Efficient Software Defined Radio Using OFDM for High Data Rate Transmission

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ABSTRACT
This paper presents a software defined radio using Ofdm for high data rate transmission. to demonstrate the concepts of SDR we use a low power fixed-point digital signal processor. for reducing the complexity we use only two operational modes BPSK and QPSK .the adoptability nature using these two modes of OFDM system is discussed. Here we use a straight line method for getting fewer clock signals and this method employs radix-2 decimation-in-time fast Fourier Transform (FFT) algorithm. And for more security we use encryption key at the transmitter and decryption key at the receiver.

Keywords-Software-defined radio, orthogonal frequency division multiplexing, FFT

I. INTRODUCTION
Current and future broadband wireless standards are based on OFDM(Orthogonal Frequency Division Multiplexing), a multi-carrier modulation scheme which provides strong robustness against Inter Symbol Interference (ISI) by dividing the broadband channel into many orthogonal narrowband sub channels in such a way that attenuation across each sub channel stays flat. Prominent representatives using OFDM are WLAN, DAB (Digital Audio Broadcasting), DVB (Digital Video Broadcasting), DSL (Digital Subscriber Line), and LTE (Long Term Evolution). The investigation and assessment of information theoretic concepts for wireless resource management of those new systems in real-world scenarios requires flexible test beds with a wide range of reconfigurable parameters. This functionality is currently offered in SDR (Software Defined Radio) technology based on general purpose hardware only. In this paper we use straight line method for efficient high data rate transmission .we feel that these most efficient technique for data transmission.

The flexibility of DSP-based solutions in the SDR systems is due to the programmability. It provides many benefits.

II SOFTWARE DEFINED RADIO:
Software-defined radio (SDR) is a radio communication technology that is based on software defined wireless communication protocols instead of hardwired implementations. In other words, frequency band, air interface protocol and functionality can be upgraded with software download and update instead of a complete hardware replacement. SDR provides an efficient and secure solution to the problem of building multi-mode, multi-band and multifunctional wireless communication devices.

An SDR is capable of being re-programmed or reconfigured to operate with different waveforms and protocols through dynamic loading of new waveforms and protocols. These waveforms and protocols can contain a number of different parts, including modulation techniques, security and performance characteristics defined in software as part of the waveform itself.

III TRANSMITTER and RECEIVER:

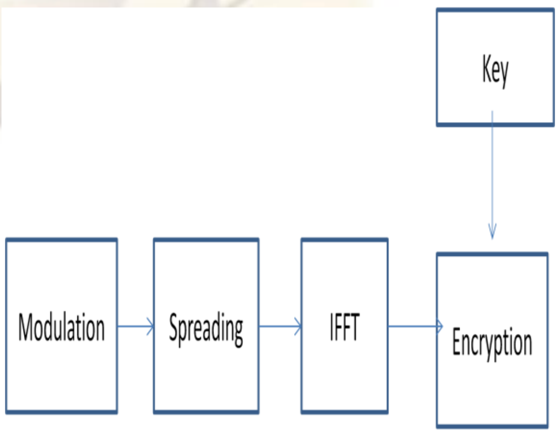

Fig:1 reconfigurable transmitter for ofdm

From fig 1 first for sending the data we perform the modulation and after that we perform the spreading and for OFDM we carry out of the data symbol –modulated spectrum don the transmitter end ,giving a N-point time multi carrier signal which we send out this would imply that there are N frequency bins in the spectrum. For converting frequency domain to time domain we use ifft. in the same way from fig2 we perform the inverse operations like demodulation and de spreading and for converting time to frequency domain we use fft algorithm and for security purposes we use encryption key in the transmitter and decryption key in the receiver.

