A Novel Approach based on Dynamic Ranges for Reduction of Peak to Average Power Ratio (PAPR) in Clipped OFDM

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ABSTRACT
Multiple transmit and receive antennas can be used to form multiple-input multiple-output (MIMO) channels to increase the capacity and data rate.In this paper we present a novel technique which is based on the equalization value where we taken several dynamic ranges from the sin and cosine values and according to those values we first take the lower limit basis on the orthogonal (peak values) and then taken the higher value basis on the orthogonal (peak values). Then apply the rate adaptive method to compare those values according to those changes. We consider those values because the distortion rate is decreases in case of decreasing values in some cases and in some cases increasing values are also important in some cases, so we analyse those cases and then finalize the result based on those parameters. In these technique the phase sequence multiplication before perform FFT operation by using PN sequence generator and second phase sequence multiplication are the invert version of PN sequence generator.

Keywords- OFDM, MIMO, Orthogonal, RA

1. INTRODUCTION
Achieving Data Rates that approach capacity over a noisy linear channel with memory requires sophisticated transmission schemes that combine coding and shaping with modulation and equalization. While it is known that single-carrier system employing a minimal-mean-square error decision feedback equalizer can be, in some cases, theoretically optimum [1], the implementation of this structure in practice is difficult. In particular, the required lengths of the transmitted pulse shaping and the receiver equalizers can be long. An alternative to this scheme that is more suitable for a variety of high-speed applications on difficult channels is the use of multiparae modulations, which is also optimal for the infinite-length case.
The main drawback of OFDM is the high peak-to-average power ratio (PAPR)[2]which is reduce the power efficiency of a HPA (High Power Amplifier) [3].OFDM is a special form of multi carrier modulation and painful Inter Symbol Interference (ISI) by multiplexing the data on orthogonal property. OFDM can be combined with MIMO to increase the system capacity and performances many techniques to deal with the PAPR problem [4]. The techniques amplitude clipping, clipping and filtering, coding, tone reservation, tone injection, active constellation extension, partial transmit sequence, selected mapping, and interleaving.

The SLM techniques [5] achieve PAPR reductions but the power increase, bit error rate increase and computational complexity increase. Optimal bit loading and subcarrier allocation problems for multiuser OFDM have been formulated in [6][7], specifically minimization of the overall transmit power under data constraint, and maximization of the data rate under power constraint. These are non linear optimization problems which can be broadly divided into two categories: Margin Adaptive (MA) [8] and Rate Adaptive (RA) optimization [9]. It is difficult to solve these problems unless the integer variables are relaxed to allow real numbers. These classical algorithms are computationally intensive due to the nature of non linear optimization.
However, OFDM systems have the undesirable feature of a large Peak to Average Power Ratio (PAPR) of the transmitted signals. Consequently to prevent the spectral growth of the OFDM signal, the transmit amplifier must operate in its linear regions. Therefore, power amplifiers with a large linear region are required for OFDM systems, but such amplifiers will continue to be a major cost component of OFDM systems. Consequently, reducing the PAPR is pivotal to reducing the expense of OFDM systems. However, the increase in bandwidth is an impractical method, and an alternate solution is to adopt some spectral efficient techniques like MIMO systems . The key advantage of employing multiple antennas is to get reliable performance through diversity and the achievable higher data rate through spatial multiplexing.
We provide here an overview of user authentication service by different researchers. The rest of this paper is arranged as follows: Section 2 introduces RA in OFDM; Section 3 describes about the Peak to average ratio; Section 4 shows the Problem Formulation; Section 5 describes the proposed scheme. Section 6 describes Conclusion.

2. RA in OFDM
n wireless broadcast multicast services (BMS), a standard assumption is that each receiver knows something about the channel h, usually referred as channel side information (CSI) or channel quality information (CQI). This is a pretty reasonable assumption when the channel is fading slowly inside the design boundary since there are pilot symbols available for the receiver to estimate CQI. Since the channel and transmitted signals are independent to each other, the ergodic capacity of the fading channel with receiver side information is given by

$$C_{fading}(\text{ SNR, h }) = E \log(\text{ } 1 + |h|^2 \text{ SNR }) \le C_{AWGN}(\text{ } E(|h|^2) \text{ SNR }).$$

This means fading hurts or reduces the capacity in general if the transmitter knows nothing of the fading. This is different to the case that assumes the transmitter can estimate channel through CQI feedback and therefore can do some precoding on broadcast signals.

