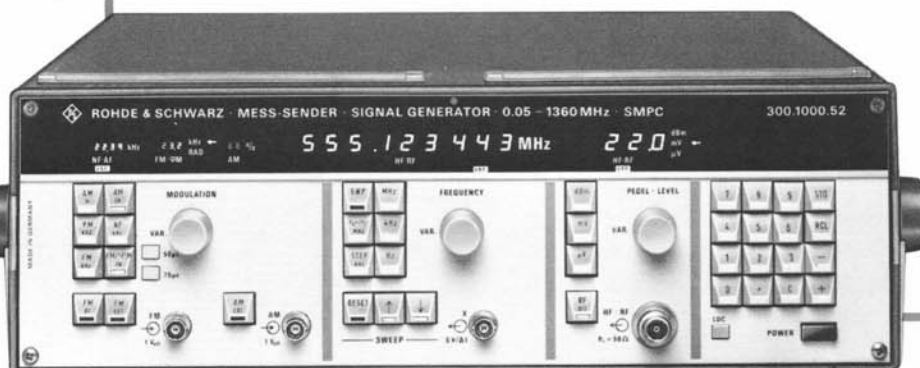


SMPC

Signal Generator SMPC ♦ 5 kHz to 1360 MHz

- High spectral purity
- Frequency resolution 0.1 Hz
- Digital sweep
- Output level -143 to +13 dBm
- AM, FM, ϕ M, stereo-compatible
- Modulation generator 10 Hz to 100 kHz
- Frequency switching time 18 ms
- Nonvolatile data memory



IEC 625Bus

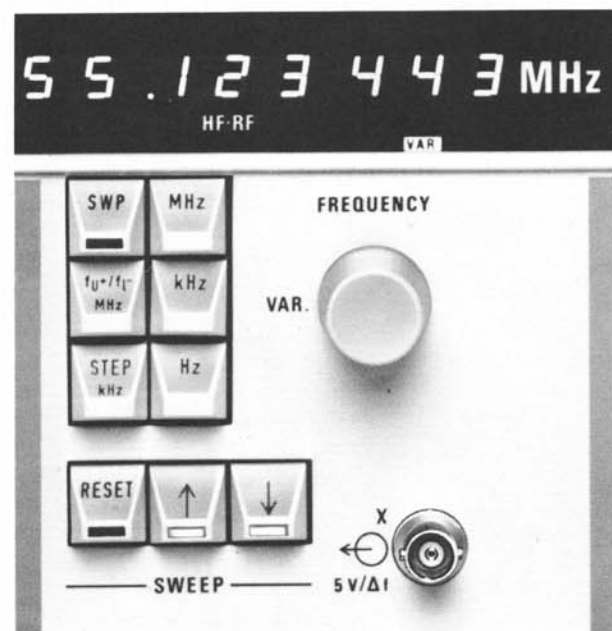
Characteristics, uses

The **Signal Generator SMPC** is outstanding for its characteristics, such as high spectral purity, low spurious FM, excellent modulation quality and wide frequency range combined with high resolution. For the first time a general-purpose synthesizer featuring such a wide frequency range and the specified signal purity offers modulation capabilities of maximum quality.

The SMPC meets all the requirements specified for **receiver measurements** – from critical adjacent-channel measurements through to distortion measurements on high-quality AM and FM sound broadcasting receivers. The SMPC can be used both as a low-noise local oscillator and a reference source in noise test assemblies.

Thanks to its excellent frequency stability, high resolution and the digital **sweep capability**, the Signal Generator SMPC can also be used for **measurements on narrowband filters and crystals**.

Front panel section
with setting controls and display for frequency



Ease of operation

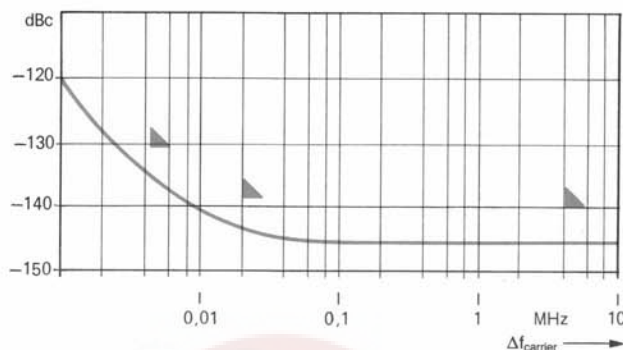
- The minimum of front panel controls plus optimum layout ensures an excellent overview and the great ease of operation of the SMPC.
- Keyboard entries in the normal order – numerical value and unit with direct display of the numerical value entered (above the numerics keyboard).
- Direct readout on separate digital displays with high resolution and floating decimal point.
- Quasi-continuous variation of the values selected for frequency, modulation and level using three rotary knobs leaving no room for operating errors.
- Frequency and level variations possible either in linear or logarithmic mode.
- All settings can be increased or reduced by any amount.
- Level readout can be selected either in V or dBm.

