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PAPR REDUCTION CONCERNING BER PERFORMANCE IN MIMO-OFDM-BASED NEXT-GEN WIRELESS SYSTEMS- A REVIEW

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ABSTRACT

Today, society's demand for high-speed and reliable wireless communication on mobile devices is paramount. With the rapid proliferation of mobile applications and users, there is a pressing need for a more dependable, high-speed wireless network with increased throughput to address the shortcomings of existing systems in this multiuser environment. In wireless systems, received signals may suffer from corruption due to noise and interferences such as inter-symbol interference and inter-carrier interference when subjected to multipath fading. Moreover, poor bit error rates and high peak-to-average power ratio values can adversely affect signal power and the spectral efficiency of transmitted signals. The integration of orthogonal frequency division multiplexing (OFDM) and multi-input multi-output (MIMO) antenna systems, known as MIMO-OFDM, promises to enhance quality of service and increase throughput to meet the demands of tomorrow. This review article primarily examines various technologies adopted by researchers to improve bit error rates, peak-to-average power ratio, signal-to-noise ratio, and spectral efficiency in wireless systems. We proceed by discussing the limitations and comparing results of conventional methods, schemes, and algorithms proposed by different researchers. Additionally, we focus on MIMO, a multiple-antenna system designed for future multiuser environments, aiming to enhance capacity or achieve high throughput while maintaining good quality of service.

Keywords: 5G, Wireless, Antenna, Interference, Multicarrier, modulation, MIMO, OFDM, PAPR, BER.

INTRODUCTION

In this modern age, advancements in digital communications via wireless links have revolutionized global connectivity with ultra-high-speed digital communication. Presently, mobile users, applications, and protocols are evolving rapidly, driving the transition towards next-generation 5G technologies. This transition faces numerous challenges, navigating various wireless communication standards such as IEEE 802.11a, IEEE 802.16a, and protocols simultaneously. The primary aim of next-generation communication systems is to simplify system complexity stemming from diverse technologies and algorithms, reduce power consumption, utilize available bandwidth optimally, and deliver error-free, reliable high-speed wireless communication. To address the challenges inherent in wireless links, the integration of MIMO (Multi-Input-Multi-Output) and OFDM (Orthogonal-Frequency-Division-Multiplexing) technology plays a pivotal role in the next-generation system. MIMO-OFDM systems effectively combat frequency-selective fading and eliminate the need for complex equalizers. This technology is well-suited for reliable communication systems, offering excellent spectral efficiency. MIMO-OFDM schemes leverage spatial diversity to achieve remarkably high capacity, throughput, and resilience against Inter-Symbol Interference (ISI).

MIMO-OFDM has been incorporated into various standards such as Wi-Fi (Wireless Fidelity), LTE (Long-Term Evolution), LTE Advanced, or 3GPP (Third-Generation Partnership Project), Wi-MAX (Worldwide Interoperability for Microwave Access)/IEEE 802.16m, WLAN (Wireless Local Area Network)/IEEE 802.11n. However, in environments prone to multipath fading, MIMO-OFDM wireless systems are susceptible to different types of error rates such as Bit Error Rate (BER), Symbol Error Rate (SER), and Framing Error Rate (FER), as well as interferences like ISI, Inter-Carrier Interference (ICI), and High Peak-to-Average Power Ratio (PAPR).

In environments affected by Additive White Gaussian Noise (AWGN), error rates can be enhanced up to 10^-3 at 1 to 2 dB higher Signal-to-Noise Ratio (SNR) using various constellation techniques and coding. Conversely, in multipath fading environments, to achieve error rates of up to 10^-3, SNR needs to be increased by up to 10 dB. Hence, it is imperative to address the challenges posed by multipath fading effects in wireless communication systems. This review article specifically focuses on error performance analysis and PAPR reduction schemes in the MIMO-OFDM system, as investigated by various researchers.

1. System Model

MIMO-OFDM stands out as an efficient technology for establishing reliable wireless systems, offering spatial diversity, high spectral efficiency, capacity, and throughput while bolstering resilience against various impairments [5].