Since a statistic analysis on a log(*) probability function is non-trivial, one approach is to apply the well-know Maclaurin expansion on C_{fading}(SNR, h) and obtain a polynomial series of it C_{fading}(SNR, h) = $-\ln^{-1}2\ \Sigma_{n=1}[\ (-SNR)^n E(|h|^n)/n\ ]$.
From here, it is much easy for us to find some interesting results in the following.

Low SNR Region

$C_{fading}(\ SNR,\ h\ ) \approx \ln^{-1}2\ SNR\ E(|h|) - \ln^{-1}2\ SNR^2\ E(|h|)^2\ K(h^{1/2})/2$

where *K*() denotes Kurtosis function.

High SNR Region

$C_{fading}(\ SNR,\ h\ ) \approx E\log(\ |h|^2\ SNR\ )$

It is hard to evaluate the above in general since the random valuable h is inside the nonlinear function log( ). However, a simple close-form solution may be possible for some special cases, including Rayleigh channel model, Weibull channel model, and Nakagami-m channel model.

Though hierarchical modulations have been widely adopted for enhancing broadcast multicast services, several issues are still left for future enhancements. The first consideration is the inter-layer interference (ILI) between layers. The ILI from enhancement layer(s) to base layer(s) is not additive white Gaussian. The base-layer achievable spectral efficiency is actually dented by ILI more than expected. In addition, for example, when orthogonal frequency division multiplexing (OFDM) is employed on the carrier, there is a frequency selectivity issue on the layered transmission in fading channels, especially when the channel bandwidth is far more than its coherent bandwidth. With the combination of hierarchical modulation and OFDM, the base layer signal and the enhancement layer signal experience the same channel fading. There is no multi-layer diversity, which can help boost the achievable throughput.

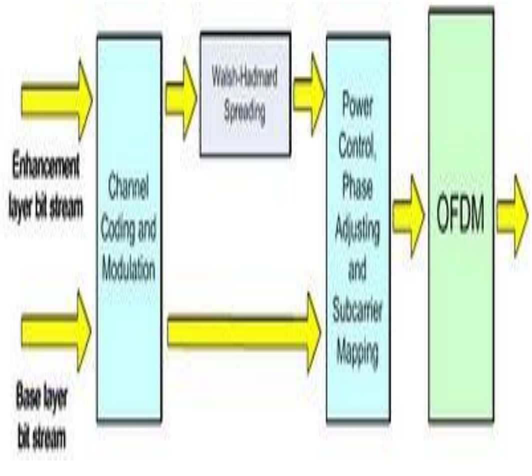

Fig. 1 Overladed OFDM Transmission

3. PEAK TO AVERAGE RATIO

Complementary cumulative distribution function (CCDF) of PAPR is a method of performance estimation used in PAPR reduction techniques. The PAPR is describes the dynamic range of the OFDM time domain signal. The very conventional definition of the PAPR for the OFDM symbol in the time domain is given

by $$\text{PAPR} = \frac{\text{Peak Amplitute of the signal}}{\text{Average value of the signal}}$$

$$\text{PAR}\ \{x\} = \frac{\max(x)^2}{E\left[(x)^2\right]}$$

The CCDF of the PAR is

$$\Pr\ [\text{PAR}\{x[n]\} > \gamma] = 1\text{-}(1\text{-}e^{-\gamma})^N$$

4. PROBLEM FORMULATION

Consider a multiuser OFDM system where different *K* users are allocated to the *N* subcarriers, and each subcarrier n is assigned power. Each of the user's bits is then modulated into *N M*-level QAM symbols, which are subsequently combined using the inverse fast Fourier transform into an OFDM symbol. This is then transmitted through a slowly time-varying frequency-selective Rayleigh channel with bandwidth B. The subcarrier allocation is made known to all the users through a control channel; hence each user needs only to decode the bits on their assigned subcarriers.

