HSA3000-R Series Spectrum Analyzer Technical Specifications

This chapter lists the technical specifications and general technical specifications of the spectrum analyzer. Unless otherwise stated, the technical specifications apply to the following conditions:

- The instrument has been preheated for 30 minutes before use.
- The instrument is in the calibration cycle and has been self-calibrated.

"Typical" and "nominal" for this product are defined as follows:

- Typical: Refers to the performance of the product under certain conditions.
- Nominal: Refers to the approximate value under product application process.

Characteristics	**Descriptions**			
Model	**HSA3036-R**	**HSA3075-R**	**HSA3140-R**	**HSA3200-R**
Frequency Range	9 kHz~3.6 GHz	9 kHz~7.5GHz	9 kHz~14.0 GHz	9 kHz~20.0 GHz
Frequency Resolution	1 Hz~5 MHz	1 Hz~5 MHz	1 Hz~5 MHz	1 Hz~5 MHz
Display average noise level	-165 dBm/Hz	-165 dBm/Hz	-165 dBm/Hz	-165 dBm/Hz
SSB Phase Noise	<-106 dBc/Hz	<-106 dBc/Hz	<-106 dBc/Hz	<-100 dBc/Hz
Third-order intercept (TOI)	+14 dbm	+14 dbm	+14 dbm	+14 dbm
Amplitude Accuracy	< 0.7 dB	< 0.7 dB	< 0.7 dB	< 0.7 dB
Tracking generator	100 kHz - 3.6 GHz	100 kHz - 7.5 GHz	--	--
Real-time bandwidth analysis	100MHz			
Real-time analysis of spurious-free dynamic range	60 dB			
100% POI Minimum	6.25 μs			

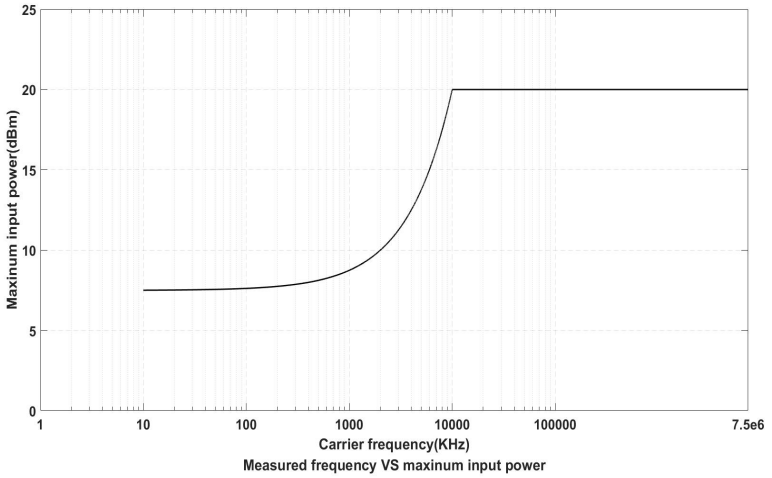
Signal Duration		
Real-time spectrum view	Probability Density Spectrum, Waterfall Plot, 3D Spectrum, Time-Power Spectrum	
Vector Network Analysis	Vector S11, Vector S21	--
Network Analysis Dynamic Range	90 dB	--
Cable Fault Location	Cable Fault Location	--
Touch Control	Multitouch, supports mouse and keyboard	
Advanced Measurement Functions	CHP, ACPR, OBW, CNR, Harmonic, Monitor, CCDF, SEM, TOI	
Modulation Analysis	AM, FM, PM	
Communication Port	LAN, USB Device, USB Host	
Remote Control Capability	SCPI/Labview/IVI based on USB-TMC/VXI-11/Socket/Telnet	
Remote Control	NI-MAX, Web Browser, Spectrum Vision software	

Spectrum Analyzer Mode

Characteristics	**Descriptions**			
Model	**HSA3036-R**	**HSA3075-R**	**HSA3140-R**	**HSA3200-R**
Frequency				
Frequency range	9 kHz~3.6 GHz	9 kHz~7.5 GHz	9 kHz~14.0 GHz	9 kHz~20.0 GHz
Frequency resolution	1Hz			
Span				
Span range	0 Hz, 100 Hz to the maximum frequency of the instrument			

