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A Highly Effective Selective Mapping Technique for High Data Rate Wireless Application in OFDM System

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Abstract- With increase in the demand of high data rate transmission over a wireless channel there is a need of modulation scheme that can give the effective high speed transmission. Orthogonal frequency division multiplexing is a one of the modulation technique that can fulfil over requirement, but there is a drawback of this technique that it has high peak to average power ratio which causes reduction in the data rate. Here in this paper over aim is to reduce peak to average power ratio with an effective selective mapping scheme.

Keywords— Orthogonal frequency division multiplexing, Peak to average power ratio, Selective mapping, CCDF

I. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is an effective modulation scheme that can be used for high data rate wireless applications. In Orthogonal Frequency Division Multiplexing (OFDM) sub-carriers are closely spaced and are used to carry data. The data is divided into a number of parallel streams. Each one corresponds to a single subcarrier. This lower data rate subcarrier is modulated by one of the modulation scheme such as Quadrature Amplitude modulation, Phase Shift Keying. [1] The subcarriers are orthogonal to each other. By making sub carrier orthogonal the interference between the sub carriers can be eliminated.one of the major drawback of this modulation scheme is high peak to average power ratio that decrease the power efficiency. Various technique has been proposed for reduction in peak to average power ratio such as clipping, companding, coding, Selective Mapping.

II. PAPR

The obstacle in an orthogonal frequency division multiplexing (OFDM) scheme is its high Peak-to-Average Power Ratio (PAPR). In OFDM 'N' signals are added with the same phase, they produce a peak power which is also (N) times the average power. The signal in an orthogonal frequency division multiplexing (OFDM) system can have high peak values in the time domain because many subcarriers are added via an IFFT (inverse fast Fourier transform) operation. Therefore, the OFDM (orthogonal frequency division multiplexing) systems are known to have a high PAPR (Peak-to-Average-Power Ratio), compared with the single-carrier systems. [2]

III. CLIPPING

High PAPR is one of the most common problems in orthogonal frequency division multiplexing (OFDM) scheme. A high PAPR causes increases in design complexity of the ADC and DAC also reduce the efficiency of radio frequency (RF) power amplifier. One of the simple peaks to average power ratio (PAPR) reduction technique is clipping that cancels the signal components that gone above some unchanging amplitude called clip level. However, clipping method yields distortion power called clipping noise and expands the transmitted signal spectrum, which causes interfering. Clipping in nonlinear process and causes in-band noise distortion, this causes poor performance of bit error rate (BER) and out-of-band noise, which decreases the efficiency. [3]

IV. COMPANDING

Companding technique was proposed, based upon the assumptions that the OFDM signal has Gaussian distribution and occurrence of high peaks is infrequent [4]. In OFDM system on transmitter side after IIFT, the signal undergoes Companding and quantization while on receiver side the signal is first digitized and then expanded. Companding was initially employed for speech processing because of infrequent occurrence of peaks [5]. Since the OFDM signal also shows infrequent peaks, hence this technique has applied for reduction of peaks in OFDM system. Since frequency of small signals is much more as compared to large ones hence there is improved quantization resolution for small signals as compared to large signals. The overall BER performance is considerably degraded because the quantization error is increased notably for large signals and hence there is overall improvement in peak to average power ratio (PAPR) which is achieved by companding is at the cast of BER performance. Companding is simply a system in which information is first compressed, transmitted through a bandwidth limited channel, and expanded the receiver side.

V. SELECTIVE MAPPING

The selective mapping (SLM) technique for PAPR reduction was proposed in 1996 [6]. In this scheme from a set of candidate signals, which are generated in order to represent the same information, the signal with lowest peak to average

power ratio (PAPR) is select for transmission [7]. The data about this selection also need to be transmitted along with the selected signal. The SLM scheme block diagram is shown in figure. SLM needs to transmit the data to the receiver, about the selected signal. If there is an error in the received data, then the receiver cannot recover the data from the transmitted selected signal and that's why a strong protection against transmission errors is needed regarded this data. Once the receiver has this data then the decoding process is very simple. Selective mapping (SLM) can be employed for larger number of sub-carriers with moderate complexity [8]. In SLM technique the data sequence is multiplied with L phase sequences which carry the same information are generated. From the generated L sequences the sequence with minimum peak to average power ratio is selected for along with data the side information is also transmitted which indicates the phase sequence with minimized the peak to average power ratio.[9]

