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Channel Estimation with Improved OFDM

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ABSTRACT:.In this paper channel estimation for orthogonal frequency division multiplexing (OFDM) is presented. This channel estimation employs two training symbol in combination with polynomial fitting thus to get accurate estimation result. Channel estimation is mainly performed by sending pilot from the transmitter and measuring the pilot at the receiver side. A sufficient amount of pilot needs to be transmitted in order for the receiver to obtain a reasonably accurate estimate of the channel response. Simulation result is also represented. Simulation makes the study of OFDM processing very easy. By simply taking the values of SNR, we can easily observe.

KEYWORDS: OFDM, CFO estimation, Channel estimation, Bit error rate (BER), Training symbols.

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is a novel technology which stands as a promising choice for future data rate system. This technology has been adopted in European digital audio broadcasting and video broadcasting system. It has high spectral efficiency transmission scheme. Currently OFDM is widely used in wireless communication because of its high transmission rate and high bandwidth efficiency. It divides wideband signal into many orthogonal subcarriers and induces a symbol period .Orthogonal frequency division multiplexing (OFDM) is a method of encoding the digital data on multiple carrier frequency. The channel response might change during an OFDM symbol period in a high-mobility environment therefore, the orthogonality among the subcarriers destroys [4] currently, and multicarrier transmission is popular because of its high data transmission rate. Orthogonal frequency-division multiplexing (OFDM) is a special case of multicarrier transmission also considered an effective technique for frequency-selective channels because of its spectral efficiency and its robustness in different multipath propagation and its ability of combating inter symbol interference. One of the major drawback for OFDM system is carrier frequency offset (CFO). The OFDM systems are sensitive to the frequency synchronization errors in form of Carrier Frequency Offset (CFO) because it can cause the Inter Carrier interference which can lead to the frequency mismatched in transmitter and receiver .[2][3]

To overcome the problem of Carrier frequency offset (CFO) which degrades the performance of OFDM subcarriers various techniques are proposed to estimate CFO so that to get accurate estimation results.

Carrier frequency offset which creates following factors [4]

1. Frequency mismatched in transmitter and receiver oscillator.
2. Inter carrier Interference (ICI)

EFFECT OF FREQUENCY OFFSET ON OFDM SIGNALS

When CFO happens, it causes the receiver signal to be shifted in frequency [4]

So difference occur between the carrier frequency at the receiver with that of at the transmitter, this difference is called Frequency offset (CFO)

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Frequency offset = $f_c - f_{C'}$

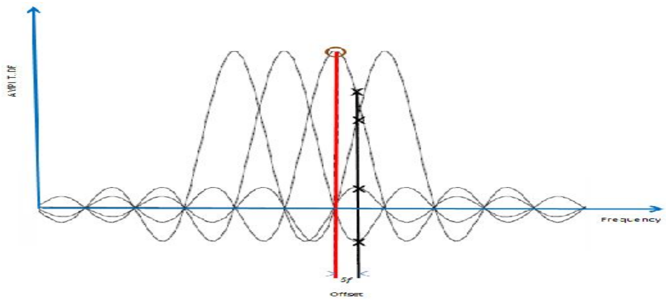

Fig.2 Frequency offset

Where f_c is the carrier frequency in the transmitter and f_c` is the carrier frequency in receiver.

II. RELATED WORK

In[7] authors tells about OFDM system related wok ,how OFDM works ,what are drawbacks in system. Carrier frequency offset is the main drawback in OFDM system, which imbalance the orthogonality among the subcarriers of OFDM , for that CFO estimation takes place[1].Channel estimation is the main part of our project, channel estimation takes place for the coherent detection of the received signal, pilots based channel estimation takes place[3].Authors explained different types of channel estimation techniques in[3].two type of pilots description is explained by authors in[4] 1.BlockType 2.Comb Type. Polynomial fitting for channel estimation is explained in [5].

