PX SERIES
PRODUCT MANUAL

IP68 RUGGED REAL-TIME SPECTRUM ANALYZER

PXR Series
9.5/20/40 GHz

V1.1 250928

PXR Series
Technical Overview

RUGGED DESIGN: HAROGIC PXR series rugged spectrum analyzer is featured with IP68-rated design for water, dust and vibration resistance and is certificated with MIL-STD-810H-516.8, MIL-STD-810H-512.6 and MIL-STD-810H-514.8 standards.

EASE OPERATION: The instrument is equipped with a 10.1-inch full touch screen with an intuitive user interface, which allows smartphone-like touch gestures. It weighs only around 2.5 kg for easy carry and operation in labs or fields.

SOLID RF PERFORMANCE: PXR series offers frequency ranges from 9 kHz up to 9.5/20/40 GHz and standard analysis bandwidth of 100 MHz. Based on fast FFT design, it also achieves a sweep speed over 500 GHz/s (RBW>250 kHz).

AI PLATFORM: Optional Nvidia Jesson Orin NX 8GB delivers up to 117 TOPS AI computing power. It features a GPU based on NVIDIA Ampere architecture with 32 Tensor Cores and 1024 CUDA cores, running at a maximum frequency of 1173 MHz, enabling fast spectrum recognition and AI-driven analysis.

HIGHLY COMPATIBLE API INTERFACES: PXR series supports mainstream programming languages including C/C++, C#, Python, MATLAB, Qt, and LabVIEW, allowing easy secondary development and seamless integration into versatile applications.

Key Features

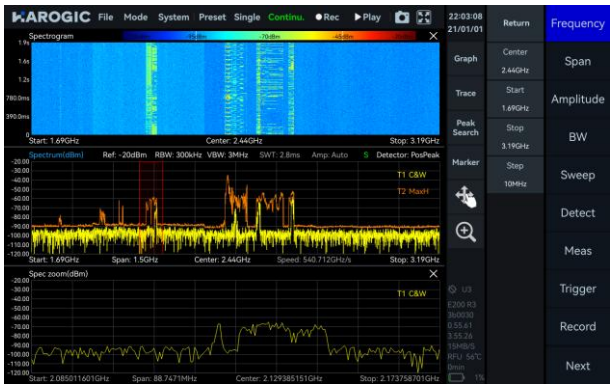
- Rugged design: IEC 60529 IP68 protection rating
- Environmental compliance: MIL-STD-810H-512.6, MIL-STD-810H-516.8 and MIL-STD-810H-514.8
- Portable design: 2.5kg with a 10.1-inch multi-touch screen
- Battery life: Typical 4 hours
- Frequency range: 9 kHz to 9.5/20/40 GHz
- Analysis bandwidth: 100 MHz
- 1 GHz DANL: < -160 dBm/Hz
- 1 GHz Phase Noise: < -100 dBc/Hz@10 kHz
- Built-in Orin NX super processing platform (optional)
- Standard SCPI protocol support

Main Operating Modes Overview

HAROGIC PXR series offers seven main operating modes including: standard spectrum analysis mode, IQ streaming mode, power detection analysis mode, real-time spectrum analysis mode, phase noise measurement, digital demodulation (optional), and harmonic analysis. The detailed description is as below:

■ Standard Spectrum Analysis Mode

This mode provides a wide range of measurement functions, including full-span spectrum sweep, channel power, OBW, ACPR, IM3 and SEM. It also supports spectrum recording and playback. Combined with auxiliary tools such as signal tracking, peak table, and amplitude correction, it delivers a one-stop platform for comprehensive spectrum check.



