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PERFORMANCE ANALYSIS OF PAPR REDUCTION IN OICF TECHNIQUES WITH OFDM SYSTEM

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Abstract

The Iterative Clipping and Filtering (ICF) has been a well-known technique to reduce the peak to average power ratio (PAPR) in orthogonal frequency division multiplexing (OFDM) signals. Orthogonal Frequency Division Multiplexing (OFDM) has become the popular modulation technique in high speed wireless communications. It has been more advantageous over other technologies. This Proposed technique shows better performance for reduction of PAPR in any technique that can be used according to performance. In this paper Simulation results show that after iterations, the original OICF algorithm can achieve the desired PAPR while the simplified one exhibits the performance for a 64, 128, 256 and 512-subcarrier and Quadrature phase shift keying (QPSK) in modulated OFDM system, the PAPR-reduction performance have been draw in CCDF versus PAPR (dB) by Matlab R2013a toll.

Keywords: **OFDM, PAPR, QPSK, AWGN etc.**

I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is an efficient method of data transmission for high speed communication systems. However, the main drawback of OFDM system is the high Peak to Average Power Ratio (PAPR) of the transmitted signals. OFDM (Orthogonal frequency division multiplexing) consist of large number of independent subcarriers, as a result of which the amplitude of such a signal can have high peak values. Coding, phase rotation and clipping are among many PAPR reduction schemes that have been proposed to overcome this problem. Here two different PAPR reduction methods e.g. partial transmit sequence (PTS) and selective mapping (SLM) are used to reduce PAPR.

II. MODULATION-QPSK

This is also known as four-level PSK where each element represents more than one bit. Each symbol contains two bits and it uses the phase shift of π/2, means 90º instead of shifting the phase 180º [6]. In this mechanism, the constellation consists of four points but the decision is always made in two bits. This mechanism can ensure the efficient use of bandwidth and higher spectral efficiency. The principle equation (1) of QPSK Modulation of the technique is:

$$S(t) = \begin{cases} A\cos\left(2\pi f_c t + \frac{\pi}{4}\right), \; for\ binary\ 11 \\ A\cos\left(2\pi f_c t + \frac{4\pi}{4}\right), for\ binary\ 01 \\ A\cos\left(2\pi f_c t - \frac{4\pi}{4}\right), for\ binary\ 00 \\ A\cos\left(2\pi f_c t - \frac{\pi}{4}\right), for\ binary\ 10 \end{cases} \qquad (1)$$

III. OFDM

The concept of Orthogonal Frequency Division Multiplexing (OFDM) has been known since 1966, but it only reached sufficient maturity for deployment in standard systems during 1990s [1]. OFDM is an attractive modulation technique for transmitting large amounts of digital data over radio waves. One major disadvantage of OFDM is that the time domain OFDM signal which is a sum of several sinusoids leads to high peak to average power ratio (PAPR). Number of techniques has been proposed in the literature for reducing the PAPR in OFDM systems. Discrete-time OFDM signal can be written as in equation.

$$x_n = x\left(\frac{nT}{JN}\right) = \frac{1}{\sqrt{N}} \sum_{k=N/2}^{N/2-1} X_{(k+N)} \times \exp\left(\frac{j2\pi nk}{JN}\right) \qquad (2)$$

n = 0,1,2,4,4,………..JN-1

IV. ITERATIVE CLIPPING AND FILTERING

The idea of adjacent channel emissions filtering after clipping has been presented in [1]. As the filtering of clipped signals results in new peaks creation, the method of repeated clipping and filtering has been subsequently proposed in [1]. This method is based on the zero padding of the signal in the frequency domain and frequency domain filtering of clipped signal at the output of IFFT. The process of clipping and filtering is repeated several times – according to the author's experiments 4 or 5 times. These repetitions result in huge signal processing - for each frequency domain filtering the pair of FFT and IFFT operation is necessary. Its PAPR reduction performance is approaching the PAPR of repeated clipping and filtering method with arbitrary number of repetitions.

