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DESIGNING OF IFFT-FFT OFDM USING DIFFERENT DIGITAL MODULATION TECHNIQUES

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Abstract: *Wireless communication enables the whole population to connect with the global audience. There were adopted due to their well-known advantages, such as higher providing services like SMS, WAP, GPRS services to mobile phone and also support analog and digital telephone networks as well as satellite phones. The overall performance is evaluated by using a modulation scheme called OFDM. In this project, a binary data is used to evaluate the functionality by using a new method of evaluation for OFDM signal reception under AWGN channel. Also, different configurations of modulation techniques such as QPSK, BPSK, PSK are considered. The valid conclusions are made from the comparison of different modulation techniques of FFT based OFDM in terms of spectrum efficiency. Finally we compute that IFFT-FFT OFDM using QPSK modulation technique over AWGN channel is the more efficient one.*

Index Terms - Orthogonal frequency division and multiplexing(OFDM),FastFourierTransform(FFT),Additivewhiteguassian noise(AWGN),QPSK,BPSK,PSK.

I. INTRODUCTION

Wireless communication which is also known as"over the air", is used to transfer the information or power between two or more than two points that are not joined by an electrical conductor. The most often wireless technologies use radio waves. The main aim of any wireless communication system is to serve good quality services to the customers. Providing high quality services to the customers means transmitting the data from the transmitter to the receiver by reducing the error or noise as small as possible.

In order to transmit and receive the data, we need a modulation scheme. There are many such modulation schemes out of which we have choosen OFDM which is one of the modern multicarrier modulation schemes. Orthogonal frequency division multiplexing is a digital signal modulation method in which minimizes the interference and crosstalk by dividing the single data stream into several separate narrowband channels at different frequencies.

The OFDM obeys the orthogonality principle by closely packing the subcarriers and reduce the inter carrier interference whereas in single carrier modulation schemes like FDM, the subcarriers are totally separated.

These subcarriers are generated by using FFT algorithm. The FFT based OFDM therefore reduces the inter symbol interference by using the cyclic prefix.

In this paper, we computed the results by passing the signal through IFFT-FFT OFDM using three modulation techniques ie., PSK, BPSK, QPSK by passing through the same channel.

II. LITERATURE REVIEW

R.Asif.R.A Abd-Alhameed and six other authors proposed their work on fast fourier transforms which suggest the use of fft which provides a better spectral efficiency. However, in the wavelet based multicarrier systems, the estimation of the channel is still a challenge for many. In their proposed work, they presented the performance of the discrete wavelet transform based multicarrier systems by using zero forcing equalization.

K.Abdullah and Z.M.Hussain proposed a work which includes zero-padding and vector transpose for transmitting the OFDM signal. Matlab simulation commands are also described.The mean amplitude for transmitting the signal, BER performance and many other parameters are also computed in this work.

M.M.Hasan proposed a work in which he examined the performance of FFT based multiuser

MIMO OFDM system. In his work, the performances of the OFDM system have been enhanced by using multiple antenna technique over Rayleigh fading channel SLR and an optimal beam forming technique is used to deal with the multi user environment based on Signal-to-Leakage Ratio(SLR).

A.Zaier and R.Bouallegue proposed their work in which they have focussed on various methods of time-frequency-selective fading channels estimation in OFDM systems which are improved under time varying conditions. However, different algorithms and schemes of modulations are used to study these different techniques. Those different modulation schemes can be 16QAM, BPSK, QPSK etc. Different schemes and algorithms gathered by the estimation of the channel. Out of these schemes and algorithms, some belongs for slowly time varying and others for highly time varying channels.

M.K.N.Umaria and P.K.Joshi proposed their work in which they mainly concentrated on the importance that is growing day by day for high performance, high capacity and high bit rate wireless communication systems to integrate wide variety of communication services like data with high speed, video and multimedia traffic and also voice signals. OFDM is a multicarrier system that provides an efficient means to handle high speed data streams over a multipath fading environment.

III. PROPOSED SYSTEM

In this paper, a binary data processing is done with IFFT-FFT based OFDM system using the PSK,BPSK,QPSK modulation schemes through AWGN channel and the results are compared among the three modulation techniques.

Results are compared in terms of different spectrum analysis using different modulation techniques and finally computing the best one out of the three techniques which are allowed to pass through the same AWGN channel.

