CLIPPING NOISE MITIGATION SENSING FOR RECOVERY OF OFDM SIGNALS

[1]J.SANDHYA, [2]V.LAVANYA
[1]Assistant Professor, Dept of E.C.E, Teegala Krishna Reddy Engineering College, Telangana, INDIA
[2]Assistant Professor, Dept of E.C.E, Teegala Krishna Reddy Engineering College, Telangana, INDIA

Abstract:To reduce the peak-to-average power ratio of orthogonal frequency division multiplexing (OFDM) signal, a simple method of clipping is used. It passes through the high power amplifier (HPA). Basically, clipping is a nonlinear process which produces in-band and out-of-band distortions. By filtering the clipped OFDM signal, it can eliminate the out-of-band distortion but it can lead to peak regrowth. Hence the both iterative clipping and filtering are used to remove out-of-band interference and suppress the regrowth of the peak power.In this paper, we propose a semi analytic scheme which depends up on compressed sensing to reconstruct the iterative clipping noise. In this the proposed system is applicable to reconstruct the nonlinear distortion of a system so that the OFDM signal passes both the clipper and HPA.At last from simulation results we can observe that the proposed scheme performs well and the nonlinear distortion is recovered.
***Index Terms*–Peak-to-average power ratio (PAPR), iterative clipping and filtering (ICF), compressed sensing (CS), high power amplifier (HPA), OFDM.**

I. INTRODUCTION

In the intensity modulated/direct detection (IM/DD) optical wireless communication (OWC) systems, OFDM is used as modulation technique. In this the transmitted signals are modulated onto intensity of light to be in unipolar. Here to convert a conventional bipolar OFDM signal into a unipolar signal an approach is used. In that approach first dc bias is added and then the OFDM signal is clipped at zero. Because of this low bias levels clipping produces distortion which produces data detection errors.

The high peak-to-average power ratio (PAPR) of an OFDM signal would drive the high power amplifier (HPA) at the transmitter to saturation, producingin-band distortion that degrades the bit error rate (BER) performance and out-of-band distortion that corrupts the spectrum of the signals. To avoid nonlinear distortion, high PAPR requires an HPA with a large linear dynamic range or a relatively large output back off (OBO) at the cost of power efficiency.

In the proposed system a number of PAPR reduction techniques are introduced. These techniques are broadly classified into three classes. They are signal distortion techniques, signal distortion less techniques and coding techniques. The former can degrade the BER performance and the latter causes spectral spreading. According to compressed sensing (CS) theory ofsparse signal processing, a sparse signal can be reconstructed from its compressed observations. Several CS reconstruction algorithms have been proposed to reconstruct the clipping noise. These approaches mainly consider cases where the OFDM signal is transmitted through the clipping and filtering module just once, not in iterative cases.

A clipped OFDM signal is the sum of the original signal and a sparse clipping noise in time domain, these approaches can reconstruct the clipping noise based on compressed sensing. The iterative processing results in an input signal at the next stage of clipping that violates the Gaussian approximation and the final clipping noise violates the sparsity required in compressed sensing.

A new algorithm is introduced to migrate the clipping noise in OFDM. By using this algorithm performance is increased in (IM/DD) system. In the algorithm the data is detected and used to regenerate an equivalent time domain signal which is then used to estimate the component of the signal removed by clipping. This is combined with the original received signal and then input into a conventional OFDM receiver. A closely related algorithm was described for radio frequency (RF) systems, but in the compensation for constellation shrinkage is not optimal and this significantly reduces the effectiveness of clipping mitigation.

II. EXISTED SYSTEM

The below figure (1) shows the block diagram of existed system. The data is mapped onto the bipolar complex QAM symbols. Due to the central limit theorem, $x_m$is approximately zero mean with Gaussian distribution. Next, $x_m$is clipped at the level of $-B$DC to generate $x_{\text{clip},m}$.. A cyclic prefix (CP) is then added and a digital-to-analog converter (DAC) converts the discrete signal sequence into an analog signal, $s_{\text{DCO}}(t)$. The real positive signal, $s_{\text{DCO}}(t)$, is then used to drive a LED. The clipping operation attenuates the signal and causes clipping noise.

