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MIMO-OFDM WIRELESS COMMUNICATIONS REDUCE THE PAPR TECHNIQUE

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ABSTRACT

Multiple inputs and multiple outputs (MIMO) orthogonal frequency division multiplexing (OFDM) is a famous technique for very high data rate wireless transmission system. High data rate are provided by WLAN, WiMax and LTE. Growing the wireless system with more spectral efficiency under varying channel condition is a key challenge to provide more bit rates with limited range. OFDM may be joined with an antenna at the transceiver to raise the diversity gain and/or to enhance the system channel capacity, One of the main disadvantages draw back in OFDM technique High Peak to average power ratio (PAPR) .due to high PAPR to increase the power efficiency, immunity to impulse interference RF power amplifiers should be operated in a very large linear region etc … in this paper we are focusing to reduce PAPR and improve the system capacity ,reduce the power efficiency ,increase to transmit signal power , BER increase, computational complexity increase, and so on[1]. Here in this paper we will describe how PAPR is increased and its reduction by adaptive SLM (A-Selected Mapping Technique) technique.

Key words:* *Multiple inputs and multiple outputs (MIMO), Orthogonal frequency division multiplexing (OFDM), Peak to average power ratio (PAPR), Selected Mapping Technique (SLM),

I.INTRODUCTION

Modern radio communication systems have to provide higher and higher data rates. As conventional methods like using more bandwidth or higher order modulation types are limited, new methods of using the transmission channel have to be used. Multiple antenna systems (Multiple Input, Multiple Output – MIMO) gives a significant enhancement to data rate and channel capacity[1]. Several different diversity modes are used to make radio communications more robust, even with varying channels. These include time diversity (different timeslots and channel coding), frequency diversity (different channels, spread spectrum, and OFDM),and also spatial diversity[2]. Spatial diversity requires the use of multiple antennas at the transmitter or the receiver end. Multiple antenna systems are typically known as Multiple Input, Multiple Output systems (MIMO). Multiple antenna technology can also be used to increase the data rate (spatial multiplexing) instead of improving robustness.

II.WORKING PRINCIPLE OF MIMO

A.Working Details of MIMO

- ✓ On the contrary MIMO takes advantage of multipath propagation (direct and reflected signals).
- ✓ MIMO uses multiple antennas to transmit multiple parallel signals.
- ✓ In an urban environment, signals will bounce off trees, high rise buildings and reach the receiver Through different path.
- ✓ Receiver end uses an algorithm / DSP to sort out the multiple signals to produce one signal having originally transmitted data.
- ✓ Multiple data streams are transmitted in a single channel at the same time and at the receiver multiple radios collect the multipath signal.
- ✓ MIMO OFDM uses IFFT in the transmitter and FFT in the receiver.
- ✓ MIMO increase range, throughput and reliability.

B.MIMO Antenna Systems

A Multiple input and multiple outputs (MIMO) system typically consists of m transmit and n receive antennas

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(Figure 2). By using the same channel, every antenna receives not only the direct components intended for it, but also the indirect components intended for the other antennas. A time-independent, narrowband channel is assumed. The direct connection from antenna 1 to 1 is specified with h11, etc., while the indirect connection from antenna 1 to 2 is identified as cross component h21, etc. From this is obtained transmission matrix
H with the dimensions n x m.

$$H = \begin{bmatrix} h_{11} & h_{12} & h_{..} & h_{1m} \\ h_{21} & h_{22} & h_{..} & h_{2m} \\ h_{..} & h_{..} & h_{..} & h_{.m} \\ h_{n1} & h_{n2} & h_{n.} & h_{nm} \end{bmatrix} \quad \text{---- (1)}$$

Equation - H Matrix

The above equation is represent for Multiple Antena Matrix representaion.