VI. PROPOSED TECHNIQUE

New technique of SLM is developed; this is an effective and distortion less technique used for the PAPR reduction in OFDM, in proposed scheme the phase sequence of that is used to generate the candidate signal copies is changed. In previously used selected mapping (SLM) method the phase sequence which is used is, S= [1,-1, j,-j]. In place of these phase sequence in new method we use other phase sequence with increase in the phase length and select the sequence that gives the minimum PAPR. Due to this there is further reduction in the PAPR.

VII. RESULTS

Different PAPR reduction techniques have been simulated using MATLAB simulating software. The system parameters are taken according to IEEE 802.11a (WLAN) standard. CCDF curve plot are taken as performance parameter.

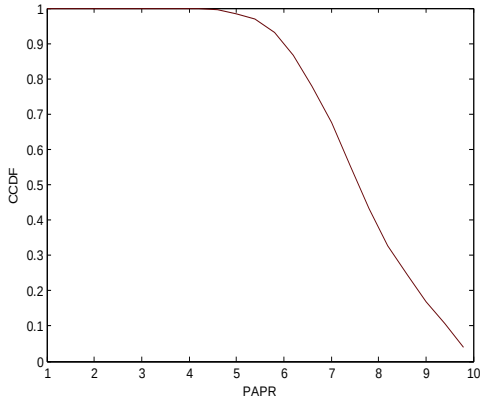

Fig 1 CCDF curve of plain OFDM

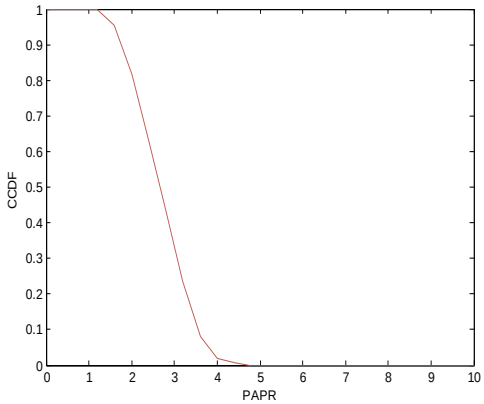

Fig.2 CCDF curve of proposed Selective Mapping Technique

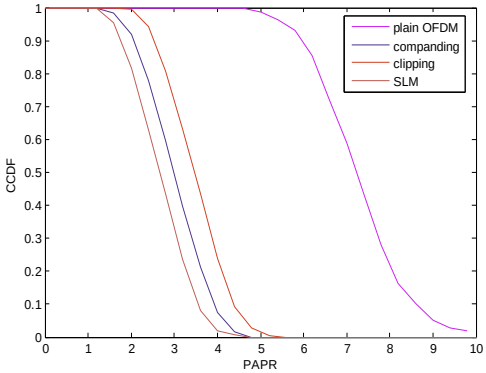

Fig.3 CCDF curve of Various PAPR reduction techniques

VIII. CONCLUSIONS

In this paper, the performance analysis of the OFDM in WLAN has been carried out for three different methods. The clipping scheme and the companding scheme are the signal distortion type techniques. These techniques are used for reducing the peak to average power ratio of OFDM system. Using MATLAB, we can see that the PAPR of the OFDM system has been successfully reduced at certain level, but these techniques produces in band distortion or out of band radiation and degrade the Bit Error Rate (BER) performance. The drawbacks of which can be overcome by using the proposed method, in which a Selective mapping technique is used to reduce the peak to average power ratio of the OFDM system. Using clipping and companding technique the value of the PAPR is reducing to approximately 3.8 dB and 3.1 dB from 7.5 dB the percentage of reduction is achieved 49% in clipping, 59% in companding. Using the SLM technique peak to average power ratio is reduced to approx. 2.6 dB, which is 65%.

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