A. MIMO Antenna System:

Studies have demonstrated that the capacity of MIMO systems increases linearly with the minimum number of transmit ( ) and receive (M_r) antennas [3]. Leveraging spatial diversity inherent in MIMO setups effectively enhances spectral efficiency (SE). Introducing additional antennas at either the receiver or transmitter can be an effective means of maximizing received power. Illustrated in Figure 1, a MIMO antenna system configured with ($M_t \times M_r$) antennas offers spatial diversity, further enhancing the Quality of Service (QoS) and throughput of the system [6]. Nonetheless, the benefits of MIMO antenna systems are somewhat constrained due to factors such as inter-channel interference (ICI), transmit power requirements, and implementation complexity [8].

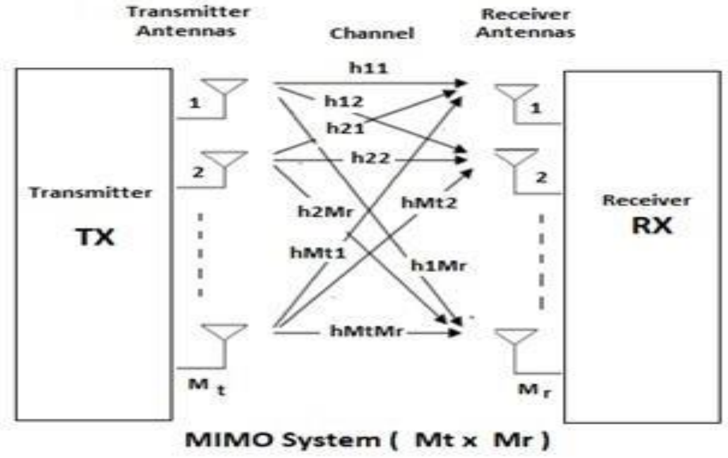

Figure -01 MIMO System

Combining the MIMO system with OFDM technology (MIMO-OFDM) represents the most promising advancement in wireless communication, as it delivers adequate data rates, optimally utilizes available bandwidth, ensures better signal quality, and effectively combats various channel impairments [2]. The architecture of the MIMO-OFDM system depicted in Figure 2 initiates with the modulation of the message signal. Modulation can be executed utilizing constellation schemes such as

Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK), or M-array Quadrature Amplitude Modulation (M-QAM). The complex output of modulation undergoes conversion into a parallel set of symbols using a serial-to-parallel converter.

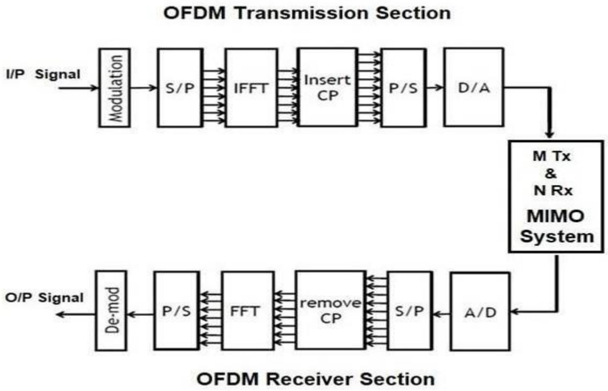

Figure-02 MIMO-OFDM Architecture

The parallel stream of symbols is then subjected to an N-point Inverse Fast Fourier Transform (IFFT). This process converts samples of the overall complex signal from the frequency domain to the time domain, which are then transmitted over N subcarriers [9, 10, 11]. The output of the IFFT is prefixed with the last P sample of the previous symbol, known as the cyclic prefix (CP), generating a block of (N + P) samples constituting one OFDM symbol. After CP addition, each block of data is reconverted into serial form using a parallel-to-serial converter and fed into a Digital-to-Analog Converter (DAC), which converts the digital data stream into analog form for transmission over the wireless link. Before transmission over the wireless link, the analog output is upconverted to the transmission frequency.

