Ettus Research™
A National Instruments Company

THE LEADER IN SOFTWARE DEFINED RADIO

OVERVIEW

Ettus Research™, a National Instruments brand, is the world's leading supplier of software defined radio platforms, including the Universal Software Radio Peripheral (USRP™). The USRP platform supports multiple development environments on an expansive portfolio of high-performance RF hardware, and enables algorithm design, exploration, prototyping, and deployment of next generation wireless technologies across a wide variety of applications spanning DC to 6 GHz such as cognitive radio, spectrum monitoring and analysis, remote sensing, advanced wireless prototyping, mobile radio, public safety, broadcast TV, satellite communication, and navigation.

PRODUCT PORTFOLIO

USRP Networked Series

The Networked Series offers Ethernet-based SDR devices ranging from cost-effective to high-performance variants. It includes the USRP N3xx and USRP N2xx devices. USRP N3xx multichannel devices offer high bandwidth of up to 100 MHz per channel and provide reliability and fault tolerance for deployment. They also feature a diverse set of remote management capabilities. The USRP N3xx devices uniquely offer the White Rabbit Ethernet-based timing protocol for precise synchronization of distributed devices in GPS-denied environments. The USRP N310/N300 RF front end uses up to two AD9371 RFIC transceivers to provide high-channel density that delivers 4x4 MIMO capability in a half-wide RU form factor. You can deploy applications on the Xilinx Zynq-7100/7035 SoC, which features a large, programmable FPGA for low-latency and real-time processing and an ARM processor for stand-alone operation. You also can choose from several high-speed interface options such as 1 GbE, 10 GbE, and Aurora for sample streaming to a host computer. The USRP N2xx single-channel and low-bandwidth devices are small, reliable, and cost-effective radios for applications with less stringent requirements.

High Channel Density USRP N310

USRP Bus Series

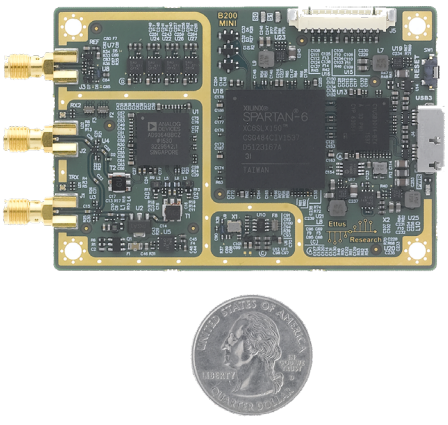
The cost-effective, low SWaP Bus Series is suitable for both hobbyist and OEM integrators. You can choose from credit card or 3U Eurocard sized board-only variants and purchase an optional steel enclosure accessory. The RF front end uses the AD9364/9361 RFIC transceiver for single-channel or 2x2 MIMO capability. You can deploy applications on the Xilinx Spartan-6 programmable FPGA or stream samples to a host computer with a USB 3.0 interface.

USRP X Series

The multichannel, high-bandwidth X Series offers up to 160 MHz per channel. This series uniquely features a wide selection of high-performance RF front ends designed in-house using discrete components. These RF front ends provide wide dynamic range, low phase noise, precise phase alignment, fast tuning, fast TX/RX switching, and DC/HF coverage. You can deploy applications on a large Xilinx Kintex-7 FPGA for low-latency and real-time processing or stream samples to a host PC with multiple high-speed interface options such as 1 GbE, 10 GbE, and PCI Express. The X Series is available in a half-wide RU form factor enclosure.

USRP Embedded Series

The Embedded Series offers a portable, stand-alone SDR platform designed for field deployment. The RF front end uses the AD9361 RFIC transceiver with 2x2 MIMO capability. You can deploy applications on the Xilinx Zynq-7020 SoC, which features a programmable FPGA for low-latency and real-time processing, and an ARM processor for stand-alone operation. You can rapidly prototype and deploy designs for mobile and embedded applications with low SWaP requirements. These devices feature options for an internal battery or an IP67 enclosure for reliable outdoor deployment.



Credit card sized USRP B200mini

USRP Daughterboards

The USRP daughterboards serve as interchangeable RF and baseband front ends for the X Series and USRP N2xx devices.

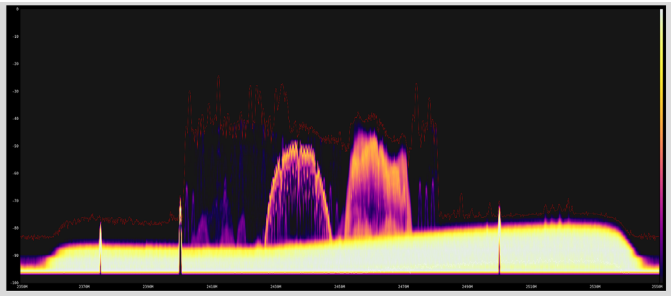
Name	Bandwidth	Frequency Range
TwinRX	80 MHz, 2 RX ch	10 MHz—6 GHz
UBX	40 MHz, 160 MHz	10 MHz—6 GHz
CBX	40 MHz, 120 MHz	1.2 GHz—6 GHz
SBX	40 MHz, 120 MHz	400 MHz—4.4 GHz
WBX	40 MHz, 120 MHz	50 MHz—2.2 GHz
LFRX, LFTX	30 MHz	0 Hz—30 MHz
BasicRX, BasicTX	250 MHz	1 MHz—250 MHz

