International Journal of Advanced Technology in Engineering and Science www.ijates.com
Volume No.02, Special Issue No. 01, September 2014 ISSN (online): 2348 – 7550

ANALYSIS AND SIMULATIONS OF NOISE REDUCTION CLIPPING TECHNIQUE IN OFDM SYSTEM

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ABSTRACT

The aim of this paper is to study the effect of noise on OFDM transmission and process to minimize the effect of noise. Bit error rate of different reduction technique is provided by simulation. OFDM communication system in environments where the interfering noise exhibits non-Gaussian behaviour due to impulsive phenomena exist .Impulsive noise is combination of Bernoulli distributed impulse and Gaussian amplitude impulses. This paper design and simulates two different impulsive noise reduction techniques in which clipping techniques is simulated and BER is calculated and result is that if both technique is used after proper analysis of threshold level of IN noise then equalization method can reduce noise effect.

Keywords: Adaptive equalizer, Bernoulli sequence, Gaussian behaviour Impulsive Noise, OFDM

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is one of the multi-carrier modulation (MCM) techniques that transmit signals through multiple carriers. These carriers (subcarriers) have different frequencies and they are orthogonal to each other. Parallel data transmission takes place in this modulation technique. One of the main limitations of demodulation of OFDM is its proper reconstruction at receiver side and this is due to unwanted signal called noise and this causes fading in signal. By the parallel transmission, the Deleterious effect of fading is spread over many bits, therefore, instead of a few adjacent bits completely destroyed by the fading, it is more likely that several bits are only slightly affected by the channel [2] Increasing the no. of subcarrier can add advantage to OFDM noise reduction.

Noise is not only added by AWGN channel but also due to manmade activities like automobiles, ignition etc and this are called as man-made noise. And this gets added in AWGN channel with impulsive noise. In this paper the effect of changing carrier and there shape on OFDM system is investigated and two different technique of noise reduction is shown. The non Gaussian impulsive noise effect the performance of OFDM system so Bernoulli's model for OFDM is modelled and simulated.

This paper is organised as follows. Section 2 describes about system overview regarding OFDM system and major noise called as impulsive noise. Section 3 describes about the two different techniques used for reducing the impulsive noise effect .Section 4 shows the simulation result for calculating BER and section 5 is the conclusion.

II. SYSTEM OVERVIEW

2.1 OFDM System

OFDM supports high rate data communication due to its parallel transmission. and also considered as optimal version of multicarrier transmission scheme. In single OFDM carrier the resulting spectrum has a sin(x)/x shape centred at the carrier frequency as shown in the Fig 2.1.1.

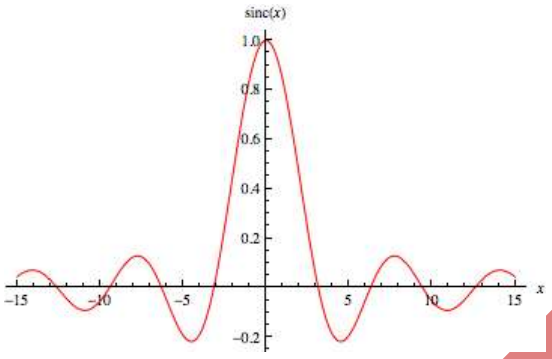

Figure 2.1.1 OFDM carrier frequency having sinc

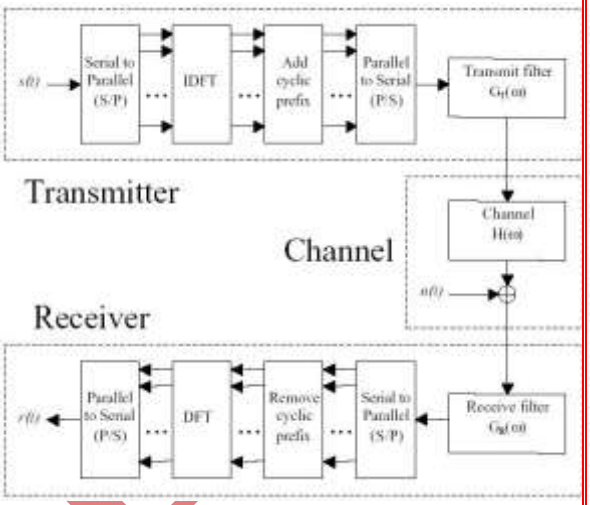

Figure 2.1.2 OFDM Block Diagram

To eliminate the bank of subcarrier completely digital implementations could be built around special-purpose hardware performing the fast Fourier transform (FFT), this is an efficient implementation of DFT.The block diagram of DFT based OFDM system is shown in Fig 2.1.2

