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An Efficient PTSDCT-LH PAPR Reduction Scheme for 5G Wireless Communication with OFDM Technology

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Abstract

Background: 5G wireless communication provides the wireless communication involved in the provision of machine-to-machine communication, internet, reliable, minimal latency, and high-speed communication links. Orthogonal Frequency Division Multiplexing (OFDM) provides the promising 5G physical layer waveform for the application. The incorporation of the OFDM with 5G technology comprises the subcarriers, self-interference, and peak amplitude. The implementation of the 5G wireless technology exploits OFDM with the multicarrier scheme which exhibits a higher peak-to-average-power ratio (PAPR). As high PAPR affects the overall performance of the OFDM communication system with the signal distortion which affects the overall communication characteristics.

Objectives: This paper presented a PAPR reduction scheme stated as Partial Transmission Sequence Discrete Cosine transforms with Likelihood estimation PTSDCT-LH. The proposed PTSDCT- LH incorporates a Partial transmission sequence (PTS) integrated with Discrete Cosine transform (DCT).

Methods: The implementation of the proposed PTSDCT-LH model exhibits reduced PAPR with the application of the PTS but it increases the complexity of the process. Finally, the proposed PTSDCT-LH model incorporated likelihood estimation the signal characteristics are computed. The simulation analysis of the proposed PTSDCT-LH model exhibits reduced PAPR by 30.3% compared with the conventional original and clipping signal.

Conclusions: The simulation results expressed that the proposed PTSDCT-LH model increases the system performance with the reduced computational complexity.

Keywords: PAPR, 5th generation communication, OFDM, Partial transmission sequence, likelihood estimation

1. Introduction

In the age of the wireless mobile revolution, an un-ended market expansion of smart phones, electronic gadgets, user demand applications and data services has gone far beyond the circuit switching and voice telephony [1]. Next generation of wireless standards are well derived from massive growth in web services, media connections, social networking and data streaming services. Long Term Evolution (LTE) is designed and deployed at many regions across the geography to fulfill the demand and necessity of mobile network expansions [2]. LTE offers enhanced spectral efficiency, higher speed, extended coverage & capacity of serving area, minimum latency, reduced capital expenditure (CAPEX), and minimized operational expenditure (OPEX). Multiple Input Multiple Output (MIMO) support and uninterrupted backward compatibility with legacy system made it easier for operators to adopt LTE deployment [3 -5].

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It is essentially required to adopt the feature enhancements to remove the performance constraints. Optimization of OFDM through Peak to Average Power Ratio (PAPR) reduction and Inter-carrier Interference (ICI) cancellation are a few steps to remove such performance barricades [6]. The OFDM becomes most fit and most favourable access technique for wideband communication. OFDM supports high-speed data applications like IEEE 802.11, IEEE 802.20, IEEE 802.16e, video chat, data stream, etc. [7 - 9]. In OFDM, overlapped orthogonal subcarriers are distributed over available bandwidth where every subcarrier is modulated based on the information-bearing in the low data rate network. OFDM model distributes the efficient utilization of the available spectrum frequency for the elimination of the interference to achieve orthogonality in the subcarriers based on the channel spacing [10]. Through the evaluation, the data stream is fragmented based on the subsets for the separated orthogonal subcarriers. In time-domain transformation, the subcarrier orthogonality is evaluated using Fourier Fast transform (IFFT) [11]. The signal propagated with the multipath channel signal is generated and evaluated with the Cyclic Prefix (CP) for every OFDM symbol [12].

In the OFDM system, the high value of PAPR is a complex scenario that occurred due to the superposition of the multiple subcarriers in the output power. The output power is increased instantaneously for the significant level of the output power that needs to be properly aligned [13]. To reduce the PAPR value the increases in average power need to be maintained or adopts amplifier for the higher PAPR value those are expensive and less efficient for the practical scenario. On other hand, the reduction in PAPR is achieved in different instances based on the consideration of different attributes, power constraints, bandwidth, data rate and complexity in OFDM system [14]. In multipath fading OFDM provides the fading for the impulse noise for the reduction of the equalizers complexity for the deployed communication system using Fast Fourier Transform (FFT). However, the in the OFDM optimization the wireless communication are affected with the PAPR and ICI those demands for the PAPR reduction technique and ICI cancellation technique [15].

High spectrum efficiency and resistant to interferences made OFDM a very good choice for the realization of LTE and other advanced mobile communication technologies. Besides the multiple merits, OFDM impacts the PAPR and ICI. Practically, there are several methods to increase the overall system performance it is required to develop an effective hybrid technique and CFO and PAPR technique with undesirable side effects [15]. Through optimization of the PAPR and ICI in the OFDM through the highly desirable the future technologies such as LTE and LTE-Adv. In order to avoid the use of CP, which consumes a significant amount of bandwidth (20% - 25%), wavelets have replaced FFT in OFDM processing. Further, spectrum wasted in cyclic prefix may be re-used to devise a bandwidth-efficient scheme to diminish the effect of ICI. Present research work is inclined to propose a novel scheme for PAPR reduction and ICI cancellation technique to enhance OFDM performance [16].

2. Objectives

This paper aimed to construct a PAPR reduction technique for the 5G OFDM communication medium. The performance characteristics of the proposed PTSDCT-LH comprise the sequence of the techniques.

1. The proposed PTSDCT-LH model incorporates the PTS model for the minimization of the PAPR in the OFDM signal.
2. Within the PTS model the DCT model is applied for the phase shift in the OFDM signal for the examination of the amplitude and phase angle in the OFDM signal.
3. Finally, to reduce the PAPR in the 5G wireless communication PTS integrated with the DCT is evaluated using the likelihood estimation. The evaluation of the likelihood estimation of the PAPR is significantly reduced.
4. The proposed model effectively reduces the PAPR more than the original signal with the clipping factor in the wireless medium. The proposed PTSDCT-LH significantly reduces the PAPR in the OFDM model.

