International Journal of Advanced Technology and Engineering Exploration
ISSN (Print): 2394-5443 ISSN (Online): 2394-7454
Volume-2 Issue-7 June-2015

A survey on BER performance analysis in AWGN and Rayleigh Fading Channel

Shraddha Rawat[1*] and Bhagwat Kakde[2]
M.Tech research scholar, RKDF IST Bhopal, India[1]
Assistant Professor, Electronics and Communication Engineering, RKDF IST Bhopal, India[2]

Abstract

Additive white Gaussian noise (AWGN) is an essential model which is utilized as a part of Information hypothesis to copy the impact of numerous arbitrary procedures that happen in nature. AWGN is frequently utilized as a channel display as a part of which the main debilitation to correspondence is a direct expansion of wideband or background noise a steady phantom thickness The model does not represent blurring, recurrence selectivity, impedance, nonlinearity or scattering. Notwithstanding, it creates straightforward and tractable numerical models which are helpful for picking up knowledge into the basic conduct of a framework before these other phenomena are considered. Rayleigh channel is a measurable model for the impact of an engendering situation on a radio sign, for example, that utilized by remote gadgets. Rayleigh blurring models expect that the extent of a flag that has gone through such a transmission medium (additionally called a correspondences channel) will fluctuate haphazardly, or blur, as indicated by a Rayleigh conveyance the spiral part of the whole of two uncorrelated Gaussian arbitrary variables. In this study we are study the combined effect of this model irrespective of transmission mode like orthogonal frequency division multiplexing (OFDM) and multiple inputs and multiple output (MIMO) system. So that the bit error rates (BER) can be reduced.

Keywords

AWGN, Rayleigh Channel, OFDM, MIMO, BER.

1. Introduction

OFDM is a successful method to relieve the medium correspondence. OFDM is a recurrence division multiplexing(FDM) scheme used as an advanced multi-bearer tweak method[1][2] as it were OFDM is recurrence division multiplexing of multi-bearers which are orthogonal to one another i.e. they are put precisely at the nulls in the regulation spectra of one another. This makes OFDM frightfully more effective [3]. In OFDM information is separated into a few parallel information streams or sub-channels, one for every sub bearer which are orthogonal to one another despite the fact that they cover frightfully Each sub-transporter is regulated with an ordinary regulation scheme (such as QAM or PSK) at a low image rate keeping up aggregate information rates like traditional single-transporter tweak plots in the same transmission capacity.

In today's situation MIMO is extremely helpful with the blend of OFDM framework. Misusing the adaptability of MIMO frameworks keeping in mind the end goal to have high information rates is a particularly alluring exploration theme for future booking plan plans and their applications. Different information various yield (MIMO) frameworks offer much bigger channel limit over customary single-information single-yield framework.

As of numerous transmit Algorithms have been produced to adventure the high limit in the MIMO frameworks [4][5].Furthermore, in MIMO frameworks, subsequent to selecting the gathering of clients with the at present greatest attainable rates dictated by a parcel scheduler in every time-opening, we have to appoint them to the transmitter's radio wires in such a route, to the point that we can accomplish the greatest throughput in the framework. Assorted qualities procedures, for example, space-time coding have gotten a lot of consideration because of their capacity to give higher unearthly productivity than routine single-information single-yield systems [6][7][8][9]. When applying these procedures in a recurrence particular channel, a space-time equalizer is needed at the beneficiary to make up for the impedance [10].

This multipath spread reasons discretionary time

*Author for correspondence

scattering, constriction, and stage movement, known as blurring, in the got signal [11][12]. Blurring is brought about by obstruction between two or more forms of the transmitted sign which touched base at the collector at somewhat distinctive times [13]. DS-CDMA procedure has the upsides of expanding the channel limit alongside the resistance against sticking [14][15][16]. In multi-client CDMA frameworks, multiple access interface (MAI) is viewed as one of the principle wellsprings of execution corruption. Versatile separating methods have been effectively used to level the channel and in this manner diminish the MAI in the DS-CDMA framework [17][18].

