

# Design a Hybrid approach to reduce PAPR in OFDM

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Abstract— A communication system is said to be efficient system if it transmits the huge data within the defined frequency range. To encode the digital data on multiple carrier frequency OFDM is used. OFDM is most preferable technique for signal encoding as compare to other techniques. The advantage of OFDM over other techniques is that it makes effective use of frequency spectrum. OFDM is a robust technique. It is much efficient against multipath fading channels. OFDM consist of guard bands and sub carriers which lead to the less effect of noise and ISI. The disadvantage of OFDM is that it affects the power efficiency due to the occurrence of PAPR. In this paper a survey of various PAPR reduction techniques is done. Various techniques used for reducing the PAPR are discussed to find an efficient technique.

**Keywords**—OFDM system, digital communication, ISI, PAPR effect.

#### **1. INTRODUCTION**

PAPR (Peak-to-Average Power Ratio) is the most trendy and challenging issue in the multi carrier systems i.e. OFDM systems. PAPR should be reduced in order to enhance the lifetime of the network. In comparison with single carrier systems PAPR is quite high in multi carrier system. Highest value of PAPR reduces the efficiency of the Power amplifier (Transmitter) [3]. PAPR effects the transmitted signal. PAPR is the problem exists in OFDM system. The input symbol stream in IFFT should have a constant value of power spectrum. But the output of IFFT can result in a variable value and fluctuated wave or spikes. Only few of the sub carriers are allotted with energy to transmit the data. This problem gives rise to other problems in OFDM system. Effect of PAPR

The OFDM system has following disadvantages:

- High value of PAPR.
- I Signal gets distorted.
- RF power amplifier has to operate in large region area. Otherwise the peak enters into the non-linear region which corrupts the signals.
- If the peak goes high it will leads to fluctuation in the signals.

### 2.TECHNIQUES

The PAPR decrease systems on which we would work upon and hope to measure up in our later stages are as per the following:

PAPR reduction techniques

There is a need to decrease the PAPR in order to perform the OFDM system efficiently. There are number of techniques available to reduce the effect of PAPR. PAPR effects the OFDM system such as loss in information rate, increase the bit Error Rate (BER). The PAPR decrease systems on which we would work upon and hope to measure up in our later stages are as per the following:

PAPR effect on the system must be reduced in order to increase the efficiency of the system. Techniques to reduce the PAPR are as follows:

I Signal scrambling

I Signal Distortion

**Signal scrambling techniqus:**In this technique signal is altered before transmitting them. Signals are altered by adding some extra or signal bits to the original data signals. The



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signal scrambling techniques are categorized into five categories as below:

- D PTS
- I SLM
- Block Coding Technique
- I Tone Reservation
- Partial Transmit Sequence (PTS): In this i. technique input data signals are divided into small parts known as sub blocks. The division in the sub block is done by using partitioning methods. These sub blocks can be adjacent to each other or can be interleaved. The position of the blocks after partitioning depends upon technique which is used to divide the signals into sub blocks. After dividing the signals into sub blocks the rotation is applied to the sub blocks and the sub block with the lowest value of PAPR is selected for transmission. This technique is one of the best techniques which are used to reduce the PAPR but this technique has a backlog that it includes many complexities and side information
- **ii.** Selective Mapping (SLM): In this technique the input data is firstly phase rotated and after rotation IFFT is applied to the signals. And then the signal with the lowest PAPR is selected for the transmission. SLM does not affect the BER of the system. SLM technique does not distort the signals and there will be no hike in the power of the signals if SLM is applied.
- iii. Block Coding Technique: In this encoding technique is used to achieve the signals with lowest PAPR value. Some code words are appended with the data signals. The sub blocks are encoded by using SOPC. SOPC stands for system on programmable chip. This technique provides the greatest fall in the value of PAPR.
- iv. Tone Reservation: In this technique the tones that have low SNR value and the other tones which are not considered for the reliable transmission are used as reserved tones. This technique of tone reservation is applied by i. collecting the sub blocks and time domain signals. The peak of the signals depends upon the block signals. Hence peak is reduced by these data blocks. The TDS relies on the signals at the sender's side and stripped on the

destination part. This technique reduces the PAPR along with the BER. Tone reservation is less complex as compare to other techniques.

**Tone Injection:** This technique uses the set of certainty points in order to reduce the PAPR. A constant namely 'C' is added to the signals which are equivalent to each other. Then set of certainty points are select to reduce the effect of PAPR. This technique does not increase the BER but reduces the PAPR.

