

Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

Test equipment Solutions Ltd
Unit 8 Elder Way
Waterside Drive
Langley
Berkshire
SL3 6EP

T: +44 (0)1753 596000
F: +44 (0)1753 596001

Email: info@TestEquipmentHQ.com
Web: www.TestEquipmentHQ.com



Signal Generator SME

SME02: 5 kHz to 1.5 GHz

SME03: 5 kHz to 3 GHz

SME03E: 5 kHz to 2.2 GHz

SME06: 5 kHz to 6 GHz

For digital communication with all types of modulation of mobile radio

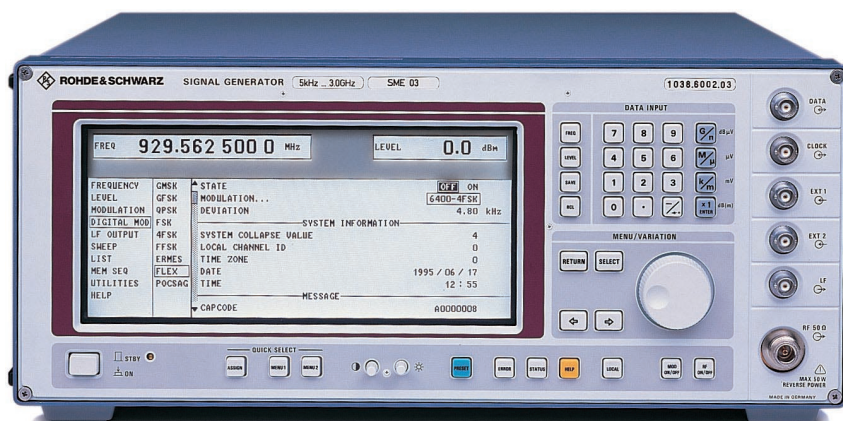


Photo 42212

Brief description

The SME supplies the complex signals required for the development and testing of digital mobile radio receivers. It is capable of generating all signals used in the main digital radio networks in line with relevant standards regarding the type of modulation, data format, TDMA structure and frequency hop patterns. The SME is completely at home also in the analog signal world of conventional signal generators.

SME02, SME03 and SME06 are identical except for the frequency range. Economy Signal Generator SME03E has been designed as an especially economical solution for applications involving digitally modulated signals. The large variety of options available allows the SME to be tailored to the specific needs of the user.

Main features

- All common digital modulation modes provided in one unit
- Great ease of operation thanks to a novel menu concept
- No external modulation and data sources required

- User-programmable data sequences and TDMA structure
- RF, LF and level sweep
- Ultra-low RF leakage for measurements on highly sensitive pagers
- List mode: programmable measurement sequence for up to 4096 frequency and level combinations, setting time <0.5 ms (not SME03E)

Overview of options

Designation, functions	Option
Reference Oscillator OCXO: aging <1 x 10 ⁻⁹ /day	SM-B1
LF Generator: supplies sinewave, noise 0.1 Hz to 500 kHz, triangular, squarewave 0.1 Hz to 50 kHz signals	SM-B2
Pulse Modulator: on/off ratio >80 dB, rise/fall time <10 ns	SME02: SM-B3 SME03E, SME03: SM-B8 SME06: SM-B9
Pulse Generator: only in conjunction with SM-B3/SM-B8/SM-B9; provides single, delayed and double pulses	SM-B4
FM/φM Modulator: FM DC to 2 MHz, φM DC to 100 kHz	SM-B5
Multifunction Generator: produces stereo multiplex and VOR/ILS signals, as well as sinewave, noise 0.1 Hz to 1 MHz, triangular, sawtooth, squarewave 0.1 Hz to 50 kHz signals	SM-B6
DM Coder: generates FSK, FFSK, 4FSK, GFSK, GMSK, QPSK, π/4 QPSK, π/4 DQPSK, O-QPSK; user-programmable data sequences and PRBS	SME-B11 *
DM Memory Extension 8 Mbit: expands the 8-kbit memory of the DM Coders to 8 Mbit (data only); required for fitting SME-B41 and SME-B42	SME-B12
FLEX Protocol: generates call signals to FLEX standard for testing pagers	SME-B41
POCSAG Protocol: generates call signals to POCSAG standard for testing pagers	SME-B42
Rear Connectors for RF and LF: to replace front-panel connectors	SMT-B19

* Already included in basic model of SME03E

Signal Generator SME

Equipped for the digital age

The SME supplies the complex signals required for the development and testing of digital mobile radio receivers. The SME is capable of generating all signals used in the important digital mobile radio networks in line with relevant standards regarding the type of modulation, data format, TDMA structure and frequency hop patterns.

The SME is completely at home also in the analog signal world. Featuring AM, FM, ϕ M and pulse modulation, it covers the entire spectrum of functions provided by conventional signal generators.

The three models SME02, SME03 and SME06 differ essentially in their frequency ranges. Economy Signal Generator SME03E has been designed as an especially economical solution for applications involving digitally modulated signals. Signal Generator SME03A already contains option Fast CPU SM-B50.

Configurable to user's requirements

The SME can be tailored to user's requirements by means of a wide range of options. The variety of options available allows the SME to be configured with the emphasis either on digital modulation or on analog applications or to be expanded into a universal unit.