■ IQ Streaming Mode

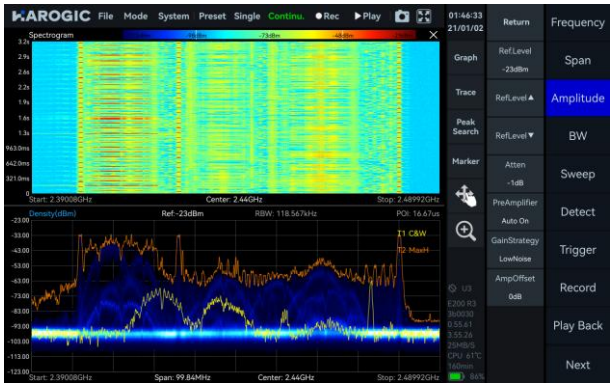
This mode supports up to 100 MHz analysis bandwidth and allows IQ data acquisition through multiple trigger methods. It provides IQ time-domain waveform display, spectrum and spectrogram views, AM/FM demodulation, and digital down conversion (DDC).

■ Power Detection Analysis Mode

This mode enables detection and analysis of time-domain signals within the analysis bandwidth, making it suitable for applications focused on in-band power-versus-time relationships, such as pulse signal measurements.

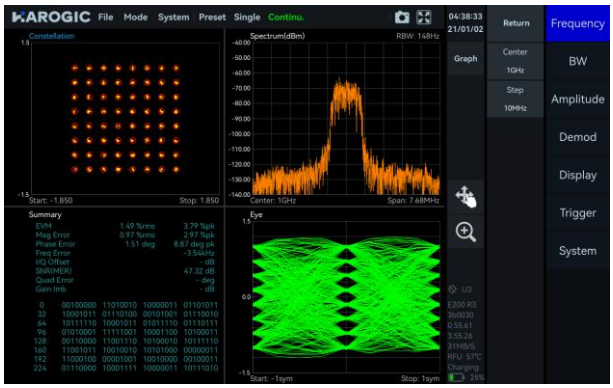
■ Real-time Spectrum Analysis Mode

This mode is powered by a high-speed FPGA-based FFT engine, featuring with strictly gapless and overlap-free FFT, achieving true real-time monitoring across the full bandwidth.



■ Digital Demodulation Mode (option)

This mode supports 2ASK, 2FSK, 4FSK, GMSK, BPSK, QPSK, 8PSK, 16QAM, 64QAM, 128QAM, and 256QAM signals.



■ Harmonics Analysis Mode

This mode supports detection and measurement of up to 10 harmonic components, including harmonic peaks, harmonic channel power, and total harmonic distortion (THD).

■ Phase Noise Measurement Mode

This mode supports offset ranges from 1 Hz to 10 MHz for evaluating carrier phase stability. With the built-in automatic carrier search function, the software can quickly locate the target carrier without manual adjustment.

