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A NEW HYBRID SUB-BLOCK PARTITION SCHEME OF PTS TECHNIQUE FOR REDUCTION PAPR PERFORMANCE IN OFDM SYSTEM

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ABSTRACT

The orthogonal frequency division multiplexing (OFDM) technique is regarded as one of the transmission techniques cardio fate, which will depend on it for the next generation of mobile communications systems because the existing features in this system. On the other hand, the important obstacle faced by OFDM system in practical applications is Peak to Average Power Ratio (PAPR). PAPR is one of the major drawbacks of the OFDM system because it leads the system devices to run out of the scope of the linear region of these devices, thus gives an increase to the non-linear region distortion, which affects and changes the superposition of the signal spectrum resulting degeneration in performance. So that, it is an important to reduce the PAPR value to be more receptive in real applications. Partial transmits sequence (PTS) one of the better techniques, which is proposed to solve the higher PAPR problem. The PTS technique divides the input data into several sub-blocks to reduce the autocorrelation between the subcarriers, compute Inverse Fast Fourier transforms for each sub-block, rotates the sub-blocks with rotation factor and then combines the sub-block for transmitting. In this paper, the new sub-block partition method is proposed by combining two traditional sub-block partition method (adjacent and pseudo-random) to reduce the higher PAPR performance. The performance of the new method is investigated by using various sizes of the subcarrier. The new method achieved better performance to reduce the PAPR value than the conventional sub-block partition interleaving (IP-PTS), adjacent (AP-PTS) and pseudo-random (PR-PTS). MATLAB software is used for comparing the new sub-block partition scheme and the other three traditional sub-block partition schemes. The simulation result appears the superiority of the new method to reduce PAPR performance with each number of the subcarriers compared with ordinary methods.

Keywords: orthogonal frequency division multiplexing (OFDM), peak to average power ratio (PAPR), partial transmit sequence (PTS), interleaving partition (IP-PTS), adjacent partition (AP-PTS), pseudo-random partition (PR-PTS).

INTRODUCTION

OFDM system is considered one of the important modulation techniques that have been used in wireless communication system. The increasing demand for internet service and various multimedia especially in commercial fields encouraged many types of research to be more interested in high-data-rate speed for a wireless communication system [1]. OFDM modulation techniques today used effectively in fourth-generation (4G) for wireless communication system, due to the ability of this technique to offer high spectral efficiency, high power efficiency and high immunity to multipath fading. In addition, it has low inter-symbol interference (ISI) and high channel utilization. The applications of OFDM have summarized into IEEE 802.11a/g/n standards, the wideband wireless metro-area network (MAN) technology, WiMAX and 4G cellular technology standard Long-Term Evolution (LTE) [2]. Moreover, Terrestrial Digital Video Broadcasting (DVB-T), digital sound recording/video broadcasting and the ETS1 HIPERLAN/2 standard and high-speed cellular data was used OFDM technique [3, 4]. The OFDM technique is regarded as one of the candidate transmission techniques, which will depend on it for the next generation of mobile communications systems [5]. On the other hand, there is some obstacles faced by OFDM system in practical applications such as peak to average power ratio and signal synchronization. PAPR is one of the major drawbacks of the OFDM system because it leads the system devices out of the scope of the linear region of a power amplifier, thus gives an increase to non-linear region distortion, which affects and changes the superposition of the signal spectrum resulting degeneration in performance. It is an important to reduce the PAPR value to be more receptive in real applications.

There are several PAPR reduction techniques proposed by researchers in the past such selective mapping (SLM) [6], partial transmit sequences (PTS) [7, 8], compounding methods [9], clipping [10], clipping and filtering [11], active constellation extension (ACE) [12], coding [13], tone reservation (TR) and tone injection (TI) [14, 15]. Each of these algorithms and techniques has various costs of the reduced PAPR as well as bit error rate (BER). Partial transmits sequence (PTS) technique is one

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type of PAPR reduction methods of the probabilistic schemes [16]. The main idea of the PTS method is based on subdividing the original modulated multi-carrier into sub-blocks and then combining of the sub-blocks, which are multiplied by weighting factors. Multiplying sequences with the lowest PAPR are chosen for transmitting [17, 18].

Sub-block partition schemes are the main step, which depended from PTS method to decrease the correlations of the data signal and thus reduce the PAPR value. There are three traditional sub-block partition schemes widely used to reduce PAPR high-performance; interleaving partition scheme (IL-PS), adjacent partition scheme (AD-PS) and pseudo-random partition scheme (PR-PS). Moreover, some algorithms were conducted to improve the PAPR reduction performance by combining two or more of the sub-block partition schemes such as interleaving and adjacent partition schemes [19], which led to the improved PAPR reduction performance. This paper shows the three types of the sub-block partition schemes and indicates the best method to reduce the PAPR value as well as presents an effective sub-block partition method. The proposed method proved superior performance to reduce the PAPR value compared with previous sub-block partition methods. Moreover, the new hybrid method combines two types of ordinary sub-block partition algorithms (pseudo random and adjacent) to combat the PAPR value into minimum value. The paper is organized as follows: Section II describes the PAPR problem. Section III discusses the principal operation of PTS method. Section IV presents the traditional sub-block partition schemes. Section V discusses the new sub-block partition method. Section VI shows the simulation results and section VII summarizes the conclusion.