III. SYSTEM OVERVIEW

In OFDM system the sub carriers are orthogonal to each other, so the cross talk between the sub channels is eliminated. OFDM orthogonality allows for efficient modulator and demodulator implementation using Fast Fourier Transform (FFT) algorithm at the receiver side and Inverse Fast Fourier Transform (IFFT) at the transmission side .Fig 3 shows the block diagram of OFDM system.

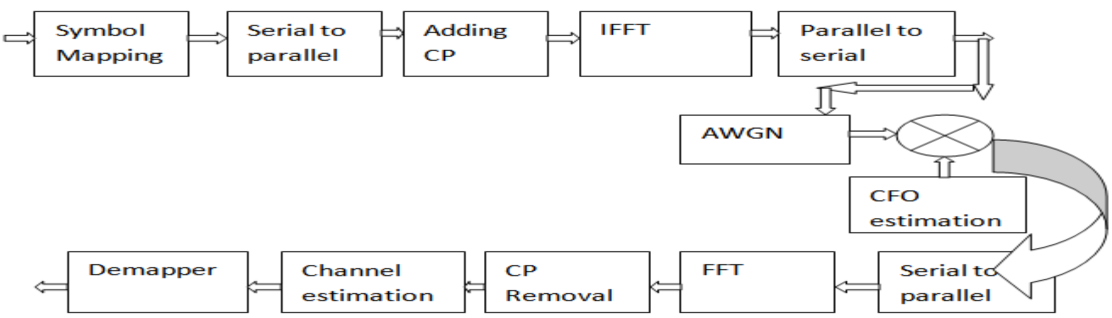

Fig.3.OFDM System

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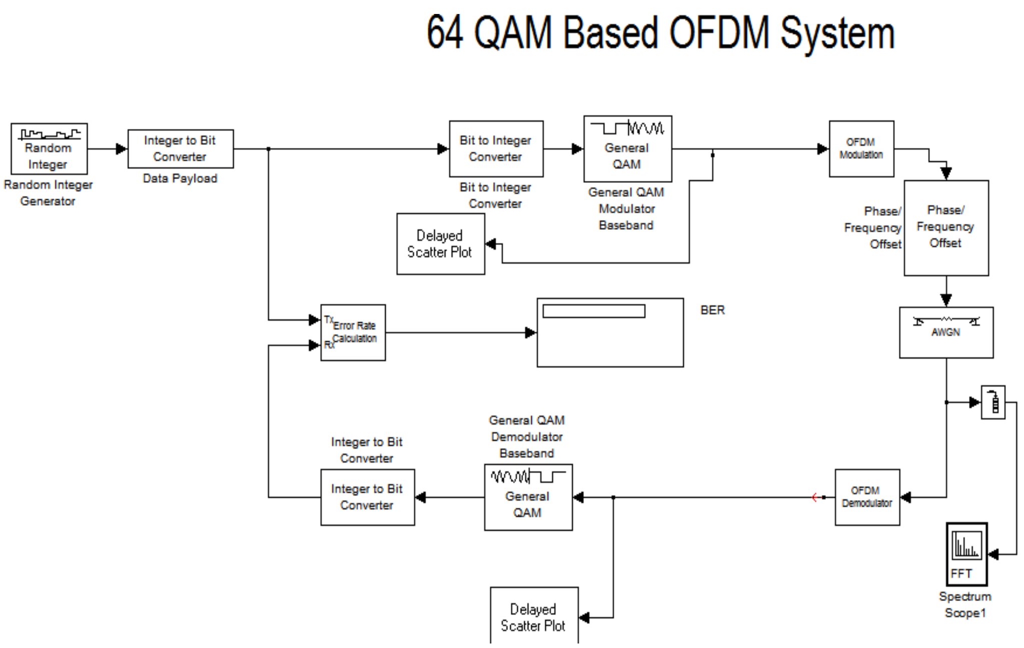

Fig 4.simulink model for 64 QAM

Parameters for channel estimation

Sr .No	Parameters	Specification
1.	IFFT Size	64
2.	Carriers	4
3.	Word Size	2
4.	Guard Type	1
5.	Data Averaging	1
6.	pilots	8
7.	Code Length	1000

Table 1

IV. PILOT BASED CHANNEL ESTIMATION

The most important part of the receiver structure in OFDM is channel estimation .Channel estimation is actually a coherent detection of the received signal. Channel estimation in OFDM is usually performed with the aid of pilot symbol. For pilot based channel estimation pilots spacing is to be determined carefully and also pilots are multiplexed with data.

