QPSK AND QAM TO ANALYSE THE PERFORMANCE OF MB-OFDM IN A WIRELESS ENVIRONMENT

Dr.T.SARAVANAN

HOD, Dept Of ETE

Bharath University

Abstract: In this paper, the aim is to analyse the performance of MB-OFDM system with higher order QPSK/QAM mapping. The main objective of this paper is to compare the performance of these two modulation techniques with an AWGN channel and the parameters considered are BER (Bit Error Rate) and PSD (Power Spectral Density) in the system.

I.INTRODUCTION

In February 2002, the Federal Communications Commission allocated 7500 MHz of spectrum for unlicensed use of commercial ultra-wideband (UWB) for the purpose of communication.. This spectral allocation has initiated an extremely productive activity for industry and academia [5]. Wireless communications experts now consider UWB as available spectrum to be utilized with a variety of techniques. Ultra Wide Band (UWB) has a characteristic features of high data rate, less power, minimum range wireless technology that is an emerging technology that has attracted a great deal of interest from various bodies laike academia, industry and global standardization . It is based on the Wi- media standard that brings the convenience and mobility of wireless communication to high speed that interconnects the devices throughout the digital home and office. Ultra wide band (UWB) communication systems use signals with a bandwidth that is larger than 25% of the central frequency or more than 500 MHz. The traditional UWB techniques has many disadvantages over the whole allocated bands and therefore there is a shift in UWB system design from initial „single band" radio that occupies the whole allocated spectrum in favour of „Multi-band" design approach. Multi-banding consists in dividing the available UWB spectrum into several sub-bands, each one occupying approximately 500 MHz. The aim of this paper is to analyze the performances in terms of BER and other relevant information such as Power Spectral Density (PSD) and signal constellations.

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II MB-OFDM

Multiband-OFDM (MB-OFDM) [3] is one of the promising candidates for PHY layer of short-range high data-rate UWB communications .It combines Orthogonal Frequency Division Multiplexing (OFDM) with the above multi-band approach enabling UWB transmission to inherit all the strength of OFDM technique which has already been proven for wireless communications (ADSL,DVB,802.11a,802.16a etc.).For that reasons MB-OFDM -UWB technology has been proposed by the IEEE 802.15.3a .High Rate Alternative Physical Layer (PHY) Task Group (TG3a) and ECMA standards. The total available spectrum (3.1 GHz − 10.6 GHz)and is divided into 14 sub-bands. The frequency of each subband is 528 MHz .The first 12 bands are grouped into four band groups consisting of three bands. The fifth band group includes the last two bands. Each OFDM symbol is transmitted across a sub-band of a band group, providing frequency diversity in the system.

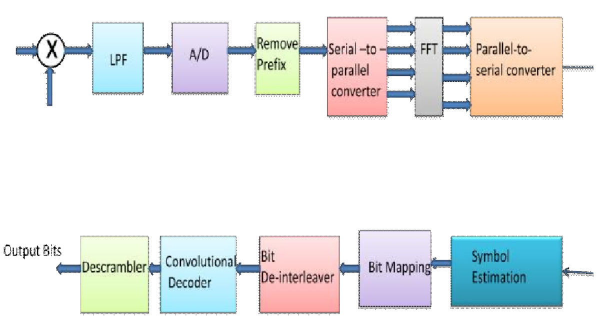

Fig 1: Architecture of MB-OFDM Transmitter and Receiver

The information bits are whitened by scrambler. After this, convolution encoder encoded the bits and then these bits are further interleaved to avoid time-frequency diversity and multipath fading. We use constellation mapping for mapped resulting bits into constellation symbols and then converted into a basic of N symbols by the serial- to-parallel converter. These N-symbols are called frequency components which are being transmitted by the use of the N-subcarrier of the OFDM modulator. These symbols are then converted to OFDM- symbols by the unitary Inverse Fast Fourier transform

