42

H5M noise figure analyzers

Features

- Operating frequency range from 10 MHz to 4/20 GHz
- Noise figure and transmission coefficient measurement
- Measurements of frequency conversion devices with fixed and external heterodyne
- Built-in temperature-stabilized preselector
- High-speed measurements
- External converters provide extended operating frequency range up to 50 GHz

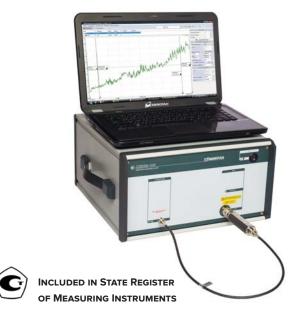
Description

H5M noise figure analyzers (IKSH) are designed to measure noise figure and transmission coefficient of receiving-amplifying devices. H5M operation principle is based on comparison of measured noise with noise of known intensity, generated by measuring noise generator (NG) characterized by excessive relative noise temperature (ERNT). Measurement is preceded by calibration to determine the characteristics of IKSH receive path, required for precise calculation of gain and noise figure of a measured device.

H5M noise figure analyzers include two device types that differ in operating frequency range:

- H5M-04: 10 MHz to 4 GHz;
- H5M-18: 50 MHz to 20 GHz;

H5M is controlled by external PC with Graphit H5M software installed. The device and PC are communicating via Ethernet. Multi-channel synchronization system provides joint operation of H5M series IKSH and other devices. Control of H5M with SCPI commands provides integration of the device with automated instrumentation systems. Depending on combination of hardware options, the noise figure analyzers are subdivided into versions. You may add hardware 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 H5M define the type of input microwave connector of measurement module:

- 11R option type N connector (female);
- 13N option 3.5 mm NMD connector (male).

Built-in controlled attenuator (ATA/70 option)

ATA/70 is a hardware option. Device input is fitted with 0 ... 70 dB electromechanical step attenuator with (10 dB step), which provides measurement of parameters of broadband amplifiers and converters with high gain.

Built-in power adapter (APA option)

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

Software capabilities

Graphit H5M software provides the following advantages:

- user-friendly interface;
- flexible reporting system;
- ERNT calibration of noise generator;
- saving/downloading profiles for measuring circuits;
- formula editor for complicated mathematical operations;
- unlimited number of memory traces.