2.2 IMPULSIVE NOISE

In this paper Bernoulli Gaussian model for Impulsive Noise is taken where in Bernoulli sequence probability of 1 is taken as ‘p’while the probability of 0 is taken as ‘1-p’ and then each impulse is shaped by filter having impulse response h(k)[3].IN can be produced as follows shown in Fig 2.2.1

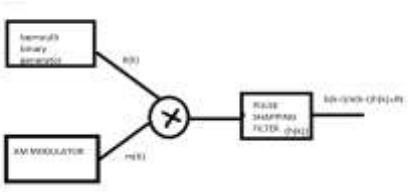

Figure 2.2.1 Illustration of Impulsive Noise Production noise output Technique

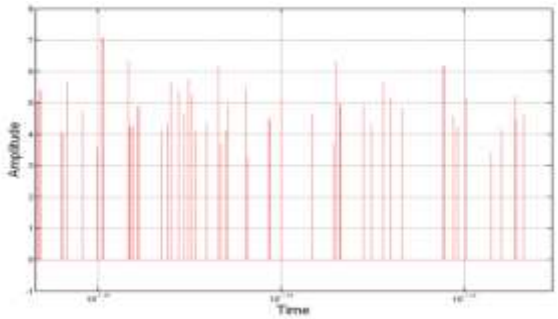

Figure 2.2.2 Impulsive

Mathematically IN can be written as Shown in equation (1)

$$IN=\sum b\,(k-i)\,m\,(k-i)\,h\,(k) \qquad (1)$$

Where i=0 to p-1

P is the no. of impulse taken by the filter,

As shown in Fig 2.2.2 Impulsive noise is a non-stationary, binary state sequence of impulses with Random amplitudes and random positions of occurrence and when it get added to signal in OFDM system it produces large Peak to Average Power Ratio(PAPR).

III. NOISE REDUCTION SYSTEM MODEL

3.1 CLIPPING TECHNIQUE

It one of the most prominent techniques for noise reduction in modern communication system and main advantage of this technique is that it could be implemented very easily [4].in this technique threshold level is decided and if noise amplitude goes above the threshold that portion is clipped off. Repeated clipping of OFDM signal significantly reduces the peak-to-average power ratio (PAPR) of the transmitted signal. Clipped signal is shown as in Fig 3.2.1

3.2 GATING TECHNIQUE

In this technique gate is used which opens and closed for a fixed duration of time allowing fixed impulsive noise to pass. This is achieved through using switching pulse generator which is activated above certain threshold value. Gating Technique is able to work effectively in low or high noisy environment [5].

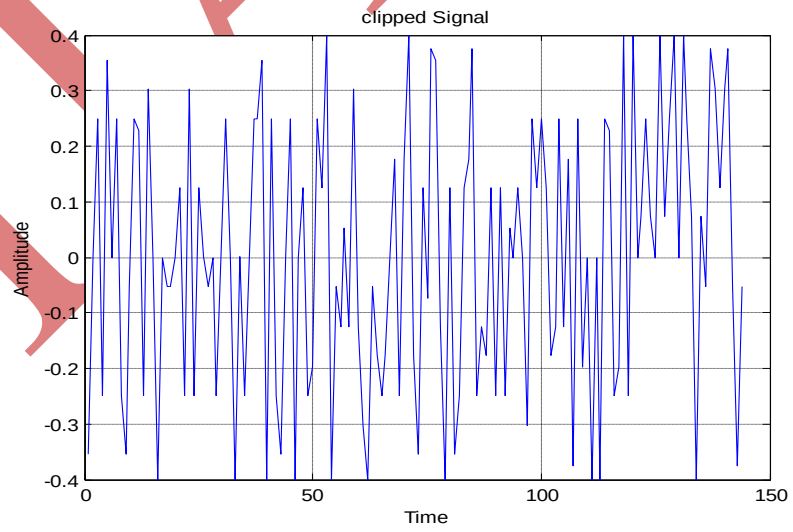

Figure 3.2.1 Output clipped signal

Table 1.Parameters used in clipping simulations

Parameters	Values
Modulation techniques	4 QPSK
No. of bits generated	128
Average	0.4
Size of cyclic prefix	0.1*8
No. of Tx/Rx	1
No. of path	1

