# Paper Reduction in Form Systems Using Slm And Pts Schemes

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**ABSTRACT:**

Orthogonal frequency division multiplexing (OFDM) is a multi carrier modulation technique where the revolution of 4G wireless communication is focused towards OFDM systems. The major drawback of OFDM system is high Peak to average power ratio .The proposed work is based on peak to average power ratio (PAPR) reduction by the implementation of Selective Mapping Technique (SLM) and Partial Transmit Sequence (PTS) methods. Here PAPR reduction efficiency parameter which will be applied on the complementary cumulative distribution function (CCDF) of each technique to compare the results. Using the proposed efficiency formula, we show that PTS system performance improves when increasing the probability, whereas the SLM system performance gets impaired when increasing the probability within the same range. Simulation results show that the complexity is reduced by using newly proposed algorithm than normal schemes.

## 1.INTRODUCTION

Nowadays the wireless applications are focused towards high data rates. The concept of multi carrier transmission provides high data rates in communication channel. The OFDM is a special kind of multi carrier transmission technique that divides the communication channel into several equally spaced frequency bands. Here the bit streams are divided into many sub streams and send the information over different sub channels. A sub-carrier carrying the user information is transmitted in each band. Each sub carrier is orthogonal with other sub carrier and it is carried out by a modulation scheme. Data‟s are transmitted simultaneously in super imposed and parallel form. The sub carriers are closely spaced and overlapped to achieve high bandwidth efficiency [2]. The main disadvantage of OFDM is high peak to average power ratio. The peak values of some of the transmitted signals are larger than the typical values [1]. High PAPR of the OFDM transmitted signals results in bit error rate performance degradation, inter

modulation effects on the sub carriers, energy spilling into adjacent channels and also causes non linear distortion in the power amplifiers. The main work of this paper is to reduce the high peak powers in OFDM systems. Several methods are there to reduce PAPR effectively(15). In this study the concept of selective mapping (SLM)and partial transmit sequence(PTS) technique is applied to the OFDM symbols to reduce high peak signals[11]. Coding and simulation were carried out for SLM, PTS and their effects on reducing the PAPR were analysed. Also Reduced Complexity approaches for the SLM and PTS techniques were carried out and their performances in reducing the PAPR were performed and analysed[3]. The power signals of all the above work are viewed in complementary cumulative distribution function (CCDF) plot. The results state that the proposed new SLM and PTS method attains a good PAPR reduction and the encoding complexity is reduced by applying the new schemes.

## 2.SELECTIVE MAPPING TECHNIQUE (SLM)

Many methods are there to reduce the PAPR , but both complexity and redundancy are high and only small gains in PAPR are achieved[12]. When the phases of different sub-carriers add up in phase the possibility

of PAPR being high is for sure. Hence one method to reduce the in-phase addition is to change the phase before converting the frequency domain signal into time domain[13]. Hence before taking the N point IDFT each block of input is multiplied by an $\varphi$ vector of length N. Now there is a possibility that the PAPR may turn low.
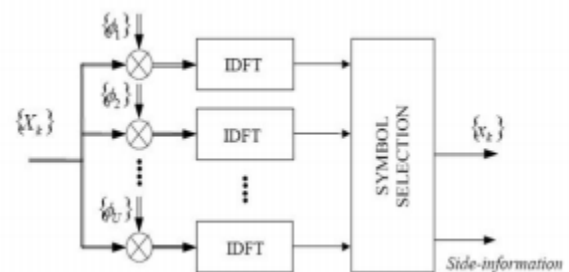


Fig 1. Scheme of modulator with a Selective mapping

The figure 1 shows the scheme of a modulator with selective mapping technique. The algorithm for selective mapping technique is as follows:

Step 1: Get the input vector(X) of length D and let N=integer

Step2: for i=1: N

Step 2.1: Generate $\varphi$ (i) of length D

Step 2.2: Multiply $\varphi$ (i) with the input vector and get Z (Freq domain)

Step 2.3: Compute IDFT and get z (Time domain)

Step 2.4: Determine PAPR using the formula

$$PAPR = \frac{\max |x(t)|^2}{E\left[|x(t)|^2\right]}$$

Step 2.5: Increment the value of i

Step 3: Go-to Step 2

Step 4: PAPR of length N is obtained.