In this we describe the effects of clipping noise in the frequency domain and study its influence on BER performance. Shrinkage affects all of the subcarriers equally and results from a reduction in the overall signal power after clipping. We can see that the clipping noise is significant and thatdue to the effect of shrinkage, the centers of the constellation symbols are not at the constellation points before clipping, which are at the intersections of the dashed lines. This system does not produces better results, so a new system is proposed which is discussed in below section.

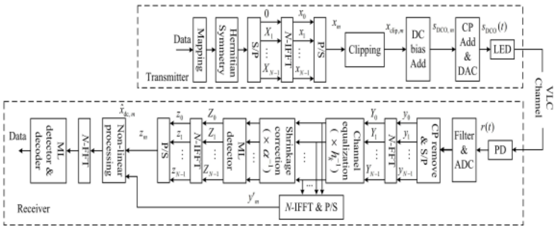

Fig. 1. Existed system

III. PROPOSED SYSTEM

The below figure (2) shows the architecture of proposed system. We first represent the statistical properties of the only clipped OFDM signal. The output of clipping can be considered as the sum of *xn*and clipping noise *cn*.Based on Bussgang theorem for Gaussian inputs, the clipped signal *xn*can be decomposed into two uncorrelated parts.The nonlinear distortion term *dn*is distributed both inside and outside of the signal bandwidth. Filtering follows clipping to remove the out-of-band interference.

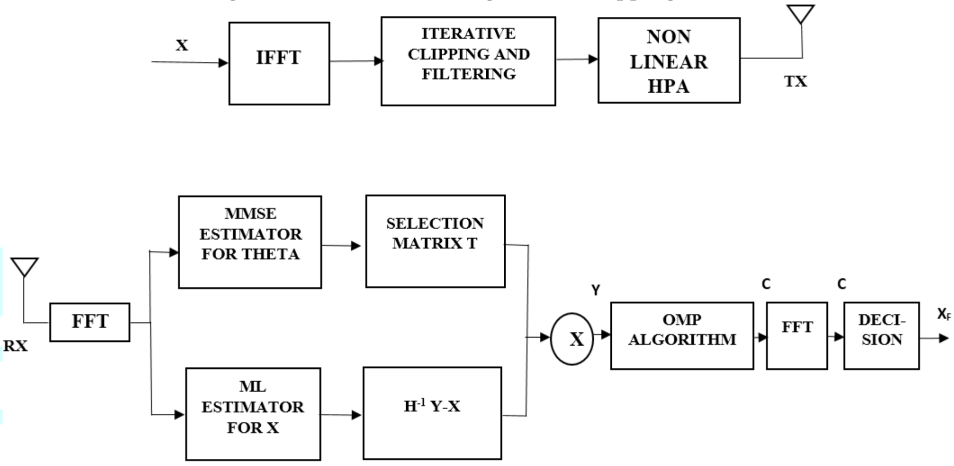

Fig. 2. Proposed system

However, the elimination of out-of-band interference in frequency will cause peak regrowth of the clipped signal in time domain. To suppress the peak regrowth, ICF is used. After several ICF operations the PAPR reaches the desired one. Soit can be observed that the total clipping noise caused by ICF is finite. When the PAPRhas reached the predefined target ratio after several ICF operations, the probability that the output power of subsequent ICF operations will approach zero and the part in frequency domain won't increase new clipping noise.

The clipping noise at the first ICF is the dominant share of the total clipping noise. The signal to the clipping process is not Gaussian, and deriving its distribution and a closed form for the BER performance of ICF is difficult. Due to the dominant position of the clipping noise at the first iteration, we can use it to quantify the total clipping noise. Due to the accordance with the form at the first iteration, we can use the compressed sensing scheme to reconstructthe iterative clipping noise based on the similar sparsity in the time domain.

However, in reality, the total distortion is not sparsein the time domain, which can be quantified in this semi analytical way. It is observed that the proposed scheme based on CS depends on the noise enhancement factor *β(L)* which is determined by simulation. When the clipping ratio and smoothing factor are fixed, it is reasonable to quantify the total system noise with the noise enhancement factor. Hence this proposed system produces better results compared to exist one.