A. PSK Modulation

Phase Shift Keying(PSK) is a digital modulation scheme which is used to transfer the data by changing the phase of a carrier wave. The modulation is practiced by varying the sine and cosine inputs at a precise time. It is mostly used for wireless LAN's and Bluetooth communication.

Like other digital modulation schemes which uses a finite number of distinct signals to produce digital data, PSK also uses a finite number of phases. Each of these phases are allowed with a unique pattern of binary digits. Generally, each phase encodes an equal number of bits. Each and every pattern of bits forms the symbol that is represented by the particular phase. The demodulator gets back the original data by mapping the received signal back to the symbol it represents.

Constellation diagram is the best way to represent the PSK modulation schemes. In this constellation diagram, the points are represented on a complex plane. Due to the 90 degrees separation between the real and imaginary axes of the complex plane, these real and imaginary axes are called in-phase and quadrature axes. The amplitude of each and every point on the in-phase and quadrature axes modulates either a sine wave or cosine wave. In general, the in-phase axes modulates a cosine wave and the quadrature axes modulates a sine wave.

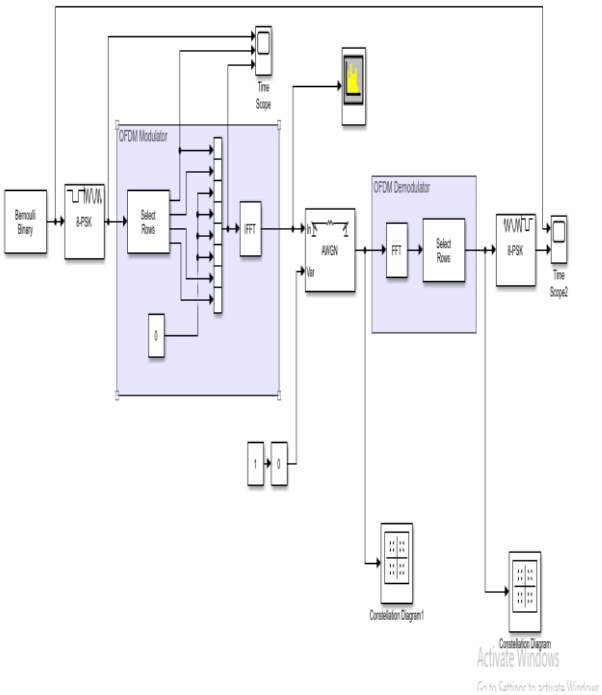

Fig-1: Block diagram of ifft-fft ofdm using psk modulation

From the above block diagram, it is clear that the bernaulli binary data is given to the PSK modulate since any input signal should be modulated. The signal is then passed through the cyclic prefix which is then passed through the serial to parallel converter in order to convert the serial data into parallel form. Then inverse fourier transform is applied to the signal which is then passed through the AWGN channel. In the demodulator section, the signal is passed through the FFT block and then the signal is converted to serial form and finally demodulated using the PSK demodulator.

B. BPSK Modulation

Binary Phase Shift Keying is also called as PRK(phase reversal keying) or 2PSK.It is one of the easiest forms of phase shift keying. It uses two phases which are divided by 180 degrees. So it can also be called 2PSK.It does not bother about the exact location of the constellation points. Therefore, it handles the highest noise level or distortion prior the demodulator reaches an incorrect decision which makes the BPSK, most tough of all PSK's. And it is only able to modulate at 1 bit/symbol which makes it unsuitable for high data rate applications.

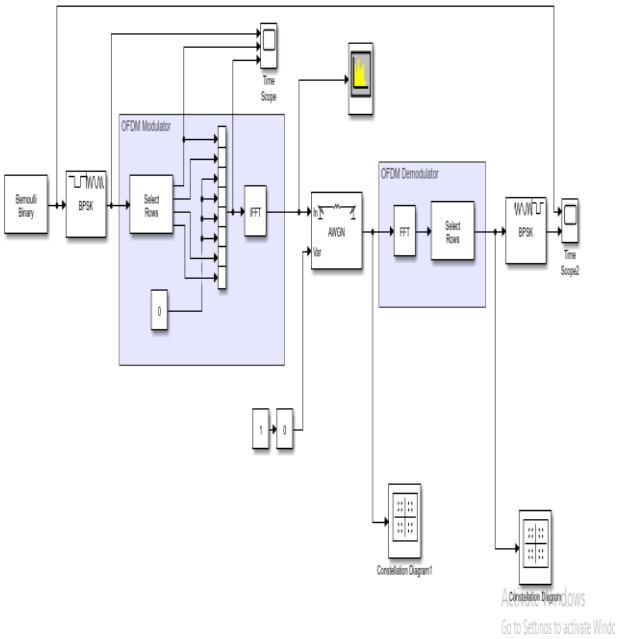

Fig-2: Block diagram of ifft-fft ofdm using bpsk modulation

The working of the above block diagram is same as the working of the previous block diagram but the only difference is the modulation technique used here. Here the modulation technique used is BPSK modulation.

