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R5200 RF Receiver Product Manual



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R5200
RF Receiver

Product Overview

The R5200 is an RF receiver covering 1 MHz to 20 GHz with up to 500 MHz real-time bandwidth. It supports evaluation and validation across a wide range of broadband wireless applications.

Advanced RF Performance

The R5200 uses a high-performance superheterodyne receiver architecture with up to 14 preselection filter bands, covering 1 MHz to 20 GHz. It delivers competitive noise performance, wide dynamic range, strong interference rejection, and fast signal analysis.



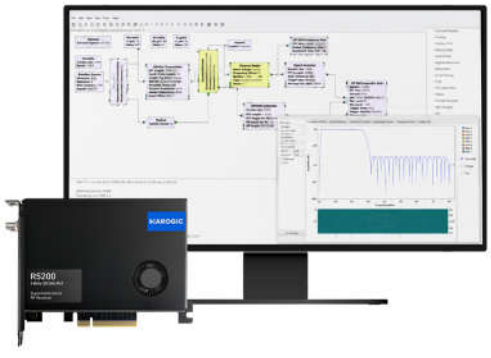
High-Speed Digital Interfaces

The R5200 provides PCIe 3.0 x8 and USB 3.0 data interfaces, plus optional Thunderbolt connectivity. The PCIe 3.0 x8 supports full-bandwidth raw-IQ streaming at up to 2.5 GB/s, meeting the needs of wideband applications. Its PCIe card form factor enables integration into compact systems, while the optional Thunderbolt dock supports desktop deployment.



Powerful API and Ecosystem

A unified SDK and API enable seamless migration across hardware platforms without requiring any code changes. The SDK supports C/C++, C#, Python, MATLAB, Qt, LabVIEW, GNU Radio, etc. It is compatible with both Windows and Linux operating systems. SAStudio4 and the HTRA API identify the R5200 by its internal core name, W200.



Key Features

- Single-channel superheterodyne RF receiver;
- Frequency range: 1 MHz to 20 GHz;
- Maximum real-time bandwidth: 500 MHz;
- Up to 14 preselection filter bands for strong interference rejection;
- Noise figure: 9 dB (1 GHz), 12 dB (20 GHz);
- 1 GHz phase noise: < -124 dBc/Hz @ 10 kHz;
- Image rejection: ≥ 90 dBc (< 8.5 GHz), ≥ 80 dBc (8.5 GHz to 20 GHz);
- IF rejection ≥ 85 dBc;
- Built-in OCXO and GNSS, supporting GNSS-aided frequency calibration;
- Data interfaces: PCIe 3.0 x8, USB 3.0, Thunderbolt (opt.);
- Comprehensive APIs and example applications;
- Weight / power consumption: ≤ 680 g / ≤ 42 W;

Typical Applications

- **Broadband Spectrum Monitoring and Anomalous Signal Detection**

  With real-time bandwidth up to 500 MHz, the R5200 supports real-time spectrum monitoring and the capture of burst and frequency-hopping signals.

- **Broadband RF Signal Recording**

  Covering 1 MHz to 20 GHz, including the X and Ku bands, the R5200 supports wideband IQ recording and high-speed streaming to disk. The PCIe 3.0 x8 and optional Thunderbolt interfaces support embedded-system integration and desktop deployment, respectively.

- **Satellite Communication Signal Monitoring**

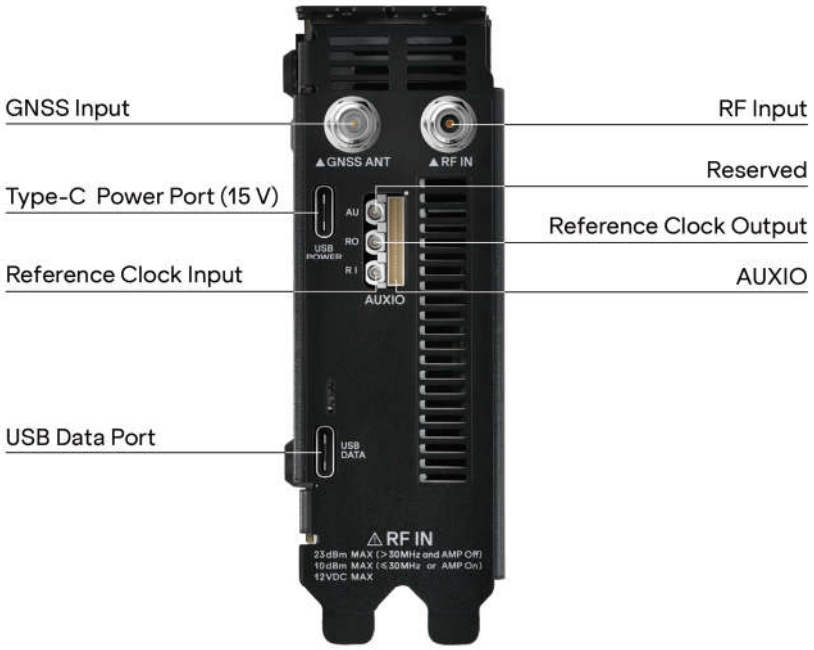
  Coverage up to 20 GHz includes the Ku band, while up to 500 MHz of real-time bandwidth supports broadband satellite downlink acquisition for non-terrestrial network (NTN) applications, telemetry recording and analysis, and satellite-interference analysis.