Technical data

Frequency The resolution is 0.1 Hz between 5 kHz and 1000 MHz, and 1 Hz above 1000 MHz. The fine resolution permits measurements on SSB receivers and extremely narrowband test objects to be performed. Up to 1360 MHz, the output signal is produced directly and not by doubling. Thus subharmonics do not exist.

Typical values of SSB phase noise in dBc (1 Hz)
f = 20 MHz (CW mode with special function RCL 07)

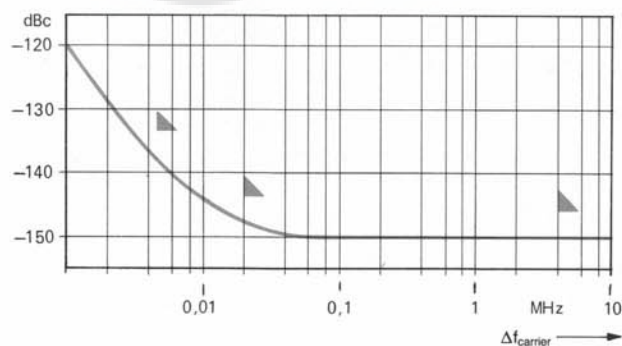
Blue triangles:
guaranteed values



Level The wide output level range from -143 to +13 dBm plus a resolution of 0.1 dB, the high level accuracy and the excellent frequency response flatness are especially important for measurements on receivers and wideband subassemblies. A level variation in 0.1 dB steps over the range of 10 dB without interrupting the RF signal permits also squelch measurements on radio equipment.

Typical values of SSB phase noise in dBc (1 Hz)
f = 100 MHz (CW mode with special function RCL 07)

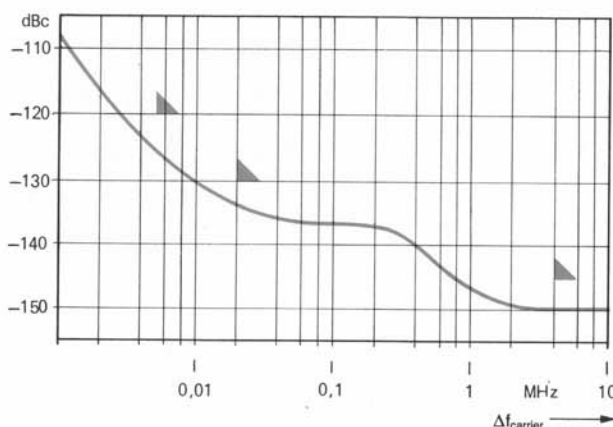
Blue triangles:
guaranteed values



Spectral purity Nonharmonic spurious signals are down more than 80 dB from 0.05 to 21.25 MHz, more than 90 dB between 21.25 and 680 MHz and more than 84 dB above 680 MHz. The SSB phase noise 20 kHz from a 500-MHz carrier at a bandwidth of 1 Hz is typically -134 dBc, see the diagrams. At the lower frequencies these values even improve until the minimum wideband noise level typically -150 dBc is reached. The typical value for residual FM to CCITT is below 1 Hz at 500 MHz and below 0.2 Hz at 100 MHz. Thanks to its high spectral purity, the SMPC is an ideal noise source for all two-source measurements on RT equipment to FTZ or CEPT specifications.

Typical values of SSB phase noise in dBc (1 Hz)
f = 500 MHz (CW mode with special function RCL 07)