Overview of digital modulation modes

GMSK

2.4/3.6/4/4.8/7.2/8/9.6/14.4/16/19.2/28.8/32/38.4/64/76.8/270.833 Kbit/s	B x T = 0.3/0.5	GSM, CDPD, DCS1800 (PCN), DSRR, MOBITEK
2.5/3/5/6/10/12/20/24/40/48/80/160/512 Kbit/s	B x T = 0.5	
8 Kbit/s	B x T = 0.25	
270.833 Kbit/s	B x T = 0.2	
1000 Kbit/s *)	B x T = 0.4	

GFSK

10.0 to 585 Kbit/s	14.4 kHz	B x T = 0.7	
640 to 1170 Kbit/s	18/20 kHz	B x T = 0.5	CT2
	25.2 kHz	B x T = 0.4	
	160/180/202/259/288/317/403 kHz *)	B x T = 0.5	CT3, DECT

FSK

0.05 to 90 Kbit/s	4/4.5 kHz	Gauss B x T = 2.73	Cityruf, POCSAG
	4.8 kHz	Bessel B x T = 1.22/2.44	FLEX™
0.05 to 1900 Kbit/s	0.01 to 25 (800) kHz **)	OFF	

4FSK

1.00 to 24.3 Kbit/s 27.0 to 48.6 Kbit/s	0.01 to 25 (800) kHz **)	cos 0.2	APCO25
		$\sqrt{\cos 0.2}$	MODACOM
		Bessel B x T = 1.25	ERMES
		Bessel B x T = 1.22/2.44	FLEX™

FFSK

0.05 to 90 Kbit/s	1.5/2/3/3.5/4/4.5 kHz	AF1 = bit rate AF2 = 1.5 x bit rate	POCSAG
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QPSK, $\pi/4$ -QPSK, $\pi/4$ -DQPSK ***)

1.00 to 24.3 Kbit/s 27.0 to 48.6 Kbit/s	cos 0.2/0.35/0.4/0.5/0.6 $\sqrt{\cos 0.35/0.4/0.5/0.6}$	APCO25, NADC, MSAT, PDC, TETRA, TFFS
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O-QPSK ***)

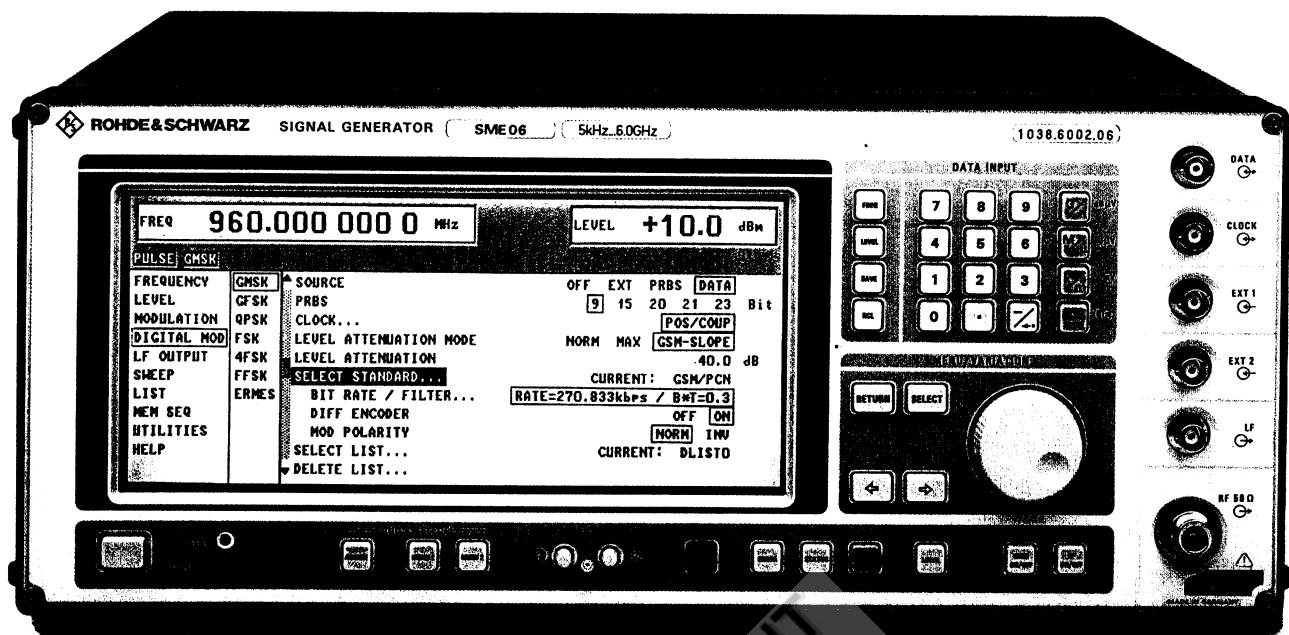
1.00 to 24.3 Kbit/s 27.0 to 48.6 Kbit/s	$\sqrt{\cos 0.6}$	INMARSAT
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*) Not possible in frequency range 130 MHz to 187.5 MHz.

**) Maximum deviation dependent on carrier frequency.

***) QPSK not specified for $f > 3$ GHz.

FLEX™ is a registered trademark of Motorola Inc. U.S.A.