The analog signal is transmitted via MIMO transmitting antennas, with or without transmitter antenna selection. Subsequently, the signal is received at the MIMO receiver section via receiving antennas. The received signal is then converted into digital form using an Analog-to-Digital Converter (ADC). At this stage, timing synchronization of symbols is achieved. The output signal of the ADC is converted back to a parallel data stream using a serial-to-parallel converter. The CP from each block is removed from the OFDM symbols, and the resulting signal is inputted into an N-point Fast Fourier Transform (FFT) to convert the signal back into the frequency domain. Prior to demodulation, the parallel signal is converted into serial form using a parallel-to-serial converter and then demodulated to retrieve the original information [14, 15, 16].

2. Bit Error Rate

In digital wireless communication, the Bit Error Rate (BER) refers to the number of erroneous bits received per symbol per unit time through the communication channel. BER performance serves as a useful metric for comparative analysis of different OFDM modulation schemes. Multipath fading in wireless channels occurs when signals are received through multiple paths and are then destructively added at the receiver, degrading system performance and leading to degraded BER performance. Effective reduction of BER can be achieved through the utilization of receiver diversity (such as the Alamouti scheme) and transmit diversity (such as the Maximum Ratio Combining (MRC) scheme) with modulation techniques like Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK), and M-ary Quadrature Amplitude Modulation (M-QAM) [17, 18].

A study by A. H. Alqahtani et al. examines an experimental setup focusing on BER performance in MIMO-OFDM systems. The authors introduce a 2 × 2 antenna system employing Rate-less Space-Time Block Code (RSTBC) to enhance the reliability of the wireless system. In the 2×2 MIMO-OFDM system, QPSK/16-QAM modulation is utilized, and to mitigate Inter-Symbol Interference (ISI), guard signals or Cyclic Prefix (CP) are employed. It is demonstrated that RSTBC is capable of reproducing the original signal at loss rates ranging from 10% to 25% for specific amounts of encoded data. The investigation reveals that BER performance improves with an increase in RSTBC blocks. An experiment is conducted to evaluate the BER results for 16-QAM modulation across varying numbers of RSTBC blocks (L = 1, 2, 4, 6, and 8), with the simulation and experimental results presented in Table 1.

Modulations	No. of RSTBC blocks	BER (Simulation)		BER (Experimental)	
		LR=10%	LR=25%	LR=10%	LR=25%
16- QAM	L=1	5 x 10^{-1}	5 x 10^{-1}	5 x 10^{-1}	5 x 10^{-1}
	L=2	3.8 x 10^{-2}	1 x 10^{-1}	3.8 x 10^{-2}	1 x 10^{-1}
	L=4	3.5 x 10^{-3}	3 x 10^{-2}	5 x 10^{-3}	3 x 10^{-2}
	L=6	4.5 x 10^{-4}	1 x 10^{-2}	1 x 10^{-3}	0.5 x 10^{-2}
	L=8	6 x 10^{-5}	4 x 10^{-3}	2 x 10^{-4}	6 x 10^{-3}
QPSK	L=1	5 x 10^{-1}	5 x 10^{-1}	4 x 10^{-1}	5 x 10^{-1}
	L=2	5 x 10^{-2}	0.25x 10^{-1}	1x 10^{-1}	0.25 x 10^{-1}
	L=4	5 x 10^{-3}	3 x 10^{-2}	0.25 x 10^{-2}	4 x 10^{-2}

Table1 BER performance for RSTBC blocks L= 1 to 8 using QPSK / 16-QAM modulation

M. El-Absi et al., proposed transmit antenna selection (TAS) for MIMO-OFDM-IA through bulk selection or per- subcarrier selection. This technique is mainly used to improve sum rate and error rate performance under erroneous channel state. Within each node antennas are spatially separated by minimum ʎ/2 (ʎ = wavelength). 02 antenna selection techniques namely MSR (Maximum Sum Rate or Max-SR) and MER (Minimum Error Rate or Min- ER) are employed. An experiment is performed indoor to validate the result of proposed system. Author proposed a Max-SR and Min-ER criterion's to get better sum rate and error rate performance respectively. Table 2 shows BER performance for analytical and deterministic channel at SNR (Signal to Noise Ratio) of 10 dB or more.

