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IMPLEMENTATION OF PAPR OF OFDMUSING SELECTED TECHNIQUE

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ABSTRACT

PAPR can be described by its complementary cumulative distribution function (CCDF). In thisprobabilistic approach certain schemes have been proposed by researchers. These includeclipping, coding and signal scrambling techniques. Under the heading of signal scramblingtechniques there are two schemes included. Which are Partial transmit sequence (PTS) andSelected Mapping (SLM). Although some techniques of PAPR reduction have been summarized

in [5], it is still indeed needed to give a comprehensive review including some motivations ofPAPR reductions, such as power saving, and to compare some typical methods of PAPRreduction through theoretical analysis and simulation results directly. An effective PAPRreduction technique should be given the best trade-off between the capacity of PAPR reductionand transmission power, data rate loss, implementation complexity and Bit-Error-Ratio (BER) performance etc.

Keywords:- simulation, complexity, power

1.INTRODUCTION

OFDM hasmade its way into many applications in both wireline andwireless environments. Some of well known examples includexDSL, digital audio broadcasting (DAB), digital video broadcasting-terrestrial (DVB-T), HIPERLAN/2, IEEE 802.11a, andIEEE 802.16. A major drawback of OFDM at the transmitter isthe high peak-to-average power ratio (PAPR) of the transmittedsignal. [1] These large peaks require linear and consequently inefficientpower amplifiers. To avoid operating the power amplifierswith extremely large back-offs, we must allow occasional saturationof the power amplifiers, resulting in in-band distortionand out-of-band radiation.There are many solutions to reduce the PAPR of an OFDMsignal. Some authors propose the use of block code, where thedata sequence is embedded in a larger sequence and only asubset of all the possible sequences are used, specifically, thosewith low PAPR [2]. For example, the use of Golay complementarysequences [3] to reduce PAPR within 3 dB was proposed[4], [5]. Codes with both PAPR reduction and error correctingcapability were also introduced in [6] by determining the relationshipof the cosets of Reed-Muller codes to Golay complementarysequences.

Furthermore, there is no effective coding techniquewith high code rate for a large number of subcarriers. Recently,multiple signal representation techniques have been proposed.These include partial transmit sequence (PTS) technique[8], selected mapping (SLM) technique [9], and interleavingtechnique [10]. These techniques improve PAPR statistics of anOFDM signal significantly without any in-band distortion andout-of-band radiation. But, they require side information to betransmitted from the transmitter to the receiver in order to letthe receiver know what has been done in the transmitter. Thereare other approaches that do not require the transmission of sideinformation. In one technique [11], a part of the subcarriers areused as peak reduction subcarriers and the value (amplitude andphase) of the peak reduction subcarriers are varied such that theresulting OFDM signal has lower PAPR. At the receiver, the informationon the peak reduction subcarriers is simply ignored.But in this technique, a portion of subcarriers should be allocatedas peak reduction subcarriers, resulting in a data rate loss.To mitigate the performance degradation in the propagationchannel, channel coding is usually used in communicationsystems [12], [13]. For OFDM, when channel coding is usedit is possible to exploit frequency diversity in frequency-selectivefading channels to obtain good performance under lowsignal-to-noise ratio conditions. Although many PAPR reductiontechniques for OFDM have been proposed, techniques forreducing the PAPR of an OFDM signal with channel coding areyet to be developed. In this paper, we propose a modified SLMtechnique for the PAPR reduction of coded OFDM signal.

2.PAPR REDUCTION TECHNIQUES

Several PAPR reduction techniques have been proposed in the literature [6]. These techniques
are divided into two groups - signal scrambling techniques and signal distortion techniques whichare given below:

a) Signal Scrambling Techniques

- Block Coding Techniques
- Block Coding Scheme with Error Correction
- Selected Mapping (SLM)
- Partial Transmit Sequence (PTS)
- Interleaving Technique
- Tone Reservation (TR)
- Tone Injection (TI)

b) Signal Distortion Techniques

- Peak Windowing
- Envebpe Scaling
- Peak Reduction Carrier
- Clipping and Filtering

One of the most pragmatic and easiest approaches is clipping and filtering which can snip thesignal at the transmitter is to eliminate the appearance of high peaks above a certain level. Butdue to non-linear distortion introduced by this process, orthogonality [8] is destroyed to someextent which results in In-band noise and Out-band noise. In-band noise cannot be removed byfiltering, it decreases the bit error rate (BER).