C. QPSK Modulation

The quadrature phase shift keying is also known as PSK, 4PSK, 4QAM.

QPSK uses four points on the constellation diagram which are equispaced around a circle. Unlike BPSK,QPSK can encode two bits per symbol with four phases and minimizes the bit error rate.

By maintaining the same bandwidth of the signal, QPSK can be used to double the data rate compared with a BPSK system. It requires half the bandwidth of BPSK in order to maintain the data rate.

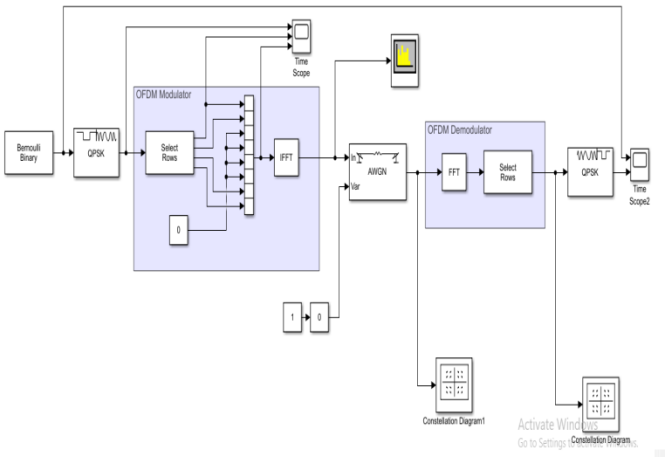

Fig-3: Block diagram of ifft-fft ofdm using qpsk modulation

The working of the above block diagram is same as the working of the previous two block diagrams ie.,PSK and BPSK but the only difference is that here we used QPSK as the modulation technique.

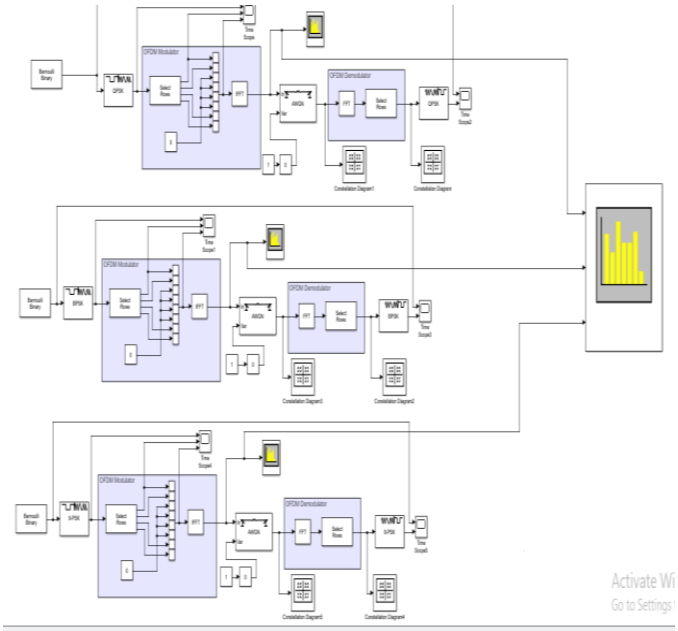

Fig-4: Block diagram of comparison of ifft-fft ofdm of all three modulation techniques

