Reduction of Peak to Average Power Ratio and Bit Error Rate Ratio in OWDM and OFDM

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***Abstract*—Orthogonal wavelet division multiplexing (OWDM) technique is used to fall computational difficulty of wireless systems, which appears to be relatively alike to the applications of orthogonal frequency division multiplexing (OFDM) with better-quality features and some additional features like PAPR(peak to average power ratio) reduction.. There are four ways to implementing Daubechies family and they are db1, db2, db3, db4. We have planned the PAPR and BER using OFDM and then again calculate in OWDM using numerous Daubechies family by swapping the inverse Fourier transform (IFFT) by separate wavelet transform (DWT). The aim of this study is to checkered the relative performance analysis of OFDM with OWDM. OWDM can be applied by using various wavelet families like Continuous Wavelet Transform, Coiflet Wavelets, but in this study we used Daubechies wavelet relations due to its better performance**

Keywords— OFDM, OWDM, IFFT, FFT, PAPR, DMT, MCM, FT

I. INTRODUCTION

The world's first cost-effective digital terrestrial services is propelled by UK In 1997, after the few years the new technique has been industrialized named as digital video, audio broadcasting has been set up in many countries. It uses Orthogonal Frequency Division Multiplex (FDM) as modulation scheme as compare to another technique like incidence division multiplexing due to its very high performance. In OFDM system, the signal is being interconnected at the very high data rate by serial transmission declaration [1]. In this study we inspect four wavelets of Daubechies family with growing order to determine which wavelet transform is the most suited for use in an Additive Gaussian White Noise (AWGN) channel and associate the presentation of OWDM with OFDM in terms of Variance in PAPR and BER for an AWGN channel [2-3]. OFDM is underlying standard and comprises of an IFFT at the transmitter end and Fast Fourier Transform (FFT) at the receiver end. [4]

A. OFDM HISTORY

The concept of using equivalent data broadcast by means of frequency division multiplexing was printed in mid 60s [7, 8]. Some early development can be traced back in the 50s. A U.S. barefaced was occupied and delivered in January, 1970. The idea of use equivalent data streams and FDM with overlying sub channels, to avoid the use of high speed equalization and to combat impulsive noise and use the available bandwidth as well as to multipath distortion fully. The initial claims were in the military communications. The broadcastings field, the terms of discrete multi-tone (DMT), multichannel modulation and multicarrier modulation (MCM) these two methods widely used and occasionally they are interchangeable with OFDM. In OFDM, each sub carrier is orthogonal to each other carriers. However, this condition is not always maintained in MCM. OFDM is an optimal version of multicarrier broadcast schemes. [9] Recently, a worldwide convergence has occurred for the use of Orthogonal Frequency Division multiplexing as an emerging technology for high data rates. In particular, many wireless standards LTE, Wi-max, IEEE802.11a, and DVB have adopted the OFDM technology as a mean to increase dramatically future wireless communications. OFDM is a particular form of Multi carrier transmission and is suited for frequency selective channels and used for very high data rates. This technique alters a frequency discerning wide band channel into a group of non-selective narrowband channels, which makes it robust against large delay spreads by preservative orthogonality in the frequency domain. Multicarrier modulation splits the broadband channel into a large number of narrowband sub stations to decrease the bandwidth [10].

B. ORTHOGONALITY

Orthogonality is a mess that permits the signals to be perfectly transmitted ended a common channel and noticed without meddling. In order to assure a high phantom competence the sub channel waveforms must have overlapping transmit spectra. Nevertheless, to enable simple parting of these overlying sub channels at the receiver they need to be orthogonal. However, loss of orthogonally results in blurring between these information signals and filth in communications, this is the result of the symbol time corresponding to the inverse of the carrier spacing. The sinc shape has a narrow main lobe with numerous side lobes that decay slowly with the magnitude of the frequency change away from the centre. Each carrier has a peak at its centre frequency and nulls evenly spaced with a incidence gap equal to the carrier spacing. [12].

II. WAVELET

The wavelet is used to substitutes the infinitely oscillating sinusoidal basis functions of the Fourier transform (FT) with a set of locally oscillating basis functions that called wavelets. [11].

