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Optimised Wireless Communication System using Interleaved Encoder with QAM and PSK

Vinita Yadav Sindhia
M. Tech. Research Scholar
Lakshmi Narain College of Technology
Jabalpur (M.P.), [INDIA]
Email: pragya.mishra1231@gmail.com

Prajyant Pathak
Head of the Department
Department of Electronics & Communication Engg.
Lakshmi Narain College of Technology
Jabalpur (M.P.), [INDIA]
Email: prajyant.pathak@yahoo.com

ABSTRACT

MIMO technology is one of the major attracting techniques in wireless communications because; it offers significant increases in data throughput and coverage without additional bandwidth or transmitter power. It also provides high spectral efficiency and link reliability. Because of these properties, MIMO is an important part of modern wireless communication standards such as IEEE 802.11n (Wi-Fi), 4G, 3GPPLTE, WI -MAX and HSPA+.MIMO wireless communication refers to the transmissions over wireless links formed by multiple antennas equipped at both the transmitter and receiver. The key advantages of employing multiple antennas lie in the more reliable performance obtained through diversity and the achievable higher data rate through spatial multiplexing.

Keywords:— *WI –MAX, IEEE 802.1, OFDM, DMT, HDSL*

I. INTRODUCTION

THE COMBINATION of orthogonal frequency-division Multiplexing (OFDM) and multiple-input multiple-output (MIMO) technologies, referred to as MIMO-OFDM, is currently under study as one of the most promising candidate for next-generation communications systems, ranging from wireless LAN to broadband access. Recent works tackled the performance assessment (both through simulation and measurements) of MIMO-OFDM systems in the presence of practical impairments, such as synchronization and channel-estimation errors channel estimation is a critical issue for MIMO-OFDM systems, especially if multilevel modulation is employed in order to achieve high spectral efficiencies. As applications for wireless access look to make the transition from voice communication to multimedia data, such as internet data and video data, demand for high-speed wireless communications is increasing. Also, to meet quality of service (QOS) requirements in various situations, reliability become an important issue. Orthogonal frequency division multiplexing (OFDM) is a promising candidate for high-speed transmissions in a frequency selective fading environment. By converting a wideband signal into an array of properly-spaced narrowband signals for parallel transmission, each narrowband OFDM signal suffers from frequency flat fading and, thus, needs only a single-tap equalizer to compensate for the Corresponding multiplicative channel distortion. Orthogonal Frequency-Division Multiplexing (OFDM) has emerged as a successful air-interface. In the case of wired environments, OFDM techniques are also known as Discrete Multi-Tone (DMT) transmissions and being used in Asymmetric

Digital Subscriber Line (ADSL), High-bit-rate Digital Subscriber Line (HDSL), and Very-high-speed Digital Subscriber Line (VDSL), in OFDM systems different modulation schemes can be employed for different subcarriers or even for different users. For example, the users close to the Base Station (BS) may have a relatively good channel quality, thus they can use high-order modulation schemes to increase their data rates. By contrast, for those users that are far from the BS or are serviced in highly loaded urban areas, where the subcarriers' quality is expected to be poor, low-order modulation schemes can be invoked. OFDM uses IFFT in transmitter and FFT in receiver, Future broadband wireless systems should provide high data rate and high performance over. Very challenging channels that may be time selective and frequency-selective. The combination of MIMO and OFDM has the potential of meeting this stringent requirement since MIMO can boost the capacity and the diversity and OFDM can mitigate the detrimental effects due to multipath fading.

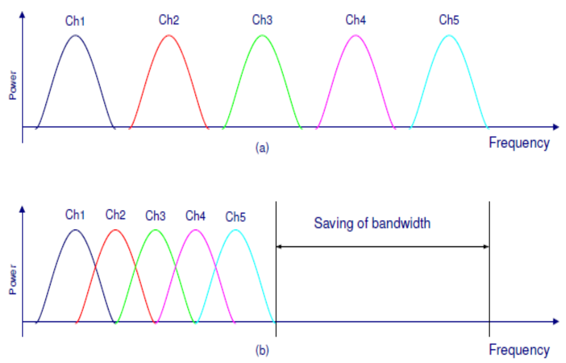

Figure 1- Comparison between Conventional FDM and OFDM

Objectives:

The research aim of this project is to design and implement an OFDM communication

Using Interleaved Encoder with QAM and PSK system, using platforms such as MATLAB to simulate the operation of virtual transmitter and receiver. The performance of the system design is then analysed by adding noise (Additive White Gaussian Noise and Power line Coloured Background Noise) in an attempt to corrupt the signal.