There is also a problem regarding the bit values which are either according to the adaptation or either not related to the adaptation. So we not know from which the value produced are best according to the situation.

5. PROPOSED MODEL

We present a novel technique which is based on the equalization value where we taken several dynamic ranges from the sin and cosine values and according to those values we first take the lower limit basis on the orthogonal (peak values) and then taken the higher value basis on the orthogonal (peak values). Then apply the rate adaptive method to compare those values according to those changes. We consider those values because the distortion rate is decreases in case of decreasing values in some cases and in some cases increasing values are also important in some cases, so we analyse those cases and then finalize the result based on those parameters. In these technique the phase sequence multiplication before perform IFFT operation by using PN (pseudo random) sequence generator. It generates random sequence of particular length. The second phase sequence generates only use inverter circuit. The phase multiplications are the invert version of PN sequence generator. After perform IFFT operation select minimum PAPR of desire data then transmitted. Which is reduce the PAPR of desire low level and reduce Computational complexity by using only single PN sequence generator in place of two. Fig 2, Fig3, Fig 4 and Fig 5 shows the above phenomena graphically.

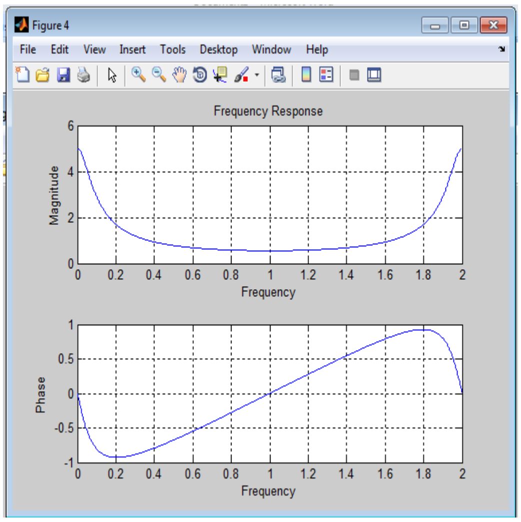

Fig 2 Frequency and Phase values

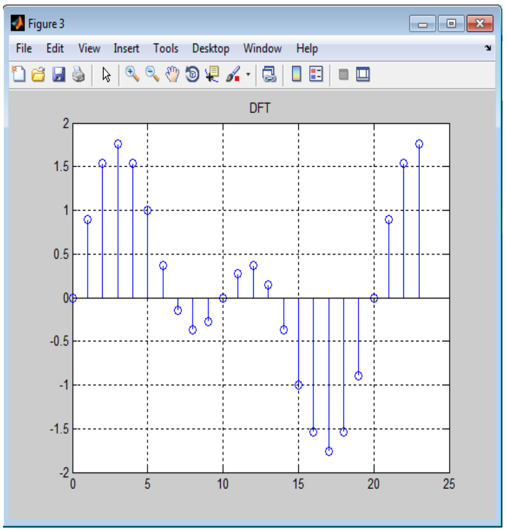

Fig 4 DFT

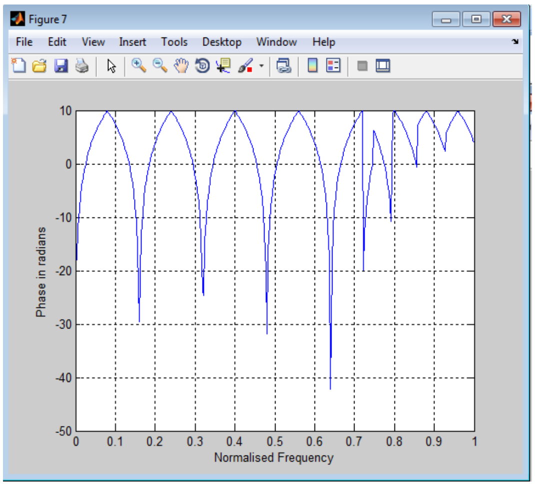

Fig 3 Normalizes Frequency

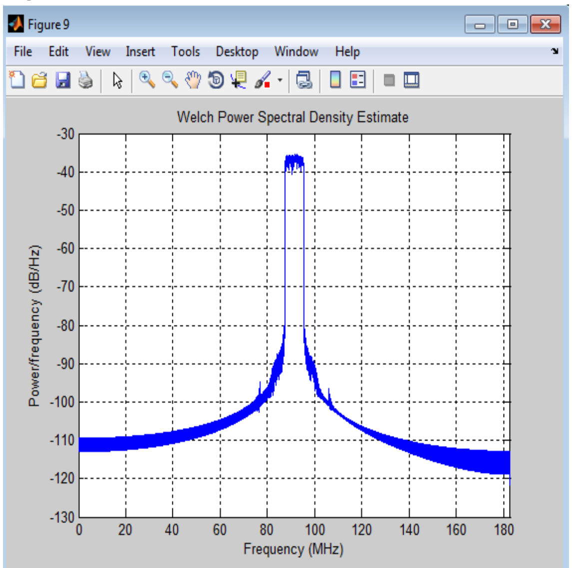

Fig 5 Power Spectral Density

6. CONCLUSION

In this paper we present a novel technique which is based on the equalization value where we taken several dynamic ranges from the sin and cosine values and according to those values we first take the lower limit basis on the orthogonal (peak values) and then taken the higher value basis on the orthogonal (peak values). Then apply the rate adaptive method to compare those values according to those changes.

