

Spectral Emission Mask Shaping for OFDM Cognitive Radios

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Abstract— orthogonal frequency division multiplexing (OFDM) is characterized by spectral efficiency. It enables flexible and agile spectrum allocation. But still it lags as it suffers from spectral leakage in the form of large side lobes. It leads to inter-channel interference if not handled carefully. In proposed system spectral emission mask system is implemented to combat spectral leakage and ultimately avoiding adjacent channel interference. A spectral mask, also known as a channel mask or transmission mask is a mathematically-defined set of lines applied to the levels of radio (or optical) transmissions. The spectral mask is generally intended to reduce adjacent-channel interference by limiting excessive radiation at frequencies beyond the necessary bandwidth. The proposed system is implemented over MATLAB platform using script language.

Index Terms—MATLAB, Spectral Mask, OFDM, Inter channel interference.

I. INTRODUCTION

OFDM, Orthogonal Frequency Division Multiplexing is a nothing but a signal waveform or modulation that leads to some significant advantages for data links.

Accordingly, OFDM, Orthogonal Frequency Division Multiplexing utilized for number of the recent wide bandwidth and higher data rate wireless systems, it includes Wi-Fi, cellular telecommunications and further more.

Practically OFDM utilizes a vast number of carriers; each carries low bit rate data that means it is very resilient to selective multipath effects, interference, fading, while providing an effective spectral efficiency.

Recent days systems using OFDM have the processing required for the signal format was comparatively high, but with modernization in technology, OFDM represents some of difficulties in terms of the processing required.

The utilization of OFDM and multicarrier modulation has come to the limelight in recent years as it gives an perfect platform required for wireless data communications transmissions.

The concept of OFDM technology was first experimented and analyzed in the 1960s and 1970s while research into methods for minimizing interference in between closely spaced channels. With addition to this other requirements needed to have a error free data transmission in the presence of interference as well as selective propagation conditions.

Earlier the utilization of OFDM for major levels of processing was not feasible for general use.

Some of the earlier systems to utilize OFDM were digital broadcasting. In it OFDM was able to provide a highly reliable form of data transport over a versatile variety of signal path conditions. One of example was DAB digital radio that was started in Europe and other countries. At Norwegian Broadcasting Corporation NRK. They launched the first service on 1st June 1995. OFDM was also utilized for digital television.

After some years processing power increased as an outcome of incremental integration levels initiating OFDM to be introduced for the 4G wireless network communications systems which initiated to be deployed from approx. 2009. Wi-Fi also utilized OFDM for its implementation. Not only Wi-Fi but for other wireless service also OFDM was adopted. Though OFDM is so successful although it is characterized by spectral leakage. This spectral leakage leads to inter channel interference. In order to avoid spectral leakage and ultimately inter channel interference, spectral emission mask is proposed.

II. LITERATURE REVIEW

The paper named as “Review Paper on OFDM-Concepts and Applications” authored by Sukhpal Singh, Harmanjot Singh, published in IJEDR Volume 3, Issue 3, 2015. States that “CO-OFDM is a very attractive modulation and multiplexing technique that is used in wideband optical systems as well as optical wireless systems. Several advantages of optical orthogonal systems is good efficiency of spectrum utilization and channel robustness. Number of small subcarriers is used to transmit data from one source and generally termed as multicarrier transmission. OFDM, a modulation as well as multiplexing technique is the origin of several telecommunications standards counting DTT and radio broadcasting. OFDM is even the source of nearly all DSL standards, and within this situation OFDM is generally known as discrete multitone (DMT). Regardless of the benefits offered by OFDM and its prevalent usage in wireless communications, it has been considered for optical communications during the last years. OFDM is a technique in which sequential data tributary transformed into parallel stream. The concept of OFDM is to divide the broadcast bandwidth into a number of orthogonal subcarriers in order to transmit the symbols using these subcarriers in parallel. In this paper, description of OFDM systems their concepts has been discussed with their several applications.” [1]

The paper named as “A Review paper on orthogonal frequency division multiplexing (ofdm)” authored by Brijesh Kumar, International Journal of Scientific & Engineering

Research, Volume 6, Issue 2, February-2015, It states that “This paper discusses the structure and implementation of an OFDM modem employed in wireless communication. Orthogonal rate of recurrence Division Multiplexing (OFDM) is just about the latest modulation techniques used so that you can combat the frequency-selectivity from the transmission channels, achieving substantial data rate without inter-symbol disturbance. This technique is employed for bandwidth hogging applications including Video Conferencing, DAB, DVB, and many others. Multi-user capacity possible making use of MC-CDMA. OFDM is several techniques proposed to be employed in 4th Generation cellular Systems For the majority of all part, Orthogonal. The bit error rate along with the ISI in multipath surroundings in conventional techniques for instance QAM are very high which often can be reduced by putting into action the OFDM technique. Nonetheless, the occurrence of the actual potentially high peak-to-average electrical power ratio (PAPR) restricts the application.”[2]

The paper named as “Behavior and Techniques for Improving Performance of OFDM Systems for Wireless communications”, authored by Alcardo Alex Barakabitze ,published in International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 1, January 2015.it states that” Orthogonal frequency division multiplexing (OFDM) is a special case of multicarrier transmission which transmits a stream of data over a number of lower data rate subcarriers. OFDM splits the total transmission bandwidth into a number of orthogonal and non-overlapping subcarriers and transmit the collection of bits called symbols in parallel using these subcarriers. This paper gives a total insight of various Peak -to Average Power Reduction (PAPR) techniques and principles of OFDM systems used in wireless communications. The research paper places a focus also on OFDM behaviors and techniques like Carrier Frequency Offset (CFO) estimation that improves performance of OFDM for wireless communications. Finally, the paper provides a number of wireless communication standards and many of the applications where OFDM systems are used.”[3]