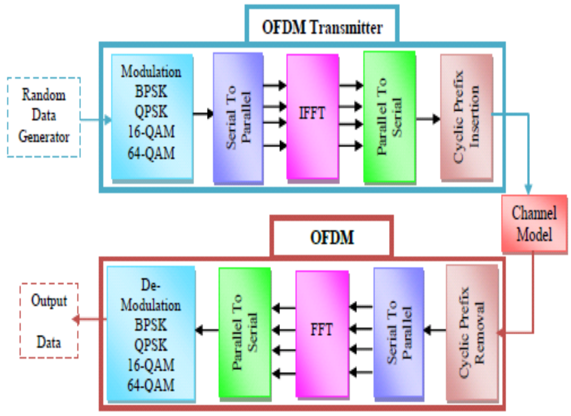

Figure 2- Basic Block Diagram of OFDM

II. Literature Review

[1] Md. Mejbaul Haque, used evaluated the performance of the ASTBC MIMO-OFDM system under Rayleigh fading channel. We observe that the performance of two transmit antennas with more receive antennas is much better than that of the system with two transmit antenna and less receive antennas in term of BER due to the more diversity. [2] Mohamed M. Zahra, Hybrid SLM-PTS techniques used to provide the same (or better) PAPR reduction performance as PTS or SLM with less number of IFFTs. ordinary, simplified, and directed are three different approaches for using PTS or SLM in reducing the PAPR of MIMO-OFDM systems. [3] Ben Lu, In this paper, considered the performance analysis and design optimization of LDPC-coded MIMO OFDM systems for high data-rate wireless transmission.

[4] GORDON L. STÜBER, This paper has discussed a number of PHY layer issues relevant for the implementation of broadband MIMO-OFDM systems. He has discussed in detail the peculiar issues relating to MIMO-OFDM synchronization and channel estimation.

III. METHODOLOGY

Proposed Methodology:

The proposed system is based on the QPSK/4- QAM modulator with convolution encoder inter leaver figure 3.6 demonstrate the block diagram of transmitter, receiver, and channel.

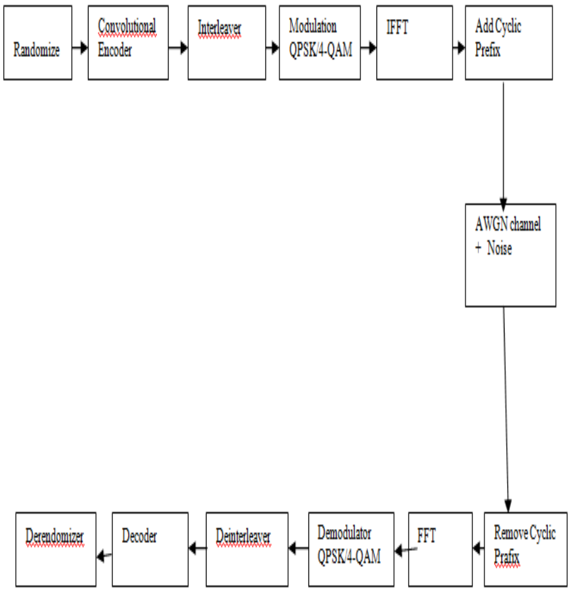

Figure 3- Block Diagram of Wireless Systems

Input data sequence is baseband modulated using digital modulation scheme as demonstrated in figure. Various modulation schemes could be employed such as BPSK, QPSK (also with their differential form) and QAM with several different signal constellations. An randomizer transform the bit sequence in to logic sequence then convolutional encoder encode the randomized sequence and The size of the interleaver determines the length of the codeword. And 4QPsk modulation applied on the modulating signal. IFFT transform and add cyclic prefix. Leave the signal through channel for transmission.

At the receiver end noisy signal is received by receiving antennas just inverse process of transmitter has done here. First of all cyclic prefix is removed from the received noisy signal. Fast Fourier transform applied to reverse IFFT. Demodulate with QPSK QAM. De-Interlever and decode de-randomize and produce output noise free test signal.