Features

- All common digital modulation modes provided in one unit
- No external modulation or data sources required
- Generation of paging signals in line with ERMES, FLEX™, FLEX-TD, REFLEX™ and POCSAG standards
- Internal control of frequency hopping and power ramping synchronous with the data signal
- Freely programmable data sequences and TDMA structure
- High spectral purity for out-of-channel measurements
- RF, LF and level sweep
- Memory sequence: programmable measurement sequence for up to 50 complete instrument settings
- List mode: programmable measurement sequence for up to 2000 frequency and level combinations, setting time <math>< 500 \mu\text{s}</math> (not SME03E)
- Ultra-low RF leakage for measurements on highly sensitive paging receivers
- Easy to operate

Overview of options

Option	Description	Part Number
Reference Oscillator	OEXO: Aging $< 1 \times 10^{-5}$ /day	SM-B1
LF Generator	sinewave, noise 0.1 Hz to 500 kHz, triangular, squarewave 0.1 Hz to 50 kHz	SM-B2
Pulse Modulator	50 MHz to 1.5/3/6 GHz, on/off ratio >80 dB, rise/fall time <math>< 10 \text{ ns}</math>	SM-B3/SM-B8/SM-B9
Pulse Generator	(only with SM-B3, SM-B8 or SM-B9): generates single pulse, delayed pulse and double pulse	SM-B4
FM/φM Modulator	FM DC to 2 MHz, φM DC to 100 kHz	SM-B5
Multifunction Generator	generates stereo multiplex and VOR/ILS signals; sinewave, noise 0.1 Hz to 1 MHz, triangular, sawtooth, squarewave 0.1 Hz to 50 kHz	SM-B6
DM Coder	generates FSK, FFSK, 4FSK, GFSK, GMSK, QPSK, π/4-QPSK, π/4-DQPSK, O-QPSK modulation; freely programmable data sequences and PRBS	SME-B11*)
8-Mbit DM Memory Extension	extends the 8-Kbit memory of the DM coder to 8 Mbit (data only)	SME-B12
FLEX Protocol	(only with SM-B11 and SM-B12): generates paging signals in line with FLEX™ and FLEX-TD standards for tests on pagers	SME-B41
POCSAG Protocol	(only with SM-B11 and SM-B12): generates paging signals in line with POCSAG standard for tests on pagers	SME-B42
REFLEX™ Protocol	(only with SM-B11 and SM-B12): generates paging signals in line with REFLEX™ standard for tests on pagers	SME-B43
Fast CPU	reduces the settling times of frequency and level (frequency: <math>< 3 \text{ ms}</math>, level: <math>< 2 \text{ ms}</math>)	SM-B50**)
Rear connectors for RF and AF	(replacing front-panel connectors)	SME-B19

*) Already included in basic model of SME03E. **) Already included in basic model of SME03A.

Possible combinations of options

The SME options can be freely combined with two exceptions:

- The LF generator (SM-B2) and the multifunction generator (SM-B6) cannot be combined if a pulse modulator (SM-B3, SM-B8 or SM-B9) is fitted.
- The LF generator (SM-B2) can be fitted twice if no pulse modulator (SM-B3, SM-B8 or SM-B9) and no multifunction generator (SM-B6) is fitted.

All modulation modes of mobile radio

Digital modulation

With the DM coder option (included in basic model of SME03E), the SME provides a variety of network-specific digital modulation modes:

Modulation	Network
GMSK	GSM, DCS 1800, PCS 1900, CDPD, MC9, DSRR, Mobitex 8000
GFSK	DECT, CT2, CT3
$\pi/4$ -DQPSK	NADC, PDC, TFTS, TETRA, APCO 25
FSK, FFSK	POCSAG, Cityruf
4FSK	ERMES, APCO 25, FLEX™, FLEX-TD

For a complete overview of digital modulation modes please refer to page 2.

Frequency and phase changes are produced by DDS (direct digital synthesis). The frequency and phase response are therefore synthesizer-accurate.

For varying the modulation spectrum, filters other than the standard ones may be used, eg filters with $B \times T = 0.2, 0.3, 0.5$ for GSM networks. With GFSK modulation for DECT, non-standard deviations may be set to allow receiver tests.

For tests on pagers, SME generates paging signals in line with the ERMES, FLEX™, FLEX-TD and POCSAG standards. All important parameters and messages to be transmitted are freely selectable.

Internal data generator

The data generator supplies freely programmable data signals and PRBS signals in line with CCITT. For PRBS signals, five sequence lengths between 2^9-1 and $2^{23}-1$ are selectable. A list editor greatly facilitates programming. Up to ten data sequences with a total length of 8 kbit can be stored.

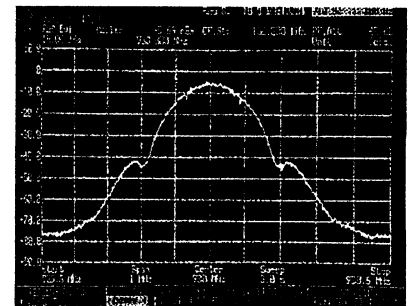
8-Mbit DM memory extension

An extension to the data generator memory is available for all applications requiring much longer data sequences. The 8-Mbit memory permits even BCCH and TCH data sequences to be stored which are needed for propagation measurements in GSM networks. This makes SME ideal as the core of a favourably priced mobile test base station.

Power ramping and frequency hopping synchronous with the data signal

In addition to the data signal, the data generator supplies a data-synchronous burst and a level switch signal for the generation of TDMA frames.

