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Performance Improvement in The Domain of upcoming Mobile Communication System

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Abstract –
The upcoming mobile communication systems are working on the more flexibility towards higher use of available spectrum. These systems also introduces the new form of waveforms, so that the existing unused spectrums can be exploited to fulfill the demands of upcoming mobile communication scenarios i.e., 5G. The collaboration of these waveforms will help us to optimize the existing unused resources of the spectrum and offer the interference free communication than orthogonal frequency division multiplexing (OFDM) based systems which are operating at lower spectrum range of 6 GHz. However, the 5G is needed to cope with the better communication service by fulfilling the demands of futuristic communication. Hence, this paper presents uplink and downlink (U&D) waveforms for performance enhancement in upcoming mobile communication system (5G). In uplink transmission, the performance of cyclic prefix-OFDM (CP-OFDM) waveforms are analyzed under multi-user MIMO scenario and compared with DFT-OFDM waveform. The paper analyzes the performance of downlink waveforms by considering CP-OFDM, windowed OFDM (W-OFDM) and filtered OFDM (F-OFDM) etc. The analysis with CP-OFDM and F-OFDM and W-OFDM with downlink transmission suggests that CP-OFDM offers better performance in reducing BER as it removes the interference and F-OFDM yields improved spectrum density than CP-OFDM and W-OFDM.

Index Terms - Bandwidth Consumption, Cyclic Prefix, Interference, 5G, Spectrum Efficiency, OFDM, Throughput.

I. INTRODUCTION

The growing use of mobile communication media has attracted many research communities where everyone are looking towards fulfillment of high data transmission. The existing mobile communication tries to utilize the available spectrum of 6 GHz but fails to have effective spectrum utilization. However, the upcoming mobile standards like 5G are providing promising path for effective spectrum usage Ref. [1]. These waveform aims to provide the significant solution to optimize available spectrum usage, reduced interferences and spectrum efficiency than OFDM (used for spectrum less than 6 GHz) Ref. [2]. Under multi user operating condition, the 5G requires new waveforms for high speed communication by predicting the improper access of the mobile nodes. This avoids the signal overhead over the mobile network Ref. [3]. For the necessary signaling the relaxed synchronization mechanism can be used. For example: if the mobile node takes the general ideal of the time synchronization. The use of multiple devices and support towards the multiple transmissions with 5G leads to higher user interferences in relaxed synchronization mechanism.

The evolution of LTE to latest mobile communication like 5G is taking place all over the world. The first remarkable step towards supporting upcoming 5G network by Huawei is through introducing the 5G chip. The size of this chip is very handy hence it can be integrated with mobile broadcast device than to the mobile device. Again, the 5G chip introduced by the Qualcomm is been first one to implement over mobile devices and it works in the frequency band of mmWave. Later, Qualcomm have introduced the many devices in partnership other manufacturers for integration of 5G in their products Ref. [1]. The naming companies like Erricsson and Samsung are trying to build the 5G chip. The incorporation of Apple and Intel has come up with 5G chip during 2018 and the same is integrated in mobile devices during 2020, which means that the year 2020 will have 5G enabled smartphones enabling the ultra-fast experience.

The European research communities are working on the 5G projects and have found many of the new form of waveforms to fulfill the requirements of 5G system Ref. [2-4]. It is been found that most of the waveform candidates like CP-OFDM Ref. [5], Ref. [6] as well as windowed OFDM (W-OFDM), filtered OFDM (F-OFDM) and other methods like filter bank multi carrier (FBMC) and generalized FDM (GFDM) etc., Ref. [7] [8] [9]. The FBMC is known for replacement option of OFDM but it exhibits some of the practical issues in implementation of FBMC over new mobile systems. Considerably, the staggered multi-tone (SMT) is the FBMC representative which helps to achieve time-frequency efficiency of 1 under infinite block lengths. The OFDM based LTE system achieves time frequency efficiency of 0.84) Ref. [10]. The FBMC considers the filtering functionality in every subcarrier which helps achieve weak side-lobes than OFDM. However, this filtering functionality leads to higher computational complexity in FBMC Ref. [11], [12]. The use of FBMC for single user transmission is more effective but it is not favorable for massive MIMO based 5G systems. Because of these limitation factors, the FBMC is not preferred for 5G communications Ref. [2].

