



USB  
REAL-TIME SPECTRUM  
ANALYZER

SAN-400 SERIES  
40 GHz

## Key facts

Frequency range: 9 kHz to 40 GHz

1 GHz DANL: -161 dBm/Hz

1 GHz phase noise: -107 dBc/Hz@10 kHz

Analysis bandwidth: up to 100 MHz

USB3.0/2.0 type C interface

Highly compatible API interface

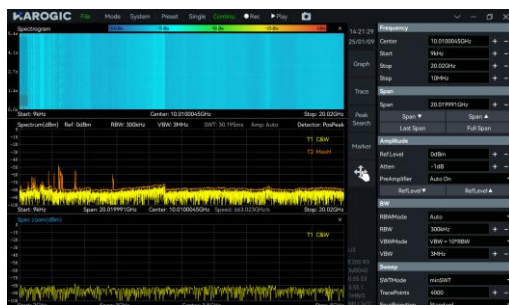
Windows 11/10/8/7 (x86, x64) are supported

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

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

## Applications

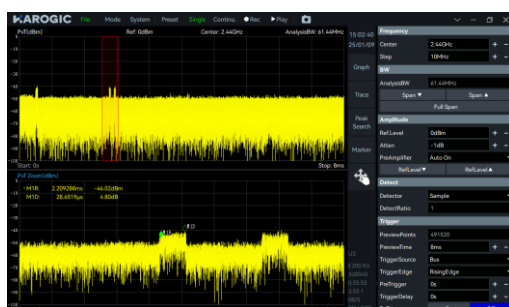
Standard spectrum sweep



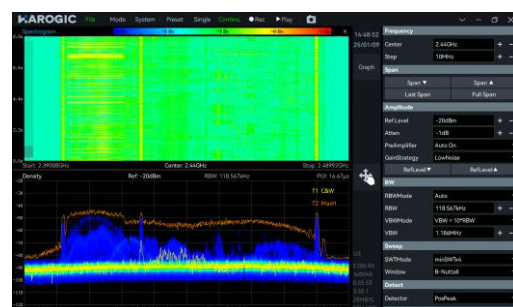
IQ streaming and analysis



Power vs time measurement



Real-time analysis



# Specifications\*

## FREQUENCY

Frequency range	<b>SAN-400 R2</b>		-
	9 kHz-40 GHz		-
Reference clock	Internal or external		
Frequency accuracy	OCXO (std.)		<1 ppm, manual correction is available
	Ext. GNSS disciplined (opt23)	OCXO	<0.05 ppm, when locked to GNSS
Aging and temperature stability	OCXO (std.)		<1 ppm/year, <0.15 ppm
	Ext. GNSS disciplined (opt23)	OCXO	<1 ppm/year, <0.05 ppm

## SPECTRUM PURITY

SSB phase noise (dBc/Hz)				
	<b>SAN-400 R2</b>		-	
Carrier frequency	1 GHz	40 GHz	-	-
1 kHz	-99.0	-78.4	-	-
10 kHz	-107.5	-85.7	-	-
100 kHz	-107.7	-85.1	-	-
1 MHz	-122.7	-100.8	-	-
Residual response (dBm)				
spur reject = bypass				
RBW =1 kHz				
PosPeak detector				
	<b>SAN-400 R2</b>		-	
Reference level (R.L.)	0 dBm	-50 dBm	-	-
9 kHz-10 GHz	-72	-103	-	-
10 GHz-20 GHz	-91	-115	-	-
20 GHz-40 GHz	-85	-105	-	-
Image rejection				
spur reject = standard				
90 MHz-33 GHz	>90 dBc (typ.)		-	
33 GHz-40 GHz	>58 dBc (typ.)		-	

IF rejection	>90 dBc; 8.2 GHz~21.75 GHz, >68 dBc
Local oscillator related spurious	<-65 dBc Center frequency $\pm (N/M)*100$ MHz, N,M = 1,2,3,4,5...

IIP3 / IIP2 (dBm)				
SAN-400 R2				
Carrier frequency	1 GHz	40 GHz	-	-
R.L. = 20 dBm	40.3 / 75.5	31.7 / 88.6	-	-
R.L. = 0 dBm	27.4 / 45.3	10.3 / 86.1	-	-
R.L. = -20 dBm	8.7 / 25.2	4.8 / 66.6	-	-

## AMPLITUDE

Max. input power (CW)	20 dBm	90 MHz-40 GHz and the preamplifier is off
	8 dBm	9 kHz-90 MHz or preamplifier is on
Max. DC voltage	$\pm 10$ VDC	
Display range	DANL-20 dBm (typ.)	
Amplitude accuracy	9 kHz-9.5 GHz	$\pm 2.0$ dB
	9.5 GHz-40 GHz	$\pm 3.0$ dB
IF in-band flatness	$\pm 2.0$ dB	
Reference level (R.L.)	-50 dBm-20 dBm (typ.)	
RF preamplifiers	automatically turn on or forcibly turn off	
VSWR	90 MHz-16 GHz	<2.0:1
	16 GHz-40 GHz	<3.0:1

