

An Overview of SDR and Enabling Technologies

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Within the past decade, software defined radio (SDR) has moved rapidly from concept to reality. SDR's are currently available for cellular and PCS base stations as well as fixed station military applications. While SDR technology has enabled some practical products, the current implementations suffer from limitations that preclude development of a practical and widely deployed handheld SDR. Challenges including reduction of power consumption, size, weight, and cost remain for implementation of practical handheld SDR devices. However, several SDR experts believe that handheld SDR's will be in widespread use within five years. This prediction is supported by the continuing rapid development of SDR's, driven by tremendous advances in key components necessary for SDR's. These key components include high-speed, high-spurious free dynamic range analog-to-digital and digital-to-analog converters; high-speed digital signal processing devices such as application specific integrated circuits (ASIC's), digital signal processors, field programmable gate arrays (FPGA's), and general purpose processors; and wideband linear power amplifiers.

While there are differing opinions as to what an SDR actually is, a good general definition of an SDR is found in the recently adopted American National Standard, *Telecom Glossary 2000*. An SDR consists of a receiver and/or transmitter with the following properties: (a) the received signal is digitized and then processed using software-programmable digital signal processing techniques (digitization may occur at the RF, IF, or baseband); (b) the modulated signal to be transmitted is generated as a digital signal using software-programmable digital signal processing techniques. The digital signal is then converted to an analog signal for transmission (the conversion to analog may occur at baseband, IF, or RF).

A key factor in SDR's is that software programmability allows easy changes of the radio's fundamental characteristics such as modulation types, operating frequencies, bandwidths, multiple access schemes, source and channel coding/decoding methods, frequency spreading/despreading techniques, and encryption/decryption algorithms. Traditional, hardware-based radios required hardware changes to modify these fundamental characteristics of a radio.

This presentation will provide an introduction to software defined radios describing what they are and the enabling technologies behind them. Topics will include the data conversion process and digital signal processing with primary emphasis on the software defined radio receiver.