20GHz Compact USB Real-Time Spectrum Analyzer

SAE-200

Product Brochure V1.1

2023-10-18

- 9 kHz~20 GHz real-time spectrum analyzer
- Superheterodyne digital receiver architecture, 19 segments pre-selected filter
- 9 kHz~9 GHz typical image suppression>90 dB, typical IF rejection>90 dB
- 9 GHz~20 GHz typical image suppression>60 dB, typical IF rejection>90 dB
- 100 MHz analysis bandwidth with adjustable sampling rate, 1.2 THz/sec spectrum sweep speed
- FPGA based digital signal processing
- Core module supported, light as 195g, size 125×60×15mm, power consumption 10-14 W
- Highly compatible API interfaces and SAStudio4 GUI
- Compatible with ARM and x86 processors, Linux and Windows operating systems
- Operating temperatures range from - 20 °C/- 40 °C to 65 °C (option)
- Built-in OCXO (option), temperature drift≤0.15 ppm



HAROGIC

SAE-200 Technical Specifications * (typical value)

Indicator test basis	Hardware Version：R3	API：0.50.1	FPGA：0.50.0	MCU：0.50.2	SAS4：1.50.40
Frequency					
Frequency Range	9 kHz~20 GHz				
Initial Frequency Accuracy	<1 ppm, Supporting program manual correction				
Reference Clock	Internal or external, program-controlled switching Internal TCXO aging<1 ppm/year, temperature drift<1 ppm; Internal OCXO (option), temperature drift<0.15 ppm				
Spectrum Purity					
SSB Phase Noise	dBc/Hz				
Carrier Frequency	1 GHz	3 GHz	10 GHz	19.9 GHz	
1 kHz	-91.2	-90.0	-86.1	-80.6	
10 kHz	-99.7	-100.9	-92.5	-90.6	
100 kHz	-101.1	-104.2	-94.4	-96.2	
1 MHz	-121.6	-123.4	-112.1	-111.5	
10 MHz	-134.4	-134.2	-131.9	-129.2	
Residual Response Spurious rejection off dBm RBW =1 kHz Positive Peak Detector	Frequency Range	R.L.=0 dBm	R.L.=-20 dBm	R.L.=-50 dBm	
	9 kHz~1.0 GHz	< -90	< -100	< -120	
	1.0 GHz~3.0 GHz	< -80	< -100	< -120	
	3.0 GHz~9.0 GHz	< -90	< -100	< -120	
	9.0 GHz~20 GHz	< -90	< -100	< -120	
Image Frequency Suppression	9 kHz~9 GHz	>90 dBc (spurious rejection off), >90 dBc (spurious rejection on)			
	9 GHz~20 GHz	>60 dBc (spurious rejection off), >90 dBc (spurious rejection on)			
IF rejection (R.L.=0 dB)	>90 dBc (spurious rejection on), >80 dBc (spurious rejection off)				
Local Oscillator Related Spurious	<-65 dBc (Offset Center Frequency +/- (N/M)*125MHz, N/M = 1,2,3,4,5…)				
Input Related Spurious	<-75 dBc (spurious rejection on), <-50 dBc (spurious rejection off)				
Linearity					
IIP3 （dBm）	1 GHz	3 GHz	10 GHz	19.9 GHz	
R.L.= 20 dBm	45.5	47.3	43.6	35.3	
R.L.= 0 dBm	27.5	27.2	23.2	21.0	
R.L.= -20 dBm	4.7	7.5	-8.9	-3.0	
Signal Processing					
Analysis Bandwidth	Maximum 100 MHz (IF analog BW set as 1) or 40 MHz (IF analog BW set as 2), Decimate Factor:1				
IQ Data	122.88 MSPS, supporting 120 MSPS-125 MSPS program adjustable, 1 Hz step Decimate factor: 1,2,4,8,16,32,64, 128,256,512,1024,2048,4096 supported (FPGA)				
Storage Depth	The built-in memory depth is 128 MBytes				
	Supports continuous and uninterrupted storage when the data generation rate is less than the bus bandwidth, and the storage depth is only limited by the hard disk capacity				
External Trigger Response	Maximum response frequency 500 times/sec				
Analog IF Output	Supporting 307.2 MHz +/-50 MHz				
Amplitude					
Maximum safe input power (CW)	23 dBm	30 MHz~20 GHz and the preamplifier off (R.L. ≥ 0 dBm)			
	10 dBm	100 kHz~30 MHz or preamplifier on (R.L. <0 dBm)			
Maximum DC Voltage	±12 VDC				
Display Range	DANL~23 dBm				

