SA Series

PRODUCT DATASHEET

USB REAL-TIME SPECTRUM ANALYZER

SAN SERIES
4.5/6.3 GHz

V1.1 24/10/28

AROGIC

SAN SERIES OVERVIEW

Key facts

Create your own RF system with limited budget

Frequency range: 9 kHz to 4.5/6.3 GHz

1 GHz DANL: -162 dBm/Hz

1 GHz phase noise: -110 dBc/Hz@10 kHz

Analysis bandwidth: up to 25 MHz

USB3.0/2.0 type C interface

Highly compatible API interface

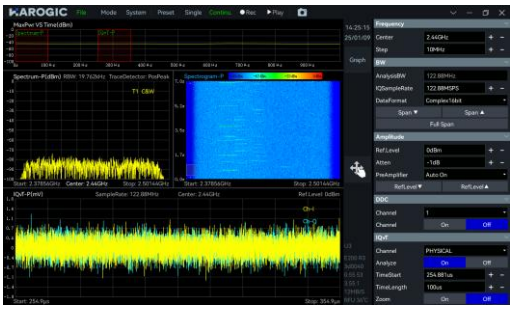
ARM and X86 processor are supported

Linux and Windows operating systems are supported

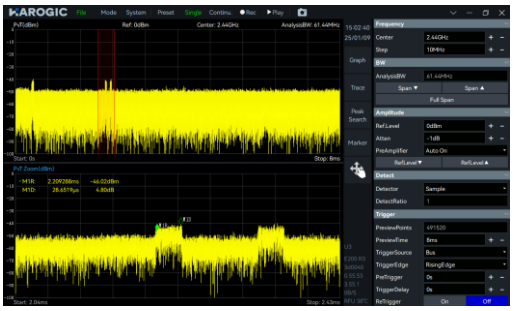
Applications

Standard spectrum sweep

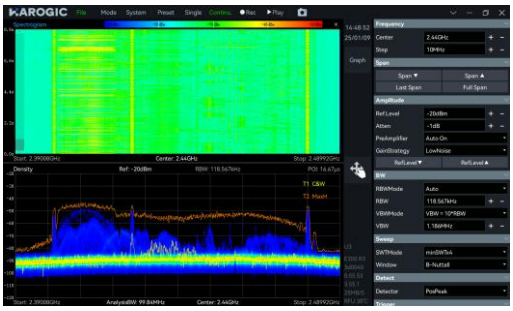
IQ streaming and analysis



Power vs time analysis



Real-time analysis



Specifications*

FREQUENCY

		SAN-45	SAN-60 M2
Frequency range		9 kHz-4.5 GHz	9 kHz-6.3 GHz
Reference clock		Internal or external	
Frequency accuracy	TCXO (std.)		<1 ppm, manual correction is available
	OCXO (opt01)		<1 ppm, manual correction is available
	Ext. GNSS disciplined OCXO (opt23)		<0.05 ppm, when locked to GNSS
Aging and temperature stability	TCXO (std.)		<1 ppm/year, <1 ppm
	OCXO (opt01)		<1 ppm/year, <0.15 ppm
	Ext. GNSS disciplined OCXO (opt23)		<1 ppm/year, <0.05 ppm

SPECTRUM PURITY

SSB phase noise (dBc/Hz)

	SAN-45		SAN-60 M2	
Carrier frequency	1 GHz	4.5 GHz	1 GHz	6.3 GHz
1 kHz	-103.4	-93.5	-105.2	-91.2
10 kHz	-111.3	-100.3	-110.4	-99.3
100 kHz	-109.3	-98.5	-110.5	-97.4
1 MHz	-129.5	-121.9	-130.1	-119.9

Residual response (dBm)
spur reject = enhanced
RBW =1 kHz
PosPeak detector

	SAN-45		SAN-60 M2	
Reference level (R.L.)	0 dBm	-50 dBm	0 dBm	-50 dBm
100 kHz-100 MHz	-85	-110	-90	-110
100 MHz-4.5 GHz	-85	-110	-90	-110
4.5 GHz-6.3 GHz	-	-	-90	-110

Image rejection	>90 dBc(typ.) for spur reject = enhanced >35 dBc (typ.) for spur reject = bypass
IF rejection	Low IF architecture

Local oscillator related spurious	<-65 dBc Center frequency ± (N/M)*125 MHz, N,M = 1,2,3,4,5...

