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RESEARCH ARTICLE OPEN ACCESS

Reduce & Compare PAPR Noise with Selecting Mapping & Partial Transmission Sequence using OFDM

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ABSTRACT:
In this paper we investigated various PAPR reduction methods viz. PTS, SLM, Clipping and filtering technique. We have compared the proposed technique with the help of SLM, PTS, Iterative flipping and Original schemes.The main problem related with OFDM is Peak to Average Power Ratio (PAPR).There are various techniques proposed to overcome the PAPR problem in OFDM. Partial Transmit Sequence (PTS) scheme is one of the most prominent distortions-less techniques for OFDM system. In these techniques increasing number of complementary sequences, decreases the transmission efficiency. The conventional PTS requires large number of Fast Fourier Transforms (FFT) for operations at the receiver, but the proposed technique requires half the FFT operations at the receiver end. Unlike the PTS, the proposed technique does not require side band information bits that increase the bandwidth efficiency of the system. PAPR reduction increases by increasing the length of complementary sequences, also the BER is improved. There are various methods for PAPR reduction such as coding, phase rotation, clipping etc.

Keywords: Analog to Digital converters, Digital to Analog converters, Orthogonal Frequency Division Multiplexing (OFDM), Partial Transmit Sequence (PTS), Peak to Average Power Ratio (PAPR) and Selected mapping (SLM).

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I. INTRODUCTION

The growing demand of multimedia services and the growth of Internet related contents lead to increasing interest to high speed communications. In wireless environment the signal is propagating from the transmitter to the receiver along number of different paths, collectively referred as multipath [7]. While propagating the signal power drops of due to the following effects of path loss, macroscopic fading and microscopic fading. These properties, MIMO is an important part of modern wireless communication standards such as IEEE 802.11n (Wi-Fi), 5G, 3GPP Long Term Evolution [3]. Multicarrier transmission, also known as OFDM or discrete multi tone (DMT), is a technique with a long history that has recently seen rising popularity in wireless and wire line applications. The recent interest in this technique is mainly due to the recent advances in digital signal processing technology [2]. International standards making use of OFDM for high-speed wireless communications are already established or being established by IEEE 802.11, IEEE 802.16, IEEE 802.20, and European Telecommunications Standards Institute (ETSI) Broadcast Radio Access Network (BRAN) committees[4]. For wireless applications, an OFDM-based system can be of interest because it provides greater immunity to multipath fading and impulse noise, and eliminates the need for equalizers, while efficient hardware implementation can be realized using fast Fourier transform (FFT) techniques[11].

II. PEAK TO AVERAGE POWER RATIO

The PAPR of the signal s(t) can be defined as the ratio between the instantaneous Power to the Average power can be represented as the [3].

$$\text{PAPR}\{\bar{s}(t)\} = (max|\bar{s}(t)|^2)/E|\bar{s}(t)|^2)$$

PAPR occurs when in a multicarrier system the different sub-carriers are out of phase with each other at each instant they are different with respect to each other at different phase values [2]. In OFDM, PAPR causes the high peak which is larger than the typical values. High PAPR in the transmitted signal will cause the bit error rate degradation inter modulation effects on the sub carriers, energy spilling into adjacent channels and also causes non linear distortion in the power amplifiers [4].Therefore PAPR can be calculated by using level crossing rate theorem that calculates the average number of times that the envelope of a signal crosses a given level. By calculating the

complementary cumulative distribution function (CCDF) for different PAPR values can be performed that can be viewed as [5].

$$CCDF=P_r\,(PAPR>PAPR_0)$$

CCDF computes the power complementary cumulative distribution function from a time domain signal. The CCDF shows the amount of time a signal spends above the average power level of the measured signal or equivalently the probability that the signal power will be above the average power level.

