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A Comparative Analysis of Co-PTS and SFBC Techniques for PAPR Reduction in MIMO OFDM

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Abstract: The work described in this article deals with the Reduction of PAPR in which MIMO is done by using multiple antennas at the transmitter side and receiver side, so that the communication will be better and OFDM is also done for reducing the computational complexity and makes the communication faster maintains the strength of the data and Co-PTS, are used to lessen the PAPR. Use to these technologies makes the communication better as SFBC uses the sub-blocks. And in co-PTS sequence circular permutation and special sub-blocks are merged with number of sequences and the signals, which are taken here are orthogonal, so there is a great reduction of PAPR and the computational complexity is reduced. By virtue of which a better communication is performed. As the high PAPR causes in band distortion and out band radiation. So, when the PAPR is reduced the performance of the wireless communications is enhanced.

Keywords: PAPR (Peak to Average Power Ratio), MIMO (Multiple Input and Multiple Output), OFDM (Orthogonal Frequency Division Multiplexing), Co-PTS (Co-operative Partial Transmission Sequence), SFBC (Space Frequency Block Code).

I. INTRODUCTION

The OFDM technique means orthogonal frequency division multiplexing [1-5], it is an eminent method aimed at increasing the wireless transmission data rate, OFDM ismerge with antennas to increase in signal to interface ratio due to some diversity scheme. It will increment the system capacity on the time dependent and frequency selective channels, giving rise to the more than one input and more thanoutputs MIMO OFDM is favored for managing fading channel with the help of SFBC and Co-PTS (Co-operative Partial Transmission Sequence) has been used to lessen peakto average ratio. The demand is growing now a days as day by day the need for high data rate wireless communication has become an essential need using more than one antenna attogether transmitter and receiver trimmings to enhance the wireless communication performance [6-11]. The great disadvantage of OFDM techniques is its increasing peak to average power ratio. As the linear power amplifier is used at the sender, so its performing point will go to the saturation point because of the increase in PAPR which leads to in band deformation or biasing and out band radiation. This can be prevented with expanding the dynamic range of power amplifier, which give rise to increase in cost and much power consumption at the base station. The work presented in this article, investigates space frequency block code and co- operative partial transmit sequence (Co-PTS) are used to lessen the PAPR. Whereas, the performance has been compared for analysis. In, [1] MIMO OFDM Technology is used here for wireless communication systems due to high band width efficiency resistance to RF interface androbustness to multi-path fading. Co PTS is used ordinary partial transmit sequence, so lower computational complexity. Whereas, in [2] It helps to reduce noise and fading, the PAPR reduction is done by analog mixed signal. PAPR is reduced better than the SFBC computational complexity is reduced. The authors in,[3] discuss the SFBC MIMO system in the presence of nonlinear misrepresentationover TWDP disappearing with flawed CSI has beeninvestigated. The amount of BER suffered is degraded. This suffers with non-linear alteration under defective CSI at the receiver and dense adaptive link adaptive techniques.

The advent of different analog devices and filters can also dothe predefined study in an efficient way as reported in [13- 20].

In [4], the authors revisited the long-standing issue of peak average ratio reduction in MIMO- OFDM system by tone reservation i.e., Complete co-efficient, on unused space frequency reserve. Reduce the computational complexity and PAPR decrease performance. Average transmit power of the antenna self-power consumption of antenna should be minimal high gain data stream down-link transmission usingdummy symbol allotment. The work done shows that the MIMO OFDM lessen the system efficiency and thus there isan increase in the cost price of the radio frequency. Modified ALG is obtained. It has SLM and PTS. Practical transmit scheme. sub-blocks are used to create an alternative MIMO OFDM signal. In this paper, [6] different techniques like Clipping, Filtering, PTS. DTP spreading with pulse shaping simulation results.

This complete study of SFBC has devoted considerable attention due to its strength towards time selective fading channel. By using IFFT, this increases the channel capacity. The method utilizes the pick cancelling signal appears to theconvey signal to be rummage-sale for amplitude rebuilding as the receiver. Low data rate loss [8]. And SLM selected mapping lower computational complexity. The paper also discusses the increases in channel capacity. The methodutilizes the pick cancelling signal appeared to the transmit signal to be used for amplitude reconstruction as the receiver.Low data rate deprivation. In the report, a novel peek to average ratio reduction scheme named as extended selected mapping (ESLAM) is put forward for SFBC MIMO OFDM,In ESLAM method [10], extension method consisting lower amplitude extension and phase rotation are built to show the signal index without any requirement of side material to minimize PAPR. The inverse discrete Fourier transformed increating the candidate signal. Low complexity ESLAM scheme is established.

