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Performance Analysis of Selective Mapping Scenario

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ABSTRACT

Orthogonal Frequency-division multiplexing (OFDM) of the most important techniques used in wireless communication systems since 1970 but not used widely because of the technology that they need to possibilities expensive as there was a difficulty then in use on a large scale., its idea was caused by problems that corresponded to the reference to previous techniques and also the result of increasing the number of users, Data transfer speed reached 54Mbps. The signals used are digital signals like QAM, BPSK, and QPSK so use the digital embedding techniques and in this paper, QPSK was used, it is noticeable in this technique that users are distributed by frequency. One of the major drawbacks of OFDM is the high Peak-to- average-power ratio (PAPR) of the Transmitter's output signal. There are many different algorithms that have been proposed to solve the high PAPR problem of OFDM system like selective mapping (SLM), partial transmit sequence (PTS), Clipping method is the easiest way to reduce the PAPR of the OFDM system but it has some limitations. In this paper, we are using Selective Mapping (SLM) method which provides better and excellent performance for reduction of PAPR. Selective Mapping is one way of probabilistic techniques where the actual transmit signal is selected from a set of signals to construct the transmitted signal.

Keywords: Selective Mapping; Peak-to-Average Power Ratio; Cumulative distributive function.

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is a promising technique in the current broadband wireless communication system, Because of the features available in it like high data rate transmission and multipath delay spread tolerance, immunity to the impulse noise and the ability to against frequency selective fading [1].

Orthogonal Frequency Division Multiplexing (OFDM) has many advantages and it is robustness against the frequency selective fading channel.

OFDM technique has been widely used in many wireless communication systems, such as Digital Audio Broadcasting (DAB), and the IEEE 802.11a standard for Wireless Local Area Networks (WLAN), and the IEEE802.16a standard for Wireless Metropolitan Area Networks (WMAN) [2].

The principle of the operation of this technique is based on split a high-rate data stream into a number of lower rate streams that are transmitted simultaneously over a number of subcarriers.

The background behind OFDM is that it divides the frequency spectrum into subcarriers and the subcarriers are made mutually independently orthogonal to each other to avoid interference.

The data in each subcarrier are transforming from serial to the parallel channel for simultaneous transmission in a different channel. The Inverse fast Fourier transform (IFFT) is used to produce orthogonal data subcarriers where the input data samples are modulated either by (e.g. QAM or PSK) and after they are jointly correlated.

The FFT transforms the cyclic prefix time domain signal to it equivalent frequency spectrum. OFDM has a significant challenge due to symbol time been less than the delay spread leading to Inter-Symbol interference (ISI) which is overcome by cyclic prefix or guard band concept. In OFDM systems, the spectrum of the individual subcarrier is overlapped with minimum frequency spacing, which is carefully designed so that each subcarrier is orthogonal to the other subcarriers [3].

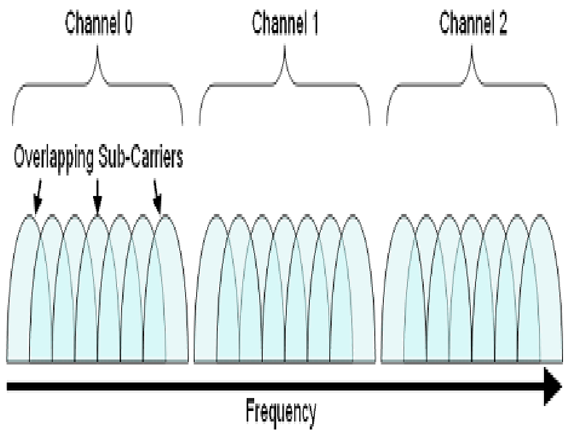

Figure (1) Orthogonal Frequency Division Multiplexing

Peak to Average Power Ratio, Orthogonal frequency division multiplexing (OFDM) is a promising technique in the current broadband wireless communication system, Because of the features available in it like high data rate transmission and multipath delay spread tolerance, immunity to the impulse noise and the ability to against frequency selective fading [4].

High Peak-to-Average Power Ratio (PAPR) is one of the challenging issues in orthogonal frequency division multiplexing (OFDM) system.

The high PAPR causes the interference and degraded the performance of the system while OFDM signal passes through the amplifier. The PAPR is the relation between the maximum powers of a sample in a given OFDM transmit symbol divided by the average power of that OFDM symbol.