This paper introduces the uplink and downlink (U&D) waveforms for performance enhancement in upcoming mobile communication system (5G). The paper is categorized as Background (Section-2), Review of literature (Section-3), Proposed System Design (Section-4), Results analysis (Section-5) and conclusion (Section-6).

II BACKGROUND

The mobile communication standardization is initialized with the LTE advancement with the aim of making upcoming mobile system (UMS) more flexible Ref. [13].

A. CHALLENGES ADDRESSED BY THE 5G TECHNOLOGY

The mobile communication in today's generation facing different challenges and are need to be addressed with the UMS like 5G:

- Higher number of device connected to the network
- Should address the large/ dynamic traffic
- Applications with variable characteristics

The services of the 5G can be grouped as:

- Large bandwidth and high data rate offering Enhanced Mobile Broadband (eMBB) service.
- Highly availability, reliability and low latency demanding services i.e., Ultra Reliable, low latency (URLL) Communications.

Low bandwidth, high coverage, connectivity and low power based service.

The above mentioned services needs latest spectrum deployment and are expected to be available in coming years. The frequency bands are exhibits between 1 GHz up to 100 GHz and are have flexibility towards 5G Ref.[14] which needs different range of bandwidths (As shown in Fig.1). These supports massive machine connectivity with low.

The vision of UMS consists of LTE Evolution and a latest mobile technology (LMT) which plays a role in deployments to meet required capacity Ref. [15, 16]. The LTE aims to standardize the LMT components and are envisioned to work up to 100 GHz range of frequency to meets connectivity in diverse use cases Ref. [16]. The LMT aimed to enhance the performance without using backward compatibility.

The LTE also considered to be evolving to gathering the 5G requirements. The LTE Evolution and a latest mobile technology (LMT) are integral parts of 5G is observed in Fig.1. The range of LTE evolution exists with operating range less than 6 GHz frequency while LMT exhibits range of about 100 GHz.

Also, a tight networking of LMT and LTE is envisioned to aggregate LTE and LMT traffic more effectively Ref. [17].

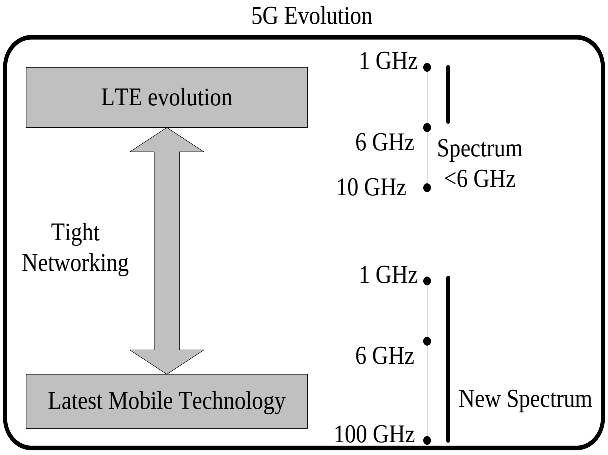


Fig.1. Vision of Upcoming mobile system (5G)

B. 5G WAVEFORM REQUIREMENTS

The upcoming mobile communication like 5G has potential to provide high speed multimedia data downloads, high speed gaming experience, vehicle to vehicle communication or vehicle to infrastructure communications etc. However, all these communication experience can only obtained with the new form of 5G waveforms offering necessary performance Ref. [18].

The following points are required to be supported by the waveforms and the modulation scheme is given below:

- Should handle the high data rate signals with wide bandwidth
- Should offer low latency transmissions during both short and long bursts.
- Should offer fast switching between U&D transmission.
- Should enable power efficient communication low data rate enabled devices.

C. 5G MODULATION CONSIDERATIONS

Among the entire waveform format, various carrier modulations can be utilized. Under, 5G communications modulation variants of PSK and QAM are exist Ref. [19]. The following parameters are needed to be considered for different modulation formats in 5G communication:

Peak-to-average-power-ratio (PAPR): This parameter is the performance aspect which is needed to be considered with different modulation schemes of 5G communications. This parameter has impact over the power amplifiers efficiency and leads to battery life issues.

The advancement in 3G and LTE using various modulation techniques and waveforms are offering high PAPR. As per efficiency of 5G, PAPR parameter is need to be considered Ref. [19].

