# A Novel SNR Utilization for OFDM Wireless Communication System using PPE and SUI Channel Model

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***Abstract - Transform techniques with different operations like cosine transform, fourier transform are having positive results in different scenarios, and these are more important for the future generation of wireless communication systems. The implementation of equalization mechanism makes system performance better in various terms, if it applied on the transmitter side it will reduces the chances of information being corrupted by the noises, and if applied on receiver side it will filter out the information from the corrupted signals. In this work the analysis and utilization of signal power is done with the help of a novel equalization technique i.e. peak power equalization(PPE) which is implemented on the transmitter just prior the transmission over SUI channel. This equalization mechanism significantly reduces the chances of power wastage and even error rate. The SUI channel gives efficient channel model for estimation of noises introduced by the environment. From the simulation results 8-QAM and 16-QAM is better in terms of error rate with power and power respectively. The performance improvements in power is 10dB when 8-QAM is implemented and 4dB when 16-QAM is implemented.***

***Keywords - SUI Channel, PPE, QAM, Error Rate, OFDM, FFT, DCT.***

## I. INTRODUCTION

The interest for interactive media information administrations has developed radically which drive us in the time of fourth era remote communication system. This necessity of sight and sound information benefit where client are in huge numbers and with limited range, current digital remote communication system embraced advancements which are data transmission effective and strong to multipath channel condition known as multi¬carrier communication system. The cutting edge digital multicarrier remote communication system give rapid information rate at least cost for some clients and also with high unwavering quality. In single transporter system, single bearer involves the whole communication transmission capacity yet in multicarrier system the accessible communication transfer speed is isolated by numerous sub-bearers. With the goal that each sub-bearer has littler data transmission as contrast with the transfer speed of the single transporter system. These gigantic highlights of multicarrier procedure pull in us to consider Orthogonal Frequency Division Multiplexing (OFDM). OFDM frames reason for every one of the 4G remote communication systems because of its enormous limit as far as number of subcarriers, high information rate in overabundance of 100 Mbps and omnipresent scope with high versatility. The presentation comprises of following parts: Outline, Chronicled Advancement of OFDM, guideline of orthogonality, points of interest and drawbacks of OFDM system, and the uses of OFDM procedure.

Wireless communication is a standout amongst the most dynamic zones of innovation improvement. Wireless Broadband Advancements permit the concurrent conveyance of voice, information and video over settled or portable stages . Wi-Fi, WiMAX, LTE, UMB are a portion of the developing advancements. WiMAX acronym remains for Overall Interoperability for Microwave Access. LTE remains for Long haul Advancement.

Orthogonal Frequency Division multiplexing (OFDM), the multi-transporter modulation (MCM) system, has been believed to be exceptionally successful for communication over channels with frequency particular blurring. It is exceptionally hard to deal with frequency particular blurring in regular communication collectors as the outline of the recipient turns out to be tremendously unpredictable. OFDM strategy productively uses the accessible channel transmission capacity by partitioning the channel into low data transfer capacity contineous channels.

Communication systems use Frequency Division Multiple Access (FDMA), Time Divi¬sion multiple Access (TDMA) and Code Division Multiple Access (CDMA) for efficient spectrum sharing between users. FDMA suffers from low spectrum usage and TDMA system performance degrades due to multipath delay spread causing Inter Symbol Interference (ISI). In contrast, OFDM enables high data rate wireless applications in a multipath radio environment without the need for complex receivers. OFDM is a multi-channel modulation scheme employing Frequency Division Multiplexing (FDM) with orthogonal sub-carriers, each modulating a low bit-rate digital stream. OFDM uses N overlapping (but orthogonal) sub bands, each carrying a baud rate of 1/Ts and author are spaced 1/Ts Hz apart.