PAPR OF THE OFDM SYSTEM

The peak to average ratio (PAPR) describes the envelope fluctuation. The OFDM system should operate in the linear region so that the large peaks of signals cause the saturation in devices such as power amplifiers, A/D converters and D/A converters. The saturation runs the devices in non-linear distortion. The envelope fluctuation is due to the superposition of the multiple channels, therefore the main problem of the multi-carrier system is large envelope fluctuation. The principle operation of OFDM system is modulation the subcarriers by constellation mapping to get independent OFDM symbols, and then they are modulated onto sub-channels of equal bandwidth [1]. Theoretically, the OFDM symbols after modulation with one of modulation schemes are taken IFFT operation can be mathematically expressed in eqn. (1).

$$X(n) = \frac{1}{\sqrt{N}} \sum_{k=0}^{N-1} XK \times e^{j2\pi nK/N} \; , 0 \le n \ge N-1 \qquad (1)$$

Where N denote the number of subcarriers, x (n) refers the OFDM symbols after IFFT operation and *XK* represents the input data sequence after modulation scheme.

The large peaks of OFDM symbols can be described as peak- to- average power ratio (PAPR) [20]. The equation (2) expresses the PAPR of x(n) OFDM symbols.

$$\mathrm{PAPR} = \frac{P_{\mathrm{peak}}}{P_{\mathrm{average}}} = 10\log_{10}\frac{\max\left[|x_n|^2\right]}{E\left[|x_n|^2\right]} \qquad (2)$$

Where E [.] denotes expected value, Peak represents peak output power and Paverage means average output power.

In OFDM system, the peak power will be (N) times the average power when the initial phase value is the same. So that, if transmit the signal with high peak power, it could be out of the scope of the linear region of the system devices and then increase the non-linear region distortion of those devices, thus may be changing the superposition of the signal spectrum and leading the system to degeneration in performance. As a result, PAPR is one of the major drawbacks of the OFDM system. Therefore, this problem should be combat into minimum value.

PTS REDUCTION TECHNIQUE

There are several techniques proposed to overcome the high PAPR value, Partial Transmit Sequence (PTS) considers one of the methods, which can significantly reduce the PAPR performance.

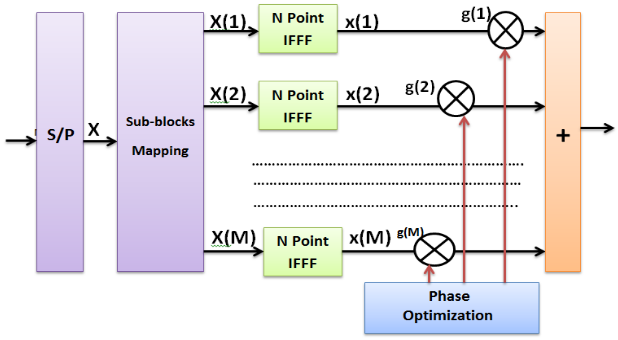

Figure-1. OFDM system block diagram [21].

The basic idea of the PTS is partition the original OFDM data sequences into several sub-blocks non-overlapping with each other and each one has the same size of subcarriers. After that, converts the sub-blocks data from the frequency domain into the time domain by applying Inverse Fast Fourier Transform (IFFT) [21], eqn. (3) and (4) expressed the partition of the input data sequence into several sub-blocks and then execute IFFT to the partition sub-blocks as shown the following:

$$\mathrm{Xm} = \sum_{\mathrm{m}=1}^{\mathrm{M}} XK \qquad (3)$$

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Where m=1, 2… M and XK refers to input data sequence partition into M sub-vector Xm.

$$\text{xm} = \sum_{m=1}^{M} \text{IFFT}\,\{\text{Xm}\} \quad (4)$$

The second step is multiplying all the subcarriers for each sub-block by the phase weighting factors, and then combines the sub-blocks together to obtain the OFDM symbol candidates. The candidate that has the minimum PAPR will be chosen for transmitting. Equation (5) represents the multiplying operation of the sub-blocks vectors with the phase rotation vector.

$$\hat{x} = \sum_{m=1}^{M} gmxm \quad (5)$$

Where g (weighting factor) = $g1$, $g2$… gm. Selecting one suitable weighting factor makes the result to achieve the optimum. On the other hand, the cost is extra M-1 times IFFTs operation. The block diagram in figure-1 shows the PTS operation.

TRADITIONAL SUB-BLOCK PARTITION SCHEMES FOR PTS

There are three types of partition schemes adopted to sub-divide the input subcarrier sequence in PTS reduction method on OFDM system. Interleaving, adjacent and pseudo-random partition schemes consider the traditional algorithms, which depended from PTS method to reduce the high PAPR performance. Each algorithm scheme has different performance of each other depending on the autocorrelation between the subcarriers for each sub-block partition. In PTS method, the main idea is reduction the autocorrelation between the subcarriers by segmentation the input subcarrier sequence into several sub-blocks vectors [22]. Therefore, the reduction of autocorrelation subcarriers depends on the segmentation type. The general point of the segmentation, the subcarriers are assigned only one time for each sub-block and the length of each sub-block is same. Below is a brief explanation of the ordinary types of partition sub-block scheme.

A. Interleaving partition scheme

Interleaving partition scheme (IP-PTS) is one of the sub-block partition types. The main idea of this algorithm is dividing the input subcarrier (N) into (L) sub-blocks for each one contains N/V contiguous subcarriers. The main goal of this operation breaks down the high correlation patterns of the input data frames on OFDM signal [23].

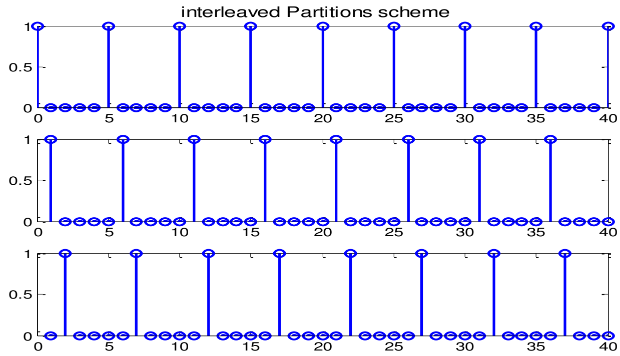

Figure-2. Interleaving partition scheme.