Amplitude Accuracy	±2.0 dB			
IF in-band spectrum ripple	±1.75 dB (40 MHz analog IF bandwidth), ±2.0 dB (100 MHz analog IF bandwidth)			
Reference level (R.L.)	-50 dBm~23 dBm			
RF Preamplifiers	Converting bands (frequency ≥ 50MHz) are equipped with preamplifier that can be set as automatically turn on or forcibly turn off			
Displayed Average Noise Level (DANL) dBm/Hz RBW=10kHz RMS detector	Frequency Range	R.L.=0 dBm (IFGainGrade = 2)	R.L.=-20dBm (IFGainGrade=2)	R.L.=-50 dBm (IFGainGrade = 3)
	9 kHz	-123.3	-141.2	-152.3
	100 kHz~100 MHz	-135.2	-152.2	-160.2
	100 MHz~3.0 GHz	-134.1	-147.2	-165.3
	3.0 GHz~9.0 GHz	-132.2	-139.1	-157.1
	9.0 GHz~20.0 GHz	-133.1	-138.2	-159.5
Standard Spectrum Analysis				
Detector	Positive peak, Negative peak, Sampling, Average, RMS, Max Power			
RBW	1 Hz~10 MHz			
VBW	1 Hz~10 MHz			
Trace Function	Sample, Positive Peak, Negative Peak, Local average, Maximum hold, Minimum hold, Average			
Data Chart	SAStudio4 software provides regular spectrum, waterfall chart, and historical trace			
Measurements	Phase noise, Channel power, Occupied bandwidth, X dB bandwidth, Adjacent channel suppression, IM3			
Sweep speed - Standard Spectrum Analysis	1.24 THz/s	FPGA	RBW≥1 MHz, B-Nuttal window, spurious rejection: Bypass	
	520.0 GHz/s	FPGA	RBW=250 kHz, B-Nuttal window, spurious rejection: Standard	
	132.0 GHz/s	FPGA	RBW=30 kHz, B-Nuttal window, spurious rejection: Bypass	
	7.3 GHz/s	CPU	RBW=1 kHz, B-Nuttal window, spurious rejection: Bypass	
Detection Analysis/Zero Span				
Highest Time Resolution	8 ns			
Maximum Analysis Bandwidth	100 MHz			
Detector	Positive peak, Negative peak, Sampling, Average, RMS, Max Power			
Real Time Spectrum Analysis				
FFT Analysis	Variable point FFT engine implemented by FPGA. frame rate compression and trace detection are supported. There is strictly no gap and overlap between FFT frames			
	FFT refresh rate=10 ^ 9 ns/(N * D * 8 ns); POI = 2*N*D*8ns N is the number of FFT points (2048, 1024,512,256,128,64,32), and D is the decimate factor (1, 2, 4, 8...)			
	Typical Settings		FFT Refresh Rate	POI
	N = 2048, D = 1		61,035 times /second	32.768 us
	N = 32, D = 1		3,906,250 times /second	0.512 us
Real-time Analysis Bandwidth	100 MHz			
Window Function	B-Nuttall, FlatTop			
RBW	14.73 MHz-3.59 kHz (Flattop window); 7.81 MHz~1.90 kHz (B-Nuttall); 13 grades for each window type			
Amplitude Resolution	0.75 dB			
General				
Input And Output	Power Supply	Type-C (1), dedicated power supply port, please provide 5 V2 A peak power supply capacity Allowable voltage range: 4.75~5.25 V, ripple less than 200 mVpp		

	Data	Type-C (2), USB3.0 (USB2.0 Available but bandwidth limited)
	RF input	2.92 mm (F), Input impedance 50 Ω
	External reference clock input	MMCX (F) (1), amplitude ≥ 1.5 Vpp, input impedance 330 Ω
	External reference clock output	Integrated in MUXIO, 3.3 V CMOS, programmable on/off
	External trigger input	Integrated in MUXIO, 3.3 V CMOS, input: high impedance
	External trigger output	Integrated in MUXIO, 3.3 V CMOS
	Analog IF Output	MMCX (F) (2), maximum output power -25 dBm, output impedance 50 Ω
Power Consumption	Peak: 14 W, typical: 10 W~14 W, power port (5 V2 A Max), data port (5 V1 A Max)	
Operating Temperature (ambient temperature /core temperature)	0~50 ºC/0~70 ºC (Standard temperature class)	
	-20~65 ºC/-20~85 ºC (Extended Temperature Class Option) (plastic enclosure and fan not included)	
	-40~65 ºC/-40~85 ºC (Wide Temperature Class Option) (plastic enclosure and fan not included)	
Storage Temperature (ambient temperature)	-20~70 ºC (Standard temperature class)	
	-40~85 ºC (Extended temperature class and wide temperature options) (plastic enclosure and fan not included)	
Size (D * W * H) and weight	125 x60 x15 mm, 195 g (excluding protective shell and structural fittings, including joint length) 139 x69 x29 mm, 385 g (including protective shell and structural fittings, including joint length)	
Packaging and Accessories	Flash disk * 1, USB 3.0 cable * 2, Power adapter * 1	

*The typical values of the indicators are applicable for the following conditions: (1) Start up and warm up for 10 minutes; (2) Ambient temperature 25 ºC (core temperature 50 ºC); (3) Spurious suppression off; (4) 100MHz analog IF and IFGainGrade=2; (5) The user shall provide the necessary heat dissipation conditions to ensure that the ambient temperature and the core temperature of the equipment are within the rated range at the same time.

Code Name	Option	Explanation
01	Built-in OCXO reference clock (hardware opt.)	Providing a reference clock with better stability than the standard configuration, with a temperature drift of<0.15 ppm, increasing the overall power consumption by 0.8 W.
10	IO extension board (accessory)	Converting the MUXIO interface into multiple MMCX and board to wire connector to facilitate the connection of trigger input, output, and other signals.
11	External GNSS (accessory)	Standard GNSS module connected to MUXIO.
12	External high precision GNSS (accessory)	High precision GNSS module connected to MUXIO.
13	External GNSS disciplined OCXO reference clock (accessory)	Providing GNSS disciplined reference clock and 1PPS, increasing the overall power consumption by 1.1W.
20	Extended temperature class (hardware opt.)	- 20~65 ℃/- 20~85 ℃(Extended temperature class opt.)
21	Wide temperature class (hardware opt.)	- 40~65 ℃/- 40~85 ℃(Wide temperature class opt.)

Saelig Company, Inc. 71A Perinton Parkway
Fairport, NY 14450 USA 1-585-385-1750

info@saelig.com www.saelig.com