III. APR REDUCTION TECHNIQUES

A. CLIPPING AND FILTERING:

Clipping and Filtering is effective Technique for reduction of PAPR. In this method, OFDM signal is deliberately clipped at particular threshold value before amplification. However, clipping causes in band distortion and out of band noise due to which bit error rate and spectral efficiency is reduced. Clipping is a non linear process in which it suppress time domain OFDM signal of which the signal power exceeds the certain threshold.

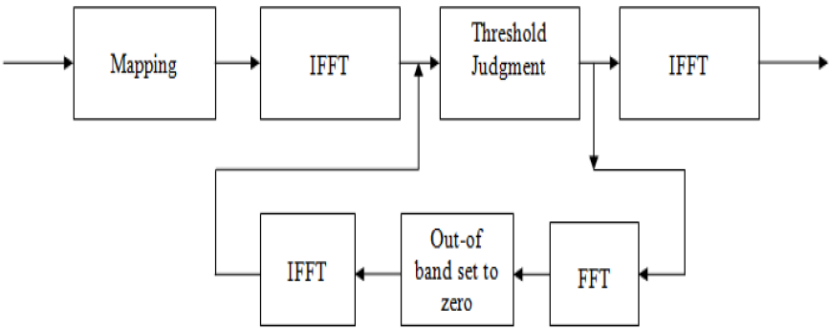

Fig 1: Clipping and Filtering block diagram

There is increase in a out of band energy as a penalty [5]. To reduce this out of band energy filtering is used after to give better performance Recursive clipping and filtering can be used so as to decreases the both PAPR and out of band energy.

B. SELECTIVE MAPPING METHOD:

In particular SLM technique, entire data stream is divided into different blocks of N symbols each. Each block is multiplied with U different phase factors to generate U modified blocks before giving to modified block [7]. Each modified block is given to IFFT block which gives OFDM signal as a output.

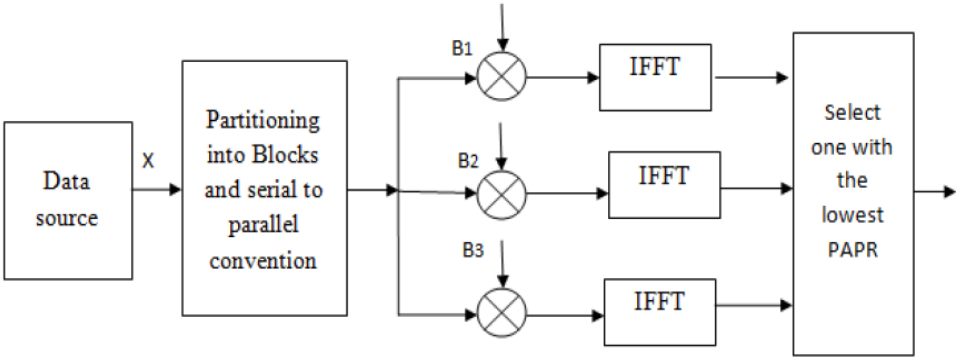

Fig 2: Block diagram of SLM technique

In SLM, one OFDM signal is selected from several signals containing the same information data. SLM is very flexible scheme and it effectively reduces the PAPR. It includes several IFFT stages and complex optimization procedure which increase the complexity and computational burden.

C. PARTIAL TRANSMIT SEQUENCE

PTS is probabilistic based method in which input data block is divided into sub blocks and each subcarrier is multiplied with phase factor .information in frequency domain X is divided into V non-overlapping vectors of same size N. Data block is divided into non-overlapping sub block such that they have independent rotation factor .rotation factor generates time domain data with lowest amplitude [6]. Ordinary PTS scheme is simple and distortion less sometimes it may be burdensome. As we know we divide data block into disjoint sub block, these sub blocks are multiplied with different phase weighing factors; and then added together to produce OFDM symbols or candidate signal with low PAPR.