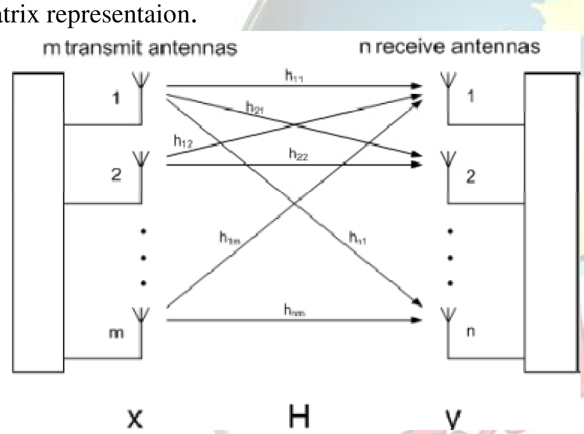

Fig.1 Block Diagram of MIMO

C.OFDM

Orthogonal frequency division multiplexing (OFDM) has become a popular technique for transmission of signals over wireless channels. OFDM has been adopted in several wireless standards such as a digital audio broadcasting (DAB), digital video broadcasting (DVB-T), the IEEE 802.11a local area network (LAN) standard and the IEEE 802.16a metropolitan area network (MAN) standard. OFDM is also being pursued for dedicated short-range communications (DSRC) for road side to vehicle communications and as a potential candidate for fourth-generation (4G) mobile wireless systems. OFDM converts a frequency-selective channel into a parallel collection of frequency flat sub channels. The subcarriers have the minimum frequency separation required to maintain orthogonality of their corresponding time domain waveforms, yet the signal spectra corresponding to the different subcarriers overlap in frequency.

D.Advantages of OFDM Systems

- ✓ High spectral efficiency due to nearly rectangular frequency spectrum for high numbers of sub-carriers.
- ✓ Simple digital realization by using the FFT operation.
- ✓ Less complex receivers due to the avoidance of ISI with a sufficiently long cyclic prefix.
- ✓ Different modulation schemes can be used on individual sub-carriers which are adapted to the transmission conditions on each sub-carrier.

E.MIMO – OFDM

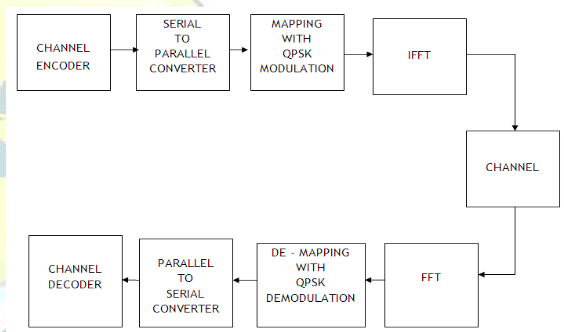

Fig 2.Block Diagram of MIMO – OFDM

Channel encoder is encoding the data the its transferred to serial to parallel converter . Serial to parallel converter is present in transmitter side[1]. Christo Ananth et al. [4] proposed a system, Low Voltage Differential Signaling (LVDS) is a way to communicate data using a very low voltage swing (about 350mV) differentially over two PCB traces. It deals about the analysis and design of a low power, low noise and high speed comparator for a high performance Low Voltage Differential Signaling (LVDS) Receiver. The circuit of a Conventional Double Tail Latch Type Comparator is modified for the purpose of low-power and low noise operation even in small supply voltages. The circuit is simulated with 2V DC supply voltage, 350mV 500MHz sinusoidal input and 1GHz clock frequency. LVDS Receiver using comparator as its second stage is designed and simulated in Cadence Virtuoso Analog Design Environment using GPDK 180nm .By this design, the power dissipation, delay and noise can be reduced.

Transmitter converting all data can be subdivided in to small set of data. Each and every small set of data having one different symbol that can be denoted as Mi, for each subcarrier. Subcarrier is given to mapping with QPSK

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modulation block that block is mapping all subcarrier using QPSK modulation. IFFT block getting time domain signal from QPSK modulation that time domain signal is converting in to frequency domain signal .Channel will pass only the Frequency domain signal. Receiver will do the reverse operation of the transmitter.

III.PAPR –PEAK TO AVERAGE POWER RATIO

In general, PAPR (Peak to Average Power Ratio) of OFDM signal is defined as the ratio of peak power to average power. It is the peak amplitude of the waveform divided by the RMS value of the waveform [3]
Mathematically, it can be expressed as

$$\text{PAPR db} = 10\,\text{Log10}\,\frac{|x|^2_{peak}}{X^2_{rms}} \quad \text{---- (2)}$$

$$PAPR_{dB} = 10\log\left(\frac{max[x(t)x^*(t)]}{E[x(t)x^*(t)]}\right) \quad \text{----(3)}$$

For Simplicity,
The peak value of the signal :

$$\text{Max}[x(t)\,x^*(t)] = max\left[\sum_0^{K-1} a_k e^{\frac{j2\pi kt}{T}} \sum_0^{K-1} a_k{}^* e^{\frac{-j2\pi kt}{T}}\right] = max\left[a_k a_k{}^* \sum_0^{K-1}\sum_0^{K-1} e^{\frac{j2\pi kt}{T}} e^{\frac{-j2\pi kt}{T}}\right]$$

Mean square value of the signal:

$$E[x(t)\,X^*(t)] = E\left[\sum_0^{K-1} a_k e^{\frac{j2\pi kt}{T}} \sum_0^{K-1} a_k{}^* e^{\frac{-j2\pi kt}{T}}\right] = E\left[a_k a_k{}^* \sum_0^{K-1}\sum_0^{K-1} e^{\frac{j2\pi kt}{T}} e^{\frac{-j2\pi kt}{T}}\right]$$

