Signal Generator SMT

For receiver and EMS measurements
5 kHz to 1.5/3/6 GHz

Signal Generator SMT covers the complete range of conventional analog receiver measurements up to 6 GHz. The SMT affords exceptionally high signal quality for a generator in this price category, as well as outstanding level accuracy, a wide variety of modulation and signal generation modes, customized configuration, and great ease of operation. Features such as programmable RF, LF and level sweeps as well as the correction of external frequency response make the SMT an ideal source for EMS measurements.

- AM, FM, qM, pulse modulation
- Broadband FM and qM
- Options for signal generation:
  - pulse generator
  - LF generator
  - multifunction generator, eg for stereo and VOR/ILS signals
Signal Generator SMT

Types of modulation

- Broadband FM from DC to 8 MHz, deviation up to 40 MHz
- Amplitude modulation
- Phase modulation from DC to 2 MHz

Standard functions

- Convenient RF, LF and level sweeps
- Memory sequence function for automatic measurements
- Programmable level correction for compensation of external frequency response

Innovative operating concept

- Large, backlit LCD for simultaneous display of all relevant settings
- All submenus and current instrument status clearly arranged on the display
- On-line help system, thus no need to consult a manual

LF generator option

- Sinewave signals from 0.1 Hz to 500 kHz
- Triangular and squarewave signals up to 50 kHz
- Noise generator with 500 kHz bandwidth
- Multitone signals in conjunction with standard fixed-frequency generator or second LF generator option

Multifunction generator option

- VOR/ILS signal generator for tests on VOR/ILS receivers
  - phase resolution 0.01°
  - DDM resolution 0.0001
- Stereo signal generator for measurements on FM broadcast transmitters and radio receivers
  - stereo separation >50 dB
  - unweighted S/N ratio >76 dB

Pulse generator option

- Single, delayed, double pulses
- Pulse width 20 ns to 1 s

Pulse modulator option

- Ideal for radar applications
- Rise/fall time <10 ns
- On/off ratio >80 dB
- Pulse frequencies up to 10 MHz
The ideal EMS signal source

With a specified lower frequency limit of 5 kHz (underrange down to 1 kHz), the SMT fully covers the frequency range for EMS measurements stipulated by IEC 801.

The digital, step-by-step sweep function with preselectable start and stop frequency, span, step width and step time enables the convenient testing of wide frequency ranges. The sweep function can also be used for the RF level and AF frequency.

The frequency response of cables, amplifiers, TEM cells, etc can be compensated already in the signal generator by means of a level correction function. Complicated external level controls or test routines are superfluous.

Excellent RF characteristics at a reasonable price

For high-accuracy measurements on AM, FM and SSB receivers, the signal source must be superior to the DUT. The low residual FM and SSB phase noise of the SMT make it suitable for in-channel and blocking measurements even on high-end receivers. The small level error of <1 dB in the frequency range ≤1.5 GHz allows high-precision sensitivity measurements.

Minimum RF emissions — for sensitive DUTs

Measurements on highly sensitive receivers such as pagers not only require high signal quality but also extremely high RF shielding of the signal source. Elaborate shielding measures keep RF emissions of the SMT to a minimum, ie <0.1 µV, induced in a two-turn loop 25 mm in diameter in the immediate vicinity of the instrument.
Characteristics and features

High-grade modulation characteristics
A wealth of modulation modes, the user-selectable combination of various types of modulation and a multitude of modulation sources make the SMT a highly flexible instrument for use in development, production and repair of radio equipment.

AM
The modulation frequency range is DC to 100 kHz. Among the outstanding AM characteristics of the SMT are its extremely low distortion and flat frequency and phase response - characteristics that play a particularly important role in measurements on VOR/ILS receivers, for example.

Broadband FM
The modulation frequency range is DC to 8 MHz. Maximum deviation is 40 MHz [at 6 GHz carrier frequency]. In the FM DC mode, high carrier frequency accuracy is ensured through the use of a special control circuit. There is virtually no drift. The SMT can thus generate highly accurate FSK signals as required for tests on radiopagers. The use of an external Gaussian filter permits GFSK signals in line with the DECT standard to be generated.

Broadband qM
Phase modulation ranges from DC to 2 MHz. This wide span opens up fields of application for which most signal generators do not qualify, for instance tests on phase-sensitive circuits or the generation of PSK modulation with freely selectable phase deviation up to 20 rad.

Pulse modulation (option)
Its high-quality pulse modulation, featuring an on/off ratio better than 80 dB and a rise/fall time shorter than 10 ns, make the SMT an ideal choice for radar applications. The pulse generator option allows pulsed signals to be produced independent of an external source.