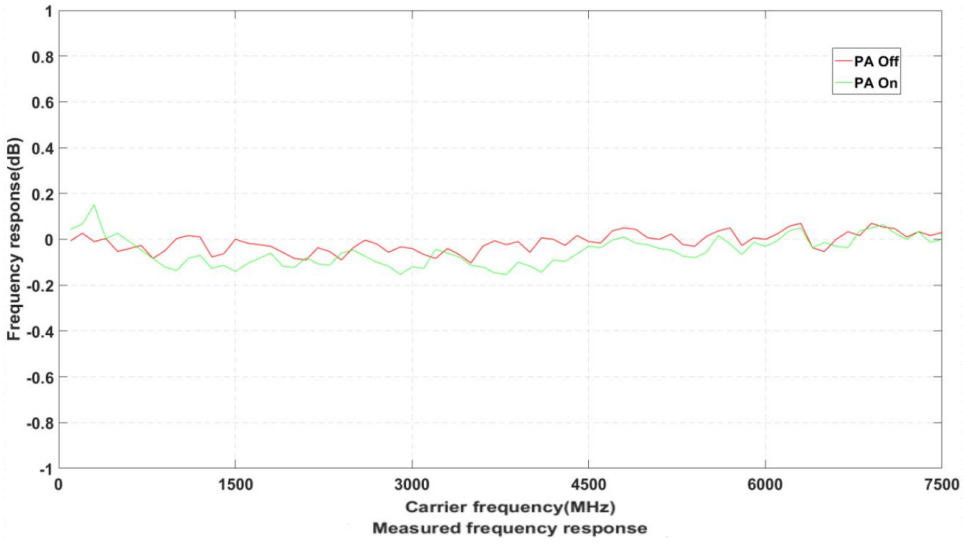
Span accuracy	± Span / (span points - 1)
Internal Reference Source	
Reference Frequency	10.000000 MHz
Reference Frequency Accuracy	± [(Time since last adjustment × Frequency aging rate) + Temperature stability + Initial accuracy]
Initial Accuracy	<1 ppm
Temperature Stability	<1 ppm, 0℃~50℃
Frequency Aging Rate	<0.5 ppm / first year, 3.0 ppm / 20 year
Marker	
Frequency Resolution	Span /(Screen resolution -1)
Frequency Uncertainty	± [Marker reading × Reference frequency accuracy + 1% × Sweep width + 0.5 × Cursor frequency resolution + 1 Hz]
Type	Normal, Delta, Stable
Function	Noise Marker, N dB Bandwidth, Frequency counter
Frequency Counter Resolution	1 Hz
Frequency Counter Uncertainty	±[Marker frequency reading × Reference frequency accuracy + Frequency counter resolution]
Bandwidth	
RBW Resolution (-3dB)	1 Hz ~ 5 MHz, step by 1-3-5-10
Discrimination Filter Shape Factor	< 5:1(60 dB:3 dB) (nom.)
RBW Uncertainty	< 5% (nom.)
Video Bandwidth (-3dB)	10 Hz~5 MHz, step by 1-3-5-10
Sweep and Trigger	

Sweep Time	29.688 us to 3000 s
Sweep Mode: RBW-Sweep	30 kHz ~ 5 MHz
Sweep Mode: RBW-FFT	1 Hz ~ 10 kHz
Sweep Rules	Continuous/Single
Trigger Source	Free, Video, External
External Trigger Setting	Level (5V TTL), Rising / Falling
Amplitude and Level	
Amplitude Measurement Range	DANL to +10 dBm, 100 kHz~1 MHz, preamp off DANL to +20 dBm, 1 MHz~7.5 GHz, preamp off
Reference Level	-120 dBm to +30 dBm, Step by 0.1 dB
Preamplifier	20 dB (nom.)
Input Attenuation	0 ~ 40 dB, Step by 1 dB
Maximum Input DC Voltage	+/- 50 VDC
Maximum Continuous Wave Radio Frequency Power	+20dBm(100mV)