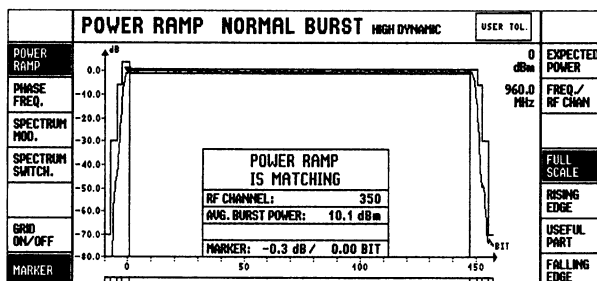
The burst and level switch signals are programmed bit-parallel with the data signal via list entries. The level switch signal controls the AM modulator to produce highly accurate level variations of up to 20 dB (overrange up to 40 dB). Together with a switchable GSM filter and the pulse modulator option, this allows the generation of bursts in line with the GSM standard.



GMSK modulation spectrum



$\pi/4$ -DQPSK vector diagram



GSM power ramping

The burst signal available at a socket serves for controlling frequency changes (<0.5 ms) via the trigger input or fast level changes (>80 dB) via the pulse input.

The internal level switch signal can be replaced by an external logic signal. The signal switches the level in selectable steps with a rise/fall time <10 μs.

Analog modulation

The SME sets new standards in the field of digital modulation – without any restrictions on the analog side. The SME also stands out for its excellent analog characteristics.

Amplitude modulation

The modulation frequency range is DC to 100 kHz. Particularly noteworthy is the extremely low incidental phase modulation with AM, which plays an important role in AM sensitivity tests on FM receivers (RF frequency ≤3 GHz).

Frequency modulation

The modulation frequency range is DC to 2 MHz. The maximum selectable deviation for modulation frequencies above 500 kHz linearly decreases to 25% at 2 MHz. In the FM DC mode, extremely high carrier frequency accuracy is ensured through the use of a novel control circuit. There is virtually no drift. This characteristic allows the digital signalling of receivers also by means of analog frequency modulation.

Phase modulation

Phase modulation ranges from DC to 100 kHz. 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.

Pulse modulation

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 SME an ideal choice for radar applications. The pulse generator option allows pulsed signals to be produced independent of an external source.

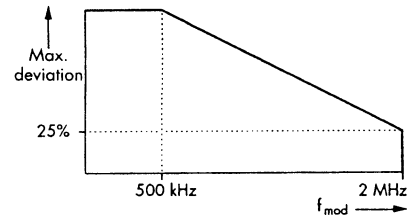
Analog modulation sources

Three optional modulation sources are available in addition to the fixed-frequency LF generator provided as standard:

- LF generator
- Multifunction generator
- Pulse generator

The **LF generator** is a synthesizer up to 500 kHz. In addition to sinewave, squarewave and triangular signals, it also supplies a noise signal. If two LF generators are provided in the unit, multitone signals can be generated internally.

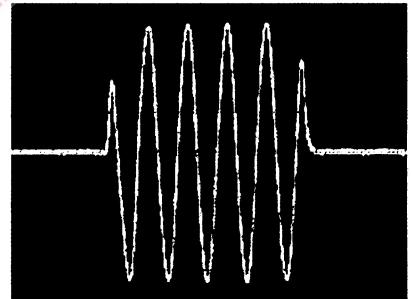
The **multifunction generator** produces sinewave and noise signals up to 1 MHz, triangular, sawtooth and squarewave signals up to 50 kHz



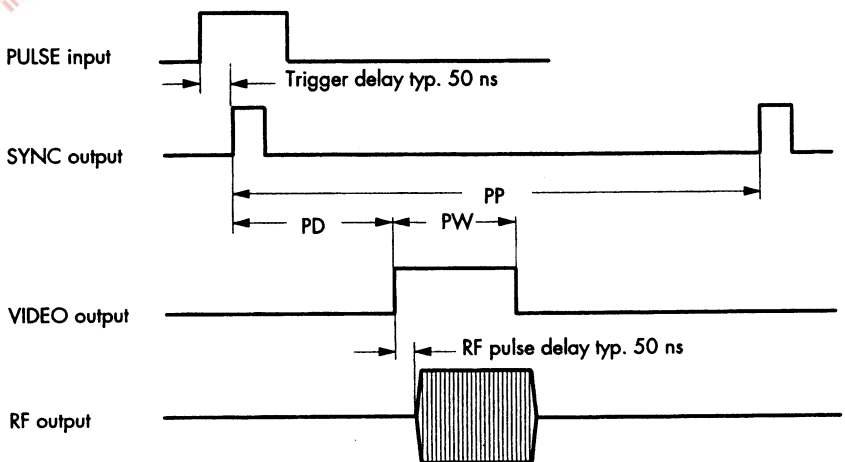
Adjustable progress of max. deviation at FM

and, in addition, stereo multiplex and VOR/ILS modulation signals. The multifunction generator option makes the SME suitable even for highly demanding measurements on FM stereo and navigation receivers.

The **pulse generator** permits the pulse repetition period, pulse width and pulse delay to be set with high accuracy and resolution. Single and double pulses required for radar receiver testing are generated.



Pulse modulation of 50-MHz carrier



The pulse generator option enables the pulse delay PD, pulse width PW and pulse repetition period PP to be set with high accuracy and resolution

State-of-the-art technology ...

Simultaneous modulation

... is required for simulating the complex signals used in modern communications and radar systems. The SME is capable of simultaneous DM, AM, FM (ϕM) and pulse modulation.

On a digitally modulated signal, for example, pulse modulation may be used to generate power bursts synchronous to the data signal in line with the TDMA structure used in today's networks. At the same time, Doppler shifts can be simulated by means of FM DC, and fading superimposed by AM DC.