A Fast Fourier Transform (FFT) is an efficient algorithm to compute the discrete Fourier transform (DFT) and its inverse. The Discrete Fourier Transform (DFT) is used to produce frequency analysis of discrete non-periodic signals. The FFT is a faster version of the Discrete Fourier Transform (DFT). The FFT utilizes some clever algorithms to do the same thing as the DTF, but in much less time. FFTs are of great importance to a wide variety of applications, from digital signal processing to solving partial differential equations to algorithms for quickly multiplying large integers.

A Discrete cosine transform (DCT) is a Fourier-related transform similar to the discrete Fourier transform (DFT), but using only real numbers. DCTs are equivalent to DFTs of roughly twice the length, operating on real data with even symmetry (since the Fourier transform of a real and even function is real and even), where in some variants the input and/or output data are shifted by half a sample. the Discrete Cosine Transform (DCT) attempts to decorrelate the image data. After decorrelation each transform coefficient can be encoded independently without losing compression efficiency. Like any Fourier-related transform, discrete cosine transforms (DCTs) express a function or a signal in terms of a sum of sinusoids with different frequencies and amplitudes. The Fourier-related transforms that operate on a function over a finite domain, such as the DFT or DCT or a Fourier series, can be thought of as implicitly defining an *extension* of that function outside the domain. That is, once you write a function*fx)* as a sum of sinusoids, you can evaluate that sum at any x, even for x where the original fx) was not specified. The DFT, like the Fourier series, implies a periodic extension of the original function. A DCT, like a cosine transform, implies an even extension of the original function.

Let x (n) be a sequence of length N

Its DCT is given by

$X(k)=N_{-1}$

$x(n)\cos(2mk/N)$

## II. SYSTEM MODEL

Orthogonal Frequency Division Multiplexing (OFDM) is a wireless communication system. OFDM develops single sub-transport modulation by utilizing parallel unmistakable sub-transporters inside a channel. It utilizes a critical number of decidedly separated orthogonal sub-transporters that are transmitted in parallel. Every last one of the sub-transporter is adjusted with any ordinary digital modulation plot, (for example, QPSK, 16QAM, and so forth.) at low picture rate. The blend of all sub-transporters attracts data rates proportionate to standard single-transport modulation designs. Hence OFDM can be considered as like the Frequency Division Multiplexing (FDM). In FDM distinctive surges of data are mapped onto separate parallel frequency channels.

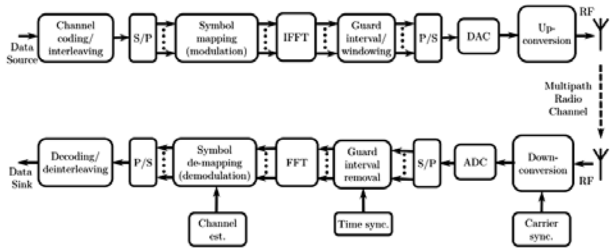


Figure 2.1 OFDM system

QAM-some flag which are recognized from each other in stage however are the greater part of a similar sufficiency. In every one of these individual systems the end purposes of the flag vectors in flag space falls on the periphery of a circle. Now authors have note that our ability to distinguished one signal vector from another in the presence of noise will depend on the distance between the vector end points. It is hence rather apparent that author shall be abe to improve the noise immunity of a system by allowing signal vectors to differ, not only in phase but also in amplitude. creators call this as adequacy and stage move keying or Quadrature sufficiency modulation (QAM).

It is obvious that there are many possible combinations of parameters to obtain a channel description. A set of 6 typical channels was selected for the three terrain types that are typical of the continental US . These Models can be used for simulations, designs, development and testing of technologies suitable for fixed broadband wireless applications. In an ordinary atomic activities lifecycle, it is regularly important to close down the reactor for support, restoration, or because of an overflow of electrical power available. Following the shutdown, a reactor is typically put in one of the shutdown states, for example, Over poisoned Ensured Shutdown State (OPGSS), or took back to criticality.