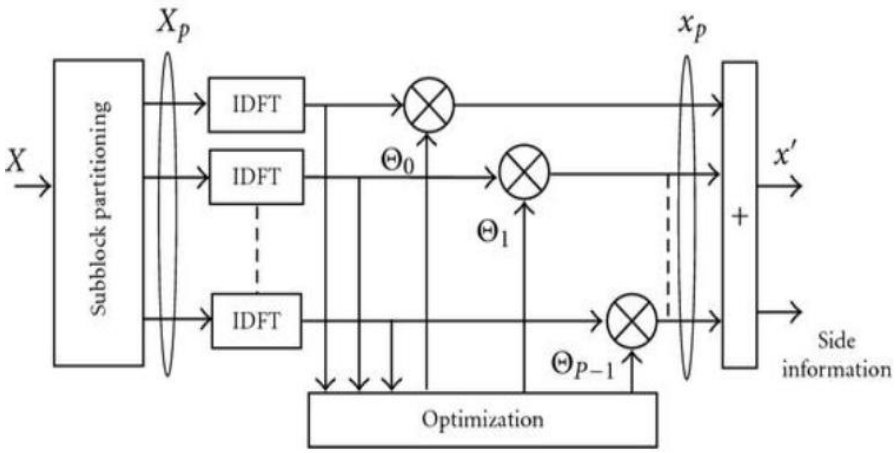

Fig 3: Block diagram of PTS technique

Phase factor is selected such that it will result in to sub block with low PAPR. Each of the sub blocks having minimum PAPR and hence combined signal having a minimum PAPR.

IV. PROPOSED APPROACH

The methods which we have discussed in this paper PTS & SLM offer better PAPR lessening performance. In this proposed technique we first applied the SLM method & then we choose the finest mixture of phase sequence & enter data which provided least amount Peak Average Power Ratio. Currently for more lessening of PAPR, we relate this blend of phase series & enter information to Partial Transmit Sequence method which even more lessens the Peak Average Power Ratio.

V. SIMULATION RESULTS

This section shows the performance of our proposed method with the help of simulation tool. For simulation we have used MATLAB 2016b simulation tool. The parameters which have been taken are shown in following table:

Table 1: Parameter

Parameter	Type/Value
No. of (N) subcarriers	255
No. of (W) sub-blocks	2,4,8,16
Oversampling(L)factor	4
Modulation methods	QPSK
No. of iterations	6000