Of the digital modulation (DM) modes, GMSK, GFSK, FSK, 4FSK, FFSK, QPSK, O-QPSK, $\pi/4$ -QPSK or $\pi/4$ -DQPSK may be selected.

With AM and FM, multitone modulation can be effected either by means of an internal and an external modulation signal or by means of two internal modulation signals (FM only).

Excellent RF characteristics for unambiguous results

To measure critical receiver characteristics such as sensitivity or adjacent-channel selectivity, exacting demands are made on the spectral purity and level accuracy of the test signal. With respect to these characteristics, the SME ranks among the top units available on the market.

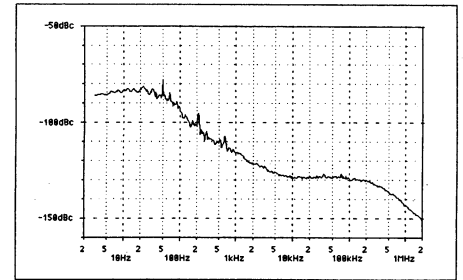
SSB phase noise at 20 kHz from a 1-GHz carrier is -130 dBc; non-harmonic spurs are below -80 dBc. Level setting in the range up to 2 GHz is accurate to 0.5 dB even for extremely small levels down to -127 dBm. Attenuator resettability is 0.01 dB.

Minimum RF leakage

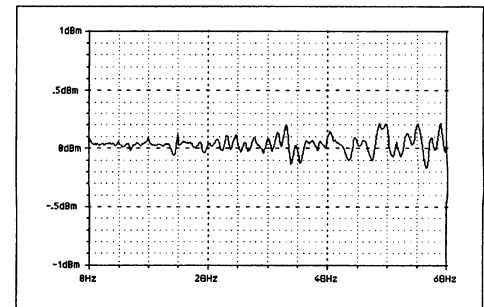
Measurements on high-sensitivity receivers such as radiopagers require signal sources with extremely high RF shielding. Elaborate shielding measures keep radiated interference on the SME to a minimum, ie $<0.1 \mu V$, induced in a two-turn loop 25 mm in diameter in the immediate vicinity of the instrument.

Modulation	AM	FM (ϕM)	Pulse	DM
AM	TT	●	●	●
FM (ϕM)	●	TT	●	●
Pulse	●	●	-	●
DM	●	●	●	-

Combination of modulation modes (TT = two-tone modulation)



Typical SSB phase noise at 1 GHz (CW)



Typical level frequency response at 0 dBm

... designed for great ease of operation

Low settling times for frequency and level

Today's applications in high volume production or ATE systems with complete test runnings in seconds require lowest frequency and level settling times to be competitive and ensure maximum throughput.

Option SM-B50 (not available for SME03G) reduces these settling times by factor 5 compared to a standard SME. Equipped with this option SME becomes one of the fastest signal generators on the market.

Convenient sweeps by means of list mode

In addition to the standard RF, AF and level sweeps, the SME offers a fast and highly flexible sweep function referred to as list mode (not SME03E). In this mode, frequency and level settings are made by means of values stored in lists which may contain up to 2000 pairs of frequency and level. This mode allows the frequency response of cable connections, amplifiers, TEM cells, etc in EMC measurements to be compensated already in the signal generator. Complicated external level controls or test routines are superfluous.

The setting time in the list mode is below 500 μ s. The list mode may be executed either automatically with presettable dwell time, in single-step operation, or by means of external triggering. The latter allows the control of frequency hopping signals. The modulation settings will not be changed by the list mode, ie this mode can be used with modulated signals of any type.

Useful extra facilities

Memory sequence for automatic sequence control

For standard measurement series and for recurring 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 sequence can be started.

External triggering

In addition to automatic control, the list mode, memory sequence, RF, LF and level sweep functions may also be triggered by an external signal. This facility enables synchronous operation with other units.

Compensation of external frequency response

The frequency response of external cables can be compensated by entering level correction values for up to 160 frequency points. The correction values for the frequencies between these points are determined by means of interpolation. The frequency response correction will be active in any operating mode, also during sweeps.

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 multi-function keys and a variety of special functions.

But not with the SME: operation is extremely easy thanks to a well thought-out operating concept featuring a large LCD display and menu guidance. All parameters and conditions selectable for a specific function are logically arranged in a single display. Looking up functions in a manual is a thing of the past.

The IEC/IEEE bus commands are in line with SCPI guidelines.

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 the 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 built-in test equipment, the SME provides these data without any extra equipment required.