Peak to Average Power Ratio Reduction Techniques. PAPR reduction techniques can be broadly classified into three main categories [5]: Signal distortion techniques like Clipping and Filtering. Multiple signalling and probabilistic techniques like Selective Mapping (SLM) and Partial Transmit Sequence (PTS). Coding techniques like Linear Block Coding

III. Selective Mapping (SLM)

Selective Mapping (SLM) method is used for minimization of peak average transmits power of multicarrier transmission system with selected mapping.

In selective mapping (SLM) technique the signal having lowest PAPR is selected from a set of sufficiently different signals which all represents the same information. The fundamental idea behind the scheme is phase rotation. A signal with low PAPR is selected from different independent phase sequences that have the same information at transmitter [6].

SLM method is a kind of phase rotation methods, Phase rotated data of the lowest PAPR will be selected to transmit. The probability of PAPR larger than a threshold z can be written as

$$(PAPR > z) = 1 - (1 - \exp{-z})\, N \qquad (1)$$

Assume that M OFDM symbols carry the same information and that they are statistically independent of each other. In this case, the probability of PAPR greater than z is equalled to the product of each independent candidates probability. This process can be written:

$$P\, PAPR_{low} > z = (P\, PAPR > Z)M = ((1 - \exp{-z})N)M \qquad (2)$$

In SLM method, firstly M statically independent sequences which represent the same information are generated and then the resulting M statically independent data blocks Sm= (Sm, 0, Sm,1 , Sm, N-1)T, m= 1,2,........M are then forward into IFFT operation simultaneously. Final stage at the end of receiving the symbol of OFDM Xm = (x1, x2, ... xN)T in discrete time-domain are acquired, and then the PAPR of these M vectors are calculated separately. Eventually, the sequences $\boldsymbol{xd}$ with the smallest PAPR will be elected for final serial transmission [7].This method can significantly improve the PAPR performance of OFDM system. Block diagram of SLM Technique is shown in Figure (2).

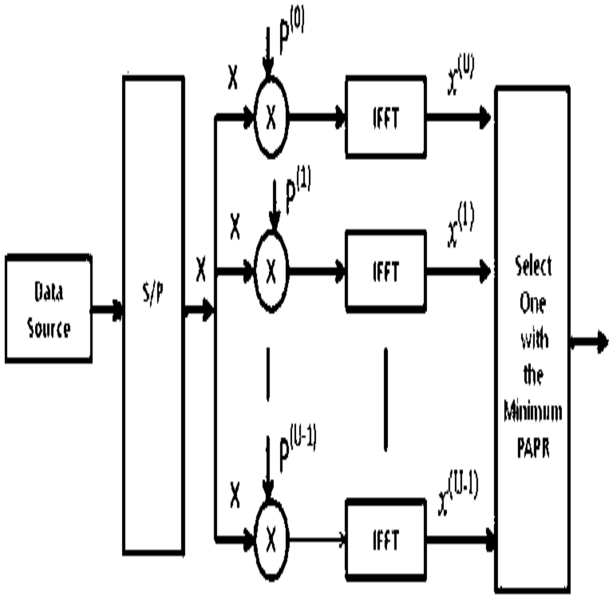

Figure (2) Block diagram of SLM technique

IV. SIMULATION RESULTS AND DISCUSSIONS

In this section, discussed PAPR reduction performance with SLM method using Mat lab 2010 a simulation. The results are given here in terms of CCDF (Pr [PAPR>PAPR0]) and PAPR0 [dB]. Firstly we set the different number of Route number (M) as 2, 4,8,16 after that we compare the result.

PAPR Reduction using SLM PAPR reduction performance with different values of Route number (M), while N is fixed at 128, It is noticeable that PAPR is decreased with the increase of the number of Route number M, to the improvement of PAPR reduction performance as shown in Figure (3).

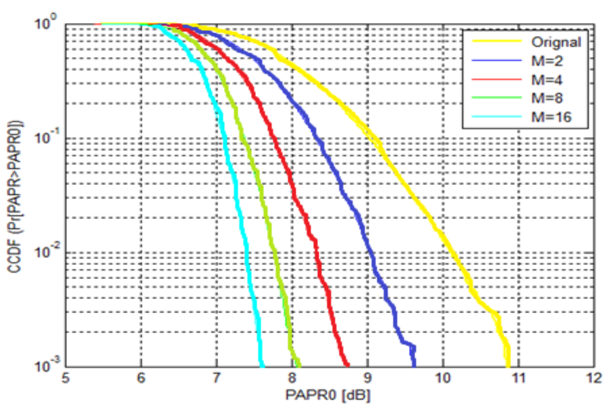

Figure (3) PAPR reduction performances with different values of M

B-Comparison of PAPR reduction performance with different values of N while the number of OFDM signal frame M is fixed at 4, it is noticeable when increasing the number of sub-carrier N increases PAPR as shown in the shapes.