Step 5: Select a threshold Y. One with minimum PAPR is used for transmission

Step 6: If min of PAPR>Y then increment a count

Step 7: Perform Steps 1-6 M times

Step 8: Obtain final count

Step 9: Increment the value of N and repeat Steps1-8

Step 10: Plot Graph for various N values where

> X axis: Threshold values
>
> Y axis: Pr[PAPR low>Y]

Step 11: It could be inferred that as the value of N increases PAPR decreases (It is required to inform the phase information controlled for the data sub-carriers to the receiver as side information)

Because of the varying assignment of data to the transmit signal, we call this „Selected Mapping". The core is to choose one particular signal which exhibits some desired properties out of „N" signals representing the same information.

## 3.PERFORMANCE ANALYSIS OF SLM

To evaluate and compare the performance of conventional SLM,

computer simulation has been performed on an input sequence of length 8. Constellation of Binary phase shift keying (QPSK) is used as a signal mapper for OFDM system. For the conventional SLM, probability that, PAPR of an OFDM symbol exceeds an arbitrary threshold „Y" is depicted below. The thresholds fixed are 1.5, 2, 2.3, 2.6 and 3.5. The experiment was repeated for over 1000 times.

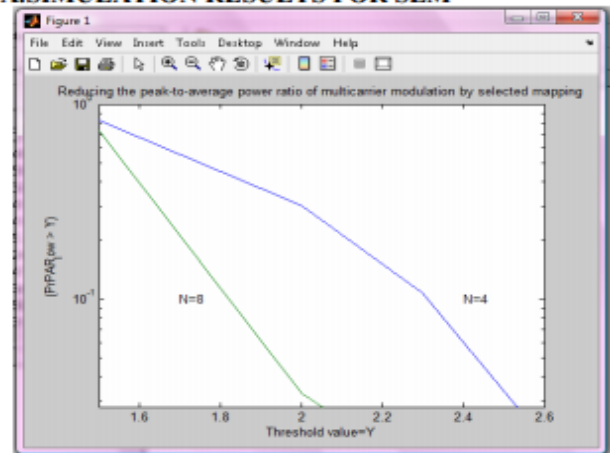**A.SIMULATION RESULTS FOR SLM**



Fig 2.simulation results for PAR reduction by selective mapping

Simulation was carried out for an input vector of length D=8. The algorithm was simulated for M=1000 times by varying the input vector which is a 4 QPSK mapped sequence. The output graphs were plotted for N=4 and N=8 as shown in fig 2.The threshold fixed are 1.5, 2, 2.3, 2.6 and 3.5. φ vector consists any of the values from +1,-1,+j, -j.

## 4. PARTIAL TRANSMIT SEQUENCES TECHNIQUE (PTS):

In the PTS approach, the input data block is partitioned into disjoint sub blocks or clusters which are combined to minimize the PAPR [5]. Define the data block,[Xn,n=0,1……N-1],as a vector ,X=[X0,X1……XN-1]T. Then, partition X into M disjoint sets, represented by the vectors [Xm,m=1,2……M]. The objective of the PTS approach is to form a weighted combination of the M clusters,

$$\mathbf{X}' = \sum_{m=1}^{M} b_m \mathbf{X}_m$$

Where [ bm , m=1,2……..M] are weighting factors and are assumed to be pure rotations[6]. After transforming to the time domain, the above equation becomes

$$\mathbf{x}' = \sum_{m=1}^{M} b_m \mathbf{x}_m$$

The vector xm, called the partial transmit sequence, is the IFFT of Xm[7]. The phase factors are then chosen to minimize the PAPR of x'. A PTS transmitter is shown in Fig 3.
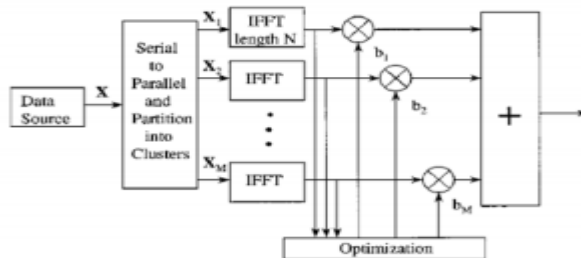


