IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 11, Issue 3, Ver. I (May-Jun .2016), PP 33-37
www.iosrjournals.org

Performance Analysis of OFDM System with QPSK for Wireless Communication

Kalaivani.P[1], Puviyarasi.T[2], Raju S.S[3,] Suresh.S[4]
[1]*Master of engineering student,* [2,3]*Assitant Professor,*[4]*Associate Professor,*
[1,2,3,4] *Department of E.C.E, A.K.T Memorial college of Engineering and Technology, Kallakurichi, Tamilnadu, India*

Abstract: *Communication is one of the important aspects in life. Modulation and Demodulation plays an important role in transmission of data from transmitter to receiver in all communication system. Working with wireless system using various multiplexing techniques like FDMA,CDMA and TDMA which encountered various problems such as multi-path fading, time dispersion, ISI and low bit rate. The use of OFDM technique provides better solution for above mentioned problems. The OFDM based wireless communication system includes OFDM transmitter and OFDM receiver with different modulation technique. In this work, an OFDM based QPSK wireless system is demonstrated which incorporates diverse channel encoding techniques over Rayleigh fading channel. The performance of the simulated result is investigated via BER assessment as a function of SNR.*

Keywords: *OFDM, QPSK, BER, ISI.*

I. Introduction

In a typical terrestrial broadcasting, the transmitted signal arrives at the receiver using various paths of different lengths. Since multiple versions of the signal interfere with each other, it becomes difficult to extract the original information. In wireless communications system allow the subscriber to send the receiving information to the base station while receiving information from the base station. It is called duplexing and the performed device called duplexer. Multiple access schemes are used to allow many mobile users to share simultaneously a finite amount of radio spectrum. The use of orthogonal frequency division multiplexing (OFDM) technique provides better solution [1]. Orthogonal Frequency Division Multiplexing or OFDM is a modulation format that is being used for many of the latest wireless and telecommunications standards. Orthogonal frequency division multiplexing has also been adopted for a number of broadcast standards from DAB, Digital Radio to the Digital Video Broadcast standards, DVB[2]. IFFT is used instead of after serial to parallel conversion of modulated data. It is converted to parallel form and fed to FFT block [3]. Then, the signal is demodulated and undergoes different channel decoding algorithms. Subsequently, the information data is recovered back after decoding. The cyclic prefixes (CP) are added before transmitting the signal. The purpose of adding cyclic prefix is to reduce inter-symbol interference (ISI).

The drawback of CP is reducing the spectral containment of the channels. OFDM requires a cyclic prefix to remove ISI, this causes overhead and this overhead may be sometimes much large for the system to be effective. BCH codes form a class of cyclic error-correcting codes that are constructed using finite fields. One of the key features of BCH codes is that during code design, there is a precise control over the number of symbol errors correctable by the code. In particular, it is possible to design binary BCH codes that can correct multiple bit errors. Bit error rate, BER is a key parameter that is used in assessing systems that transmit digital data from one location to another [3]. Systems for which bit error rate, BER is applicable include radio data links as well as fiber optic data systems, Ethernet, or any system that transmits data over a network of some form where noise, interference, and phase jitter may cause degradation of the digital signal. When data is transmitted over a data link, there is a possibility of errors being introduced into the system. If errors are introduced into the data, then the integrity of the system may be compromised. As a result, it is necessary to assess the performance of the system, and bit error rate, BER, provides an ideal way in which this can be achieved.

II. Peak To Average Power Ratio (Papr)

Large number of independently modulated sub-carriers in an OFDM system the peak value of the system can be very high as compared to the average of the whole system. This ratio of the peak to average power value is termed as Peak-to-Average Power Ratio (PAPR). Coherent addition of N signals of same phase produces a peak which is N times the average signal [4].The PAPR increased complexity in the analog to digital and digital to analog converter and also reduce efficiency of RF amplifiers.

