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Analysis of OFDM and OWDM System with various Wavelets Families

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ABSTRACT - To increase the data rate of wireless standard orthogonal frequency division multiplexing (OFDM) is used which is a great method that uses an Inverse Fast Fourier Transform (IFFT) at the transmitter to modulate a high bit-rate signal into a number of sub-carriers. The problem with this technique is that it is inherently more complex IFFT core. This paper delivers an examination of a technique to actions respective acts, called Orthogonal Wavelet Division Multiplex (OWDM), an substitute method to OFDM, which uses a Discrete Wavelet Transform (DWT) in its place of using the IFFT at the transmitter to produce the output and intensifications elasticity in system . In this research, we associated bit error rate using OFDM and OWDM. Actually OWDM **(**orthogonal wavelet division multiplexing**)** is realized by using various Daubechies family. There are dissimilar ways of applying Daubechies family, we have calculated the bit error using OFDM and then again simulated these results using various Daubechies family and then compare it. The numerous simulations are done in MATLAB.

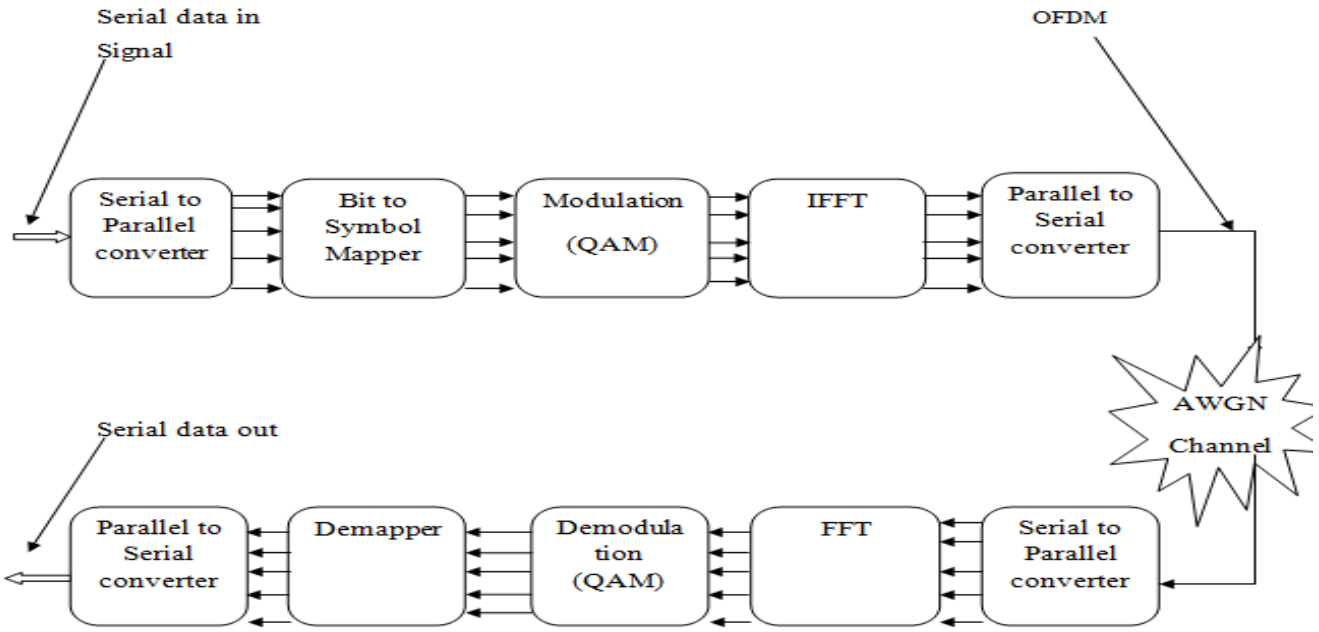
KEYWORD: OFDM, OWDM, IFFT, FFT, BER, SNR, FDM, DAB, DVB, WLAN, MMAC

INTRODUCTION

The concept of using parallel data broadcast by means of frequency division multiplexing (FDM) was Printed in mid 60s [1-2]. OFDM can be simply defined as a form of multicarrier variation scheme where its carrier planning is sensibly selected so that each subcarrier is orthogonal to the each other subcarriers. [1] OFDM is a method widely used in wireless message systems due to its high data rate transmission capability with high bandwidth effectiveness and also its robustness to multi-path fading without necessitating complex equalization techniques [3-4]. OFDM has been adopted in a number of wireless tenders including Digital Audio Broadcast (DAB), Digital Video Broadcast (DVB), and Wireless Local Area Network (WLAN) standards such as IEEE802.11g and Long Term Evolution (LTE) [5-6]. As is known, orthogonal signals can be divided at the receiver by correlation techniques; hence, inter symbol interference among channels can be rejected.