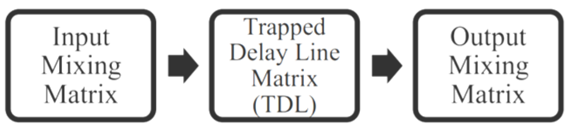


Figure 2.2 SUI channel model

Error rate - In the absence of interface from non systematic noise sources received signal fading is the primary factor affecting the BER performance of the indoor radio propagation channel. By the selection of an indoor venue which offers a static measurement environment, and therefore provides a constant received signal levels in the absence of motion, it has been possible to determine the affect of fading and interference on BER for the indoor channel with data transmission rates up to 8 megabits. The upper limit of 8 megabits being for QAM modulation at the 4 mega symbol.

The X is an estimation parameter that is expressed as a % rms esteem and a % top esteem .it is often convenient to think of physical data in term of a static or time invariant component and a dynamic or fluctuating component. the equation mean (x) are given by,

$$x = -\frac{lim \sum_{j-1}^{n} X_j}{N \to \infty N}$$

## III. PROPOSED METHODOLOGY

A Novel SNR Utilization for OFDM Wireless Communication System using PPE and SUI Channel Model has been proposed in this work 8 and 16 QAM modulation are derive in OFDM system operations.

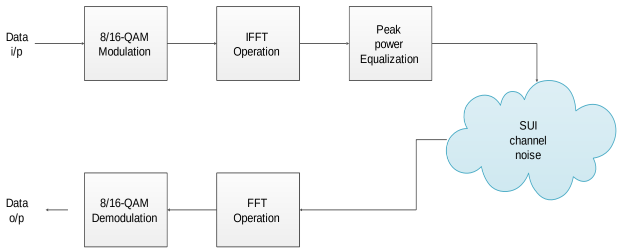


Figure 3.1 block diagram of 8 and 16 QAM modulation and demodulation

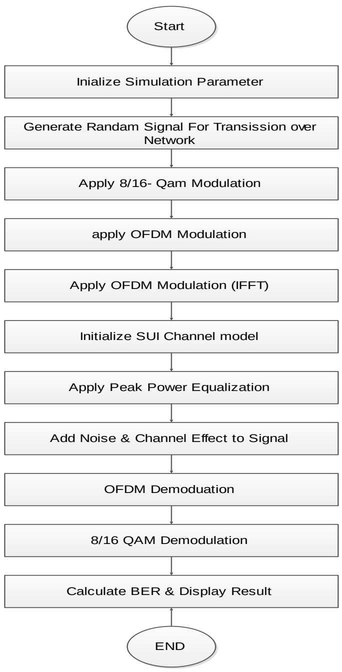


Figure 3.2 flow chart of 8 and 16 QAM modulation and demodulation

In figure 3.2 show the flow chart diagram .in flow chart derive the step by step operations .firstly initialize simulation parameters than generate the signal transmission. So apply the 8 and 16 QAM modulation. Then provide the OFDM modulation. after the modulation the modulation signal are derive in the SUI channels. Than in SUI channel apply the peak power equalization. In the SUI channel add the noise and the channel effect to signal . than start the 8/16 QAM ODFM demodulation process. After demodulation than calculate bit error rate and display results.

## IV. SIMULATION RESULTS

Fig. 4.1 below shows peak SNR equalization of OFDM system using the SUI channel and 4 quadrature amplitude modulation (QAM) for different peak power equalization levels. In peak SNR equalization the peak power equalization levels μ=6,7,8 that the bit error rate value are same.