In interleaving partition scheme, the subcarriers are contiguous and the subcarriers signal is spaced equally when assigned at the same sub-block. Figure-2 and the equations below show the operation of interleaving partition scheme.

$$I_o = [I_0^{(1)}0 \ldots 0I_0^{(2)}0 \ldots \ldots 0I_0^{(V)}00 \ldots 0] \quad (6)$$

$$I_1 = [0I_1^{(1)}0 \ldots 00I_1^{(2)}0 \ldots \ldots 000I_1^{(V)}0 \ldots 0] \quad (7)$$

$$I_L = [00 \ldots I_L^{(1)}0 \ldots 00I_L^{(2)}0 \ldots \ldots 0I_L^{(V)}] \quad (8)$$

Where V=N/L (subcarrier elements) are interleaved in each sub-block. Although interleaving partition scheme has low computational complexity, it is considers the worst PAPR reduction performance of the other methods.

B. Adjacent partition scheme

Adjacent partition scheme (AP-PTS) is a simple method to implement the partition process, and its performance is better than the interleaving partition scheme. An adjacent partition scheme divides the sequence into (L) sub-block vectors similar to the interleaving partition scheme but each sub-block contains N/V of the consecutive subcarriers. Figure-3 and the equations bellow illustrate the principle idea of the adjacent partition scheme.

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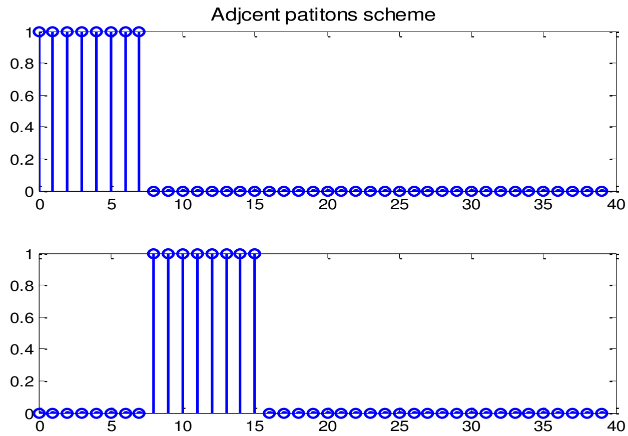

Figure-3. Adjacent partition scheme.

$$A_o = [A_0^{(1)} A_0^{(2)} A_0^{(3)}, 00000 \ldots \ldots . .0] \quad (9)$$

$$A_1 = [00000 \ldots .0, A_1^{(1)} A_1^{(2)} A_1^{(3)}, 0000 \ldots \ldots . .0] \quad (10)$$

$$A_v = [00000 \ldots .0{,}0000 \ldots \ldots 00, A_V^{(1)} A_V^{(2)} A_V^{(3)}] \quad (11)$$

In the adjacent partition scheme, the sub-carriers are assigned into the same sub-block vector sequentially so that, it achieves low autocorrelation pattern thus it provides high reduction of the PAPR performance.

C. Pseudo-random partition scheme

Pseudo-random partition scheme (PR-PTS) has the best PAPR reduction performance compare with interleaving and adjacent partition schemes. Each subcarrier can be randomly distributed on any position of the sub-block (L). A pseudo-random scheme is the best method to decrease the correlation subcarriers due to the subcarrier signal is assigned into any sub-block partition randomly, so that it can achieve a significant value of the PAPR reduction performance. Figure-4 and equations bellow indicate the partition method of the pseudo-random scheme.

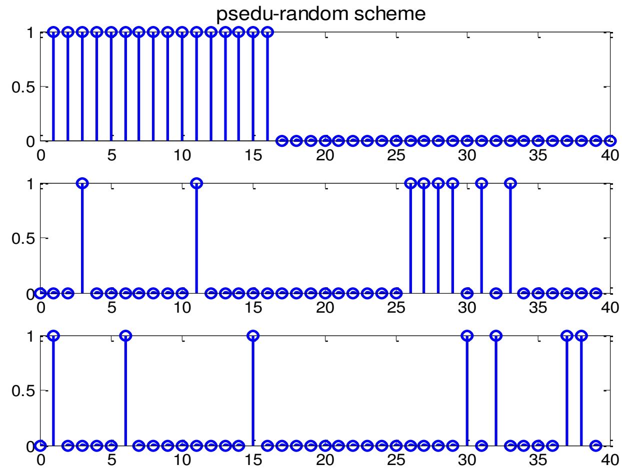

Figure-4. Pseudo-random scheme.

$$P_o = [P_0^{(1)} 0 \ldots 000 P_0^{(V)} 0 \ldots \ldots 0 P_0^{(2)} 00 \ldots 0] \quad (12)$$

$$P_1 = \left[00 P_1^{(V)} 0 P_1^{(2)} 0..00 P_1^{(1)} 0 \ldots 0\right] \quad (13)$$

$$P_L = [0000 \ldots .0 P_L^{(1)} 00..0 P_L^{(V)} 00 P_L^{(2)} 000..0] \quad (14)$$

Each of the sub-block partition is converted from frequency domain into time domain by applying IFFT, and then the result of each one is rotated with the optimum-weighting factor before combining the sub-blocks vectors to choose the OFDM symbols, which have the minimum PAPR for transmitting.

NEW HYBRID SUB-BLOCK PARTITION METHOD

In the OFDM signals, the data sequences have high autocorrelation between their elements so that the PAPR is high value due to the large envelope fluctuation of the OFDM signals. The main reason of using PTS technique is combat the increasing of PAPR value; this will be achieved if it decreases the autocorrelation between the subcarriers into minimum value.