2. Related Work

In 2011, Dubey et al. [19] proposed a Modernize SLM (MSLM) plan to diminish the PAPR by utilizing the mind boggling sign separate into genuine & fanciful parts and separately stage succession numerous genuine and nonexistent piece of complex flag then select least PAPR sign of genuine & fanciful and these are consolidate. The reproduction show accomplishes great PAPR, which is an in number contender for Future remote correspondence. In 2011, George A. Ropokis et al. [20] present a diagnostic bit slip rate (BER) execution investigation of three recognize and-forward (DaF) arrangements under a typical system. All the more particularly, the immediate, limit and connection versatile plans are concentrated on, which contrast in the way the choice on the transmitted image is sent from the hand-off to the destination. The investigation is completed for a solitary hand-off DaF transmission convention and considers the image choice mistakes that may happen at the transfer. Straightforward shut structure diagnostic BER expressions are inferred for every one of the three plans, which are totally confirmed by recreations. In 2012, Mohamed Samir et al. [21] proposes an improvement to the execution of a Direct Sequence Code Division Multiple Access (DS-CDMA) framework by using a versatile channel in the vicinity of distinctive sticking methods. To battle the effect of such sticking, the versatile channel uses three versatile calculations which are the Variable Step-Size Affine Projection (VSS-APA) calculation, the Generalized Normalized Gradient Descent (GNGD) calculation, and the Generalized Square-Error-Regularized (GSER) NLMS calculation. As per the creators these calculations have the benefits of quick meeting, low consistent state mean squared mistake and the capacity to enhance the bit mistake rate (BER) execution of the customary CDMA framework, in the vicinity of multi-way, numerous entrance, and distinctive sticking signs. Results demonstrate that the VSS-APA outflanks different calculations in the vicinity of flood sticking. While in the vicinity of halfway band sticking the GSER-NLMS versatile channel gives the best execution. In 2014, Le et al. [22] demonstrate an accurate bit error rate estimation method for QPSK CO-OFDM transmission based on the probability density function of the received QPSK symbols. Authors had been compared some known approaches, including data-aided and non-data aided error vector magnitude, they show that the proposed method offers the most accurate estimate of the system performance for both single channel and wavelength division multiplexing QPSK CO-OFDM transmission systems. In 2014, Zahed et al. [23] presented an analytical approach to determine the impact of frequency offset, timing jitter and additive white Gaussian noise (AWGN) on the bit error rate (BER) performance of a multi-carrier direct-sequence code division multiple access (MC-DS-CDMA) system over a Rayleigh Fading Channel. The analysis developed the pdf (probability density function) at the receiver considering combined influence of fading, timing jitter and Doppler frequency offset etc with maximal ratio combining (MRC) scheme. The expression for the conditional BER conditioned on a given timing error and fading is derived and the average BER is evaluated in the presence of Multiple Access Interference (MAI) and Inter-Carrier Interference (ICI). The performance results are evaluated numerically in terms of SINR and BER considering system parameters like number of users, number of sub-carriers. The result shows significant deterioration in SINR and BER performance due to fading along with the changes in parameters. In 2015, Kumar et al. [24] proposed a wavelet based SCFDMA for analysing Bit Error Rate (BER) performance. Analysis is carried out using different wavelets and different modulation schemes under AWGN channel. This analysis will show that the reduction in BER takes place by using wavelet transform in SCFDMA. Thus wavelet based SCFDMA provides better BER performance than that of DFT based SCFDMA. In 2015, Qin et al.,[25] discussed bit error rate (BER)which minimization problems in multiple amplify-and-forward (AF) relay-assisted orthogonal frequency-division multiplexing (OFDM) system over frequency-selective fading channels with total power and

individual power constraints, respectively. A joint optimization method of power loading, relay selection and subcarrier pairing is solicited to solve the problems with respect to the above two power constraint conditions by the authors. Particularly, they transform subcarrier pairing into a linear assignment problem and apply Jonker-Volgenant (JV) algorithm to deal with it. A simulation result demonstrates superior performances of our algorithm to those of other schemes for different relay locations.