The organization of the paper is presented as follows: In section II the related works for the PAPR reduction are presented. The research methodology adopted for the PAPR is presented in section III. The simulation results obtained with the proposed PTSDCT-LH model is provided in section IV and the overall conclusion is presented in section V.

3. Methods

In this paper concentrated on the PAPR reduction in the 5G wireless communication channel through the Partial transmit sequence (PTS) integrated with the Discrete Cosine transformation (DCT). Additionally, the PAPR reduction technique utilizes the likelihood estimation model. The proposed model is termed as PTSDCT-LH. In 5G technology, Orthogonal Frequency Division Multiplexing (OFDM) gained significant attention in the wireless communication for effective

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transfer of data with higher data rate and bandwidth efficiency to achieve robustness in the multipath fading scenario. Conventionally, the OFDM technology applied in the 5G wireless communication uses the Peak to Average Power Ratio (PAPR). In OFDM, the transmitted signal subjected to PAPR which is defined as ratio of maximum instantaneous power to the average power in the communication channel. The PAPR in the 5G wireless communication channel is defined as in equation (1)

$$PAPR = \frac{\max|x(t)|^2}{E[|x(t)|^2]} \tag{1}$$

In above equation (1) the process of IFFT in the OFDM signal is represented as $(t)$and expectation is denoted as E [.]. Consider the length of N data block in the vector form is denoted as $Y = [Y_0, Y_1, Y_2, \dots \dots, Y_{N-1}]^T$, where the subcarrier number is denoted as N and the transpose is represented as (.)T. The data symbol Y modulation with subcarrier is represented as $F_N = 0,1, \dots \dots, N-1$. The orthogonal signal subcarrier N is denoted as $f_m = m\Delta f$, where $\Delta f = 1/NT$ and NT stated as the OFDM data duration. The transmitted signal OFDM complex signal is represented as in equation (2)

$$x(t) = \frac{1}{\sqrt{N}} \sum_{k=1}^{N-1} Y_k e^{j2\pi k \Delta f t} \tag{2}$$

where $Y_k$is the denoted as the k^{th}data symbol of subcarrier.

Based on the central limit theorem, the N is larger for the both real and imaginary part denoted as $x(t)$ with the Gaussian distribution. Through the gaussian distribution the Cumulative Distribution Function (CDF) of the signal is represented as in equation (3) and equation (4)

$$F(z) = 1 - e^{-z} \tag{3}$$

$$P(PAPR > PAPR_0) = 1 - (1 - e^{PAPRo})^N \tag{4}$$

With absence of the no over sampling, the important parameters PAPR in OFDM signal is evaluated with the Cumulative Distribution Function (CCDF). The clipping level of the OFDM signal is denoted as $PAPR_o$. The block symbol with the clip level in PAPR is represented as $PAPR_o$ presented in equation (5)

$$p(PAPR_{MIMO-OFDM} > PAPR_o) = 1 - (1 - e^{PAPRo})^{M_i N} \tag{5}$$

In MIMO-OFDM the system time domain with the OFDM signal is represented as $M_i N$. In the SLM the OFDM signal with the PAPR reduction probabilistic techniques is required for the minimization of the signal distortion those subjected to data loss. In figure 1 presented the input data applied for the SLM technique with partitioning of the data block Y with the length of block as N. The OFDM data block with the multiple elements in the phase sequences as $E^{(u)} = [e_{u,0}, e_{u,1}, \dots \dots, e_{u,N-1}]^T$where $u = 1,2, \dots \dots \dots, U$ with the achieved data block Y^U.

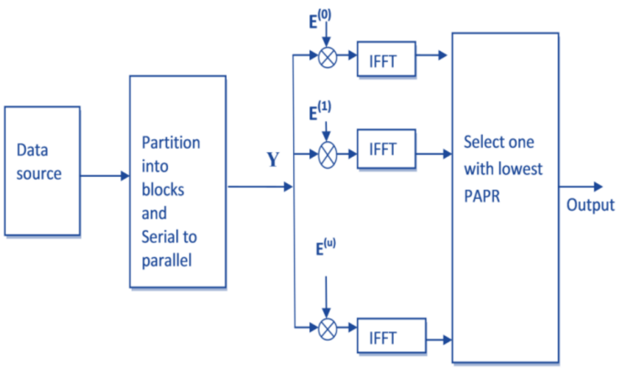

Figure 1: Input for SLM in PTSDCT-LH

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The data blocks in the OFDM signal with the different information and the OFDM data block phases are presented in equation (6) as follows,

$$Y(t) = \frac{1}{\sqrt{N}} \sum_{k=1}^{N-1} Y_k e_m k e^{j2\pi k \Delta f t} \quad (6)$$

In the OFDM rotated phase the data blocks subjected to the minimal PAPR for the data transmission in the network. The selected information about the phase sequence are transmitted and received with the information process. In the receiver end, the operation reverse to transmitter need to be performed to recover the data block of the OFDM. Conventionally, the SLM technique does not subjected to any construction phase sequence for the process.

3.2 PTSDCT-LH integrated Discrete Cosine Transform for PAPR Reduction

Generally, the Discrete Cosine transform is similar to that of the discrete Fourier transform for real number. The process of DCT is equal to DFT as the length is twice, real data were operated for the symmetry process for the transformation of real and even function were the variants are shifted based on the input/output data sample. The proposed PTSDCT-LH comprises of the eight standard variants in which 4 are common. In the Fourier-related transformation process, the expression is based in the DCT function or the sum of the sinusoidal signal based on consideration of the various amplitude and frequencies. In DFT process the operation of the DCT is based on the consideration of the finite number of data point functions. In PTSDCT-LH the difference is computed based on the distinction based on the consideration of the boundary condition in the DFT transform. The input sequence of the signal are evaluate based on the auto correlation estimation of peak and average value. Conceptually, the original sequence of the N-point DCT are evaluated based on the data sequence for the mirror extension of the data sequence in N-point. The data process of DCT is continuous with the components of lower order transformed signal domain those are converted to DCT. The DCT transformation is evaluated based on the reduction of autocorrelation estimation for the input sequence to minimize peak to average power those need to be transmitted at any instance of the receiver signal. In the different 4 dimensional DCT process the orthogonality property is computed in the one-dimensional process represented as A[k] of a sequence a[n] with the length N is denoted in equation (7)