Spectral efficiency: This is another parameter in 5G modulation mechanism and is need to be maintained well for effective communication. There is a huge difference 64QAM and 16QAM in noise handling during communication. Hence, higher order modulation mechanism is needed to be considered in system having better SNR Ref. [20].

III RELATED WORK

The section describes the various existing researches supporting the upcoming mobile communication systems such as 5G. The investigational works of (Yil-Kaakinen et al.,) have addressed the application of fast convolution mechanism (FCM) for the generation of effective waveforms for 5G system processing. The FCM aims to generate the processing and generation of the signals for CP-OFDM through which the interferences can be eliminated. The outcomes of the CP-OFDM mechanism is compared with the existing time domain mechanism and come up with spectrum control and least implementation complexity Ref. [21].

Achieving the desired data rate in the 5G system leads to stringent constraints. Hence, a coding scheme with digital to analog converter (DAC) is presented (Veyrac et al.,) for 5G transmitter. The system outcome with lower power consumption at 9 dB SNR improvement Ref.[22]. The upcoming mobile systems (UMS) need to be adaptable in fulfilling the needs of the service scenarios of data communication. Hence, (Ijaz et al.,) introduced frame structure for the IoT provision in 5G networks. The structure is validated with system-level simulation and outcomes with the improved bandwidth and reduced interferences Ref. [23]. The consideration of waveforms based on orthogonal-subcarrier for the mobile communication were failed to support the upcoming mobile networks, hence there is a need of significant waveforms for effective mobile communication. Regarding this, various waveforms have discussed in (Liu et al. Ref. [24]. The UMS may face the special diversity leading to underlying waveforms for accommodating flexible service requirements. Hence, (Guan et al.,) gives a configurable test bed for downlink in real time environment and performs the analysis of different OFDM waveforms. Among the OFDM waveforms, f-OFDM eliminates the guard band effectively Ref. [25]. Another recent work of (Yil-Kaakinen et al.,) proposed generalized FCM that combines both time and frequency domain windowing with overlapped block processing through which sub-band filtering can be achieved with low intrinsic interference level. The outcomes suggest that the FCM outperforms effective in interference handling and complexity minimization than windowing and filtering-based mechanisms Ref. [26]. The enormous scope of 5G systems needs to have necessary direction of research ideas. Hence, (Shafi et al.,) have discussed latest technologies, examined their significances and limitation factors which are falling behind the required 5G targets Ref. [27]. The performance analysis of the DSP based waveforms for flexible 5G communication is introduced in (Borges et al.,). The analysis suggests that the low latency high throughput is achieved in mobile to mobile communication Ref. [28]. The challenges, implementation issues of the OFDM based waveforms for the LTE, 5G networks are studied in (Barneto et al.,). The problems of the unused subcarriers are addressed and offer channel bandwidth for the effective transmitter & receiver system Ref. [29]. The constant envelope multicarrier (CEM) waveforms are analyzed in (Rahman et al.,) for 5G transmission. The system outcomes suggest that CEM waveforms offer better channel capacity, coverage and robustness than existing OFDM systems Ref. [30]. The spectral efficiency is also considered as another prime parameter in the 5G network. Hence, (Wang et al.,) have focused on this parameter and performed analysis with different OFDM schemes and found improvement in spectral efficiency Ref. [31].The demands of the flexible communication under different users and channel condition is need to be attained for 5G network. The work of (Ankarali et al.,) has considered OFDM based parameterization and achieves performance improvement with respect to power efficiency, spectral efficiency and latency Ref. [32]. The application of narrowband IoT is considered in LTE and it can be considered for UMS. The work of (Xu et al.,) have discussed a downlink mechanism for UMS and is been tested under different antenna systems. The systems come up with improved data rate at lower computational complexity Ref.[33]. Increasing multiuser capacity is always been a prime concern, hence (Mhedhbi and Boukour) the performance evaluation with pattern division multiple access for the 5G system was introduced The system comes with reduced BER and performance improvement Ref. [34]. When comes to the better consumer experience in the mobile communication, 5G has giving better results as it uses available spectrum more effectively. Towards same work (Park et al.,) have introduced different OFDM based waveforms and outcomes with better performance improvement in spectral efficiency. The comparative analysis of these waveforms suggests that W-OFDM and f-OFDM improved results in 5G stability supporting UMS Ref. [35].The high capacity and low latency architecture for the LTE and 5G network is introduced in (Delmade et al.,). The spectral efficiency is considered with different waveforms of OFDM and comes with cost effective connectivity for the different users Ref. [36].The physical layer verification (PLV) for UMS is necessary to achieve effective mobile communication. Hence, (Liu et al.,) have presented the hardware design for PLV with FPGA implementation. The design is analyzed with different QAM based waveforms and outcomes with the significant transmission power, reduced BER, performance improvement Ref. [37].The growing traffic all over the world is leading congestion as well as accidents and by which the more researches are focusing towards the vehicle positioning with mobile communication system. Towards vehicle positioning (Cui et al.,) have presented the 5G millimeter wave systems by which the timing estimation is performed. The performance analysis of this system suggests that computational complexity is minimized improved the performance in vehicle positioning Ref.[38].Nowadays, fiber technology is playing major role in communication with analog radio system over UMS. The work of (Moutaly et al.,) proposed the intensity modulation and interferometric detection scheme over fiber front haul in downlink and uplink. The system performance is verified and found its effectiveness with power efficiency Ref.[39], increased demand of high bandwidth utilization and improved PAPR. Thus, the work of (Cappello et al.,) presented the efficient system where both supply and load modulations are combined to improve the efficiency of 5G network. The author has focused on supply modulation mechanism and outcomes with better spectrum usage Ref. [40]. The proper synchronization is also necessary in 5G waveforms as it helps in efficient mobile communication. Hence, (Wang et al.,) have considered OFDM based waveforms for side lobes minimization and interference minimization in uplink. The outcomes suggest that BER, complexity is reduced and improved the spectral efficiency In 5G Ref. [41]. The existence of limited spectrum resources in IoT faces critical issues. Thus, (Liu et al.,) provides flexible 5G which can be combined with IoT. The system consists of multichannel IoT for spectrum sharing and performs communication with 5G network. The system reduced the errors and improved the throughput in 5G with IoT implementation Ref. [42]. The improvement of the vehicle positioning with mobile communication is an booming research area which aims to provide highly accurate and efficient positioning of vehicle. In same direction, (Koivisto et al.,) have presented the effective tracking of vehicle with filtering mechanism where clock offsets are considered and achieved accurate tracking of moving devices and can be feasible for UMS such as 5G networks Ref. [43]. The UMS requires significant solution in satisfying the various services and application prospective in mobile communication. Thus, the work of (Sexton et al.,) has proposed the different aspects relating to 5G adaptivity in flexible mobile communication Ref. [44]. The work towards addressing the power allocation issues in the 5G communication is found in (Chen and Liang). The author has introduced the Granger casualty mechanism with 5G channel forecasting by using transfer entropy mechanism Ref. [45]. The obtained research gaps in the 5G system are described below.

