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Data Transmission through OFDM System by using Discrete Wavelet Transform Techniques

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Absract-- *The efficient use of data transmission is main problem in advanced type communication systems. Many technologies are used for higher data rates, in this process the OFDM system plays main role compared to the technologies. The OFDM system is one type of multicarrier modulation technique, in this system the original signal can be divided into many number sub carriers. The same process is also done in other type of modulation techniques, but in OFDM system orthogonality condition is existed between the subcarriers. In OFDM system two types of interferences will be there, they are Inter Carrier Interference (ICI) and Inter Symbol Interference (ISI) and these are occurred due to the orthogonality loss between the subcarriers, to overcome this problem cyclic prefix (CP) is used. CP is a guard band in OFDM system that uses 20% of required subcarrier. Wavelet based OFDM system provides better orthogonality between subcarriers. Signal to Noise Ratio (SNR) of the message signal improved by the wavelet transform techniques. Wavelet based OFDM system doesn't require cyclic prefix, so bandwidth can't be wasted. Compare the obtained results of 16QAM, 64QAM and 256 QAM with conventional DFT method. This is the one advantage to improve the utilization of the spectrum. OFDM system based on wavelet transform is proposed in the place of Discrete Fourier Transform (DFT) based OFDM in LTE. Comparing performance of Bit Error Rate (BER) in wavelet transform based techniques with DFT based OFDM.*

Keywords- *OFDM, FFT, DWT Families [Haar, DB, Biorthogonal], BER, SNR,LTE.*

I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) could be a band wireless data communication technique that's supported block modulation. With the wireless multimedia system applications changing into a lot of and a lot of in style, the desired bit rates area unit achieved thanks to OFDM multicarrier transmissions. Multicarrier modulation is usually utilized to combat channel distortion and improve the spectral potency. Multicarrier Modulation schemes divide the computer file into bands upon that modulation is performed and multiplexed into the channel at totally different carrier frequencies so info is transmitted on every of the sub carriers, specified the sub channels area unit nearly distortion less. In typical OFDM system, IFFT (Inverse quick Fourier Transform) and FFT (Fast Fourier Transform) area unit accustomed multiplex the signals along and rewrite the signal at the receiver severally. During this system, the Cyclic Prefix is added before transmittal the signal to channel. However in moving ridge based mostly transmission technique has stronger ability of suppressing Directorate for Inter-Services Intelligence and ICI than the traditional OFDM theme. Two types modulation schemes area unit employed in this paper that is typical and non-convention modulation schemes. BPSK, QPSK and QAM area unit the elements of typical modulation schemes whereas Differential BPSK and Differential QPSK area unit the non-conventional modulation schemes. BPSK is that the one among the best sorts of digital modulation. The part of the constant amplitude carrier signal moves between zero and one hundred eighty degree. Differential PSK could be a non coherent kind of part shift keying that avoids the necessity for a coherent reference signal at receiver.

II. RELATED WORK

1. Zahraa Abd El Hamid discusses about interleaving process for the examination of OFDM system with FFT and DWT techniques. One new interleaving process is used for effective use data transmission over various types of fading channels that is chaotic baker maps. Before the modulation method the binary data is interleaved with the proposed method. In order to reduce the channel problems on the data of transmission, this method adds amount of encryption to the data transmitted signal. Chaotic maps exhibits very strong interleaving process, it is used for minimize the channel effects without a need for difficult coding techniques for detection of error.

2. K. Abdullah and Z. M. Hussain had discussed on performance of OFDM system with FFT and DWT techniques. The OFDM system with DWT transform getting best results compare to the OFDM system with FFT transform presence of AWGN channel. The gain (ratio of energy per bit to noise) of the system is increased by 5dB when the system uses HAAR transform in place FFT transform in AWGN channel. In this process a

cyclic prefix (CP) occupy 25% of total symbol period of the OFDM system, at this time same BER of 0.001 is presented.