The peak to average power ratio for a signal x(t) is defined as

Papr = max [x(t)x*(t)]/E[x(t)x*(t)]

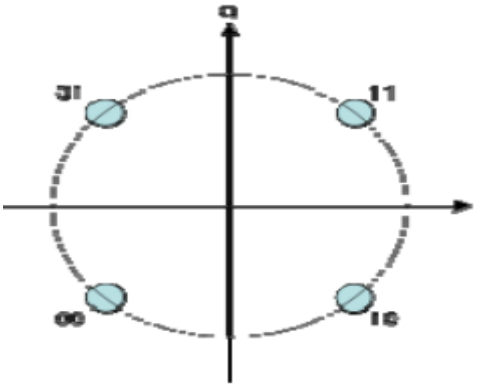
PAPR was represented by decibels

$$\mathbf{Papr_{db} = 10 \log_{10}(papr)}$$

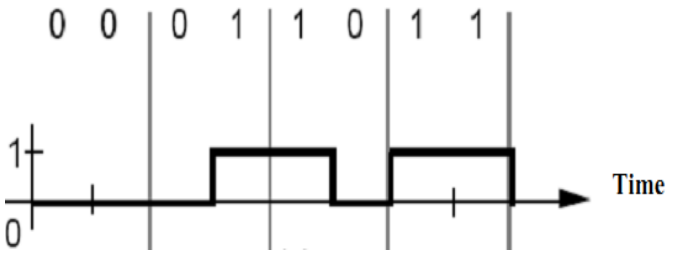
III. Modulation Technique

There are different types of modulation like MPSK, BPSK, QPSK, 16-PSK, 32-PSK. QAM etc. Each modulation technique has its own error function, so the performance of modulation technique is different at the time when noise is present. But high data rate transmission in limited bandwidth increase the BER. Some time it destroys the original data.

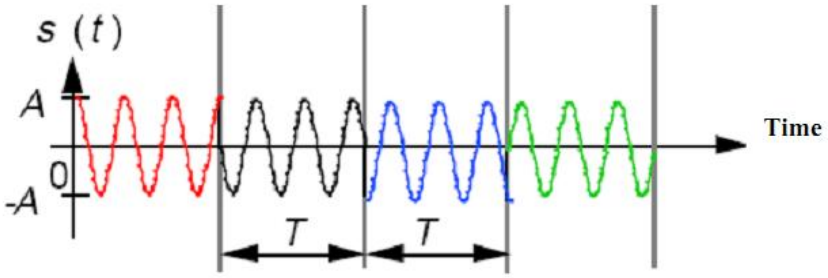
QPSK is a form of four possible carrier the carrier phase shifts (0,π/2,π and 3π/2)[4,5].



Constellation diagram of QPSK



Binary Sequence

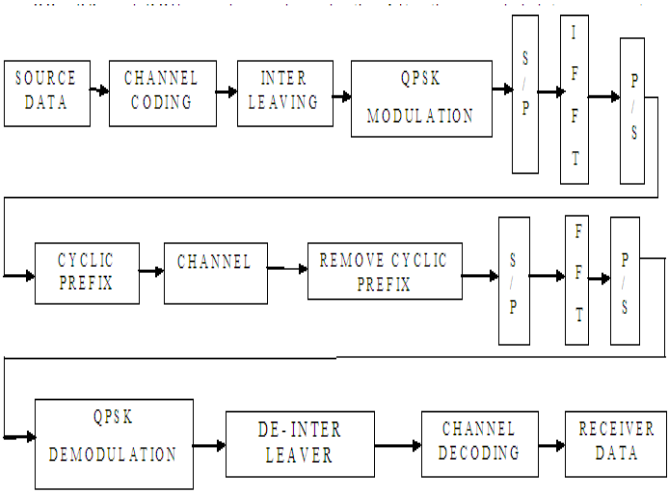


QPSK Signal

The techniques which are generally used in wireless communication are QAM (Quadrature Amplitude Modulation) and QPSK (Quadrature phase shift keying). Higher order modulation technique transmits high data rate but higher order modulation techniques required high SNR. Larger area the QPSK technique is more efficient than the QAM.