Research Gap: The findings of literatures are:

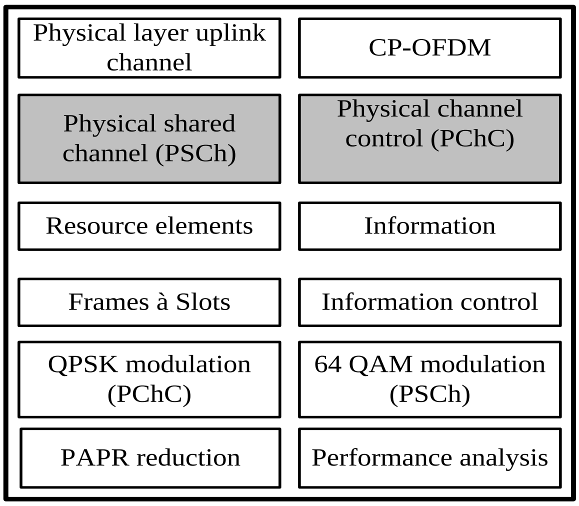
- Flexibility enhancement is needed to address in diverse cases.
- The flexibility of the latest mobile system leads to various research opportunities than existing mobile systems.
- These research opportunities may go beyond the 5G beyond technologies.
- From existing it is observed that very few works are presented with parameterization and waveform generation for 5G networks.
- The researches for downlink carrier or uplink carrier transmission in 5G are less compared to LTE network.
- There is no standard work is exist for the parameterization and generation of both U&D waveform for 5G.
- Thus, an efficient system is need to be presented to support upcoming mobile communication (5G).