IV. SIMULATION RESULTS

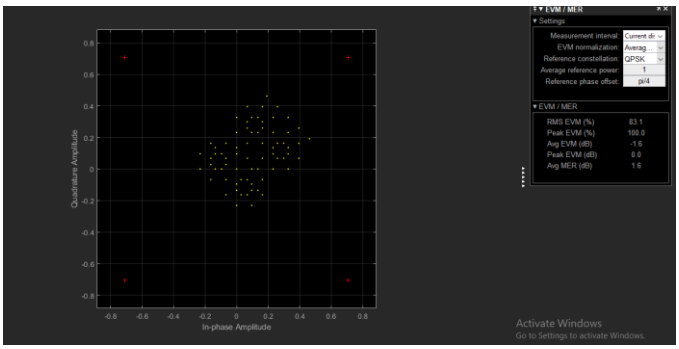

Fig-5: Constellation diagram of ifft-fft ofdm using psk modulation

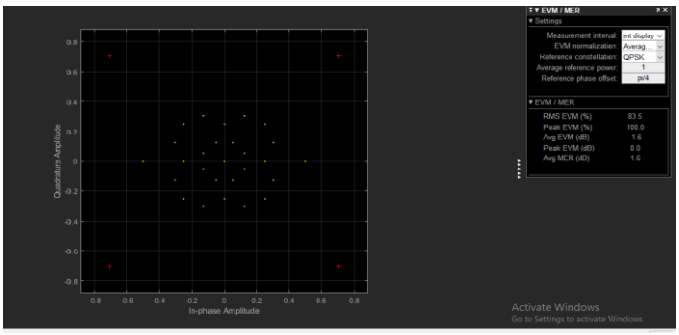

Fig-6: Constellation diagram of ifft-fft ofdm using bpsk modulation

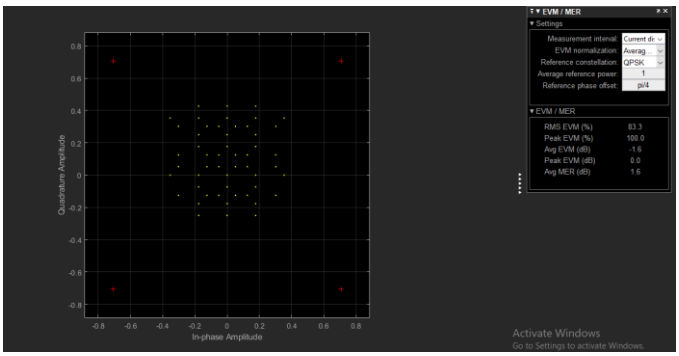

Fig-7: Constellation diagram of ifft-fft ofdm using qpsk modulation

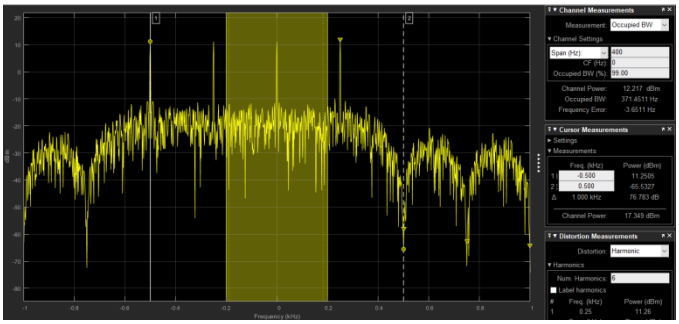

Fig-8: Spectrum of ifft-fft ofdm using psk modulation

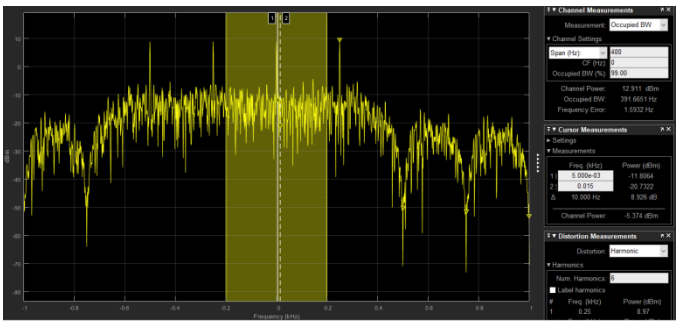

Fig-9: Spectrum of ifft-fft ofdm using bpsk modulation

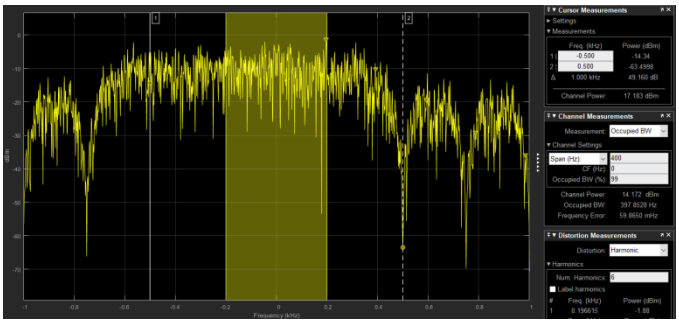

Fig-10: Spectrum of ifft-fft ofdm using qpsk modulation

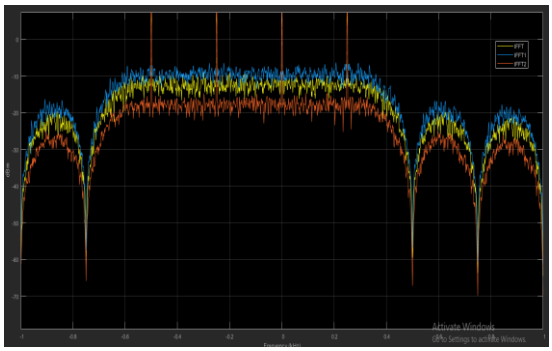

Fig-11: Spectrum analysis of comparison of ifft-fft ofdm of all three modulation techniques

In the above spectrum, the blue colour spectrum represents QPSK, the yellow colour spectrum represents BPSK and the orange colour spectrum represents PSK.

Table-1:

	QPSK	BPSK	PSK
Bandwidth	397.8528 Hz	391.6651 Hz	371.4511 Hz
Frequency error	59.8650 mHz	1.5932 Hz	3.6511 Hz
Channel power	14.172 dBm	12.911 dBm	12.217 dBm

V. CONCLUSION

The main aim of this paper is to transmit the data as efficiently as possible to provide good quality services to the recipients. We are using one of the modern multicarrier modulation schemes called FFT based OFDM. We have taken three modulation techniques namely QPSK, BPSK and PSK, and made computations in terms of spectral efficiency by comparing the three techniques using the same AWGN channel for a better efficient result and finally concluded that IFFT-FFT OFDM using QPSK modulation is the more efficient one.

REFERENCES

1. R.Asif, R. A. Abd-Alhameed, O.OAnoh, Y. Dama, H.S.Migdadi, J.M.Noars, et al., "Performance Comparison between DWT-OFDM and FFT-OFDM Using Time Domain Zero Forcing Equalization," in International Conference on Telecommunications and Multimedia (TEMU), 2012.

2. K. Abdullah and Z. M. Hussain, "Studies on DWT-OFDM and FFT-OFDM Systems," in International Conference on Communication, Computer and Power (ICCCP'09), Muscat, 2009.