The paper named as “OFDM transmission and reception: review” authored by Amit Saini, published in International Research Journal of Engineering and Technology (IRJET), 2015. It states that” The paper concentrates on the review of Orthogonal Frequency Division Multiplexing (OFDM) technique, for digital data transmission and reception. OFDM is relied upon to be utilized as a part of future television and remote LAN (WLAN) systems. For instance, IEEE802.11 in the United States, ETSI BRAN in Europe [4], and ARIB MMAC in Japan have officially embraced the OFDM transmission technique as a physical layer for future broadband WLAN systems. In OFDM information transmission and reception uses IFFT and FFT in modulator and demodulator respectively. The literature review is carried from some of the journals.”[4]

The paper named as “Review on OFDM a Brief Survey”,authored by Vishal Pasi, published in International Journal of Scientific and Research Publications, Volume 3, Issue 11, November 2013.it states that “Orthogonal frequency-division multiplexing (OFDM) effectively mitigates intersymbol interference (ISI) caused by the delay spread of wireless channels. Therefore, it has been used in

many wireless systems and adopted by various standards. In this Paper, we present a comprehensive survey on OFDM for wireless communications. We address basic OFDM and related modulations, as well as techniques to improve the performance of OFDM for wireless communications, including channel estimation and signal detection, time- and frequency-offset estimation and correction, peak-to-average power ratio reduction PAPR, inter carrier interference (ICI) and multiple-input–multiple-output (MIMO) techniques. We also describe the applications of OFDM in current systems and standards.”[5]

III. SYSTEM DEVELOPMENT

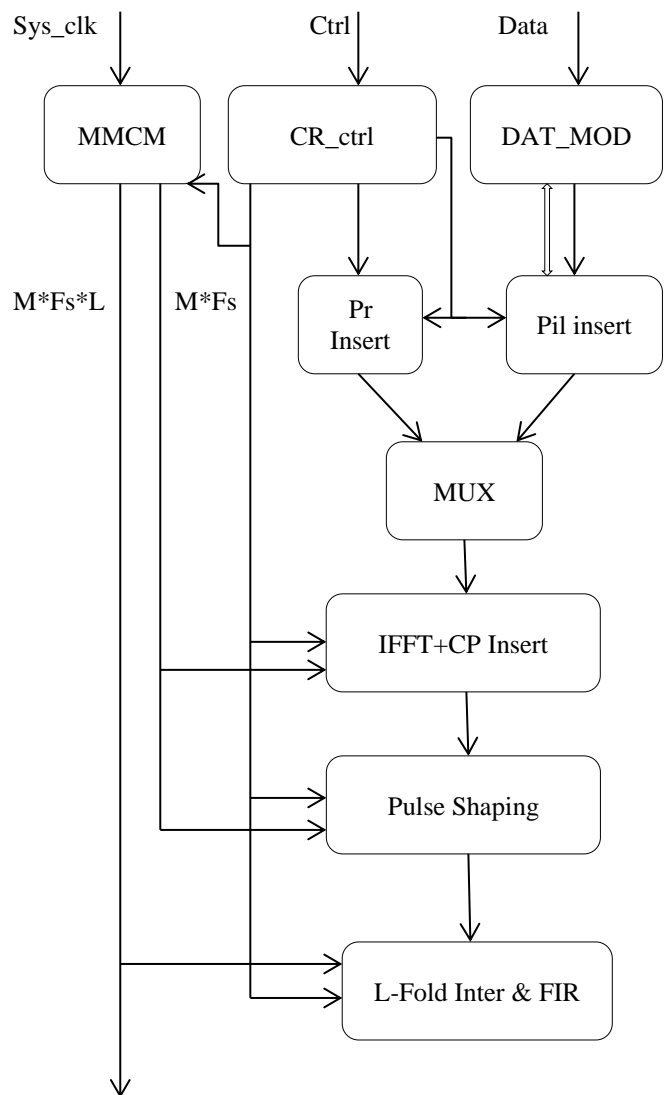


Figure.1 Proposed System

Proposed method takes a different approach. Instead of using a large proportion of the guard interval for FIR filtering, we allow the pulse shaping to occupy a significant portion of the guard space, with large roll-off factors. To obtain the significant spectral leakage reduction.

IV. RESULT & CONCLUSION

The proposed system has been implemented successfully. It is found that spectral emission mask is working accurately as shown in figure. 2 to avoid spectral leakage.by avoiding

spectral leakage, spectral emissions mask shaping limiting inter channel interference. Proposed system will be effective.

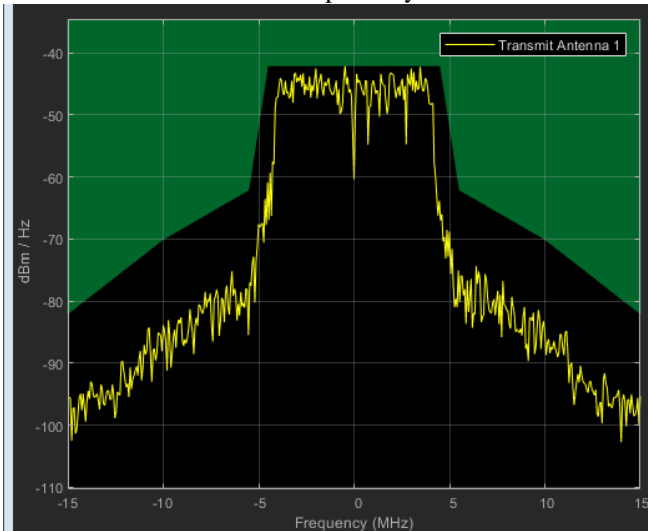


Figure.2

The proposed system will play important role to make OFDM more effective.

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