**Signal Distortion Techniques:** There are certain kinds of signal distortion techniques applied on OFDM system for PAPR reduction. The description of the techniques is given below:

Clipping & filtering: This is easiest and simplest way or technique to reduce the PAPR. It is the combination of two processes i.e. clipping and filtering. Clipping is a technique in which a user defined threshold level or clip level is defined. This threshold level is predefined and then the signals are compared by these pre-defined levels and the signal which crosses the threshold levels clipped or cancelled. The process of clipping causes in-band or out-of-band noise in the signals and clipping is a non-linear process. This process may reduce the spectral efficiency of the signals and also increases the BER. After applying clipping, filtering is applied to the signals which are received after clipping. Filtering is applied to remove the noise from the signals. It is applied to remove the out-of-band distortion and spectrum growth efficiency of the signals. After applying filtering signal may rises above the clip level which is considered as the re-growth f the signals. This is the lacking point of applying filtering after clipping. To overcome the disadvantage of filtering the process clipping and filtering should be applied alternatively.

**k Windowing:** This technique is employed by multiplying a particular window like Kaiser, cosine or hamming window with the peak of large signals. This will form a spectrum of the convolved original OFDM signals which will



reduce the PAPR of the signal. In this technique the size of the window should be restricted to avoid increase in BER. The advantage of this technique is that it reduces signal peaks at compact volume of interference. Superior spectral properties of the OFDM signal are obtained with diminished PAPR.

- **ii. Envelope Scaling:** in this technique scaling is applied to the input envelope. Scaling is applied to obtain the lowest value of PAPR after getting the output of IFFT. In this technique scaling is applied in order to get the reduced value of PAPR.
- iii. Peak Reduction Carrier: This technique considers the highest order modulation instead of lowest order modulation. In this the data which has PRC i.e. Peak Reduction Carriers is used for reducing the PAPR. This technique is suitable for PSK because it uses the equal envelopes for all sub carriers

# **3.RELATED WORK**

- 1. Reshma Elizabeth [14], In this paper OFDM is explained as the most promising technique which is used to increase the high data transmission over multiple channels by avoiding multipath fading problems of channel. PAPR is the only problem which exists in OFDM and still has no technique which can totally reduce the effect of the PAPR on OFDM system. In this paper author uses the SLM technique to reduce the PAPR. In this SLM works by rotating the input data after applying IFFT. It is done by using matrix which is generated by using hadmard code which is little bit complex. After rotating the input data the clipping and filtering technique is applied in order to remove the noise from the signals. After simulation it is observed that the proposed technique has better results in order to reduce the PAPR. The proposed technique is compared by the convention SLM technique along with clipping and filtering.
- 2. V.**B.MALODE** [5], the use of OFDM has been increased use to its robustness and the feature of multicarrier transmission of the data. The coded form of OFDM is used by IEEE 802.11 standard. In this paper author compares the

performance of coded OFDM in various channels. Bit Error Rate of the system is calculated by using LBC along with hamming by using various channels like rician, Rayleigh and AWGN. The results are simulated by using QPSK and DQPSK with traditional SLM.

- 3. Suverna Sengar [3]. In this author defines that OFDM is an orthogonal technique which is used to transfers the high speed data over various sub carrier. The lacking point is that it does not supports the high PAPR. There are many techniques used t reduce the problem of high APR. The reason behind the problem of PAPR is that all of the sub carriers are orthogonal or independent to each other due to which the peak value of the signals goes out of the linear region and gives rise to the highest PAPR. In this paper SLM and PTS is used to reduce the value of PAPR. And the performances of the techniques are compared in order to proof the efficiency of the techniques.
- 4. **Md. Ibrahim Abdullah [4],** In this author explains that the OFDM is a system which transmits the data over the multipath fading channels. It is the widely used technique for the purpose of multiple sub carriers' data transmissions. The main problem of exist in OFDM is PAPR which rises due to the miss-alignment if RF section of the transmitter. Many techniques are used by author to reduce PAPR and the results of all techniques are simulated by using MATLAB. The technique preferred to solve the problem of PAPR is SLM.
- 5. Zhongpeng Wang [5], In this paper author defines that the OFDM suffers from the problem of PAPR which can be removed by using many techniques which are specifically meant to reduce the PAPR. In this paper two techniques are combined for the purpose of reducing PAPR DCT along with Conventional SLM is used for reducing the PAPR.
- 6. **K Srinivasarao[6],** In this author explains that the MIMO-OFDM system is a candidate technique for multiple sub carrier transmission, IT removes the multipath fading from the channels and provides reliable transmission of data. There are many techniques which are used to bring the value of PAR to minimum level.



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PAPR reduction techniques are coding, clipping and filtering and phase rotation etc. All the techniques have some advantages along with some disadvantages. In this PTS and SLM is used to reduce the PAPR. These methods come under the category of phase rotation. An algorithm is presented in this paper and named as SUB-Optimal algorithm. This algorithm is proved as much efficient technique to reduce the PPAR.

## 4. CONCLUSION AND FUTURE SCOPE

From the results obtained it is concluded that this method is efficient, accurate and secure than the traditional approaches. A comparison is also performed that shows the accuracy of the system is more.

In future this technique can be enhanced further by developing a new hybrid approach which can lead to the best results of PAPR reduction. Hybrid approach can consist of multiple technique of PAPR reduction. The selection of technique for hybrid approach is based on the performance ratio of the techniques.

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