$$A[k] = a[k] \sum_{n=0}^{N-1} a[n] \cos \frac{\pi(2n+1)}{2N} \quad (7)$$

For$k = 0,1, \dots \dots, N-1$, the process of the inverse DCT is represented using equation (8) and (9),

$$A[k] = \frac{1}{\sqrt{N}} \quad for\ k = 0 \quad (8)$$

$$= \sqrt{\frac{2}{N}}\ for\ k = 1,2, \dots \dots \dots \dots N-1 \quad (9)$$

In the 1D DCT applied with PTSDCT-LH comprises of the discrete-time and real time denoted as in equation (10)

$$C_N[N, K] = \cos \frac{\pi(2n+1)k}{2N} \quad (10)$$

The process of DCT comprises of the real sequences $C_N[N,0], C_N[N,1], \dots \dots, C_N[N, n-1]$ denoted in equation (11) for N as follows:

$$A_N = C_N \alpha \quad (11)$$

Where, the vector Nx1 and CN in the DCT is estimated based on vector A and α with the transformation matrix N x N. The orthogonal matrix vector in the PTSDCT-LH computed for the DCT estimation. The OFDM signal peak power is computed based on the consideration of the DCT matrix property. The operation in the proposed PTSDCT-LH is computed based on the consideration of the $O(N^2)$operations with the computation of complexity $O(Nlog\ N)$ with factorizing and computation of similarity using Fast Fourier Transform (FFT). In pre and post-processing steps FFT is computed through DCT process. In general, the DCT computation process computes FFT process using $O(Nlog\ N)$.

3.3 PTSDCT-LH with likelihood for the PAPR Reduction

The proposed PTSDCT-LH comprises of the DCT with the PTS for minimization of the autocorrelation and modulation of digital signal using data bits. The reduction in the signal with proposed PTSDCT-LH computed based on computation of the similarity between phases for reduction of data. Data scrambling in the PTS is evaluated based combination of the different phase factor for computation of autocorrelation in the data. In figure 2 presented the proposed PTSDCT-LH for the PAPR with the PTS.

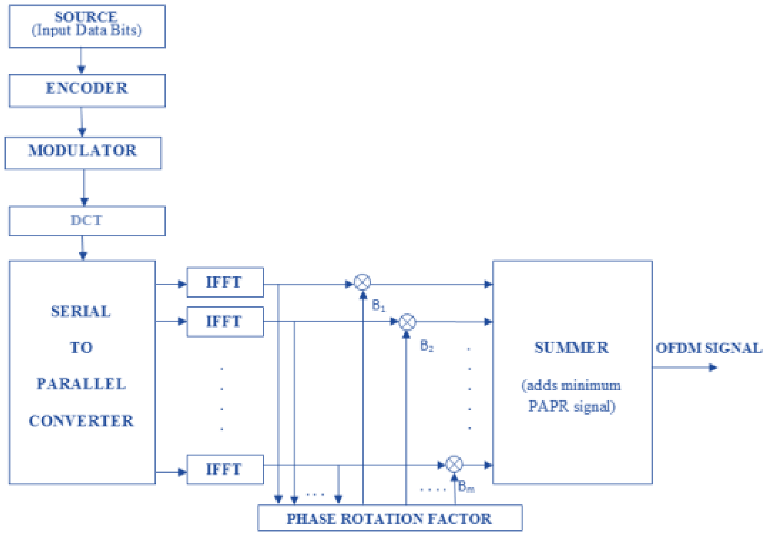

Figure 2: Block Diagram of DCT before Partial Transmit Sequence

The mathematical computation of the proposed PTSDCT-LH evaluated for the DCT integrated with PTS for the computation of the sub-sequences using IFFT. The modulated DCT data process is presented in equation (12)

$$C_N = \frac{1}{2}[a_0 + -1^k a_0] + \sum_{i=1}^{n-2}\left(a_i cos\frac{\pi ki}{n-2}\right) \quad (12)$$

The inverse operation in the DCT process with IFFT is presented in equation (13)

$$x(u) = \sum_{j=1}^{m}\sum_{i=1}^{n/m}\left(C_N e^{\frac{j2\pi ui}{n}}\right) \quad (13)$$

In above equation (13) the data bits modulation phase is represented as e for the data length sequence of K = 0, 1, ...N-1, the data sequence discrete cosine transform is denoted as CN, the subcarriers number are represented as u, phase factor total number is denoted as m and data sequence is denoted as n. The proposed PTSDCT-LH with the DCT and PTS are evaluated for the conversion of the bit sequence in the parallel streams. The converted parallel data comprises of the scrambling of the data using the PTS technique which involved in minimization of the similarity between data sequences with the rotation operation with the phase factor of 'm'. The signal sequence with the reduced PAPR are added to the summer for the DCT block output with minimization of the autocorrelation with summed OFDM signal. The PAPR reduction with the DCT and PTS exhibits the significant performance to reduce autocorrelation between the signals through digital modulated data bits. The mathematical formulation of the DCT with PTS technique involved in computation in IFFT for the DCT subsequences. The modulated data DCT is represented in equation (14)

$$x(u) = \sum_{j=1}^{m}\sum_{i=1}^{\frac{n}{m}}\left(a_N e^{\frac{j2\pi ui}{n}}\right) \quad (14)$$

The proposed PTSDCT-LH with the DCT for orthogonal signal represented in equation (15),

$$C_N = \frac{1}{2}[x(0) + -1^k x(1)] + \sum_{i=1}^{u-2}\left(x(u) cos\frac{\pi ki}{u-2}\right) \quad (15)$$

In above equation (15) the modulated data bits for the length N and the sequence of data is represented as K = 0, 1, ...N-1 for the data sequence of the Discrete Cosine transform of the subcarrier number u and the total data sequence n and the phase factor m. The overall process involved in the proposed PTSDCT-LH is shown in figure 3.