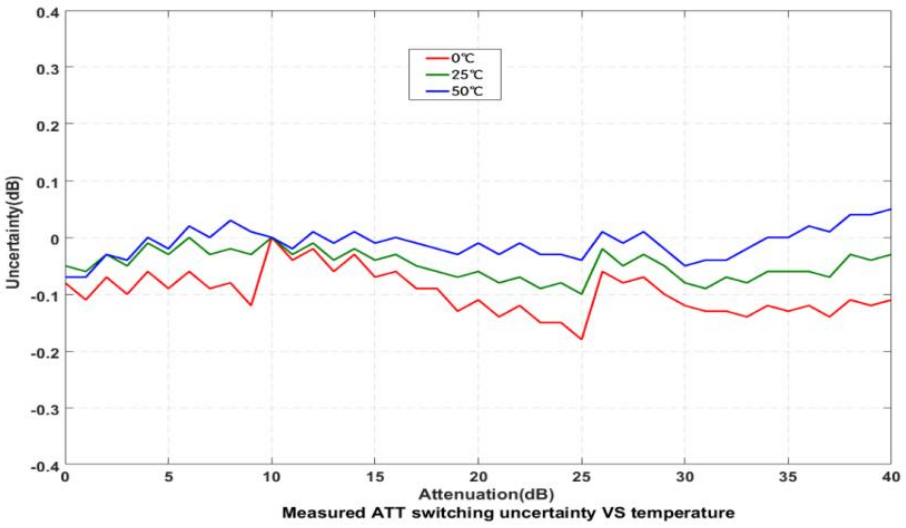
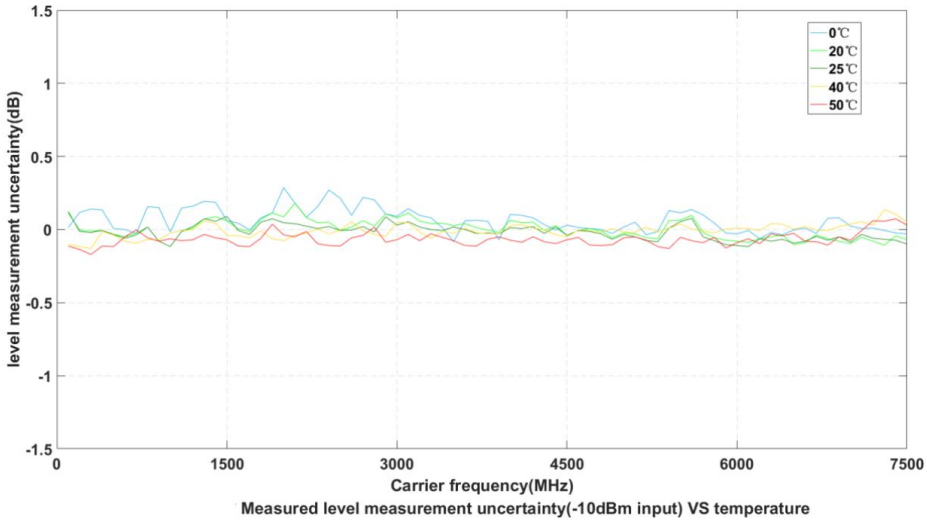