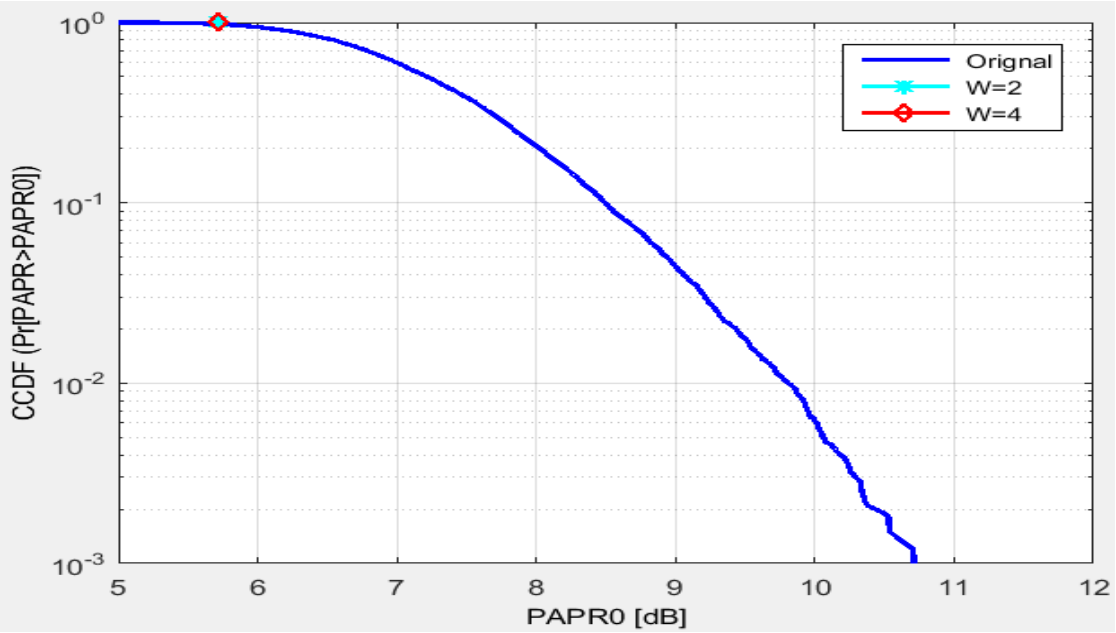

Fig 4: PAPR v/s CCDF using Proposed PTS technique

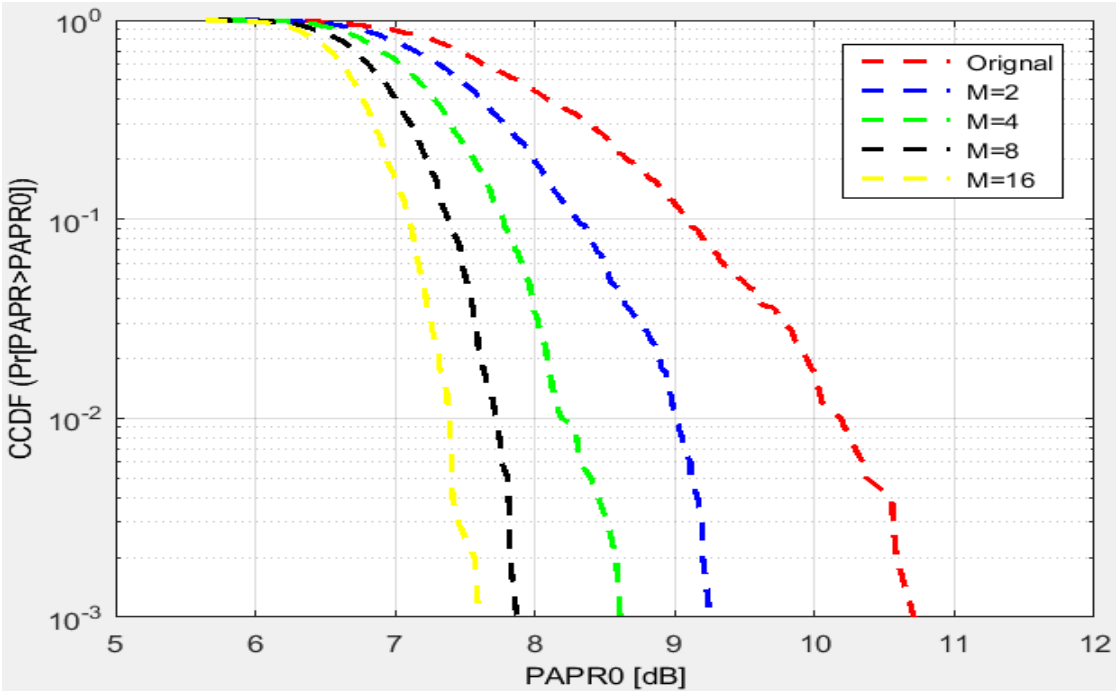

Fig 5: PAPR v/s CCDF using Proposed SLM technique

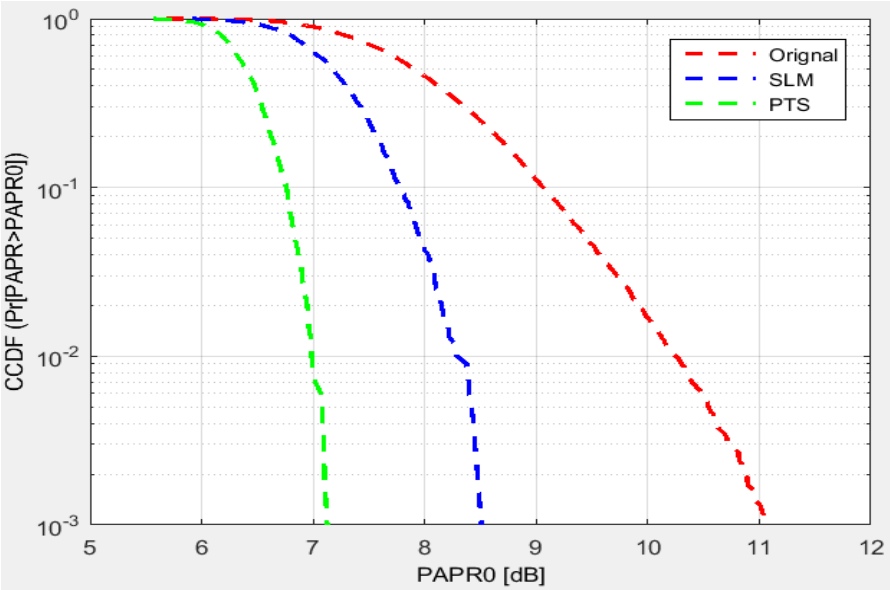

Fig 6: Comparison of PAPR reduction between SLM and PTS method.

TABLE 2: Comparison between Various Techniques

Techniques	Distortion less	PAPR Reduction	Data Rate Loss
Clipping(Original)	NO	Minimum PAPR Reduction	NO
Selecting Mapping	YES	Data with minimum PAPR is Transmitted	YES
PTS	YES	PAPR Varies as block size varies	YES
Tone Reservation Tone Injection	Yes Yes	Peak reduction possible PAPR reduction increases with the size of Constellation	Yes Yes

TABLE 3: Comparison of Various Techniques with Popoola et. al

S.No	Technique	Popoola et.al	My work
1	Clipping(original)	11.5db	11db
2	SLM	10.2db	8.5db
3	PTS	9.6db	7db

VI. CONCLUSION

It is clear by this result that the PTS technique having PAPR reduction techniques gives better performance than SLM technique. Comparative study has been done between two PAPR reduction techniques i.e. Partial Transmit Sequence (PTS) and Selective Mapping Technique (SLM). In this paper, Partial Transmit Sequence (PTS) and Selective Mapping Technique (SLM) schemes were used for PAPR reduction in OFDM systems. The simulation results show that all the schemes can lower the PAPR, but PTS scheme gives good performance with significantly lower complexity compared with the other techniques.

REFERENCES

[1]. Mr.Dande A.R, Mr. Kotgire S.L"PAPR Reduction by CSI-PTS in OFDM System with Low Computational Complexity "International Journal of Computer Networks and Wireless Communications (IJCNWC) Vol.5, No.1, February 2015.

[2]. Abhimanyu Thakur, Naveen Dhillon, "Hybrid Approach using SLM and PTS Techniques to Reduce PAPR International Journal of Science and Research (IJSR) Volume 4 Issue 5, May 2015 pp 173-177.

[3]. Rui J. P. de Figueiredo and Byung Moo Lee, "A New Pre- Distortion Approach to TWTA Compensation for Wireless OFDM Systems," 2nd. IEEE International Conference on Circuits and Systems for