Specifications

HSM-18 with 11R option	Operating frequency range		
with 11R option 50 MHz 18 GHz with 13N option 50 MHz 20 GHz 10 °	H5M-04 10 MHz 4 G		
with 13N option	H5M-18		
Maximum allowable relative frequency setting error 100 kHz, 10 MHz, 1 MHz, 3 MHz 100 kHz, 300 kHz, 1 MHz, 3 MHz 300 kHz, 100 kHz, 300 kHz, 10 MHz, 300 kHz, 100 kHz, 300 kHz, 10 MHz, 300 kHz, 300 k	with 11R option	50 MHz 18 GHz	
Nominal passbands at -3 dB	with 13N option	50 MHz 20 GHz	
Transmission coefficient measurement range -2030 dB Noise figure measurement range -2030 dB Noise figure measurement range -2030 dB For noise generator ERNT from 12 to 17 dB 24 dB For noise generator ERNT from 12 to 17 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ERNT from 20 to 22 dB 24 dB For noise generator ATA 40 dB 24 dB 24 dB For noise generator ATA 40 dB 24 dB 24 dB 24 dB For noise generator ATA 40 dB 24 d	Maximum allowable relative frequency setting error	±2 × 10 ⁻⁵	
Noise figure measurement range for noise generator ERNT from 4 to 7 dB 015 dB for noise generator ERNT from 20 to 22 dB 03 ∪ B Inherent noise figure, max Guaranteed value Typical value H5MM-04 8 dB 6 dB H5MM-04 8 dB 6 dB H5MM-04 8 dB 6 dB H5MM-18 - 13 dB 50 MHz to 3.2 GHz 9 dB 5 dB 3.2 to 16 GHz 8 dB 5 dB 18 to 20 GHz 11 dB 5 dB 18 to 20 GHz 11 dB 5 dB 18 to 20 GHz 10 dB 6 dB 18 to 20 GHz 10 dB 7 dB 18 to 20 GHz 10 dB 6 dB 18 to 20 GHz 10 dB 7 dB 18 MM-18 10 dB 7 dB 18 MB-18 10 dB 6 dB 18 MB-18 10 dB 7 dB 15 MHz to 4 GHz 10 dB 6 dB 3.2 to 16 GHz 10 dB 6 dB 3.2 to 16 GHz 12 dB<	Nominal passbands at −3 dB	100 kHz, 300 kHz, 1 MHz , 3 MHz	
for noise generator ERNT from 4 to 7 dB 0 15 dB for noise generator ERNT from 12 to 17 dB 0 24 dB for noise generator ERNT from 20 to 22 dB 0 30 dB Inherent noise figure, max Guaranteed value Typical value H5M-04 US dB 6 dB H5M-18	Transmission coefficient measurement range		
for noise generator ERNT from 12 to 17 dB	Noise figure measurement range		
For noise generator ERNT from 20 to 22 dB Inherent noise figure, max	for noise generator ERNT from 4 to 7 dB	0 15 dB	
Inherent noise figure, max	for noise generator ERNT from 12 to 17 dB	0 24 dB	
H5M-04	for noise generator ERNT from 20 to 22 dB	0 30 dB	
10 MHz to 4 GHz	Inherent noise figure, max	Guaranteed value	Typical value
H5M-18	H5M-04		
10 to 50 MHz to 3.2 GHz	10 MHz to 4 GHz	8 dB	6 dB
50 MHz to 3.2 GHz	H5M-18		
3.2 to 16 GHz	10 to 50 MHz	_	13 dB
11 dB	50 MHz to 3.2 GHz	9 dB	5 dB
18 to 20 GHz	3.2 to 16 GHz	8 dB	5 dB
Inherent noise figure for ATA/70 and/or APA option, max H5M-04 10 MHz to 4 GHz 10 dB 7 dB T5M-18 10 dB 6 dB 3.2 to 16 GHz 12 dB 7 dB 12 dB 7 dB 18 to 20 GHz 12 dB 7 dB 18 to 20 GHz 14 dB 8 dB 18 to 20 GHz 14 dB 8 dB 18 to 20 GHz 14 dB 8 dB 18 to 20 GHz 15 dB 18	16 to 18 GHz	11 dB	5 dB
H5M-04 10 MHz to 4 GHz 10 dB 7 dB H5M-18 50 MHz to 3.2 GHz 10 dB 6 dB 50 MHz to 3.2 GHz 12 dB 7 dB 16 to 18 GHz 12 dB 7 dB 18 to 20 GHz 14 dB 8 dB Maximum allowable absolute systematic noise figure measurement error ±0.1 dB ERNT calibration error of noise generator ±0.1 dB Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement¹ 0.06 dB Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable absolute systematic transmission coefficient measurement error ±0.06 dB Maximum allowable orot-mean-square deviation of random transmission coefficient measurement error² 0.06 dB Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option 0 70 dB Rated input impedance 50 Ohm Maximum operating power at microwave input for 0 dB high-frequency attenuator, min -30 dBm Microwave input VSWR, max 1 1.8 1.5 H5M-18 1 1 1 10 to 50 MHz 2.8 2.0 <td>18 to 20 GHz</td> <td>14 dB</td> <td>6 dB</td>	18 to 20 GHz	14 dB	6 dB
10 MHz to 4 GHz	Inherent noise figure for ATA/70 and/or APA option, max		
### H5M-18 50 MHz to 3.2 GHz	H5M-04	· · · · · · · · · · · · · · · · · · ·	
50 MHz to 3.2 GHz 10 dB 6 dB 3.2 to 16 GHz 12 dB 7 dB 16 to 18 GHz 12 dB 7 dB 18 to 20 GHz 14 dB 8 dB Maximum allowable absolute systematic noise figure measurement error ±0.1 dB ERNT calibration error of noise generator ±0.1 dB Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement¹ 0.06 dB Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² 0.06 dB Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option 0 70 dB Rated input impedance 50 Ohm Maximum operating power at microwave input for 0 dB high-frequency attenuator, min -30 dBm Microwave input VSWR, max 1.8 1.5 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	10 MHz to 4 GHz	10 dB	7 dB
12 dB	H5M-18	· · · · · · · · · · · · · · · · · · ·	
16 to 18 GHz 12 dB 7 dB 18 to 20 GHz 14 dB 8 dB Maximum allowable absolute systematic noise figure measurement error ±0.1 dB ERNT calibration error of noise generator ±0.1 dB Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement! 0.06 dB Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error ² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option 0 70 dB Rated input impedance 50 Ohm Maximum operating power at microwave input for 0 dB high-frequency attenuator, min -30 dBm Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	50 MHz to 3.2 GHz	10 dB	6 dB
18 to 20 GHz Maximum allowable absolute systematic noise figure measurement error ±0.1 dB ERNT calibration error of noise generator ±0.1 dB Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement¹ Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Maximum operating power at microwave input for 0 dB high-frequency attenuator, min —30 dBm Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 1.6 to 18 GHz 2.0 1.3	3.2 to 16 GHz	12 dB	7 dB
Maximum allowable absolute systematic noise figure measurement error ±0.1 dB ERNT calibration error of noise generator ±0.1 dB Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement 1 Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable absolute systematic transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable absolute systematic transmission coefficient measurement error 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB Maximum allowable root-mean-square deviation of random transmission coefficient 0.06 dB 0.06 dB 0.06 dB 0.06 dB 0.07 dB 1.5 dB 1.6 dB 1.7 dB 1.8 dB 1.9 dB 1.0 dB 1.	16 to 18 GHz	12 dB	7 dB
ERNT calibration error of noise generator Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement¹ Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance 50 Ohm Maximum operating power at microwave input for 0 dB high-frequency attenuator, min —30 dBm Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 1.6 to 18 GHz 2.0 1.3	18 to 20 GHz	14 dB	8 dB
Maximum allowable root-mean-square deviation of random error of inherent noise figure measurement¹ Maximum allowable absolute systematic transmission coefficient measurement error ±0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min —30 dBm Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 1.6 to 18 GHz 2.0 1.3	Maximum allowable absolute systematic noise figure measurement error	±0.1 dB	
Maximum allowable absolute systematic transmission coefficient measurement error #0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 1.4 1.6 to 18 GHz 2.0 1.3	ERNT calibration error of noise generator	±0.1 dB	
Maximum allowable absolute systematic transmission coefficient measurement error #0.15 dB Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 1.6 to 18 GHz 2.0 1.3	Maximum allowable root-mean-square deviation of random error of inherent noise figure	0.00 ID	
Maximum allowable root-mean-square deviation of random transmission coefficient measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 1.6 to 18 GHz 2.0 1.3	measurement ¹	0.06 dB	
Measurement error² Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min —30 dBm Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	Maximum allowable absolute systematic transmission coefficient measurement error	±0.15 dB	
Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option Rated input impedance Maximum operating power at microwave input for 0 dB high-frequency attenuator, min Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 1.4 1.6 to 18 GHz 2.0 1.3	Maximum allowable root-mean-square deviation of random transmission coefficient	0.06	٩D
Rated input impedance 50 Ohm Maximum operating power at microwave input for 0 dB high-frequency attenuator, min -30 dBm Microwave input VSWR, max 1.8 1.5 H5M-18 1.5 1.8 2.0 10 to 50 MHz 2.8 2.0 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	measurement error ²	0.06 as	
Maximum operating power at microwave input for 0 dB high-frequency attenuator, min -30 dBm Microwave input VSWR, max 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	Attenuation range of high-frequency attenuator with 10 dB step for ATA/70 option	0 70 dB	
Microwave input VSWR, max 10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	Rated input impedance	50 Ohm	
10 MHz to 4 GHz 1.8 1.5 H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	Maximum operating power at microwave input for 0 dB high-frequency attenuator, min		
H5M-18 10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	Microwave input VSWR, max		
10 to 50 MHz 2.8 2.0 50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	10 MHz to 4 GHz	1.8	1.5
50 MHz to 3.2 GHz 1.8 1.4 3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	H5M-18		
3.2 to 16 GHz 1.8 1.4 16 to 18 GHz 2.0 1.3	10 to 50 MHz	2.8	2.0
16 to 18 GHz 2.0 1.3	50 MHz to 3.2 GHz	1.8	1.4
16 to 18 GHz 2.0 1.3	3.2 to 16 GHz	1.8	1.4
		2.0	1.3
	18 to 20 GHz		

