



USB
REAL-TIME SPECTRUM
ANALYZER

SAN SERIES
4.5/6.3 GHz

Key facts

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

Windows 11/10/8/7 (x86, x64) are supported

Debian 12/11/10 (x64, AArch64) are supported

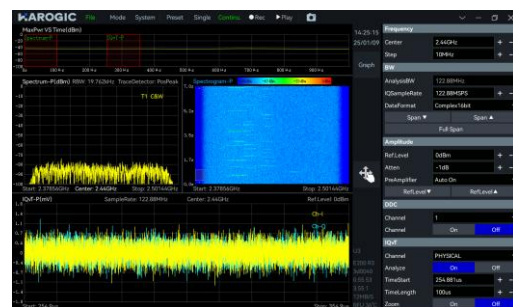
Ubuntu 24.04/22.04/20.04/18.04 (x64, AArch64) are supported

Applications

Standard spectrum sweep



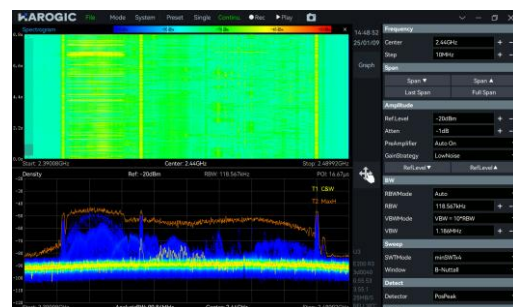
IQ streaming and analysis



Power vs time analysis



Real-time analysis



Specifications*

FREQUENCY

Frequency range	SAN-45		SAN-60 M2	
		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 (opt23)	disciplined OCXO	<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 (opt23)	disciplined OCXO	<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
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	
	0 dBm	-50 dBm	0 dBm	-50 dBm
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 $\pm (N/M)*125$ MHz, N,M = 1,2,3,4,5...

IIP3 / IIP2 (dBm)

	SAN-45		SAN-60 M2	
	1 GHz	4.5 GHz	1 GHz	6.3 GHz
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	
	-20 dBm	-50 dBm	-20 dBm	-50 dBm
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	SASudio4 software provides spectrum, waterfall chart, and historical trace
Measurements	Channel power, OBW, X dB bandwidth, Adjacent channel power ratio, 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: 1,2,4,8,16,32,64,128,256 supported (FPGA)	31.25MSPS, decimate factor: 1,2,4,8,16,32,64,128,256,512,1024 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 \geq 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	Windows 11/10/8/7	x86, x64
	Debian 12/11/10	x64, AArch64
	Ubuntu 24.04/22.04/20.04/18.04	x64, AArch64
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