Fig 3: Scheme of a Modulator with Partial Transmit Sequences Technique

The PTS scenario supported with mathematical expressions is summarized in the following steps:

1. The input data block X is divided and separated into M sub-blocks,

$$X_m = [X_{m,0}, X_{m,1}, \dots, X_{m,L-1}], \quad m=1, 2,\dots M \qquad ----(1)$$

That means if we recombine these sub-blocks, we would get the original data block X as the following,

$$\sum_{m=1}^{M} X_m = X \qquad --(2)$$

2. The second stepis to convert the sub-blocks to the time domain using inverse fast Fourier transform (IFFT) to form the signal xm from Xm as the following:

$$x_m = [x_{m,0}, x_{m,1}, \dots, x_{m,L-1}], \quad m=1, 2,\dots M \qquad ---(3)$$

3. To the purpose ofminimizing PAPR, each sub-block in time domain is rotated by the phase factor

$$b = [b_0, b_1, \dots, b_{M-1}], \text{ where } b_m = e^{j\emptyset}, 0 \le \emptyset < 2\pi \qquad ---(4)$$

4. The last step isto add all the sub-blocks up to form the final time domain signal which is

$$X'(b) = \sum_{m=1}^{M} b_m X_m$$

$$\text{Or, } X'(b) = [X'_0(b), X'_1(b), \dots, X'_{NL-1}(b)]$$

### A. PERFORMANCE ANALYSIS OF PTS

To evaluate and compare the performance of conventional PTS, computer simulation has been performed on an input sequence of length 32 that was sub-divided into 4 blocks each block of length 8 and also on an input sequence of length 64 that was sub-divided into 8 blocks each block of length 8. Constellation of Binary phase shift keying (QPSK) is used as a signal mapper for OFDM system[14]. For the conventional PTS, probability that, PAPR of an OFDM symbol exceeds an arbitrary threshold Y is depicted in figure 4. The thresholds fixed are 1.5, 2, 2.3, 2.6 and 3.5. The experiment was repeated for over 1000 times.
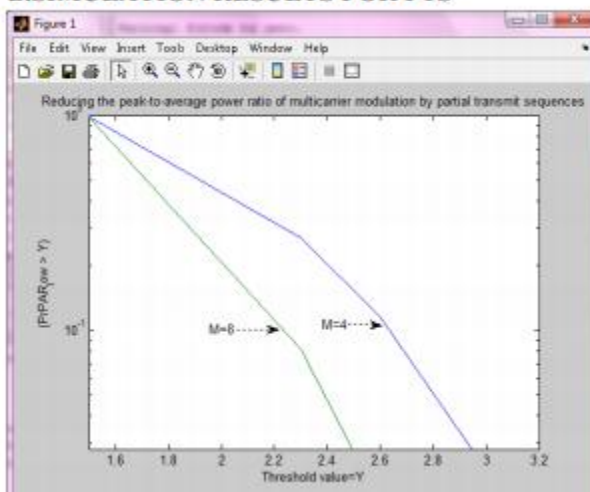
### B. SIMULATION RESULTS FOR PTS



Fig 4: Simulated results for PAPR Reduction by Partial Transmit Sequences

The results described in figure 4 show that the sub-optimal iterative approach to combining PTS's provides significant improvement with only a small degradation compared to the expected. Nevertheless, the iterative approach requires feedback for implementation. An alternative approach, which avoids feedback, is to approximate the optimum by multiplying the information sequence by a random sequence and choosing the best to transmit.