A size comparison of USRP E310 and the battery powered USRP E312

SOFTWARE

USRP Hardware Driver™ (UHD)

The UHD software API supports application development on all USRP products. You can efficiently develop applications then seamlessly transition designs to other USRP platforms as requirements expand. UHD integrates with multiple development environments and frameworks and is available on Linux, Windows, and Mac OS. As a dual-licensed software, UHD is available under both an open-source license and a less-restrictive license offered only by Ettus Research. For more information on the licensing policy, please contact info@ettus.com.



An FPGA-accelerated RTSA-like display showing a 200 MHz spectrum implemented with RFNoC and GNU Radio.

LabVIEW™

LabVIEW Communications System Design Suite, designed by National Instruments, supports select USRP motherboard and daughterboard configurations with the goal of accelerating productivity by providing a seamless tool flow from the host PC to FPGA. The software combines intuitive graphical programming with tools for managing complex system configurations, multi-rate DSP design of the FPGA, and float to fixed point conversion. Application Framework add-ons and reference designs are available for LTE, 802.11, and high-channel count massive MIMO configurations. Visit www.ni.com/sdr to learn more.

RF Network on Chip (RFNoC™)

The RFNoC architecture decreases the development time for experienced FPGA engineers seeking to integrate IP into the USRP signal-processing chain. It provides a system-level view of SDR applications spread across the FPGA and host PC, and integrates with GNU Radio's tools to provide a graphical front-end. You can leverage existing RFNoC blocks or integrate their own IP into new blocks. RFNoC is available under both an open-source license and an alternative license offered only by Ettus Research.

GNU Radio

GNU Radio is a free software development framework that provides signal processing functions for implementing software radios. The framework offers a graphical design approach in addition to supporting development in Python and C++. Supported globally by the open-source community and widely used in government, commercial and academic environments, GNU Radio gives users access to a diverse set of existing projects focused on wireless communications research and implementation of real-world radio systems.

MATLAB® and Simulink®

MATLAB and Simulink connect to the USRP family of software-defined radios to provide a radio-in-the-loop environment for SISO and MIMO wireless system design, prototyping, and verification. Communications System Toolbox™ supports all USRP devices, to transmit and receive RF signals in real time, enabling the use of MATLAB and Simulink to configure radio parameters, generate waveforms, design algorithms, and measure and analyze signals. Visit www.mathworks.com/hardware-support/usrp.html to learn more.

APPLICATIONS

Defense and Public Safety

The USRP platform combines performance and stand-alone operation into portable and durable designs, enabling rapid prototyping and deployment of sophisticated communication systems. Through a diverse portfolio of interchangeable RF front ends, the USRP product family offers extensive frequency coverage across multiple bands of interest to address defense and public safety applications such as:

- Spectrum monitoring and analysis
- Geolocation and direction finding
- Military Communications
- Public safety communication bridges
- Emergency low-power beacons
- Underground communications RADAR
- Battlefield and survivable networks

Advanced Wireless Research

The USRP platform enables rapid prototyping of next-generation wireless systems. The reconfigurable and compute-intensive FPGA provides the flexibility and determinism necessary for real-time exploration of algorithm designs. Fast data transfer rates allow instantaneous acquisition of wide bandwidth signals. Multiple devices can be coherently synchronized to implement scalable, multi-channel testbeds. The USRP product family is designed for a wide range of advanced wireless applications, including:

- MIMO systems
- Base stations/access points for LTE, 802.11, and other standards
- Cognitive radio
- PHY-Layer and MAC-Layer prototyping
- Mobile ad-hoc and mesh networking

Academia

The Ettus Research SDR platform is widely adopted by academic environments worldwide for teaching and research. With a flexible cross-platform software interface supporting multiple development environments, the platform exposes students to industry standard tools, and integrates easily into existing laboratory infrastructure. Compact, portable form factors equipped with fast and convenient host interfaces facilitate transportation between research sites for field testing, and around campus for analysis of real-world wireless signals. The USRP platform enables the academic world to explore topics such as:

- Wireless protocols
- Digital signal processing
- Communication systems
- FPGA design
- Remote sensing

PARTNERS

The USRP platform is a key component in a growing ecosystem of expertise and experience. Ettus Research has established a network of trusted and capable partners that offer turn-key products and services with specializations in LTE base stations, cognitive radio, the SCA, GNSS simulation, system integration, and training. For more information, please contact info@ettus.com, or visit ettus.com/partners.

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