ORTHOGONALFREQUENCY DIVISION MULTIPLEXING (OFDM)

OFDM is of great interest by investigators and research laboratories all over the world. It has previously been familiar for the new wireless local area network criteria IEEE 802.11a, High Routine LAN type 2 (HIPERLAN/2) and Mobile Multimedia Access Communication (MMAC) Systems. Also, it is expectable to be used for wireless broadband multimedia communications. Data rate is actually what broadband is about. The new standard agrees bit rates of up to 54 Mbps. Such high rate executes large bandwidth, thus confident carriers for values higher than UHF band. For instance, IEEE802.11a has regularities billed in the 5- and 17- GHz bands [8].



OFDM BLOCK DIAGRAM

The Orthogonal Frequency Division Multiplexing is a MCM technique that is broadly putative and most frequently used today. In OFDM system, the modulation and demodulation can be applied easily by means of IDFT and DFT operators. In such a system, conversely, the involvement data bits are actually reduced by a rectangular opening and the wrapper of the spectrum takes the forms of sinc (w) which create rather high side lobes. This leads to rather high nosiness when the station deficiencies can‘t be fully remunerated. [9]

ORTHOGONALITY

In order to assure a high spectral efficiency the sub channel waveforms must have overlapping transmit spectra. Nevertheless, to enable simple separation of these overlapping sub channels at the receiver they need to be orthogonal. Orthogonality is a property that allows the signals to be perfectly transmitted over a common channel and detected without interference. However, loss of Orthogonality results in blurring between these information signals and degradation in communications this is the result of the symbol time equivalent to the inverse of the carrier spacing. The sinc shape has a narrow main lobe with many side lobes that decay slowly with the magnitude of the frequency modification away from the centre. Every carrier has a highest at its centre frequency and nulls evenly spaced with a frequency slit equal to the mover spacing. [10]