3.SIGNAL SCRAMBLING TECHNIQUES

The fundamental principle of these techniques is to scramble each OFDM signal with differentscrambling sequences and select one which has the smallest PAPR value for transmission.Apparently, this technique does not guarantee reduction of PAPR value below to a certainthreshold, but it can reduce the appearance probability of high PAPR to a great extent. This typeof approach include: Selective Mapping (SLM) and Partial Transmit Sequences (PTS). SLMmethod applies scrambling rotation to all sub-carriers independently while PTS method onlytakes scrambling to part of the sub-carriers.

Coding

The coding technique [10] is used to select such codewords that minimize or reducethe PAPR.It causes no distortion and creates no out-of-band radiation, but it suffersfrom bandwidth efficiency as the code rate is reduced. It also suffers from complexityto find the best codes and to store large lookup tables for encoding and decoding,especially for a large number of sub carriers.

Partial Transmit Sequence

In the Partial Transmit Sequence(PTS) [11] technique, an input data block of Nsymbols is partitioned into disjoint sub blocks. The sub-carriers in each sub-block areweighted by a phase factor for that sub-block. The phase factors are selected suchthat the PAPR of the combined signal is minimized. But by using this techniquethere will be data rate loss.

Tone Reservation

According to this technique the transmitter does not send data on a small subsetof subcarriers that are optimized for PAPR reduction. Here the objective is to findthe time domain signal to be added to the original time domain signal such that thePAPR is reduced. Here the data rate loss will be take place also probability of powerincrease is more.The antenna diversity is a technique which combats the effect of frequency selectivemultipath fading channel. If at the base station multiple antennas are used and atthe remote unit only one antenna is used then i.e. called the transmit diversity.We can also call it as Multiple Input Single Output (MISO) case. This diversitytechnique is very economical. If at the transmitter side we use single antenna andat the receiver side multiple antenna then that will be known as receiver diversityor SIMO (Single Input Multi Output) system. If we use multiple antennas at bothtransmitter and receiver side then that will be known as MIMO (Multi Input MultiOutput) system. As we are using OFDM technique before transmitting the messagethrough the antenna hence it will be called as MIMO-OFDM Technique.

3. CODING& ANALYSIS

Space Frequency Block Coding (SFBC)

Here instead of two adjacent symbol periods, two adjacent carriers can be used. Letus consider the original OFDM frame as X then the two vectors X1 and X2 will begenerated using this SFBC as follows

$$\begin{pmatrix} X_1(2k) & X_1(2k+1) \\ X_2(2k) & X_2(2k+1) \end{pmatrix} = \begin{pmatrix} X(2k) & X(2k+1) \\ X^*(2k+1) & -X^*(2k) \end{pmatrix}$$

The block diagram shown in figure (3.1) describes the wayof applying this SLM technique into MIMO-OFDM system