 $^{^{\}mbox{\tiny 1}}$ For averaging degree of 18 and selective filter bandwidth of 3 MHz.

 $^{^{\}rm 2}$ For averaging degree of 13 and selective filter bandwidth of 3 MHz.

44

Ordering information

Basic supply set

Noise figure analyzer

Noise figure analyzer supply set

1) Noise figure analyzer H5M-04/18. 2) Ethernet cable. 3) Power cable. 4) Graphit H5M software. 5) Operational documentation.

6) Carrying case. 7) Calibration certificate. 8) Power cable for noise generator.

Versions	
H5M-04/1	Noise figure analyzer, 0.01 4 GHz with 11R option
H5M-04/2	Noise figure analyzer, 0.01 4 GHz with 11R and ATA options
H5M-04/3	Noise figure analyzer, 0.01 4 GHz with 11R and APA options
H5M-04/4	Noise figure analyzer, 0.01 4 GHz with 11R, APA and ATA options
H5M-18/1	Noise figure analyzer, 0.01 18 GHz with 11R option
H5M-18/2	Noise figure analyzer, 0.01 18 GHz with 11R and ATA/70 options
H5M-18/3	Noise figure analyzer, 0.01 18 GHz with 11R and APA options
H5M-18/4	Noise figure analyzer, 0.01 18 GHz with 11R, APA and ATA/70 options
H5M-18/5	Noise figure analyzer, 0.01 20 GHz with 13N option
H5M-18/6	Noise figure analyzer, 0.01 20 GHz with 13N and ATA/70 options
H5M-18/7	Noise figure analyzer, 0.01 20 GHz with 13N and APA options
H5M-18/8	Noise figure analyzer, 0.01 20 GHz with 13N, APA and ATA/70 options

Ordering example

- Noise figure analyzer H5M-18/8 1 pcs.
- Control and data display device PKU-11-1 pcs.