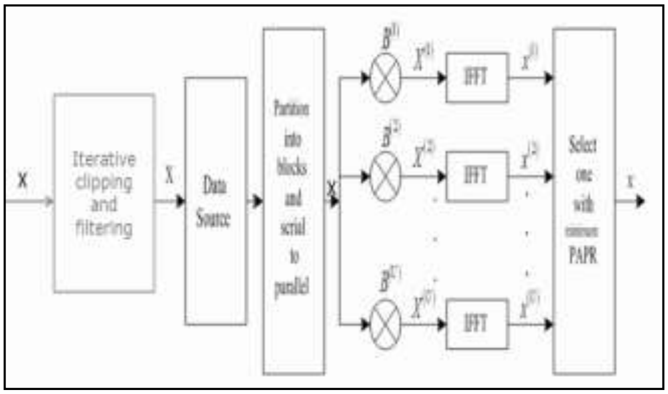

Fig. 1: Block diagram of the proposed method.

V. AWGN CHANNEL

The simplest radio environment in which a wireless communications system or a local positioning system or proximity detector based on Time of-m flight will have to operate is the Additive-White Gaussian Noise (AWGN) environment. Additive white Gaussian noise (AWGN) is the commonly used to transmit signal while signals travel from the channel and simulate background noise of channel. The mathematical expression in received signal:

$$r(t) = s(t) + n(t) \qquad (3)$$

That passed through the AWGN channel where $s(t)$ is transmitted signal and n(t) is background noise. In AWGN channel adds white Gaussian noise to the signal that passes through it. It is the basic communication channel model and used as a standard channel model. The transmitted signal gets disturbed by a simple additive white Gaussian noise process. If the average received power is $P'[W]$ and the noise power spectral density is N_0 $[W/hz]$, the AWGN channel capacity is:

$$c_{awgn} = W \log_2\left(1 + \frac{P'}{N_0 W}\right) \text{ Bit/Hz} \qquad (4)$$

Where P'/NoW is the received signal-to-noise ratio (SNR).

VI. SIMULATION RESULTS

A. Peak to Average Power Ratio (PAPR)

Peak to average power ratio is a signal property that is calculated by dividing the peak power amplitude of the waveform by the RMS value of it, a dimensionless quantity which is expressed in decibels (dB). In digital transmission when the waveform is represented as signal samples, the PAPR is defined as in equation 5:

$$\text{PAPR} = \frac{\max(|S[n]|^2)}{E\{|S[n]|^2\}}, \; 0 \le n \le N-1$$

(5)

Where S[n] represents the signal samples, $\max(|S[n]|^2)$ denotes the maximum instantaneous power and $E\{|S[n]|^2\}$ is the average power of the signal [1].

B. Complementary CDF

The Complementary Cumulative Distribution function (CCDF) is used to measure the probability that the PAPR of a certain data block exceeds the given threshold. The CCDF of the PAPR of the data block is desired to compare outputs of various reduction techniques. It is defined as:

$$P(PAPR > z) = 1 - P(PAPR \le z)$$
$$= 1 - (1 - exp(z))$$

(6)

Or

$$CCDF(PAPR\, x(n)) = Pr\,(PAPR\, x(n)) > PAPR_0)$$

(7)

Where $PAPR_0$ is a certain threshold value that is usually given in decibels relative to the Root Mean Square (RMS) value.

Table 1: Analysis parameter in PAPR Reduction

S. No.	Parameter	Value
01	OFDM	128 subcarriers
02	Modulation	QPSK
03	Channel	AWGN & Raylight
04	Oversampling Factor	4
05	Claping Ration	2.10

C. PAPR Reduction performance

In this performace we are used 128 subcarriers, QPSK-modulation, claping ration ϒ is still set to 2.10, L=4 with PAPR with OFDM signal. Figure shows the PAPR CCDF curves for the signals processed by using the orignal and simplified OICF algorothms, respectively.