IV PROPOSED SYSTEM DESIGN

The performance of the upcoming mobile systems (UMS) such as 5G is analyzed in this paper and is been aimed to bring performance improvement with uplink and downlink systems.

A. UPLINK SYSTEM WITH OFDM WAVEFORMS

This system addresses the interference and multiuser MIMO effects over the OFDM based waveforms. The architecture of uplink system is given in Fig.2. The (CP-OFDM) uplink system is considered in this work as it offers various aspects with simplified transmitter (Tx) and receiver (Rx) chain, advanced interference removal and proper alignment of the reference symbols (RefS) designs in U&L.



Figute.2. uplink transmission

The physical layer uplink channels corresponding to group of resource elements are analyzed in this system. These resource elements carries higher layer (such as physical shared channel (PSCh) and physical channel control (PChC) for uplink) generated information's by using CP-OFDM technique. The transmission with uplink is organized as frames and every frame is subdivided as slots. In this, PChC for uplink is modulated by using QPSK modulation techniques and exhibits two OFDM symbol lengths in each slot to control the information. The modulation of PSCh for uplink is performed with 64-QAM technique. The tap delay line (TDL)-c channel is used to evaluate the performance with RMS delay using the above modulation schemes. The simple PAPR reduction mechanism is used with the 5G uplink signal based on CP-OFDM which offers output power without minimizing the error vector magnitude (ErVM). The channel filter is added to the 5G system which limits the spectral spreading offered by the peak clipping process of PAPR reduction. The performance of CP-OFDM waveforms are analyzed under multi-user MIMO scenario and compared with Discrete Fourier Transform-OFDM (DFT-OFDM) waveform.

The CP-OFDM is considered in both the ends of Tx and Rx where the CP is added as shown in Fig.3 in input of OFDM symbol. The data in the transmitter end is modulated into the symbols and are mapped to the every subcarrier by using inverse FFT algorithm. The use of CP increases the symbols into guard interval. Consider transmit complex symbol (Ts) with number of symbols as s=0, 1, 2..., N. The corresponding base band signal (T_t) can be represented as,

$$T_t = \sum_{s=0}^{N-1} d_k \times e^{j2\pi f_s t} \quad for\ t \in [0, T_d],$$

Where symbol duration (T_d), subcarrier spacing (Δf) and $f_s = s\Delta f$. The Δf, T_d is need to satisfy the orthogonal condition i.e., $\Delta f \times T_d = 1$. The change in time duration is $\Delta t = T_{d/N}$ and hence 'T_t' is sampled with samples (S).

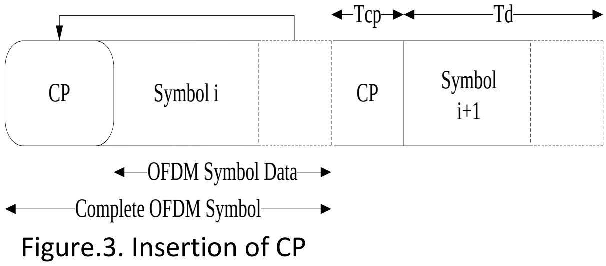


Figure.3. Insertion of CP

B .DOWNLINK SYSTEM WITH OFDM WAVEFORMS

The physical channel control (PChC) of downlink system can be considered for the scheduling of the U&D data channels and to control the uplink power or indicate the slot format. This PChC of the downlink offers higher scheduling flexibility to perform transmission of channel data. The information which is carried over the PChC of downlink is known as control information of downlink (CID). In order to get the CID over the PChC, a set of PChC candidates i.e., user equipment (UEq) monitors (UEqM) are configured in one or more control resource sets (CRS) with respect to search space set (SSS) configuration associated with one CRS. The significance of PChC of downlink is that it offers configuration of CRS and underlying CRS frequency configuration which is not found in LTE. The PChC of downlink uses polar coding with predefined defined rate matching, payload size and QPSK modulation. The blind decoding mechanism (generally used in LTE) is used to monitor the PChC of downlink where UEq performs the cyclic redundancy check (CyRC). The CyRC bits are masked by the user with an identifier. In LTE 16 CyRC bits are used while in the proposed system CyRC bits are increased to 24 which helps to minimize the false alarm rate or improvise or eliminate the consistency checks by the UEq. The architecture of downlink transmission is given in Fig.4.