When performing a frequency analysis of a signal, if there is minimal variation in time, Fourier transform with appropriate windowing will provide accurate information of

the signal. If however, there are fast fluctuations in the time domain this domain contains information that is relevant to how the frequency domain information is reacting, a time-frequency analysis that is necessary to get the proper information of signal [1]. Wavelet transform is designed. For signal analysis; for example, to study EEG or other biomedical signals, to detect faults in machinery from sensor measurements, to determine how the frequency content of a signal evolves over time. In these cases, a modified form of the original signal is not needed and the wavelet Transform need not be inverted it can be done in principle, but requires a lot of computation time in comparison with the rest type of wavelet transform[13]. The Wavelet alter is a transform that provides the time-frequency representation at same time. [14].

A. DWT

The foundations of the separate wavelet transform (DWT) go back to 1976 when Croiser, Esteban, and Galand devised a technique to decompose discrete time signals. Crochiere, Weber, and Flanagan did a similar work on coding of speech signals in the same year. They named their analysis scheme as sub band coding. In 1983, Burt defined a technique very similar to sub band coding and named it pyramidal coding which is also known as multi resolution analysis. Later in 1989, Vetterli and Le Gall made some improvements to the sub band coding scheme, removing the existing idleness in the pyramidal coding scheme. A detailed coverage of the distinct wavelet transform and theory of multi resolution analysis can be found in a number of articles and books that are available on this topic, and it is beyond the scope of this tutorial [14]. On the other hand the discrete wavelet transform is provides adequate information both for synthesis and analysis of the original signal, with a significant discount in the computation time. The DWT is considerably easier to implement when compared to the continuous wavelet transform (CWT).

B. OWDM

OWDM is a modulation frontend that has been proposed as an alternative to OFDM. In DWT OWDM, the modulation and demodulation are implemented by wavelets rather than by Fourier transform [5].

OWDM is used with the discrete wavelet transform is a multiplexing transmission method in which data being assigned to wavelet sub bands having dissimilar time and frequency resolution. Wavelet based system establishes a small peak to average likelihood rather than that of the Fourier transform based system. Wavelet modulation is scheme to make use of wavelet alterations consistent to the data being transmitted. The Advantage of wavelet alter than other transforms such as Fourier transform is discrete both in time as well as scale. By cumulative the order of the wavelets, the effect of aliasing can be decreased and therefore the orthogonality between the subs Bands is established. OWDM allows each subcarrier to have different modulation and different coding depending on the channel requirements so increase in flexibility. [1]

Mathematical transformations are applied to signals to obtain further information from that signal that is not readily available in the input signal. Let assume a time-domain signal as an input signal, and a signal that has been distorted by any of the available mathematical transformations as a processed signal. There are numbers of transformations that can be applied, among which the Fourier alters are probably by far the most popular. Most of the signals in practice are time-domain signals in their raw format (input signal).

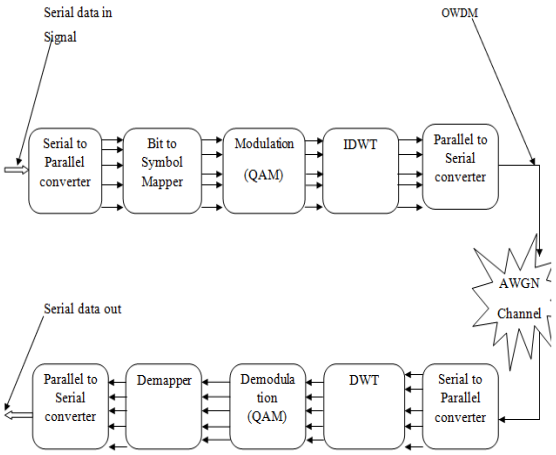

Fig.1.0 OWDM Block Diagram

That is, whatever that signal is gauging, is a function of time. In other language, when we plot the signal one of the axes is amplitude (dependent variable) and time (independent variable). When we plot time-domain signals, we obtain a time-amplitude representation of the input signal. This representation is not always the best representation of the signal for most signal processing related uses. In many cases, the most illustrious information is concealed in the frequency gratified of the signal that is not comprising in time domain. OWDM by the discrete wavelet transform is a multiplexing transmission method in which data being allocated to wavelet sub bands having different time and frequency resolution. [6]

III. RESULTS

The result section is divided into two parts first is PAPR vs. SNR and BER vs. SNR the program code of OFDM and OWDM is simulated in MATLAB. The coding of all block of OFDM and OWDM is done by using matlab and finally conclude that the result of parameter PAPR vs. SNR and BER vs. SNR are better in OWDM system . As OFDM include large calculation because of large size FFT and with OWDM only with Daubechies wavelet the result is shown better, and comparison of these technologies is done on the basis of parameter PAPR and BER.