3. A. A. Labade, G. V.Lohar P. R. Dike N. N. Pachpor had study about wavelet based techniques and how to improve the spectrum efficiency by using wavelet techniques. IFFT and FFT transform techniques are used in conventional OFDM scheme to maintain the orthogonality, but in this method a unit circle with only N points in Z plane. Interference is obtained between the sub channels by sampling frequency changes because of this impairment the performance of the OFDM system decreases.

III. EXISTING METHOD

A. *Fourier Transform Based Channel Estimation*

DFT is used at the same time as Associate in nursing correct interpolation technique methodology frequency domain once the orthogonality between coaching sequences is predicated on the transmission of scattered pilots.

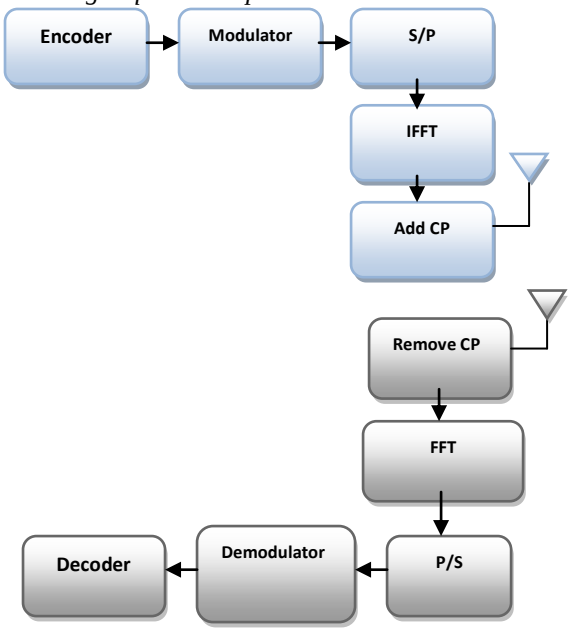

Fig: Block Diagram: FFT Based OFDM

In received signal constellation before and when channel compensation for the OFDM system with 16-QAM, illustrating the result of channel estimation and compensation Here; illustrates the channel estimates obtained by victimization LS- linear, LS-spine and MMSE channel estimation ways with and while not DFT technique and divulges that the DFT-based channel estimation technique improves the performance of channel estimation.

IV. PROPOSED METHOD

Wavelet Based Channel Estimation

A riffle may be a little piece of a wave. Wherever a curved wave as is employed by Fourier transforms carries on continuance itself for eternity, a riffle exists solely inside a finite domain, and is zero-valued elsewhere.

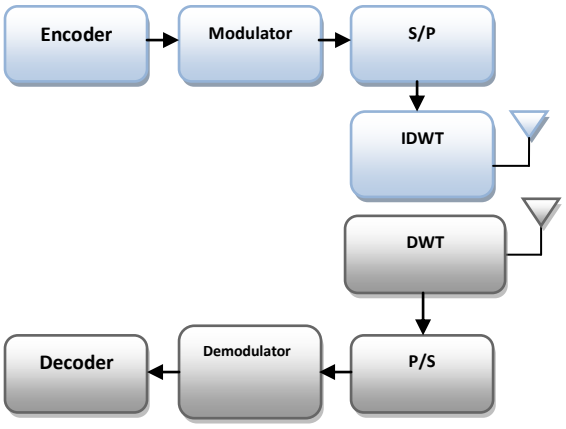

Fig: Block Diagram: DWT Based OFDM

A riffle rework involves convolving the signal against explicit instances of the riffle at varied time scales and positions. Hence, riffle rework as a joint time-frequency domain. The everyday application fields of wavelets area unit like physical science, acoustics, engineering science, sub-band secret writing, signal and image process. There area unit some sample applications characteristic pure frequencies, De-noising signals, detective work discontinuities and breakdown points, detective work self similarity and pressing samples.