Communications, ICCSC-2004, Moscow, Russia, No. 130, June 30 - July 2, 2004.
[4]. Y. Kou, W. Lu and A. Antoniou, "New Peak-to-Average Power-Ratio Reduction Algorithms for Multicarrier Communications," IEEE Transactions on Circuits and Systems I, Vol. 51, No. 9, September 2004, pp. 1790-1800.
[5]. X. Li and L. J. Cimini, "Effect of Clipping and Filtering on the performance of OFDM," IEEE Communication Letters, Vol. 2 No. 5, May 1998, pp.131-133.
[6]. A.E.Jones, T.A.Wilkinson, and S.K.Barton, "Block coding scheme for reduction of peak to mean envelope power ratio of multicarrier transmission scheme," Electronics Letters, vol 30, pp. 2098-2099, December 1994.
[7]. J. Tellado and J. M. Cioffi, "Efficient algorithms for reducing PAR in multicarrier systems," IEEE International Symposium on Information Theory, Cambridge, MA, pp. 191, Aug. 1998.
[8]. V. Tarokh and H. Jafarkhani, "On the computation and reduction of the peak-to-average power ratio in multicarrier communications," IEEE Trans. Commun., vol. 48, pp. 37-44, Jan. 2000.
[9]. S. H. Muller and H. B. Huber, "OFDM with reduced peak-to-mean power ratio by optimum combination of partial transmit sequences," Electronics Letters, vol. 33, pp. 368-369, Feb. 1997.
[10]. L. J. Cimini, Jr. and N.R. Sollenberger, "Peak-to-average power ratio reduction of an OFDM signal using partial transmit sequences," IEEE Communication Letters, vol. 4, pp. 86-88, Mar. 2000.
[11]. R. O'Neil and L. N. Lopes, "Envelop variations and spectral splatter in clipped multicarrier signals," in Proc. of PIMRC'95, Sept. 1995 pp. 71-75.
[12]. L. Wang and C. Tellambura, "A Simplified Clipping and Filtering Technique for PAR Reduction in OFDM Systems," IEEE Signal Processing Letters, Vol. 12, No. 6, June 2005, pp. 453-456.
[13]. J. Tellado, "Peak to average power reduction for multicarrier modulation," PhD dissertation, Stanford university, Sept. 1999.
[14]. S. H. Muller and J. B. Huber "A Comparison of Peak Power Reduction Schemes for OFDM," IEEE GLOBECOM'97, Phoenix, Arizona, pp. 1-5, Nov. 1997.
[15]. S. H. Han and J. H. Lee "PAPR reduction of OFDM signals using reduced complexity PTS technique," IEEE Signal Processing Letters, Vol. 11, No. 11, Nov. 2004.
[16]. A. D. S. Jayalath and C. Tellambura "Adaptive PTS approach for reduction of peak-to average power ratio of OFDM signal," Electronics Letters, pp. 1226-1228, vol. 36, no. 14 6th July 2000.
[17]. Pankaj Gupta "Performance Analysis of Peak to Average Power Ratio Reduction Techniques in OFDM System", International Journal of Engineering Research & Technology (IJERT), Vol. 3 Issue 3, March – 2014.
[18]. Shilpa Jaswal, Shonakk Bansal, Gaurav Jaswal "Comparative analysis of SLM and Iterative Flipping PAPR Reduction Techniques", International Journal of Engineering Research & Technology (IJERT) Vol. 2 Issue 11, November – 2013 ISSN: 2278-0181.
[19]. Kamal Singh, Manoranjan Rai Bharti, Rohit Sharma "Comparative Analysis of PTS and Iterative Flipping Scheme for Reduction of PAPR in OFDMA Networks", International Conference on Computer Communication and Networks CSI- COMNET-2011.
[20]. Salmanzadeh, Rahim, and Behzad Mozaffari Tazehkand. "A Modified Method Based on the Discrete Sliding Norm Transform to Reduce the PAPR in OFDM Systems." ETRI Journal 36.1 : 42-50.2014.
[21]. Yu, Zhenhua, Robert J. Baxley, and G. Tong Zhou. "Iterative Clipping for PAPR Reduction in Visible Light OFDM Communications." Military Communications Conference (MILCOM), 2014 IEEE. IEEE, 2014.
[22]. Popoola Wasiu O., ZabihGhassemlooy, and Brian G. Stewart. "Pilot-assisted PAPR reduction technique for optical OFDM communication systems." Journal of Lightwave Technology 32.7 (2014): 1374-1382.