IV. Ofdm System

The source data is being encoded by using different channel encoding schemes viz. CC-, RS- and BCH-encoding independently [6]. After this encoded data is given to modulation block which is configured to implement modulation. Then, IFFT is used instead of after serial to parallel conversion of modulated data. After this, data is again being converted to serial form for the purpose of CP addition and transmitted through the channel. At the receiver, first of all CP is removed from the signal then it is converted to parallel form and fed to FFT block. Then, the signal is demodulated and undergoes different channel decoding algorithms. Subsequently, the information data is recovered back after decoding.



Block diagram of OFDM

BCH CODES

BCH codes form a class of cyclic error-correcting codes that are constructed using finite fields. One of the key features of BCH codes is that during code design, there is a precise control over the number of symbol errors correctable by the code. In particular, it is possible to design binary BCH codes that can correct multiple bit errors. Another advantage of BCH codes is the ease with which they can be decoded, namely, via an algebraic method known as syndrome decoding. This simplifies the design of the decoder for these codes, using small low-power electronic hardware.

The Encoder design by Random number is used in this project is most commonly used in the modern digital communication system. This Encoder design is almost common to all the BCH code architecture, which uses the random number generator for polynomial division. BCH encoder is usually implemented

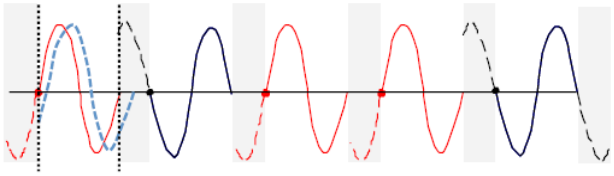
INTERLEAVING

Interleaving is a process or methodology to make a system more efficient, fast and reliable by arranging data in a noncontiguous manner. There are many uses for interleaving at the system level, including: Storage: As hard disks and other storage devices are used to store user and system data, there is always a need to arrange the stored data in an appropriate way.

Error Correction:Errors in data communication and memory can be corrected through interleaving. Multi-Dimensional Data Structures. Interleavers and Deinterleavers are designed and used in the context of characteristics of the errors that might occur when the message bits are transmitted through a noisy channel.To understand the functions of an Interleaver/Deinterleaver,understanding of errors characteristics is essential. Two types are errors concern communication system design engineer. They are burst error and random error. One of the most popular ways to correct burst errors is to take a code that works well on random errors and interleave the bursts to “spread out” the errors so that they appear random to the decoder.

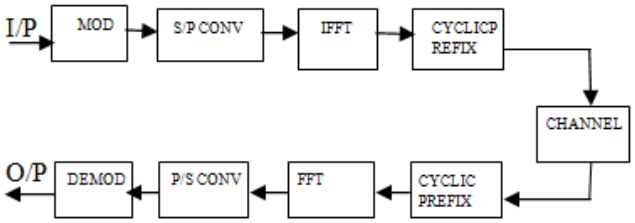
CYCLIC PREFIX

Use of cyclic prefix is a key element of enabling the OFDM signal to operate reliably. The cyclic prefix acts as a buffer region or guard interval to protect the OFDM signals from intersymbol ISI. This can be an issue in some circumstances even with the much lower data rates that are transmitted in the multicarrier OFDM signal.



FFT based OFDM. In the conventional OFDM system Fast Fourier transform (FFT) and inverse fast Fourier Transform (IFFT) are used to multiplex all the signals together in transmitter and decode the signal at the receiver. The cyclic prefixes (CP) areadded before transmitting the signal. The purpose of adding cyclic prefix is to reduce inter-symbol interference (ISI).The drawbackof CP is reducing the spectral containment of the channels. In the transmitter side, the input digital data is processed by M- ary QAM or PSK modulator to

map the data with N subcarriers. Once symbol mapping is done, we have to convert the digital data stream into parallel form where each parallelstream denotes a sub-channel, so serial to parallel block is used.



