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PTS PRECODING TECHNIQUE FOR PAPR REDUCTION IN MOBILE WIMAX

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ABSTRACT- Many precoding techniques are used to reduce PAPR in mobile WiMAX. Those techniques are nonlinear companding technique, OFDM supported low complexness transform to extend multipath Resilience and cut back PAPR. However it's the disadvantages like higher modulation order, degradation of BER and SNR performance, increasing of average power. However here PTS technique is employed. It overcomes the disadvantages of higher than techniques. The Mobile WiMAX interface adopts Orthogonal Frequency Division Multiple Access (OFDMA) as multiple access technique to enhance signal performances even once the signal is tormented by multipath distortion. However it's the matter of high PAPR. By victimization PTS technique based RI OFDMA it overcomes the higher than disadvantages. It is analyzed with root-raised-cosine pulse shaping filter to stay out of band radiation low and to meetl the spectrum mask needs.

Index Terms Orthogonal frequency division multiple access (OFDMA), Mobile WiMAX, Hadamard transform, Root-raised-cosine (RRC), Partial Transmit Sequence (PTS) I INTRODUCTION

The mobile worldwide ability for microwave access (Mobile WiMAX) is a third Generation broadband wireless technology that allows the convergence of mobile and glued broadband networks through a typical wide area radio-access (RA) technology and versatile specification. Since Jan2007, the IEEE 802.16 unit (WG) has been developing a new amendment of the IEEE 802.16 standard i.e. IEEE 802.16m as a complicated air interface to fulfill the requirements of ITU-R/IMT Advanced for 4G systems. The mobile WiMAX air interface adopts orthogonal frequency division multiple access (OFDMA) a multiple access technique for its transmission (UL) and downlink (DL) to enhance the multipath performance. OFDMA system splits the high speed data stream into variety of parallel low data rate streams.

The key distinction among OFDM and OFDMA is that, rather than allocating all the offered subcarriers to users, the base station assigns solely a set of carriers to every user so as to accommodate many transmissions synchronic. An inherent gain of the OFDMA primarily based systems is its ability to use multiuser diversity through sub channel allocation. OFDMA additionally has the advantage of being simply decoded at the receiver side, due to the absence of inter-carrier-interference. There are two different approaches for subcarrier mapping in OFDMA systems, namely

- Localized subcarrier mapping and
- Distributed subcarrier mapping.

The distributed subcarrier mapping are be often classified in two modes,

- Interleaved mode and
- Random interleaved mode.

Multiplexing a serial data symbol stream into an oversized range of orthogonal sub channel makes the OFDM signals spectral bandwidth efficient. It's been shown that the performance of OFDM system over frequency selective attenuation channels is best than that of the only carrier modulation system. The high PAPR brings on the OFDM signal distortion with the nonlinear region of high power amplifier (HPA) and also the signal distortion induces the degradation of bit error rate (BER). Moreover, to prevent spectral growth of the multicarrier signal within the style of intermodulation among subcarriers and out-of-band radiation, the transmit power amplifier should be operated in its linear region (i.e., with an oversized input backoff), where the power conversion is inefficient. This could have a deleterious resultt on battery life in mobile applications. In several cheap applications, the drawback of high PAPR could outweigh all the potential advantages of multicarrier transmission systems [1].

In terms of PAPR reduction, generally there are two classes of PAPR reduction techniques: techniques with distortion and techniques without distortion . About our approach, proposed a method for PAPR reduction in an OFDM system by combining selective mapping (SLM) and dummy sequence iteration (DSI) with the Walsh-Hadamard transform (WHT). The researchers achieved PAPR reduction, however at the expense of the high complexness of victimization several inverse fast Fourier transforms (IFFTs) and WHTs, and data rate losses through redundant SI. Though these techniques reduced the peak power of the transmitted signals, the complexness was high due to the use of IFFT and therefore the WHT one by one. Relating BER performance improvement, several techniques are investigated to reduce the injurious resultt of multipath dispersion. Moreover, subcarrier spreading by employing a WHT-OFDM system may be a lot of convenient approach to exploiting broadband channel diversity potential than using an adaptive system. Furthermore, WHTOFDM has lower complexity, better bandwidth efficiency, and a better data rate compared to adaptive systems . Additionally the advantages of adding WHT to an OFDM system to reduce the influence of the selective fading channel on system performance. this improvement is barely achieved at the expense of an increase in the computational complexity of using WHT and therefore fast Fourier transform separately in a cascaded form[2].

