

Small Cell Radio Development Kit

Get your prototypes up and running quickly with the Pico Radio Enablement Platform, co-developed by Intel and Analog Devices, Inc. (ADI)

Executive Summary

As operators increase network density to accommodate both 4G and 5G growth, they are deploying small cells to increase connection points and coverage. An important component of the small cell is the remote radio head/unit (RRH or RRU). The faster an RRH can be developed, the faster the operator can grow the network. However, RRH development can be challenging due to difficulties associated with prototyping, testing, and reducing power consumption.

Analog Devices, Inc. (ADI) and Intel have collaborated to create an end-to-end small cell radio development kit, called the Pico Radio Enablement Platform (see Figure 1). This platform directly connects ADI's Madura Sub-6 GHz development kit to the Intel® Arria® system on a chip (SoC) development board. The platform supports a variety of radio frequency bands, provides a single programmable platform for 5G and software-defined radio (SDR) applications, and is Open Radio Access Network (O-RAN)-compliant. The platform can be connected to a PC, and includes a graphical user interface (GUI) that customers can use to configure the hardware platform.

Using the Pico Radio Enablement Platform helps speed prototyping and testing, and can significantly decrease time to market for new RRH architectures.

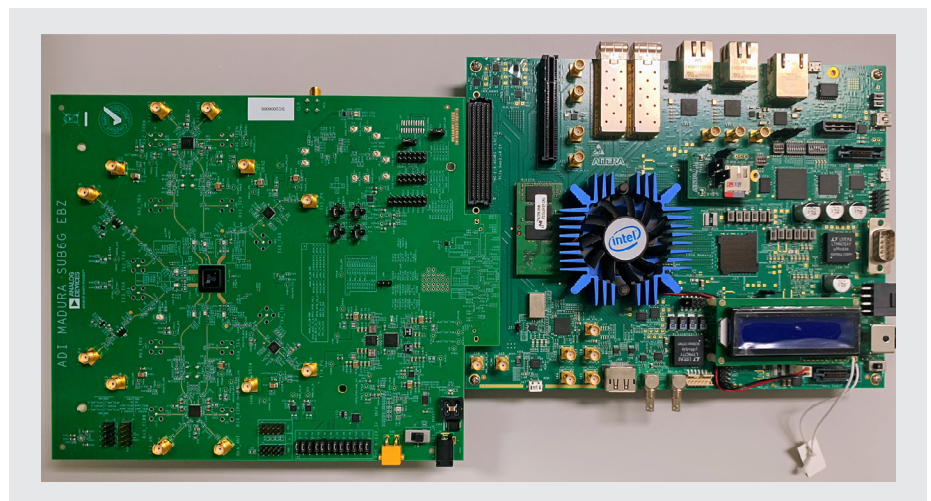


Figure 1. Flexible 5G small cell radio development platform.

Solution Benefits

- Ready solution for evaluation and prototype development
- Speed time to market with commercially available accelerator and performance-optimized reference design
- Flexible radio frequency band support with external power amplifier (PA) modules
- Common programmable platform for 5G and other software-defined radio (SDR) applications
- Open Radio Access Network (O-RAN) compliant radio unit

Business Challenge: Getting to Market Before the Competition

With emerging 5G networks, a key strategy to increase network coverage and capacity is “densification,” which involves adding new connection points. Small cells are expected to be a core element of this strategy, and the RU or RRH is the differentiator for equipment manufacturers. But developing new RUs/RRHs poses significant challenges, which can delay time to market:

- Building a working prototype, including evaluation and benchmarking with different analog front ends, and different power amplifiers (PAs)
- Designing and developing the required product variants (frequency, power and bandwidth) and supporting multiple partition options with different interfaces such as Common Public Radio Interface (CPRI), Enhanced CPRI (eCPRI) and Ethernet
- Reducing the total cost of 5G radio network deployment, especially reducing the RU/RRH power consumption

Solving all these challenges—and quickly creating new RRH architectures that are flexible and efficient—demands an all-in-one development kit. And that is exactly what ADI and Intel have created: the Pico Radio Enablement Platform.