Table 2 BER Performance for different antenna selection method

Antenna Selection type	Selection criteria	BER (Analytical Channel)		BER (Deterministic channel)	
Per- subcarrier selection		SNR= 10dB	SNR= 20dB	SNR= 10dB	SNR= 20dB
	Max-SR	10-4	<< 10-4	3 x 10-2	4 x 10-3
	Min-ER	10-4	<< 10-4	5 x 10-2	4 x 10-3
Bulk Selection	Max-SR	4 x 10-2	6 x 10-4	5 x 10-2	10-2
	Min-ER	5 x 10-2	2 x 10-3	5.5 x 10-2	0.5 x 10-2

S. A. Nambi and K. Giridhar, proposed OFDM-IM (Index Modulation) scheme to improve BER performance using QPSK and M-QAM modulation technique. Authors show that the given approach offer better gain performance compared to conventional schemes without affecting spectral efficiency of OFDM. Further they compared BER results of OFDM-IM using 16- QAM and 8-QAM modulation techniques. Using 8-QAM modulation scheme better BER performance is obtained with less complexity at receiver. Table 3 shows BER performances using 16-QAM and 8- QAM modulation techniques.

Table 3 BER comparison for QPSK, 8-QAM and 16-QAM

SNR	BER at spectral efficiency about 2 bits/s/Hz		
	QPSK	8-QAM	16-QAM
10 dB	3 x 10-2	9 x 10-2	7 x 10-2
20 dB	3 x 10-3	9 x 10-3	8 x 10-3
30 dB	2.5 x 10-4	4 x 10-4	4 x 10-4
40 dB	2.5 x 10-5	2 x 10-5	4 x 10-5

A. Afana et al., presented the MIMO scheme with QSM (Quadrature-spatial-modulation) in a co-operative DF (decode and forward) diversity scheme. Analytical and simulation outcomes are compared and they found that QSM provide 3 dB gain over conventional spatial modulation scheme. Two spectral efficiencies of 4 and 6 bits/s/Hz and 2 × 2 and 4 × 4 antenna configurations are used to measure average bit error probability (ABEP) versus SNR for analytical calculation and simulation purpose. For 2 × 2 antenna systems with 4-QAM modulation accomplish 4 bits/s/Hz SE and ABEP of 3 × 10−5 at SNR of 20 dB. Similar result is also obtained with conventional SM (spatial Modulation) using 8-QAM, but the former scheme provides 3 dB gain over SM scheme. Similarly the result for 4 ×4, QSM-DF system using 4-QAM modulation and spectral efficiency of 6 bits/s/Hz is obtained. When the result is compared with conventional SM technique with 4×4 antenna system and 16-QAM modulation scheme, a gain of 3 dB is obtained.

S.M. Alamouti, proposed transmits diversity technique with 2×1antenna system. Author shows that 2×1 system and MRRC (maximal ratio receiver combining) 1 × 2 schemes provide similar diversity order. He also shows that $(2 \times Mr)$ antenna system provide diversity order of $2Mr$. No additional bandwidth and feedback from receiver to transmitter required for the scheme suggested by the author. The proposed new scheme with 2×1 antenna systems and BPSK modulation provides 3 dB less gain compared to MRRC technique. Proposed scheme with 1 and 2 receive antennas provide diversity Gain of 15 dB and 24 dB respectively at BER of 10−4 in Rayleigh fading channel.
K. Tiwari and D. S. Saini, introduces transmit diversity (Alamouti scheme) and receive diversity (MRC scheme) for enhancing the error performance of wireless link. They employed MIMO-OFDM system with BPSK, QPSK and 16QAM constellation schemes along with STBC code over fading channels to improve the BER performance. The BER performance is improved significantly at the SNR of 0 to 20dB.