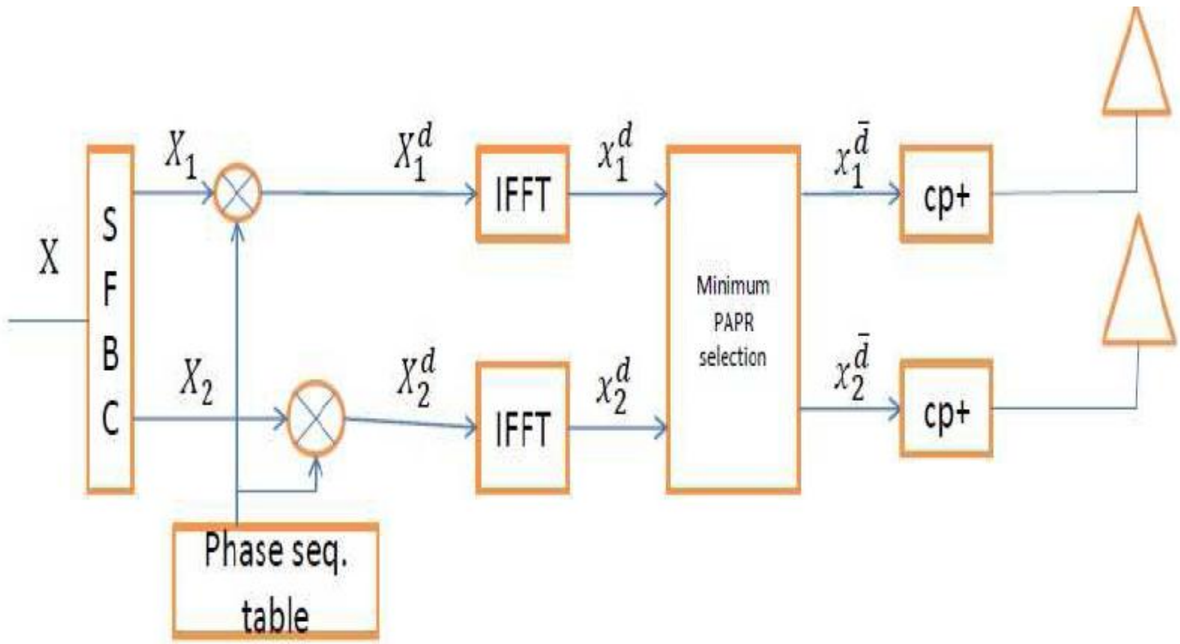

Figure 3.1: Block Diagram for application of SLM to MIMO

For the simulation studies the SFBC scheme has been used. According to the figure 3.1the same phase sequence will be multiplied to the two different signals that are X1 andX2. Then do the IFFT of these signals for one antenna and choose the OFDM signalwith minimum PAPR and also the same thing will be done for the another antenna.Then to find out the Complementary Cumulative Distribution Function plot for theperformance analysis of PAPR the maximum PAPR value will be considered out oftwo different minimum PAPR value from that of two antennas. So with considering 64number of subcarriers and oversampling factor of 4 the PAPR reduction performancehas been shown in figure (3.1). Also with considering Riemann matrix the simulationfor PAPR reduction .

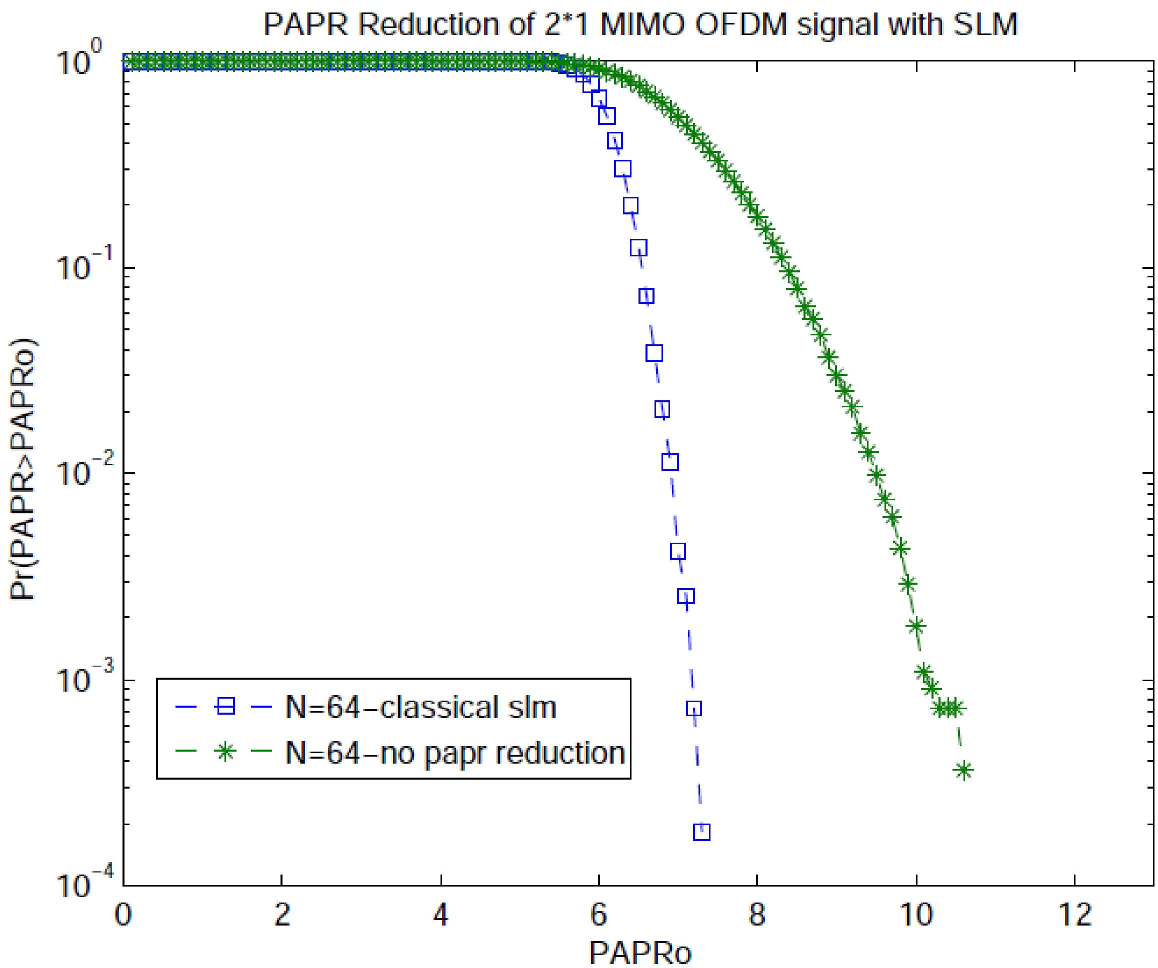

Figure 3.2: PAPR Reduction of 2*1 MIMO OFDM signal with SLM

Also the application of the proposed scheme has done for this 2×1 transmit diversity case with consideration of 64 number of subcarriers .