In data aided channel estimation, known information to the receiver is inserted in OFDM symbols so that channel can be estimated, sending known information together with data called as pilot aided channel estimation.

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V. EXPERIMENTAL RESULT

Simulation is done in MATLAB. The input bit stream is randomly generated at the transmitted. Fig 5 shows randomly generated input sequence. Fig 6 shows transmitted sequence.

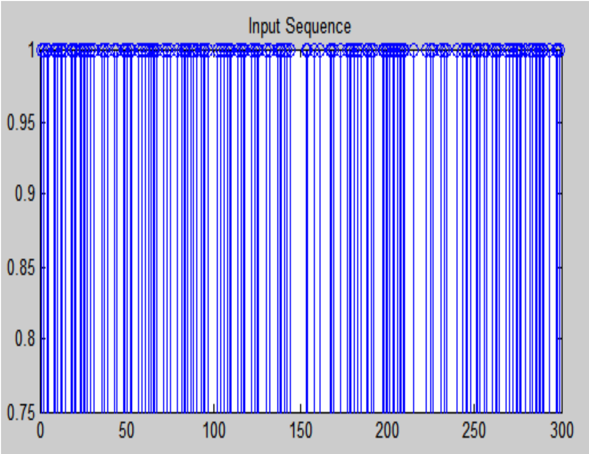

Fig 5.Input sequence to OFDM system

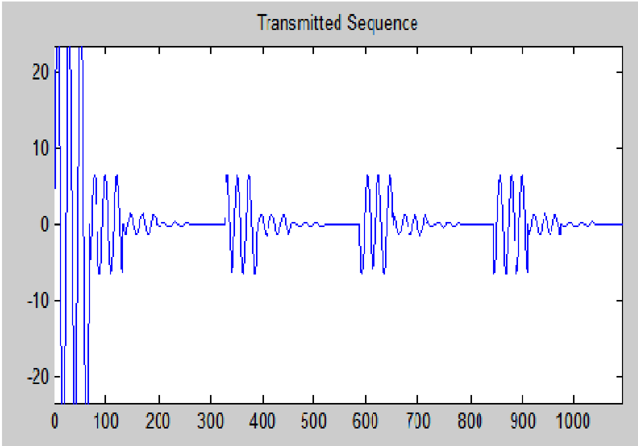

Fig6.Transmitted Sequence

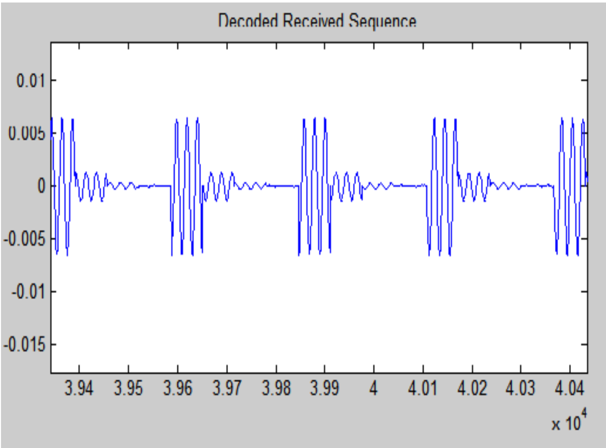