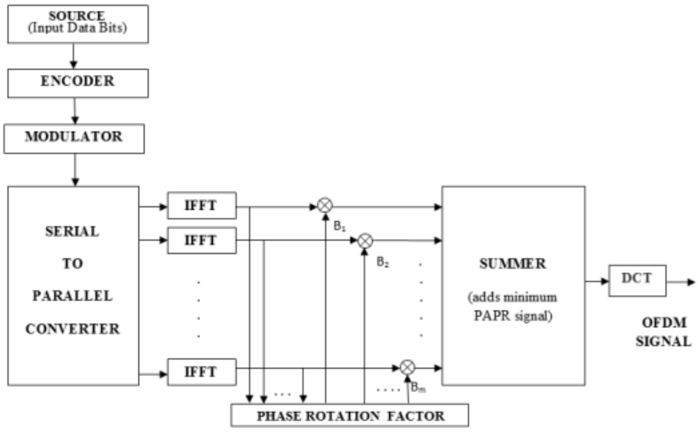

Figure 3: PTSDCT-LH process in OFDM

In the proposed PTSDCT-LH the neighbourhood search through likelihood estimation is performed with computation of the phase factor and the reduction of the computational complexity through suboptimum computation. Initially, the proposed algorithm PTSDCT-LH comprises of the solution S0 for estimation for better solution iteratively. To derive those solution s′, s0 are computed for the optimum value of s′ to achieve better results. The features of the neighborhood estimation is based on the computation of the neighborhood estimation based on initial condition and optimization. Practically, in the OFDM system the PAPR is reduced with the signal amplitude in the linear region of the amplifier. With the proposed PTSDCT-LH model the threshold is set as L with the neighborhood phase factor for minimal PAPR to perform neighbourhood estimation for the phase factor PTS those are listed as follows:

1. The neighborhood region is denoted as ∆s for the present PAPR for present value L and$\Delta s = f(\Delta E) = f(PAPR - L)$. Within this region the PAPR is reduced for the estimation.
2. With the neighborhood estimation significant solution is is achieved between s for the 1 times, where s randomly changes for the region in one time.
3. Set the search time maximal as C, in case if PAPR is not reduces with the L at C times terminate the search and derive the final solution with the optimal solution.

The overall flow chart for the proposed PTSDCT-LH is illustrated in the figure 4 as follows:

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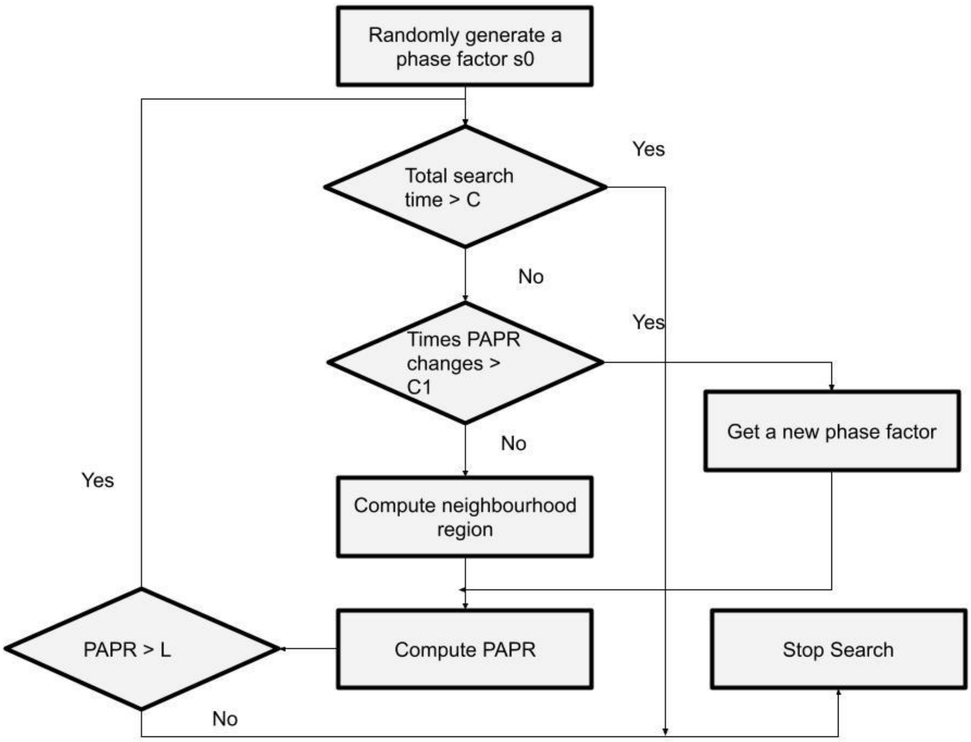

Figure 4: Flow Chart for propose PTSDCT-LH

Algorithm 1: Steps for PTSDCT-LH
Consider the information blocks of $X_1, X_2, \dots \dots, X_n$ Assume the code word length as W Encode the every block encoded with the Hamming encoder w Append the control bit with the hamming code 8-bits for calculation Evaluate the code word for the every vector w^{+e1}, w^{+e2}, …, $w+^{e16}$ Calculate Compute the transferred minimum code word in the OFDM signal with the IFFT constellation mapping scheme Apply the steepest descent approach with the unit circle for the modulus process with the IFFT and IDCT Obtain the minimal value obtained for the sequence

The incorporation of the DCT in the PTS system minimizes the autocorrelation and conventional data bits modulation scheme. To reduce the PAPR in the signal phase similarity between the variable need to be minimized. The proposed scheme comprises of the OFDM process which involve din information transmission between antennas. The proposed OFDM scheme incorporates PTS for the data scrambling process with combination of the different phases for reduction of the autocorrelation. In figure 5 the overall process involved in proposed PTSDCT-LH is presented.