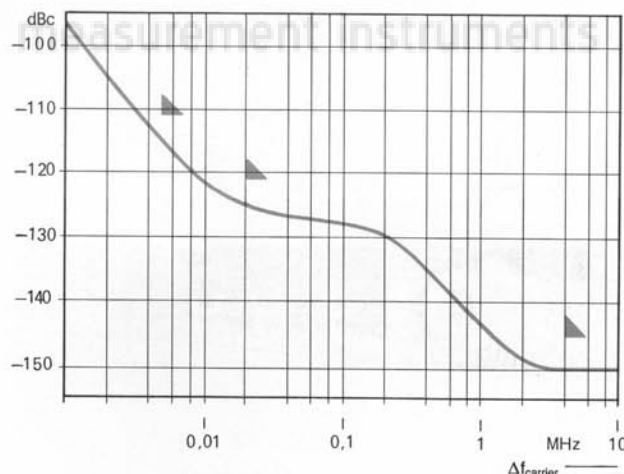
Blue triangles:
guaranteed values



Modulation (wideband and low-noise). The Signal Generator SMPC provides AM, FM and ϕ M modulation capabilities. The modulation modes can be selected separately at the same time. The outstanding modulation characteristics (FM distortion 0.1%, AM distortion 0.5%, stereo FM crosstalk down 56 dB) permit all measurements required on AM and stereo sound broadcasting receivers. For the frequency range of wideband-modulated radio services, deviations up to 800 kHz can be set on the SMPC. The modulation generator is an AF synthesizer for 10 Hz to 100 kHz.

Typical values of SSB phase noise in dBc (1 Hz)
f = 1360 MHz (CW mode with special function RCL 07)

Blue triangles:
guaranteed values



Digital sweep The digital sweep capability facilitates frequency response measurements, Q-factor determination and similar tasks. The sweep limits, step widths and dwell time per step can be freely selected.

Storage Up to 40 device settings can be stored. Even with the device switched off, the memory contents are retained for about three weeks.

Remote control All device functions can be remote-controlled via the IEC-bus interface.

SMPC

IEC-bus commands

Setting commands consist of data (optional) and of a two-character combination designating the unit and/or function and serving also as a delimiter. **Storage commands** and special functions are terminated with numerics.

All characters can be used as separators except numerics, the decimal point, polarity signs and the letters used in the commands. Places in the data block which exceed the resolution of the SMPC are ignored.

List of most important commands

Function	Data	Command Delimiter
Set carrier frequency in MHz in kHz in Hz	up to 10 places, decimal point	MH KH HZ
Set level in dBm in mV in μ V	up to 4 places, decimal point	DB MV UV
Switch RF output off to minimum on		F0 F1
Program sweep: upper limit frequency MHz lower limit frequency MHz step width kHz single sweep upwards downwards periodic sweep	up to 10 places, decimal point	FU FL SK SU SD SP
Set AF generator in kHz	up to 4 places, decimal point	NK
Frequency/phase modulation: set deviation in kHz in rad switch on FM/ φ M switch off FM/ φ M select internal FM/ φ M select external FM/ φ M FM AC FM DC	up to 4 places, decimal point	FK PR P1 P0 PI PE FA FD
Amplitude modulation: set modulation index in % AM on AM off internal AM external AM external level control	up to 2 places, decimal point	AP A1 A0 AI AE LC
Storage functions Complete device setup: store recall	n: memory location 1 to 5	ST n RC n
Frequency setting: store recall		ST MH n RC MH n
Level setting: store recall		ST DB n RC DB n

Specifications

Frequency	
Range	5 kHz to 1360 MHz
Setting/resolution	a) keyboard entry with least increments of 0.1 Hz for f_{carrier} up to 1000 MHz 1 Hz for $f_{\text{carrier}} > 1000$ MHz
(Frequency variation)	b) quasi-continuous with rotary knob
Frequency readout	10-digit display
Error referred to reference frequency	$< 5 \times 10^{-12}$ at $f_{\text{carrier}} > 21.25$ MHz < 0.8 mHz at $f_{\text{carrier}} \leq 21.25$ MHz to an offset from output frequency of 1×10^{-6} 2 $\times 10^{-8}$ ($f_{\text{carrier}} > 21.25$ MHz)
Setting time	150 Hz 3 Hz ($f_{\text{carrier}} \leq 21.25$ MHz)
Standard mode (after reception of last IEC-bus character)	< 18 ms < 50 ms
Fast mode (incl. IEC-bus transfer time)	7 ms 40 ms
Reference frequency	from internal temperature-controlled crystal oscillator or external
Internal crystal oscillator	10 MHz, output: > 0.2 V into 50 Ω
Crystal aging	$< 2 \times 10^{-9}$ /day (after 100 days of operation)
Temperature effect	$< 5 \times 10^{-9}/^{\circ}\text{C}$
Warmup time	15 min
External control	10 MHz ± 100 Hz, 0.2 to 2 V V_{rms} into 500 Ω , sine or squarewave signal or TTL levels