The new sub-block partition method depends on the decreasing the autocorrelation subcarriers by combining two traditional methods (adjacent and pseudo-random) partition method to generate a new hybrid algorithm for achieving better reduction PAPR performance than traditional methods. The new algorithm is employed to combine the pseudo-random and adjacent sub-block partition schemes. The first stage of the algorithm begins at frequency domain by rearranging the completely input data frame randomly. After that, the sequence is divided into sub-blocks similar to the adjacent partition scheme. Finally, the subcarriers into each sub-block assigns randomly like pseudo-random partition scheme. This method satisfies lower correlation pattern thus the PAPR reduction performance improves better than tradition sub-block scheme. The other steps of PTS technique are conducted normally. The sub-blocks

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partitions converts from frequency domain into time domain by applying IFFT and then rotating the subcarriers of each sub-block with a set of optimum rotation factors. Finally, the sub-blocks partitions combine together to generate the OFDM symbol candidates and the symbols that have the lowest PAPR value will be chosen for transmitting. Figure-5 and the equation (15-19b) illustrate the operation of the new sub-block partition method.

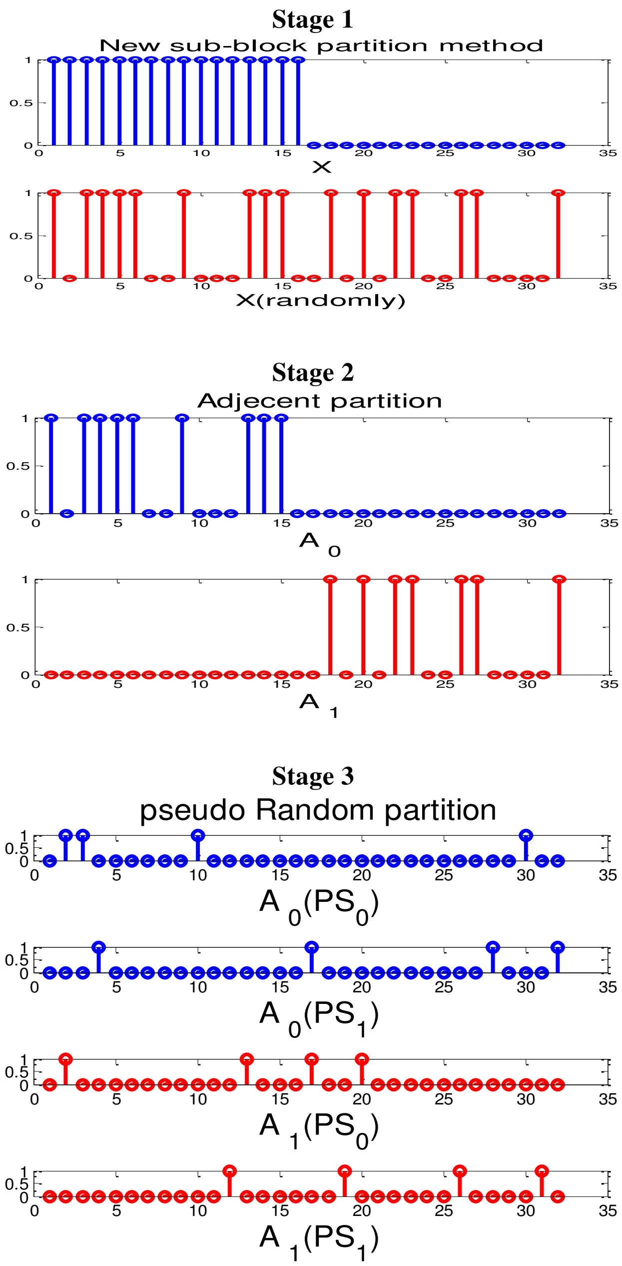

Figure-5. New hybrid sub-block partition method.

$$X = [X^{(1)}X^{(2)}X^{(3)}X^{(4)}X^{(5)} \ldots\ldots\ldots X^{(V)}] \tag{15}$$

Random

$$X(R) = [X^{(5)}X^{(2)}X^{(V)}X^{(3)}X^{(4)} \ldots\ldots\ldots X^{(1)}] \tag{16}$$

Adjacent partition

$$A_0 = [X_0^{(5)}X_0^{(2)}X_0^{(V)}X_0^{(7)}000 \ldots,000 \ldots..000000] \tag{17a}$$

$$A_1 = [000 \ldots..000 \ldots.00, X_1^{(3)}X_1^{(6)}X_1^{(4)} \ldots..X_1^{(1)}] \tag{17b}$$

Pseudo-random partition

$$A_0(PS_0) = [00\ X_0^{(2)}\ 000\ X_0^{(5)}\ 0000 \ldots.00] \tag{18a}$$

$$A_0(PS_1) = [000X_0^{(V)}\ 0000 \ldots\ldots X_0^{(7)}\ 000..000] \tag{18b}$$

$$A_1(PS_0) = [0000\ X_1^{(6)}\ 000 \ldots 00\ \ X_1^{(1)}\ 00 \ldots.00] \tag{19a}$$

$$A_1(PS_1) = [00X_1^{(4)}\ 000 \ldots\ldots 00\ X_1^{(3)}\ 000..000] \tag{19b}$$

The equations below show the transferring partitions data from the frequency into the time domain.

$$x_0\ (n) = IFFT A_0(PS_0) \tag{20a}$$

$$x_1\ (n) = IFFT A_0(PS_1) \tag{20b}$$

$$x_2\ (n) = IFFT A_1(PS_0) \tag{20c}$$

$$x_3\ (n) = IFFT A_1(PS_1) \tag{20d}$$

The sub-blocks partition data rotate with the optimum rotation factor (g_m) and combine together to generate the OFDM candidates. The OFDM symbols that have the lower PAPR value are chosen for transmitting. The equation (21) bellow clarifies the operation.

$$\tilde{x} = \sum_{m=0}^{M} g_{opt}.x_m(n) \tag{21}$$

The new partition method is compared with the other traditional methods and it reduces the PAPR value. It can be seen in the next section.