V.PAPR REDUCTION RECHNIQUES

Due to high PAPR, to degrades the performance of an OFDM system, it is essential to require the reduce the PAPR. Several techniques are to introduce to reduce PAPR in OFDM systems. In this section, the PAPR reduction techniques are divided into two categories: scrambling techniques and Signal distortion technique

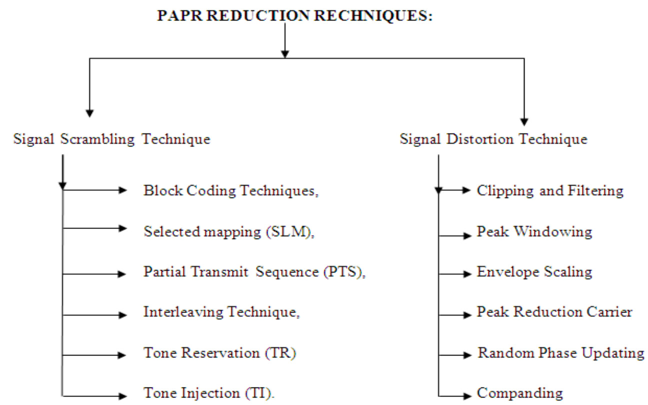

TABLE 1. PAPR REDUCTION TECHNIQUE SYSTEMS

A.Block Coding Techniques

The Block Coding Technique was first introduced by the Wilkinson and Jones in year of 1995. One of main objective of this technique was to choose a codeword which does not contain excessive peak envelope carrier powers. A appropriate set of code words is selected for any number of carriers, modulation scheme, and any code rate. Different encoding/decoding methods are to recover a such a code words. The unsophisticated approach to produce a block coding technique is to successively search the Peak carrier Power for all possible code words for a given length and a given number of sub carriers.

B.Selected mapping Technique

One of the Famous techniques to reduce the PAPR, it was first developed by the Baumlet al. In this SLM technique, all the input data sequences are product with by each of the phase sequences vector to make alternative input symbol sequences. Each of these alternative input data sequences is made the IFFT operation, and then the one with the less PAPR is selected for transmission. The CCDF of the original signal sequence PAPR above threshold A written as Pr(PAPR>A) . Thus for K statistical independent signal waveforms, CCDF can be Written as [Pr(PAPR>A)]R . So the probability of PAPR exceeds the same threshold. The probability of PAPR larger than a threshold A can be written as P(PAPR<A)=F(A) N=(1-exp(A))N . The SKM technique can handle any number of carriers and drawback of SLM technique is that the overhead of side information needs to be transmitted to the receiver.

C.Partial Transmit Sequence

It is a one of technique to reduce the PAPR. Advanced system of PTS, the given input data's are divided into the

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disjoint sub-blocks codes, the main three operation is done here .that three PTS scheme operations are

- Interleaved
- adjacent
- Pseudo-random.

Among with them, pseudo-random partitioned PTS scheme can obtain the best PAPR performance. Each and every sub-block in sub carriers are weighted by phase vector rotations. This rotation factor generate time domain data using which it selects signal having lowest PAPR.

At the receiver side all original data are recovered by applying inverse phase factor rotations

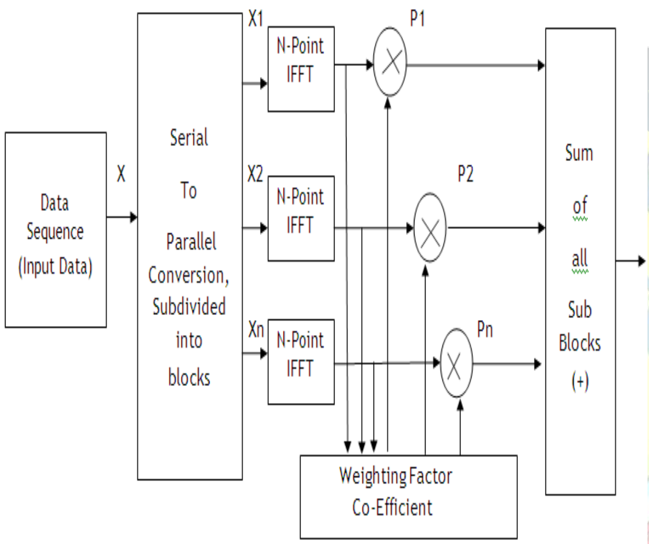


Fig 3.Block Diagram of Partial Transmit Sequence

parallel data like x1,x2,x3….xn that datas can be processed by IFFT block , IFFT can be producing the output as p1,p2,….pn.the corresponding p1,p2,..pn having different peak values in that peak values which peak is minimum that can be chosen by selected lowest PAPR block using that peak value clipping process is clip the remaining peaks only particular peak value is transmitted in channel . The reverse process of transmitter operation is producing the original data in the receiver side.