Output level	
Range	-143 to +13 dBm (0.016 μ V to 1 V into 50 Ω)
Resolution log	0.1 dB
lin	0.1% to 1%
Frequency response flatness	
50 kHz to 680 MHz	$< \pm 0.5$ dB
1360 MHz	$< \pm 1$ dB
10 kHz	typ. -1 dB
5 kHz	typ. -3 dB
Total error	0.05 to 680 MHz 0.05 to 1360 MHz
from +13 to -20 dBm	$< \pm 1.2$ dB $< \pm 1.7$ dB
-20 to -143 dBm	$< \pm 1.7$ dB $< \pm 2.2$ dB
Source impedance 50 Ω , VSWR ¹⁾ at level ≤ -2 dBm	< 1.2 < 1.35
> -2 dBm	< 1.4 < 1.6
Level switchoff (LEV MIN)	switchover to minimum output level, Z_{out} remains 50 Ω

Switching time for level variations	
	< 25 ms
Spectral purity	
Harmonics for output ≤ 10 dBm	< -30 dBc, typ. -35 dBc ²⁾
12 dBm	< -25 dBc, typ. -30 dBc ²⁾
(without special function 07)	
Subharmonics	none
Nonharmonic spurious signals from 50 kHz to 1360 MHz (at ≥ 1 kHz from carrier)	
at $f_{\text{carrier}} \leq 21.25$ MHz	< -80 dBc
> 21.25 to 680 MHz	< -90 dBc, typ. -100 dBc
> 680 MHz	< -84 dBc

Signal-to-noise ratio, referred to 1-Hz bandwidth	
	Carrier frequency Carrier spacing 20 100 500 1360 MHz
SSB phase	5 kHz < -130 < -134 < -120 < -111 dBc
noise	20 kHz < -138 < -143 < -130 < -121 dBc
Wideband noise	> 4 MHz < -140 < -145 < -145 < -145 dBc

Wideband noise specifications apply with special function RCL 07 active; with RCL 07 inactivated, the values will increase by 3 dB, with AM operation by 7 dB.

Modulation generator	
Frequency range	10 Hz to 100 kHz
Resolution up to 10 kHz	1 Hz
above 10 kHz	10 Hz
Frequency error	< 1 Hz + reference error
Frequency response flatness	< 0.1 dB
Level at rear output	1 V_{rms} into 600 Ω , $Z_{\text{out}} = 10$ Ω
Distortion	$< 0.1\%$
Harmonics	typ. < -65 dBc
Nonharmonics	typ. < -65 dBc
Phase-continuous frequency change: Switching time (after receiving last character via IEC bus)	< 10 ms

¹⁾ Applies only if special function RCL 94, noninterrupting level variation, is disabled.

²⁾ In the frequency range 50 kHz to 1360 MHz.

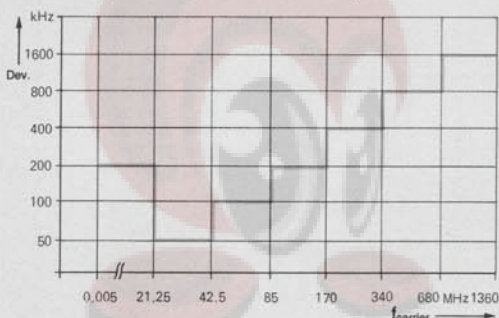
³⁾ At 10 kHz typ. -30 dBc.

Amplitude modulation

Modes	internal, external, external DC-coupled for level control with external probe
Modulation frequency, internal	10 Hz to 50 kHz
external	DC or 10 Hz to 50 kHz
Modulation frequency response flatness	
up to 10 kHz	<0.4 dB ¹⁾
up to 50 kHz	<1.0 dB
Modulation depth	0.1 to 99%
Resolution	0.1 to 10% / 1 to 99%
Setting error at 1 kHz/±80%	
up to 500 MHz	<3% of set value ¹⁾
above 500 MHz	<6% +1% absolute error
Incidental FM, peak value	<0.1 rad (up to 680 MHz)
at 1 kHz and m = 30%	<0.15 rad (up to 1360 MHz)
Modulation distortion ¹⁾	
f _{mod} : DC to 1 kHz	<1% (up to 30% AM)
	<1.5% (up to 80% AM)
DC to 10 kHz	<1.5% (up to 30% AM)
	<3% (up to 80% AM)
Modulation input	
AC-coupled	1 V (V _{rms})
DC-coupled	0 to -2.82 V for linear level reduction by 35 dB
Input impedance	600 Ω

Frequency modulation

Modes	internal, external, AC, DC; preemphasis 50 μs, 75 μs
Modulation frequency, internal	10 Hz to 100 kHz
external	DC or 10 Hz to 125 kHz
Modulation frequency response flatness	
internal, 10 Hz to 100 kHz	<0.2 dB
40 Hz to 15 kHz	<0.1 dB
external, 10 Hz to 125 kHz	<0.1 dB
40 Hz to 53 kHz	<0.02 dB
Maximum adjustable deviation	see diagram