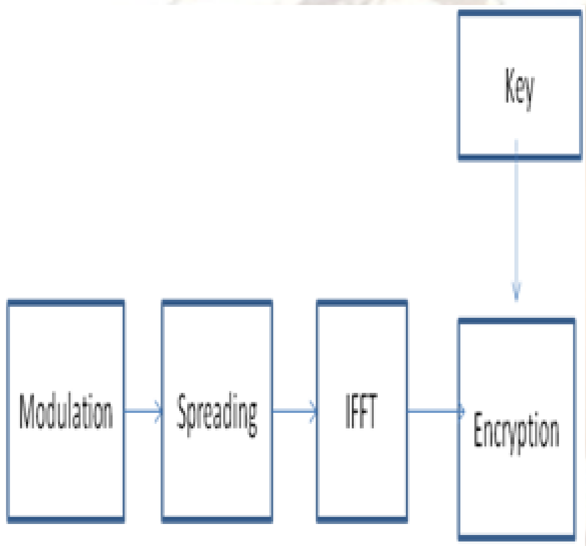

Fig:2 reconfigurable receiver for ofdm.

IV ADAPTIBILITY:

The Software-Based Transceiver Enjoys Its Flexibility And Adaptability For Many Applications. For Example, Certified Software Components Compliant With 802.11 Wi-Fi Standards Are Guaranteed To Be Interoperable With Other Modules.

BPSK (also sometimes called PRK, Phase Reversal Keying, or 2PSK) is the simplest form of phase shift keying (PSK). It uses two phases which are separated by 180° and so can also be termed 2-PSK. It does not particularly matter exactly where the constellation points are positioned, and in this figure they are shown on the real axis, at 0° and 180°. This modulation is the most robust of all the PSKs since it takes the highest level of noise or distortion to make the demodulator reach an incorrect decision. It is, however, only able to modulate at 1 bit/symbol (as seen in the figure) and so is unsuitable for high data-rate applications.

In the presence of an arbitrary phase-shift introduced by the communications channel, the demodulator is unable to tell which constellation point is which. As a result, the data is often differentially encoded prior to modulation.

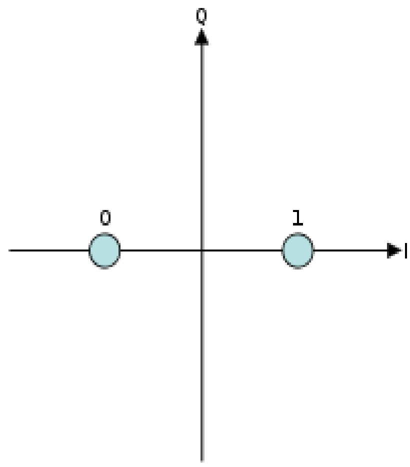

Fig:3 Constellation diagram example for BPSK.

The general form for BPSK follows the equation:

$$s_n(t) = \sqrt{\frac{2E_b}{T_b}} \cos(2\pi f_c t + \pi(1-n)), n = 0, 1.$$

V QUADRATURE PHASE SHIFT KEYING:

Sometimes this is known as quaternary PSK, quadriphase PSK, 4-PSK, or 4-QAM. (Although the root concepts of QPSK and 4-QAM are different, the resulting modulated radio waves are exactly the same.) QPSK uses four points on the constellation diagram, equispaced around a circle. With four phases, QPSK can encode two bits per symbol, shown in the diagram with gray coding to minimize the bit error rate (BER)- sometimes misperceived as twice the BER of BPSK.

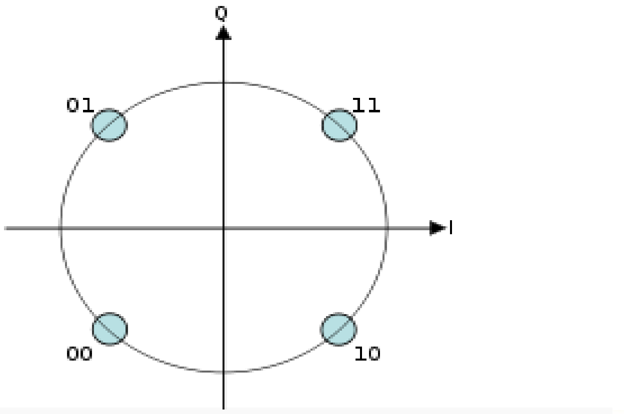

Fig4: Constellation diagram for QPSK with Gray coding. Each adjacent symbol only differs by one bit.