Display average noise level  
(DANL) (dBm/Hz)

RBW=10 kHz

SAN-400 R2				
Reference level	-20 dBm	-50 dBm	-	-
9 kHz	-134	-145	-	-
100 kHz - 88 MHz	-151	-157	-	-
88 MHz - 9.0 GHz	-148	-154	-	-
9.0 GHz - 19 GHz	-153	-158	-	-
19 GHz - 40 GHz	-146	-147	-	-

## STANDARD SPECTRUM ANALYSIS

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<b>Detector</b>	PosPeak, NegPeak, Sample, Average, RMS, MaxPower
<b>RBW</b>	0.1 Hz-10 MHz
<b>VBW</b>	0.1 Hz-10 MHz
<b>Data chart</b>	SASudio4 software provides spectrum, waterfall chart, and historical trace
<b>Measurements</b>	Channel power, OBW, X dB bandwidth, Adjacent channel power ratio, IM3

<b>Sweep speed</b>	<b>SAN-400 R2</b>	-
<b>RBW <math>\geq</math> 1 MHz FPGA spur reject = standard</b>	about 590 GHz/s	-
<b>RBW = 250 kHz FPGA spur reject = standard</b>	about 571 GHz/s	-
<b>RBW = 30 kHz FPGA spur reject = standard</b>	about 21 GHz/s	-
<b>RBW = 1 kHz CPU spur reject = standard</b>	about 2.3 GHz/s	-

## IQ RECORDING

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<b>Burst recording bandwidth</b>	Maximum: 100 MHz The built-in memory depth is 128 Mbytes
<b>Continuous recording bandwidth</b>	Maximum: 50 MHz Limited by the bandwidth of USB interface and hard disk. The storage depth is limited by the hard disk capacity
<b>IQ sample rate</b>	125MSPS, decimate factor: 1,2,4,8,32,64,128,256,512,1024,2048,4096 supported (FPGA)
<b>External trigger response</b>	Maximum response frequency 500 times/sec

## DETECTION ANALYSIS/ZERO SPAN

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<b>Lowest time resolution</b>	8 ns
<b>Max. analysis bandwidth</b>	100 MHz
<b>Detector</b>	PosPeak, NegPeak, Sample, Average, RMS, MaxPower

## REAL TIME SPECTRUM ANALYSIS

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### 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 =  $10^9 \text{ ns} / (N * D * 8 \text{ ns})$ ; POI =  $N * D * 8 \text{ ns}$   
 N for FFT points (2048, 1024, 512, 256, 128, 64, 32)  
 D for decimate factor (1, 2, 4, 8...)

Typical settings	FFT refresh rate	POI
N = 2048, D = 1	61,035 times/sec	16.384 us
N = 32, D = 1	3,906,250 times/sec	0.256 us

<b>Max. analysis bandwidth</b>	100 MHz
<b>Window function</b>	B-Nuttall, Flat-top, LowSideLobe
<b>RBW</b>	14.73 MHz-3.59 kHz (Flat-top) 7.81 MHz-1.90 kHz (B-Nuttall) 13 grades for each window type
<b>Amplitude resolution</b>	0.75 dB

## GENERAL

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### Input and output

<b>Power supply</b>	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 (limited bandwidth) Device will fetch up to 1 A current from this port
RF input	2.92 mm (F), Input impedance 50 $\Omega$
Reference input	MMCX (F), amplitude $\geq 1.5 \text{ Vpp}$ , input impedance is 300 $\Omega$
Reference 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), maximum output power – 25 dBm, output impedance 50 $\Omega$ Supporting, 307.2 MHz $\pm$ 50 MHz
<b>Power consumption</b>	10-14 W
<b>Enclosure</b>	Core with no enclosure and fan is provided

<b>SAN-400 R2</b>		
<b>Size (D * W * H) and weight</b>	139 x68 x31 mm and about 420 g	-
<b>GNSS synchronization</b>	External GNSS (opt21)	+/- 100 ns
	External GNSS (opt22)	+/- 75 ns
	External GNSS (opt23)	+/- 50 ns
<b>System requirements</b>	Windows 11/10/8/7	x86、x64
	Debian 12/11/10	x64、AArch64
	Ubuntu 24.04/22.04/20.04/18.04	x64、AArch64
<b>Operating temperature (ambient/core)</b>	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)
<b>Storage temperature (ambient)</b>	T0 class (std.)	-20-70 °C
	T1 class (opt40)	-40-85 °C
	T2 class (opt41)	-40-85 °C (core)
<b>Packaging and accessories</b>	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

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Code		
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



 [www.harogic.com](http://www.harogic.com)

 [info@harogic.com](mailto:info@harogic.com)