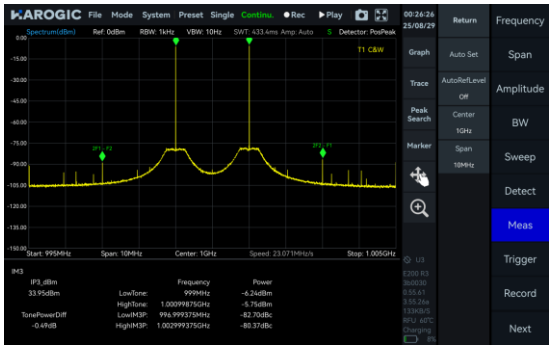
Main Functions Overview

Channel power

OBW

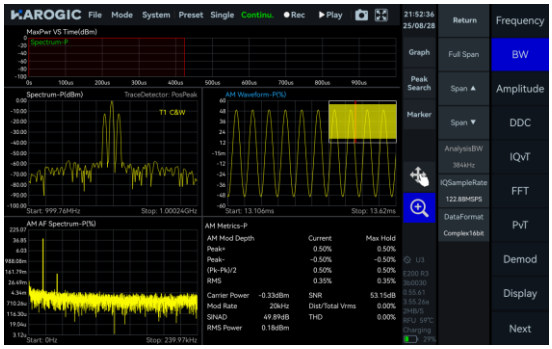
ACPR

IM3



SEM

AM/FM Demodulation

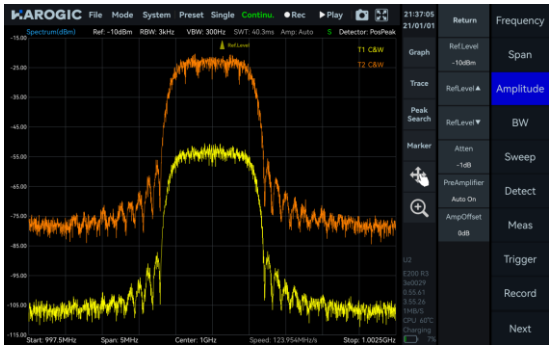


Data Record and Playback

Pulse Detection (option)

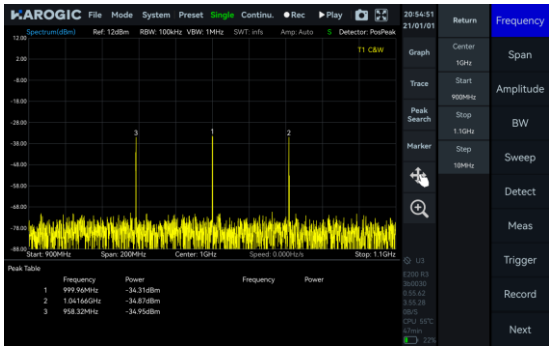
Antenna Factor

Amplitude Offset



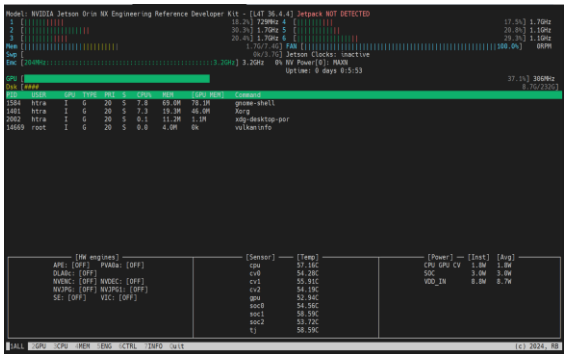
Signal Track

Peak Table



Multiple Unit Display

Orin NX Super Processing Platform (Opt.)



Specifications*

FREQUENCY

	PXE-90R	PXE-200R	PXN-400R
Frequency range	9 kHz to 9.5 GHz	9 kHz to 20 GHz	9 kHz to 40 GHz
Reference clock	Internal or external		
Frequency accuracy	TCXO (std.)	<1 ppm, manual correction is available	
	OCXO (opt01)	<1 ppm, manual correction is available	
Aging and temperature stability	TCXO (std.)	<1 ppm/year, <1 ppm	
	OCXO (opt01)	<1 ppm/year, <0.15 ppm	

SPECTRUM PURITY

SSB phase noise (dBc/Hz)

	PXE-90R		PXE-200R		PXN-400R	
Carrier frequency	1 GHz	9.5 GHz	1 GHz	20 GHz	1 GHz	40 GHz
1 kHz	-95.2	-91.5	-91.2	-80.6	-99.0	-78.4
10 kHz	-101.6	-98.5	-99.7	-90.6	-107.5	-85.7
100 kHz	-100.6	-99.7	-101.1	-96.2	-107.7	-85.1
1 MHz	-120.9	-116.2	-121.6	-111.5	-122.7	-100.8

Residual response (dBm)
Spur reject = bypass
RBW =1 kHz
PosPeak detector

	PXE-90R		PXE-200R		PXN-400R	
Reference level (R.L.)	0 dBm	-50 dBm	0 dBm	-50 dBm	0 dBm	-50 dBm
9 kHz to 1 GHz	-83	-120	-90	-120	-72	-103
1 GHz to 3 GHz	-83	-120	-80	-120	-72	-103
3 GHz to 10 GHz	-90	-130	-90	-120	-72	-103
10 GHz to 20 GHz	-	-	-90	-120	-91	-115
20 GHz to 40 GHz	-	-	-	-	-85	-105