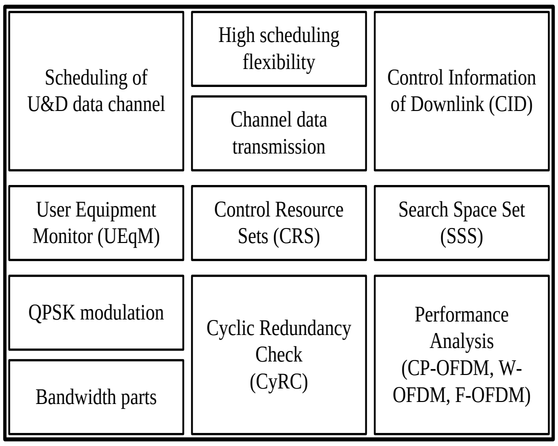


Fig.4. Downlink Transmission

Another significant feature of this system is that it exhibits bandwidth part (BP) that defines UEq's carrier can be spread narrower than the 5G base station (gNB's) carrier. A UEq may be configured with up to four BPs per serving cell, where different BPs may be configured with different numerologies, and gNB may switch between them by configuration or dynamically by scheduling CID. A single BP is active at a given time, and up to 3 CRS and up to 10 SSS can be configured per BP. The CRSs are need to be restricted within the BP bandwidth as the UEq are limited for receiving/transmission within the existing bandwidth. A UEq are configured on an active BP so that three unicast CID can be configured. The configuration of UEq is performed with monitoring of CID format size so that the periodicity is higher than one slot which leads to variation in the blind decoding. The different OFDM-based techniques for 5G network like, (CP-OFDM), (F-OFDM), and (W-OFDM) are analyzed in downlink system. The F-OFDM is a frequency aware OFDM system and it uses sub band splitting as well as filtering mechanism. The consideration of well-designed filters in F-OFDM can eliminate the limitations of conventional OFDM technique. Similar to F-OFDM, the W-OFDM is a frequency aware OFDM system and it uses sub band splitting mechanism in time domain that modifies the CP-OFDM rectangle pulse shape at both ends.

V. RESULTS ANALYSIS

The system performance is analyzed by considering different performance parameters. The link performance with uplink transmission under both QPSK (as shown in Table.1) and 64 QAM (as given in Table.2) modulation mechanisms is analyzed. In this, four resource blocks allocation is assumed and which exhibits independent of multiuser operation each. Hence, total six UEqs are exist within three of four resource block allocations for transmitting to the base station. In this condition, the CP-OFDM plays significant role in upcoming mobile communication than DFT-OFDM.

Table.1. (5G uplink at QPSK modulation under multiuser condition)

SNR	BER	
	CP-OFDM	DFT-OFDM
4	0.5	0.6
6	0.2	0.3
8	0.05	0.1
10	0.02	0.07
12	0.0	0.05
14	0.0	0.02
16	0.0	0

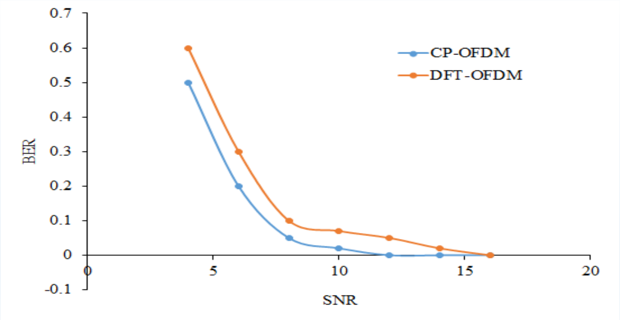


Fig.5. SNR Vs BER under QPSK modulation

The graphical representation of SNR Vs BER under QPSK modulation is given in Fig.5. It is observed that the CP-OFDM based uplink transmission needs lesser SNR (of about 1.7 dB) than the DFT-OFDM (at target BER of 10%). A notable difference of 4 dB is observed at 1% of BER and it can be considered for the control channel or upcoming communication systems demanding low latency in service.

Table.2. (5G uplink at 64QAM modulation under multiuser condition)

SNR	BER	
	CP-OFDM	DFT-OFDM
20	0.8	0.75
22	0.7	0.73
24	0.6	0.6
26	0.5	0.5
28	0.3	0.4
30	0.09	0.085
32	0.06	0.07
34	0.04	0.065

36	0.02	0.06

Similarly, Fig.6 indicates the graphical representation of SNR Vs BER under 64QAM modulation. It is observed that the CP-OFDM based uplink transmission with 64QAM modulation needs lesser SNR (of about 1.4 dB) than the DFT-OFDM (at target BER of 10%). Hence, the CP-OFDM yields higher SNR improvement than DFT-OFDM and is considered to be effective under multi-stream interference condition.