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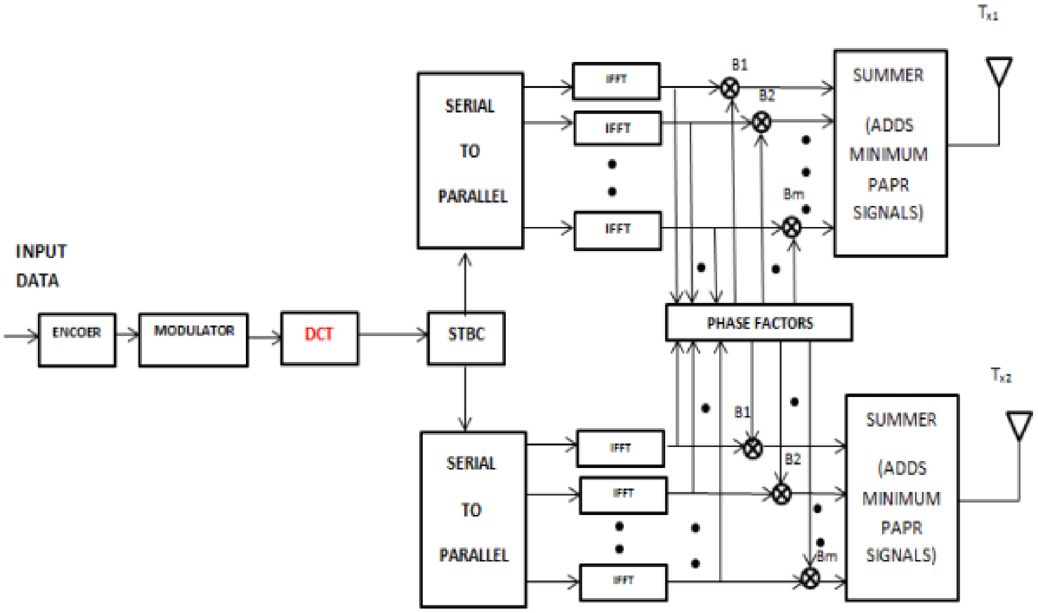

Figure 5: PTSDCT-LH Process

The mathematical examination of the proposed PTSDCT-LH perform the DCT computation with the IFFT subsequences. The data modulation with the DCT is presented in equation (16)

$$x_N = \frac{1}{2}[a_o + -1^k a_o] + \sum_{i=1}^{n-2}\left(a_i cos\frac{\pi ki}{n-2}\right) \tag{16}$$

The process of the IFFT in the comprises of the DCT as states in equation (17)

$$x_u = \sum_{j=1}^{m}\sum_{i=1}^{\frac{n}{m}}\left(x_N e^{\frac{j2\pi ui}{n}}\right) \tag{17}$$

Where, the phase modulated data for N length bits are represented the data sequence of K = 0, 1, ...N-1. The process of Discrete Cosine transformation in the data sequences for the subcarrier is represented as x_u for the total sequence subcarrier is n for the phase factor.

4. Results and Discussion

The proposed PTSDCT-LH model comprises of the DCT process for the PTS based DCT technique for the OFDM technique implemented in MATLAB simulation software. The parameters utilized in proposed PTSDCT-LH is presented in table 1.

Table 1: Simulation Setting

Parameter	**Type/Value**
Number of subcarrier	64, 128,256, 512, 1024
Modulation scheme	4-QAM
Number of Phase Rotation Factor	2, 4, 8, 16
Number of combinations of Phase Factors	16

The proposed PTSDCT-LH model comprises of the OFDM process integrated with PTS for the reduction of PAPR in the OFDM. The developed model comprises of the DCT process with the computation of the orthogonality with simulated PTS. The simulation results of proposed PTSDCT-LH is evaluated and examined based on consideration of different

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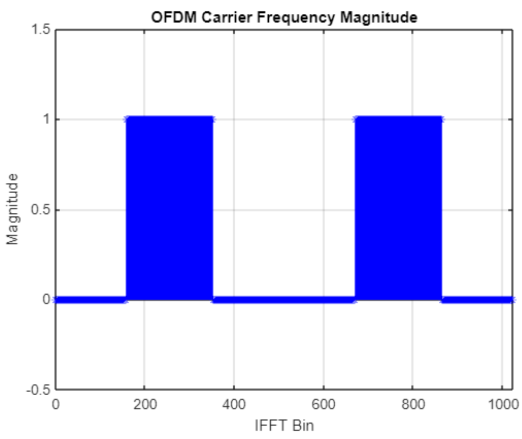
subcarrier count in the OFDM signal for the reduction of the PAPR in the 5G OFDM communication. The simulation analysis of the proposed PTSDCT-LH in the 5G technology with the OFDM reduction is shown in figure 6.



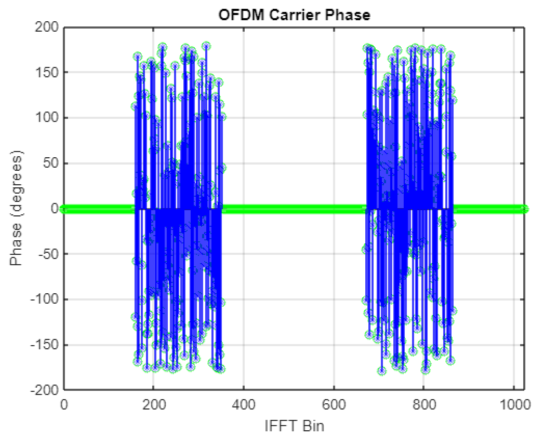
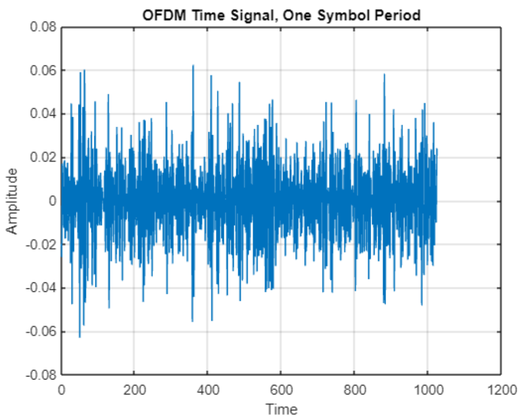


Figure 6: Carrier Frequence in PTSDCT-LH Figure 7: Carrier phase in PTSDCT-LH

The proposed PTSDCT-LH is evaluated based on the consideration of the PAPR reduction in the 5G OFDM communication. The carrier frequency in the signal is evaluated through the computation of the 5G OFDM signal based on the magnitude. The analysis is based on the IFFT bin in the OFDM carrier frequency signal with magnitude of the signal. The carrier phase of the OFDM frequency magnitude of the signal is estimated as 1 for the carrier frequency of the OFDM signal. In figure 7 the carrier signal phase of the PTSDCT-LH is computed and evaluated. The examination of the carrier phase of the signal exhibits the maximal phase of 180 for the transmission of the 5G wireless signal. The time signal response of the proposed PTSDCT-LH for the varying time instance signal are presented in figure 8 and figure 9.