To solve this high PAPR, several solutions are given within the literature, which can be divided in two categories—One category is to reduce the probability of generating high PAPR signals before doing multicarrier modulation, such as coding, Selective Mapping (SLM) and Partial Transmit Sequence (PTS). The other category is to manage with the signals when multicarrier modulation, like clipping and therefore companding transform, among which, the best and most generally used for reducing the PAPR of OFDM signals is clipping. It causes further clipping noise. Additionally, this clipping noise becomes very significant with high modulation orders and seriously degrades the system performance, which makes companding more suitable for high data rates applications.

II EXISTING SYSTEM

The existing systems are

- Random Interleaved OFDMA
- Hadamard transform
- Discrete-Sine-transform

2.1 RANDOM INTERLEAVED OFDMA

There are two different approaches for subcarrier mapping in Orthogonal frequency division multiple access systems are

- Localized subcarrier mapping and
- Distributed subcarrier mapping.

The distributed subcarrier mapping can be further categorized in two modes,

- Interleaved mode and
- Random interleaved mode.

The random interleaved mapping is used for mobile WiMAX because it increases the capacity in frequency selective fading channels and offers maximum frequency diversity.

2.2 HADAMARD TRANSFORM

The Hadamard transform (also known as the Walsh–Hadamard transform, Hadamard–Rademacher–Walsh transform, Walsh transform, or Walsh–Fourier transform) is an example of a generalized category of Fourier transforms. It performs an orthogonal, symmetric, involutional, linear operation on real numbers (or complex numbers, although the Hadamard matrices themselves are strictly real).The Hadamard transform are often considered being designde out of size-2 discrete Fourier transforms (DFTs), and is in fact equivalent to a multidimensional DFT of size . It decomposes an arbitrary input vector into a superposition of Walsh functions.The Hadamard transform H_m is a $2^m \times 2^m$ matrix, the Hadamard matrix (scaled by a normalization factor), that transforms 2^m real numbers x_n into 2^m real numbers X_k. The Hadamard transform are often outlined in two ways: recursively, or by using the binary (base-2) representation of the indices *n* and *k*. The Hadamard transform is additionally employed in data encryption, as well as many signal processing and data compression algorithms, such as JPEG XR and MPEG-4 AVC. In video compression applications, it is usually used in the form of the sum of absolute transformed differences. It is also a crucial part of Grover's algorithm and Shor's algorithm in quantum computing.

Computational complexity:

The Hadamard transform are often computed in $n \log n$ operations ($n = 2^m$), using the fast Hadamard transform algorithm.

2.3 DISCRETE-SINE-TRANSFORM

The **discrete sine transform** (DST) is a Fourier-related transform similar to the discrete Fourier transform (DFT), however employing a purely real matrix. It is equivalent to the imaginary parts of a DFT of roughly double the length, in operation on real information with odd symmetry (since the Fourier transform of a real and odd function is imaginary and odd), where in some variants the input and/or output data are shifted by half a sample.

A related transform is the discrete cosine transform (DCT), which is equivalent to a DFT of real and *even* functions. See the DCT article for a general discussion of however the boundary conditions relate the varied DCT and DST varieties.

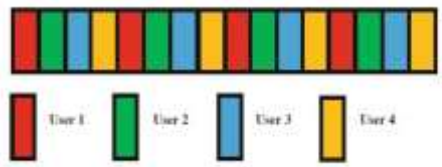

Fig .1. Interleaved OFDMA

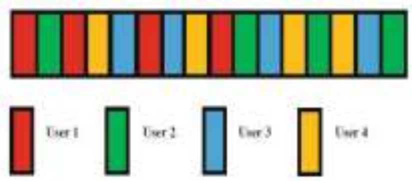

Fig.2. Random interleaved OFDMA

Fig.1. shows subcarrier mapping within the interleaved mode, wherever's subcarriers are mapped equidistant to each other. Fig 2 explains subcarrier mapping in random interleaved mode, where the subcarriers are mapped indiscriminately based on a permutation formula.

In data block generation the input data of size 128 is generated and the generated input is given to the next block. The next block is precoder,it produces the data of size 128. The precoder output is given to subcarrier mapping block.

In subcarrier mapping block a separate analog or digital signal carried on main radio transmission, which carries extra information such as voice or data.

The so produced analog or digital signal is given to Inverse Fast Fourier Transform block. The Inverse Fast Fourier Transform performs opposite to that of Fast Fourier Transform. The Inverse Fast Fourier transform block produces the data of size 512.It is given to filtering block.