A. HAAR

Alfréd Haar was invented first DWT technique and he was Hungarian mathematician. The input is denoted as a list of 2^n numbers, the Haar Wavelet Transform (HWT) can be taken as two values of input, the difference of these symbols can be stored and transient the sum. This method is recursively repeated, pairing up the sums to prove the next scale, which leads to $2^n - 1$ differences and a final sum. In mathematics, the wavelet family is formed by the function of rescaled "square-shaped" sequence in Haar wavelet. The analysis wavelet process is same as Fourier analysis but in the wavelet method allows particular function over time period to be signified in form of orthogonality condition between subcarriers

B. Daubecheis

The Daubechies wavelets are based on the Ingrid Daubechies function. Family of orthogonal wavelets defining a discrete wavelet transforms and categorized by a more number of vanishing moments for some given support. Father wavelet has scaling function for each wavelet type of this class, which generates an orthogonal multi-resolution analysis.

C. Bi-orthogonal

A biorthogonal wavelet is a wavelet where the associated wavelet transform is invertible but not necessarily orthogonal. More degree of freedom occurs in the design of biorthogonal wavelets than orthogonal wavelets. For constructing symmetric wavelet functions one degree of freedom is required. Two scaling functions Φ, $\tilde{\Phi}$, are available in the biorthogonal case, which may produce different multi-resolution analysis, and therefore two various wavelet functions ψ, $\tilde{\psi}$. So the numbers M and N of coefficients in the scaling sequences α, $\tilde{a}$ may differ.

V. RESULT ANALYSIS

BER PERFORMANCE EVALUATION

A. HAAR : In the HWT the input values are taken by the list of numbers and these numbers are taken pair up input values, passing the sum and storing the difference. The same procedure is repetitive recursively, getting the next scale value by pairing up the sums, finally resulting in differences and one final sum. The HWT is an effortless form of compression in which reconstruct the matrix this matrix is similar to the initial matrix and eliminates unwanted data, storing detail coefficients of signal and also differencing values.

The simulation results of HWT is shown in the form of graphical representation BER vs SNR is given by,