SIMULATIONS AND RESULTS

Firstly, we analyzed the traditional partition methods (interleaving partition, adjacent partition and pseudo-random partition). The simulation results show the influence of sub-block partition schemes on the PAPR performance of OFDM system.

In this simulation, the Complementary Cumulative Distribution Function (CCDF) was employed to determine PAPR distribution for 1000 samples of OFDM signal. The simulation parameters are as follows: number of subcarriers N=128, 16-QAM adopted as a modulation scheme, oversampling rate OF=8, rotation phases are W= [1, -1, j, -j] and the number of segmentation V= 2, 8.

Figure-6 shows the influence of interleaving sub-block partition scheme (IP-PTS) to reduce the PAPR performance compared with the normal case when the numbers of segmentation (V=2, 8) and N=128. The simulation result showed the PAPR values at 10.26 dB and 8.4 dB when the number of sub-blocks partition V= 2, 8 respectively. Moreover, the normal case of the original OFDM signal (signal without PTS technique) was 11.4 dB. Therefore, the IP-PTS reduction method reduced the PAPR value of OFDM signal by (1.14 dB) and (3 dB) when V=2 and 8, respectively.

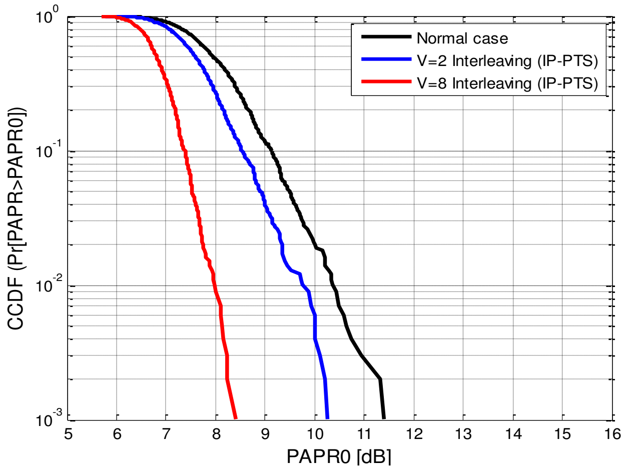

Figure-6. CCDF of the PAPR values with interleaving sub-block partition (V=2, 8) and the number of sub-carriers N=128.

Figure-7 illustrates the CCDF of PAPR when using an adjacent sub-block partition scheme (AP-PTS). The simulation result appears improvement to reduce the PAPR performance when applying (AP-PTS) compared with (IP-PTS) by 10 dB when V=2 and 7.65 dB when V=8, while the PAPR of the original signal is 11.42.

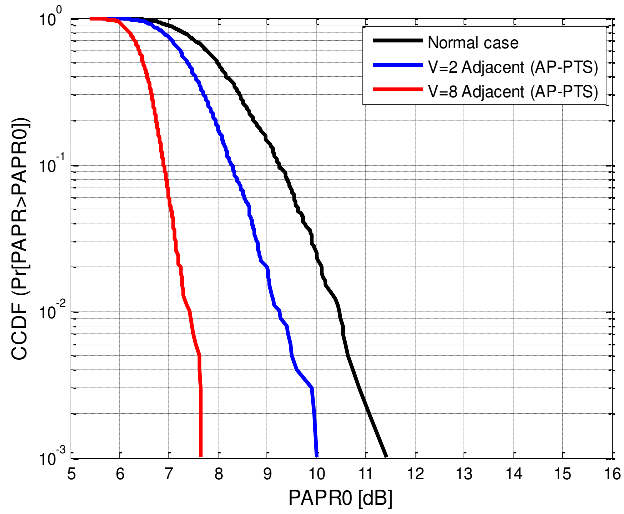

Figure-7. CCDF of the PAPR values with adjacent sub-block partition (V=2, 8) and the number of sub-carriers N=128.

The simulation result is shown in Figure-8. The PAPR performance of OFDM signal with the pseudo-random partition scheme (PR-PTS) is the best of other traditional methods in PTS technique. It can be seen clearly the (PR-PTS) scheme reduces the PAPR value about (2.41 dB) and (4 dB) when V= 2 and 8 respectively.

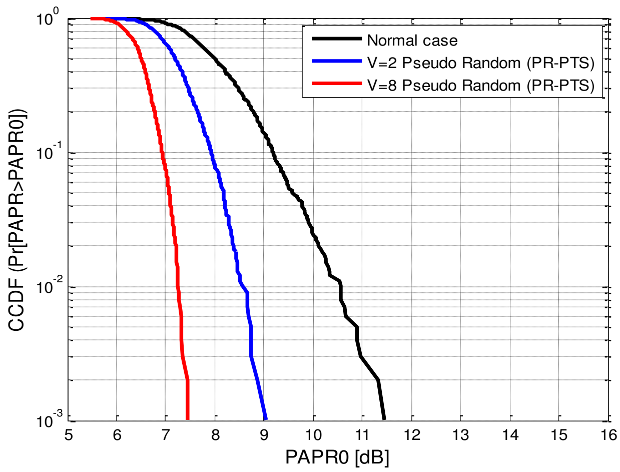

Figure-8. CCDF of the PAPR values with pseudo-random sub-block partition (V=2, 8) and the number of sub-carriers N=128.