II. RELATED WORKS

MIMO Technology with OFDM can be confirmed as an active method for wireless communication, it is areliable technique to deal with multi-channel fading and to improve band width efficiency, so it makes the system's ability better to provide better transmission and reduce PAPR[2]. The OFDM is an exceptional form of multi-carrying parallel or orthogonal sub-carriers. This is reached by keeping the carrier at the nulls in the modulation spectrum the amplitude distortion caused due to increase in PAPR oftransmitted signal, is a lacuna in OFDM system. Merging thesignal at sender side to lessen PAPR. The DHT pre coded AMS scheme is used to lessen PAPR [3]. Selective mappingis a distortion technique used in PAPR reduction for OFDM system in a SLM phase sequence are merged with the data forachieving alternative signals. OFDM SLM based on mathematical co-relation analysis among the analytical according alternative signals. By this proposed norm themessy phase sequence implemented for improving PAPR reduction performance in SLM [5]. OFDM is a leading technique its limitation is increased PAPR drawback [6]. OFDM is a leading technique its limitation is increased PAPR problem, the PAPR can be decreased by using filtering scheme and iterative clipping, but it requires the same signalshould be clipped with a fix clipping threshold at different types of clipping iterations using a second order programmed. This optimize ICF was again simplified after some time by large Lagrange multiplied. (LM), the second order ICF resultsa decrease in PAPR is shown and the BER is also reduced, that can be under one db. By using the clipping threshold in

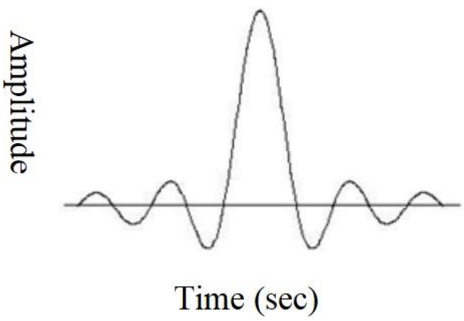
[8] High PAPR is reduced using the discrete cosine transform Pre coding based SLM technique for the PAPR reduction the constellation symbols with BCT pre coder after the multiplication of phase rotation factor and IFFP in the SLM OFDM system. The clipping probability is $10^{3.}$

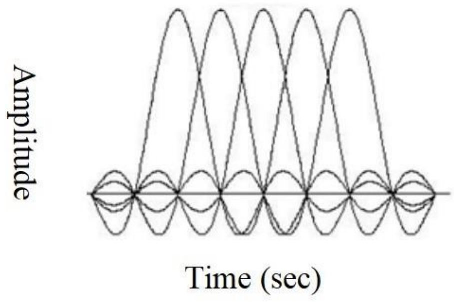
Here, in [10] Increase PAPR of the transmission signal give rise to in and out band radiation and in band deformation. Thetwo methods of PAPR reduction are SLM and PTS. Phase factor is required for searching to make PAPR better, so computational complexity is greater. This paper used AI based optimization technologies to achieve PAPR reduction. as decrease searches directly influences the number of computations. In this paper, practical swarm optimization, ABC (Artificial Bee Colony) and DE (Differential evolution)methods are used.

The receiver blends novelty of balanced recurrence OFDM with various evidence. Also, numerous skilled researchers give a reasonable choice towards the improvement of the administration, but the complexity is high in this paper FM based strategy, that was exploited to get the ideal stage factor for the PTS method. To decline computational complexity, as there is a lot of guaranteed imperatives, at this point the FM based strategy to look at this factor and an ideal stage factor [11]. The polar coding of PTS is based on MIMO OFDM andIFFA , calculating is employed by PTS strategy to decrease PAPR at a quicker rate[12]. High spectra efficiency and robustness to frequency selective adding channel, however, has a peek to average ratio, which is the main disadvantage of PTS, so a sub-block is used with a random segmentation method [13]. Constructive interference is used to reduce the transmit signal PAPR optimization issues that mutually performs power minimization and PAPR reduction is owed to non-conveys PAPR constraint. The first iterative shrinkage threshold algorithm in terms of transmission power is saved 52% in terms of PAPR is minimized [19].