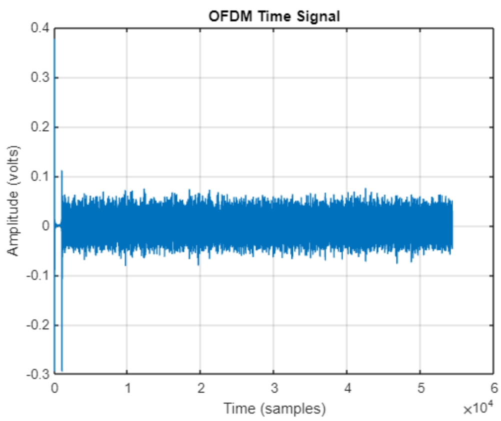


Figure 8: Time signal response in OFDM with PTSDCT-LH Figure 9: Time signal response of all subcarriers

The time signal analysis of the OFDM signal for 5G network exhibits the variation of the 0.06 for the amplitude and 0.1 volts for the different time instances of the signal. The overall signal spectrum computation involved in the computation of the normalized frequency range of 0.5 with the OFDM signal spectrum magnitude computed as 10dB as illustrated in figure 10. In figure 11 presented the overall spectrum magnitude of the receiver signal for the different IFFT bin in the OFDM signal.

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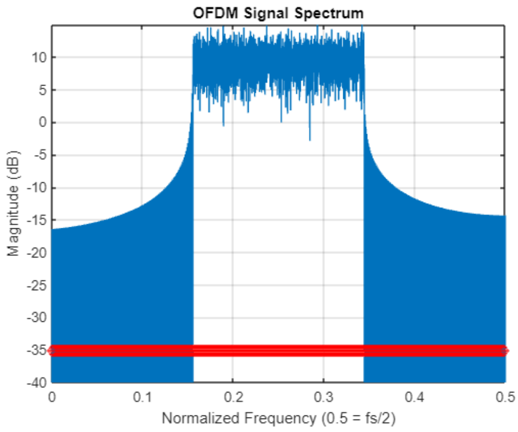

Figure 10: Estimation of OFDM spectrum

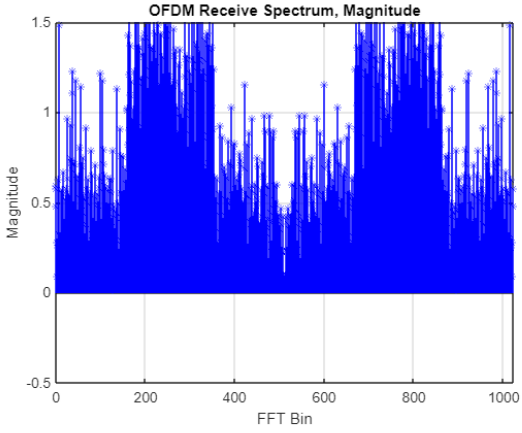

Figure 11: Receiver Spectrum Magnitude

In figure 12 the receiver OFDM signal in receiver are evaluated spectrum of the receiver signal for the FFT bin in the network. The examination is based on the consideration of the phase magnitude of the OFDM signal in the network of the receiver end. The angle spectrum of the propsoed PTSDCT-LH in the OFDM signal is illustrated in figure 13.

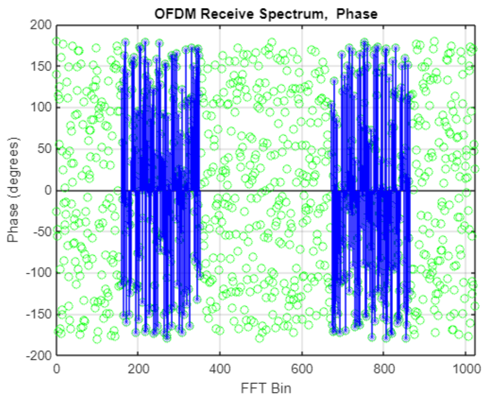

Figure 12: Spectrum of OFDM Receiver

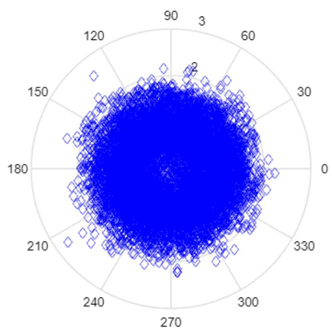

Figure 13: OFDM receiver angle Spectrum

The PAPR estimated for the proposed PTSDCT-LH is provided for the different DFT bins in the network. The computation of PAPR is evaluated based on the consideration of the original, SLM, PTS signal with the propised PTSDCT-LH.