On the other hand, the new sub-block partition method is presented by the simulation result as shown in Figure-9. The blue curve indicates the CCDF of the PAPR for the new partition method when V= 2 while the red curve marks the CCDF of the PAPR when V= 8. The new partition method recorded (8.55 dB) when V= 2 and (7.067 dB) when V= 8, thus the proposed method appears the best reduction of the PAPR performance compared with other three traditional methods. The reducing of PAPR by using the new sub-block method compared with

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the best conventional method (PR-PTS) is (0.5 dB) when V= 2 and about (0.4 dB) when V= 8 at the same circumstance. Therefore, the new method is suitable to reduce the PAPR performance of OFDM system more than the ordinary sub-block partition schemes.

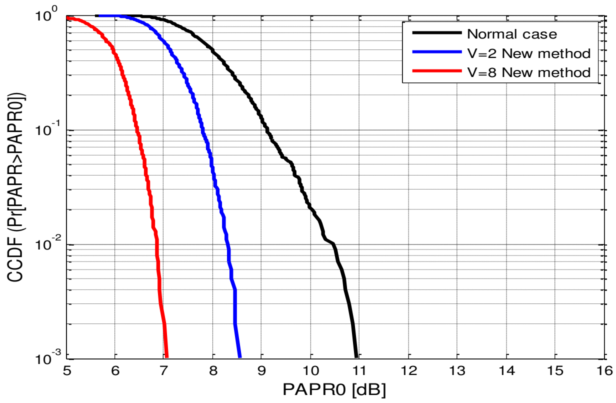

Figure-9. CCDF of the PAPR values with new sub-block partition method (V=2, 8) and the number of sub-carriers N=128.

The simulation results of PAPR for different scenarios of sub-block partition schemes are listed in Table-1.

Table-1. Numerical simulation parameters for PAPR with different sub-block partition schemes with N=128.

Partition method	**No. of Subcarriers**	**PAPR of original OFDM** (dB)	**PAPR of PTS when V=2** (dB)	**PAPR of PTS when V=8** (dB)
New method-PTS	128	11	8.55	7.06
PR-PTS	128	11.46	9.05	7.45
AP-PTS	128	11.42	10	7.65
IP-PTS	128	11.4	10.26	8.4

The simulation results in Figure-10, Figure-11, Figure-12, Figure-13 and Figure-14 respectively, have shown the comparison of the PAPR performance of the new partition method and the ordinary sub-block partition methods with consideration the PAPR of the original OFDM signal (PAPR without PTS) as a reference.

The parameters used in this simulation are: 16-QAM modulation mapping, over sampling factor OF= 8 and the number of subcarriers N= 64, 128, 256, 512, 1024 while the number of sub-block partition was chosen as 2 and 8.

The simulation results are shown in Figure-10, Figure-11, Figure-12, Figure-13 and Figure-14 appear the superiority of the new partition method to reduce the PAPR performance compared with other traditional sub-block partition method pseudo-random, adjacent and interleaving.

The simulation results of PAPR for different scenarios of the sub-block partition schemes are summarized in Table-2 and Table-3.

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Table-2. Numerical simulation parameters for PAPR with different scenarios of the sub-block partition schemes with V=2.

No. of Sub-carriers	PAPR of original OFDM (dB)	PAPR of new method PTS (dB)	PAPR of PR-PTS (dB)	PAPR of AP-PTS (dB)	PAPR of IP-PTS (dB)
64	10.5	8.34	8.91	9.42	10.07
128	11	8.8	9	9.63	10.37
256	12.72	9.1	9.7	10.03	11.1
512	14	9.58	10.17	12.06	12.6
1024	15.8	9.96	10.63	13.64	13.9

Table-3. Numerical simulation parameters for PAPR with different scenarios of the sub-block partition schemes with V= 8.

No. of Sub-carriers	PAPR of original OFDM (dB)	PAPR of new method PTS (dB)	PAPR of PR-PTS(dB)	PAPR of AP-PTS (dB)	PAPR of IP-PTS (dB)
64	10.5	6.42	7.08	7.1	7.78
128	11	7.17	7.6	7.8	8.24
256	12.72	7.65	8.07	8.6	9.05
512	14	8.23	8.38	9.04	9.74
1024	15.8	8.69	8.75	10.18	11.6

It can be observed clearly from the simulation results, the new method reduces the increasing of PAPR value more than 4 dB when the number of subcarriers N= 64, 128 and 256 as shown in Figure-10, Figure-11, Figure-12. In addition, Figure-13 and Figure-14 show the reduction of the PAPR performance more than 6 dB. Moreover, the new sub-block partition scheme has the superiority of reduction PAPR performance more than the best traditional sub-block partition method (pseudo-random). The new sub-block partition method achieved at least a 0.6 dB reduction when the number of sub-blocks equals two while the reduction was between 0.4 dB and 0.6 dB when the number of sub-blocks equals eight. Therefore, the PTS considers the best reduction technique to overcome the high PAPR performance and the new sub-block partition method proved the ability to improve the PTS technique to be more suitable in practical applications.

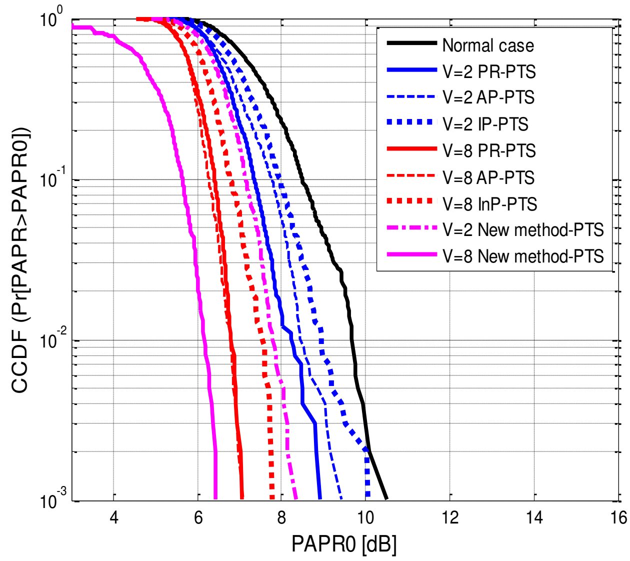

Figure-10. Comparison the PAPR values of traditional sub-block methods and new partition PTS method (V=2, 8) and the number of sub-carriers N=64.