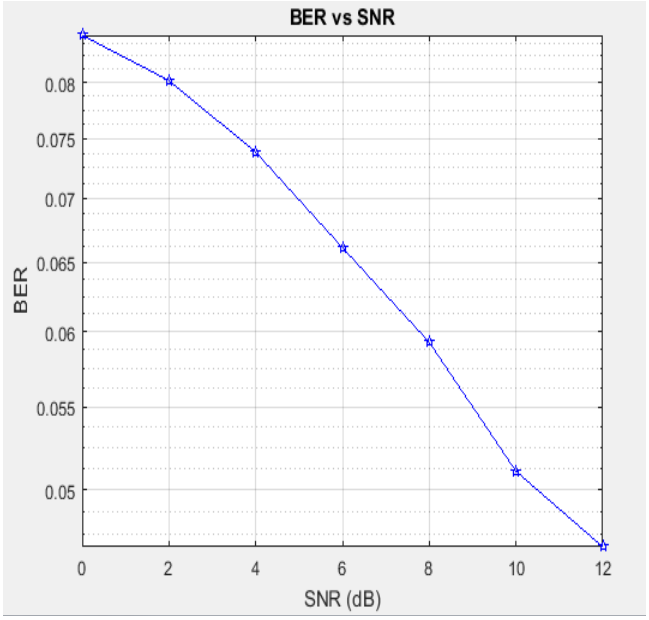

Fig: 16QAM Modulation on HAAR Transform on OFDM Channel

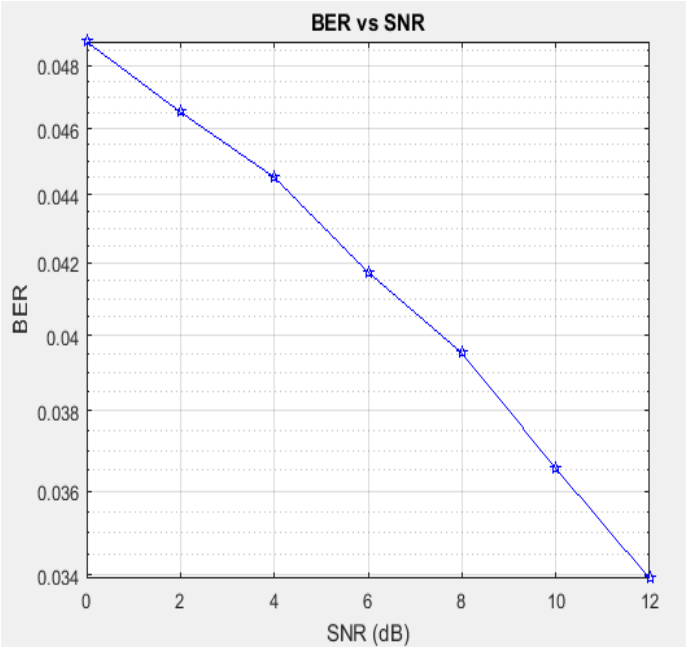

Fig: 64QAM Modulation on HAAR Transform on OFDM Channel

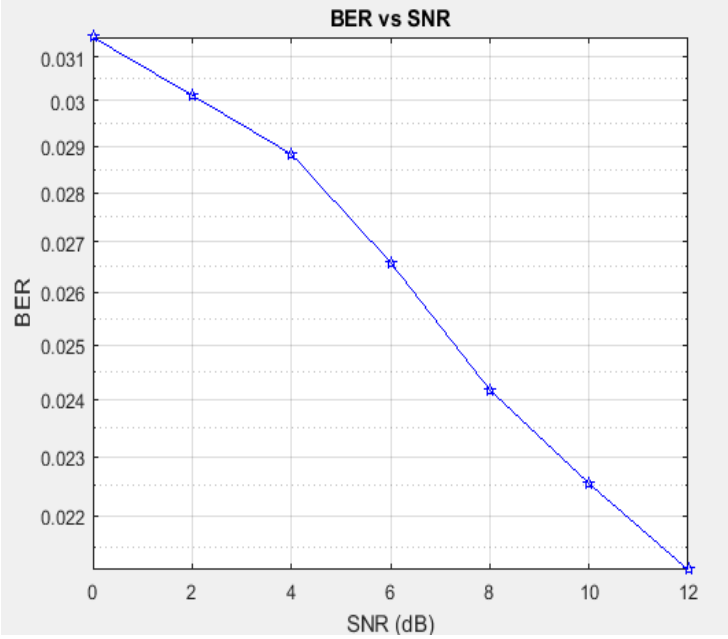

Fig: 256QAM Modulation on HAAR Transform on OFDM Channel

B. Daubechies

Ingrid Daubechies, is best mathematician doing research on wavelet transform, daubechies wavelets are generally supported orthonormal wavelets -- thus assembly forms discrete wavelet process practicable. Daubechies wavelets are denoted as db N, where, N is the order, and db is the wavelet "surname". The HWT is known as db1 wavelet. Here nine types of wavelet functions are defined and they are: DB2; DB3; DB4; DB; DB6; DB7; DB8; DB9; DB10.

The simulation results of daubechies wavelet transform are getting by MATLAB software and these results are shown in the graph of BER vs SNR is given by,