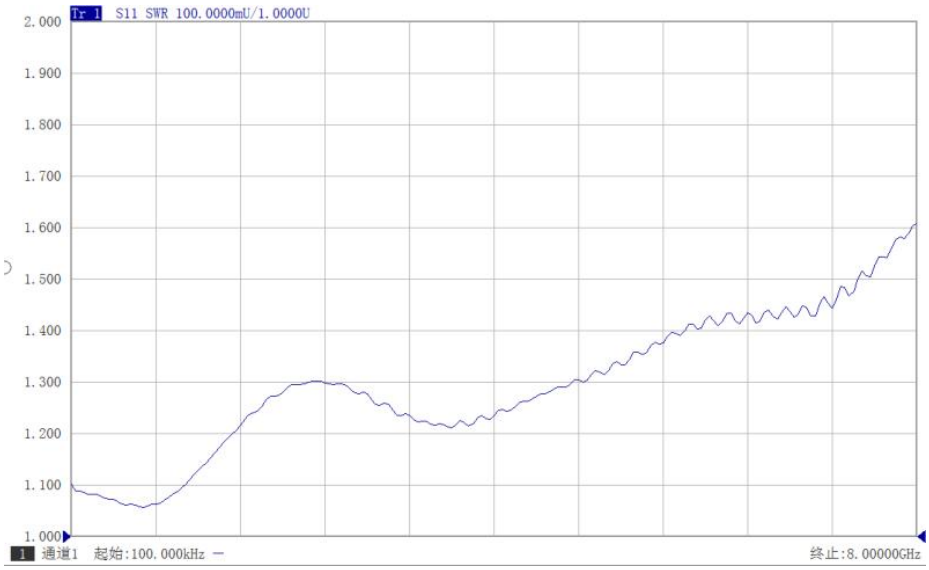
Level Display Range				
Display Log Scale	0.01 dB to 1000 dB			
Display Linear Scale	0% to 100% (Reference level)			
Level Coordinate Unit	dBm, dBmV, dBμV, dBμA, Volt, Watt, dBμW			
Screen Resolution	801			
Trace number	5			
Trace Detector Mode	Positive Peak, Negative Peak, Sample, Normal, Average, RMS, Quasi-Peak			
Trace Function	Clear Write, Max. Hold, Min. Hold, View, Close, Average			
Phase Noise				
Offset	20 °C to 30 °C, fc = 1 GHz, Normalized to 1 Hz			
10 kHz	-106 dBc/Hz (typ.)	-100 dBc/Hz (typ.)		
100 kHz	-104 dBc/Hz (typ.)	-100 dBc/Hz (typ.)		
1 MHz	-115 dBc/Hz (typ.)	-108 dBc/Hz (typ.)		
Displayed Average Noise Level (DANL) at 20℃～30℃, with 0 dB input attenuation, sample detection, trace averaging >50 times, normalized to 1 Hz, and tracking generator off.				
Preamplifier off				
100 kHz ~ 1 MHz	-95 dBm (typ.),<-88dBm			
1 MHz~ 500 MHz	-140 dBm (typ.), <-130dBm			
500MHz~ 3.6GHz	-138dBm (typ.), <-128dBm			
3.6 GHz~ 6.0 GHz		-134dBm (typ.), <-124dBm		
6 GHz~7.5 GHz		-129dBm (typ.), <-119dBm		
8GHz~14GHz			- 134 dBm (typ.), <-124 dBm	
14GHz~ 20GHz				-132 dBm (typ.), <-122 dBm

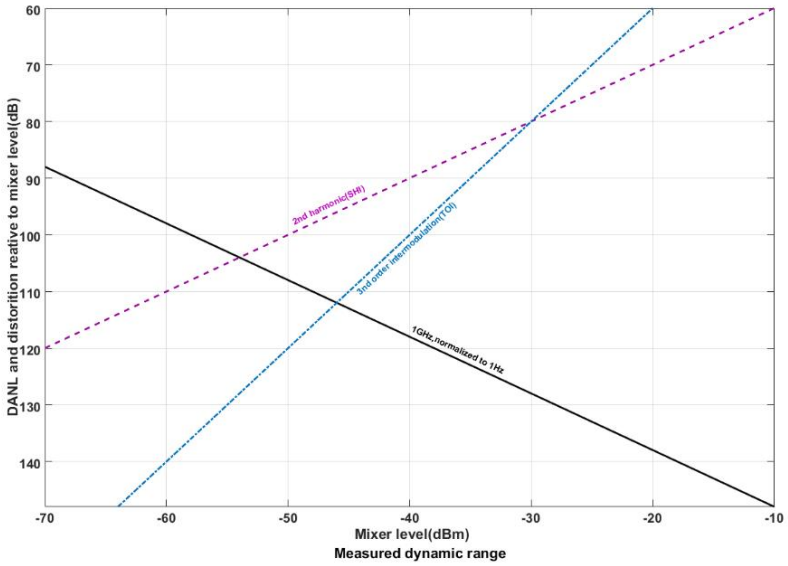
Preamplifier on				
100 kHz ~ 1 MHz	-135 dBm (typ.),<-128dBm			
1 MHz~ 500 MHz	-160 dBm (typ.), <-150dBm			
500MHz~ 3.6GHz	-158dBm (typ.), <-148dBm			
3.6 GHz~ 6.0 GHz		-154dBm (typ.), <-144dBm		
6 GHz~7.5 GHz		-149dBm (typ.), <-139dBm		
7.5GHz~14G Hz			-154 dBm (typ.), <-144 dBm	
14GHz~ 20GHz				-152 dBm (typ.), <-142 dBm
Frequency response: 20℃～30℃, 30%～70% relative humidity, input attenuation 20 dB, reference frequency 50 MHz				
Preamplifier off	<0.7dB			
Preamplifier on	<1.0dB			