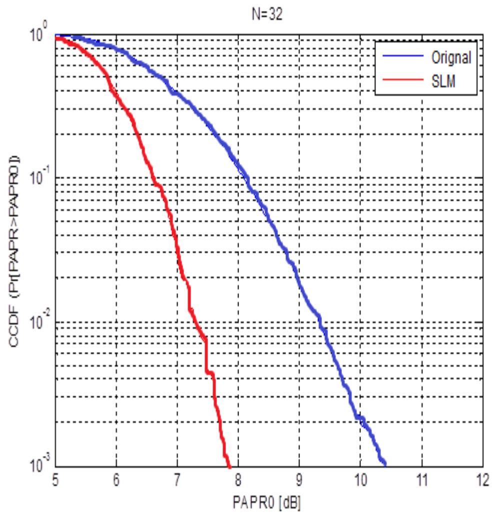

Figure (4) PAPR when N=32 and M =4

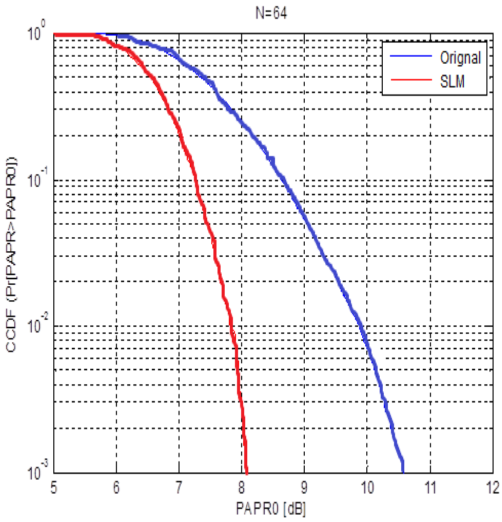

Figure (5) PAPR when N=64 and M =4

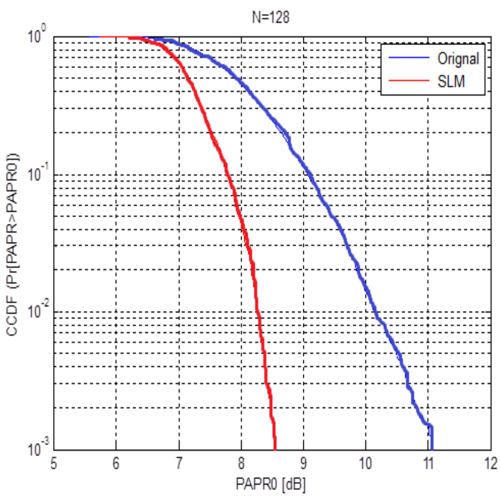

Figure (6) PAPR when N=128 and M = 4

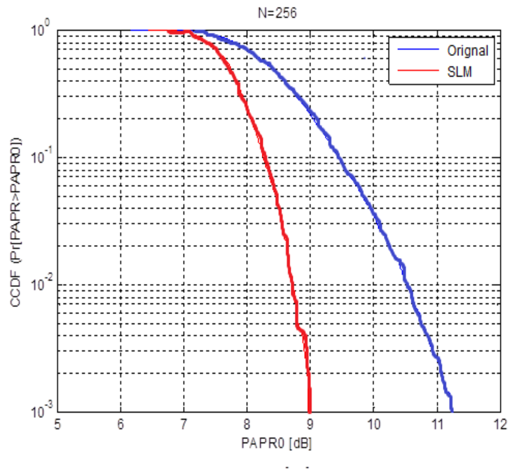

Figure (7) PAPR when N=256 and M = 4

Figures 4-7 SLM algorithm can be adapted to any length of FFT frame; It is particularly suitable for the OFDM system with a large number of sub-carriers (more than 128).

VI.CONCLUSION

OFDM is a very attractive technique for wireless communications due to spectrum efficiency and channel robustness. Simulation results show that the improvement in performance of OFDM system by reducing the PAPR using Selective Mapping (SLM). The Simulation results show that in SLM technique as the Route number. Increases, the PAPR decreases as shown in Figure (3). Simulation results for the PAPR Reduction Represented by Selective Mapping (SLM) simulated in MATLAB are shown in Figures (4-7). Selected Mapping (SLM) method is improving the performance of OFDM system by reducing the PAPR, but at the same time, the price is also very clear that is the complexity of its implementation.

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