IF rejection (dBc) Typical

	PXE-90R		PXE-200R		PXN-400R	
Spur reject function	enhanced	bypass	enhanced	bypass	enhanced	bypass
	> 90	> 80	> 90	> 80	8.2-21.75GHz: >68 Other: > 90	-

Image rejection (dBc)	Typical					
	PXE-90R		PXE-200R		PXN-400R	
Spur reject function	standard	bypass	standard	bypass	standard	bypass
90 MHz to 3 GHz	>90	>76	>90	>79	>90	-
3 GHz to 9.5 GHz	>90	>60	>90	>68	>90	-
9.5 GHz to 20 GHz	-	-	>90	>60	>90	-
20 GHz to 33 GHz	-	-	-	-	>90	-
33 GHz to 40GHz	-	-	-	-	>58	-

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

IIP3/IIP2 (dBm)

	PXE-90R		PXE-200R		PXN-400R	
Carrier frequency	1 GHz	9.5 GHz	1 GHz	20 GHz	1 GHz	40 GHz
R.L. = 20 dBm	46.1 / 83.2	40.5 / 92.8	45.5 / 82.6	35.3 / 93.6	40.3 / 75.5	31.7 / 88.6
R.L. = 0 dBm	26.7 / 85.0	19.2 / 90.3	25.5 / 81.1	21.0 / 89.0	27.4 / 45.3	10.3 / 86.1
R.L. = -20 dBm	10.5 / 82.2	2.0 / 49.3	7.9 / 81.5	-4.5 / 55.3	8.7 / 25.2	4.8 / 66.6

AMPLITUDE

	PXE-90R	PXE-200R	PXN-400R
Display range	DANL to 23 dBm(typ.)		DANL to 20 dBm(typ.)
Reference level (R.L.)	-50 dBm to +23 dBm(typ.)		-50 dBm to +20 dBm(typ.)
VSWR	90 MHz to 9.5/20 GHz: <2.0:1		90 MHz to 16 GHz: <2.0:1 16 GHz to 40 GHz: <3.0:1
Max. DC voltage	±10 VDC		
IF in-band flatness	±2.0 dB		
Max. input power (CW)	23 dBm: 50 MHz to 9.5/20/40 GHz and the preamplifier is off 10 dBm: 9 kHz to 50 MHz or preamplifier is on		
Amplitude accuracy	9 kHz to 9.5 GHz: ±2.0 dB 9.5GHz to 20/40GHz: ±3.0 dB		
RF preamplifiers	Automatically turn on or forcibly turn off		

Display average noise level(DANL)
dBm/Hz
RBW=1 kHz

	PXE-90R		PXE-200R		PXN-400R	
Reference level (R.L.)	-20 dBm	-50 dBm	-20 dBm	-50 dBm	-20 dBm	-50 dBm
9 kHz to 1 MHz	-143.0	-152.4	-143.6	-152.6	-136.0	-145.8
1 MHz to 90 MHz	-152.0	-159.2	-151.8	-160.0	-153.7	-158.0
90 MHz to 3.0 GHz	-146.0	-167.5	-149.7	-166.3	-154.1	-159.9
3.0 GHz to 9.5 GHz	-153.6	-167.0	-151.4	-157.5	-154.1	-159.9
9.5 GHz to 19 GHz	-	-	-156.1	-160.6	-156.8	-161.5
19GHz to 20 GHz	-	-	-156.1	-160.6	-145.2	-149.3
20 GHz to 40 GHz	-	-	-	-	-145.2	-149.3

STANDARD SPECTRUM ANALYSIS

Detector	PosPeak, NegPeak, Sample, Average, RMS, MaxPower
RBW	1 Hz to 10 MHz
VBW	1 Hz to 10 MHz
Data chart	SAStudio4 software provides spectrum, spectrogram, and historical trace
Measurements	Channel power, OBW, X dB bandwidth, Adjacent channel power ratio, IM3