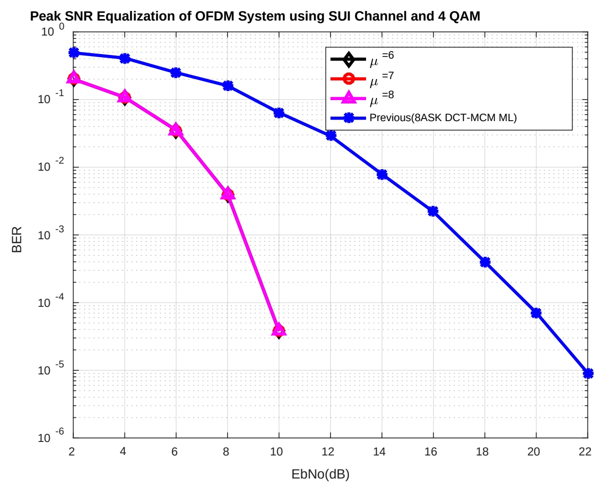


Fig.4.1 BER comparison for different peak power equalization levels $\mu$ and 4-QAM modulation

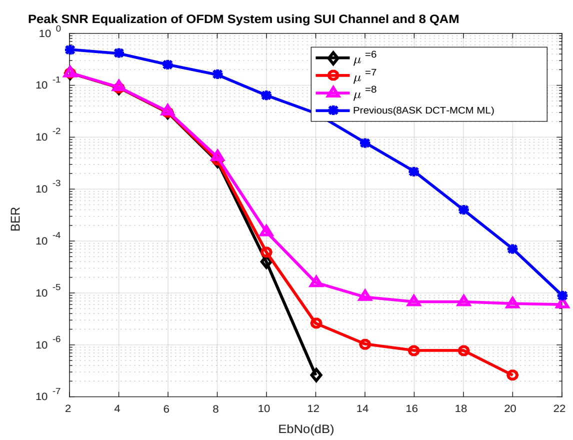


Fig.4.2 BER comparison for different peak power equalization levels $\mu$ and 8-QAM modulation

Figure 4.2 below shows peak SNR equalization of OFDM system using the SUI channel and 8 quadrature amplitude modulation (QAM) for different peak power equalization levels. In peak SNR equalization the peak power equalization levels the bit error ratio are increases with the value are increase μ.

Figure 4.3 below shows peak SNR equalization of OFDM system using the SUI channel. in 16 quadrature amplitude modulation (QAM) for different peak power equalization levels. In peak SNR equalization the peak power equlization levels the bit error ratio are same with the value are increase μ.

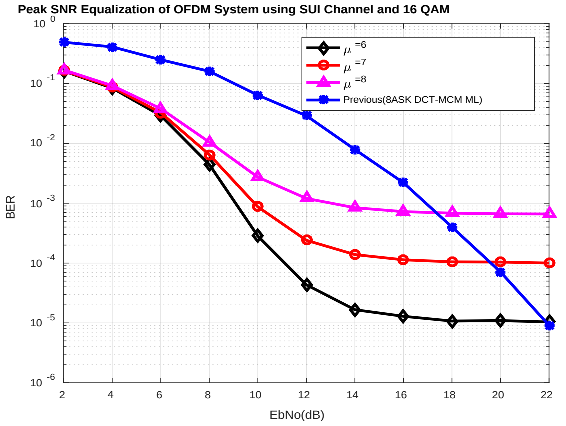


Fig.4.3 BER comparison for different peak power equalization levels $\mu$ and 16-QAM modulation

Table 4.1 below shows the various parameters SNR range and BER levels in previous system and proposed system.

Table:4.1 Simulation Parameters for System

| ***Parameters*** | ***Previous System*** | ***Proposed System*** |
|---|---|---|
| *Wireless Channel Model* | Rayleigh Fading Channel | SUI Channel |
| *Modulation Scheme* | 8-ASK | 8-QAM, 16-QAM |
| *Equalization Method* | Maximum Likelihood (ML) | Peak Power Equalization (PPE) |
| *Transforms* | Discrete Cosine Transform (DCT) | Fast Forier Transform (FFT) |
| *SNR Range* | 5-22 dB | 2-22 dB |
| *Optimum BER* | 9.1 x $10^{-6}$ | 2.8 x $10^{-7}$ (8-QAM) 9.1 x $10^{-6}$(16-QAM) |
| *Optimum SNR* | 22 dB | 12 dB (8-QAM) 18 dB (16-QAM) |