T.V. Luong and Y. Ko, investigated BER performance in OFDM-IM (Index modulation) scheme. MRC-GD (Greedy Detector) is employed with PSK modulation scheme for the BER investigation. BER performance is investigated using MRC-GD and compared with BER performance using MRC-ML (Maximum likelihood) detector. It is shown that BER results from both schemes are nearly same at perfect and variable channel state information (CSI) and number of receive antennas L (1, 2, 4, 8). Experimental result shows BER values in the range (10−4 to 10−5) at SNR ranges from 0 to 20 dB.
P. Bento et al., considered PSK signal obtained through magnitude modulation (MM) technique. The analytical BER is examined for both flat fading channel and time varying channel. They proposed a BER expression that depends upon only the order of modulation and the Kullback–Leibler divergence of the MM factors' PDF from the Gaussian one, and the expression found to be very precise. The analytical and Experimental result shows BER values in the range (10−4 to 10−5) at SNR ranges from 0 to 18 dB.
It is found that spatially modulated OFDM has better BER performance compared to other OFDM scheme at lower spectral efficiency. At higher spectral efficiency BER is greatly affected due to trade off between spatial diversity (Ms × Mr) and constellation size [19].

3. Paper Reduction Technique

OFDM is the most promising technology in high-speed wireless network. It is an efficient system providing high spectral efficiency and combating inter-symbol interference (ISI). But its performance seriously affected due to presence of high PAPR [20, 21]. High PAPR is one of the key issue in OFDM technology [22]. PAPR is defined as the ratio of peak signal power to the average signal power [16]. OFDM system consists of orthogonal subcarriers, which are logically added in IFFT leads to produce some large peaks at the output [23]. Large peaks in output signal may cause out of band radiation and signal distortions [24]. To accommodate such large peaks in OFDM system, highly linear analog devices like DAC and PA (Power Amplifier) are required [19, 25]. While dealing with large peaks, the PA may enters into saturation and exploit large amount of system power [26]. To back off operating point of PA so as to handle large peak signal in linear region, leads to drop efficiency of PA and degrade SNR [23, 27, 28]. Most of the PAPR minimization schemes face tradeoff between various performances such as BER, Spectral efficiency (SE) and computational complexity [19, 23]. Many PAPR reduction schemes have been introduced namely ICF (Iterative Clipping and Filtering), ICTF (Iterative Companding Transform Filtering), Bayesian approach, SLM (Selective Mapping), PTS (Partial Transmit Sequence) and tone reservation (TR) and so on [21,27,29].
H. Bao et al., proposed a Bayesian approach by employing the surplus degrees-of- freedom of the transmit array in an adaptive PAPR reduction technique. The GAMP (generalized -approximate message passing) when combined with EM (Expectation Maximization), computational complexity is reduced. Simulation result of proposed method shows enhancement in PAPR performance and computational complexity over conventional schemes. To perform experiment, TGM (Truncated

Gaussian Mixture) based EM-TGM-GAMP algorithm is planned. The experimental result of EM-GTM-GAMP is compared with FITRA and ZF (Zero Forcing) algorithm. Analytical result shows that proposed algorithm has advantage over FITRA, ZF and iterative clipping. Proposed algorithm gives lowest PAPR result of 08 dB where as FITRA, Clipping and ZF algorithm gives PAPR of 2.4 dB, 4.3 dB and 10.6 dB respectively. SER performance is also obtained for all the above said algorithms, ie for FITRA algorithm SER $= 10^{-3}$ at SNR of 11 dB. Similarly for SER for ZF, FITRA and Clipping, SER $= 10^{-3}$ at the SNR of 8 dB, 9.5 dB and 15 dB respectively.