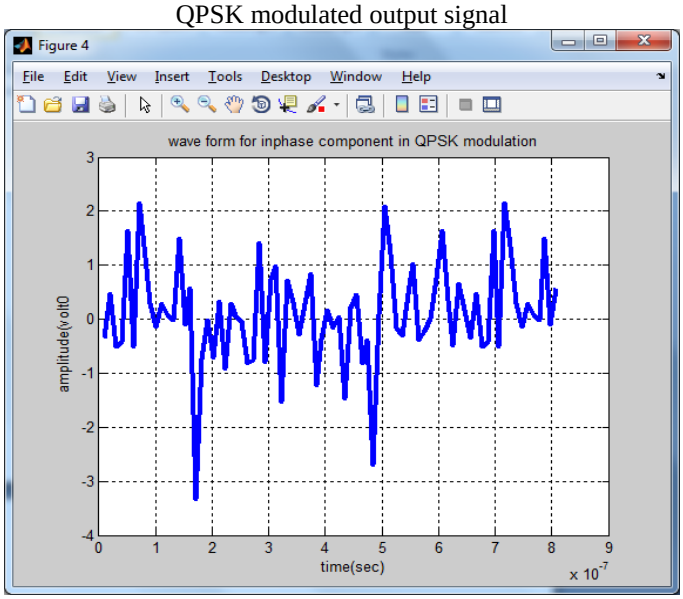
FFT AND IFFT BASED OFDM ARCHITECTURE

IFFT block is then used to modulate this low data rate stream and also converts the domain of the input signal. Then the output of IFFT is the sum of the information signals in the discrete time domain. After applying IFFT on the symbols in all the channels, cyclic prefix is added. The addition of a cyclic prefix to each symbol solves for both the Inter Symbol Interference and Inter Carrier Interference. If the channel impulse response has a known length L, then the prefix consists simply of copying the last L-1 values from each symbol and appending them in the same order to the front of the symbol. Digital data is then converted to serial form and transmitted over the channel. At the receiver side, the process is reversed and decoded the data. The output of FFT is the sum of the received signal in discrete frequency domain. After FFT, the signal is converted back to parallel form and demodulated to yield the transmitted signal back. In wireless applications particularly, calculating the channel impulse response length is a tiresome task. So other techniques have to be introduced. One can attempt to go for other compensating methods, making the overall system more and more complex. Another solution is to replace the Fourier Transform by a transform that is less subject to all these channel effects, and that can thus more easily compensate for the resultant effect.

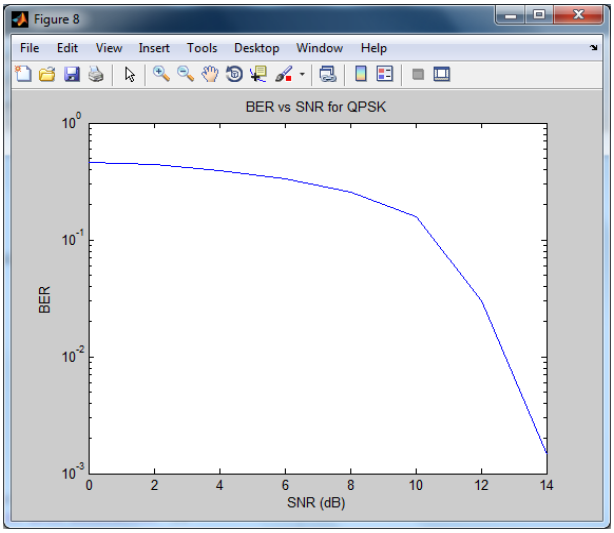
V. Results And Discussion

The OFDM based QPSK wireless system was simulated using MATLAB environment. The simulation result was obtained for the OFDM system. The performance analysis for BER vs SNR curve was obtained. In that BER ranges from 10^{-1} to 10^{-2} was obtained.