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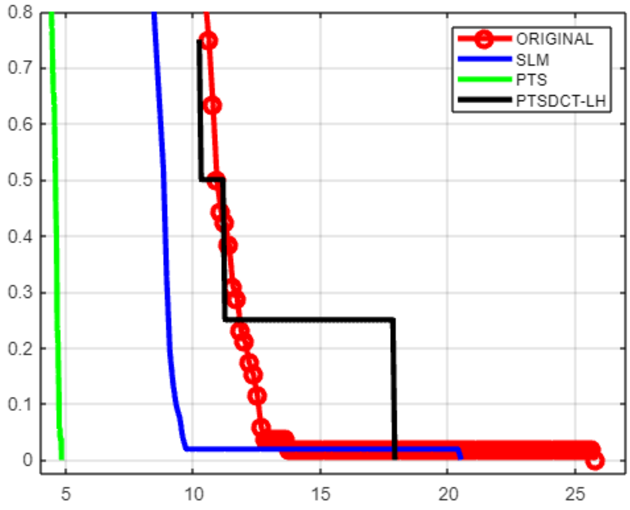

Figure 14: PAPR of the different signal

The proposed PTSDCT-LH concentrated on the minimization of the PAPR in the 5G communication with the consideration of the different signal. The evaluation of the signal is based on the consideration of the different scenarios such as original, SLM, PTS and PTSDCT-LH. In figure 14 and figure 15 presented the estimated PAPR for the different signal based on the consideration of the instances with the SLM, PTS and original signal. The analysis stated that original signal exhibits the higher PAPR value. The proposed PTSDCT-LH model exhibits the minimal PAPR value of around 5dB which is significantly minimal than the SLM, PTS and original signal.

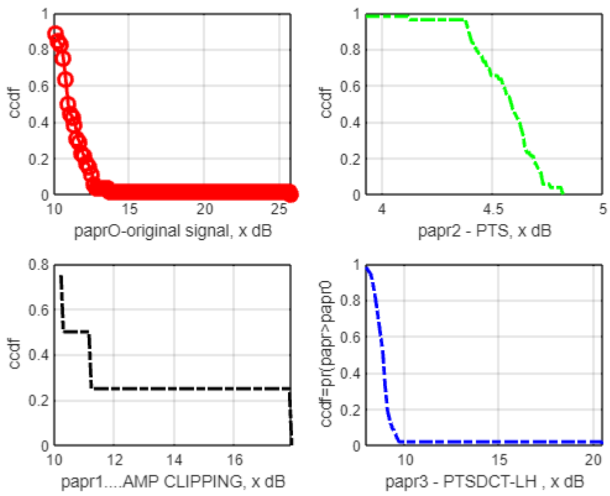

Figure 15: Estimated PAPR for different signal

As the proposed model PTSDCT-LH involved in the estimation of the PAPR signal for the time varying instances of the signal. The original signal ranges form 25db with the PAPR value of 13 dB alone with the application of the PTS over the signal the PAPR is computed as high even for the 4.8dB. Similarly, the PAPR estimated in the clipping signal provides the value of 16dB with the ccf of 0.8. With the proposed PTSDCT-LH model the PAPR is significantly reduced with the minimal distortion in the signal. The proposed model incorporates the PTS for the processing of the signal with reduced PAPR. The analysis expressed that the proposed PTSDCT-LH significantly reduces the PAPR than the original, clipping and PTS signal.

5. Conclusion

Recently wireless communication is facing a lot of challenges and researches for achieving reasonable data rate without sacrificing the bandwidth efficiency. The principle deliberation of OFDM system has been to prevent spectral growth and improve the efficiency of the power amplifier at the transmitter side. The basic idea is to explore the special structure of interleaved OFDM, so as to reduce the complexity for PAPR reduction. Although it takes extra power to transmit the side information and PAPR will be increased, this investigation determines the optimal phase weighting factor such that the overall system complexity is reduced. When the subblocks size is increased to 4, 8, and 16 for 256 subcarriers, the modified PTS with interleaving and pulse shaping method provides PAPR of 4.7dB, 1.8dB and 0.5dB respectively at CCDF of . The modified PTS with interleaving and pulse shaping method has 30.3% improvement in PAPR reduction performance compared to modified PTS with superimposed training sequence method. Discrete Cosine Transform technique has the property of signal energy compaction and reduction of autocorrelation. Efforts can be made to provide a power control technique based on PAPR reduction using water filling algorithm in the channel estimation approach. ii. Developing a Channel Dependent Scheduling (CDS) algorithm for the system to monitor the channel quality as a function of frequency for the each terminal and adapt subcarrier assignments to change in the channel frequency response of all the terminals.

Refrences

[1] Al-Rayif, M. I., Seleem, H. E., Ragheb, A. M., & Alshebeili, S. A. (2020). Papr reduction in ufmc for 5g cellular systems. *Electronics*, *9*(9), 1404.

[2] Gökceli, S., Levanen, T., Riihonen, T., Yli-Kaakinen, J., Brihuega, A., Turunen, M., ... & Valkama, M. (2020). Novel iterative clipping and error filtering methods for efficient PAPR reduction in 5G and beyond. *IEEE Open Journal of the Communications Society*, *2*, 48-66.

[3] Tani, K., Medjahdi, Y., Shaiek, H., Zayani, R., & Roviras, D. (2018, June). PAPR reduction of post-OFDM waveforms contenders for 5G & Beyond using SLM and TR algorithms. In *2018 25th International Conference on Telecommunications (ICT)* (pp. 104-109). IEEE.

[4] Al-Rayif, M. I., Seleem, H., Ragheb, A., & Alshebeili, S. (2019). A novel iterative-SLM algorithm for PAPR reduction in 5G mobile fronthaul architecture. *IEEE Photonics Journal*, *11*(1), 1-12.

[5] Kaur, S., Kansal, L., Gaba, G. S., Alraddady, F., & Arora, S. K. (2020). Impact of Hybrid PAPR Reduction Techniques on FBMC for 5G Applications. *International Journal on Smart Sensing and Intelligent Systems*, *13*(1), 1.

[6] Mohammady, S., Farrell, R., Malone, D., & Dooley, J. (2019). Performance investigation of peak shrinking and interpolating the PAPR reduction technique for LTE-advance and 5G signals. *Information*, *11*(1), 20.

[7] Shawqi, F. S., Audah, L., Hammoodi, A. T., Hamdi, M. M., & MOHAMMED, A. H. (2020, October). A Review of PAPR Reduction Techniques for UFMC Waveform. In *2020 4th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)* (pp. 1-6). IEEE.