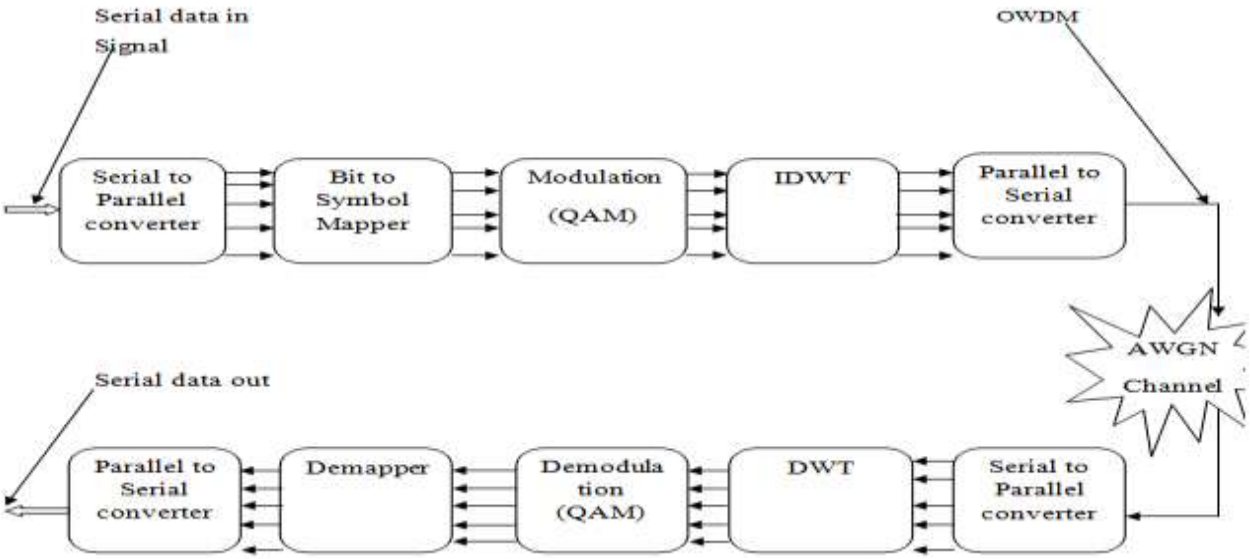
DWT

The foundations of the DWT go back to 1976 when Croiser, Esteban, and Galand devised a method to decay discrete time signals. Crochiere, Weber, and Flanagan did a parallel work on coding of communication signals in the same year. They named their examination scheme as sub band coding. In 1983, Burt defined a technique very parallel 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 enhancements to the sub band coding scheme, eradicating the existing severance in the pyramidal coding scheme. A complete exposure of the discrete wavelet transform and theory of multi tenacity analysis can be originate in a number of articles and books that are obtainable on this topic, and it is beyond the scope of this tutorial. [11] The discrete wavelet transform (DWT), on the other hand, it delivers sufficient information both for examination and synthesis of the original signal, with a significant drop in the computation time. The DWT is considerably easier to gadget when related to the CWT. The basic concepts of the DWT will be introduced in this section along with

its properties and the algorithms used to compute it. As in the previous chapters, examples are providing to aid in the interpretation of the DWT. [11]

OWDM

OWDM is a modulation frontend that has been proposed as an alternative to OFDM. In DWTOWDM, the modulation and demodulation are apprehended by wavelets rather than by Fourier transform. [12] The OFDM device by IFFT's and FFT's has some problems. The OFDM grieves from ISI pattern. This is recurrently taken care of by using a adding a cyclic prefix greater than the channel length but this may not constantly be conceivable. This ensues due to loss of Orthogonality due to channel properties.

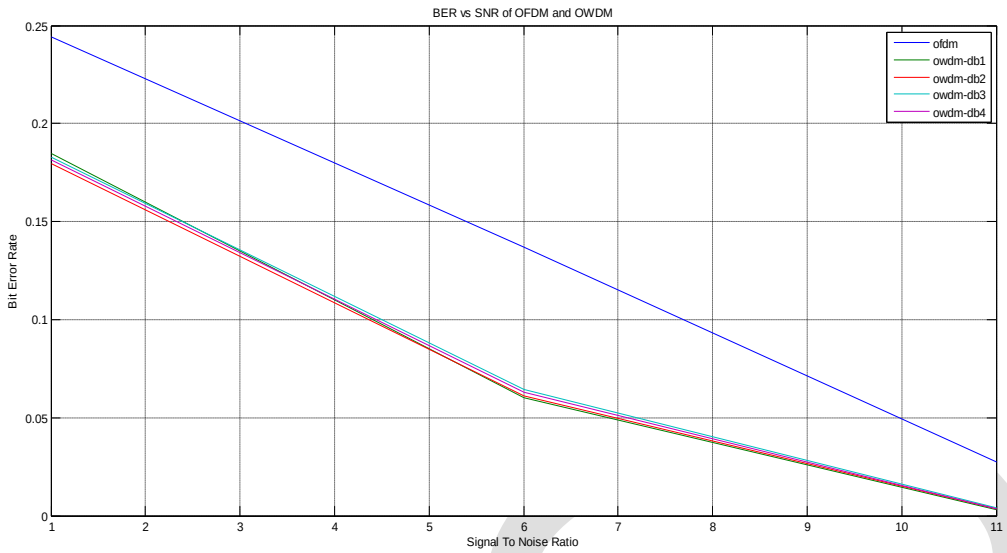


OWDM BLOCK DIAGRAM

The OFDM requires time and frequency synchronization to get a low bit error rate. Carrier frequency offset- The offset amongst the carrier frequency and the frequency of the local oscillator also causes a large bit error rate. One of these is wavelet transform. The wavelet transform is proposed by many authors, it has a higher degree of side lobe suppression and the loss of orthogonal leads to lesser ISI and ICI. In wavelet OFDM the FFT and IFFT is replace by DWT and IDWT respectively. In DWT -OWDM, the modulation and demodulation are implemented by wavelets rather than by Fourier transform. [7]