III. QAM & QPSK MODULATION TECHNIQUES

(A) QUADRATURE PHASE SHIFT KEYING

Quadrature Phase Shift Keying (QPSK) is a form of Phase Shift Keying where two bita are modulated at the same time, which selects any one of four possible carrier phase shifts (0, Π/2, Π, and 3Π/2).QPSK perform by changing the phase of the In-phase (I) carrier from 0° to 180° and the Quadrature-phase (Q) carrier between 90° and 270°. Each state of these carriers is referred to as a Symbol. Quadrature Phase-shift Keying (QPSK) is a widely used method of transferring digital data by changing or modulating the phase of a carrier signal. In QPSK, the data is in digital form and is represented by a circle with 4 points which correspond to 4 phases of the carrier signal. These points are called symbols. With four phases, QPSK can encode two bits per symbol, with gray coding to minimize the BER. The QPSK signal consists of two parts In phase and Quadrature phase. In phase gives the real part of the signal and quadrature gives the imaginary part of the signal. The implementation of QPSK is more general than that of BPSK and also indicates the implementation of higher- order PSK

(B) QUADRATUREAMPLITUDE MODULATION

Quadrature Amplitude Modulation (QAM) is a type of modulation use for high speed digital signals. QAM has become a necessary part of our daily lives and is used in ADSL modems and in personal communicators and in military. QAM is produced by combining two amplitude-modulated (AM) signals into a single channel, which results in double bandwidth . In a QAM signal, there are two carriers, each having the same frequency but with a phase difference of 90 degree .One is the Inphase signal and the other is the Quadrature signal . One of the signals is represented by a sine wave, and the other by a cosine wave. At the transmission end the carriers are combined and at the receiving end the carriers are separated and then the data is converted to its original modulating information.

IV. SIMULATION SET UP

The simulation model of the QPSK and QAM modulation technique as shown in figure 2 and 3.

(a) Simulation setup of QPSK

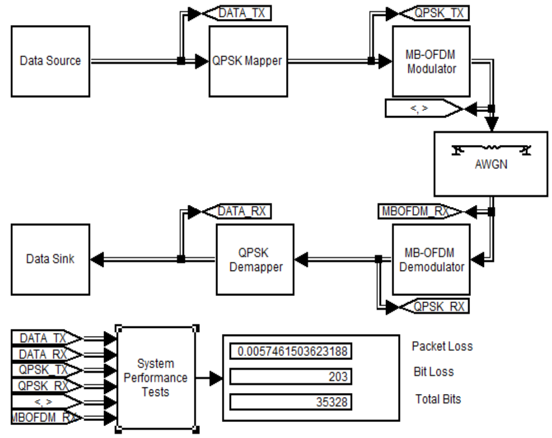

Figure 2.Simulating set up of MB-OFDM system architecture with QPSK

b) Simulation setup of QAM

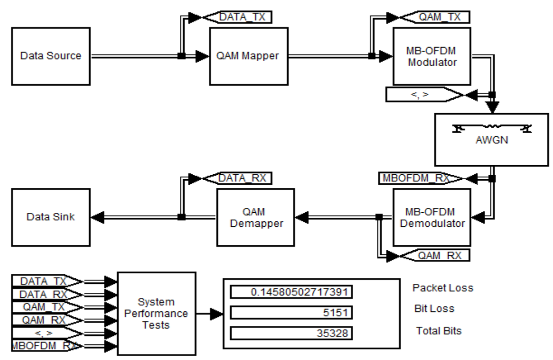

Figure 3.Simulating set up of MB-OFDM system architecture with QAM

V. SIMULATION RESULTS AND ANALYSIS

In the performance analysis of MB-OFDM system, we have used Bit loss and packet loss for evaluating the performance of both the modulation techniques with MB-OFDM. From the simulation result, we observed that QPSK modulation is more prone to errors while transmitting signal through noisy channel than QAM. The comparative analysis is shown in Table 1

TABLE 1. Comparative Analysis

Modulation	Total Bits	Packet Loss	Bit Loss
QPSK	35328	0.0057461503623188	203
QAM	35328	0.14580502717391	5151