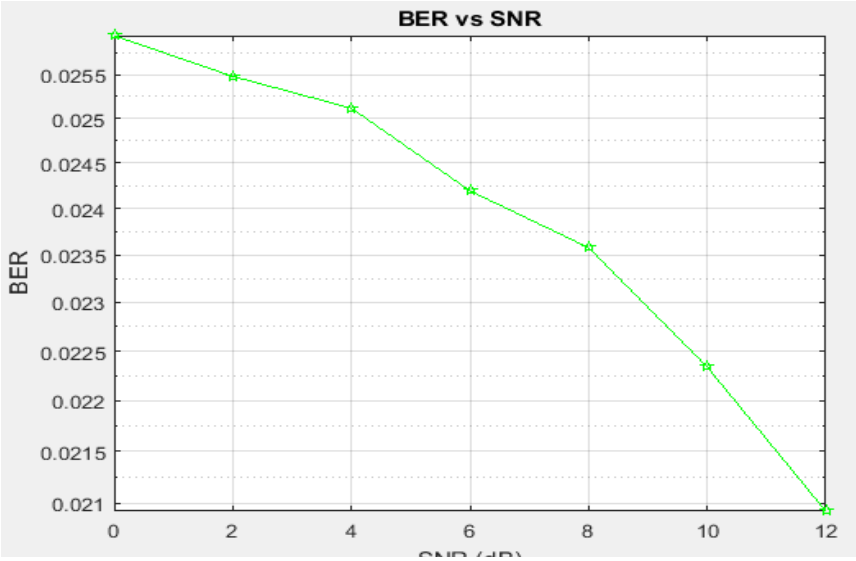

Fig: 16QAM Modulation on Daubechies Transform on OFDM Channel

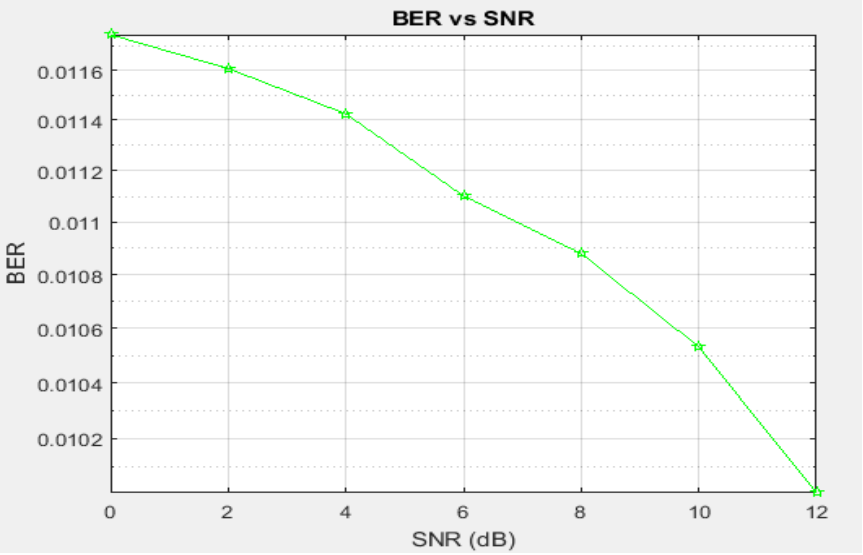

Fig: 64QAM Modulation on Daubechies Transform on OFDM Channel

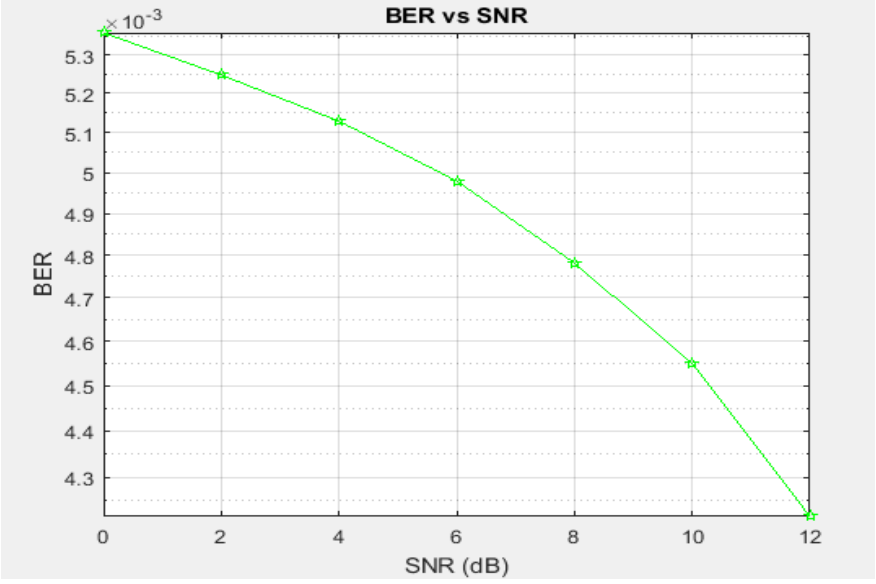

Fig: 256QAM Modulation on Daubechies Transform on OFDM Channel

C. Biorthogonal

The linear phase property is existing in these types of wavelets, this process is used for reconstruction of the signal and image. In this 2 wavelets are used, one is used at left side for decomposition and another one is used at right side for reconstruction in place of single one, types of bi-orthogonal wavelets are defined as follows. They are Bior1.3; Bior1.5; Bior2.2; Bior2.4; Bior2.6; Bior2.8; Bior3.1; Bior3.3; Bior3.5; Bior3.7; Bior3.9; Bior4.4; Bior5.5; Bior6.8

a. Step1: Column wise process to urge H and L

H = ($C_o - C_e$), L = (C_e + H/2) Where C_o and C_e is expressed as odd and even columns of pixel values.