[8] Timoshenko, A. G., Osipenko, N. K., Bakhtin, A. A., & Volkova, E. A. (2018, July). 5G communication systems signal processing PAPR reduction technique. In *2018Systems of Signal Synchronization, Generating and Processing in Telecommunications (SYNCHROINFO)* (pp. 1-4). IEEE.

[9] Baig, I., Farooq, U., Hasan, N. U., Zghaibeh, M., Rana, U. M., Imran, M., & Ayaz, M. (2018, April). On the PAPR reduction: A novel filtering based hadamard transform precoded uplink MC-NOMA scheme for 5G cellular networks. In *2018 1st International Conference on Computer Applications & Information Security (ICCAIS)* (pp. 1-4). IEEE.

[10] Wang, Y., Wang, Y., & Shi, Q. (2018). Optimized signal distortion for PAPR reduction of OFDM signals with IFFT/FFT complexity via ADMM approaches. *IEEE Transactions on Signal Processing*, *67*(2), 399-414.

[11] Hosseinzadeh Aghdam, M., & Sharifi, A. A. (2021). A novel ant colony optimization algorithm for PAPR reduction of OFDM signals. *International Journal of Communication Systems*, *34*(1), e4648.

[12] Aghdam, M. H., & Sharifi, A. A. (2019). PAPR reduction in OFDM systems: An efficient PTS approach based on particle swarm optimization. *ICT Express*, *5*(3), 178-181.

[13] Ibraheem, Z. T., Rahman, M. M., Fazea, Y., & Ahmed, K. K. (2020). PAPR reduction in OFDM signal by incorporating Mu-Law companding approach into enhanced PTS scheme. *Journal of Optical Communications*, *41*(4), 437-444.

[14] Ahmad, R., & Srivastava, A. (2020). PAPR reduction of OFDM signal through DFT precoding and GMSK pulse shaping in indoor VLC. *IEEE Access*, *8*, 122092-122103.

[15] Liu, Y., Wang, Y., & Ai, B. (2019). An efficient ACE scheme for PAPR reduction of OFDM signals with high-order constellation. *IEEE Access*, *7*, 118322-118332.

[16] Hao, M. J., Yao, H. H., & Lin, S. S. (2019, December). Novel Subblock Partitioning for PTS Based PAPR Reduction of OFDM Signals. In *2019 International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS)* (pp. 1-2). IEEE.

[17] Hao, M. J., Yao, H. H., & Lin, S. S. (2019, December). Novel Subblock Partitioning for PTS Based PAPR Reduction of OFDM Signals. In *2019 International Symposium on Intelligent Signal Processing and Communication Systems (ISPACS)* (pp. 1-2). IEEE.

[18] Padarti, V. K., & Nandhanavanam, V. R. (2021). An improved ASOICF algorithm for PAPR reduction in OFDM systems. *Int J Intell Eng Syst*, *14*(2), 352-360.

[19] Geetha, M. N., & Mahadevaswamy, U. B. (2022). Crest Dwindling and Interposing for PAPR Reduction in OFDM Signal with Sustainable Spectral Efficiency. *Wireless Personal Communications*, 1-20.

[20] Azarnia, G., Sharifi, A. A., & Emami, H. (2020). Compressive sensing based PAPR reduction in OFDM systems: Modified orthogonal matching pursuit approach. *ict express*, *6*(4), 368-371.

[21] Lekouaghet, B., Himeur, Y., & Boukabou, A. (2020, May). Improved SLM technique with a new phase factor for PAPR reduction over OFDM signals. In *2020 1st International Conference on Communications, Control Systems and Signal Processing (CCSSP)* (pp. 8-12). IEEE.

[22] Fu, X., Bi, M., Zhou, X., Yang, G., Li, Q., Zhou, Z., & Yang, X. (2018). A chaotic modified-DFT encryption scheme for physical layer security and PAPR reduction in OFDM-PON. *Optical Fiber Technology*, *42*, 126-131.

[23] Wang, B., Si, Q., & Jin, M. (2020). A novel tone reservation scheme based on deep learning for PAPR reduction in OFDM systems. *IEEE Communications Letters*, *24*(6), 1271-1274.

[24] Singh, M., & Patra, S. K. (2018). On the PTS optimization using the firefly algorithm for PAPR reduction in OFDM systems. *IETE Technical Review*, *35*(5), 441-455.

[25] Iwasaki, R., & Ohuchi, K. (2018, December). PAPR Reduction in OFDM Signal by Combining Partial Transmit Sequences with Precoding Matrix. In *2018 12th International Conference on Signal Processing and Communication Systems (ICSPCS)* (pp. 1-6). IEEE.

[26] Wang, J., Lv, X., & Wu, W. (2019). SCR-based tone reservation schemes with fast convergence for PAPR reduction in OFDM system. *IEEE Wireless Communications Letters*, *8*(2), 624-627.

[27] Gökceli, S., Levanen, T., Riihonen, T., Renfors, M., & Valkama, M. (2019). Frequency-selective PAPR reduction for OFDM. *IEEE Transactions on Vehicular Technology*, *68*(6), 6167-6171.

[28] Sharifi, A. A. (2019). PAPR reduction of optical OFDM signals in visible light communications. *ICT Express*, *5*(3), 202-205.

[29] SEKIGUCHI, Y., NONAKA, N., & HIGUCHI, K. (2022). PAPR Reduction of OFDM Signals Using Null Space in MIMO Channel for MIMO Amplify-and-Forward Relay Transmission. *IEICE Transactions on Communications*, 2021EBT0006.

[30] Tran, V. N., Vu, V. K., Nguyen, T. C., & Dang, T. H. (2020, November). Optimization of Partial Transmit Sequences Scheme for PAPR Reduction of OFDM Signals. In *2020 International Conference Engineering and Telecommunication (En&T)* (pp. 1-5). IEEE.

[31] Sharifi, A. A., & Emami, H. (2020). PAPR reduction of asymmetrically clipped optical OFDM signals: Optimizing PTS technique using improved flower pollination algorithm. *Optics Communications*, *474*, 126057.