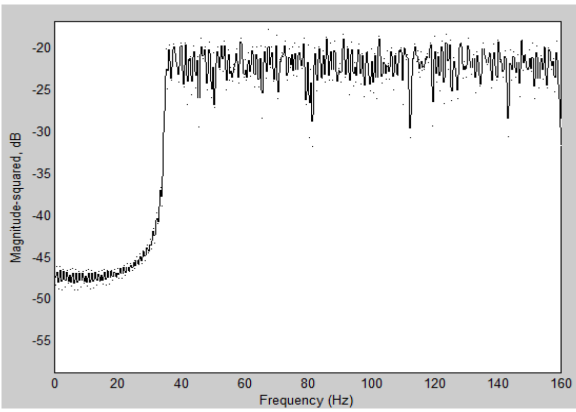

Figure 4 : Frequency response of QPSK

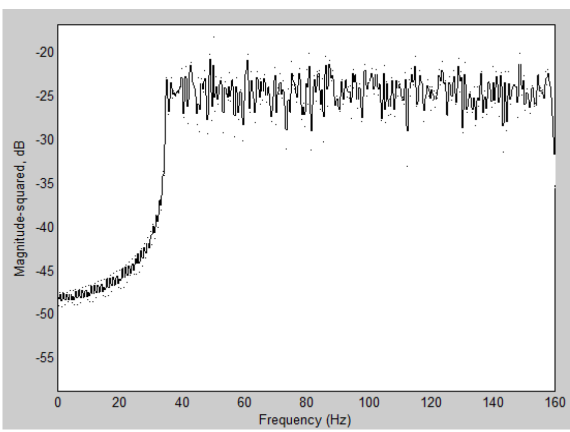

Figure 5 : Frequency response of QAM

VI. CONCLUSION

Performance analysis of MB-OFDM System with QPSK and QAM has been carried out in this research. In this paper, we have analyzed the effects of a QPSK and QAM modulation technique on the performance of MB-OFDM signal. The performance analysis of MB-OFDM UWB system using QPSK technique is better than that of 16-QAM

REFERENCES

[1] S. Ramesh, V vaidehi, "Performance Analysis of UWB Channels for Wireless Personal Area Network" Wireless Personal Communication, pp 169-178 , 2007.

[2] Tan and K.-C. Lin, "Performance of space-time block coded MB-OFDM UWB systems" in Proc.4th Annual Communication Networks and Services Research Conference (CNSR06), pp.323-327, May 2006.

[3]Brian Krongold, Timo Pfau, Noriaki Kaneda and Sian Chong Jeffrey, "Comparison between PS-QPSK and PDM-QPSK with equal rate and bandwidth" IEEE photonics technology letters, vol.24, no. 3, February 1, pp 203-205 ,2012.

[4] Kyung-chul Cho, Young-Chang Kang, Sun-hyung, "Performance Analysis of the DQPSK-OFDM System with Equalizer for the Wireless Multimedia Communication" Second International Conference on Future Generation Communication and Networking, pp 78-81,2008.

[5] Zhiweii Lin , Xiaoming Peng, Khiam-Boon and Francois Chin, "Iterative sampling frequency offset estimation for MB-OFDM UWB systems with long transmission packet" IEEE Transactions on vehicular technology, vol.61, no.4, pp 1685-1697 ,May 2012.

[6] Qiyue Zou, Alireza Tarighat and Ali H. Sayed, "Performance Analysis of Multiband OFDM UWB communications with application to range improvement" IEEE Transactions on vehicular technology, vol. 56, no. 6, pp 3864-3878 ,November 2007.

[7] Gerhard Wunder, Thomas Michel and Chan Zhou, "Delay- Limited Transmission in OFDM Systems: Performance Bounds and Impact of System Parameters" IEEE Transactions on wireless communications, vol. 8, no.7, pp 3747-3757, July 2009.