b. Step 2: Row wise process to urge LL,LH,HL and HH

Separate the even and odd rows of H and L, defined as, H_{odd} – odd row of H, L_{odd} - odd row of L, H_{even} - even row of H,L_{even} – even row of L.

LH = L_{odd} - L_{even} LL = L_{even} + (LH / 2)

HL = H_{odd} – H_{even} HH = H_{even} + (HL /2)

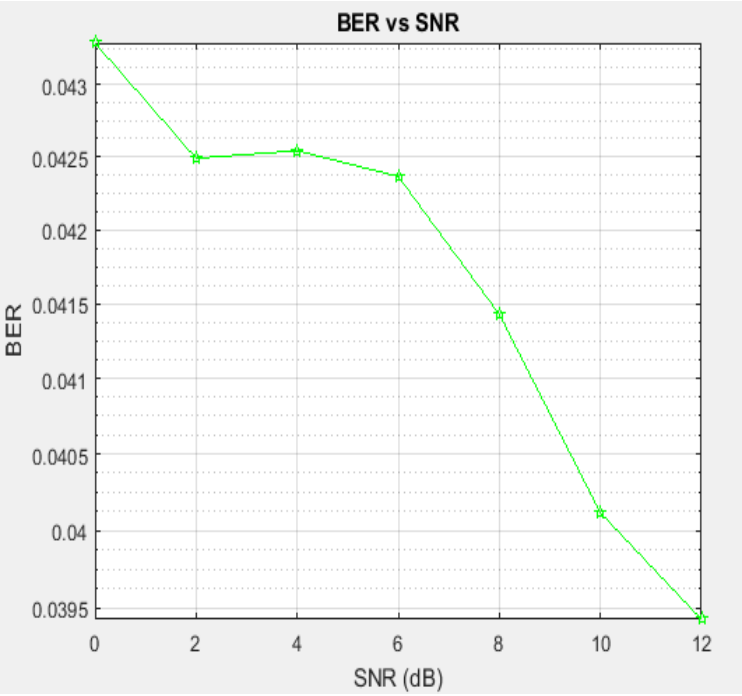

Fig: 16QAM Modulation on Biorthogonal Transform on OFDM Channel

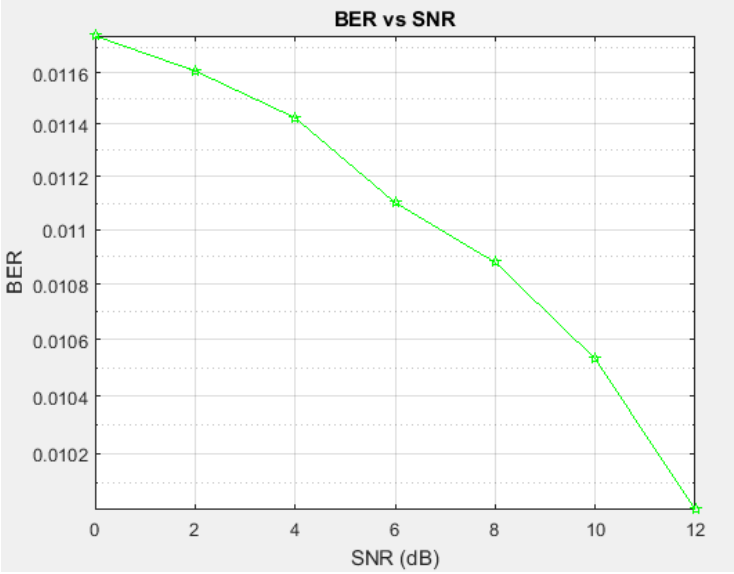

Fig: 64QAM Modulation on Biorthogonal Transform on OFDM Channel

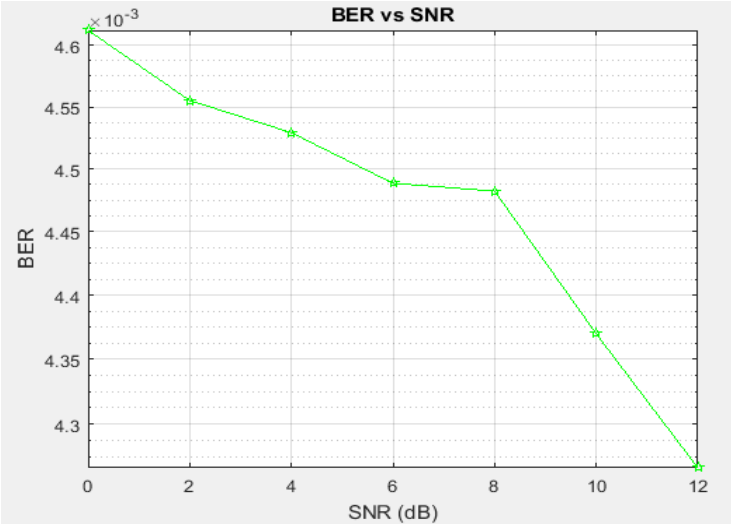

Fig: 256QAM Modulation on Biorthogonal Transform on OFDM Channel

D. Modulation

It is available in both an analogy and a digital modulation scheme. It conveys two digital bit streams, by changing the amplitudes of two carrier waves, using the amplitude-shift keying (ASK) in digital modulation method or amplitude modulation (AM) in analog modulation.

MODULATION	Bits/Symbol	Symbol Rate
BPSK	2	1/2(0.5)
QPSK	4	1/4(0.25)
QAM-8	8	1/8(0.125)
QAM-16	16	1/16(0.0625)
QAM-64	64	1/64(0.015625)
QAM-256	256	1/256(0.00390625)