S. Gokceli et al., proposed two new algorithms namely enhanced ICEF (Iterative Clipping and Error Filtering) and FC (fast convolution) processing. The Enhanced-ICEF (E- ICEF) algorithm cancel out INI (inter numerology interference) between each BWP (bandwidth parts) along with PAPR minimization. In FC algorithm allows block wise PAPR minimization. The proposed E-ICEF algorithm based on cancels out INI between each BWP through the iterative process of PAPR minimization. Result shows significant reduction in PAPR. Parameters considered for the analytical results are; PRB size =20 subcarriers, Modulation order QPSK, 64-QAM and Maximum number of (I/E/FC)-ICEF iterations = 20. At 1% probability, Complementary Cumulative Distribution Function (CCDF)
$= 10^{-3}$ and target PAPR-5dB. Result shows PAPR performance for IICEF (Independent ICEF), E-ICEF, FC- ICEF as 7.3 dB, 5.2 dB and 5.1dB respectively. It is found that PAPR performance of E-ICEF and FC-ICEF shows very close performance to the target 5dB PAPR.

S. Gökceli et al., also proposed a PAPR reduction scheme for frequency selective fading channel, where clipping noise controlled and filtered in the transmitter pass band. Simulation result for the target PAPR = 6 dB, CCDF 0.1%, Modulation QPSK and 16-QAM, and ICEF PAPR reduction algorithm over 1 to 20 iterations given in table 4.

Table 4 The PAPR performance using ICEF

Reduction Technique	No of Iterations	PAPR for CCDF = 0.1%
ICEF	1	8.3 dB
	10	6.3 dB
	20	6.0 dB

K. Anoh et al., proposed MC (µ Law Companding) PAPR minimization technique. In this method amplitudes of low power signals are enhanced without affecting signals with high amplitude. But this process limits the PAPR performance, thus new method known as RBMC (Root based µ Law Companding) have been suggested, where OFDM signals are simultaneously compressed and amplified. The result of RBMC technique is better than other popular companding techniques keeping BER value at desired level. Simulation result of MC technique for $\mu=30$, PAPR equals to 4.6 dB at CCDF of 0.01% and BER performance equals to 10^{-5} at 16 dB SNR.

F. Gao et al., suggested a new hybrid PTS model where IPTS (iterative partial transmit sequence) and Clip method are combined for PAPR reduction. The proposed scheme gives better result of PAPR reduction as compare to conventional PTS scheme and clipping algorithm separately. The threshold value of proposed scheme is optimized by
1.01 dB and 4.09 dB when compared with PTS splicing and IPTS scheme and it is optimized by 2.60dB and 0.08 dB when compared with conventional PTS scheme and the Clip method. The result of simulation of PAPR performance at probability (CCDF) of 10^{-4} for different PTS and Clipping method is given in Table 5.

Table 5 The PAPR performance at CCDF of 10^{-4} fordifferent PTS methods

Reduction Technique	PAPR for CCDF $= 10^{-4}$
Original	11.3 dB
PTS	9.5 dB
IPTS	8.8 dB
Clipping (4 clips)	6.5 dB
PTS-Clipping	6.25 dB
IPTS-Clipping	5.19dB

Lahcen Amhaimar et al., proposed a PTS (Partial- Transmit-sequence) with firework algorithm (FWA) for PAPR reduction in MIMO-OFDM system. This PTS-FWA scheme is employed to lessen the PAPR with minimum computational complexity. From the simulation result, it is shown that the given PTS-FWA method provides better PAPR performance as compared to other schemes. Table 6 shows PAPR values at CCDF of 10^{-3} for FWA (Firework- Algorithm), SPSO (Standard-Particle-Swarm Algorithm), SA (Simulated-Annealing), PTS (Partial-Transmit- sequence), GA (Genetic-Algorithm), and SLM (Selective- Mapping) scheme.

Table 6 PAPR for different algorithms at CCDF of 10^{-3}

	FWA	SPSO	SA	PTS	GA	SLM
PAPR at 10^{-3} CCDF	4 dB	4.421 dB	4.948 dB	5.226 dB	5.879 dB	7.034 dB

P. Gupta et al., proposed a new scheme of PAPR optimization using DCT (Discrete Cosine Transform) with SLM scheme. This scheme performs better as compared to other schemes and same has been depicted through simulation result which shows significant gain is accomplished using SLM-DCT scheme. Suggested SLM- DCT scheme effectively minimize PAPR without affecting BER performance. Simulation is carried out on following parameters; number of subcarriers = 32 to 128, phase sequences = 1, 2, 4, 8, 16, 32, 64, 128, and M-PSK (M=order of modulation) modulation. Proposed method achieves gain of 1.35 dB at CCDF of 10^{-3} for different phase sequences from 1 to 8.