Sweep Speed	
RBW ≥ 1 MHz FPGA spur reject = bypass	1.0 THz/s
RBW = 250 kHz FPGA spur reject = standard	558.8 GHz/s
RBW = 50 kHz FPGA spur reject = bypass	212.6 GHz/s
RBW = 1 kHz CPU spur reject = bypass	2.6 GHz/s

IQ RECORDING

Burst recording bandwidth	Maximum: 100 MHz The built-in memory depth is 128 Mbytes
Continuous recording bandwidth	Maximum: 25 MHz

IQ sample rate	Maximum: 125 MSPS decimate factor: 1, 2, 4, 8, 32, 64, 128, 256, 512, 1024, 2048, 4096
Ext. trigger response	Maximum frequency response: 500 times/s

DETECTION ANAYLSYS

Lowest time resolution	8 ns
Max. analysis bandwidth	100 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 * 8 ns); POI = N * D * 8 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/s	16.384 us
N = 32, D = 1	3,906,250 times/s	0.256 us

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

ENVIRONMENTAL ADAPTABILITY

Water and dust resistance	IEC 60529 IP68 rating, MIL-STD-810H-512.6
Drop resistance	MIL-STD-810H-516.8
Vibration resistance	MIL-STD-810H-514.8

ORIN NX SUPER (OPT.)

AI performance	117 TOPS
GPU	Equipped with an NVIDIA Ampere architecture GPU with 32 Tensor Cores and 1024 CUDA cores
GPU max frequency	1173 MHz

RAM	8 GB
Third party SSD	256 GB (std.), 512 GB/1 TB(opt.)
Software compatibility	Compatible with JetPack SDK, Accelerating development and Simplifying deployment

GENERAL

Input and output			
	PXE-90R	PXE-200R	PXN-400R
RF input	N(F)		2.4mm(M)
	Input impedance 50 Ω		
Power	USB PD (65W)		
USB port	USB3.0 Type-C * 1, USB2.0 Type-C*1, USB2.0 Type-A * 1		
Audio interface	Micro HDMI * 1 (support for extended display), 3.5 mm headphone port * 1		
Ext. reference clock input	MMCX (F), amplitude ≥ 1.5 Vpp, input impedance is about 330 Ω		
Reference clock output	Integrated in MUXIO, 3.3 V CMOS, programmable on/off		
Ext. trigger input	MMXC (F), 3.3 V CMOS, input: high impedance		
Trigger output	MMCX (F), 3.3 V CMOS		
Ext. antenna input	MMCX (F)		
Analog IF output	MMCX(F), -25 dBm max output power, output impedance 50 Ω supported, 307.2 MHz ± 50 MHz		

Display	IPS LCD 1280 * 800, 10.1-inch multi-touch screen	
RAM and EMMC storage	For standard PXR: 4 GB/32 GB	
Power consumption	25 W (standard PXR, typ.)	
Battery life	about 4 hours (standard PXR, typ.), external power bank supply supported	
Size (D * W * H)	285 mm * 208 mm * 58 mm	
Weight	2.5 kg	
GNSS synchronization	GNSS (only support external antenna)	±100 ns
Operating Temp.(ambient)	T1 class (std.)	-20 to +65 °C
Storage Temp. (ambient)	T1 class (std.)	-40 to +85 °C
Packaging and accessories	Protected main unit * 1, power adapter * 1, power cord * 1, lanyard * 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) Standard spectrum analysis mode-spurious rejection standard on.
(4) Necessary heat dissipation is provided to ensure the ambient and core temperature within the rated range at the same time
(5) Sweep speed and display average noise level test conditions: MCU:0.55.57, FPGA:0.55.22, API:0.55.61

OPTIONS

Code		
01	Built-in OCXO reference clock	built-in hardware
08	Buit-in Orin NX Super Processing Platform	built-in hardware
34	External omnidirectional antenna, 400 to 8000MHz, Gain<2dBi	accessory
35	External active directional antenna, 0.5-10 GHz, Gain: 5dBi (AMP OFF), Gain: 25dBi (AMP ON)	accessory
71	Basic digital demodulation	software
72	Pulse detection	software

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