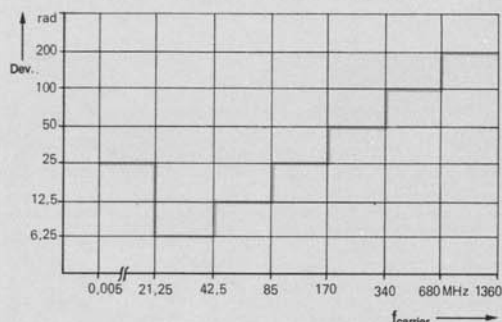
Resolution of deviation setting	<1% of set value or 10 Hz
Deviation error (at f _{mod} = 1 kHz)	<3% of set value or 20 Hz
Modulation distortion	
at 50% maximum deviation	<0.1% at 1 kHz (<1% for internal pre-emphasis)
	<0.3% at 20 kHz
with stereo (40 kHz deviation, f _{carrier} <21.25 MHz or 85 to 170 MHz)	<0.1% at 1 kHz
Stereo crosstalk	>45 dB down at 40 Hz to 15 kHz (conditions same as above)
	56 dB at 500 Hz to 10 kHz
Unweighted signal-to-noise ratio	
Stereo (40 kHz deviation, 50 μs)	
f _{carrier} <21.25 MHz or 85 to 170 MHz	>76 dB
Mono (conditions same as above)	>76 dB
Preemphasis (switch-selected)	50 μs, 75 μs
Additional deviation error	<2%
Incidental AM at f _{mod} = 1 kHz and 40 kHz deviation	<0.1%
Accuracy of carrier frequency at FM DC	
Frequency error when switching to FM DC	<1% of set positive deviation, <1 × 10 ⁻⁶ for f _{carrier} ≥ 21.25 MHz, <155 Hz for f _{carrier} <21.25 MHz
Recalibration	each time FM AC or FM OFF is selected
Modulation input	
AC-coupled	1 V (V _{rms})
DC-coupled	1.41 V (V _p), yielding set deviation
Input impedance	600 Ω

Phase modulation

Modes	internal and external
Modulation range	10 Hz to 8 kHz
Maximum adjustable deviation	see diagram

¹⁾ Applies only if special function RCL 94, noninterrupting level variation, is disabled.

Maximum adjustable deviation as a function of the carrier frequency



Resolution of deviation setting	<1% of set value or 0.01 rad
Error of deviation setting	<5% of set value or 0.02 rad (at f _{mod} = 1 kHz)
Frequency response flatness	<1 dB up to 3 kHz, <3 dB up to 8 kHz
Modulation distortion at 50 % of maximum deviation, internal	<1%
external	<0.1%

Digital sweep

Modes	single sweep up or down, periodic triangular sweep
Sweep width	freely selectable over entire frequency range
Step width	freely selectable, least increment 1 Hz, log 0.01 to 50% per step
Dwell time	normally 18 ms per step, programm- able up to 5 s per step
Voltage swing at X-output	5 V (BNC female)

Programming and data output

System	IEC 625-1 (IEEE 488)
Connector	24-contact, Amphenol
Interface functions	T6, L4, SR1, RL1, DC1

Overload Protection SMPC-B2

Protects the RF attenuator against externally applied RF (1 to 1360 MHz) or DC voltages	
Max. permissible RF power	30 W
Max. permissible DC voltage	35 V
Response indication	OFF indicated in level display, service request possible via IEC Bus

General Data

Rated temperature range	+5 to +45 °C
Storage temperature range	-40 to +70 °C
AC supply	115/125/220/235 V ±10%, 47 to 66 Hz, 220 VA, 150 W, safety class I to VDE 0411
RF leakage	conforming to VDE 0871 and MIL- STD. 461 B (methods CE 03 and RE 02) with respect to radiated and conducted interference, and to VDE 0875 (limit values of radio interfer- ence grade K)
Mechanical resistance	shock-tested to DIN 40 060, Part 7 (30 g, 11 ms) and vibration- tested to DIN 40046, Part 8 (11 to 55 Hz, 2 g) corresponding to IEC Publi- cations 68-2-27 and 68-2-6
Dimensions, weight	470 mm × 162 mm × 485 mm, 23 kg

Ordering information

Order designation	► Signal Generator SMPC
5 kHz to 1360 MHz	300.1000.53
5 kHz to 1000 MHz	300.1000.55
Accessories supplied	power cable

Recommended extras

19" Rack Adapter	SMPC-Z9	346.1219.02	(overall mounting height 176 mm)
Service Kit	XPC-Z1	337.9810.02	