III. METHODS

Orthogonal Frequency division Multiplexing method , in which the orthogonal frequency signal are taken , which are completely independent to each other and the datais grouped into many parallel streams of the channel and in this techniques the frequency multiplexing is there, which makes the communication faster and the orthogonal frequency division multiplexing is a method of FDM and those are to be used in a MIMO ,i.e., multiple input and multiple output [1-5], in which we will connect multiple antenna at the transmitter side and the multiple antenna receiver side. , in this the large amount of data transmitted will be transmitted and the OFDM is merged with antenna. So, there is an increment in the diversity gain., the high-speed internet is necessary for today [7]. Thus, the system capacity will become better. On the time dependent and frequency dependent channel, which will give rise to MIMO. Fading channels are controlled using SFBC, MIMO, OFDM, they are converted into Sub Block Carriers and then modulated with single carrier modulation at same band width by this the strength of the signal increased and then the data rate becameless, so computational complexity reduces. And to decrease the PAPR and co-PTS is used the totally independent signals are used [8], which are orthogonal to each other and this can be achieved by putting the carriers at the nulls in the modulation spectrum.





(a)

The block diagram shown in Fig.2 describes the SFBC system in MIMO OFDM that employs the scheme of extension to more than two transmitters.

B. PAPR and OFDM:

The OFDM techniques is famous for the multicarrier and modulation, that provides the improved spectral efficiency low computational complexity and less echoes are caused and also nonlinear distortion. One of the biggest drawbacks of MIMO OFDM is high peak to average power ratio. And thus, the competence of the radio frequency power amplifier decreases because of the converter of digital to analog and analog to digital.

Now, representing the data block of length N by a vector, it can be given by (1),

A. Orthogonality:

(b)

$X = [x0, x1, x2..... x N - 1]$ (1)

Period of any symbol X_n the set X is T and represent one ofthe sub carriers $\{fn, n = 0, 1, 2,$ $N - 1\}$set.

As the N sub-carrier chosen to transmit the signal areorthogonal to each other.

So $fn = n\Delta$, where $n\Delta f = 1/NT$ and NT is the

The two signals are set to be orthogonal, when their periodic and the integration has been carried out of their product, while over one period is given as zero, both the independent signal are taken. When the integral of their product over one period is zero, then the two signals are set to be orthogonal. The two completely independent signals are taken.

For case of continuous time:

$$\int_0^T \cos(2\pi n f t)\cos(2\pi m f t)dt = 0 \qquad (1)$$

For the case of discrete time:

$$\sum_{k=0}^{N-1} \cos(2\pi kn/N)\cos(2\pi km/N)dt = 0$$

where m$\neq n$, *in both the cases*

MIMO (Multiple Input and Multiple Output) , both transmitter side and the receiver side have more than antenna to make the communication better and then improve communication rate , the OFDM is merged with the MIMO which makes the wireless communication system better as it has high data rate transmission strength of the signal also increases to the multi path heading , now MIMO OFDM is one of the best communication to increase the strength and the drawback of it is , the increase in PAPR (Peak to Average Power Ratio).

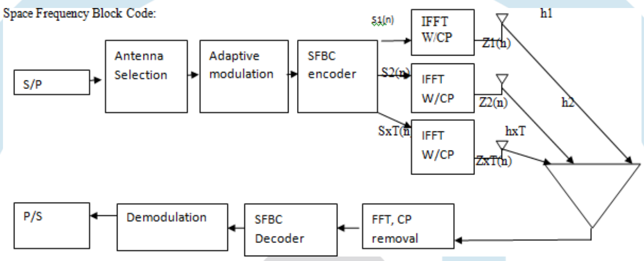


Fig. 2 Block diagram of SFBC MIMO OFDM

duration of OFDM block X, the complex data block for the OFDM signal to be transmitted is given by

$$\overline{(t)} = 1/\sqrt{N} \sum_{n=0}^{N-1} Xn.e^{j2\pi n\Delta f t}, \quad 0 \leq t \leq NT \quad (2)$$

C. Proposed Co-PTS schemes.

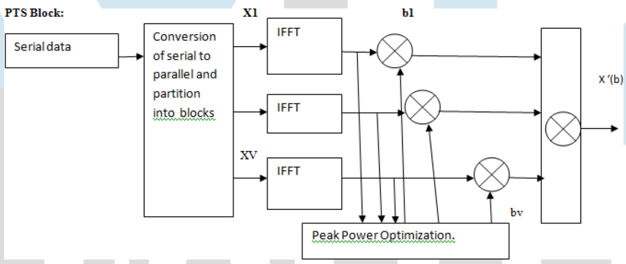


Fig. 3 Partial Transmit Sequence (PTS) Block.