VI EXPERIMENTAL RESULTS:

As shown in Fig. 5, the coherent BPSK- and QPSK-OFDM systems have the same BER and agreed with the theoretical bit error rate (BER). Note that the QPSK-OFDM system employs I- and Q-channels, named as dI and dQ for BER testing as depicted in Fig. 5.

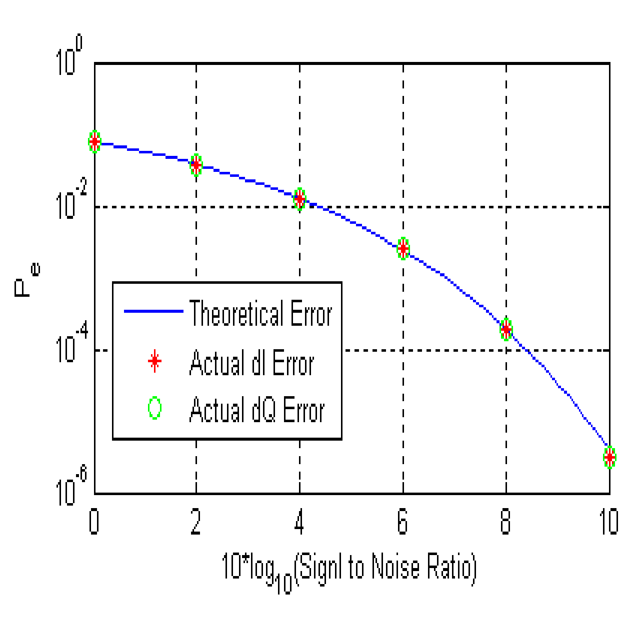

Fig. 5. BER of the BPSK- and QPSK- OFDM system

It can be seen that the straight-line QPSK OFDM code requires a slightly higher clock cycles than that of BPSKOFDM as shown in Fig. 6. This shows that given the same channel bandwidth, the QPSK-OFDM system enjoys twice the amount of data bit transmission as the BPSK-OFDM system, with only a slightly increase in computational clock cycles.

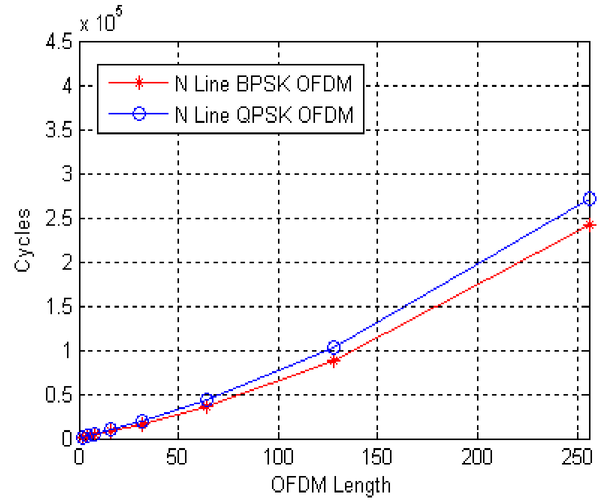

Fig. 6. Comparison of straight-line code for BPSK- and QPSKOFDM - Length vs. Clock Cycles.

VII CONCLUSIONS:

We present a software defined radio using ofdm is reconfigurable system by using fixed point signal processor.Thus the basic concepts of SDR architecture and OFDM have been studied and the various sections that are needed to reduce ISI are analyzed. The OFDM system is carried out in digital domain and can be easily implemented in SDR. The performance of the system is very efficient, flexible and fast and having high data rate transmission.

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