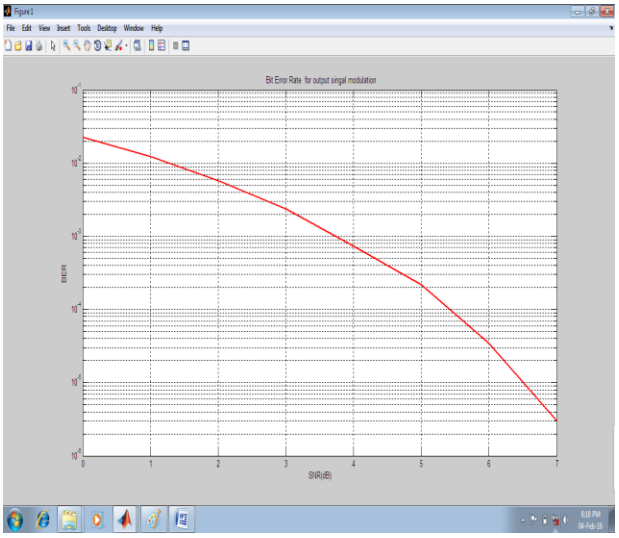
QPSK modulated output signal



BER vs SNR performance of input signal



BER vs SNR performance of output signal



VI. Conclusion

The OFDM system characteristic depends upon the modulation technique. The performance of OFDM was increasing by improving the BER value. It uses higher order modulation of QPSK modulation and it was using various coding technique.In this paper BCH coding was used to encoding the source datas.The simulation result was obtained with low BER value for OFDM based QPSK wireless system.

References

[1]. Lavish Kansal, Vishal Sharma, Jagjit Singh, (2015),BER Assessment of FEC incorporated OFDM-MPSK Wireless System, IEEE Transaction on Adv.com & comm.tech, Vol.12

[2]. Sandeep Kaur, Gurpreet Bharti.(2012),'Orthogonal Frequency Division Multiplexing in Wireless Communication Systems: A Review',Int.Jour. Adv.Res.Com.Eng.& Tech.,Vol.1.

[3]. Lavish Kansal, Ankush Kansal and Kulbir Singh.(2011),'Performance Analysis of MIMO-OFDM System Using QOSTBC Code Structure for M-QAM', Can.Jour.Sig.Proc.,Vol.2, No.2.

[4]. AthinarayananVallavaraj,Stewart,G.B,David,K.Harrison,Francis ,G.McIntosh. (2005), 'The Effects of Convolutional Coding On BER Performance of Companded OFDM Signals',Int.Conf.,Comm.Com & Pow.

[5]. Arpita Mishra, Stuti Rastogi, Ritu Saxena, Pankaj Sharma, Sachin Kumar, (2013), 'Performance Analysis Of MB-OFDM System With QPSK and QAM For Wireless Communication', Int.Jour.Adv.Res.Com.Comm.Eng.,Vol.2.

[6]. Hamood Shehab,Widad Ismail.(2010), 'The Development & Implementation of Reed Solomon Codes for OFDM Using Software-Defined Radio Platform', Int. Jour.Com.Sci.& Comm.,Vol.1,No.1,pp.129-136.

[7]. Geert Van Meerbergen, Member, IEEE, Marc Moonen, Fellow, IEEE, and Hugo De Man, Fellow, IEEE. (2006), 'Reed-Solomon codes implementing a coded Single-Carrier with Cyclic Prefix scheme'.

[8]. Hindumathi,V. RamaLinga,K. Reddy and Prabhakara Rao,K.(2012),

[9]. 'Performance Analysis of OFDM by using different Modulation Techniques', Int.Jour. Eng.Res. & Dev.,Vol.3, pp.07-10.

[10]. Riaz Ahamed,S.S.(2008),'Performance Analysis of OFDM', Jour.Theor.&App. Infor.,tech.