SLM Technique is affected by the PAPR technique. like route number M and sub carrier N. Simulation

V.PROPOSED SYSTEM

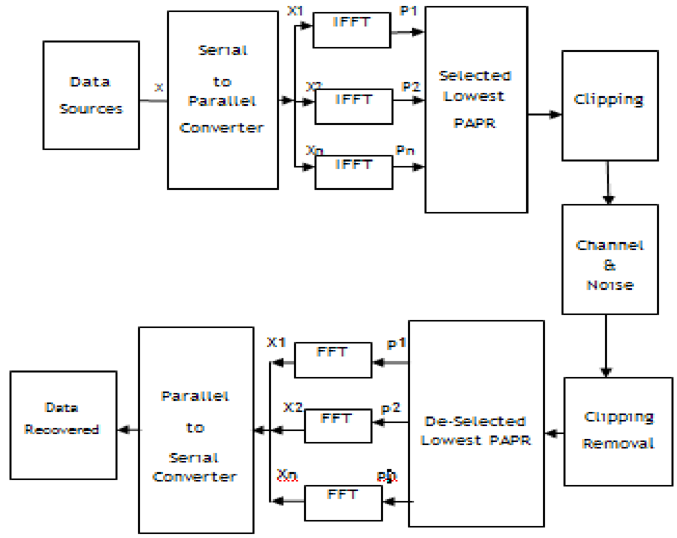
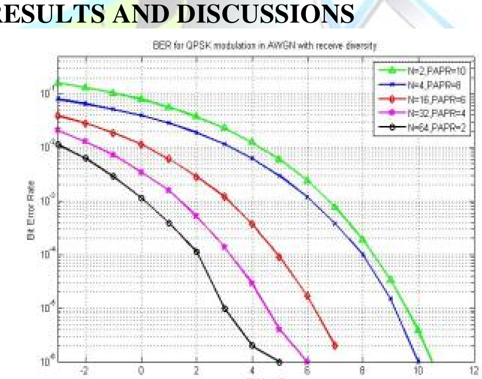


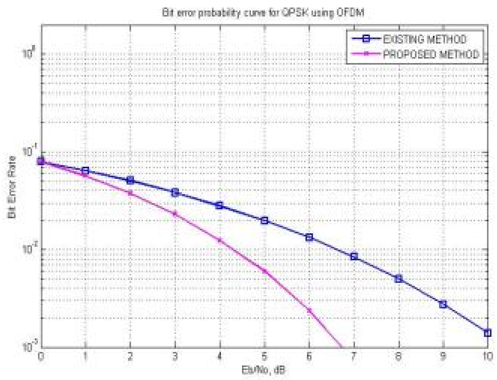
Fig 4.Block Diagram of Proposed Systems

The above diagram having three blocks transmitter block, channel block and receiver block. Transmitter contains Data source , data source is producing data to serial to data converter that serial to parallel converter is producing

RESULTS AND DISCUSSIONS



with different values of M and N .the results exhibits some desired properties of signals representing same information. various N values can be compared (i.e) N= 2,4,8,16,64 for this various N values THE Eb/No is shown in graph. N=2 value We are getting the Eb/No value is 10.3 ,N=4 & Eb/No= 10 N=8 & Eb/No= 6.5 N=16 & Eb/No=6 N=64 & Eb/No=4.5.the value of Eb/No value s reducing if we sre increasing N value automatically Eb/No.



The above graph is mention is comparison of existing method and proposed method .in this existing method value is 10.5 Eb/No in dB, the proposed method Value is 6.8 Eb/No. it can be experimental that the future SLM method displays a recovered the PAPR reduction performance than the original OFDM signal . PAPR. PAPR reduction concepts will be expanded for distortion less transmission and identifying the best alternatives in terms of performance increase Secondly, PAPR reduction technique will be develop for low data rate loss and efficient use of channel. A study of the complexity issues of the PAPR reduction technique is required, especially looking at ways of further reducing the complexity of the sphere decoder. The selected technique provides us with a good range in performance to reduce PAPR problem.

V.CONCLUSION

Here we discussed about various PAPR techniques and SLM techniques which is the best solution for SLM algorithm adapted to any length of route number that means it can be used for different OFDM systems with different number of carriers. It is particularly suitable for the OFDM system with a large number of sub-carriers (more than 128). This research will continue in directions Firstly,

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