IV. RESULTS

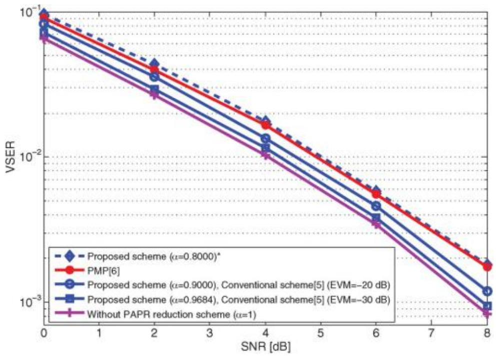

Fig 3. SNR performance of the proposed scheme, conventional scheme and PMP.

V. CONCLUSION

In this paper we proposed a modified scheme with the noise enhancement factor using cs. This system will reconstruct the total nonlinear distortion of the system which involves iterative clipping and filtering. We can determine the noise enhancement factor by determining the simulation results. Compared to existed system, the proposed system gives better results and good reliability.

REFERENCES

[1] Y. Rahmatallah and S. Mohan, "Peak-to-average power ratio reduction in OFDM system: A survey and taxonomy," *IEEE Commun. SurveysTuts.*, vol. 15, no. 4, pp. 1567–1592, 4th Quart., 2013.

[2] Y.-C. Wang and Z.-Q. Luo, "Optimized iterative clipping and filtering for PAPR reduction of OFDM signals," *IEEE Trans. Commun.*, vol. 59, no. 1, pp. 33–37, Jan. 2011.

[3] Y. Wang, W. Chen, and C. Tellambura, "Genetic algorithm based nearly optimal peak reduction tone set selection for adaptive amplitude clipping PAPR reduction," *IEEE Trans. Broadcast.*, vol. 58, no. 3, pp. 462–471, Sep. 2012.

[4] M. Hu, Y. Li, W. Wang, and H. Zhang, "A piecewise linear compandingtransform for PAPR reduction of OFDM signals with companding distortion mitigation," *IEEE Trans. Broadcast.*, vol. 60, no. 3, pp. 532–539, Sep. 2014.

[5] H.-S. Joo, S.-J. Heo, H.-B. Jeon, J.-S. No, and D.-J. Shin, "A new blind SLM scheme with low decoding complexity for OFDM systems," *IEEETrans. Broadcast.*, vol. 58, no. 4, pp. 669–676, Dec. 2012.

[6] C. Ye, Z. Li, T. Jiang, C. Ni, and Q. Qi, "PAPR reduction of OQAMOFDM signals using segmental PTS scheme with low complexity," *IEEETrans. Broadcast*., vol. 60, no. 1, pp. 141–147, Mar. 2014.

[7] K.-H. Kim, "On the shift value set of cyclic shifted sequences for PAPR reduction in OFDM systems," *IEEE Trans. Broadcast.*, vol. 62, no. 2, pp. 496–500, Jun. 2016.

[8] T. Jiang, C. Ni, C. Ye, Y. Wu, and K. Luo, "A novel multi-block tone reservation scheme for PAPR reduction in OQAM-OFDM systems,"*IEEE Trans. Broadcast.*, vol. 61, no. 4, pp. 717–723, Dec. 2015.

[9] S. B. Slimane, "Reducing the peak-to-average power ratio of OFDM signals through precoding," *IEEE Trans. Veh. Technol.*, vol. 56, no. 2, pp. 686–695, Mar. 2007.

[10] M. J. Hao and C. H. Lai, "Precoding for PAPR reduction of OFDM signals with minimum error probability," *IEEE Trans. Broadcast.*, vol. 56, no. 1, pp. 120–128, Mar. 2010.

J.SANDHYA present working as Assistant professor in Teegala Krishna Reddy Engineering College. Completed M.Tech degree in VLSI System Design from TKR College of Engineering and Technology, JNTU, Hyderabad and Received B.Tech degree in Electronics and Communication Engineering from SVEC, JNTU, Hyderabad, in 2010. Research interests include Digital, wireless communication, Radar system, Telecommunications and frontend logic design andhardware/software co-frication.

V.LAVANYApresent working as Assistant professor in Teegala Krishna Reddy Engineering College. Completed M.Tech degree in communication and radar systems from KLCE, ANU, Guntur and Received the B.Tech degree in Electronics and Communication Engineering from SCREC, JNTU, Kakinada, in 2004. Research interests include Wireless communication, Radar system, Telecommunications and frontend logic design.