Error and Accuracy	
Resolution Bandwidth Switching Error	Logarithmic resolution, relative to 10 kHz RBW ±0.2 dB (nom.)
Input Attenuation Error	20℃~30℃, reference frequency 50 MHz, preamplifier off, relative to 20 dB attenuation, input attenuation 0~40 dB ±0.5 dB

<table>
<tr><td colspan="3">
</td></tr>
<tr><td>Absolute Magnitude Accuracy</td><td colspan="2">20℃~30℃, fc=50 MHz, RBW=1 kHz, VBW=1 kHz, peak detection, input attenuation 20 dB, 95% confidence level
±0.4 dB, input signal level -20dBm, preamplifier off
±0.5 dB, input signal level -40dBm, preamplifier on</td></tr>
<tr><td>Full Range Accuracy</td><td colspan="2">20℃~30℃, fc > 100 kHz, input signal level -50 dBm~0 dBm, RBW=1 kHz, VBW=1kHz, peak detection, input attenuation 20 dB, preamplifier off, 95% confidence level
±0.7 dB</td></tr>
<tr><td colspan="3">
</td></tr>
<tr><td>Voltage Standing Wave Ratio (VSWR)</td><td>Input attenuation ≥10 dB, fc ≥ 1 MHz
<1.8 (nom.)</td><td>Input attenuation ≥10 dB, fc ≥ 1 MHz
<2.0 (nom.)</td></tr>
</table>



Distortion and Spurious Response	
Second Harmonic Distortion (SHD)	20℃~30℃, fc≥50 MHz, Input mono level -20 dBm, input attenuation 0 dB, preamplifier off -65 dBc / +45 dBm, (nom.)
Third-Order Intercept Point (TOI)	20℃~30℃, fc≥50 MHz, Input Dual-tone Level -20 dBm, frequency interval 100 kHz, input attenuation 0 dB, preamplifier off +14 dBm, (typ.)
1 dB Gain Compression	20℃~30℃, fc≥50MHz, input attenuation 0 dB,preamplifier off >0 dBm (nom.)
	
Residual response	20℃~30℃, input port is terminated with a 50Ω load, input attenuation 0 dB <-90 dBm
Input-related clutter	20℃~30℃, mixer level -30 dBm <-65 dBc

Tracking Generator				
Frequency Indicator				
Frequency range	100 kHz ~ 3.6GHz	100 kHz ~ 7.5 GHz	--	--
Frequency resolution	1 Hz, Zero Span		--	--
RBW, only span mode	300 Hz ~ 5 MHz		--	--
Power Indicator				
Output power range	-40 dBm ~ 0 dBm		--	--
Output resolution	1 dB		--	--
Output Flatness	±3 dB (nom.)		--	--
Joint and Impedance	N-Type Female, 50Ω		--	--
Average Reverse Safe Power	Average power: 30 dBm(1 W)		--	--
Maximum Reverse Safe Voltage Level	±50 VDC		--	--
Advanced Measurement Kit				
Power Measurement				
Channel Power	Channel Power, Power Integral Density			
ACPR	Main Channel Power, Left Adjacent Channel Power/Power Ratio, Right Adjacent Channel Power/Power Ratio			
Bandwidth consumption	Power consumption			
Time-Domain Power	Zero Sweep Time Integrated Power			
Power Statistics	Statistical power probability			
Phase Noise	Auto Tune, Frequency Offset Fixed			
Spectrum Emission Mask	Built-in template, custom template, maximum 5 channels			
Transmit Power	Peak trigger, Threshold limit			

Spurious Emission Measurement	Amplitude limit, 5 Ranges, 10 Spurious signals
Nonlinear Measurement	
Third-Order Intermodulation Analysis	Based on dual-tone peak search
Harmonic Analysis	Maximum Harmonic 10

