Analysis of OFDM using PTS with Different Modulation Techniques

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Abstract

PTS based OFDM system is fast growing new wireless broadband technology which has capability of high data rate transmission and advantages like inter carrier interference (ICI) reduction; high reliability; and better performance in multi-path fading. The major effect to be considered at receiver is fading effects which must be mitigated at transmitter and receiver using different modulation technique. In this paper we presented the PAPR performance of the OFDM system with two different modulation technique. Proposed OFDM system is presented using various modulation techniques that is BPSK, QPSK, 16-QAM and 64-QAM.

Keywords: OFDM, PTS,BER, PAPR, CCDF

1. Introduction

In wireless communication technology the main objective is to provide high quality of data. Orthogonal frequency division multiplexing (OFDM) has become a more popular technique for transmission of signals over wireless channels. In OFDM, signals are transmitted in sub channel of different frequency in parallel. The frequency of sub-channel are so selected that these frequencies are orthogonal to each other and therefore do not interfere with each other. This phenomenon makes it possible to transmit the data in overlapping frequency and hence reduces the bandwidth requirement considerably. OFDM is beneficial in many aspects such as high spectral efficiency, robustness, low computational complexity, frequency selective fading, and easy to implementation using IFFT/FFT [1]. In wireless communication systems the data bits are transmitted in radio space, channels are typically multipath fading channels, which causes inter symbol interference (ISI) in the received signal.

ISI is undesirable and it increases bit error rate. ISI causes due to multipath propagation and band limited channels. Whenever the modulation bandwidth exceeds the radio channel coherence bandwidth, ISI is produced. To eliminate ISI from the signal, strong equalizers are used, which requires channel impulse response (CIR) [2]. Equalizer compensate the inter symbol interference means it works in such a way that BER should be low and SNR should be high [3]. Equalization techniques have importance to design of high data rate wireless systems. Most of the wireless receivers are equipped with the equalizer which gives good result. The quality of wireless communication depends upon the three parameters i.e. rate, range and reliability of transmission. These parameters are related with each other.

Due to orthogonal carriers,OFDM signal has high PAPR which lowers efficiency of HPA. The high PAPR is mitigated by many techniques [2] like clipping, peak windowing, peak cancellation, companding,tone reservation, tone injection or by distorting the signal or by scrambling and spreading the signal like selected mapping(SLM), partial transmit sequence(PTS) [3][4], interleaving, precoding by using liable sequences. The hardware complexity is less in PTS technique but computational complexity increases as the number of IFFT's increases. The computational complexity is reduced by many reduced PTS techniques [5]- [8]. One technique is by applying Cost Function Qn to OFDM symbols [8]. To reduced complexity PTS summation, the A-law or μ- law compander is fixed to further improve HPA efficiency without hardware complexity.

2. PROPOSED DESIGN

In this paper, PTS based OFDM system with an interleaved coded transmission is proposed with different modulation schemes. To demonstrate a OFDM system is considered with 64 data subcarriers and 16-QAM constellation. Further we also demonstrated system with 128 data subcarriers. To simulate OFDM system Matrix interleaves are used, the cyclic prefix code of length is said to the channel maximum delay, it will prove channel capacity. PTS-OFDM system increases PAPR, BER. The spectrum signal required to get acceptable result of simulation is first chosen based on the input data and the modulation scheme used (such as Differential BPSK, QPSK or 16-QAM). Amplitudes and phases of the carrier signals is calculated based on the chosen scheme of modulation. The Transmitting data before transmission is first assigned to each carrier that is to be produced and further it is modulated. The BER performance evaluation of various modulation system such as DPSK, PSK and 16-QAM modulation schemes for BCH and Convolutionally coded system over AWGN channel is demonstrated in this paper. The performance of different modulation techniques is analyzed in terms of PAPF and CCDF.

To achieve error free communication and multiplexing data, guard interval is inserted in the time domain using cyclic prefix since the ISI gets mitigated between OFDM symbols. The OFDM guard interval can be inserted by the cyclic extensions of the OFDM symbol with cyclic prefix (CP) or cyclic suffix (CS) [9]. In this demonstration we used 16-bit cyclic prefix code. System to be practical, we added AWGN noise to channel. AWGN is a noise that affects the transmitted signal when it passes through the communication channel. It contains a uniform continuous frequency spectrum over a particular frequency band. Here BCH and Convolutional coding are opted as one knows [7]-[8], This section defines PTS-OFDM system model as summarized in figure 2, which represents the communication procedure in MIMO-OFDM.