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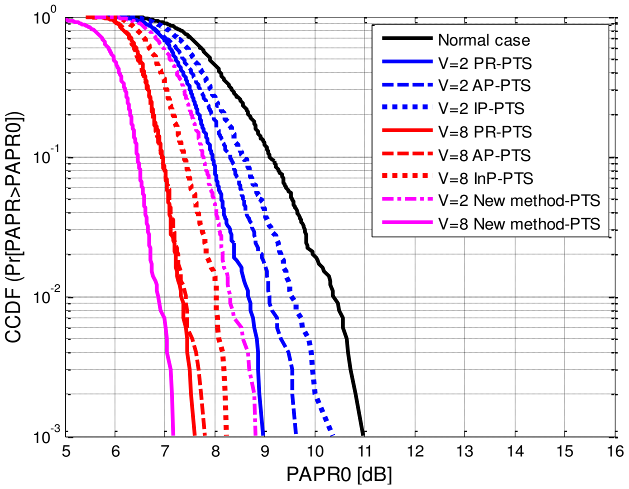

Figure-11. Comparison the PAPR values of traditional sub-block methods and new partition PTS method (V=2, 8) and the number of sub-carriers N=128.

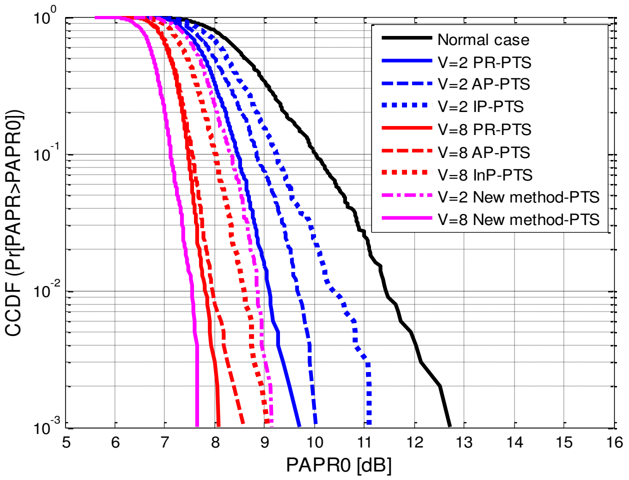

Figure-12. Comparison the PAPR values of traditional sub-block methods and new partition PTS method (V=2, 8) and the number of sub-carriers N=256.

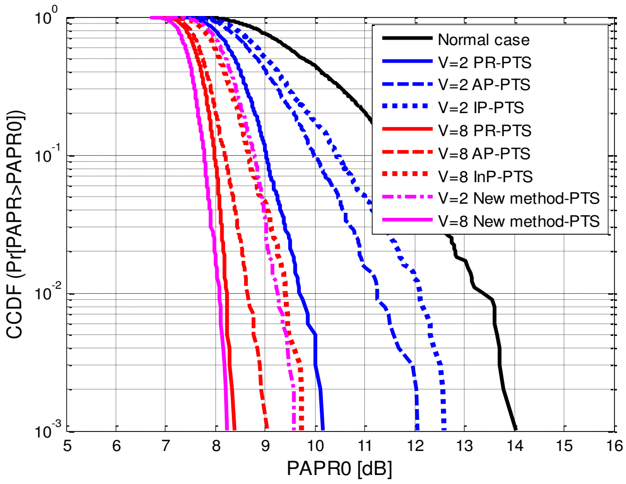

Figure-13. Comparison the PAPR values of traditional sub-block methods and new partition PTS method (V=2, 8) and the number of sub-carriers N=512.

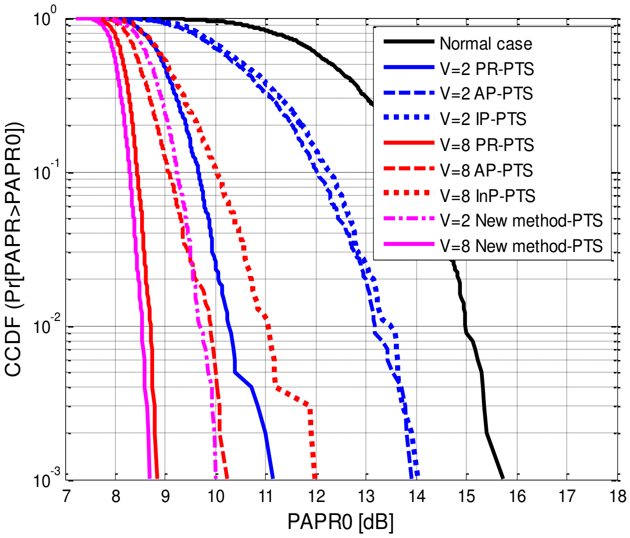

Figure-14. Comparison the PAPR values of traditional sub-block methods and new partition PTS method (V=2, 8) and the number of sub-carriers N=1024.

CONCLUSIONS

The main drawback of the OFDM system is the higher PAPR performance, this problem leads the system devices to run out of the scope of the linear region of these devices so that the system encounter a big problem in the practical use. Many techniques founded to solve PAPR problem, PTS is one of the techniques, which proved the effectiveness to overcome this problem. Many types of research proposed to combine two traditional sub-block partition schemes to improve the performance of PTS technique. In this paper, a new sub-block partition scheme has been proposed to reduce the higher PAPR value. The new method combines two conventional sub-block partition methods (adjacent and pseudo-random). The performance of the new method was investigated and analyzed. The simulation results proved this method could reduce the PAPR value more than 6 dB compared with the original PAPR value when the number of sub-block partition equal 8. Moreover, several comparisons were conducted and they proved the new method has better performance to reduce the PAPR value compared with the traditional sub-block partition methods.