EMI Measurement Mode

Measurement Function	
Measurement View	Frequency scan, Meter, Signal List
Pre-compliance Sequence	Scan, Search, Meas
EMI Filter RBW (-6 dB)	200 Hz, 9 kHz, 120 kHz, 1 MHz
RBW Uncertainty	<5% (nom.)
Detector	Peak, RMS, Quasi-peak
Dwell time	1 ms ~ 1 s
RBW/Steps	0.1, 0.3, 0.5, 1, 2, 3
Limit and Trace	3
Limit Standards	EN550xx / CISPR, GB/T 9254.1, FCC Part 15B, IEC/EN 61000-6-3/6-4, as well as industry templates for railway, marine, electric vehicles, etc., and user-defined limit lines
Attenuator	0-40 dB
Frequency scale	Logarithmic

Real-Time Spectrum Analyzer Mode

Frequency and Time	
Real-Time Bandwidth	100 MHz
100% POI Minimum	Full Span, Kaiser Window, Frequency Mask Triggering at full amplitude accuracy

Signal Duration	6.25 μs
Measurement view	Density: 33 ms ~ 1 s 3D+Spectrogram: 33 ms ~ 1 s Spectrogram: 100 us ~ 1 s PvT+Spectrum: 100 us ~ 1 s
Points	800
Span min	5 kHz
Max Sample rate	128MHz
FFT Frequency/s	166666 (100 MHz analysis bandwidth)
Marker	8
Window	Kaiser(Default), Hanning, Flattop, Gaussian, Blackman-Harris, Rectangular
RBW	Any SPAN, six RBW for every window (only one for Rectangular), default min RBW. Typical RBW for Kaiser: Span RBW Min RBW Max 100MHz 251.076kHz 8.285484MHz 50MHz 125.538kHz 4.142742MHz 20MHz 50.215kHz 1.657096MHz 10MHz 25.107kHz 828.548kHz 1MHz 2.51kHz 82.85kHz 100kHz 251Hz 8.285kHz
Spectrogram /PvT Maximum stored	50 000 (Loop store)
Amplitude Accuracy and Range	
Trace	3
Detector	+Peak, -Peak, Sample, Average
Spectrum Density Display	0~100% (resolution 0.1%)
Dynamic range for Spectrogram	200 dB
Amplitude	Flatness: < 0.5dB Resolution: 0.01 dB Dynamic range: < 60 dB
Trigger	Free Run, PvT, External
Frequency Mask Trigger (FMT)	Source: Traces Type: Greater Than, Less Than, Outside Mask, Inside Mask, Frequency module trigger

Color Display	Warm (Default)						
Different RBW and span, 100% POI (μs)	Analysis	RBW1	RBW2	RBW3	RBW4	RBW5	RBW6
	100MHz	14	10	8	7	6.50	6.25
	40MHz	26	16	11	8.5	7.25	6.62
	20MHz	46	26	16	11	8.5	7.25
	10MHz	86	46	26	16	11	8.5
Different window length for RBW	Length/ Type	1024	512	256	128	64	32
	Kaiser (Beta= 12)	398.2849	198.9478	99.2793	49.4450	24.5279	12.0693
	Hanning	533.4785	266.4785	132.9785	66.2285	32.8535	16.1660
	Flattop	212.2447	106.0182	52.9050	26.3483	13.0700	6.4309
	Gaussian(alpha=3.5)	404.8707	202.2399	100.9244	50.2666	24.9376	12.2729
	Blackman-Harris	399.2401	199.4250	99.5174	49.5636	24.5868	12.0983
	Rectangular	801	--	--	--	--	--

Modulation Analyzer Mode

Characteristics	**Descriptions**			
Model	**HSA3036-R**	**HSA3075-R**	**HSA3140-R**	**HSA3200-R**
General Parameters				
Carrier Frequency	10kHz~3.6GHz	10 kHz ~7.5 GHz	10kHz ~ 14.0GHz	10 kHz ~ 20.0GHz
Carrier Power Accuracy	±2 dB (nom.)			
Carrier Power Range	-30 dBm ~ +20 dBm (nom.)			
Analog Modulation Analysis				
AM				
Modulation rate range	20 Hz ~ 100 kHz			