In QAM method, the points on constellation diagram lies equally on vertical and horizontal axis in the form square grid. Constellation points of QAM equal to power of 2 i.e. 4, 16, 64 . . . . Higher order modulation schemes are used more number of constellation points for transmitting huge number of bits per symbol. In higher order modulation methods the points are very closer by this process noise and data errors occur easily. Generally a QAM constellation points are existed as power of 2 and therefore frequently used methods are QAM, 16QAM, 64QAM and 256QAM.

Compare the simulation results of various modulation methods by MATLAB software of OFDM scheme with DFT and OFDM scheme with wavelet transform, this process is useful in LTE schemes. The various types of modulations techniques that are classified as QPSK, 16 QAM and 64 QAM. In QPSK method very high speed of data can't be occur. Advanced type of modulation methods are used for getting the SNR of the signal is high. The SNR value can't be useful in lower types of modulation techniques (QPSK)

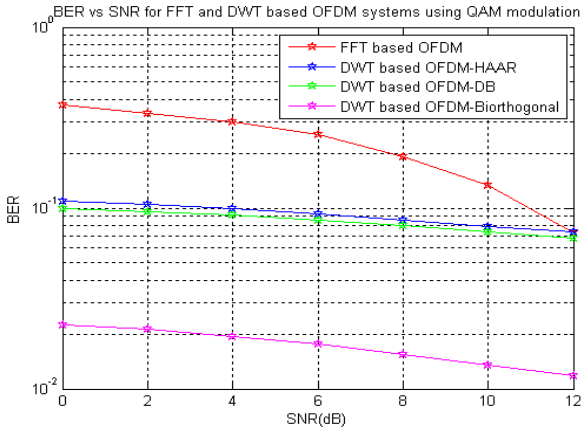

Fig:Comparison Analysis of FFT vs. Wavelet for HAAR; DB; Biorthogonal Process Using 16QAM

