SK4M spectrum analyzers

Features

— Operating frequency range from 100 Hz to 20/50 GHz

— Third-order intercept (TOI) level > +20 dBm

— Low inherent noise < −165 dBm/Hz

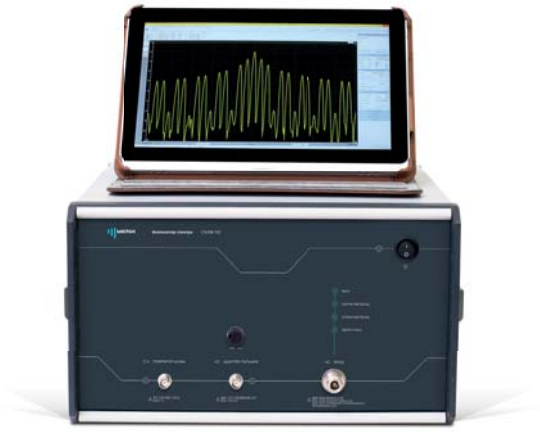
— Low phase noise < −120 dBc/Hz at 100 kHz offset

— Built in reference oscillator with high frequency setting accuracy $\pm 1 \times 10^{-7}$

— Selective and FFT filters 1 Hz to 10 MHz

— Built-in input attenuator and temperature-stabilized preselector

— Built-in interruptible low-noise amplifier of 100 Hz ... 3.2 GHz range



Included in State Register of Measuring Instruments

Description

SK4M spectrum analyzers are designed to measure level and frequency of harmonic components of periodic signal spectrum, and spectral power density of stationary random processes. Use of linear path with wide dynamic range designed in superheterodyne circuit with synthesized heterodynes, in combination with digital processing unit for intermediate-frequency signal provides solution for a wide variety of tasks arising in analyze, development, manufacturing and operation of radio electronic devices.

SK4M products include two types of analyzers with different operating frequency ranges:

- SK4M-18: 100 Hz to 20 GHz;
- SK4M-50: 100 Hz to 50 GHz.

SK4M is controlled by external PC with Graphit SK4M software installed. The device and PC are communicating via Ethernet. Multi-channel synchronization system provides joint operation of the analyzer and other devices. Control of SK4M with SCPI commands provides integration of the device with automated instrumentation systems. Depending on combination of hardware options, spectrum analyzers are subdivided into versions. You may add options to the selected version of the device, which provides extension of device functionality.

Features and options

Output microwave connector type
The following options of SK4M spectrum analyzer define the type of input microwave connector of measurement module:

- 11R option — type N connector (female);
- 13N option — 3.5 mm NMD connector (male);
- 05N option — 2.4 mm NMD connector (male). Available for SK4M-50 only.

Built-in interruptible low-noise amplifier (MUA option)
MUA is a hardware option. The interruptible low-noise analyzer is installed at the device input and increases analyzer sensitivity up to −166 dBm/Hz. In addition, this option extends capabilities for measurement of noise figure of radio equipment.

Built-in interruptible power adapter

(APA option)
APA is a hardware option. Analyzer input is fitted with interruptible power adapter that supplies voltage up to ±20 V and current up to 500 mA to the analyzed amplifiers and converters via central conductor of input RF connector.

Built-in interruptible blocking capacitor (RKA option)
RKA is a hardware option. Interruptible blocking capacitor installed at analyzer input provides protection for input circuits of the device against voltage up to 20 VDC, which provides easier tuning of active microwave devices. The blocking capacitor increases minimum operating frequency of the analyzer up to 20 MHz.

Noise figure measurement (IKSH option)
IKSH is a software option. The option provides measurement of noise figure and transmission coefficient using modulation technique. To use this option, noise generator (not supplied) is required and MUA option is recommended.

Phase noise measurement (IFSH option)
IFSH is a software option. The option allows to measure phase noise of harmonic signal sources.

Software capabilities
Graphit SK4M software provides the following advantages:

- user-friendly interface;
- flexible reporting system;
- saving/downloading profiles for measuring circuits;
- formula editor for complicated mathematical operations;
- unlimited number of measurement traces and memory traces;
- adjustable marker system.