Accuracy	1 Hz (nom.), modulation rate < 1 kHz < 0.1% modulation rate (nom.), modulation rate ≥ 1 kHz
Modulation depth range	5% ~ 95%
Accuracy	±4% (nom.)
FM	
Modulation rate range	20 Hz ~ 100 kHz
Accuracy	1 Hz (nom.), modulation rate < 1 kHz < 0.1% modulation rate (nom.), modulation rate ≥ 1 kHz
Frequency deviation	1 kHz ~ 400 kHz
Accuracy	±4% (nom.)
PM	
Modulation rate range	50 Hz ~ 50 kHz
Accuracy	1 Hz (nom.), modulation rate < 1 kHz < 0.1% modulation rate (nom.), modulation rate ≥ 1 kHz
Phase deviation	0.2 ~ 100 rad
Accuracy	±4% (nom.)

Vector Network Analysis Mode

Characteristics	**Descriptions**	
Model	**HSA3036-R**	**HSA3075-R**
Stimulation and Measurement		
Frequency range	100 kHz ~ 3.6 GHz	100 kHz ~ 7.5 GHz
Measurement Parameter	S11, S21	
IF Bandwidth	300Hz, 500Hz, 1kHz, 3kHz, 5kHz, 10 kHz	
Port1 output power	-40~0 dBm (nom.)	
Display	Reflection/Transmission Coefficient, Return/Insertion Loss, Phase, Group Delay, Logarithmic Amplitude, Fault Location, Linear Amplitude, Real Part, Imaginary Part, Voltage Standing Wave Ratio (VSWR), Smith Chart (Linear/Phase, Log/Phase, Real/Imaginary, Resistance/Reactance, Conductance/Susceptance), Polar Plot	

<table>
<tr><td colspan="2"></td><td colspan="3">(Linear/Phase, Log/Phase, Real/Imaginary)</td></tr>
<tr><td colspan="2">Points</td><td colspan="3">201~10001, 201(Default)</td></tr>
<tr><td colspan="2">Trace function</td><td colspan="3">Maximum 32 traces, Trace average, Maximum hold, Minimum hold, Trace memory</td></tr>
<tr><td colspan="2">Marker</td><td colspan="3">Maximum 16 markers per trace</td></tr>
<tr><td colspan="2">Directionality after S11 calibration</td><td colspan="3">Logarithmic Amplitude Average Frequency 50, 10MHz
> 50 dB</td></tr>
<tr><td rowspan="3">S21 Dynamic range (IFBW= 10 kHz, Logarithmic,Amplitude Average Frequency 50)</td><td>100 kHz ~ 10 MHz</td><td colspan="3">70 dB (typ.)</td></tr>
<tr><td>10 MHz ~ 3.6 GHz</td><td colspan="3">80 dB (typ.)</td></tr>
<tr><td>3.6 GHz ~ 7.5 GHz</td><td colspan="2"></td><td>90 dB (typ.)</td></tr>
<tr><td colspan="2" rowspan="4">Transmission Line Noise</td><td colspan="3">10 kHz RBW, output power 0dB, Log mag, Average=20, >10MHz</td></tr>
<tr><td></td><td>Amplitude (dB)</td><td>Phase (deg)</td></tr>
<tr><td>100kHz~3.05GHz</td><td>0.005</td><td>0.1</td></tr>
<tr><td>3.05GHz~7.5GHz</td><td>0.005</td><td>0.3</td></tr>
<tr><td colspan="2" rowspan="4">Open-Loop Trace Noise</td><td colspan="3">10 kHz RBW, output power 0dB, Log mag, Average=20, >10MHz</td></tr>
<tr><td></td><td>Amplitude (dB)</td><td>Phase (deg)</td></tr>
<tr><td>100kHz~3.05GHz</td><td>0.04</td><td>0.3</td></tr>
<tr><td>3.05GHz~7.8GHz</td><td>0.03</td><td>0.1</td></tr>
<tr><td colspan="2">Calibration item</td><td colspan="3">Full 1-Port Calibration
Through Response Calibration</td></tr>
<tr><td colspan="2">Calibration Mechanisms</td><td colspan="3">Built-in calibration parameters, user-defined calibration standards, adjustable phase/delay offset</td></tr>
<tr><td colspan="2">Socket Extension</td><td colspan="3">1 Port Manual, 2 Ports Manual, 1 Port Automatic Open Circuit</td></tr>
<tr><td colspan="2">System Impedance</td><td colspan="3">50Ω</td></tr>
<tr><td colspan="2">Velocity coefficient</td><td colspan="3">0.01~1</td></tr>
</table>

