Companding technique to Reduce PAPR in OFDM System

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Abstract: World is going so faster so for the communication field this sentence is very important that's why every day innovation is done. In this case OFDM (Orthogonal Frequency Division) is best technique to achieve get higher data rate in communication field. But as per the basic scenario every invention has demerits. So in OFDM system PAPR (Peak to Average Power ratio) is disadvantage. So to reduce this PAPR here one technique has been proposed in this paper name Companding technique.

Keywords: -Orthogonal Frequency Division Multiplexing (OFDM), Peak to Average Power Ratio, Problems & Solutions, Companding.

I. INTRODUCTION

OFDM (Orthogonal Frequency Division Multiplexing) is multi path multiplexing technique. OFDM is a spectrally efficient multiplexing technique. It is conveniently implemented using IFFT and FFT operations It handles frequency selective channels well when combined with error correction coding,OFDM system has a Large number of Orthogonal, Over lapping sub carriers transmitted in parallel. This technique contains higher data rate is divided into lower data rate. That's why all data will be divided into small sub carrier.OFDM System has all the subcarrier which is arranged orthogonally. More complex than single-carrier modulation. OFDM System Requires a more linear power amplifier.OFDM system best in its way and provides higher data rate. which can be useful in the high data rate communication but as per the disadvantage side if we see at least we have to see that PAPR problem is very difficult in OFDM system that's why Removal of PAPR is must important because due to PAPR problem more power has to transmit while transmission. So to reduce PAPR no of techniques. Has been proposed all the techniques was best in its own way but here I proposed one technique name Companding technique.

ILOFDM BASIC

In OFDM system main thing is to divide high data rate transmission into lower data rate and that are transmitted Fig.2 shows the OFDM signal with orthogonality in time simultaneously over number of subcarriers. Each of these signal sub carrier is modulated and transmitted over the channel. And

at the Receiver and signal will be demodulated and recombine to recover the Original Signal. In OFDM system the series and parallel converter Is considered the concept of parallel data transmission..In basic serial data system, the symbols are transmitted sequentially with the frequency spectrum of each data sub carrier allowed to occupy the entire available bandwidth. When the data rate is sufficient high, so due to high data rate several adjacent symbols may be completely distorted over frequency selective fading or multipath delay spread channel .In OFDM system each signal is orthogonal to each other. As per the figure given below each subcarrier is arranged orthogonally to each other in frequency domain over entire OFDM signal.



Fig-1 Orthogonality in Frequency domain



Fig-2 Orthogonality in time domain

domain over entire OFDM Signal. Now fig.3 will shows the block diagram of OFDM system. as per the block diagram first

of all signal performs modulation (QAM) and the receiver after gets modulated by an independent information. Mathematically, perform IFFT the signal is applied to Parallel to serial the transmit signal is. converter. Guard interval is added. In OFDM system QAM modulation is used.



Fig-3 BLOCK DIAGRAM OF OFDM SYSTEM

This Modulation Scheme is used to reduce the noise effect while transmission of OFDM signals. This Modulation is sufficient modulation for the OFDM. now after performing guard interval addition the signal will be transmitted over communication channel. so after receive this signal at the receiver side reverse procedure will be done. first of all the signal will pass from LPF (Low Pass Filter).then guard interval will be removed. And again signal will converted from serial to parallel. After performing FFT and QAM Demodulation again it is converted into serial signal. now we will discuss about Main concept of this paper that PAPR (Peak To Average Power Ratio).

III.PAPR (Peak to average power ratio)

Now here is the explanation of PAPR in Mathematical equation form. PAPR is defined as the maximum power occurring in the OFDM transmission to the average power of the OFDM transmission. Mathematical Expression has been given below.

The peak to average power ratio for a signal x(t) is defined as

$$papr = \frac{\max[x(t)x^*(t)]}{E[x(t)x^*(t)]},$$

Where,

corresponds to the conjugate operator.

Expressing in decibels,

$$papr_{dB} = 10\log_{10}(papr)_{.}$$

OFDM signal is the sum of different sinusoidal having frequency separation and subcarriers. Where each sinusoidal



Fig. 4 OFDM signal containing sinusoidal high peaks

In previous discussion we have seen about basics of OFDM system and about PAPR of OFDM system OFDM system is very efficient technique in its way. Here in figure we can see the sinusoidal peaks are occurred during transmission of OFDM system. Now here we have discussed about PAPR in OFDM system. Here the technique name Commanding is being proposed. Here power level of PAPR is must PAPR>PAPR0

This is the simulation of OFDM system to observe PAPR in it. So this is the basic explanation about PAPR and why it is reduce in OFDM system. Now there are different techniques has been proposed for the reducing PAPR in OFDM system.

IV.PROPOSED TECHNIQUE A. COMPANDING

The OFDM signal can be assumed Gaussian distributed, and the large OFDM signal occurs infrequently. So the companding technique can be used to improve OFDM transmission performance. U-law companding technique is used to compand the OFDM signal before it is converted into analog waveform. The OFDM signal, after taking IFFT, is companded and quantized. After D/A conversion, the signal istransmitted through the channel. At the receiver end then the received signal is first converted into digital form and expanded. Companding is highly used in speech processing where high peaks occur in frequently. OFDM signal also exhibit similar characteristic where high peaks occur infrequently.Companding technique improves the quantization resolution of small signals at the price of the reduction of the resolution of large signals, since signals occur more frequently than large ones. Due to companding, the quantization error for large signals is significantly large which degrades thebe performance of the system. So the companding technique improves the PAPR in expense of BER performance of the system.

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B.SIMULATION RESULT-1

C. SIMULATION RESULT -2

Below fig shows the simulation of PAPR reduction by using Companding technique.

This technique is very good in its own way because it give very good reduction in PAPR by changing the value of u.



Fig.5 shows PAPR reduction up to 8.16 dB u=16&u=32 QPSK

TABLE-1 DATA ON REDUCTION OF PAPR FOR COMPANDING

| Data | Reduction of Power in |
|----------|-----------------------|
| | dB |
| Original | 11.41dB |
| U=16 | 3.76dB |
| U=32 | 3.25dB |



FIG.5 shows PAPR reduction up to 8.78 dB u=32 & u=64 QPSK

TABLE-2 DATA ON REDUCTION OF PAPR FOR COMPANDING

| Data | Reduction of Power in |
|----------|-----------------------|
| | dB |
| Original | 11.58dB |
| U=32 | 3.26dB |
| U=64 | 2.8dB |

D.SIMULATIONRESULT-3



FIG.-6 shows PAPR reduction up to 9.58 dB u=128&u=255 QPSK

TABLE- 3 DATA ON REDUCTION OF PAPR FOR

COMPANDING

| Data | Reduction of |
|---------------|--------------|
| | Power in dB |
| | |
| Original | 11.88dB |
| | |
| U=128 | 2.57dB |
| <i>U</i> =255 | 2.3dB |
| | |

V.CONCLUSION

As per the basic conclusion of this paper on this particular technique on companding to reduce PAPR is very effective technique. As per the result it can be seen. And easily can be used in communication system for better performance.

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