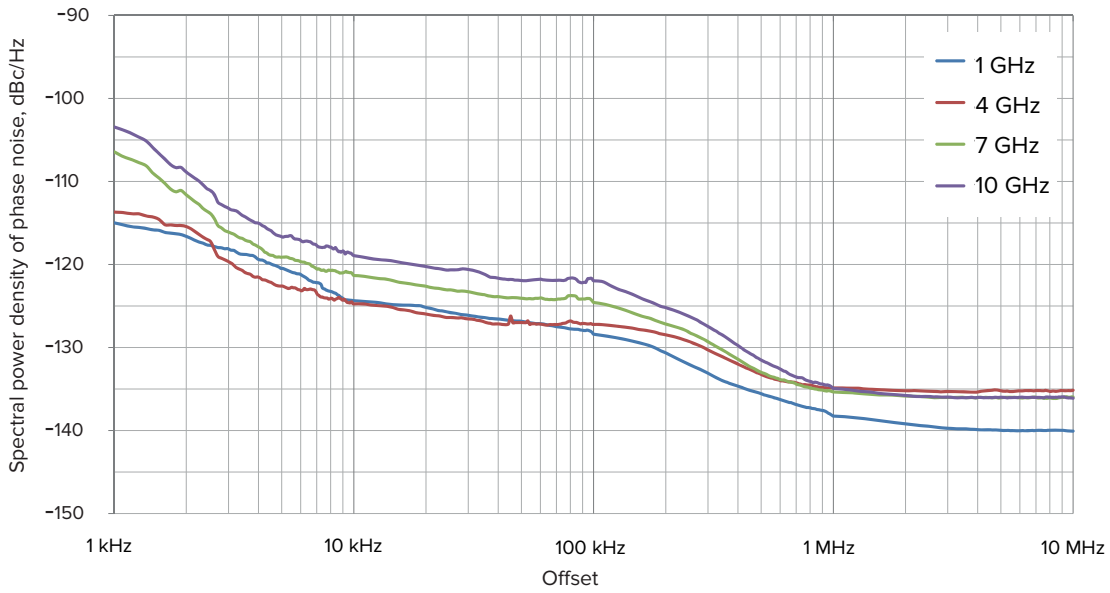
Specifications

Operating frequency range		
SK4M-18		
with 11R option	100 Hz ... 18 GHz	
with 13N option	100 Hz ... 20 GHz	
SK4M-50		
with 05N option	100 Hz ... 50 GHz	
Maximum allowed relative frequency error of internal reference oscillator for one year	$\pm 1 \times 10^{-7}$	
Phase-noise level at 1 GHz with frequency offset	Guaranteed value	Typical value
10 Hz	—	−60 dBc/Hz
100 Hz	—	−95 dBc/Hz
1 kHz	−110 dBc/Hz	−115 dBc/Hz
10 kHz	−115 dBc/Hz	−120 dBc/Hz
100 kHz	−120 dBc/Hz	−125 dBc/Hz
1 MHz	−135 dBc/Hz	−150 dBc/Hz
10 MHz	−145 dBc/Hz	−160 dBc/Hz
Residual frequency modulation at 1 GHz	< 1 Hz/sec	
Selective filters		
Passbands at −3 dB	1 Hz to 10^3 Hz with 1 Hz/2 Hz/3 Hz/5 Hz/7 Hz step, 10^3 Hz to 10^7 Hz with 1 Hz/3 Hz step, Special 140 Hz and 6366 Hz filters	
Maximum allowed absolute switching error of intermediate-frequency filter relative to reference band of 3 MHz intermediate-frequency filter	Guaranteed value	Typical value
1 Hz to 10 MHz	±0.1 dB	±0.05 dB
Maximum allowable relative setting error of intermediate-frequency filter bands at −3 dB		
1 Hz to 1 kHz	±5%	±1%
3 kHz to 300 kHz	±10%	±6%
1 to 3 MHz	±15%	±12%
10 MHz	—	±15%
Signal level measurement range	from −130 to +30 dBm	
Maximum input signal level		
direct voltage	0 V (±20 V for closed input)	
sine-wave signal (input att. = 0 dB)	+20 dBm	
sine-wave signal (input att. > 10 dB)	+30 dBm	
Maximum allowable absolute power measurement error[1] at 100 MHz of −30 dBm level	Guaranteed value	Typical value
	±0.2 dB	±0.1 dB
Level measurement error due to scale nonlinearity at fixed frequency[2] of 100 MHz	±0.1 dB	±0.02 dB
Maximum allowable absolute error of reference level setting at fixed frequency of 100 MHz	±0.2 dB	±0.1 dB