Memory sequence function for automatic measurements
For frequently repeated measurement series, eg frequency response measurements or sequences of different types of single measurements, the memory sequence function affords a convenience otherwise obtained only by means of processor control. Up to 50 instrument settings can be stored in a non-volatile memory. After programming the sequence of measurements and the step time in a list, the automatic test run can be started.

A wealth of functions – yet easy to operate
As a rule, the more functions provided in a unit, the more complex the operation. This certainly applies to conventional signal generators with multifunction keys and a variety of special functions.

But not with the SMT: operation is extremely easy thanks to a well thought-out operating concept featuring a large LCD display and menu guidance. All parameters selectable for a specific function are arranged in hierarchical order in a single display. Help texts for the individual functions mean that it is often unnecessary to consult a manual.

The FM modulation menu shows the clear-cut representation of selectable parameters and current instrument status on the display. Each setting can be made quickly and easily by means of the spinwheel and a few keys.
Configurable to user's requirements

AM, FM, qM and pulse modulation can be used with various internal and external modulation sources. The SMT can be tailored to suit specific applications by means of optional modules. These can also be retrofitted quickly and easily at a later date.

The LF generator, which can be fitted in addition to the fixed-frequency LF generator provided as standard, is a synthesizer up to 500 kHz. Besides sinewave, squarewave and triangular signals, it also supplies a noise signal. If two optional LF generators are fitted in a unit, multitone signals can be generated internally.

The multifunction generator with a frequency range from DC to 1 MHz produces the same signals as the optional LF generator and, in addition, stereo multiplex and VOR/ILS modulation signals. The multifunction generator option makes the SMT suitable even for highly demanding measurements on FM stereo and navigation receivers.

The pulse generator provides single and double pulses as required for radar receiver testing. The pulse repetition period (PP), pulse width (PW) and pulse delay (PD) (see diagram) can be set with high accuracy and resolution.
Specifications

**Frequency**
- **Range:**
  - 5 kHz to 1.5 GHz (SMT02)
  - 5 kHz to 3 GHz (SMT03)
  - 5 kHz to 6 GHz (SMT06)
- **Underrange (specs not binding):**
  - down to 1 kHz
- **Resolution:** 0.1 Hz
- **Setting time after IEC/IEEE bus delimiter to within:**
  - <1 x 10^-7 for f >67.5 MHz and
  - <70 Hz for f <67.5 MHz
- **Phase offset:** <20 ms adjustable in steps of 1°

**Reference frequency** (1 year after 30 days of operation)
- **Temperature effect (O to 55°C):** 2 x 10^-5/year
- **Warm-up time:** <5 x 10^-6/day 10 min

**Output for internal reference**
- **Frequency (ESE, sine wave):**
  - 10 MHz
- **Source impedance:** 50 Ω

**Input for external reference**
- **Frequency:** 5 or 10 MHz
- **Permissible frequency error:** 1 x 10^-4
- **Input impedance:** 200 Ω
- **Electronic tuning (TUNE):** 1 x 10^-7/V
- **Input voltage range:** ±10 V
- **Input impedance:** 10 kΩ

**Spectral purity**
- **Spurious signals**
  - Harmonics level at 0 dBm
  - Level without Overrange
  - Subharmonics f <1.5 GHz
  - f =1.5 GHz
  - f >3 GHz
- **Nonharmonics at >10 kHz**
  - from carrier
  - f <1.5 GHz
  - f =1.5 GHz
  - f >3 GHz
- **Broadband noise for CW**
  - >10 MHz from carrier
  - 1 Hz bandwidth
  - f =1.5 GHz
  - f =3 GHz
- **SSB phase noise 20 kHz from carrier**
  - 1 Hz bandwidth, FM/AM deviation
  - <0% of maximum deviation
  - <67.5 MHz
  - 80 MHz
  - 125 MHz
  - 250 MHz
  - 500 MHz
  - 1000 MHz
  - 2000 MHz
  - 3000 MHz
  - 6000 MHz

**Residual FM, rms, at carrier frequency**
- <0 Hz
- >67.5 kHz
- 67.5 to 187.5 MHz
- 187.5 to 375 MHz
- 375 to 750 MHz
- 750 to 1500 MHz
- 1500 to 3000 MHz
- 3000 to 6000 MHz

**Residual AM, rms (0.03 to 20 kHz):** <0.02% 0.3 to 3 kHz (CCITT) 0.03 to 20 kHz
- <4 Hz
- >1 Hz
- <2 Hz
- >4 Hz
- <5 Hz
- >4 Hz
- >10 Hz
- >8 Hz
- >20 Hz
- >16 Hz
- >40 Hz
- >32 Hz
- >80 Hz

