# Chapter 89
# Secure Baseband Techniques for Generic Transceiver Architecture for Software-Defined Radio

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## ABSTRACT

*Software Defined Radio (SDR) systems are the ones which can adapt to the future-proof solution and it covers both existing and emerging standards. An SDR has to possess elements of reconfigurability, intelligence and software programmable hardware. The main interest in any communication group is the sure sending of signals of info from a transmitter to a receiver. The signals are transmitted via a guide who corrupts the signal. To ensure reliable communication forward error-correcting (FEC) codes are the main part of a communication system. This chapter will discuss an SDR system built using LabVIEW for a Generic Transceiver. This chapter has covered emerging software radio standards and the technologies being used to specify and support them.*

## INTRODUCTION

The term *software defined radio* has become associated with a large number of different technologies and no standard definition exists. The term is usually used to refer to a radio transceiver in which the key parameters are defined in software and in which fundamental aspects of the radio's operation can be reconfigured by the upgrading of that software.

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A number of associated terms have also been used in the context of programmable or reconfigurable mobile systems(Paul Burns, 2002):

- **Software Defined Radio (SDR):** This is the term adopted by the SDR Forum—an international body looking at the standards aspects of software radio (Mitola, 1995).
- **Multi-Standard Terminal (MST):** This type of terminal is not necessarily a software defined radio in the context of this book, although it may be implemented in that way. It simply refers to a terminal which is capable of operation on a number of differing air interface standards (Maskell & Vinod, 2008). This type of terminal will provide either wider international roaming than would a single-standard device, or a necessary smooth upgrade path from a legacy system to a new standard, for example, the transition from Global System for Mobile communications (GSM) to wideband code-division multiple access (WCDMA) (Ramacher & Ag, 2007).
- **Reconfigurable Radio:** This term is used to encompass both software and firmware reconfiguration [e.g., through the use of programmable logic devices, such as field programmable gate array (FPGAs)]. Both forms of reconfiguration are likely to be necessary in any cost and power-efficient software radio implementation.
- **Flexible Architecture Radio (FAR):** This is a wider definition still than those above. It indicates that all aspects of the radio system are flexible, not just the baseband/digital section. A true FAR should allow parameters such as the number and type of up/downconversion stages to be altered by software as well as, for example, IF filter bandwidths and even the RF frequency band of operation. This is clearly a utopian goal for software radio (Mitola, 2001).

Further variations on the above themes are also in use; however, they all fall into one or other of the above categories.

## ABOUT SOFTWARE DEFINED RADIO

Reconfigurability is a prerequisite for SDR functionality, but time and again one forgets that it can also be an enabler for low power consumption. Indeed, once flexibility is built into a transceiver, it can be used to adapt the functioning and performance of a radio to the surrounding environment. As linearity, filtering, noise, bandwidth, and so on, can be traded for power utilization in the SDR, a smart controller is able to adapt the radio at runtime to the actual performance required, and hence can reduce the average power consumption of the SDR.

The ideal SDR architecture would be an analog-to-digital converter (ADC) coupled directly to an antenna(Yuce, Tekin, & Liu, 2008). Large chunks of the RF spectrum of interest could be sampled so that digital signal processing could separate out unwanted signals, extract the signal of interest, and perform such functions as automatic gain control (AGC) and demodulation. Such an ADC would require a sampling rate, dynamic range, and signal-to-noise ratio (SNR) to cover existing and future standards with varying performance requirements. Furthermore, this topology would require tunable RF bandpass filters.

There are, however, other radio architectures that are practical today and can achieve the frequency-agile reconfigurable characteristics required for SDR transceivers. In the rest of this chapter we explore the building blocks of such transceivers and present an implementation example. There are some levels