Flow of proposed system:

Create Simulation Environment using Simulink MatLab Simulator. Generate test signal to transmit. Apply randomizer on test signal which is to be transmitting. Apply convolution encoding Interleaving on randomized test transmitting signal. Modulate with QPSK 4-QAM OFDM modulation with inverse fast Fourier transform Add cyclic prefix on ready to transmit signal. Transmit prepared signal with AWGN channel model where certain random noise is added in it. Remove cyclic prefix from received signal at receiver end. Apply Fast Fourier transformer. Demodulate QPSK /4QAM. De-interleve and decode demodulated signal. De-randomize and calculate bit error rate from received signal. And finally compare and display result.

This is provides the key tools, methods and strategies selected for achieving the stated aims. In doing so, researches and publications related to the OFDM and QAM and PSK communication systems have been classified into three groups based on their topics. Such classification of the publications provides assistance in selecting the best methods for the current project. Although the above presented research and publications, by some means, follow the same method or technique, but most of the valuable help and support for the current project can be obtained from the second, but largely from the third group of publications.

The main research aim of this project is to design and implement an OFDM system for QAM and PSK based communication, by simulating the operation of virtual transmitter and receiver.

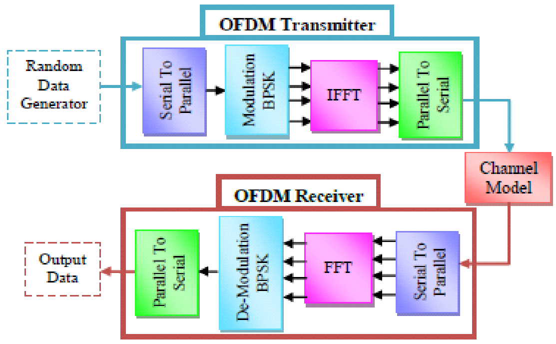

Figure 4 - Block diagram of a basic structure OFDM transceiver

IV. Simulation Result

Proposed system has simulated on Matlab. simulation results of proposed system has given in figure 5.1 to 4.3 on different parameters figure 5.1 illustrate performance of proposed system using 2-FFT with convolution encoder with PSK QAM modulation.

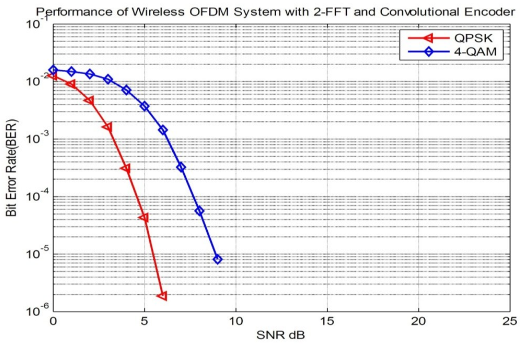

Figure 5- Proposed System Performance using 2-FFT using Convolution Encoder with PSK and QAM Modulation

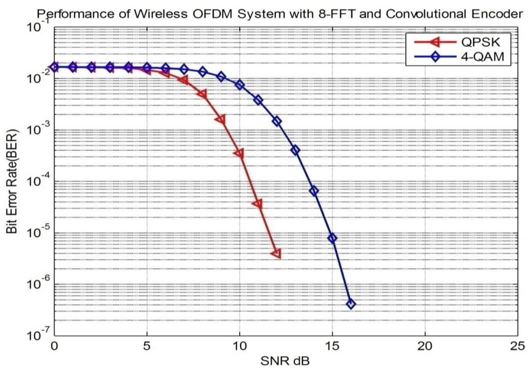

Figure 6- Proposed System Performance using 8-FFT using Convolution Encoder with PSK and QAM Modulation

