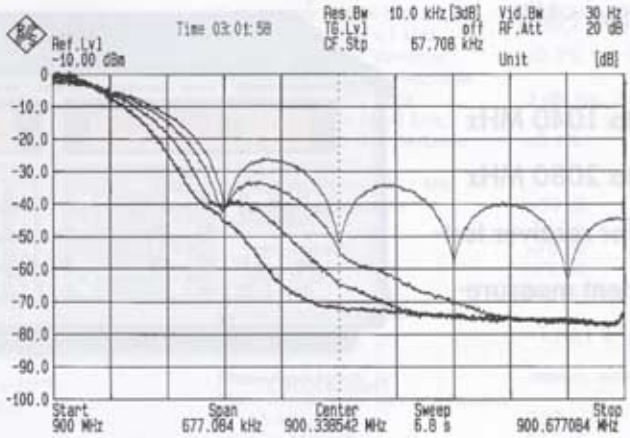
Rise/fall times of 20 ns (typ. <10 ns for frequencies >200 MHz) and an on/off ratio of 80 dB open up a wide range of possibilities for testing telemetry, microwave link, radar and satellite communications systems.



Dynamic adjacent-channel selectivity can be measured with an uncertainty of <1 dB (modulation for RT applications, channel spacing 20 Hz, AF bandwidth 3 kHz)

External I/Q modulation

The Arbitrary Waveform Generator ADS (page 218) is a versatile I/Q modulation signal source and ideal supplement to the SMHU58. It can be used to generate various types of digital modulation; modulation mode, data sequence, filter characteristics as well as power burst can be defined by the user.



GMSK modulation spectra for B x T = 0.2/0.3/0.5/∞

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Specifications in brief

Valid for I/Q modulation, GMSK, GFSK, π/4 DQPSK, BB-FM and BB-AM, supplementary data to specifications of basic model SMHU, page 205

Frequency

Range		10 to 1900 MHz
Overrange without guarantee of specs		1 to 2000 MHz
Setting time for frequency change		<4 ms in fast mode

Spectral purity

Spurious signals		
Harmonics		<–30 dBc
Nonharmonics at >10 kHz from carrier		<–74 dBc
SSB phase noise with I/Q modulation, GMSK and BB-AM, 1 Hz bandwidth		
Carrier offset	1 kHz	<–94 dBc
	20 kHz	<–98 dBc
	100 kHz	<–112 dBc

2nd RF output (RF 2)

Unmodulated coherent carrier with I/Q, GMSK and BB-AM; the output level is unregulated.

Broadband AM (BB-AM)

Operating mode	EXT DC
Level range	up to +7 dBm (overrange up to +13 dBm)
Modulation frequency response at 140 MHz and m = 60% (DC to 50 MHz)	3 dB

Broadband FM (BB-FM)

Operating modes	INT, EXT AC
Deviation range	50 kHz to 50 MHz, adjustable from 1 kHz
Modulation frequency	
BB-FM, INT	20 Hz to 100 kHz
BB-FM, EXT AC	20 Hz to 20 MHz

I/Q modulation

Vector DC accuracy, referred to full-scale I input, fed from 50 Ω source, input voltage range $\sqrt{I^2 + Q^2} \leq 0.5$ V

Carrier frequency 140 MHz	<1.5%
10 to 1900 MHz	typ. <1.5%

Residual carrier at 0 V input voltage, fed from 50 Ω source (I and Q), referred to full-scale input

Carrier frequency 140 MHz	<0.3%
10 to 1900 MHz	typ. <0.3%
I/Q imbalance, setting ranges	
Carrier leakage	0 to 50%
I not equal to Q	–12 to +12%
Quadrature offset	–9.9 to +9.9
Modulation inputs I and Q	
Input impedance	50 Ω
VSWR (DC to 200 MHz)	<1.4

Ordering information

Signal Generator	SMHU58	0835.8011.58
Options		
GMSK Coder	SMHU-B2	0820.4350.02
DECT Coder	SMHU-B3	0836.4010.02
NADC/PDC Coder	SMHU-B4	0836.4161.02
PHS Coder	SMHU-B5	0836.4410.02
Qualcomm CDMA Coder	SMHU-B6	0836.4661.02
TETRA 25 Coder	SMHU-B7	0836.3788.02

Signal Generator SMHU58

0.1 to 4320 MHz

RF signal generator with I/Q modulator and coder options for generating modulation signals for digital radio networks to relevant standards; basic model SMHU page 204

Photo 39080

Brief description

Signal Generator SMHU58 is identical with SMHU apart from an additional extremely broadband I/Q modulator making for high versatility.

Any digital modulations can be generated with the aid of Software IQSIM-K (page 221) for computing user-programmable waveforms of Generator ADS (page 218). This is a particularly invaluable feature in view of new modulation standards.

The coder options (see overview) provide modulation signals in line with the relevant standards.

Main features

- I/Q modulator 1 MHz to 2 GHz, modulation bandwidth DC to 200 MHz
- Second, coherent carrier for simple I/Q demodulation
- Broadband amplitude modulation for TV applications
- Broadband frequency modulation for satellite communications, radar and video applications
- Coders for generating modulation signals for digital radio networks to relevant standards
- Frequency hopping – 4800 stored frequency and level settings; setting time <1 ms
- Extremely high spectral purity for out-of-channel measurements and LO applications
- High output power (+19 dBm)
- Fast AM DC for generating level bursts
- RF, AF, level and memory sweeps for automatic test runs, built-in AF generator

Level, modulation

Level

The I/Q modulator provides very fast level control:

Level control via the I/Q inputs

In the input voltage range from 0 to 0.5 V there is a linear level control over 60 dB from the minimum value to the set nominal output level. The input frequency range is from DC to 200 MHz.

