Advances in Computer Science and Information Technology (ACSIT)
p-ISSN: 2393-9907; e-ISSN: 2393-9915; Volume 4, Issue 1; January-March, 2017, pp. 55-56
© Krishi Sanskriti Publications
http://www.krishisanskriti.org/Publication.html

A Survey on PAPR Reduction using Signal Scrambling Techniques

Vanitha M U[1], B N Ravisimha[2] and M.Z. Kurian[3]

[1]PG Student, Department of ECE, Sri Siddhartha Institute of Technology, Tumkur, India
[2,3]Department of ECE, Sri Siddhartha Institute of Technology, Tumkur, India
E-mail : [1]vanithamu111@gmail.com, [2]ravisimhabn@gmail.com, [3]mzkurianvc@yahoo.com

Abstract—*In recent years, there is a rapid growth in multimedia based applications which requires high data rate transmission. Orthogonal Frequency Division Multiplexing (OFDM) is the efficient multiplexing and modulation technique adopted for 4G wireless communication applications. OFDM is high speed data transmission scheme in wireless communication. One of the main disadvantage of the OFDM is Peak to Average Power Ratio (PAPR). Mainly, because of non-linearity of high power amplifier these results Inter Carrier Interference (ICI) and degradation of Bit Error Rate (BER). OFDM consist of large number of independent subcarriers as a result of which amplitude of such signal have high values. However, as the number of subcarriers increases PAPR also increases. The different PAPR reduction techniques are available such as Companding, Selective Mapping (SLM), Tone Injection (TI), Tone Rejection (TR) and Partial Transmit Sequence (PTS).*

Keywords*: OFDM, BER, PAPR, PTS, SLM.*

1. INTRODUCTION

With the increase of communications technology, the demand for higher data rate services such as multimedia, voice, and data over both wired and wireless links is also increased. New modulation schemes are required to transfer the large amount of data which existing techniques cannot support. These techniques must be able to provide high data rate, allowable Bit Error Rate (BER), and maximum delay. OFDM is one of them. OFDM has been used for Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB) and for Asymmetric Digital Subscriber Line (ADSL) high data rate wired links. OFDM is superior multicarrier modulation technique that transmits signals through multiple carriers. It divides broadband channel into number of channels. OFDM is suffering from high PAPR (Peak to Average Power Ratio) and high Side lobe Power. When PAPR is high, a Power amplifier works on non-linear region. It gives non-linear distortion. It also causes Out Of Band distortion and ICI. When Side lobe Power is high, it causes Side lobe Suppression and interference with Primary Users.

2. LITERATURE SURVEY

2.1 Orthogonal Frequency Division Multiplexing (OFDM)

OFDM is a widely used modulation and multiplexing technology which has become the basis of many telecommunications standards including wireless Local Area Networks (LANs), Digital Terrestrial Television (DTT) and Digital Radio Broadcasting in much of the world. In the past, as well as in the present, the OFDM is referred in the literature as Multi-carrier, Multi-tone and Fourier Transform. The OFDM concept is based on spreading the data to be transmitted over a large number of carriers, each being modulated at a low rate. The carriers are made orthogonal to each other by appropriately choosing the frequency spacing between the carriers. A multicarrier system, such as Frequency Division Multiplexing divides the total available bandwidth in the spectrum into sub-bands for multiple carriers to transmit in parallel. It combines a large number of low data rate carriers to construct a composite high data rate communication system. Orthogonality gives the carriers a valid reason to be closely spaced with overlapping without ICI [1, 3].

2.2 Peak to Average Power Ratio (PAPR)

The only drawback of this multicarrier transmission system is the PAPR effect that causes power inefficiency. PAPR is the effect of coherent addition of multiple sub-carrier amplitudes & phases from the OFDM system. The efficiency of the OFDM system is reduced due to PAPR effect because it limits the range of linear operation of RF power amplifier in transmitter. To avoid distortions caused in the signal, peaks should be shown in the linear region only and for that there is a need of large linear region for the operation of RF power amplifiers. For this, numbers of PAPR reduction techniques have been developed. In a multicarrier system the different sub-carriers are out of phase with each other, then PAPR occurs. There are large numbers of independent modulated subcarriers in an OFDM system. Because of subcarriers in an OFDM system, the peak value of the OFDM system can be very high as compared to the average value of the whole

system. This ratio of the peak to average power value is termed as Peak to Average Power Ratio (PAPR).

