# An OFDMA Uplink System Approach for PAPR Reduction in Mobile WI-MAX: A Review

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***Abstract -*** In all-optical OFDM systems, high PAPR is a serious intrinsic defect, deteriorating nonlinear impairment in optical fibers. This paper probes the peak-to-average power ratio (PAPR) theory in all-optical orthogonal frequency division multiplexing (OFDM) optical fibre communication systems. To increase dramatically future wireless communications, many wireless standards (WiMax, IEEE802.11a, LTE, DVB) have adopted the OFDM technology. On the other hand, WiMAX is one of the hottest broadband wireless technology today. WiMAX systems are expected to deliver broadband access services to enterprise and residential customers in an economical way. But, due to outside interference these (WiMAX and OFDM channels) experience the negative effect of a higher value of peak to average power ratio (PAPR or we also call it crest factor). High PAPR (Peak to Average Power Ratio) is the main drawback of OFDM systems. We aim to reduce this value and provide a better communication channel**.**

***Keywords -*** *Peak to average power ratio (PAPR); orthogonal frequency division multiplexing (OFDM); Digital video broadcasting (DVB); Long term evolution (LTE); Worldwide interoperability for microwave access (WiMAX).*

## I. INTRODUCTION

Mobile WiMAX is the mobile worldwide interoperability for microwave Access. It is a 3rd Generation broadband wireless technology which enables the assembling of mobile and fixed broadband networks through a common wide area radio-access (RA) technology and flexible network architecture. The mobile WiMAX air interface adopts orthogonal frequency division multiple access (OFDMA)is used for for its uplink (UL) and downlink (DL) to improve the multipath performance as low complexity is the mandatory in transmission and reception, high performance and high implementation flexibility as well as the attainable render OFDMA a highly hypnotic candidate for high data rate communications over time-varying frequency selective radio channels contrived by multipath distortion .The major difference between OFDMA and OFDM is that, in OFDMA, the base station attributes only a subset of carriers to each user, whereas in OFDM all the available subcarriers are allocated to a single user. Thus, OFDMA facilitates several transmissions simultaneously. Through subcarrier allocation OFDMA

based systems exploit multiuser diversity. Two different techniques for subcarrier mapping in OFDMA systems are distributed subcarrier mapping and localized subcarrier mapping. The distributed scheme can be further classified into two modes as random interleaved mode and interleaved mode. The random interleaved mode accosts maximum frequency diversity and increased capacity in frequency selective fading channels. Hence it is a advisable choice for Mobile WiMAX. The scalable OFDMA (SOFDMA) is debuted in the IEEE 802.16e amendment to patronize scalable channel bandwidth. OFDM has become popular because of its hypnotic features such as its high bandwidth efficiency and robustness over frequency selective fading channels. Instead of its benefits, it agonizes from some drawbacks such as Peak to Average Power Ratio in the transmission system. Due to power amplifier nonlinearity high PAPR causes out-of-band radiation and inter modulation. High linearity signalizes low efficiency and greater power dissipation, which should be least for use in portable devices. So, it is the main necessity to revitalize PAPR performance of the signal. Many techniques are used to vanquish the effect of PAPR. [1], [2], [3]

## II. RELATED WORK

WiMAX standard IEEE 802.16d/e is the advanced technology which is used for long range communication with high data rate. In multi path fading environment, the orthogonal frequency division multiplexing (OFDM) is a promising technique for getting high data rate. Hence OFDM is used by the physical layer of WiMAX as it is well known that high PAPR is the major drawback of OFDM. So, PAPR reduction is attained by using selected mapping (SLM) technique and at same time without sending the side information along with the OFDM symbol. For WiMAX standard IEEE 802.16e, the PAPR performance using CCDF plot and the probability of SI detection error performance have been standardised. [4]

Multipath reflects the signal with different time arrivals and phases. Orthogonal Frequency Division Multiplexing (OFDM) is the best solution of the multipath fading and it is a multicarrier modulation technique which is used for wireless communication for the high speed data transmission over multipath fading channels. OFDM faces a

major drawback of multicarrier transmission system named Peak-to-Average Power Ratio (PAPR) which leads to power inefficiency in the transmitter at RF section. So, to reduce the PAPR several methods have been proposed. [5], [6]

The techniques used for PAPR reduction are nonlinear companding technique, OFDM supported low complexness transform to reduce PAPR and enhance multipath Resilience. However these are the disadvantages like degradation of BER and SNR performance, higher modulation order, increasing of average power. However to overcome the drawbacks of higher than techniques PTS technique is employed in a research. The Mobile WiMAX interface adopts Orthogonal Frequency Division Multiple Access (OFDMA) as multiple access technique to enhance the performances of the signal even once the signal is tormented by multipath distortion. It overcomes the higher than disadvantages by victimization PTS technique based RI OFDM. Root-raised-cosine pulse shaping filter is used to stay out of band radiation low and to meet the spectrum mask. [7]