Table: BER Vs SNR Comparison

| SNR | Previous (8-ASK) | Proposed (16-QAM) | Proposed (8-QAM) |
|---|---|---|---|
| 2 | 4.90 x $10^{-1}$ | 1.61 x $10^{-1}$ | 1.74 x $10^{-1}$ |
| 4 | 4.10 x $10^{-1}$ | 8.41 x $10^{-2}$ | 9.04 x $10^{-2}$ |
| 6 | 2.50 x $10^{-1}$ | 2.91 x $10^{-2}$ | 2.96 x $10^{-2}$ |
| 8 | 1.60 x $10^{-1}$ | 4.40 x $10^{-3}$ | 3.42 x $10^{-3}$ |
| 10 | 6.40 x $10^{-2}$ | 2.9 x $10^{-4}$ | 3.78 x $10^{-5}$ |
| 12 | 2.90 x $10^{-2}$ | 3.96 x $10^{-5}$ | 2.81 x $10^{-7}$ |
| 14 | 7.90 x $10^{-3}$ | 1.54 x $10^{-5}$ | - |
| 16 | 2.20 x $10^{-3}$ | 1.09 x $10^{-5}$ | - |
| 18 | 4.00 x $10^{-4}$ | 1.03 x $10^{-5}$ | - |
| 20 | 7.10 x $10^{-5}$ | 1.07 x $10^{-5}$ | - |
| 22 | 9.10 x $10^{-6}$ | 9.70 x $10^{-6}$ | - |

Graphical representation of table 4.1 has been given in Figure 4.4. BER Bar Chart Comparison of the System Performance.

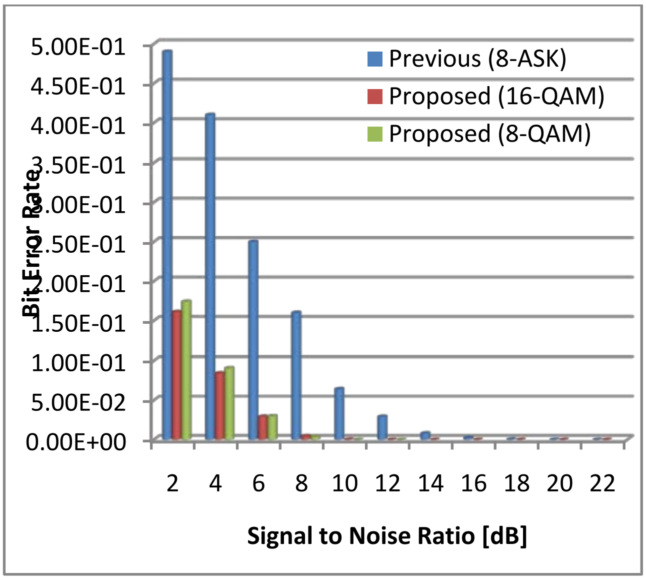


Fig.4.4 BER Bar Chart Comparison of the System Performance

## V. CONCLUSION AND FUTURE SCOPES

In this study, all the simulation results in this paper are computed for OFDM. The performance of OFDM system in transmission over the SUI channel catches up with the same with AWGN channel. The performs observed in SUI against AWGN channel even better sometimes. Hence, with SUI channel modelling, it is possible to get better performance compared to AWGN channel. AWGN is not a suitable model for many terrestrial links due to interference and multipath terrain blocking but SUI model considers these effects. Hence, SUI channel model is a more practical model as compared to the ideal AWGN model and the proposed system shows that its performance in the practical scenario is similar to the ideal case. Due to advantages peak cancellation of symbol in OFDM, overall performance of OFDM system is enhanced. Thus it is recommended for future real time system implementation.

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