Here the Up sampling process is carried first and then filtering process takes place. The filter used is Pulse The so produced analog or digital signal is given to Inverse Fast Fourier Transform block. The Inverse Fast Fourier Transform performs opposite to that of Fast Fourier Transform. The Inverse Fast Fourier transform block produces the data of size 512.It is given to filtering block.

Here the Up sampling process is carried first and then filtering process takes place. The filter used is Pulse shape filter. It is a process of changing the waveform of transmitted pulse. Its purpose is to make the transmitted signal better suited to meet its requirements by limiting the bandwidth of transmission by filtering the transmitted pulse. This way the ISI caused by the channel can be kept in control. Finally it is given to PAPR calculation and the PAPR is calculated.

Transmitter

The computer file is fed to the mapper block is shown in fig 4. The mapper block generates the information and it's fed to the serial-to-converter block.The baseband modulated information is passed through serial-to-parallel converter to generate a complex vector. The information from the previous block is given to the seperate Discrete Sine Transform block. Then the result from the above block is given to subcarrier mapping. The subcarrier mapping produces analog or digital signal and conjointly carries further data like voice or information. It is given to IFFT block. The result is given to pulse shaping. It will scale back the bandwidth due to the absence of Inter symbol interference. It produces the result without changing the waveform of the signal.

The result from the above block is given to the channel and therefore the noise is added by the additive white Gaussian noise. Here the digital to analog method is carried out.

Receiver

In receiver aspect the analog to digital method is administered. The result is given to the Fast fourier transform. It operates to the inverse of IFFT. It is then fed to the subcarrier De-mapping and in this block it will produce the reverse operation to that of subcarrier mapping. And the output is given to parallel-to-serial block.It will produce the signal in serial fashion. The result of the above block is fed to the Demapper. Then the output data stream is produced. In receiver aspect it will perform the operation simply opposite to that of in transmitter side.

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BLOCK DIAGRAM

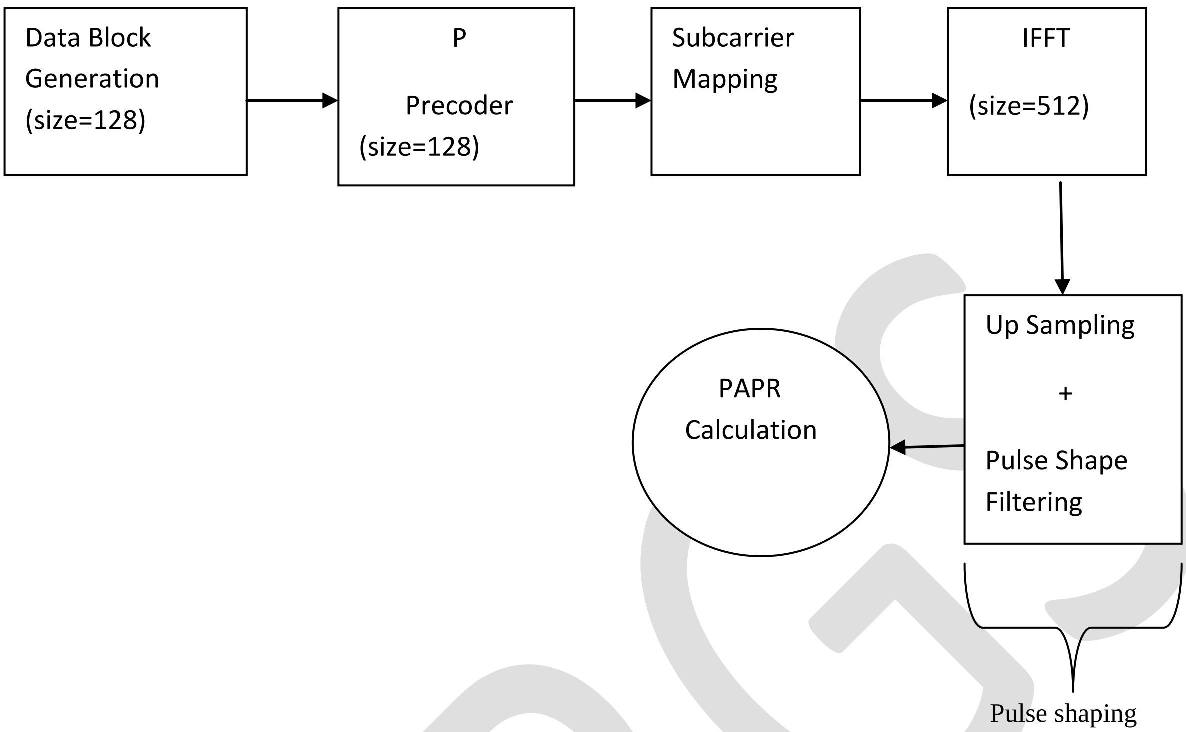

Fig. 3Blog Diagram of PAPR calculation for ZCMT-OFDMA uplink systems

Effects of DST

All the elements of the precoding matrix should have an equivalent magnitude. The DST precoding matrix should be non-singular. The primary criterion ensures that every output symbol has the same amount of information of each input data.