**Level**
- **Range:**
  - -144 to +13 dBm
  - up to 16 dBm
- **Resolution:** 0.1 dB

**Total error for levels >-127 dBm**
- f <1.5 GHz
- f =1.5 GHz
- f >3 GHz

**Level flatness at 0 dBm**
- f <3 GHz
- f =3 GHz
- f >5 GHz

**Output impedance:** 50 Ω

<table>
<thead>
<tr>
<th>VSWR</th>
<th>f &lt;3 GHz</th>
<th>3 GHz &lt; f &lt;5 GHz</th>
<th>f &gt;5 GHz</th>
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<tbody>
<tr>
<td>Level &gt;0 dBm</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Level &gt;0 dBm and option SM89</td>
<td>&lt;2</td>
<td>&lt;2</td>
<td>&lt;2</td>
</tr>
<tr>
<td>filtered (SMT06)</td>
<td>&lt;1.5</td>
<td>&lt;2</td>
<td>&lt;2</td>
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</tbody>
</table>

**Setting time (IEC/IEEE bus)**
- <25 ms (<10 ms with electronic level setting)

**Non-interrupting level setting** (ATTENUATOR MODE FIXED)
- Setting range: 23 dB

**Typical level response at 0 dBm**

**Overvoltage protection**
- protects the unit from externally applied RF power (50 Ω source) and DC voltages.
- **Max. RF power:**
  - 50 W (SMT02/03)
  - 10 W (SMT06)
- **Max. DC voltage:**
  - 55 V (SMT02/03)
  - 0 V (SMT06)

![Typical SSB phase noise at 1 GHz (CW)](image)
Simultaneous modulation

Amplitude modulation
Operating modes: Modulation depth
- Modulation depth
  - Internal, external AC/DC
  - Maximum modulation depth
  - Resolution
  - Setting error at 1 kHz [m < 0.1%]
  - AM distortion at 1 kHz [m = 0%]
  - m = 30%
  - m = 80%
  - Modulation frequency range
  - Modulation freq. response (m = 0%)
- 20 Hz (DC) to 50 kHz
- Incident AM with 30% AM, AF = 1 kHz
- EXT 1 modulation input
- Input impedance
- Input voltage for selected modulation depth
  - 10 mm (high/low indication for inaccuracy >3%)

Frequency modulation
Operating modes: Internal, external AC/DC, two tone with two separate channels FM1 and FM2
- Max. deviation at carrier frequency
  - <150 kHz
  - 130 to 187.5 MHz
  - 187.5 to 375 MHz
  - 375 to 750 MHz
  - 750 to 1500 MHz
  - 1500 to 3000 MHz
  - 3000 to 6000 MHz
- Resolution
  - Setting error at AF = 1 kHz [FM AC]
  - FM distortion at AF = 1 kHz and 10% max. deviation
  - Frequency modulation range, FM1, FM2
  - 20 Hz (DC) to 1 kHz
  - Modulation frequency response
    - <0.5 dB
  - 0.1% dB
  - Stereo separation at 40 kHz deviation, AF = 1 kHz, RF = 88 to 108 MHz
  - Unweighted S/N ratio (rms)
  - Weighted S/N ratio (rms)
  - Distortion
    - Carrier frequency offset
  - Ext 1 modulation input
  - Input impedance
  - Input voltage for selected deviation
    - 100 kHz
  - 0.1% dB
  - 10 mm (high/low indication for inaccuracy >3%)

Phase modulation
Operating modes: Internal, external AC/DC, two tone with two separate modulation channels qM1 and qM2
- Narrowband, qM1, Broadband, qM2
  - Bandwidth: 100 kHz
  - Bandwidth: 2 MHz
  - 50 rad
  - 25 rad
  - 12.5 rad
  - 5 rad
  - 2.5 rad
  - 1.25 rad
  - 0.625 rad
  - 0.25 rad
  - 0.01 rad

EXT1, EXT2 modulation inputs
- Input impedance
- Input voltage for selected deviation
  - AF = 10 Hz to 100 kHz

Pulse modulation
Operating modes
- Frequency range
- Max. output level
- Harmonics
- On/off ratio
- Rise/fall time (10%/90%)
- Pulse repetition rate
- Pulse delay
- Video feedthrough
- PULSE modulation input
  - Input level
  - Input impedance

Internal modulation generator
- Frequency
- Open-circuit voltage
- 0.4/1.5 kHz: ±3
- 10 mm
- 10 mm
- 10 mm
- 10 mm
- 10 mm

LF generator
- Waveforms
  - Frequency range
    - sinewave, triangular, squarewave, noise
  - 0.1 Hz to 500 kHz
  - 0.1 Hz to 50 kHz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz

Multifunction generator
- Waveforms
  - Frequency range
    - sinewave, triangular, sawtooth, squarewave, noise, stereo MXP signals
  - 0.1 Hz to 1 MHz
  - 0.1 Hz to 50 kHz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz
  - 0.1 Hz