IIP3 / IIP2 (dBm)

	SAN-45		SAN-60 M2	
Carrier frequency	1 GHz	4.5 GHz	1 GHz	6.3 GHz
R.L. = 20 dBm	47.4 / 85.8	45.6 / 98.0	46.6 / 86.0	42.9 / 109.5
R.L. = 0 dBm	35.1 / 85.5	26.1 / 91.6	29.6 / 85.8	24.6 / 98.5
R.L. = -20 dBm	10.0 / 66.3	6.9 / 19.4	10.5 / 67.3	3.9 / 17.1

AMPLITUDE

Max. input power (CW)	23 dBm	30 MHz-4.5/6.3 GHz and the preamplifier is off
	10 dBm	9 kHz-30 MHz or preamplifier is on
Max. DC voltage		±10 VDC
Display range		DANL-23 dBm
Amplitude accuracy		±2.0 dB
IF in-band flatness		±2.0 dB
Reference level (R.L.)		-50 dBm-23 dBm
RF preamplifiers		automatically turn on or forcibly turn off
VSWR	R.L. = 10 dBm	<1.7:1
30 MHz to Max.Freq.	R.L. = 0 dBm	<2.0:1
	R.L. = -40 dBm	<2.5:1

Display average noise level (DANL) (dBm/Hz)
RBW=10 kHz

	SAN-45		SAN-60 M2	
Reference level	-20 dBm	-50 dBm	-20 dBm	-50 dBm
9 kHz	-133.5	-149.5	-134.2	-134.3
100 kHz - 30 MHz	-139.2	-161.8	-138.6	-156.0
30 MHz - 3.0 GHz	-148.4	-163.4	-147.6	-163.4
3.0 GHz - 4.5 GHz	-148.1	-162.6	-150.2	-162.1
4.5 GHz - 6.3 GHz	-	-	-150.1	-160.1

STANDARD SPECTRUM ANALYSIS

Detector	PosPeak, NegPeak, Sample, Average, RMS, MaxPower
RBW	0.1 Hz-2.5 MHz
VBW	0.1 Hz-10 MHz
Data chart	SAStudio4 software provides spectrum, waterfall chart, and historical trace
Measurements	Channel power, OBW, X dB bandwidth, Adjacent channel power radio, IM3

Sweep speed	**SAN-45**	**SAN-60 M2**
RBW = 250 kHz FPGA spur reject = standard	about 89.6 GHz/s	about 212.7 GHz/s
RBW = 250 kHz FPGA spur reject = enhanced	about 42.1 GHz/s	about 103.7 GHz/s
RBW = 30 kHz FPGA spur reject = enhanced	about 13.4 GHz/s	about 9.0 GHz/s
RBW = 1 kHz CPU spur reject = enhanced	about 1.3 GHz/s	about 1.3 GHz/s

IQ RECORDING

	SAN-45	**SAN-60 M2**
Burst recording bandwidth	Maximum: 6.25 MHz	Maximum: 25 MHz
	The built-in memory depth is 128 Mbytes	
Continuous recording bandwidth	Maximum: 6.25 MHz	Maximum: 25 MHz
	Limited by the bandwidth of USB interface and hard disk. The storage depth is limited by the hard disk capacity	
IQ sample rate	7.8125MSPS, decimate factor: 1,2,4,8,16,32,64128,256 supported (FPGA)	31.25MSPS, decimate factor: 1,2,4,8,16,32,64128,256,512,1024 supported (FPGA)
External trigger response	Maximum response frequency 500 times/sec	

DETECTION ANAYLSYS

	SAN-45	SAN-60 M2
Lowest time resolution	128 ns	32 ns
Max. analysis bandwidth	6.25 MHz	25 MHz
Detector	PosPeak, NegPeak, Sample, Average, RMS, MaxPower	

REAL TIME SPECTRUM ANALYSIS

FFT analysis	FFT engine is implemented in FPGA. Frame compression and trace detection are supported. No missing samples between FFT frames. FFT frame update rate=10 ^ 9 ns/(N * D * highest time resolution) POI = N * D * lowest time resolution N for FFT points (2048,1024,512,256,128,64,32) D for decimate factor (1, 2, 4, 8...)