Fig7.Decoded Received Sequence

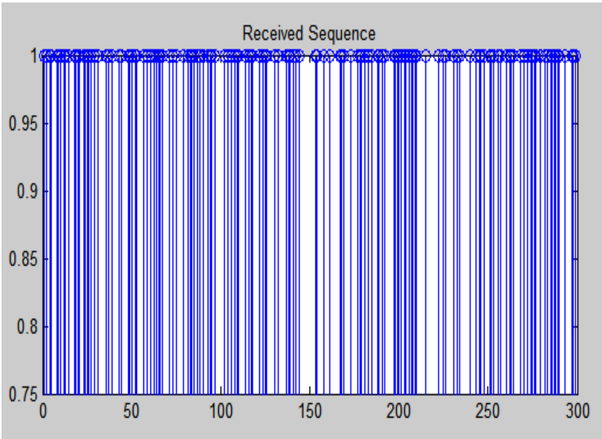

Fig.8 Received Sequence

Fig 7 shows decoded sequence, decoding is done to get original sequence.

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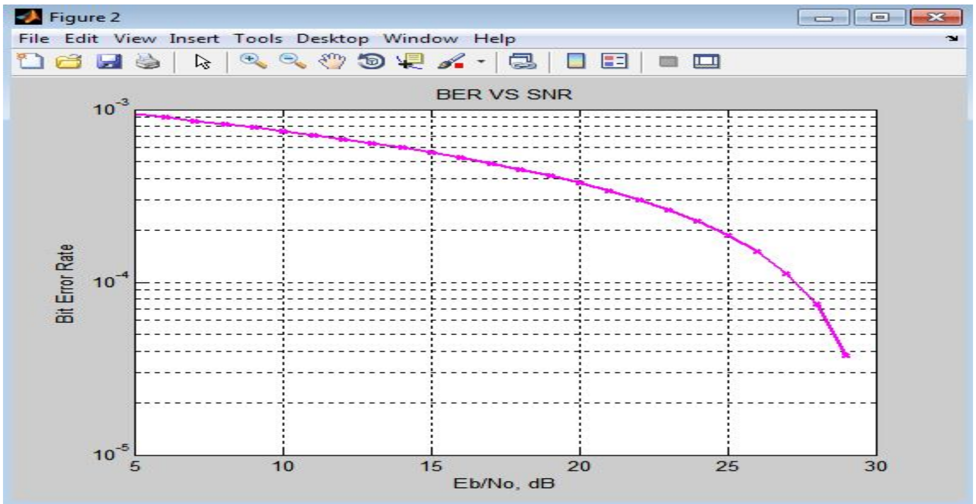
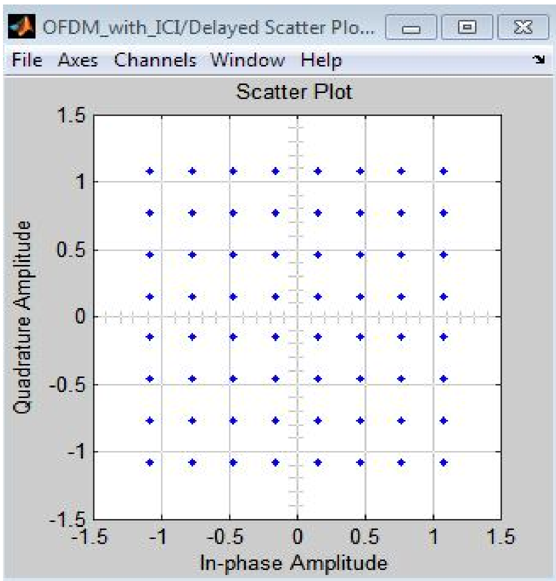


Fig 9.BER Curve

VI. OFDM SIMULATION RESULT

Simulation was performed to measure BER in M- ary QAM OFDM scheme. The transmitted and received Magnitude spectrum, OFDM frame and constellation diagram are represented..Fig10 shows constellation diagram of 64 QAM, after addition of noise we get scatter plot as shown in gig 11.Signal spectrum of 64 QAM is show in fig 13.



