6.3 GHz Compact USB Real-Time Spectrum Analyzer

SAM-60 M3

Product Brochure V1.0

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- 9 kHz~6.3 GHz real-time spectrum analyzer
- Integrated 100 kHz-6.3 GHz analog signal generator (opt.)
- 100 MHz analysis bandwidth, 300 GHz/sec spectrum sweep speed, FPGA signal processing
- 1GHz phase noise: -114 dBc/Hz@10kHz
- Equipped with preamplifier, 1GHz DANL: -166.6 dBm/Hz
- Core module supported, weight 168g, size 142×54×16mm, power consumption 7-10W
- Highly compatible API interfaces and SAStudio4 GUI
- Compatible with ARM and x86 processors, Linux and Windows operating systems
- Operating temperatures range from -20 oC/-40 oC to 65 oC (option)
- Built-in OCXO (option), temperature drift≤0.15 ppm
- USB3.0/2.0 Type-C interface

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SAM-60 M3 Technical Specifications * (typical value)

Indicator test basis **Hardware Version: R5** **API: 0.55.12** **FPGA: 0.55.2** **MCU: 0.55.9** **SAS4: 1.55.57**

Frequency				
Frequency Range	9 kHz~6.3 GHz			
Initial Frequency Accuracy	<1 ppm, supporting program manual correction			
Reference Clock	Internal or external, program-controlled switching. Internal 10 MHz TCXO aging<1 ppm/year, temperature drift<1 ppm; built-in OCXO (option), temperature drift<0.15 ppm			
Spectrum Purity				
SSB Phase Noise	dBc/Hz			
Carrier Frequency	500 MHz	1 GHz	3 GHz	6 GHz
1 kHz	-112.8	-107.5	-99.3	-93.1
10 kHz	-120.6	-114.2	-103.6	-101.2
100 kHz	-120.1	-112.5	-101.8	-99.3
1 MHz	-134.1	-132.8	-127.7	-122.7
Residual Response Spurious rejection on dBm, RBW =1 kHz, positive peak detector	Frequency Range	R.L.=0 dBm	R.L.=-20 dBm	R.L.=-50 dBm
	100kHz~100MHz	-90	-104	-132
	100MHz~6.3GHz	-90	-103	-111
Residual Response Spurious rejection off	100kHz~100MHz	-79	-97	-120
	100MHz~6.3GHz	-90	-103	-111
Image Frequency Suppression	>90 dBc (spurious rejection on, typical value), >35 dBc (spurious rejection off, typical value)			
Local Oscillator Related Spurious	<-65 dBc (Offset Center Frequency +/- (N/M)*125MHz, N/M = 1,2,3,4,5…)			
Signal Processing				
Analysis Bandwidth	Maximum 100 MHz, Decimate Factor:1			
IQ Data	125MSPS, Decimate factor: 1,2,4,8,16,32,64128,256,512,1024,2048,4096 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	Not available			
Amplitude				
Maximum safe input power (CW)	26 dBm	30 MHz~6.3 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	±15 VDC			
Display Range	DANL~26 dBm			
Amplitude Accuracy	±1.5 dB			
IF in-band spectrum ripple	±1.75 dB (100 MHz analog IF bandwidth)			
Reference level （R.L.）	-50 dBm~23 dBm			
RF Preamplifiers	Converting bands (frequency ≥ 30MHz) are equipped with preamplifier that can be set as automatically turn on or forcibly turn off			
VSWR	<1.7:1	30 MHz~6.3 GHz （R.L. ≥ 10 dBm）		
	<2.0:1	30 MHz~6.3 GHz （R.L. ≥ 0 dBm）		
	<2.5:1	30 MHz~6.3 GHz （R.L. ≥ -40 dBm）		

Display Average Noise Level (DANL) dBm/Hz RBW=10kHz RMS detector	Frequency Range	R.L.= 0 dBm (IFGainGrade = 3)	R.L.=-20 dBm (IFGainGrade = 3)	R.L.=-50 dBm (IFGainGrade = 3)
	9 kHz	-122	-134	-149
	100kHz	-132	-140	-152
	100 MHz~3.0 GHz	-129	-145	-161
	3.0 GHz~6.3 GHz	-129	-141	-158

Standard Spectrum Analysis			
Detector	Positive peak, Negative peak, Sampling, Average, RMS, Max Power		
RBW	0.1 Hz~10 MHz		
VBW	0.1 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		
Sweep speed - Standard Spectrum Analysis	310.3 GHz/s	FPGA	RBW≥250 kHz, B-Nuttal window, spurious rejection: Standard
	150.2 GHz/s	FPGA	RBW=250 kHz, B-Nuttal window, spurious rejection: Enhanced
	38.7 GHz/s	FPGA	RBW=30 kHz, B-Nuttal window, spurious rejection: Enhanced
	1.8 GHz/s	CPU	RBW=1 kHz, B-Nuttal window, spurious rejection: Enhanced

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		

Signal generator (option)					
Frequency range	100 kHz~6.3 GHz, 10 Hz for each step				
Power range	-50 dBm~0 dBm, 0.25 dB for each step				
VSWR	<2.0:1		30 MHz~6.3 GHz		
Non-harmonic spurs	<-50 dBc				
Harmonic wave	100 kHz~30 MHz	30 MHz~1.6 GHz	1.6 GHz~3 GHz	3 GHz~3.2 GHz	3 GHz~6.3 GHz
Second harmonic	<-10 dBc	<-10 dBc	<-20 dBc	<-20 dBc	<-20 dBc
Third harmonic and above	<-10 dBc	<-10 dBc	<-20 dBc	<-20 dBc	<-20 dBc
Signal leakage to receiver	100 kHz~30 MHz		>90 dBc		
	30 MHz~3 GHz		>80 dBc		
	3 GHz~6.3 GHz		>70 dBc		

General		
Input and Output	Power Supply	Type-C (1), dedicated power supply port, please provide 5V 2A 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	SMA (F), Input impedance 50 Ω
	External reference clock input	MCX (F) (1), amplitude ≥ 1.5 Vpp, input impedance 330 Ω
	External reference clock output	Not supported
	External trigger input	Integrated in MUXIO, 3.3 V CMOS, input: high impedance
	External trigger output	Integrated in MUXIO (type C), 3.3 V CMOS
	Analog IF output	Not supported
Power Consumption	Peak: 10 W, typical: 7 W~10 W, Power port (5V 2A Max), Data port (5V 1A Max)	
Operating Temperature (ambient temperature /device core temperature)	0~50 °C/0~70 °C (Standard temperature class)	
	-20~65 °C/-20~85 °C (Extended Temperature Class Option) (plastic enclosure and fan not included)	
	-40~65 °C/-40~85 °C (Wide Temperature Class Option) (plastic enclosure and fan not included)	
Storage Temperature (ambient temperature)	-20~70 °C (Standard temperature class)	
	-40~85 °C (Extended temperature class and wide temperature options) (plastic enclosure and fan not included)	
Size and Weight	142x54x16mm, 168 g (Excluding protective case and structural fittings, including connector length) 156x62x22mm, 296 g (Including protective case and structural fittings, including connector length)	
Packaging and Accessories	Flash drive * 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 20 minutes; (2) Ambient temperature 25 °C (core temperature 50 °C); (3) SWP-Spurious rejection on; (4) 100MHz analysis bandwidth and IFGainGrade=3; (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	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.
02	Built-in analog signal generator	100 kHz-6.3 GHz signal generator
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.)

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