- **6G Wireless Research in the FR3 Band**

  Within its 1 MHz to 20 GHz frequency coverage, the R5200 supports 6G wireless communications research in the FR3 range, including wideband signal acquisition and wireless-channel research.

R5200 Interface Description

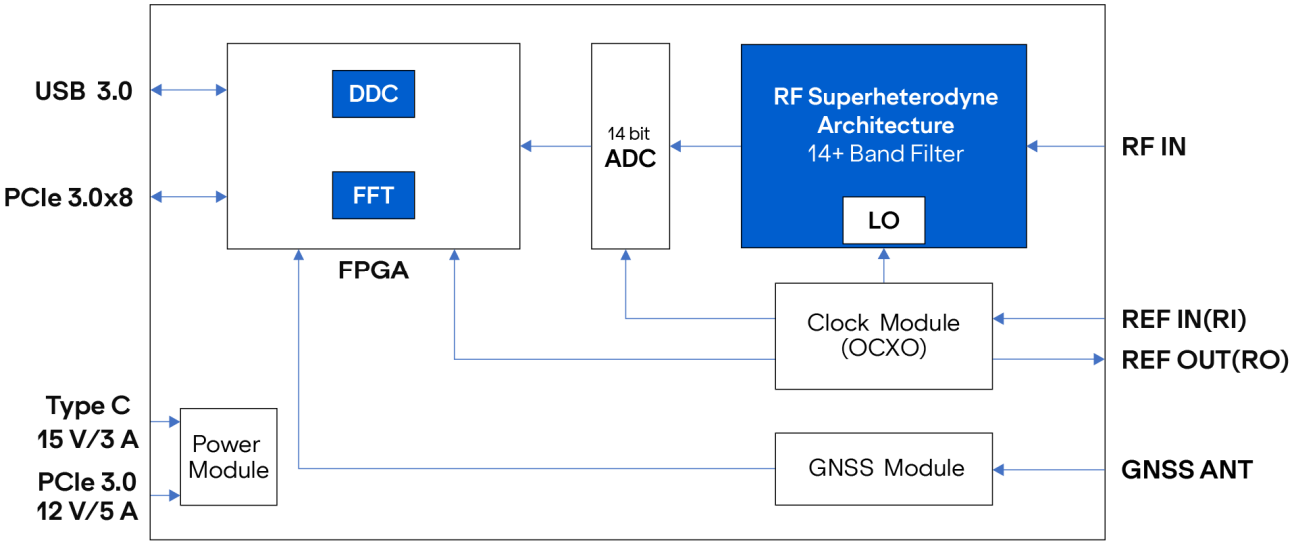




Technical Specifications*

Frequency and Clock	R5200	
Number of Channels	1	
Frequency Range	1 MHz to 20 GHz	
Frequency Step	1 Hz	
Reference Clock	Internal or external; supports manual correction or calibration via built-in GNSS	
Frequency Accuracy	Built-in OCXO: ≤ 0.2 ppm; manual correction supported	After GNSS-aided correction: ≤ 0.05 ppm
Aging and Temperature Drift	OCXO (standard), ≤ 1 ppm/year, ≤ 0.15 ppm	
Built-in GNSS 1PPS Accuracy	≤ 20 ns, under clear-sky conditions	
External Reference Clock Input	10 MHz or 100 MHz; MMCX (female); amplitude ≥ 1.5 Vpp; input impedance 330 Ω	
Reference Clock Output	100 MHz; MMCX (female); amplitude ≥ 0.3 Vpp; programmable on/off	

System Block Diagram



Amplitude

Maximum Input Power Before Damage	23 dBm (> 30 MHz, preamplifier off); 10 dBm (≤ 30 MHz or preamplifier on)
Maximum DC Voltage at RF Input	±12 VDC
Level Accuracy	≤ 8 GHz: ±1.5 dB; 8 GHz-20 GHz: ±2.5 dB

Noise Figure (dB)

Reference Level: -50 dBm	**1 GHz**	**9 GHz**	**20 GHz**
Noise Figure	9	12	12

Phase Noise (dBc/Hz)

Carrier Frequency	**1 GHz**	**3 GHz**	**10 GHz**	**20 GHz**
1 kHz	-115	-111	-103	-100
10 kHz	-124	-117	-112	-107
100 kHz	-124	-117	-112	-108
1 MHz	-136	-124	-114	-112

Local Oscillator (LO)

LO Leakage	< -90 dBm (0 dBm reference level)
LO-Related Spurs	< −65 dBc at offsets of ±(N/M) × 100 MHz from the center frequency, where N, M = 1, 2, 3, 4, 5, ...