The second requirement preserves the power at the precoder output. The third requirement ensures the recovery of the initial information at the receiver.The three autocorrelation functions have totally different sidelobe values. If the sidelobes of autocorrelation have higher values, then the input sequence is highly correlated and its PAPR is high.

Disadvantages of Existing system

- The elements are not having the similar magnitude.
- The autocorrelation of input sequence is not reduced.
- Due to high autocorrelation the PAPR is high and it is not reduced.

Table 1 System parameters to evaluate PAPR

Channel bandwidth	5 MHz
Oversampling factor	4
Modulation	QPSK,X-QAM(where X=16,64,128,256 and 512)
Precoder type	ZCMT,WHT and DHT

User sub-carriers	128
Precoder size	128
Sub-carrier mapping	Interleaved, random-interleaved or distributed and localized

DST PRECODING MODEL

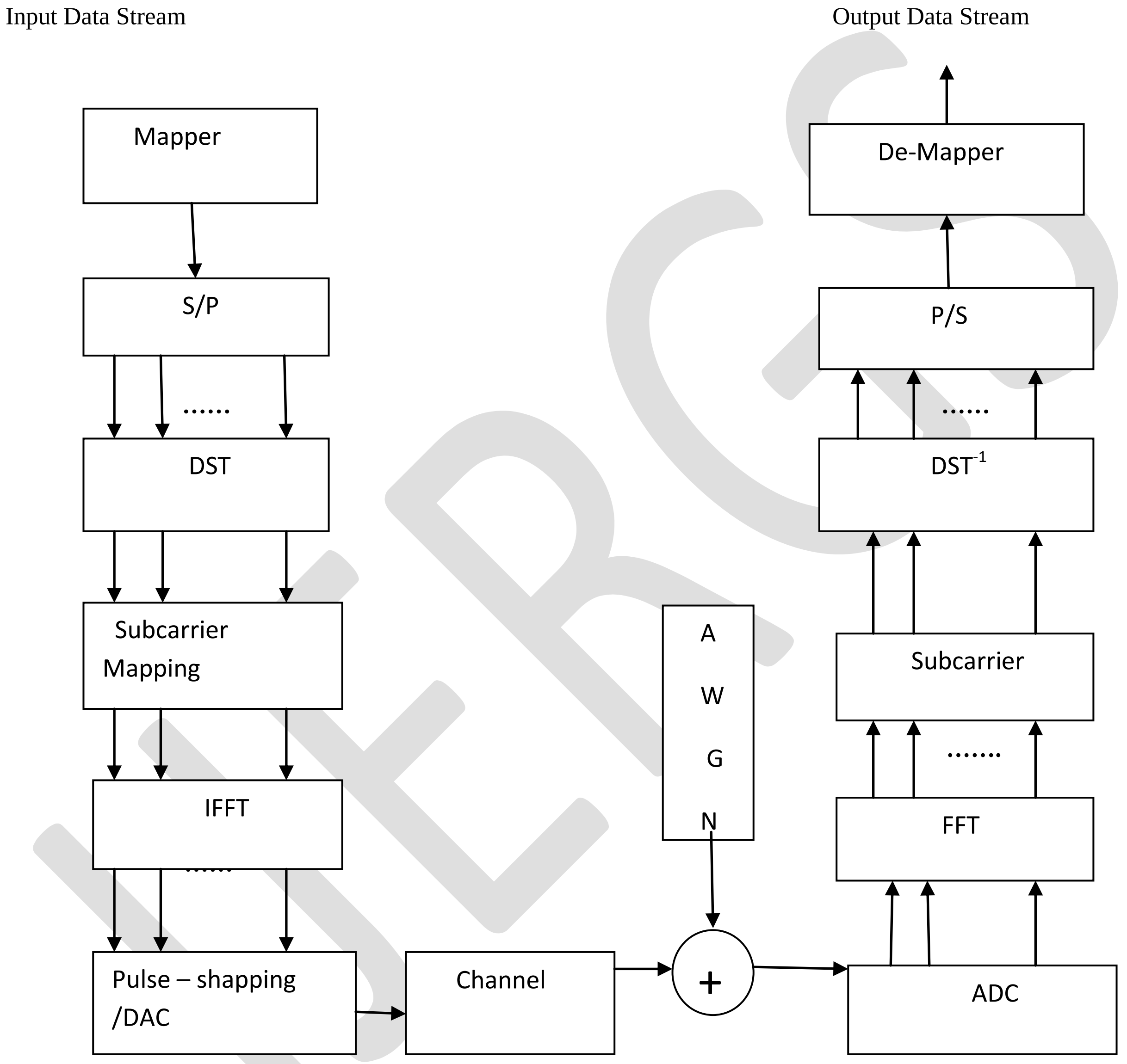

Fig .4.DST precoding based random interleaved OFDMA

III PROPOSED SYSTEM

To overcome the disadvantages within the existing system the proposed system uses a technique called Partial Transmit Sequence. OFDM systems have the inherent problem of a high peak to average power ratio (PAPR). OFDM Suffers because the no of Subcarriers operating in the large dynamic range operates in the non-linear region of amplifier due to OFDM suffer the PAPR problem Application of high power amplifiers results in increased component cost. In general, there has been a trade-off between PAPR reduction and computational complexity in partial transmits sequence (PTS) OFDM. The complexness reduction of PTS PAPR reduction scheme in OFDM systems by reducing the complexity of the IFFT design is investigated. In the IFFT design of PTS OFDM scheme, there are a lot of additions and multiplications with