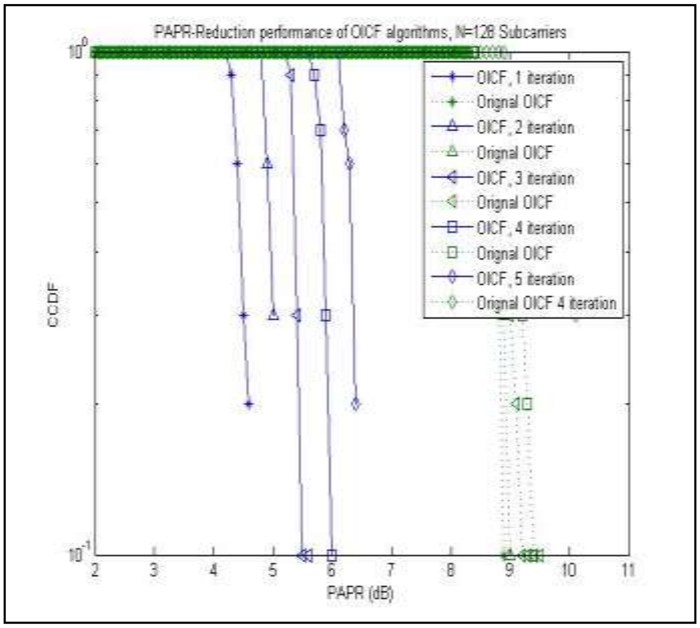

Fig. 2: PAPR Reduction performance oforignal and simplified OICF algorithms, QPSK, 128 subcarriers, L=4 and ϒ=2.10

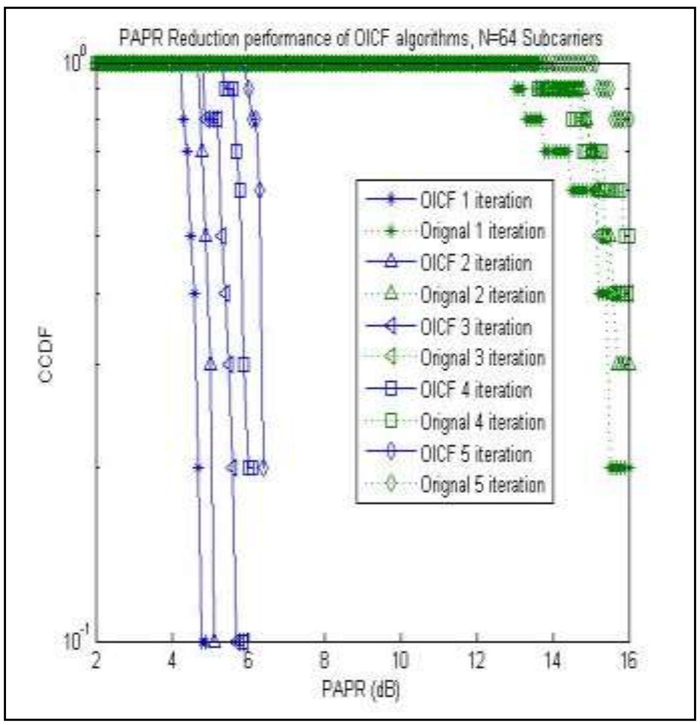

Fig. 3: PAPR Reduction performance of orignal and simplified OICF algorithms, QPSK, 64 subcarriers, L=4 and ϒ=2.10