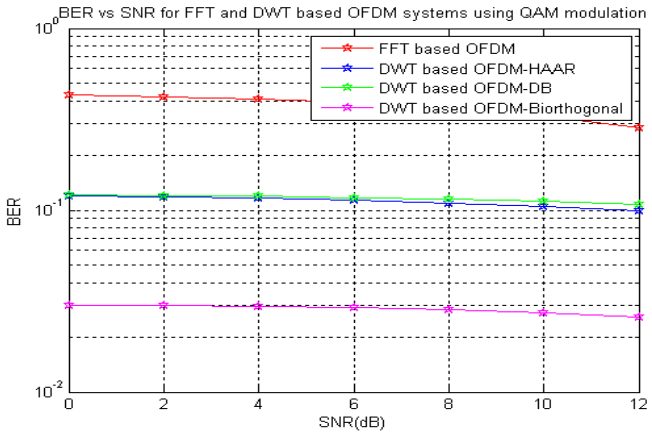

Fig:Comparison Analysis of FFT vs. Wavelet for HAAR; DB; Biorthogonal Process Using 64QAM

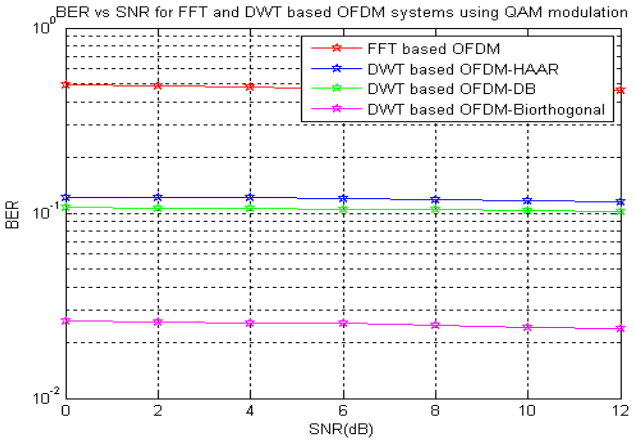

Fig:Comparison Analysis of FFT vs. Wavelet for HAAR; DB; Biorthogonal Process Using 256QAM

VI. CONCLUSION

SNR has been improved by the Wavelet Transform based Techniques compared with conventional FFT based OFDM. In this process 3 types of modulation methods are used for implementation of QPSK, sixteen QAM and 256 QAM, which are employed to LTE. Primarily at low SNR, the system achieves 1 bit per symbol, i.e., BPSK. However, in higher types of modulation techniques the system attains more number of bits like 64QAM, 256QAM according to switching level and estimated SNR. Here, the SNR is improved by three different techniques they are haar, daubechies2 and biorthogonal wavelets, each one shows better results compared to the conventional IFFT based OFDM.

REFERENCES

[1] Zahraa Abd El Hamid, "FFT/DWT/DCT OFDM Channel Estimation using EM Algorithm in the presence of Chaotic Interleaving," Egypt, 28 March 2013.
[2] K. Abdullah and Z. M. Hussain, "An Optimal Circular 16-QAM Modulation Technique for Wavelet and Fourier Based OFDM," 11-13 May 2010, Kuala Lumpur, Malaysia.
[3] A. A. Labade, G. V.Lohar P. R. Dike N. N. Pachpor, "Spectral Efficiency Enhancement Through Wavelet Transform (WT) for 5G," SIT, Lonavala, 2014.
[4] Yun-Nan Chang et al, "An Efficient Pipelined FFT Architecture," Analog and Digital Signal Processing, VOL. 50, NO. 6, JUNE 2003.
[5] G.L. Tuber, J.R. Barry, S.W. McLaughlin, Ye Li, M.A. Ingram and T.G. Pratt, "Broadband MIMO-OFDM wireless communications," Proceedings of the IEEE, vol. 92, No. 2, pp. 271-294, February. 2004.
[6] S. Adhikari, S. L. Jansen, M. Kuschnerov, B. Inan, and W. Rosenkranz, "Analysis of spectrally shaped DFT-OFDM for fiber nonlinearity mitigation," Opt. Express, to be published.
[7] Jan-Jaap van de Beek, O.Edfors, and M.Sandell, "On channel estimation in OFDM systems," Presented at in proceedings of Vehicular Technology, Chicago, pp. 815-819, 1995.