zero, which are obviously unnecessary. We can efficiently reduce the computational complexity without changing the resulting signal or degrading the performance of PAPR reduction by eliminating the additions and multiplications with zero. Linear and non liner techniques are used. It includes Tone Injection, clipping, companding, Dummy sequence insertion and Partial Transmit sequence. Partial Transmit sequence is a distortion less method but it is a time-consuming process and has large number of computations. To avoid high PAPR, PTS technique is used. PTS is a distortion less phase optimization scheme which provides excellent PAPR reduction. In this technique, an input data sequence is divided into number of dis-joint sub blocks and then it is weighted by a set of phase factors.

To produce the PAPR output using PTS technique, the equation can be given as

PAPR{X(t)}=max|x(t)|^2 / E[x(t)^2]

where

max|x(t)|^2 is maximum power

E[x(t)^2] is average power

E{.} denotes expected value

$\text{PAPR (dB)}=10\log_{10}\text{PAPR}$

IV EXPERIMENTAL RESULT

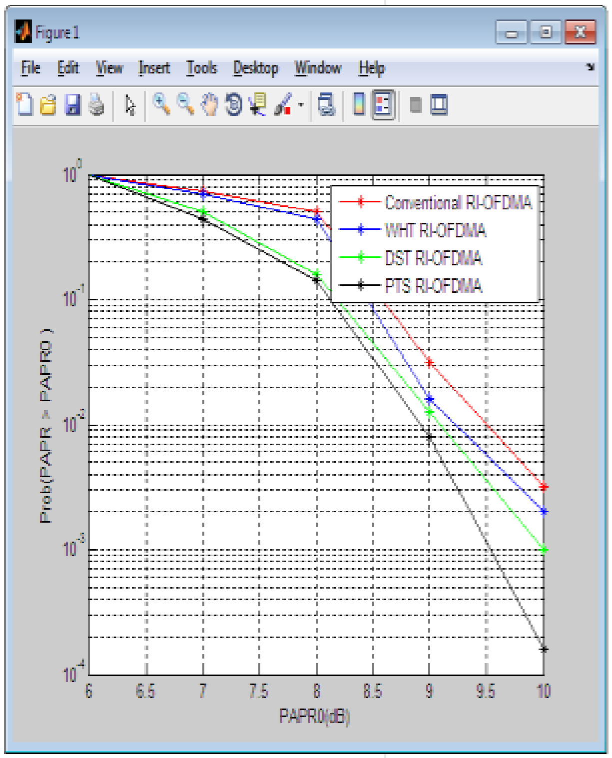

Fig 5 CCDF based comparision of PAPR of ZCMT,DHT,WHT and PTS precoding techniques using 16-QAM

V CONCLUSION

More number of simulations can be produced by using 64-QAM, 125-QAM. DST precoding based RI-OFDMA transmission system is employed to reduce high PAPR.But the PAPR is not reduced as much as possible as compared to the proposed system. Using PTS technique the PAPR reduction is economical. It is efficient, distortion less and signal freelance. It does not need advanced optimization. PTS technique has the advantage of frequency variation of the communication channel and will increase the performance gain in fading multipath channels.

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