S.H. Wang et al., proposed a new PAPR lessening scheme with frequency-domain phase rotation, cyclic shifting, complex conjugate, and sub-carrier reversal operations in order to increase the diversity of the signals. The analytical and experimental result shows that proposed scheme reduces PAPR significantly compared to traditional SLM scheme.

K.H. Kim, proposed OFDM-IM multicarrier scheme employing multi-level dithers signals in the idle subcarriers to minimize the PAPR. Multi-level dither signals are added in idle subcarriers such that the amplitudes of the symbols in the active subcarriers are variously distributed for different sub-blocks. Proposed scheme accomplishes good BER performance compared to single level dither signal. At the CCDF of 10^{-2} the PAPR is found to be 6 dB in proposed scheme.

B. Tang et al., proposed a clipping-noise compression scheme which reduces computational complexity such that only one FFT is required for this approach. This scheme show good PAPR and BER performance compared to conventional ICF scheme. Proposed method provide BER value in the range of (10^{-3} to 10^{-4}) at the SNR of 10 to 15 dB. Also the PAPR value at the CCDF of 10^{-3} is found to be 4.5 dB in proposed scheme.

EXPECTED RESULT

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This section mainly highlights on PAPR reduction schemes in perspective of BER performance and PAPR in future MIMO-OFDM wireless system. Different modulation schemes with different combination of transmit and receive antennas ($M_t \times M_r$) is overviewed for enhancing overall performances of including error rates, PAPR, Spectral- efficiency and computational complexity of the future wireless system. Based on findings of various reviewed literature, the key observations has been tag and summarized. Table 1 to 3 summarizes BER performances and Table 4 to 6 summarizes PAPR performances using different algorithms and methods. It is also understood from the above cited literatures that various techniques, schemes and algorithms are playing important role to enhance the performances (BER, SER, and PAPR) of the wireless system under the umbrella of MIMO-OFDM technology. It is found that there are some tradeoffs between PAPR, BER, SE and computational complexity which compromising any of facilities like QoS (Quality-of-Service) range of communication, throughput and healthy network link.

CONCLUSION

This article is presenting the performance enhancement of the MIMO-OFDM scheme without affecting system stability and key parameters. The MIMO-OFDM systems with space time block code (STBC) schemes leads to offer optimized error rate performance. The packets loss and data link degradation can be delimited by employing RSTBC and Alamouti's space time block code schemes. From literature review it is found that the BER values ranges in between 10^{-3} to 10^{-4} at the SNR value in between 8 dB to 15 dB. Some of promising techniques for the PAPR reduction are ICF, ICTF, PTS and SLM and Bayesian approach. Among these ICF technique is still doing well and minimizes PAPR up to satisfactory level without affecting BER much. The MIMO technology is found to be good candidate to offer spatial diversity that further improves the QoS (Quality of service) and the system channel capacity. The error rate presentation of the MIMO-OFDM schemes can be boosted by adopting various schemes, antennas configuration and algorithms such as MRC scheme and Alamouti scheme which offer better error rate and throughput using less number of antennas at receiver and transmitter. ICF as PAPR reduction scheme and 2 × 2 & 2 × 1 antenna configuration or MRC scheme is found to be the best suitable scheme for enhancing BER and PAPR performance of the wireless system which fulfill the requirement of next frontier wireless system (5G) using 16-QAM or QPSK modulation. Also this scheme when used in MIMO-OFDM systems leads to high SE with optimized PAPR, BER and ISI. The MIMO antenna (4 × 1) configuration take up the transmit power within range of 100mw to 150 mw with per sub-carrier and bulk carrier selection. Different MIMO antenna configurations such as 2×2, 4×4, 2×1, 1×2, 4×1, and 4 × 2 may be adopted to attend the high throughput, better SE and error rate performance.

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