IIP3 (dBm)

Reference Level	**1 GHz**	**3 GHz**	**10 GHz**	**20 GHz**
+20 dBm	42	41	42	37
0 dBm	25	22	21	22
-20 dBm	15	4	9	7

Interference Rejection

R5200	Image Rejection	1 MHz to 8.5 GHz	≥ 90 dBc (typical)
		8.5 GHz to 20 GHz	≥ 80 dBc (typical)
	IF Rejection	1 MHz to 8.5 GHz	≥ 85 dBc (typical)
		8.5 GHz to 20 GHz	≥ 85 dBc (typical)

General Specifications

RF Input	2.92 mm (F)	
Power	USB Type-C, 15 V / 3 A; or 12 V / 5 A for the PCIe configuration	
Data Connection	PCIe 3.0 x8 or USB 3.0 (cannot be used simultaneously); Thunderbolt interface via optional PCIe 3.0 x8 expansion dock (Option 25)	
External Trigger Input	available through AUXIO; 3.3 V CMOS; high-impedance input	
Trigger Types	bus trigger, digital-edge trigger, and level trigger	
Trigger Output	available through AUXIO; 3.3 V CMOS	
GNSS Antenna Input	SMA (F), 50 Ω impedance	
External Reference Clock Input	MMCX (female), 10 MHz or 100 MHz, amplitude ≥ 1.5 Vpp, 330 Ω impedance	
Reference Clock Output	MMCX (female), 100 MHz, amplitude ≥ 0.3 Vpp, programmable enable/disable	
Overall Weight	≤ 680 g	
Overall Dimensions (L × W × H)	159 × 122 × 41 mm	
Power Consumption	≤ 42 W	
Package Accessories	1 × USB flash drive; 1 × USB power cable; 1 × power adapter with AC power cord	
Host System Requirements	USB data interface: Windows 11/10 (x86_64), Ubuntu 22.04/20.04 (x64, AArch64) PCIe/Thunderbolt data interface: Ubuntu 20.04.6, Linux kernel 5.15.0-139-generic; Ubuntu22.0.5 LTS， Linux kernel 4 6.8.0-40-generic	
Operating / Storage Temperature (Ambient)	T0 Temperature Class	0 °C to 50 °C / −20 °C to 70 °C
Operating Relative Humidity	Ambient Temperature: 0 °C to 40 °C	5% RH to 75% RH
	Ambient Temperature: above 40 °C	5% RH to 45% RH

Baseband

ADC Resolution	14 bits
SFDR	> 65 dB. The ADC may occasionally produce conversion errors; the typical error amplitude is 4 mV
IQ Sample Rate	adjustable from 600 MS/s to 640 MS/s in steps of ≤ 1 MHz
Continuous IQ Streaming Throughput	PCIe 3.0: 2500 MB/s (sampling rate: 625 MS/s, bandwidth: 500 MHz) Thunderbolt (Option 25): 900 MB/s (sampling rate: 225 MS/s, bandwidth: 180 MHz) USB 3.0: 250 MB/s (sampling rate: 62.5 MS/s, bandwidth: 50 MHz)
FPGA Decimation Factors	Supports decimation factors of 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 24, 30, 40, 48, 60, 80, 96, 120, 160, 192, 240, 320, 384, 480, 640, 768, 960, 1280, 1536, 1920, 2560, 3072, 3840, 5120, 6144, 7680, 10240, 12288, 15360, 20480, 24576, 30720, and 40960
FPGA On-Board Memory	2 GB
FPGA FFT Analyzer	real-time 8,192-point FFT across the full 500 MHz bandwidth
Timestamp	supports recording timestamps together with the IQ stream
Trigger Types	Supports multiple trigger methods for IQ acquisition, including edge trigger, level trigger, etc.
External Trigger Response	maximum 500 triggers/s

* Specifications apply under the following conditions:
(1) Power on the unit and allow it to warm up for 10 minutes. Unless otherwise specified, all values are typical.
(2) Ambient temperature: 25 °C.
(3) Specifications may change with hardware and software revisions without prior notice.

OPTIONS

Code	Option	Type
20	AUXIO I/O Expansion Board	External Accessory
25	Thunderbolt Expansion Dock	External Accessory
71	Basic Vector Modulation Analysis	Software
72	Pulse Analysis	Software

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