Self-test for enhanced reliability

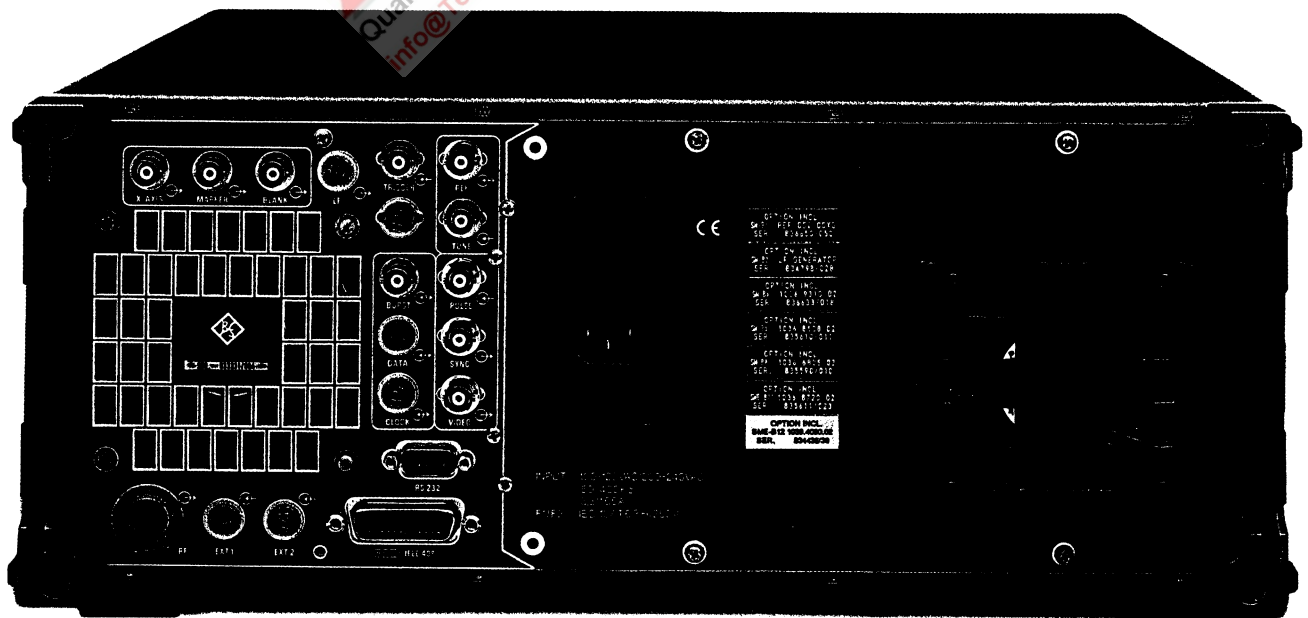
The signal generator status is continuously monitored. The SME signals malfunctions and deviations from nominal values by means of a message on the display.

Built-in test equipment

The signal generator can be fully checked without any extra test equipment required and without opening the unit. There are 80 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-Z2) 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 SME is continuously checked through with the aid of this program. This ensures that an extremely reliable instrument tested over the entire temperature range will be supplied to the customer.

Rear panel of SME



Specifications

Frequency

Range	SME02	5 kHz to 1.5 GHz
	SME03E	5 kHz to 2.2 GHz
	SME03	5 kHz to 3 GHz
	SME03A	5 kHz to 3 GHz
	SME06	5 kHz to 6 GHz

Underrange

(specs not binding)	down to 1 kHz
Resolution	0.1 Hz
Setting time (to within $<1 \times 10^{-7}$ for $f > 130$ MHz and <73 Hz for $f < 130$ MHz)	
after IEC/IEEE-bus delimiter	<10 ms
SME03A, SME including option SM-B50	<3 ms
after trigger pulse in list mode	<500 μ s
Phase offset	adjustable in steps of 1°

Reference frequency

Aging (after 30 days of operation)	Standard	Option SM-B1
Temperature effect (0 °C to 55 °C)	1×10^{-6} /year	$<1 \times 10^{-9}$ /day
Warm-up time	2×10^{-6}	$<5 \times 10^{-8}$
Output for internal reference		10 min
Frequency	10 MHz	
Level (EMF, sinewave)	$1 V_{rms}$	
Source impedance	50 Ω	
Input for external reference		
Frequency	1 MHz to 16 MHz in steps of 1 MHz	
Permissible frequency error	3×10^{-6}	
Input level	$0.1 V_{rms}$ to $2 V_{rms}$	
Input impedance	200 Ω	
Electronic tuning (TUNE)	1×10^{-7} /V	
Input voltage range	0 V to ± 10 V	
Input impedance	10 k Ω	

Spectral purity

Spurious signals	
Harmonics	
level ≤ 10 dBm ¹⁾	≤ -30 dBc
level without overrange	≤ -26 dBc
Subharmonics	
f < 1.5 GHz	none
f > 1.5 GHz	≤ -40 dBc
f > 3 GHz	≤ -34 dBc
Nonharmonics at	
>5 kHz from carrier	
f < 1.5 GHz	≤ -80 dBc,
	≤ -66 dBc for digital modulation
f > 1.5 GHz	≤ -74 dBc,
	≤ -60 dBc for digital modulation
f > 3 GHz	≤ -68 dBc,
	≤ -54 dBc for digital modulation

Broadband noise for CW¹⁾

at >10 MHz from carrier,	
1-Hz bandwidth	
f ≤ 3 GHz	≤ -140 dBc (typ. ≤ -145 dBc)
f > 3 GHz	≤ -134 dBc (typ. ≤ -139 dBc)

SSB phase noise 20 kHz from carrier

at 1-Hz bandwidth, FM/ ϕ M	
deviation $<5\%$ of maximum deviation	
f = 6 GHz	≤ -110 dBc
f = 3 GHz	≤ -116 dBc
f = 2 GHz	≤ -120 dBc
f = 1 GHz	≤ -126 dBc
f = 500 MHz	≤ -132 dBc
f = 250 MHz	≤ -137 dBc
f = 125 MHz	≤ -140 dBc
f < 93.75 MHz	≤ -129 dBc

Residual FM, rms (f = 1 GHz)

0.3 kHz to 3 kHz (CCITT)	<1 Hz
0.03 kHz to 20 kHz	<4 Hz
Residual AM, rms (0.03 kHz to 20 kHz) ¹⁾	$<0.02\%$