In Mobile-WiMAX physical layer (PHY) standard, B. Siva Kumar Reddy and B. Lakshmi addresses the reduction of peak to average power ratio (PAPR) for the OFDM. In the approach, to avoid the nonlinear distortion the best achievable PAPR of 0 dB is found for the OFDM spectrum using phase modulation technique. The performance of the WiMAX PHY standard is handled by the software defined radio (SDR) prototype in which USRP N210 and GNU Radio employed as hardware and software platforms respectively. In the research, it is also found that BER performance is shown for different coding and different modulation schemes.By using SDR testbed, a sliding correlator wireless channel sounding system is designed to empathize wireless propagation in specific environments. [8]

## III. Problem Formulation

WIMAX (Worldwide Interoperability for Microwave Access) takes OFDM (Orthogonal frequency-division multiplexing) in consideration to be its physical layer to satisfy and guarantee the very big data rates (speed) in frequency selective environment. High PAPR (Peak to Average Power Ration) is the main disadvantage for OFDM. Due to this high PAPR, the chances of operating point for the linear power amplifier being shifted towards the high saturation region at any given time instant becomes more and more probable. In-band distortion and out-of-band radiation are some side effects for this shifting of operating point. This issue can be easily avoided by changing the dynamic range of power amplifier and increasing it. But yes, it will surely pave way for larger size and higher production cost of power amplifier. Hence, if we take into consideration the power constraint problem, it is very much required and necessary to reduce the PAPR.

## IV. Objectives

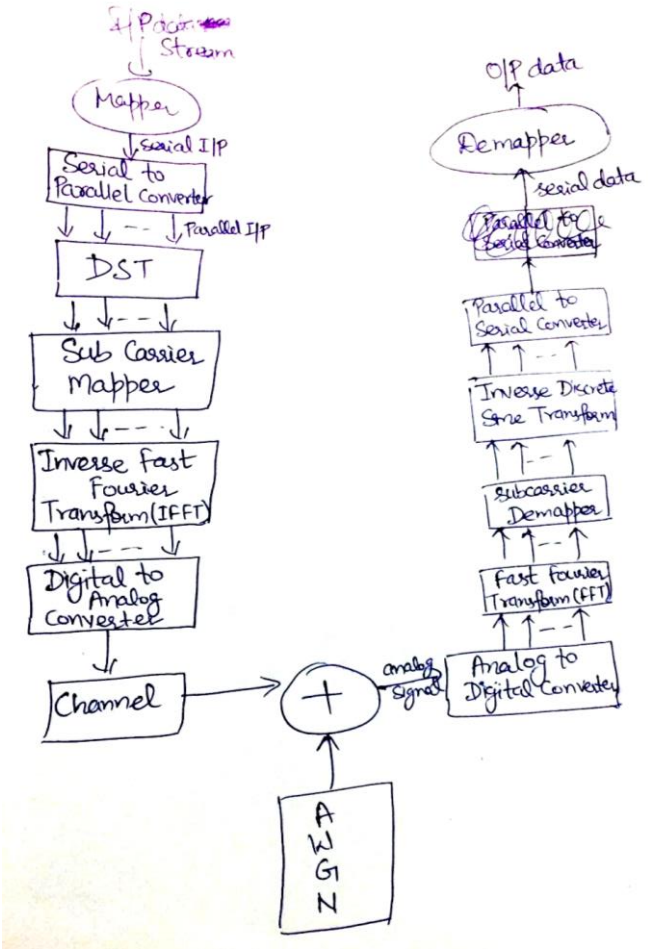
Following are the main objectives we have to deal with

1. Reduce PAPR
2. Improve efficiency in terms of MSE and PSNR
3. Reduce the magnitude variation
4. Achieve smaller back off margin
5. Higher PAPR reduction gains

## V. Methodology

Following are the steps which we are taken throughout the process to achieve our desired objectives. The whole scenario will be divided into 2 parts:

1. Sender
2. Receiver




### A. SENDER

- An input data stream which will carry the data to be transmitted.
- This will be fed into a mapper which will map each bit accordingly for transmission.
- These bits are still in a single dimension (serial input) which can convert it into a parallel bit stream using serial to parallel convertor.
- Now, perform discrete sine transform of this parallel data.

- Nos again, we have to pass it through a mapper called subcarrier mapper as now put it into the carrier signal.
- Then perform inverse Fast Fourier transform of this signal.
- This digital signal is now converted into an analog signal using a digital to analog convertor and it is also called as pulse shaping.
- This data is now transferred into the channel.

The channel will add noise to the transmitted signal which cannot be avoided. So add AWGN to our signal to simulate the noise.

*B. RECEIVER*

- Receiver process is exactly opposite of that of sender process.
- We will receive analog signal, which will be converted to digital signal.
- We now perform Fast Fourier transform of this signal.
- Subcarrier de-mapping operation is performed with the help of which we will get proper order of our bits.
- Then we perform inverse discrete sine transform.
- This parallel bit stream is converted into serial data.
- And finally, perform the de-mapping of this serial data to get the received signal.

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