A Solution for Radio Equipment Development

The Pico Radio Enablement Platform can be used to develop single-model or multiple-model radio with different spectrum/band configurations and equipment:

- 5G single-band wide-bandwidth 2T/4T radio (up to 200 MHz)
- Support for flexible 5G and 4G bands selection
- 5G distributed antenna system (DAS)/repeater
- 5G test equipment
- Phased array radar

Solution Value: Evaluate and Benchmark Remote Radio Head (RRH) Designs with Ease

The Pico Radio Enablement Platform provides customers with a flexible setup to modify their field-programmable gate array (FPGA) design, PA selection and radio components, without breaking the entire setup. A baseline reference example is provided to let customers quickly bring up their own system. Then, customers can verify new algorithms and IP before system integration, using test-driven development controls and software integration. By combining commercial off-the-shelf (COTS) silicon from ADI and Intel into a single unified system, the Pico Radio Enablement Platform provides customers with an out-of-the-box solution for evaluation and prototype development. That means that prototype development can be substantially accelerated. Other benefits of the platform include the following:

- Support for several radio frequency bands, with external PA modules
- Common programmable platform for 5G and SDR applications
- Compatible with the O-RAN interface specification

The platform can be connected to a PC, and includes a GUI that customers can use to configure the hardware platform (see Figure 2). These configurations include selecting frequency bands, radio standards and different 5G/4G test signals, as well as capturing real-time data for performance analysis and evaluation. These capabilities provide a loop emulation system for customers to explore the results with different algorithms and implementations to shorten the development cycle.

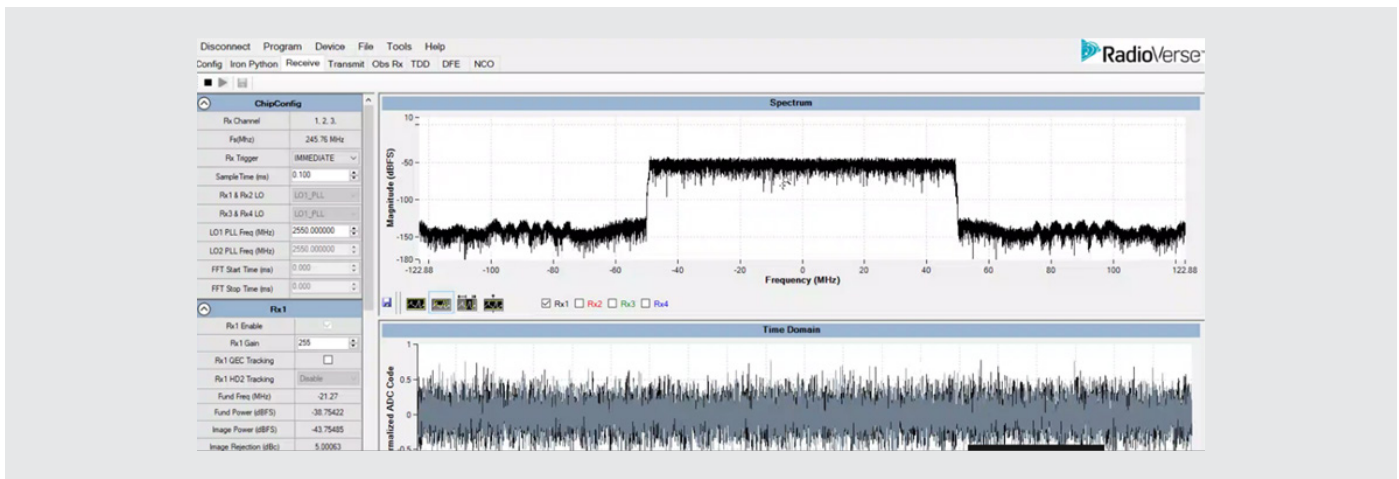


Figure 2. Quickly generate waveforms with the Pico Radio Enablement Platform.

Solution Architecture: Flexible System Prototyping Tool

The Pico Radio Enablement Platform represents the marriage of ADI's Madura Sub-6 GHz development kit and the Intel Arria SoC development board. These two silicon components are directly connected to create a single entity (see Figure 3).

The ADI **Madura Sub-6 GHz development kit** supports 4T4R transmit-and-receive channels. In addition to 4 radio frequency (RF) transmit and receive functions, it also includes advanced Digital Pre-Distortion (DPD) and Crest Factor Reduction (CFR) capabilities, which enhance PA efficiency and lower implementation costs. RU clock, power, and RF amplifiers and front ends are also supported in the development kit. The GUI can be used for lab evaluation of the transceiver, the clock and RF Front End Control Interface (RFFE) solutions.

The **Intel Arria 10 SoC development board** provides a hardware platform for developing and prototyping low-power, high-performance, and logic-intensive designs using the Intel Arria 10 SoC. The board provides a wide range of peripherals and memory interfaces to facilitate the development of Intel Arria 10 SoC designs. The platform also provides a Radio DFE reference design to connect/configure the Madura kit/transceiver, SoC subsystem for host control and different RAN split (option 8/7) protocol shells.