Level

Range	-144 dBm to +13 dBm
Overrange (specs not binding)	up to 16 dBm
Resolution	0.1 dB
Total error for levels > -127 dBm ¹⁾	
f < 2 GHz	<0.5 dB
f > 2 GHz to 4 GHz	<0.9 dB
f > 4 GHz	<1.2 dB

Level flatness at 0 dBm ¹⁾	<1 dB
f ≤ 3 GHz	<1 dB
f > 3 GHz	<1.5 dB
Output impedance	50 Ω

VSWR ¹⁾	f ≤ 3 GHz	3 GHz < f ≤ 5 GHz	f > 5 GHz
Level >0 dBm	<2	<2	<2
Level >0 dBm and option SM-B9 fitted (SME06)	<2	<2	<2.5
Level ≤ 0 dBm	<1.5	<2	<2

Setting time (IEC/IEEE bus) with electronic level setting	<25 ms
SME03A, SME including option SM-B50	<10 ms
Non-interrupting level setting (ATTENUATOR MODE FIXED)	
Setting range	<2 ms
Rise/fall time	0 dB to 20 dB
	<10 μ s

Setting range	0 dB to 20 dB
Rise/fall time	<10 μ s

Overvoltage protection

protects the unit from externally applied RF power (50- Ω source) and DC voltages	
Max. RF power	50 W (SME02, SME03/A/E)
	1 W (SME06)
Max. DC voltage	35 V (SME02, SME03/A/E)
	0 V (SME06)

Simultaneous modulation

any combination of AM, FM (ϕ M), pulse modulation and DM (DM = FSK, 4FSK, FFSK, GFSK, GMSK or QPSK)	
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Amplitude modulation

Operating modes	internal, external AC/DC
Modulation depth	0 % to 100 %
	modulation depths meeting AM specifications linearly decrease on increasing the level from 7 dBm to 13 dBm; a status message will be output if the modulation depth is too great
Resolution	0.1 %
Setting error at 1 kHz (m $<80\%$) ¹⁾	$<4\%$ of reading $\pm 1\%$
AM distortion at 1 kHz ¹⁾ 2)	
m = 30 %	$<1\%$
m = 80 %	$<2\%$

Modulation frequency range	DC to 100 kHz
Modulation frequency response (m = 60 %) ¹⁾	
20 Hz (DC) to 50 kHz	<1 dB, typ. 0.3 dB

SME06:	
20 Hz (DC) to 50 kHz	<1 dB (f ≤ 3 GHz)
20 Hz (DC) to 10 kHz	<1 dB (f > 3 GHz)

Incidental ϕ M with 30 % AM, AF = 1 kHz	<0.1 rad (f ≤ 3 GHz)
	<1 rad (f > 3 GHz)

EXT1 modulation input

Input impedance	>100 k Ω
Input voltage for selected modulation depth	$1 V_p$ (high/low indication for inaccuracy $>3\%$)

Frequency modulation

Operating modes	with option SM-B5
	internal, external AC/DC, two tone with two separate channels FM1 and FM2

Max. deviation at carrier frequency	
<130 MHz	500 kHz
130 MHz to 187.5 MHz	125 kHz
187.5 MHz to 375 MHz	250 kHz
375 MHz to 750 MHz	500 kHz
750 MHz to 1500 MHz	1 MHz
1500 MHz to 3000 MHz	2 MHz
3000 MHz to 6000 MHz	4 MHz

Frequency response (sinewave)
 up to 100 kHz <0.3 dB
 up to 1 MHz <0.5 dB
 Distortion (20 Hz to 100 kHz) <0.1 % (level >0.5 V)
 Open-circuit voltage 1 mV_p to 4 V_p (R_{out} = 10 Ω, R_L >200 Ω)
 Resolution 1 mV
 Setting error at 1 kHz 1 % + 1 mV
 Frequency setting time <10 ms (after receipt of last character from IEC/IEEE bus)

Stereo multiplex signal
 Stereo operating modes option SM-B6
 R, L, R = L, R = -L, ARI (pilot tone or MPX signal can be connected to LF socket)

Frequency range of L, R signal 0.1 Hz to 15 kHz
 Preemphasis 50 μs, 75 μs
 Pilot-tone frequency 19 kHz ±1 Hz
 Pilot-tone phase 0° to 360°
 Resolution 0.1°
 Stereo separation >60 dB
 Distortion <0.1 % (L, R = 1 kHz)
 Carrier suppression (38 kHz) >65 dB
 Settings selectable for ARI³⁾

(ARI = broadcast information for motorists)
 Area identification A, B, C, D, E, F
 Traffic announcement identification on/off
 Additional signals (RDS, RDS+ARI) application via EXT1 input

VOR modulation signal¹⁾
 Settings option SM-B6
 30 Hz (VAR, REF)/9.96-kHz FM carrier, FM deviation, COM/ID tone
 Phase 0° to 360°
 Phase resolution 0.01°
 Bearing error (RF output, 108 MHz to 118 MHz) <0.05°
 FM error (deviation 480 Hz) <1 Hz

ILS modulation signal¹⁾
 Settings option SM-B6
 90-Hz, 150-Hz tone, COM/ID tone, marker beacon
 DDM setting range 0 to ±0.8
 DDM resolution 0.0001
 DDM error (RF output) <0.0004 + 2% of DDM reading
 Localizer (108 MHz to 112 MHz) <0.0008 + 2% of DDM reading
 Glideslope (329 MHz to 335 MHz)