Cable and Antenna Measurement Mode

Characteristics	Descriptions	
Model	**HSA3036-R**	**HSA3075-R**
Measurement Function		
Frequency range	100 kHz ~ 3.6GHz	100 kHz ~ 7.5 GHz
Maximum Distance Resolution (meters)	1.5e12*Velocity Factor/Sweep Width	
Minimum Distance Resolution (meters)	1.5e8*Velocity Factor/Sweep Width	
Windowing Form	Rectangular, Hamming	
Calibration	Full 1-Port Calibration (OSL)	
Velocity coefficient	0.01~1	

Inputs and Outputs

Front Panel					
Model		**HSA3036-R**	**HSA3075-R**	**HSA3140-R**	**HSA3200-R**
RF input	Impedance	50Ω (nom.)		50Ω (nom.)	
	Connector	N-type female		2.92mm male	
Tracking Generator Output	Impedance	50Ω (nom.)		--	
	Connector	N-type female		--	
Internal / External Reference					
Internal Reference	Frequency	10 MHz			
	Output Level	+3 dBm to +10 dBm，+8 dBm (typ.)			
	Impedance	50Ω (nom.)			
	Connector	BNC female			
External Reference	Frequency	10 MHz ± 5 ppm			
	Output Level	0 dBm to + 10 dBm			
	Impedance	50Ω (nom.)			
	Connector	BNC female			
External Trigger Input					
External Trigger Input	Impedance	1 kΩ (nom.)			
	Connector	BNC female			
Audio Interface	Impedance	30Ω (nom.)			

	Connector	3.5 mm
Communication Interface		
USB Master Terminal		
USB Host	Connector	Type-C
	Protocol	USB 2.0
USB Device		
USB Devise	Connector	Micro USB
	Protocol	2.0 Version
LAN		10/100Base，RJ-45

General Specification

Structure	
Dimensions	270mm*190mm*60mm (W*H*D)
Weight	Net: 4.70 kg (10.0 lb); Shipping: 5.50 kg
Display	TFT LCD, 1024x600, 8 inch capacitive multi-touch screen
Storage	Internal (Flash) 3.3 GByte, External (U storage device) 32 GByte
Working Environment	
Power Supply	AC Voltage range: 100 V~240 V, 50/60Hz; 100~120V, 400Hz
Consumption	48 W
Temperature	Working temperature: 0℃~50℃ Storage temperature: -20℃~70℃
Humidity	0℃~30℃, ≤95% Relative humidity 30℃~50℃, ≤75% Relative humidity
Altitude	Operating: 3000 meters (10000 feet)
Electromagnetic Compatibility	
EN 61326-1: 2013 /EN 61000-3-2: 2014	Class A
EN61000-3-3: 2013	Plt : 0.65 Pst : 1.00, dmax : 4.00 %, dc : 3.00 %, dtLim: 3.30 % dt>Lim: 500ms
IEC61000-4-2: 2008	AD ±8.0kV, CD ±4.0kV

IEC61000-4-3: 2006 +A1: 2007 + A2: 2010	80MHz to 1000MHz: 10V/m；1.4GHz to 2.0GHz:3V/m；2.0GHz to 2.7GHz:1V/m
IEC61000-4-4: 2004 +A1: 2010	AC Line:±2.00kV
IEC61000-4-5: 2005	Line to Line: 1.0kV, Line to Earth: 2.0kV
IEC61000-4-6: 2008	0.15-80MHz: 3V 1KHz 80% AM
IEC61000-4-8: 2009	30A/m, 50/60Hz
IEC61000-4-11: 2004	Voltage Dips:0%/0.5P;40%/10P;70%/25P; Short Interruptions Test Level%UT:0%/250P
Safety	IEC 61010-1:2010/EN 61010-1:2010 CAN/CSA-C22.2 No.61010-1:2012 CAN/CSA-C22.2 No.61010-2-30:2012 UL 61010-1:2012 UL 61010-2-30:2012
RoHS	2011/65/EU

Adjustment interval: The recommended calibration interval is one year.

7007020100255

V1.0.0