SIMULATION & RESULTS

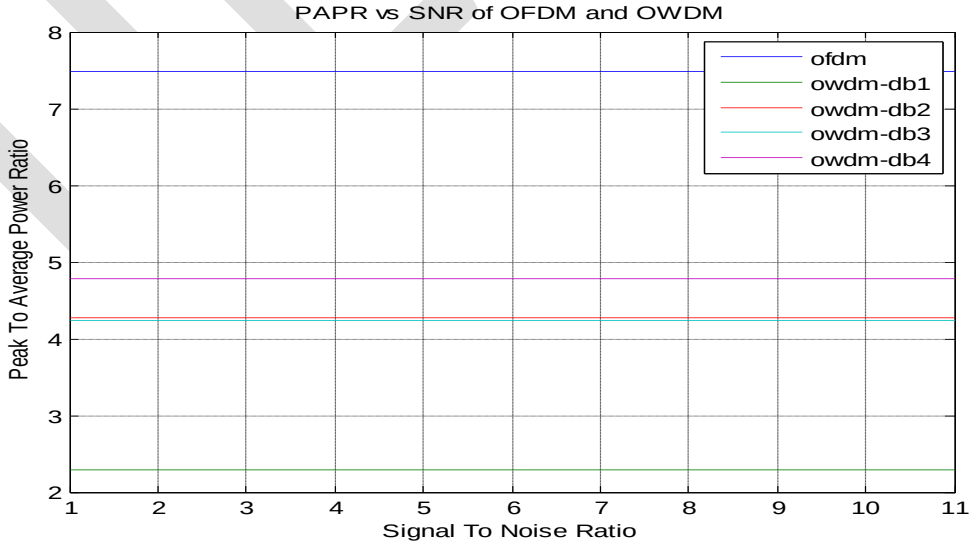
OWDM scheme is shown to be overall quite similar to Orthogonal Frequency Division Multiplexing but with some additional features and value-added characteristics, the aim of this thesis is to examine the outcome of wavelets on the appearance of the Orthogonal Wavelet Division Multiplexing system.



Bit Error Rate vs. Signal to Noise Ratio for OFDM and OWDM (db1, db2, db3, db4)

It is a dominant technique that uses an IFFT at the source to modulate a high bit error rate signal onto a number of movers. But it faced one problem that is inherently inflexible and needs a complex IFFT core. To overwhelmed this problem a new system is prearranged that employs the flexible nature of Discrete Wavelet Transform by OWDM in its place of OFDM.

The four wavelets of Daubechies family OWDM (coif1, coif2, db1, db2) are restrained with increasing order to regulate which wavelet translate is the most suited for use in an AWGN channel and degree the presentation in terms of Variance and Signal to noise ratio SNR for AWGN channel in comparison with OFDM and demonstrates the next level examination of new system comparing different wavelets. To parallel the dissimilar wavelets, the buffered Quadrature modulated block (containing the same information for each trial) was passed over the dissimilar wavelet filters. The output from the riddle was passed over the AWGN channel with reducing Signal to Noise Ratio (SNR) and then demodulated



Peak to Average power vs. Signal to Noise Ratio for OFDM and OWDM (db1, db2, db3, db4)

CONCLUSION

In this study a low difficulty equipment OWDM is proposed to perform better over the earlier used technology OFDM as in the OWDM the controls are larger size FFF's are used that make a system complex so a new knowledge named as OWDM is less trying AS with the help of Daubechies wavelet the result are shown better. In this study it surveys a set of simulation and assessment has been flourished of dissimilar wavelet filters of OWDM with OFDM. From these results , it is recommended that the db1 wavelet (the first wavelet of Daubechies family) is the most suited for OWDM because of the lesser variance to noise in channel followed by Daubechies family, while db4 (the forth wavelet of Daubechies family) is the smallest suited because it has high variance. The conclusions exposed that there were some OWDM system whose modification outperformed that of OFDM and db1 wavelet reached the best recital compared to other wavelet db2, db3, db4 and OFDM as well the finally accomplish that peak to average power ratio and BER VS SNR of db1 wavelet (the first wavelet of Daubechies family) is the most suited for OWDM as equate to OFDM..The outcomes displayed that there were some OWDM scheme whose variance surpassed that of OFDM and db1 wavelet achieved the best recital compared to other wavelet db2, db3, db4 and OFDM as fit the lastly arrange that bit error rate of db1 wavelet (the first wavelet of Daubechies family) is the most suited for OWDM as associate to OFDM.

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