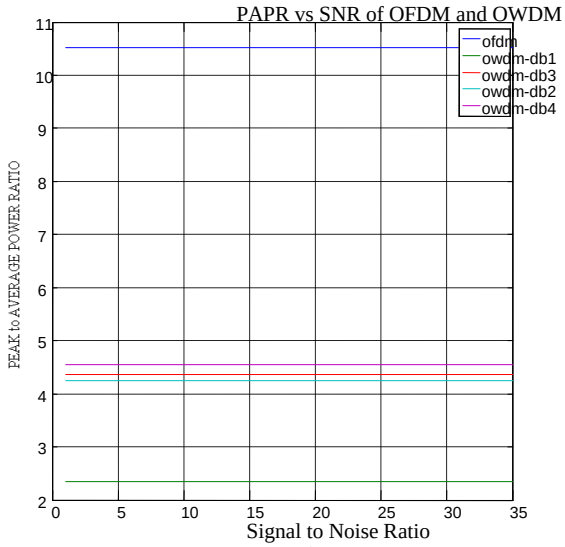

Fig.2.0 PAPR vs. SNR for OFDM and OWDM (db1, db2, db3, db4)

In this thesis, we have compared PAPR and BER using OFDM and OWDM system. Actually orthogonal wavelet division multiplexing is applied by using various Daubechies family. There are four ways of implementing Daubechies family and they are db1, db2, db3, db4. Firstly, we have calculated the result of PAPR and BER using OFDM and then again simulated these results using various Daubechies family and then compared these results.

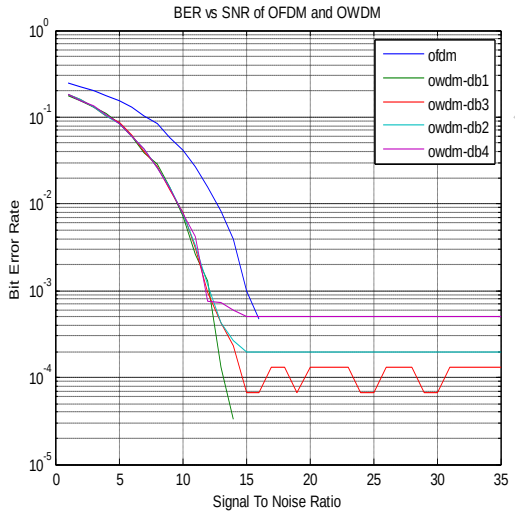

Fig.2.0 BER vs. SNR for OFDM and OWDM (db1, db2, db3, db4)

IV. CONCLUSION

In this research we have demonstrated a set of Simulation and assessment has been succeeded of Daubechies wavelet filters of OWDM with OFDM. From these results, it is suggested that the db1 wavelet (the first wavelet of Daubechies family) is the most suited for OWDM because of the lower variance to Noise in channel shadowed by Daubechies family, while db2 (the second wavelet of Daubechies family and db3 (the third wavelet of Daubechies family) db4 (the fourth wavelet of Daubechies family) is the least suited because it has high variance, this means as the order of wavelet filters increasing in a family, the alteration is also increasing. The effects showed that there were some OWDM scheme whose alteration out achieved that of OFDM and db1 wavelet achieved the best performance compared to other wavelet db2, db3, db4 and OFDM as well. The system presented has no error correction coding, although in a practical system, coding would be included. In this paper, no error correction codes have been combined. However, these codes can be measured later on. In this study we have analyze a set of simulation and comparison has been succeeded of different wavelet filters of OWDM with OFDM. From these results , it is optional that the db1 wavelet (the first wavelet of Daubechies family) is the most suited for OWDM because of the lower alteration to noise in channel followed by Daubechies family, while db4 (the forth wavelet of Daubechies family) is the least suited because it has high variance. The results presented that there were some OWDM scheme whose variance outdid that of OFDM and db1 wavelet achieved the best recital compared to other wavelet db2, db3, db4 and OFDM as well the lastly conclude that peak to average power ratio and bit error rate of db1 *wavelet* (the first wavelet of Daubechies family) is the chief suitable for OWDM as compare to OFDM.

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