Co-PTS sequence is proposed with SFBC, OFDM, the need to reduce the computational complexity, another optimization and specials sub block and circular permutation are merged with antenna at the transmitter side and thus the number of sequences are there that increases the reduction of PAPR.

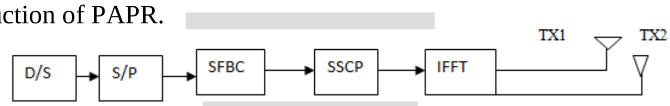


Fig. 4 Block diagram of Co-operative partial transmission sequence using SFBC and SSCP.

D. Cumulative Distribution Function:

The complementary Cumulative Distribution Function (CDF) is a method of a statistical our calculation method, that can be done in time domain. It is taken from cumulative distribution function and it can measure the PAPR with the help of it, the probability of PAPR exceeds the given threshold. The CCDF of PAPR of the data block is desired to compare the reduction techniques.

$$(PAPR > Z) = 1 - P(PAPR \leq Z) \qquad (3)$$
$$= 1 - F(\,)$$
$$= 1 - (1 - exp(-z))^{N}$$

Table. I Parameters used in the PTS algorithm.

Parameter	Value
System sub carrier	128
MIMO scheme (Tx * Rx)	2 x 2
Over Sampling factor (L)	4
Modulation scheme	QPSK.
Clipping Ratio (C R)	4
Phase Factor	1, -1, j, -j
Guard Index length	60
Number of Sub-blocks used in PTS method.	V=8
Random OFDM symbols generated.	1000

PAPR reduction algorithm technique :

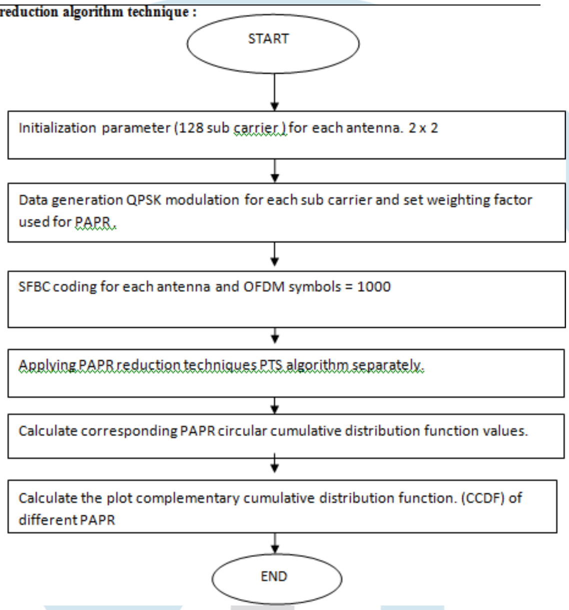


Fig. 5 Block diagram of PAPR reduction algorithm technique.

IV. RESULTS AND DISCUSSION

To generate a random signal used as an input to the transmitter.

$$X = \sin(2\pi\, f1t) + \sin(2\pi f2t) \qquad (4)$$

;

Where f1=20Hz., f2=30 Hz. A random signal is taken in this simulation to generate the desired output. This is the original signal which is shown here and the amplitude is taken as x(t)with respect to time.

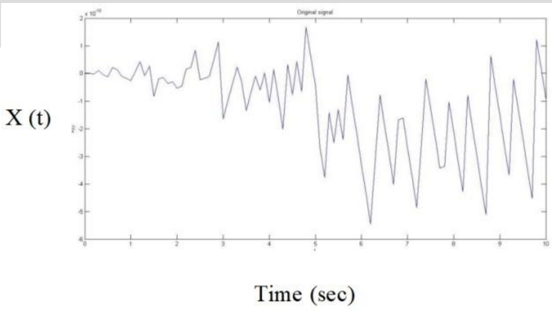


Fig.6 Graph of Original Random Signal.