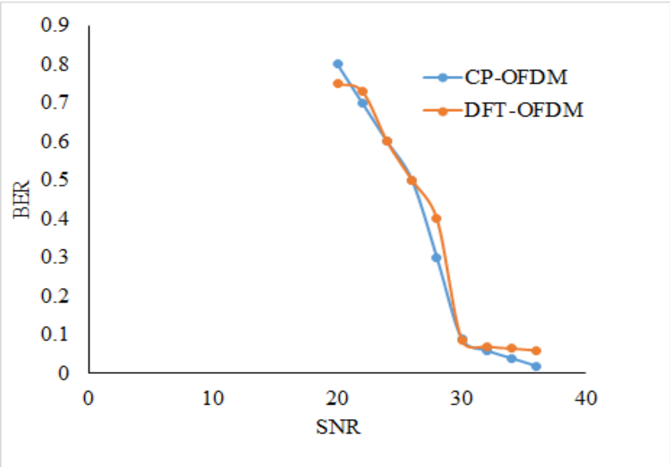


Fig.6. SNR Vs BER under 64QAM modulation

The optimization of the signal clipping ratio is performed before analyzing the ErVM performance of the uplink transmission with respect to CP-OFDM and DFT-OFDM. The clipping mechanism is used to minimize the high PAPR causing higher clipping distortion. Table.3 and Table.4 indicates the clipping ratio for PChC and PSCh of uplink respectively. The high clipping ratio helps to minimize the clipping distortion and the low clipping ratio leads to higher clipping distortion. This distortion can generate a small signal and is
flexible to the receiver noise.

Table.3. (Clipping ratio Vs PChC of uplink)

Clipping ratio	ErVM	
	CP-OFDM	DFT-OFDM
4	15.5	15
6	11.5	11
8	8.2	8
10	6	6.2
12	5.5	5.8
14	5.9	7
16	7	7.8

Table.4. (Clipping ratio Vs PSCh of uplink)

Clipping ratio	ErVM	
	CP-OFDM	DFT-OFDM
4	19	18.5

6	14.3	14
8	10	10.2
10	8	8
12	6.5	6.8
14	7	8
16	9	10

The plots of the Clipping ratio Vs ErVM is presented in Fig.7 and Fig.8 for PChC and PSCh of uplink transmission respectively. The ErVM is computed for both PChC and PSCh of all channels at distribution network of 30 dB. The optimal clipping ration for both the signal type is found about 12dB.

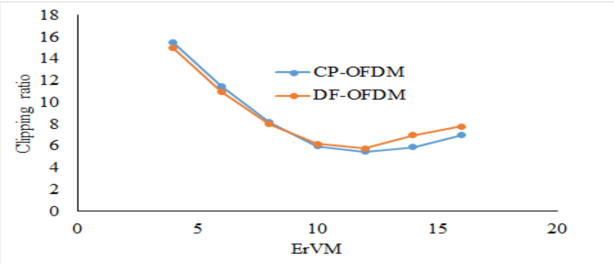


Fig.7. Clipping ratio Vs ErVM (PChC of uplink)

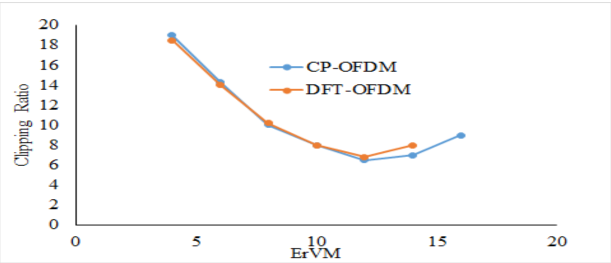


Fig.8. Clipping ratio Vs ErVM (PSCh of uplink)

The following table.5 indicates the spectrum density analysis with different waveforms of downlink transmission.

