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Design roundup: software-defined radio

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Communication has always been a cornerstone of defense. With conflicts featuring multi-branch forces and coalitions from different countries, radio communications takes place over a range of frequency bands, with devices having to adhere to a variety of standards. Meanwhile, continuous improvements in technology pressure designers to field products that can be modified in the late stages of development or even upgraded in the field. Meanwhile performance standards remain high, even in the face of price pressures. Software-defined radio (SDR) provides the means to address the challenge, for the military and aerospace sector, and even the commercial market.

The **exact definition of the technology varies** depending upon who is doing the defining, but we can loosely characterize a software-defined radio as one in which some or all of the physical-layer components are executed in software. In this round up, you can review the fundamentals, familiarize yourself with the challenges, understand test, and discover the most recent advances in the field.

Fundamentals of SDR

Before you can think about new developments, you have to have a common set of definitions and operating assumptions. Start out with this three-part tutorial from *RF and Wireless Technologies*:

- **Basics of Software Defined Radio, Part 1**: Learn the fundamental definitions, architectures, and the trade-offs involved in dynamic characteristics such as data rate, channel bandwidth, and modulation schemes.
- **SDR Basics: Receivers**: Before you can move into the digital domain, you need an analog front end. Superheterodyne architectures provide a good solution.
- **SDR Basics Part 3: Transmitters**: Tactical military radios need to transmit as well as receive. Here, too, devices leverage either super-heterodyne or direct conversion schemes, depending on the application.

Looking for more background? Review the **Software Defined Radio Handbook** to learn how SDRs replace conventional analog receivers with digital downconverters and upconverters. Enhance your understanding with a review of board- and system-level implementations, as well as off-the-shelf SDR products for embedded systems.

SDR design challenges – and solutions

SDR is not as simple as it sounds. Find out more about the challenges of SDR, including the use of standard platforms with varying requirements and the need to balance workloads for tasks running in parallel in **Software defined radio: defining the challenges**.

Testing is an essential part of engineering. An SDR needs to operate at high data rates over multiple channels. It needs enough bandwidth to conform to multiple standards. When you have a unit capable of running a variety of different tasks, the number of testing scenarios expands significantly. Find out more about the problems and solutions in **Understanding SDRs and their RF Test Requirements**.

Enhanced ADCs have enabled the development of wideband SDR solutions that offer high-channel-count, high-frequency operation. In these applications, traditional ADC specifications such as the effective number of bits (ENOB) no longer apply, however. Find out why, and the correct criteria to apply in **Software Defined Radio: Don't Talk to Me about ENOBs, Part 1** and **Part 2**.

___Software Defined Radio Handbook, 9th Edition

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