3. Problem formulation

The bit error rate or bit error ratio (BER) is the quantity of bit blunders separated by the aggregate number of exchanged bits amid a considered time interim. BER is a unit less execution measure, frequently communicated as a rate. The bit mistake likelihood pe is the desire estimation of the BER. The BER can be considered as a rough gauge of the bit lapse likelihood. This appraisal is exact for quite a while interim and a high number of bit mistakes. Measuring the bit mistake rate helps individuals pick the proper forward blunder adjustment codes. Since most such codes just bit-flips, however not bit insertions or bit discovery, the hamming separation metric is the suitable approach to quantify the quantity of bit lapses.

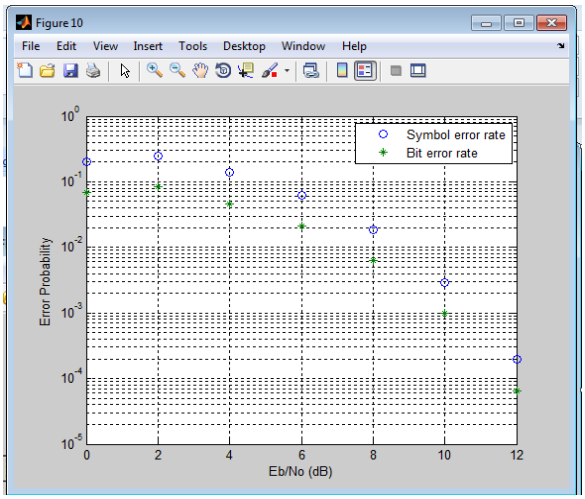

Figure 1: Error Probability

The BER may be enhanced by picking the error sign quality by picking a moderate and strong tweak plan or line coding plan, and by applying channel coding plans, for example, repetitive forward lapse redress codes. As the name infers, a bit mistake rate is characterized as the rate at which lapses happen in a transmission framework. This can be straightforwardly deciphered into the quantity of lapses that happen in a string of an expressed number of bits. The meaning of bit slip rate can be interpreted into a straightforward equation:

BER = number of errors / total number of bits sent

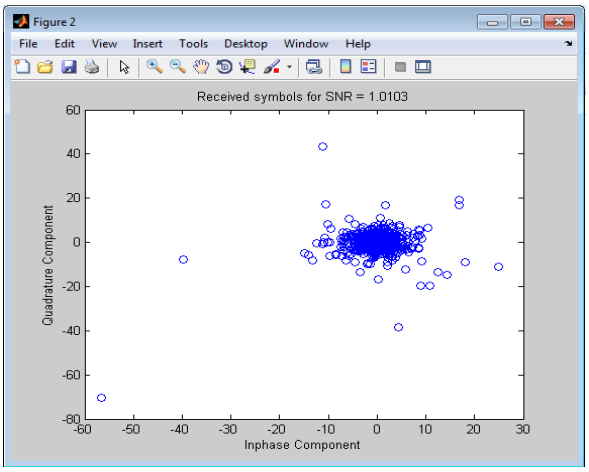

Figure 2: BER for 1.0103 SNR

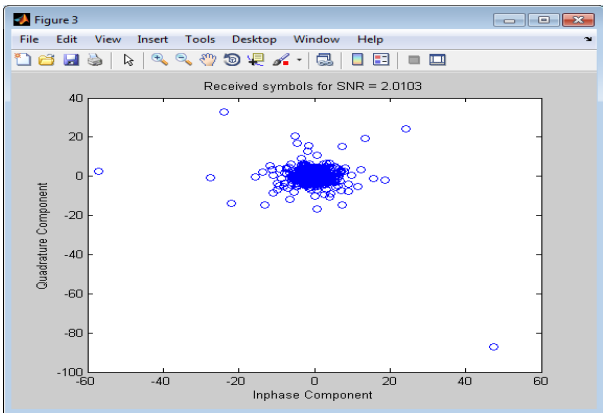

Figure 3: BER for 2.0103 SNR

Figure 1, 2 and 3 shows the different effects of SNR to form the standard BER rates.