2.3 PAPR Reduction Techniques

Many PAPR reduction techniques proposed so far, some of the well-known techniques are as follows:

1. Companding: Companding is typically applied to speech signals to optimize the required number of bits per sample. Since OFDM and speech signals behave similarly in the sense that high peaks occur infrequently, companding can also be used to reduce the PAPR of OFDM signal. Besides having relatively low computational complexity compared to other PAPR reduction techniques, companding complexity is not affected by the number of subcarriers. Also, companding does not require side information and hence does not reduce bit rate. The simplicity of implementation and the advantages of companding make it an attractive PAPR reduction technique. The PAPR reduction obtained by companding comes though with the price of increasing the BER [2].

2. Partial Transmit Sequence (PTS): Partial Transmits Sequences is one of the Symbol Scrambling methods used to reduce PAPR in the OFDM system. There are two main steps for presenting PTS. Firstly divide the original OFDM signal into several sub-blocks and secondly add the sub-blocks after rotating their phase and develop several candidate signals. Then select one of the candidate signals which has lowest PAPR for transmission [2].

3. Selective Mapping (SLM): Selective Mapping is one of the scrambling technique used for PAPR reduction in OFDM system. The idea behind the SLM technique is to create a number of OFDM symbols called candidates and then select one of them which has lowest PAPR value for actual transmission. In OFDM system, Selective Mapping is considered one of the techniques for PAPR reduction. Phase rotation is the main idea behind this technique. For transmission the lowest PAPR signal will be selected from a number of different data blocks that have the same information at the transmitter [3].

4. Tone Reservation (TR): Tone reservation is a technique in which a subset of tones is reserved for PAPR reduction. Due to their low SNR, these tones carry no information data. A structured time domain vector c is added to the OFDM signal x to change its statistical distribution to reduce PAPR. In Efficient TR algorithm a few frequency domain tones are reserved to generate a time domain Gaussian pulse to be used as a peak cancellation signal while minimizing the occurrence of secondary peaks [4].

5. Tone Injection (TI): In this technique the constellation size is increased so that each point in the original complex plane constellation is mapped onto several other points in the expanded constellation prior to IDFT processing. Substituting a point in the original constellation for one in the expanded one is equivalent to injecting a tone with proper frequency and phase to the OFDM signal [4].

6. Active Constellation Extension (ACE): Active Constellation Extension or Active Set Extension (ASE) is a PAPR reduction technique where the modulation constellation over active subcarriers in the OFDM data block is modified such that the PAPR of the data block is reduced without significantly degrading the BER performance [3].

3. CONCLUSION

The main drawback of the OFDM system is high PAPR. This leads the Power Amplifier to run in the non-linear region. This results in problems for practical Implementations. Many techniques are used to solve PAPR problem. In this paper, Signal Scrambling techniques have been proposed for the reduction of the PAPR.

REFERENCES

[1] N. A. AbdualLatiff, N.I.A Ishak and M. H Yusoff “Performance Analysis on Peak-to-Average Power Ratio (PAPR) Reduction Techniques in Orthogonal Frequency Division Multiplexing (OFDM) system”, *International Journal of Inventive Engineering and Sciene*, vol. 1, Issue-9, August 2013.

[2] Han, S. H., & Lee, J. H. (2005)” An overview of peak-to average power ratio reduction techniques for multicarrier transmission “*IEEE Wireless Communications*, *12*(2), 56–65.

[3] G. Hill, M. Faulkner, and J. Singh, "Reducing the peak-to-average power ratio in OFDM by cyclically shifting partial transmit sequences," *Electronics Letters*, vol. 36, pp. 560-561, Mar 16 2000.

[4] S. Muller, R. Bauml, R. Fischer, and J. Huber, "OFDM with reduced peak-to-average power ratio by multiple.

[5] Acosta, Guillermo. “OFDM Simulation Using MATLAB” 2000.

[6] N. A. AbdualLatiff, N.I.A Ishak and M. H Yusoff “Performance Analysis on Peak-to-Average Power Ratio (PAPR) Reduction Techniques in Orthogonal Frequency Division Multiplexing (OFDM) system”, International Journal of Inventive Engineering and Science, vol. 1, Issue-9, August 2013.

[7] Eugen Victor Cuteanu and Dorian Isar,”Hybrid PAPR Reduction Scheme using Walsh HadamardPrecoding and Signal Companding” IEEE comm.., 15-16 Nov.

[8] Shilpa Sharma, Pradeep Kumar Gaur , “Survey on PAPR Reduction Techniques in OFDM System” International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 6, June 2015.

[9] Prashant Pandey, Rajeev Tripathi , “ Performance Analysis of Peak-to- Average Power Ratio Reduction Techniques in an OFDM System”,IEEE International Conference on Computer and Communication Technology, 2012.