Table: Comparison with Previous Work

SNR	*Previous Methodology*	*Proposed Methodology*	
		QPSK	*4-QAM*
0	5.9 x 10^{-2}	1.67 x 10^{-2}	1.67 x 10^{-2}
1	4.5 x 10^{-2}	1.66 x 10^{-2}	1.67 x 10^{-2}
2	3.3 x 10^{-2}	1.66 x 10^{-2}	1.66 x 10^{-2}
3	2.4 x 10^{-2}	1.66 x 10^{-2}	1.66 x 10^{-2}
4	1.8 x 10^{-2}	1.65 x 10^{-2}	1.66 x 10^{-2}
5	1.2 x 10^{-2}	1.65 x 10^{-2}	1.66 x 10^{-2}
6	8.1 x 10^{-3}	1.64 x 10^{-2}	1.66 x 10^{-2}
7	5.5 x 10^{-3}	1.58 x 10^{-2}	1.66 x 10^{-2}
8	3.8 x 10^{-3}	1.49 x 10^{-2}	1.63 x 10^{-2}
9	2.5 x 10^{-3}	1.29 x 10^{-2}	1.59 x 10^{-2}
10	1.7 x 10^{-3}	9.17 x 10^{-3}	1.50 x 10^{-2}
11	1.1 x 10^{-3}	4.82 x 10^{-3}	1.35 x 10^{-2}
12	6.9 x 10^{-4}	1.57 x 10^{-3}	1.11 x 10^{-2}
13	4.2 x 10^{-4}	3.65x 10^{-4}	7.47 x 10^{-3}
14	2.8 x 10^{-4}	3.81x 10^{-5}	3.78 x x10^{-3}
15	1.9 x 10^{-4}	4.38 x 10^{-6}	1.42 x 10^{-3}
16	1.2 x 10^{-5}		3.82x 10^{-4}
17	7.4 x 10^{-5}		7.69x 10^{-5}
18	4.8 x 10^{-5}		1.52x 10^{-5}
19	2.9 x 10^{-5}		4.17 x 10^{-7}

V. Conclusion

The main aim of conducting this research project was to design and implement an OFDM system for QAM and PSK based communication, by simulating the operation of virtual transmitter and receiver. More specifically, the overall aim of this research was to design an OFDM modem for a QAM and PSK based communication in order to propose and examine a novel approach in comparing the different modulation.

VI. Future Work

The results' summary presented above and contributions made by this research have shown that although presence of QAM and PSK based background noise cause a significant impairment in the performance and subsequently to the transmission of the system, various framing techniques such as the use of appropriate modulation and error correction techniques, can reduce the impact of the noise and interference.

REFERENCES:

[1] D. J. Love and R. W. Heath, Jr., “Equal gain transmission in multiple inputs Multiple output wireless systems”, IEEE Trans. Commune, vol. 51, pp. 1102–1110, Jul 2003.

[2] H. El Gamal, G. Caire, and M. O. Damen, “Lattice coding and decoding achieve the optimal diversity-multiplexing tradeoff of MIMO channels”, IEEE Trans. Inform. Theory, vol. 30, pp. 968–985, June 2004.

[3] S. Das and P. Schniter, “Max-SINR ISI/ICI-shaped multi-carrier communication Over the doubly dispersive channel,” IEEE Trans. Signal Processing, 2006.Submitted.

[4] S. Das and P. Schniter, “Design of multi-carrier modulation for doubly Selective channels based on a complexity constrained achievable rate Metric” in Proc. Asilomar Conf. Signals, Systems and Computers, Nov.

[5] C. Siegel, R.F.H. Fischer, “Peak-to-Average Ratio Reduction in Multi-User OFDM”, ISIT2007, Nice, France, June 24-June 29, 2007.

[6] A. Goldsmith, “Wireless Communications”, Cambridge University Press, 2007.

[7] U. Madhow, “Fundamentals of Digital Communication”, Cambridge University Press, 2008.

[8] R. Prasad, “OFDM for Wireless Communication Systems”, 2004.

[9] (Mitalee Agrawal & Yudhishthir Raut (2011), “Effect of Guard Period Insertion in MIMO OFDM System”, International Journal of Computer Technology (IJCTEE), Vol. 1, No. 2.

[10] Yong Soo Cho, Jack won Kim, Won Young Yang & Chung G. Kang (2010), “MIMO-OFDM Wireless Communications with MATLAB”, John Wiley and Sons (Asia) Pte Ltd.

[11] Hermann Rohling (2011), “OFDM Concept and Future”, Springer Heidelberg Dordrecht London New York.

[12] M. Jiang and L. Hanzo, “Multiuser MIMO-OFDM for Next-Generation Wireless Systems,” Proceedings of the IEEE Vol.95, No.7, pp.1430-1469, July 2007.

[13] C. Tu and B. Champagne, “Subspace Blind MIMO-OFDM Channel Estimation with short Averaging Periods: Performance Analysis,” 2008 IEEE Wireless Communications and Networking Conference, pp.24-29, March 31 - April 3, 2008.

[14] H. Lee, S. Park and I. Lee, “Orthogonalized Spatial Multiplexing for MIMO Systems,” IEEE 64th Vehicular Technology Conference, pp.1-5, Montreal, Canada, September 2006.

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