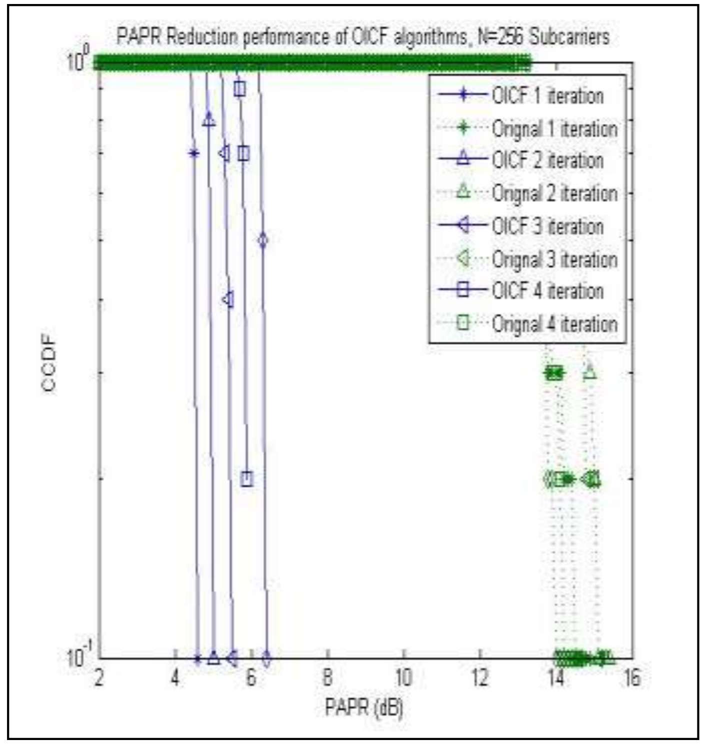

Fig. 4: PAPR Reduction performance oforignal and simplified OICF algorithms, QPSK, 256 subcarriers, L=4 and ϒ=2.10

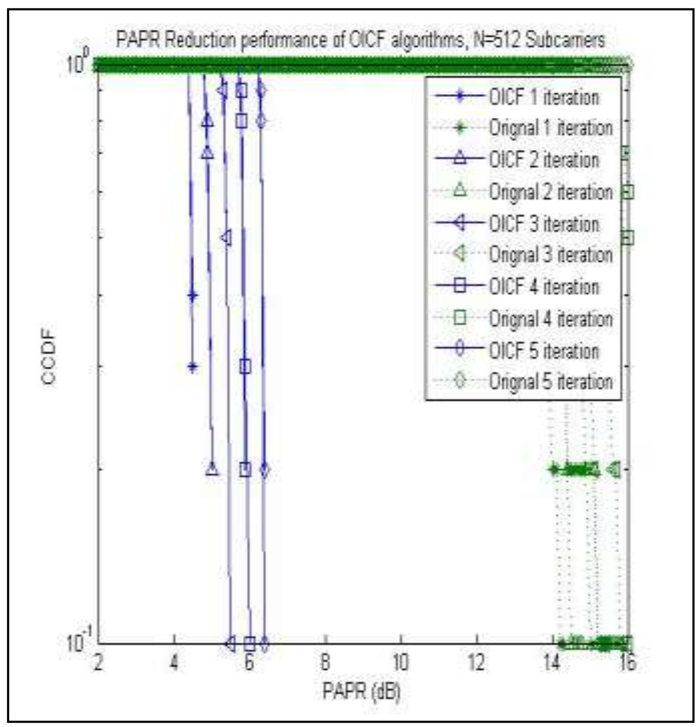

Fig. 5: PAPR Reduction performance oforignal and simplified OICF algorithms, QPSK, 512 subcarriers, L=4 and ϒ=2.10

Table 7.2 PAPR Reduction Comparision

PAPR Techniques	Subcarriers N	CCDF	Itration No.	PAPR (dB)
OICF With QPSK	64	10^{-1}	1	4.9
	128		3	5.5
	256		1	4.7
	512		3	5.8

VII. CONCLUSION

We have also aimed at investigating some of the techniques which are in common use to reduce the high PAPR of the system. Among the three techniques that we took up for study, we found out that Amplitude Clipping and filtering results in Data Loss, whereas, Selected Mapping (SLM) and Partial Transmit Sequence (PTS) do not affect the data. We could infer that OICF is more effective in PAPR reduction.

The Simplified OICF at Subcarrier N=64, 128, 512 and 512 iteration. The performance at the 10^{-1} CCDF probability in simplified OICF, 1st iteration at N=256 was batter PAPR reduction as compared to other and another terms iteration 3rd at N=128 was batter result (0.3dB) obtain as compared to N=512.

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