We propose the novel approach which is reduce The performance of Space-Frequency (SF) block coding for MIMO OFDM along with different equalizers is also analyzed. Bit Error Rate (BER) analysis is presented using different equalizers and then optimum equalization method is suggested.We show the practical aspect of propose scheme in MATLAB environment.

7. REFERENCES

[1] J. Tellado, \Multicarrier modulation with low PAR: applications to DSL and wireless," Phd Stanford dissertation, vol. 1, no. 1, pp. 65{92, April 2000.

[2] A. E. Jones, T. A. Wilkinson, and S. Barton, "Block coding scheme for reduction of peak to mean envelope power ratio of multicarrier transmission schemes," IEE Electronics Letters, vol. 30, pp. 2098–2099, Dec. 1994.

[3]Luqing Wang and Chmtha Tellambura" An Overview of Peak-to-Average Power Ratio Reduction Techniques for OFDM Systems" IEEE Trans vol. 39, no. 3, pp -740-754 June 2006.

[4] B. S. Krongold and D. L. Jones, "A study of active constellation extension for PAR reduction in OFDM," Proc. International OFDM Workshop, Germany, pp. 107-111, Sept. 2002.

[5] Seok-Joong Heo, Hyung-Suk Noh "A Modified SLM Scheme With Low Complexity for PAPR Reduction of OFDM Systems" IEEE Trans. Communications, vol. 53, no. 4, pp. 365-369, December 2007.

[6] C.Y.Wong, R.S.Cheng, K.B.Letaief, and R.D.Murch,"Multiuser OFDM with adaptive sub-carrier, bit, and power allocation," IEEE J.Select, Areas Commun., vol. 17, pp.1747-1758, Oct 1999.

[7] W. Rhee and J.M. Cioffi," Increase in capacity of multiuser OFDM system using dynamic sub-channel allocation," in Proc. IEEE Vehicular Technology Conf. (VTC'2000),2000, PP. 1085-1089.

[8] Zukang Shen, Jeffrey G. Andrews and Brian L. vans,"Optimal Power Allocation in Multiuser OFDM Systems",Proc. IEEE Global Commun. Conf., San Francisco, CA,Dec. 2003, pp. 337- 341.

[9] Ian C. Wong, Zukang Shen, Brian L. Evans and Jeffrey G. Andrews, "A Low Complexity Algorithm for Proportional Resource Allocation in OFDMA Systems"Proc. IEEE Int.Workshop on Signal Processing Systems,pp. 1-6, Oct.2004.