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Reduction of PAPR through PTS Technique in MC-CDMA

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***Abstract:The most favorable technique for high speed data transmission is Multicarrier Code Division Multiple Access. The MC-CDMA signals, which are characterized through PAPR, which can reduce the efficiency of the system. In this paper, we have to reduce the PAPR of an MC-CDMA system using PTS (Partial Transmit Sequence) through suboptimal combination algorithms (BPSO&BFO), which uses binary phase factors, for different number of subcarriers and for different length of sub blocks of PTS*.**

Keywords*:* MC-CDMA, PAPR, Partial Transmit Sequence, Complementary Cumulative Distribution Function (CCDF).

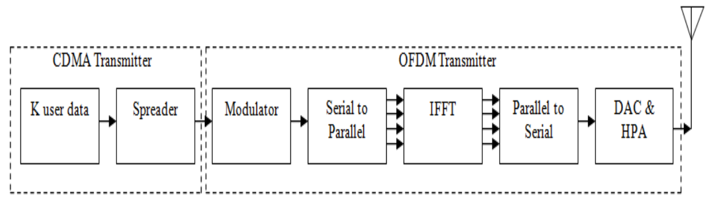
I. Introduction

Mainly, the transmission of multi-carrier is to divide the entire bandwidth into smaller bandwidths. Each bandwidth with a different sub-carrier frequency, such that each of these narrow-band signals is protected from frequency selective fading and the data-rates are improved as compared to single-carrier system as we say that the total bandwidth can be increased significantly.MC-CDMA is a combination of both OFDM and CDMA that can provide protection from frequency selective fading and time dispersion. The CDMA part that provides both multiple access ability as well as spread each user signal over the frequency domain provide protection cover from the impact of frequency selective fading. The OFDM provides spreading across time domain of each spreading code's chip which decreases the effect of inter-symbol interference. So that we are able to get high data rate for transmission purpose. As we see, MC-CDMA is a powerful technique which has multiple accesses, but not free from problem. MC-CDMA signal has large peak to average ratio (PAPR) which largely limits its applications. High PAPR values causes a critical problem to the power amplifier (PA) used at transmitter. The efficiency performance of power amplifier decreases as PAPR increases. At transmitter side, the signal suffers from non-linear distortion. At receiver side, it degrades Bit Error Rate performance. This implements the use of power amplifier with large linear range so that the cost increases. Therefore it is necessary to reduce the impact of PAPR by means of PAPR reduction schemes. PTS is one of them most suitable probabilistic distortion less technique due to its less complexity.

II. MC-CDMA System and PAPR

II.1 MC-CDMA System

MC-CDMA defines itself in block diagram which is shown in Figure, which allows the multiple users access at the same time



MC-CDMA Transmitter [xi]

K user data: It transmits data symbol of K user simultaneously over on several narrow band sub channels [xi].

Spreader: The most important purpose of the spreading codes is to help preserve orthogonality among different physical channels.

Modulator: Mainly to minimize the effect of noise, we have to use modulator. The signal wave is transformed in over the communication channel through modulation technique.

Serial to parallel converter: Data to be transmitted is in the form of a serial. So a serial to parallel conversion stage is required .For this we have to convert the input serial bit stream to the data to be transmitted in each OFDM symbol.

IFFT: Through working with MC-CDMA in frequency do-main the data symbols which are in modulated form are fed onto the orthogonal sub-carriers. But transfer of signal over a channel is possible only in its time-domain. So that we have to implement IFFT which converts the MC-CDMA indication in from frequency domain to time do-main form.

Parallel to serial converter: The parallel to serial converter is used for conversion purpose, which convert data back into serial data form.

Digital to Analog Converter and high power amplifier: The parallel to serial conversion of the data, that data is send to the digital to analog converter followed by high power amplifier and up convertor for transmission purpose.

II.II PAPR of Signal

Peak-to-Average Power Ratio is defined as the ratio of the peak to average power value & their mathematical representation is as:

$$\mathrm{PAPR} = \max\,[p(t)^2] \div E[p(t)^2]$$

Where E [.] denotes expected value.

Disadvantages due to High PAPR

1. The cost of the system is increased.
2. The efficiency of amplifiers is reduced.

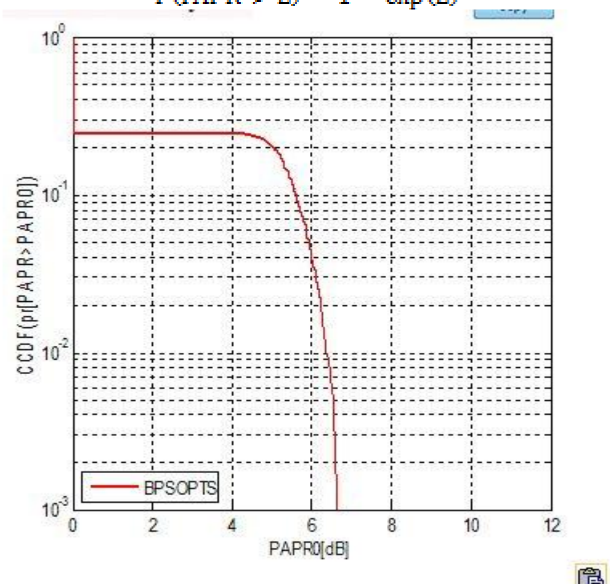
II.III CCDF (Complementary Cumulative Distributive Function)

It helps us to measure the probability that the PAPR of a certain data block exceeds the given threshold [xi]. The CDF of the amplitude of a signal sample is given by mathematical expression in:

$$F(Z) = 1 - \exp$$

The CCDF of the PAPR of the data block is desired is our case to compare outputs of various reduction techniques. This is as shown:

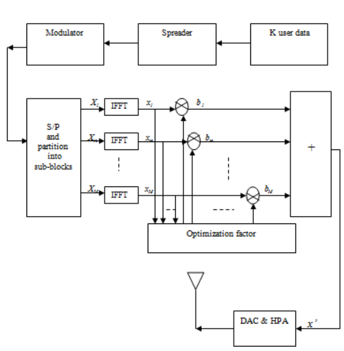
$$P(PAPR > Z) = 1 - P(PAPR \le Z)$$
$$= 1 - F(Z)^N$$
$$P(PAPR > Z) = 1 - \exp(Z)^N$$



CCDF Performance

II.IV.PTS (Partial Transmit Sequence)

Distortion less technique is the other name of PTS. For each MC-CDMA symbol, the input sequence is divided into a certain number of sub-blocks. The smallest PAPR is transmitted in the form of the output signal. In this process, data of varying sub-carrier is only transmitted which covers all the information to be sent in the signal as a whole is known as Partial Transmit Sequence. The MC-CDMA with PTS is shown in figure. [xi]



MC-CDMA with PTS [xi]

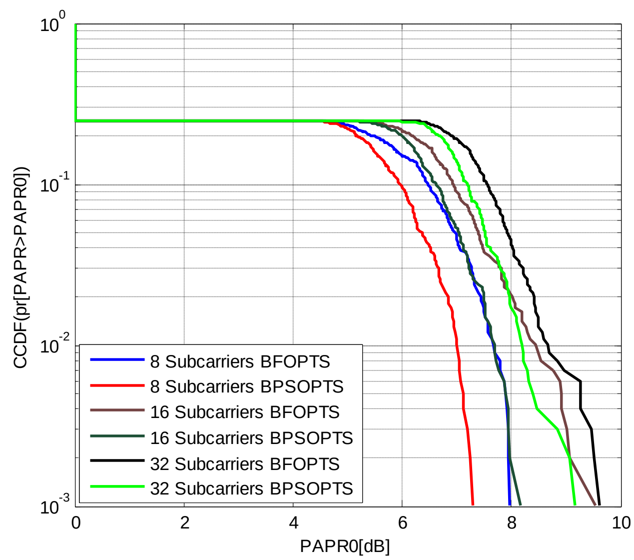
In this we have to reduce PAPR .For PAPR reduction of an MC-CDMA system using PTS technique, which is investigated by using suboptimal combination algorithms(BPSO,BFO), which uses binary phase factors for different number of subcarriers and for different length of sub blocks of PTS.

First for number of subcarriers, we have to take the PAPR performance for 8, 16 & 32. After that we have to compare these performances in a graph.

Second for different length of Sub blocks, we have to take the PAPR performance for 4, 8 & 16. After that we have to compare these performances in a graph.

III. Result

III.I For different number of Subcarriers



PAPRIII.I.I: PAPR having 8 ,16 & 32 Subcarriers

.III.II For different length of Sub blocks

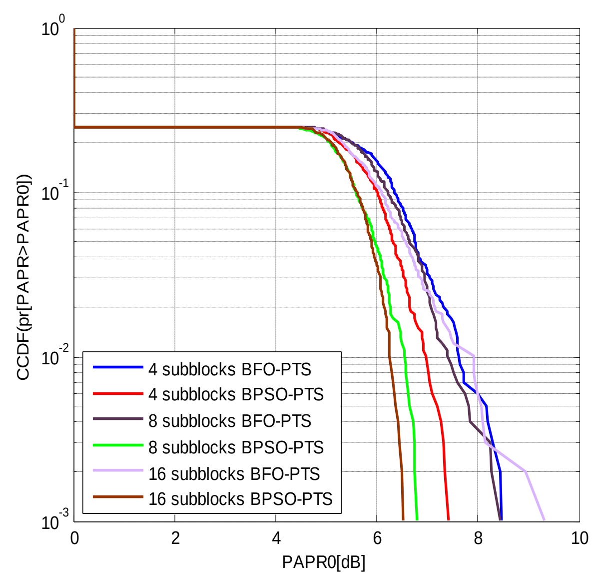


Figure III.II.I: PAPR Curve for different Sub blocks

Table: For different number of subcarriers

Number of subcarriers	PAPR of BFO-PTS(dB)	PAPR of BPSO-PTS(dB)	Improvement in PAPR (dB)
8	8	7.1	0.9
16	9.5	8.1	1.4
32	9.7	9	0.7

In this case, with the increase in number of subcarriers keeping all other factors are constant. PAPR increases with number of sub carriers. BPSO-PTS improves PAPR then BFO-PTS.

Table :For different of sub blocks

Number of PTS subblocks	PAPR of BFO-PTS(dB)	PAPR of BPSO-PTS(dB)	Improvement in PAPR (dB)
4	8.4	7.5	0.9
8	8.4	6.8	1.6
16	9.2	6.4	2.8

PAPR improvement works well when length of sub blocks of PTS increases all other factors are constant. BPSO-PTS improves PAPR then BFO-PTS.

IV. Conclusion

For the reduction of PAPR, we examined the effect of PTS in MC-CDMA; we have to compare the PTS (BPSO-PTS & BFO-PTS) with different number of subcarriers & for different length of sub blocks. Higher PAPR reduction performance is achieved when 16 sub blocks BPSO-PTS. Higher PAPR reduction performance is achieved when numbers of subcarriers are 8 in BPSO-PTS. The results showed that BPSO-PTS is more effective. PAPR increases with number of sub carriers & improves with larger length of sub blocks of PTS.

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