Conclusion

By combining ADI's Madura Sub-6 GHz development kit and the Intel Arria 10 SoC development board, the Pico Radio Enablement Platform lets RRH developers verify new algorithms and IP before system integration—which can drive down costs and speed development. This out-of-the-box solution is just what the industry needs to accelerate network densification and prepare for large-scale 5G deployments.

Spotlight on Analog Devices, Inc. (ADI)

Analog Devices, Inc. (ADI) is a large semiconductor company specializing in data conversion, signal processing and power management technology. With headquarters in Norwood, Massachusetts, the company employs more than 15,000 employees around the globe and has over 100,000 customers worldwide. Founded in 1965, ADI has developed a broad portfolio of high-performance analog, mixed-signal, and digital signal processing (DSP) integrated circuits (ICs). ADI continues to invest in the wireless communication market for Sub-6 GHz and the mmWave 5G market. The firm has established a substantial presence in the small cell market in the past years. Known for its high-quality radio frequency (RF) transceiver products, ADI also offers great clocking, RF front end and low-power capabilities for wireless communication.

Learn More

You may find the following resources helpful:

- [Analog Devices, Inc. Wideband Solutions page](#)
- [Intel® Arria® 10 SoC Development Kit](#)
- [Arria 10 SoC Development Kit User Guide](#)
- Find the solution that is right for your organization. Contact your Intel representative or visit www.intel.com/content/www/us/en/communications/products/programmable/overview.html.

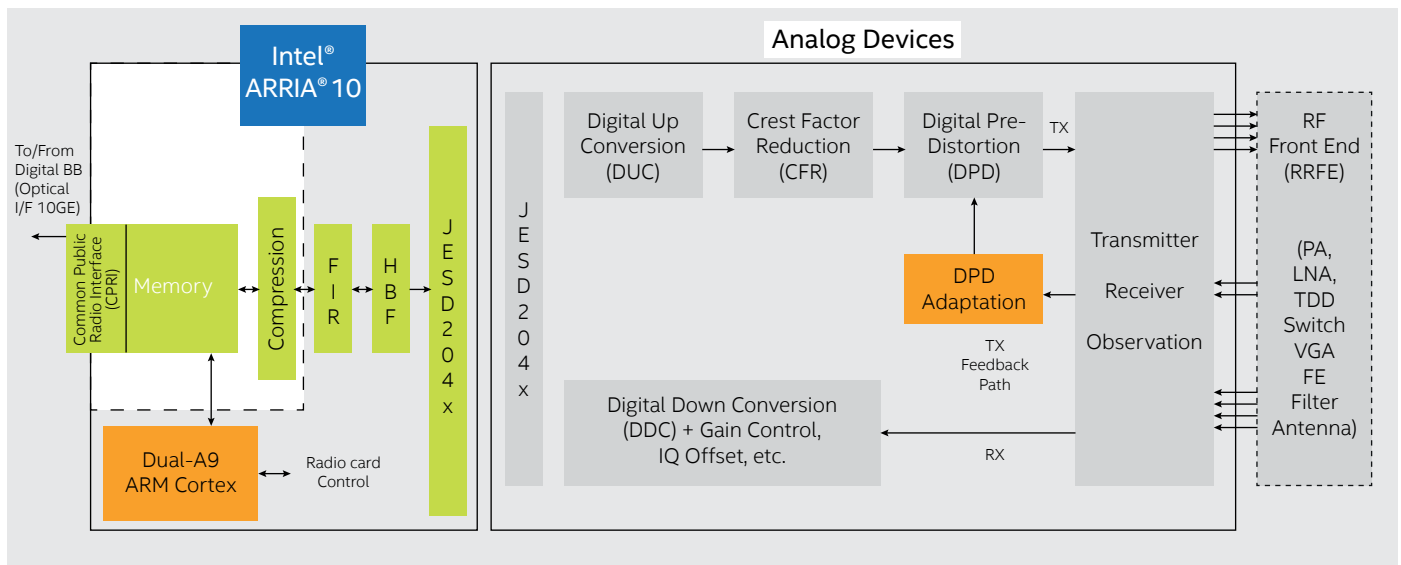


Figure 3. The Pico Radio Enablement Platform combines Analog Devices, Inc.'s (ADI's) Madura Sub-6 GHz development kit and the Intel® Arria® system on a chip (SoC) development board.



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