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REFERENCES

[1] I. Abdullah, S. K.Kundu and S. Hossain. 2013. Reducing PAPR of OFDM using PTS techniques for different number of Sub-blocks. COMPUSOFT, an International Journal of Advanced Computer Technology. 2(1): 35-38.

[2] Baig I. and Jeoti V. 2011. A novel precoding based hybrid MC/SC radio access system for PAPR reduction in layered OFDMA of LTE-Advanced. IAENG International Journal of Computer Science. 38(4): 314-319.

[3] Abdulhasan R. A., Alias R., Awaleh A. A. and Mumin A. O. 2015, April. Design of circular patch microstrip ultra wideband antenna with two notch filters.In Computer, Communications, and Control Technology (I4CT). 2015 International Conference on (pp. 464-467).IEEE.

[4] Han S. H. and Lee J. H. 2005. An Overview of Peak-to-Average Power Ratio Reduction Techniques for Multicarrier Transmission. IEEE Wireless Communications. 12(2): 56-65.

[5] J Sarawong T Mata, P Boonsrimuang, H Kobayashi. 2011. Interleaved partitioning PTS with new phase factors for PAPR reduction in OFDM systems. 8th International Conference. Electrical Engineering Electronics, Computer, Telecommunications and Information Technology (ECTI-CON). 361-364.

[6] Bae. Kitaek. Changyong Shin and E. Powers.2003. Performance Analysis of OFDM Systems with Selected Mapping in the Presence of Nonlinearity. pp. 1-9.

[7] I. Baig and V. Jeoti. 2010. DCT preceded Selective Mapping technique for PAPR reduction in OFDM systems. in Intelligent and Advanced Systems (ICIAS). International Conference. pp. 1-6.

[8] C. P. Li, S.-H.Wang and C.-L. Wang. 2010. Novel low-complexity SLM schemes for PAPR reduction in OFDM systems, Signal Processing, IEEE Transactions on. 58: 2916-2921.

[9] Jeng S. S. and Chen J. M. 2011. Efficient PAPR reduction in OFDM systems based on a companding technique with trapezium distribution. Broadcasting, IEEE Transactions on. 57(2): 291-298.

[10] M. Naeiny and F. Marvasti.2011.Selected Mapping Algorithm for PAPR reduction of space-frequency coded OFDM systems without side information. Vehicular Technology. IEEE Transactions on. 60: 1211-1216.

[11] I. Baig and V. Jeoti. 2011. On the PAPR reduction in OFDM systems: a novel ZCT preceding based SLM technique, Journal of Engineering Science and Technology. 6: 266-378.

[12] K Bae JG, Andrews EJ Powers.2010. Adaptive active constellation extension algorithm for peak-to-average ratio reduction in OFDM. IEEE Communications Letters.14: 39-41.

[13] J.Hou, J. Ge and J. Li. 2011. Peak-to-average power ratio reduction of OFDM signals using PTS scheme with low computational complexity, Broadcasting, IEEE Transactions on. 57: 143-148.

[14] D. Guel and J. Palicot. 2009. FFT/IFFT pair based digital filtering for the transformation of adding signal PAPR reduction techniques in tone reservation techniques. In Wireless and Mobile Communications ICWMC'09. Fifth International Conference on. pp. 200-204.

[15] D.Guel., J. Palicot and Y. Louët. 2010. Tone reservation technique based on geometric method for orthogonal frequency division multiplexing peak-to-average power ratio reduction. IET communications. 4: 2065-2073.

[16] Z. T. Ibraheem, M. M. Rahman, S. N. Yaakob. 2014. PTS Method with Combined Partitioning Schemes for Improved PAPR Reduction in OFDM System. TELKOMNIKA Indonesian Journal of Electrical Engineering. 12(11): 7845-7853.

[17] L Yang, K Soo, S Li, Y Siu. 2011. PAPR reduction using low complexity PTS to construct of OFDM signals without side information. IEEE Broadcasting Transactions. 57: 284-290.

[18] YJ Cho. JS No. DJ Shin.2012. A new low-complexity PTS scheme based on successive local search using sequences. IEEE Communications Letters. 16: 1470-1473.

[19] Z. T. Ibraheem, Md. Mijanur Rahman, S. N. Yaakob, M. S. Razalli, Z. G. Aliand K. K. Ahmed. 2014. Efficient papr reduction of OFDMsignal using pts technique with hybrid partitioning method. ARPN Journal of Engineering and Applied Sciences. 9(12): 2762-2769.

[20] P. Boonsrimuang, K. Mori, T. Paungma and H. Kobayashi.2007. Proposal of improved PTS method for OFDM signal, in Personal, Indoor and Mobile Radio Communications.PIMRC 2007. IEEE 18th International Symposium on. pp. 1-5.

[21] Garima Singhal and Manoj Kumar.2014. A new sub-block partition technique for PTS in OFDM systems. Int. Journal of Engineering Research and Applications. 4(1), (Version 1): 287-291.

[22] Goel A., Gupta P.and Agrawal M. 2013. SER analysis of PTS based techniques for PAPR reduction in OFDM systems. Digital Signal Processing. 23(1): 302-313.

[23] Pandurangan Mukunthan and Perumal Dananjayan. 2014. Modified PTS with interleaving for PAPR reduction of OFDM signal with QPSK sub-blocks. International Journal of Future Computer and Communication. 3(1): 22-25.