Stereo multiplex signal
- Stereo operating modes
- Frequency range of L, R signal
  - Preemphasis
  - Pilot tone frequency
  - Pilot tone phase
  - Resolution
  - Stereo separation
  - Distortion
  - Carrier suppression (38 kHz)
  - [ARI = broadcast identification for area]
  - A, B, C, D, E, F

Signal Generator SMT
VOR modulation signal

Settings

Phase

Phase resolution

Bearing error (RF output)

FM error (deviation 480 kHz)

ILS modulation signal

Settings

DDM setting range

DDM resolution

DDM error (RF output)

Localizer (108 to 112 MHz)

Glideslope (329 to 335 MHz)

Pulse generator

Operating modes

Active trigger edge

Pulse repetition period

Resolution

Accuracy

Pulse width

Resolution

Accuracy

Pulse delay

Resolution

Accuracy

Double pulse

Resolution

Accuracy

Trigger delay

PULSE modulation input

Input level

Input impedance

Sync output

Video output

Sweep

RF sweep, LF sweep

Operating modes

Sweep range and step width (lin)

Sweep range and step width (log)

Level sweep

Operating modes

Sweep range

Step time

Resolution

Markers

MARKER output signal

X output

BLANK output signal

Memory for instrument settings

Storable settings

Memory sequence modes

Step time

Resolution

Remote control

System

Instruction set

Connector

IEC/EIAE bus address

Interface functions

General data

Power supply

90 to 132 V (AC), 47 to 440 Hz, 180 to 265 V (AC), 47 to 440 Hz, autosetting to AC voltage, max. 300 VA, safety class I VDE 0411 (IEC 348)

Electromagnetic compatibility

Standards met

German Postal Decree 243/1991, EN 55011 (VDE 0875 T1), class B, VDE 0875, interference suppression level K, MIL-STD 461 B

- RO 02 radiated emissions
- CE 03 conducted emissions
- CS 01/02 conducted susceptibility

RF emissions (f<1 GHz)

<0.1 μV [induced in a two-turn loop 25 mm in diameter at a distance of 25 mm from any surface of the enclosure]

Radiated susceptibility

Ambient conditions

- Operating temperature range
- Storage temperature range

Humidity

0 to 55 °C

40 to 70 °C

DIN IEC 68-2-30, +40 °C

Mechanical stress

Shock to MIL-STD 810 D

Vibration, sinusoidal

Vibration, noise

Dimensions (W x H x D)

Weight

Ordering information

Order designations

Signal Generator SMT02

Signal Generator SMT03

Signal Generator SMT06

Accessories supplied

power cable, operating manual

Options

Reference Oscillator OXKO

LF Generator

Pulse Modulator for SMT02

Pulse Modulator for SMT03

Pulse Modulator for SMT06

Pulse Generator (with option SM83 or SM88 SM89)

Multifunction Generator

Rear Connectors for RF and AF

Recommended extras

19" Rack Adapter

Service Kit

SMT Service Manual

Certified Quality System

ISO 9001

DOS 86 NO 1954-97

1) Does not apply to non-interrupting level setting

2) ATTENUATOR MODE FIXED and user control

3) In the RII mode, L = R = OFF

4) Contrast of LCD display degraded at high temperatures

5) A second optional modulation generator (SM82 or SM85) can be fitted only if no pulse modulator (SM83, SM88 or SM89) is fitted.

6) Retrofit by authorized service centers only.
Minimum maintenance requirements

Calibration

Calibration of the unit is required every three years at the earliest. Calibration values are loaded via the RS-232-C or IEC/IEEE-bus interface to ensure frequency and level accuracy to specifications. The unit neither needs to be opened, nor are any mechanical adjustments to be made.

Self-diagnostics

For maintenance and calibration, precise data on the instrument status are needed. Using the built-in test equipment, the SMT supplies these data without any extra equipment required.

Self-test for enhanced reliability

The signal generator status is continuously monitored. The SMT indicates malfunctions and deviations from nominal values by means of a message on the display.

Built-in test equipment

The signal generator can be fully checked without any extra test equipment required and without opening the unit. There are 65 test points covering all crucial areas in signal generation such as RF signal levels and control circuit monitoring voltages. When a test point is called up via the keyboard or the IEC/IEEE bus, its number and value appear on the display. The source of error can thus easily be identified in the event of a malfunction.

A diagnostic and adjustment program for process controllers compatible with the industry standard (included in Service Kit SM-22) enables the automatic evaluation and logging of the instrument status. Adjustments can easily and rapidly be made without any extra test equipment required. During the several days of burn-in following production, the SMT is continuously checked through with the aid of this program. This ensures that an extremely reliable instrument tested throughout the entire temperature range will be supplied to the customer.

Rear panel of SMT