4.CONCLUSION

In this paper, we proposed a modified SLM technique forthe PAPR reduction of coded OFDM signal. By appropriatelyembedding the phase sequence information on the check symbolsof the coded OFDM data block, we can achieve both PAPRreduction from the SLM technique and error performance improvementfrom the channel coding with no loss in data rate.We also derived approximate expression for the distribution ofPAPR of modified SLM technique. It is shown that the approximateexpression matches quite well with the simulation resultswith properly chosen parameters.

REFERENCES

[1] L. J. CiminiJr, "Analysis and simulation of a digital mobile channelusing orthogonal frequency division multplexing," *IEEE Trans.Commun.*, vol. 33, pp. 665–675, July 1985.

[2] A. E. Jones, T. A. Wilkinson, and S. K. Barton, "Block coding schemefor reduction of peak to mean envelope power ratio of multicarrier transmissionscheme," *Electron. Lett.*, vol. 30, no. 25, pp. 2098–2099, Dec.1994.

[3] M. J. E. Golay, "Complementary series," *IEEE Trans. Inform. Theory*,vol. 7, pp. 82–87, Apr. 1961.

[4] S. Boyd, "Multitone signals with low crest factor," *IEEE Trans. CircuitsSyst.*, vol. 33, pp. 1018–1022, Oct. 1986.

[5] B. M. Popovic, "Synthesis of power efficient multitone signals with flatamplitude spectrum," *IEEE Trans. Commun.*, vol. 39, pp. 1031–1033,July 1991.

[6] J. A. Davis and J. Jedwab, "Peak-to-mean power control in OFDM,Golay complementary sequences and reed-muller codes," *IEEE Trans.Inform. Theory*, vol. 45, pp. 2397–2417, Nov. 1997.

[7] V. Tarokh and H. Jafarkhani, "On the computation and reduction ofthe peak-to-average power ratio in multicarrier communications," *IEEETrans. Commun.*, vol. 48, pp. 37–44, Jan. 2000.

[8] S. H. Muller and J. B. Huber, "OFDM with reduce peak-to-averagepower ratio by optimum combination of partial transmit sequences,"*Electron. Lett.*, vol. 33, no. 5, pp. 368–369, Feb. 1997.

[9] R. W. Bauml, R. F. H. Fisher, and J. B. Huber, "Reducing the peak-toaveragepower ratio of multicarrier modulation by selected mapping,"*Electron.Lett.*, vol. 32, no. 22, pp. 2056–2057, Oct. 1996.

[10] A. D. S. Jayalath and C. Tellambura, "Reducing the peak-to-averagepower ratio of orthogonal frequency division multiplexing signalthrough bit or symbol interleaving," *Electron. Lett.*, vol. 36, no. 13, pp.1161–1163, June 2000.

[11] E. Lawrey and C. J. Kikkert, "Peak to average power ratio reductionof OFDM signals using peak reduction carriers," in *Proc. ISSPA '99*,Brisbane, Australia, Aug. 1999, pp. 737–740.

[12] R. E. Blahut, *Algebraic Codes for Data Transmission*. Cambridge,U.K.: Cambridge University Press, 2003.

[13] S. B. Wicker, *Error Control Systems for Digital Communication andStorage*. Englewood Cliffs, NJ: Prentice Hall, 1995.

[14] C. Tellambura, "Computation of the continuous-time PAR of an OFDMsignal with BPSK subcarriers," *IEEE Commun.Lett.*, vol. 5, pp.185–187, May 2001.

[15] R. van Nee and R. Prasad, *OFDM for Wireless Multimedia Communications*.Boston, MA: Artech House, 2000.

[16] O. Muta and Y. Akaiwa, "A peak power reduction scheme withphase-control of clustered parity-carriers for a systematic block-codedOFDM signal," in *Proc. IEEE VTC 2003-Fall*, Orlando, FL, Oct. 2003,pp. 562–566.