### 5. REDUCTION EFFICIENCIES OF SLM AND PTS

An OFDM system is simulated under the following specifications: 10,000 OFDM symbols, 64 subcarriers, oversampling factor of 4, 16 OFDM candidates, and QPSK modulation scheme. The simulation results of SLM and PTS algorithms are shown in Fig. 3 and 4, respectively, where the CCDFs are plotted for both schemes. In the previous comparison of SLM and PTS, It has been proven that PTS is more complex than the SLM is in most cases . Far away from the complexity metric used in the previous comparisons, we develop a PAPR reduction efficiency factor in this paper based on CCDF information for both SLM and PTS. Form CCDF information, we calculate the PAPR reduction at certain standard

probabilities which are 10-4, 10-3, 10-2, and 10-1. At these probabilities we get the corresponding PAPR values for both SLM and PTS PAPR reduction systems. These PAPR values extracted from both systems will be compared to those values extracted at the same standard probabilities from the original OFDM signal. Comparing original OFDM PAPRs with those from SLM and PTS response we can calculate PAPR reduction values at the each of these standard probabilities. Therefore, the PAPR reduction is:

$$OFDM\ PAPR\ Reduction = Original\ PAPR - mod$$

Both the original and modified PAPRs should be at the same probability point. Finally, the proposed formula for the PAPR Reduction Efficiency is:

$$PAPR\ Reduction\ Efficiency = \frac{OFDM\ PAPR\ R}{Original\ OFL}$$

6.**DISCUSSION OF SIMULATION RESULTS**

After applying the proposed two formulas, 7 and 8 on both SLM and PTS CCDF's, we have come up with the results shown in following figures.
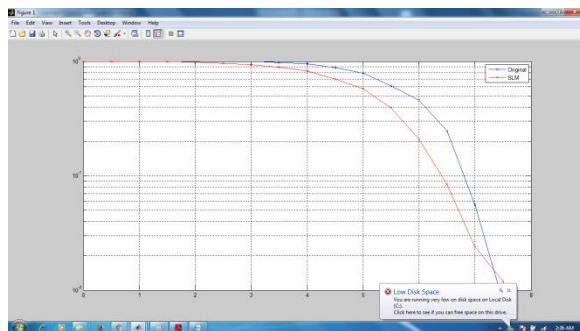


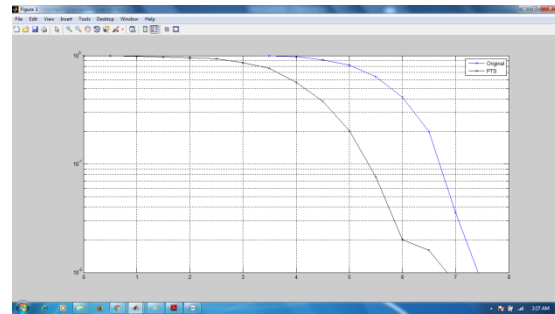Fig 5. CCDFs of SLM for OFDM PAPR reduction
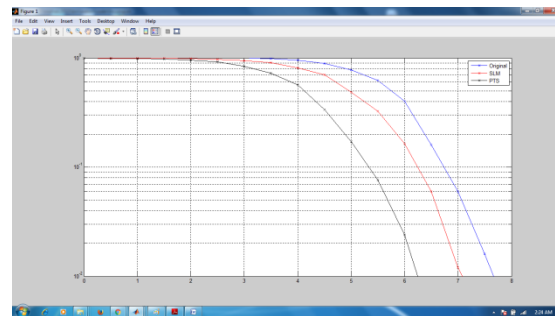


Fig 6. CCDFs of PTS for OFDM PAPR reduction



Fig 7. CCDFs of OFDM,SLM ,PTS for OFDM PAPR reduction

**7.CONCLUSION**

The simulation result shows that the ordinary SLM and PTS have better PAPR reduction but the complexity is more. The proposed new scheme reduces the complexity of the OFDM systems as the PAPR increases. The work can be extended by applying the same procedures for other PAPR reduction schemes

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