3. A.Mannan and A. Habib, "Performance comparison of DWT OFDM and FFT OFDM in presence of AWGN and Rayleigh Channel using Haar Wavelet," International Journal of Computer and Communication System Engineering, 2016.

4. K. Abdullah and Z. M. Hussain, "Performance of Fourier-Based and Wavelet-Based OFDM for DVB-T

Systems," presented at the Australasian Telecommunication Networks and Applications Conference, New Zealand, 2007.

5. M. M. Hasan, "Performance Comparison of Wavelet and FFT Based Multiuser MIMO OFDM over Wireless Rayleigh Fading Channel," International Journal of Energy, Information and Communications, 2012.

6. H. Nikookar, Wavelet radio adaptive and reconfigurable wireless systems based on wavelets vol. 1. U.S.A New York: Cambridge, 2013.

7. S.K.Narang and A. Ortega, "Perfect Reconstruction TwoChannel Wavelet Filter-Banks for Graph Structured Data," IEEE Transactions of Signal Processing, 2012.

8. A. Zaier and R. Bouallègue, "A full performance analysis of channel estimation method for time varying OFDM systems," International Journal of Mobile Network Communications & Telematics, 2011.

9. H. N. Abdullah and F. S. Hasan, "Performance Evaluation of Complex WSavelet Packet Modulation (CWPM) System over Multipath Rayleigh Fading Channel," Journal of Signal and Information Processing, 2012

10. M.K. N.Umaria and P. K. Joshi, "Comparative analysis of BER Performance of DWT based OFDM system with conventional FFT based OFDM system," presented at the International Conference on Emerging Technology Trends in Electronics, Communication and Networking, 2012.

11. A. Ghaith, R. Hatoum, and H. M. A. Alaeddine, "The Performance Analysis of the Wavelet-OFDM New Scheme in AWGN Channel," Journal of Physical Science and Application, 2014.

12. F. Farrukh, S. Baig, and M. J. Mughal, "Performance comparison of DFT-OFDM and wavelet-OFDM with zeroforcing equalizer for FIR channel equalization," in International Confrence on Electrical Engineering, 2007.

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