I/Q modulator

The I/Q modulator is adjusted for minimum amplitude and phase error in an automatic calibration routine. The settings can also be varied to simulate a non-ideal behaviour of the modulator. With the aid of selectable defined modulation distortion, effects on bit error rates can be determined and demodulator maladjustments corrected.

Overview of options

Designation, functions	Option
GMSK Coder	SMHU-B2
DECT Coder	SMHU-B3
NADC/PDC Coder	SMHU-B4
PHS Coder	SMHU-B5
Qualcomm CDMA Coder	SMHU-B6
TETRA 25 Coder	SMHU-B7

Digital and analog sweep
In addition to the digital, step-by-step sweep with presettable start and stop frequency, span, step width and step time, an analog frequency and level sweep is also provided.

Phase offset
The phase of the RF output signal can be varied in steps of 1° using keyboard entry or the spinwheel. This makes it easier to adjust for phase quadrature during noise measurements and to investigate phase-critical components.

Specifications in brief

Frequency

Range	
SMGU	100 kHz to 2160 MHz
SMHU	100 kHz to 4320 MHz
Underrange without guarantee of specs	down to 1 kHz
Resolution	0.1 Hz
Stability	same as reference frequency
Setting time	<10 ms, <1 ms in fast mode
Reference frequency, aging	<1 x 10^{-9}/day after 30 days of operation
Temperature effect	<2 x 10^{-9}/°C
Reference frequency input/output	5 or 10 MHz, selectable

Level

Range	–140 to +13 dBm
Overrange without guarantee of specs	up to 16 dBm (SMGU) up to 19 dBm (SMHU)
Frequency response at 0 dBm	
f ≤2160 MHz	1 dB
Characteristic impedance	50 Ω
VSWR	<1.5 for levels ≤0 dBm (SMGU) <1.8 for f ≤3000 MHz (SMHU)
Setting time	<25 ms (<10 ms with non-interrupting level setting)
Non-interrupting level setting	0 to –20 dB
Overload protection (maximum permissible RF power)	50 W (SMGU)/30 W (SMHU)

Spectral purity

Spurious signals	
Harmonics	<–30 dBc
Subharmonics	
f <2160 MHz	none
f >2160 MHz	<–60 dBc
Nonharmonic spurious signals at >10 kHz from carrier	see line a in table below
Residual FM, rms, 0.3 to 3 kHz (CCITT)	see line b in table below
SSB phase noise at 20 kHz from carrier, 1 Hz bandwidth (FM/φM deviation <2% of max. deviation), typical	see line c in table below

f <	15.6	125	250	500	1000	2000	4000	MHz
a <	–100	–100	–100	–100	–94	–94	–88	dBc
b <	0.5	0.5	0.5	0.5	1	2	4	Hz
c	–145	–150	–145	–137	–134	–128	–121	dBc

Amplitude modulation

Modes	INT, EXT AC, EXT DC, two-tone
Modulation depth	0 to 100%
AM distortion at 1 kHz and m = 60%	<2%
Modulation frequency (3 dB bandwidth)	
AM EXT AC (DC)	10 Hz (DC) to 50 kHz
AM INT	1 Hz to 50 kHz

AM square (AM-SQU)

Dynamic range	typ. 30 dB
Rise/fall time	typ. 2 µs
Modulation signal (AM EXT)	logic signal

Frequency modulation

Modes	INT, EXT AC, EXT DC, two-tone, preemphasis

Max. deviation (without preemphasis)

f<	15.625	31.25	62.5	125	250	500	1000	2160	4320	MHz
	200	25	50/800*	100	200	400	800	1600	3200	kHz

*) With special function "heterodyne band 0.1 to 125 MHz"

FM distortion at 1 kHz and 50% of max. deviation	<0.2% (<1% with preemphasis)
Modulation frequency	
FM INT	10 Hz to 100 kHz
FM EXT AC (DC)	10 Hz (DC) to 100 kHz, 10 Hz (DC) to 1 MHz (with deviation <10% of max. deviation)
Preemphasis	50 µs, 75 µs

FSK modulation

Rise/fall time	10 µs
Modulation signal (FM/φM EXT)	logic signal

Phase modulation

Modes	INT, EXT AC, two-tone
Maximum deviation	

f<	15.625	31.25	62.5	125	250	500	1000	2160	4320	MHz
	20	2.5	5/80*	10	20	40	80	160	320	rad

*) With special function "heterodyne band 125 MHz"

φM distortion at f = 1 kHz and 50% of max. deviation	<0.5%
Modulation frequency	10 Hz to 10 kHz

Pulse modulation

	external
On/off ratio	>80 dB
Rise/fall time	<20 ns (f >125 MHz)

Sweep

Modes	automatic, single-shot or manual

	RF sweep	AF sweep	RF level sweep	Memory sweep
Sweep range	user-selectable	user-selectable	0.1 to 20 dB	user-selectable
Step size (lin)	user-selectable	user-selectable	–	1
Step time	10 ms to 1 s	10 ms to 1 s	10 ms to 1 s	50 ms to 60 s 1 ms to 60 s*)

*) In fast mode

General data

Remote control	IEC625-1 (IEEE488)
Power supply	100/120/220/240 V ±10%, 47 to 63 Hz, max. 270 VA
Dimensions (W x H x D)	435 mm x 192 mm x 460 mm
Weight	26 kg for fully equipped unit

Ordering information

Signal Generator	SMGU	0819.0010.52
	SMHU	0835.0011.52

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