Maximum frequency response flatness relative to reference frequency of 100 MHz for 10 dB input attenuator		
100 Hz to 19 MHz	±1 dB	±0.5 dB
19 MHz to 3.2 GHz	±0.75 dB	±0.5 dB
3.2 to 9 GHz	±1.5 dB	±1.0 dB
9 to 20 GHz	±2.0 dB	±1.5 dB
20 to 50 GHz	—	±2.5 dB
Maximum allowable level measurement error due to switching input attenuation at fixed frequency of 100 MHz	±0.3 dB	±0.1 dB
Average level of inherent noise normalized to 1 Hz band		
Without MUA option		
10 kHz to 20 MHz	−140 dBm	−155 dBm
20 MHz to 3.2 GHz	−148 dBm	−153 dBm
3.2 to 9 GHz	−138 dBm	−142 dBm
9 to 20 GHz	−133 dBm	−138 dBm
20 to 26.5 GHz	—	−130 dBm
26.5 to 40 GHz	—	−125 dBm
40 to 44 GHz	—	−125 dBm
44 to 50 GHz	—	−125 dBm
With MUA option		
20 MHz to 3.2 GHz	−164 dBm	−167 dBm
3.2 to 9 GHz	−162 dBm	−166 dBm
9 to 20 GHz	−160 dBm	−164 dBm
20 to 26.5 GHz	—	−155 dBm
26.5 to 40 GHz	—	−150 dBm
40 to 44 GHz	—	−150 dBm
44 to 50 GHz	—	−150 dBm
Third-order intermodulation distortion		
Without MUA option[3]		
20 MHz to 3.2 GHz	15 dBm	20 dBm
3.2 to 20 GHz	15 dBm	20 dBm
20 to 50 GHz	—	20 dBm
With MUA option[4]		
20 MHz to 3.2 GHz	−20 dBm	−10 dBm
3.2 to 20 GHz	−20 dBm	−10 dBm
20 to 50 GHz	—	−10 dBm
Interference level due to second-order harmonic distortions		
Without MUA option[5]		
2 to 9 GHz	90 dBm	100 dBm
10 to 25 GHz	—	100 dBm
With MUA option[6]		
2 to 9 GHz	−5 dBm	5 dBm
10 to 25 GHz	—	5 dBm
Rated input impedance	50 Ohm	
Input VSWR in frequency range from 10 MHz to 20 GHz (input att. = 10 dB)	< 2.0	

[1] For 10 dB input attenuator and 10 kHz intermediate frequency filter. — [2] For 10 dB input attenuator, at input signal level from 10 dBm to -90 dBm. — [3] For two −10 dBm signals with frequency spacing more than 5 times intermediate-frequency filter bandwidth, for 0 dB input attenuator. — [4] For two −30 dBm signals with frequency spacing more than 5 times intermediate-frequency filter bandwidth, for 0 dB input attenuator. — [5] Expressed as second-order intercept (SHI), for 0 dB input attenuator, at −10 dBm input signal level. — [6] Expressed as second-order intercept (SHI), for 0 dB input attenuator, at −50 dBm input signal level.

Phase noise



Ordering information

Basic supply set

1) Spectrum analyzer SK4M-18/50. 2) Ethernet cable. 3) Power cable. 4) Graphit SK4M software.
5) Operational documentation. 6) Carrying case.

Versions	
SK4M-18/1	Spectrum analyzer, 100 Hz ... 18 GHz with 11R option
SK4M-18/2	Spectrum analyzer, 100 Hz ... 18 GHz with 11R and APA options
SK4M-18/3	Spectrum analyzer, 100 Hz ... 18 GHz with 11R and MUA options
SK4M-18/4	Spectrum analyzer, 100 Hz ... 18 GHz with 11R and RKA options
SK4M-18/5	Spectrum analyzer, 100 Hz ... 18 GHz with 11R, APA and MUA options
SK4M-18/6	Spectrum analyzer, 100 Hz ... 18 GHz with 11R, MUA and RKA options
SK4M-18/7	Spectrum analyzer, 100 Hz ... 20 GHz with 13N option
SK4M-18/8	Spectrum analyzer, 100 Hz ... 20 GHz with 13N and APA options
SK4M-18/9	Spectrum analyzer, 100 Hz ... 20 GHz with 13N and MUA options
SK4M-18/10	Spectrum analyzer, 100 Hz ... 20 GHz with 13N and RKA options
SK4M-18/11	Spectrum analyzer, 100 Hz ... 20 GHz with 13N, APA and MUA options
SK4M-18/12	Spectrum analyzer, 100 Hz ... 20 GHz with 13N, MUA and RKA options
SK4M-50/1	Spectrum analyzer, 100 Hz ... 50 GHz with 05N option
SK4M-50/2	Spectrum analyzer, 100 Hz ... 50 GHz with 05N and MUA options
SK4M-50/3	Spectrum analyzer, 100 Hz ... 50 GHz with 05N and RKA options
SK4M-50/4	Spectrum analyzer, 100 Hz ... 50 GHz with 05N and APA options
SK4M-50/5	Spectrum analyzer, 100 Hz ... 50 GHz with 05N, MUA and RKA options
SK4M-50/6	Spectrum analyzer, 100 Hz ... 50 GHz with 05N, MUA and APA options
Software options	
IKSH[1]	Noise figure and transmission coefficient measurement
IFSH	Phase noise measurement of harmonic signal sources

[1] GSHM2 noise generator should be purchased and calibrated separately.

Ordering example

- Spectrum analyzer SK4M-18/12-IKSH — 1 pcs.
- Noise generator GSHM2-20B-13 – 1 pcs.
- Control and data display device PKU-11 — 1 pcs.