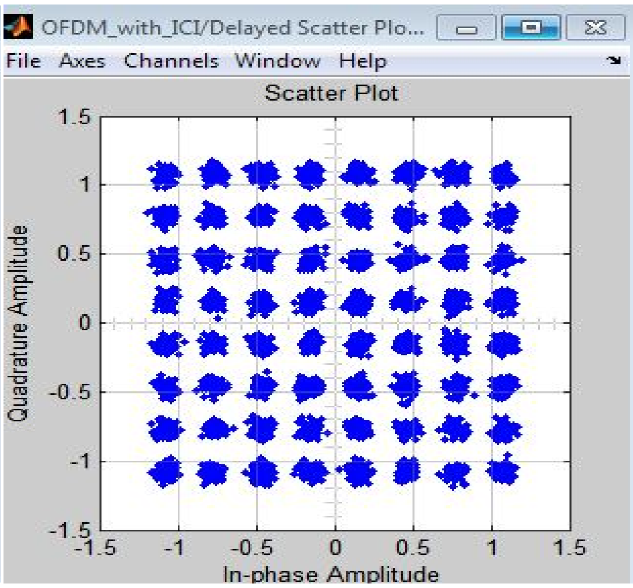


Fig 10.Constollaton diagram of 64 QAM

Fig 11.scatter plot

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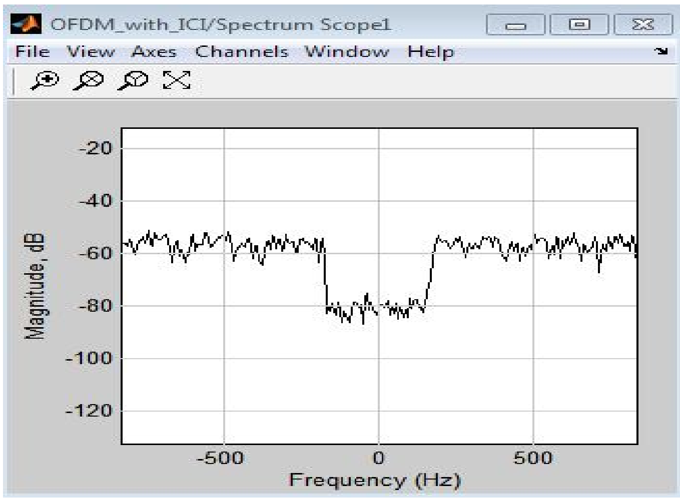

Fig 12.Spectrum of 64 QAM

VII. CONCLUSION

Here OFDM channel estimation is presented to get accurate estimation result, for improving system performance. The channel estimation is done in time domain and frequency domain. The frequency offset can estimate very closely with wide range to improve the system performance to a large extent.
Simulation results are also shown, simulation makes the study of OFDM processing very easy. By simply taking the values of SNR, we can easily observe.

REFERANCES

1. Yuping Zhao, Aiping Huang, "A novel channel estimation method for OFDM mobile communication systems based on pilot signals and transform-domain processing ," IEEE VTC , Vol. 3, May 2010.
2. "Carrier Frequency Offset estimation in OFDM System "Praween Kumar Nishad, P.Singh Proceedings of 2013 IEEE Conference on Information and Communication Technologies.
3. N. Lalan ,G. kumar pandey "Estimation and compensation and carrier frequency offset" (cfo)International Journal of Electrical, Electronic and Data Communication, ISSN: 2320-2084 Volume- 1, Issue- 8, Oct 2003
4. Saeed Mohseni and Mohammad A. Matin "Study of the estimation techniques for the Carrier Frequency Offset (CFO) in OFDM systems" IJCSNS International Journal of Computer Science VOL.12 No.6, June 2012
5. Md Faran, Pardeep Mor "Comparison of Different Channel Estimation Techniques in OFDM Systems" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-4, September 2012
6. Jan-Jaap van de Beek, Ove Edfors, Magnus Sandell "On channel estimation in OFDM system" Proceedings of Vehicular Technology Conference (VTC Ô95), vol. 2, Chicago, USA, September 1995.
7. Zijian Tang, Geert Leus, Paolo Banelli "Pilot-Assisted Time-Varying Channel Estimation for OFDM System" IEEE transaction on signal processing vol 55, No. 5, may2007