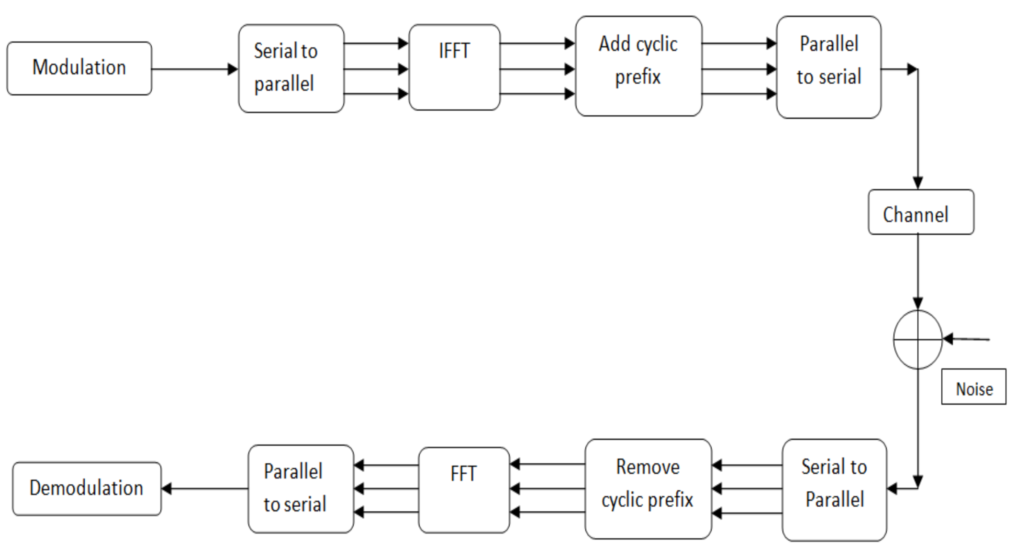

Fig.1. Transmitter and Receiver processing for the generalized OFDM system

3.RESULT AND DISCUSSION

This paper analyses the PAPR using BPSK, QPSK, 16-QAM, 64-QAM as modulation schemes. The BCH encoder block creates a BCH code with constraint length K=5. Here a coded OFDM system with 64 subcarriers (N=64) and the number of constellations for QAM are 16, 64, 256 i.e. 16-QAM, 64-QAM, 256-QAM is considered. Matrix interleaver is used and cyclic prefix is set at 25 %(16). There are two transmit and receive antennas. The figure (4-9) shows the PAPR Vs CCDF for different systems using different modulation schemes. Parameter of proposed system is presented in table 1.OFDM signal with multiple carrier at transmitter by using BPSK modulation is presented in figure 3.

Table 1. Parameters of proposed system

Parametrs	Values
Modulation Techniques	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM
coding	Cyclic Prefix
Interleaver	Matrix
Data Subcarriers	128
Cyclic Prefix	16
System	OFDM
IFFT Points	128
No. of Samples	5000

It is even observed from figure that BER keeps improving on using BCH coding for BPSK, QPSK, and 16-QAM respectively.

To show the performance of PAPR reduction, the OFDM is combined with Reduced complexity PTS and companding methods which are imitative of the existing methods with number of symbols 500, subcarriers 6,16-QAM and V=2 which are simulated by randomly generated data. A CCDF=Prob{PAPR>PAPRo}, was used to present the range of PAPR in term of a probability of occurrence is presented in figure 3.

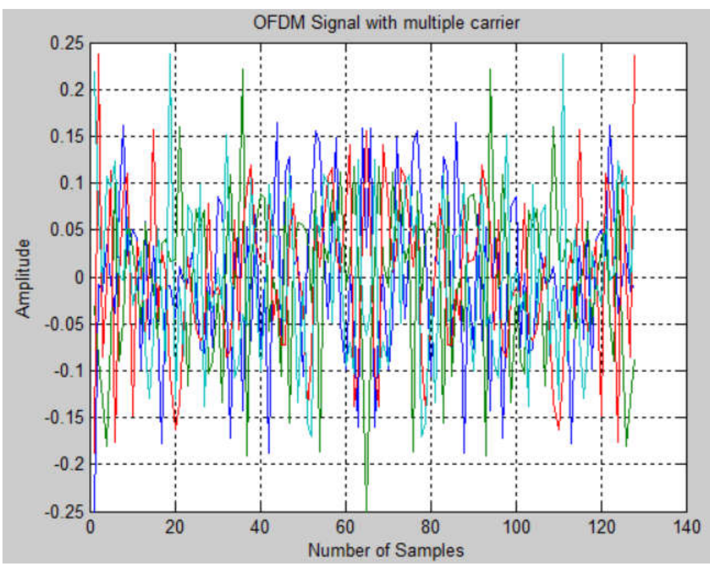

Fig.2 OFDM Signal with multicarrier

To demonstrate proposed PTS-OFDM, CCDF is calculated as presented in figure (3) for BPSK, QPSK, 16-QAM and 64-QAM modulation respectively.

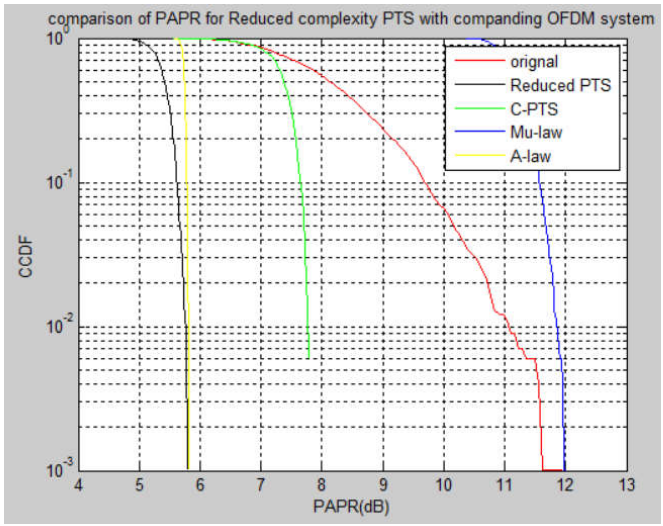

Fig.3 Comparison of PAPR using different Companding technique

CONCLUSION

In proposed system results show the comparison analysis of BPSK, QPSK, 16-QAM,64-QAM and 256-QAM modulation schemes over AWGN channel. Based on the simulation results it is concluded that by using 16-QAM scheme better SNR performance for same value of BER is obtained as Compared to the BPSK and QPSK. Through simulation the BER performance of the system and the minimum required SNR to satisfy both high quality and low quality of data services is obtained.

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