POI/FFT refresh rate	**SAN-45**	**SAN-60 M2**
N = 2048, D = 1	262.144 us / 3,814 times/sec	65.536 us / 15,258 times/sec
N = 32, D = 1	4.096 us / 244,140 times/sec	1.024 us / 976,562 times/sec
Max. analysis bandwidth	6.25 MHz	25MHz
RBW	920 kHz-3.59 kHz (Flat-top) 488 kHz-1.90 kHz (B-Nuttall) 9 grades for each window type	3.68 MHz-3.59 kHz (Flat-top) 1.95 MHz-1.90 kHz (B-Nuttall) 11 grades for each window type
Window function	B-Nuttall, Flat-top, LowSideLobe	
Amplitude resolution	0.75 dB	

GENERAL

Input and output	
Power supply	Type-C, dedicated power supply port. Acceptable voltage range: 4.75 to 5.25 V (ripple < 0.2 Vpp). Device will fetch up to 2 A current from this port
Data interface	Type-C, USB3.0 and USB2.0 (lower bandwidth) Device will fetch up to 1 A current from this port
RF input	SMA (F), input impedance 50 Ω
RF output	SMA (F), input impedance 50 Ω
Reference input	MCX (F), amplitude ≥ 1.5 Vpp, input impedance is about 330 Ω

Reference output	Unavailable
External trigger input	Type-C, 3.3V CMOS, input: high impedance
External trigger output	Type-C, 3.3 V CMOS
Analog IF output	Unavailable

Power consumption	7-10 W	
Size (D * W * H) and weight	156 x62 x22 mm and about 296 g	
GNSS synchronization	External GNSS (opt21)	+/- 100 ns
	External GNSS (opt22)	+/- 75 ns
	External GNSS (opt23)	+/- 50 ns
System requirements	Linux	aarch64, x64
	Windows	x64
Operating temperature (ambient/core)	T0 class (std.)	0-50 °C/0-70 °C
	T1 class (opt40)	-20-65 °C/-20-85 °C
	T2 class (opt41)	-40-85 °C (core)
Storage temperature (ambient)	T0 class (std.)	-20-70 °C
	T1 class (opt40)	-40-85 °C
	T2 class (opt41)	-40-85 °C (core)
Packaging and accessories	Flash disk * 1, USB 3.0 cable * 2, Power adapter * 1	

*Specification applies under the following conditions:

(1) Start up and warm up for 10 minutes

(2) Ambient temperature 25 °C (core temperature 50 °C)

(3) Stand spectrum analysis mode-spurious rejection enhance on.

(4) Necessary heat dissipation is provided to ensure the ambient and core temperature within the rated range at the same time

OPTIONS

Code		
01	Built-in OCXO reference clock	built-in hardware
02	Built-in signal generator	built-in hardware
20	MUXIO IO board	accessory
21	External GNSS	accessory
22	External high precision GNSS	accessory
23	External GNSS disciplined OCXO reference clock	accessory
34	External omnidirectional antenna, 400-8000MHz, Gain<2dBi	accessory
40	T1 temperature class	built-in hardware
41	T2 temperature class, only available for core	built-in hardware
71	Basic digital modulation analysis	software
72	Pulse signal measurement	software

BUILT-IN SIGNAL GENERATOR (opt02)

Frequency range	100 kHz-6.3 GHz, step 10 Hz	
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	

Harmonics

Frequency range	Second harmonic	Third harmonic and above
100 kHz-30 MHz	<-10 dBc	<-10 dBc
30 MHz-1.6 GHz	<-10 dBc	<-10 dBc
1.6 GHz-3 GHz	<-20 dBc	<-20 dBc
3 GHz-3.2 GHz	<-20 dBc	<-20 dBc
3.2 GHz-6.3 GHz	<-20 dBc	<-20 dBc

Leakage to receiver

100 kHz-30 MHz	>90 dBc
30 MHz-3 GHz	>80 dBc
3 GHz-6.3 GHz	>70 dBc

www.harogic.com
info@harogic.com