

# Chapter 23

## Modulation Recognition for Software Defined Radio Signal

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### ABSTRACT

*Software Defined Radio (SDR) is the foundation for universal wireless devices. To realize SDR system, the parameters like carrier frequency, symbol rate, and modulation scheme should be reconfigured by the adaptive receiver. Automatic modulation recognition (AMR) algorithm has to identify the modulation scheme of a transmitted signal with a high probability of success within a short observation time. Blind recognition algorithms are useful in identifying the modulation type without any prior knowledge of the transmitted signal parameters. The blind modulation detection determines the type of modulation within the information conveyed by the least possible number of received samples. Therefore, the objective is to make use of the distribution of data or errors to make a statistical inference about type of modulation used.*

### INTRODUCTION

Radio monitoring of multiple standards certainly needs the identification of modulation technique for accurate reception of the signal. Integration of the receivers for software based radio would require the identification of multiple modulations at the receiving end. Meaning thereby, an intelligent algorithm identifying the modulation must be running at the receiver end. AMR is the key

technology that helps for dynamically changing the function of radio and reacting to the changes in the intercepted signal.

Blind Modulation Recognition techniques can be used with an intelligent receiver yielding an increase in transmission efficiency by reducing overhead as it does not use any explicit signaling to indicate modulation signal. The blind modulation detector has to determine the type of modulation used within the information conveyed by the least

possible number of received samples. The main task is to recognize simultaneously the various linear digital modulation type such as BPSK, QPSK, OQPSK, 8-PSK and  $\pi/4$ - DQPSK. Proposed method basically uses Constellation Shape based identifications to distinguish the above said modulations under varying Signal to Noise Ratio (SNR), channel and data rate conditions.

### **SDR**

The existence of incompatible wireless standards in different countries often inhibit deployment of global roaming facilities and problems in rolling out new service features due to widespread presence of legacy subscriber handset. The need for ability of radio to operate with all standards in different geographical regions of the world has fostered the growth of SDR concept. Traditional radios use hardware circuits, fixed at time of manufacture to perform the high speed signal processing to convert back and forth between user data and radio waveform. Since frequent redesign is expensive, time consuming and inconvenient to end users, interest is increasing towards future proof radios. Integrated services can be obtained with a single device capable of delivering various services and providing complementary services. This single platform can be shared dynamically among multiple users operating with different communication standards. This significantly reduces the cost of infrastructure to support the newly deployed standards. SDR technology promises to solve these problems by implementing the radio functions as software modules running on generic platform. It allows ease of design, multimode operation, flexibility to incorporate additional functions and use of advanced signal processing techniques.

SDR represents an emerging concept that may offer a pragmatic approach to address the multiple-

standard problems. It also enables radio processing to reach a new level by permitting the systems to switch from analog to digital. The advent of realizable SDR allows implementation of creative transceiver design, which can dynamically adapt to communication channel and user application. Instead of dedicated hardware designed to carry out a rigid set of objectives, software implementation of hardware devices are entirely flexible regarding their functionality. Supplementary information transmitted is used to reconfigure SDR systems. Some of the major advantage in deploying SDR terminal is that as network topology changes the terminal can adapt to user requirement, change the mode of operation, channels and access methods and request new software upgrades if required without user intervention.

SDR evolving as a 4G technology offers flexibility, global mobility, service portability, wider bandwidth and higher bit rates. The general idea behind the SDR architecture is to perform signal processing in software instead of being defined in hardware. This enables the radio to get adapted to change in environment and user requirements by simply updating the software or by using adaptable software systems. In such scenarios, a broadcaster could change the appropriate modulation scheme according to the capacity of the channel. Since a single SDR system robustly handles multiple modulations, AMR is an important issue for such system. Meaning thereby, an intelligent algorithm identifying the modulation must be running at the receiver side.

### **MODULATION RECOGNITION**

In the conventional communication system design, the modulation recognition relied heavily on operator interpretation of measured parameters to classify the incoming signals. This method requires information like IF waveform, signal spectrum,

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