Table.5. Spectrum density with different waveforms of downlink transmission

Frequency (MHz)	Spectral Density		
	CP-OFDM	W-OFDM	F-OFDM
-4	-52	-75	-77
-3	-50	-72	-75
-2	-47	-69	-72
-1	-41	-60	-65
0	-10	-9	-8
1	-41	-60	-65
2	-47	-69	-72
3	-50	-72	-75
4	-52	-75	-77

The plot of the spectrum density analysis with different OFDM based waveforms is given in Fig.9 where the data transferred through F-OFDM yields 20 dB improvement of spectrum density than CP-OFDM and W-OFDM.

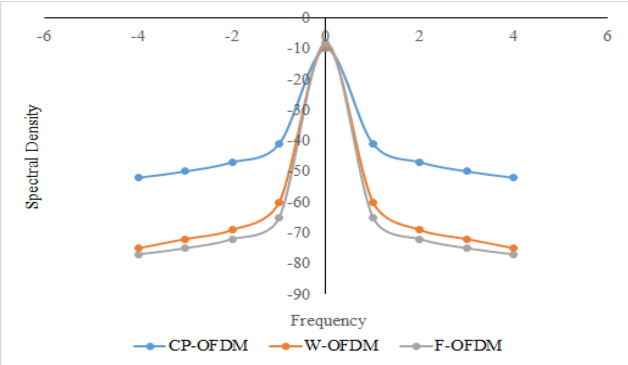


Figure.9. Spectrum analysis of downlink transmission

The analysis of BER Vs SNR of downlink transmission is given in Table.6.

Table.6. BER Vs SNR for downlink

SNR	BER		
	CP-OFDM	W-OFDM	F-OFDM
0	0.9	0.9	0.9
5	0.7	0.8	0.85
10	0.2	0.3	0.35
15	0.02	0.03	0.35
20	0.001	0.02	0.025

The given plot (Fig.10) for the BER Vs SNR indicates that the CP-OFDM offers better performance in reducing BER as it removes the interference. The F-OFDM and W-OFDM exhibits higher BER as it suffers with some extra interference.

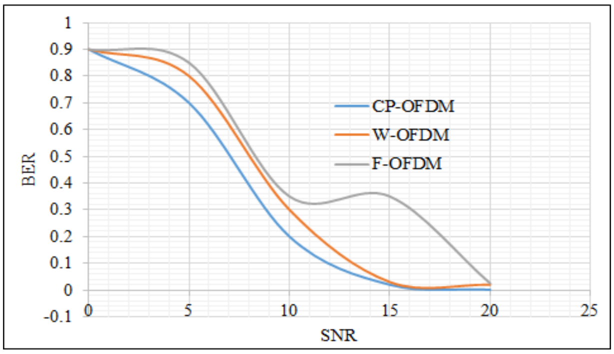


Fig.10. BER analysis of downlink transmission

VI. CONCLUSION

The existing mobile communication tries to utilize the available spectrum of 6 GHz but fails to have effective spectrum utilization. However, the upcoming mobile standards like 5G are providing promising path for effective spectrum usage by using the new waveforms. This paper introduces the uplink and downlink (U&D) waveforms for performance enhancement in upcoming mobile communication system (5G). In uplink transmission, the performance of CP-OFDM waveforms are analyzed under multi-user MIMO scenario and compared with DFT-OFDM waveform. The system performance is analyzed by considering different performance parameters. It is observed that the CP-OFDM based uplink transmission needs lesser SNR (of about 1.7 dB and 1.4 dB with QPSK and 64 QAM modulations respectively) than the DFT-OFDM (at target BER of 10%). The optimization of the signal clipping ratio is performed before analyzing the ErVM performance of the uplink transmission with respect to CP-OFDM and DFT-OFDM. The clipping mechanism is used to minimize the high PAPR causing higher clipping distortion. The different OFDM-based techniques for 5G network like, (CP-OFDM), Filtered-OFDM (F-OFDM), and Window OFDM (W-OFDM) are analyzed in downlink system. The analysis with CP-OFDM and F-OFDM and W-OFDM with downlink transmission suggests that CP-OFDM offers better performance in reducing BER as it removes the interference and F-OFDM yields improved spectrum density than CP-OFDM and W-OFDM.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare . We certify that the submission is original work and is not under review at any other publication.

AUTHOR CONTRIBUTIONS

Nagapushpa K.P: NKP
Chitra Kiran N: CN
Conceived and designed the flow and framework of research paper: NKP CN. .
Paper was written by NKP. Reviewed and final correction: NKP CN.
All authors have read and approved the manuscript.

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