Pulse generator
 Operating modes option SM-B4
 single pulse, delayed pulse, double pulse
 Active trigger edge positive or negative
 Pulse repetition period 100 ns to 85 s
 Resolution 5-digit, min. 20 ns
 Accuracy same as for reference frequency
 Pulse width 20 ns to 1 s
 Resolution 4-digit, min. 20 ns
 Accuracy 5 % of reading ±5 ns
 Pulse delay 40 ns to 1 s
 Resolution 4-digit, min. 20 ns
 Accuracy 5 % of reading -10 ns to +20 ns
 Double pulse 60 ns to 1 s
 Resolution 4-digit, min. 20 ns
 Accuracy 5 % of reading -10 ns to +20 ns
 Trigger delay typ. 50 ns

PULSE modulation input
 Input level TTL (HCT)
 Input impedance 50 Ω or 10 kΩ
 Sync output TTL level (HC), 40 ns pulse width
 Video output TTL level (HC)

Sweep
 RF sweep, AF sweep digital, in discrete steps
 Operating modes AF sweep with option SM-B2 or -B6
 automatic, single-shot, manual or externally triggered, linear or logarithmic

Sweep range and step width (lin) freely selectable
 step width (log) 0.01 % to 100 %
 Level sweep automatic, single-shot, manual or externally triggered, logarithmic
 Operating modes

Sweep range 0.1 dB to 20 dB
 Step width 0.1 dB to 20 dB
 Step time 10 ms to 5 s
 SME03A, SME including option SM-B50
 Resolution 2 ms to 5 s
 Markers 0.1 ms
 3, freely selectable
 MARKER output signal TTL/HC logic signal, selectable polarity
 0 V to 10 V
 X output TTL/HC logic signal, selectable polarity
 BLANK output signal

List mode (not SME03E) frequency and level values can be stored in a list and will be set in an extremely short time; permissible level variation: 20 dB
 Operating modes automatic, single-shot, manual, externally triggered
 2000

Max. number of channels SME03A, SME including option SM-B50
 4000
 Step time 1 ms to 1 s
 Resolution 0.1 ms

Memory for instrument settings
 Storable settings 50
 Memory sequence modes automatic, single-shot, manual or externally triggered
 Step time 50 ms to 60 s
 Resolution 1 ms

Remote control
 System IEC 625 (IEEE 488)
 Instruction set SCPI 1993.0
 Connector 24-contact Amphenol
 IEC/IEEE-bus address 0 to 30
 Interface functions SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, CO

General data

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

Electromagnetic compatibility

Standards met German Postal Decree 243/1991, EN 55011 (VDE 0875 T11), class B VDE 0875, interference suppression level K, MIL-STD 461 B
 - RE 02 radiated emissions
 - CE 03 conducted emissions
 - CS 01/02 conducted susceptibility
 <0.1 μV (induced in a two-turn loop 25 mm in dia at a distance of 25 mm from any surface of the enclosure)
 10 V/m

RF leakage (f < 1 GHz)

Radiated susceptibility

Ambient conditions
 Operating temperature range 0 °C to 55 °C⁴⁾
 Storage temperature range -40 °C to +70 °C
 Humidity DIN IEC 68-2-30, +40 °C

Mechanical stress

Shock to MIL-STD 810 D, 40 g shock spectrum
 Vibration, sinewave to DIN IEC 68-2-6, 5 Hz to 55 Hz
 Vibration, noise 10 m/s² rms, 10 Hz to 300 Hz

Dimensions (W x H x D) 435 mm x 192 mm x 460 mm

Weight 25 kg for fully equipped unit

Certified Quality System
ISO 9001
 DQS REG. NO 1954

Ordering information

Order designations

Signal Generator	SME02	1038.6002.02
	SME03	1038.6002.03
	SME03A	1038.6002.53
	SME03E	1038.6002.13
	SME06	1038.6002.06

Recommended extras

19" Rack Adapter	ZZA-94	0396.4905.00
Service Kit	SM-Z2	1039.3520.02
Trolley	ZZK-1	1014.0510.00
Transit Case	ZZK-944	1013.9366.00
SME Service Manual		1039.1856.24

Accessories supplied

power cable, operating manual

Options

(for possible combinations see page 3)

Reference Oscillator OCXO	SM-B1	1036.7599.02
LF Generator	SM-B2	1036.7947.02
Pulse Modulator for SME02 ⁵⁾	SM-B3	1036.6340.02
SME03/A/E ⁵⁾	SM-B8	1036.6805.02
SME06 ⁵⁾	SM-B9	1039.5100.02
Pulse Generator (only with option SM-B3, SM-B8 or SM-B9)	SM-B4	1036.9310.02
FM/ϕM Modulator	SM-B5	1036.8489.02
Multifunction Generator	SM-B6	1036.7760.02
DM Coder	SME-B11	1036.8720.02
DM Memory Extension (8 Mbit)	SME-B12	1039.4090.02
FLEX Protocol	SME-B41	1039.5645.02
POCSAG Protocol	SME-B42	1039.5745.02
REFLEX TM Protocol	SME-B43	1039.5797.02
Fast CPU	SM-B50	1104.8410.02
Rear Connectors for RF and AF	SME-B19	1039.3907.02

- 1) Does not apply to non-interrupting level setting (ATTENUATOR MODE FIXED and USER CORR).
- 2) Applies to levels ≤ 7 dBm.
- 3) In the ARI mode, L = R = OFF.
- 4) Contrast of LCD display degraded at high temperatures.
- 5) Retrofit by authorized service centers only.

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