The plot in fig. 6 shows the simulation that has been obtainedfrom the sampled signal after encoding.

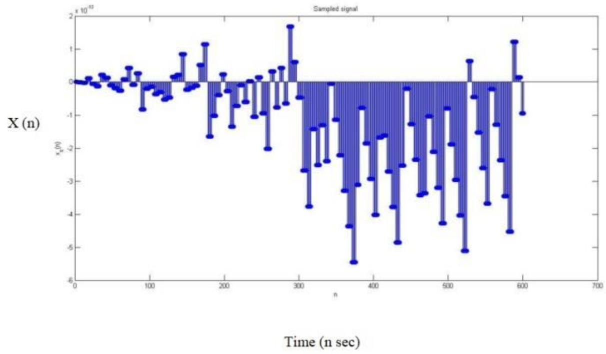


Fig. 7. Graph of sample signal after encoding.

OFDM sampled signal after encoding in this x (n) is shown with respect to n. To find OFDM modulated signal with 128 sub carriers, 8 sub blocks and phase weighting factors (+/- j)and (+/-1) are used. The OFDM is done, where the sub carrieris taken or multiple carriers are taken for the study of frequency division.

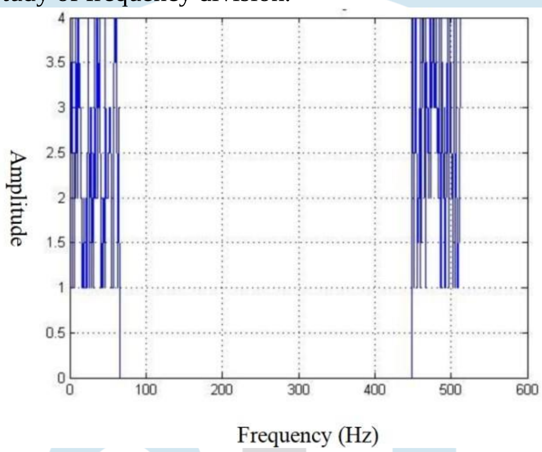


Fig.7 OFDM modulated signal.

To analyses the variation of PAPR peak to average power ratio in different radiation techniques by taking various parameters, i.e. The number of sub block V is 4, 8, QPSK is set {1, -1, j, -j} and over sampling factor L is 4 in this simulation, CO-PTS SFBC MIMO OFDM is shown in the blue line and SFBC, MIMO is shown in red line and the original signal shown in green line. This graph shows that while using the combination of CO PTS and SFBC, MIMO, OFDM, the peak to average power ratio is much less and reduced.

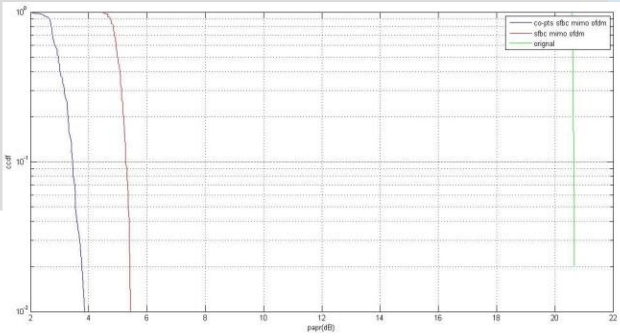


Fig.8 Complementary Cumulative Distribution Function vs peak to average power ratio.

V. CONCLUSIONS

MIMO are OFDM are a very appealing technique for multiple transmission of the data and high-speed data transmission, which improves the communication and itspeak to average ratio is decreased here, the techniques of OFDM CCDF and Space Frequency Block Code and CO- PTS to lessen the PAPR, this application of CO-PTS is able to analyze to avoid the sending of selective index Riemann Matrix can also be used for further decrease in computation complexity. Co-PTS sequence circular permutation and special sub-blocks are merged with number of sequences andthe signals, which are taken here are orthogonal, so there is agreat reduction of PAPR and the computational complexity isreduced. And better communication is performed. As the large value of PAPR causes in band alteration and out band radiation. So, when the PAPR is reduced a better communication is performed.

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