IV. SIMULATION RESULT

Simulation of OFDM system with QPSK modulation is performed with AWGN plus IN is taken into account and BER performance was evaluated as shown in Fig 4.1.Parameters used in simulation are given in Table1

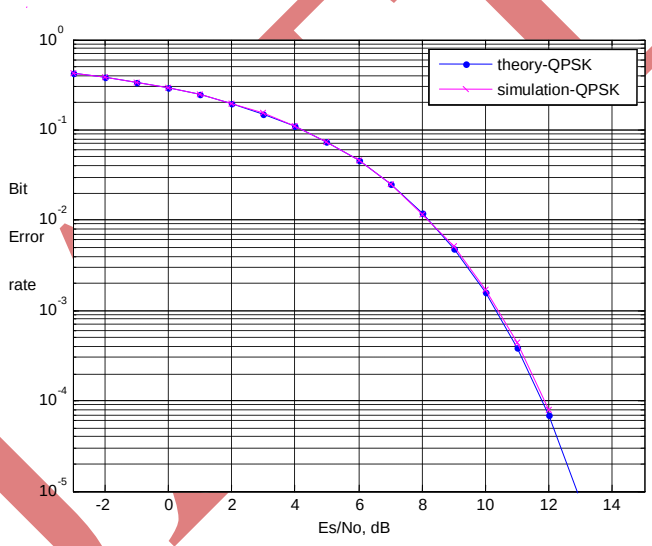

Figure 4.1 bit error rate vs Es/No curve for QPSK modulated OFDM system

In the clipping or limiting technique a clipping circuit is employed at the front-end of OFDM receiver before demodulating using Fast Fourier Transform (FFT)[6].In this technique only amplitude is changed according to the threshold value while the phase remains constant.

Signal is firstly modulated using QPSK modulation scheme with 4 signal constellation point and 128 data source then IFFT is perform on each block then data is converted to parallel form at the receiver end clipping is performed before demodulation

```
avg=0.4;
clipped=ofdm_signal;
for i=1:length(clipped)
```

```
if clipped(i) > avg
clipped(i) = avg;
end
if clipped(i) < -avg
clipped(i) = -avg;
end
end
```

BER is calculated as shown in Fig 4.2

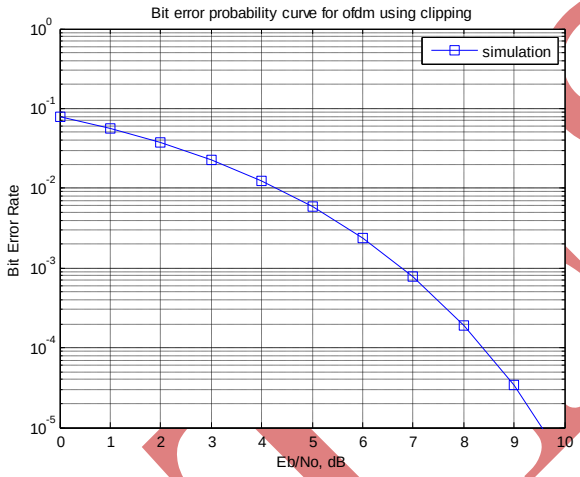

Figure 4.2 Bit error rate of OFDM system using clipping technique

V. CONCLUSION

In this paper the performance of clipping technique for impulsive noise in OFDM system was characterised. Bernoulli model for impulsive noise for designed and BER rate performance of OFDM system with clipping was compared with OFDM system without clipping and it was found that there is 3 db improvement in signal to noise ratio at 10^-3..The proposed clipping technique shows that there is improvement over without using clipping.

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