Authors in [25] have been considered the following parameters which is shown table 1.

Table 1: Simulation Parameter [25]

Parameter	
Channel Model	Rayleigh/ AWGN
Channel Bandwidth	4M
R V parameters	[0 I 2 3]
HARQ combining	Incremental redundancy
Frame structure	TDD
modulation	16QAM
Diversity scheme	2 or 4 Tx ,lor 2 Rx antennas
separation distance	4 λ
antennas Transmitting Power	equality

The achieved results by the STBC has better in transformation than the uncoded ones.

Authors in [26] have been considered the following parameters which is shown table 2.

Table 2: Simulation Parameter [26]

Parameter	
Simulation Parameters	Range/Value
Modulation schemes	256QAM,64-PSK
FFT Size	64
SNR(dB)	O to 70
Channels	Rayleigh fading channel
Receiver detection schemes	MMSE and ZF

In [26] the observation received is that the simulation result for 2x5 antenna configuration of MMSE detection schemes achieves BER of 10^{-3} at less SNR value of 32 dB than that of 2x3 antenna configuration which achieves the same BER value at SN R of 36 dB. The improvement in the BER performance of2x5 antenna configuration is due to the increase in the number of receiver antennas and high level modulation schemes. In [25] they also observed that the simulation results for 2x5 antenna configuration of ZF detection schemes out performs 2x3 antenna configuration by achieving BER of 10^{-2} at SNR value 32dB. The high order (2x5) antenna configuration improves the BER performance of MIMO-OFDM using ZF detection scheme. Authors in [27] have been considered the following parameters which is shown table 3.

Table 3: Simulation Parameter [27]

Parameter	
Simulation parameters	Type/Values
Number of sub carriers (N)	64,128, 256,512,1024
Number of sub blocks (V)	2,4,8,1 6
Overs amp ling factor (L)	4
Ro1 1-0 ff factor (a)	0. 6
Subblock partitioning scheme	Interleaving
Number of antennas	2
Modulation scheme	QPSK
Phase weighting factor (b)	1,-1,j,-j

The MIMO with Rayleigh and AWGN channel has three diverse performance advantages, like Beam forming technology, Spatial Diversity based on space-time coding and spatial multiplexing. Space-time coding can be used to achieve high diversity gains also. So the symbol error probability is reduced and channel fading can be retraced. It can likewise build the repetition of sign by joint-coding, and addition spatial differing qualities of sign in the recipient. We can exploit the extra differences addition to enhance the unwavering quality of correspondence connections. Also, we can enhance information exchange rate and unearthly productivity by utilizing higher request tweak under the same unwavering quality of connections. There is additionally a need of BER conveyance with diverse correlation point and perform the examination with the SNR. High rate STBC frameworks have pulled in a considerable measure of enthusiasm since they are obliged to construct high throughput remote correspondence frameworks. The methods concentrated on in this work can be connected to future research around there.

4. Conclusions

Based on the above analysis we can suggest that AWGN and Rayleigh channel with STBC can be efficient in reducing BER rates. It is more efficient in the case of correlated conjunction of the transmitter and the receiver signal. It can be better with white timing jitter and inverse fast Fourier transform also. The transmission variance will be effective if it is correlated with different parameters.

References

[1] F.B. Frederiksen and R.prasad, "An overview of OFDM and related techniques towards development of future wireless multimedia communications," in proc. IEEE National conference on Radio and Wireless Communication conf.pp.19-22, Aug.2002.

[2] Bingham, John AC. "Multicarrier modulation for data transmission: An idea whose time has come." Communications Magazine, IEEE 28, no. 5 (1990): 5-14.
[3] Zhengdao Wang,"OFDM or single carrier block transmission," IEEE Trans.on Comm., vol.12, no.3, pp.380-394, Mar 2004.
[4] Shruti Trivedi, Mohd. Sarwar Raeen, Shalendra Singh pawar, " BER Analysis of MIMO-OFDM System using BPSK Modulation Scheme " , International Journal of Advanced Computer Research (IJACR), Volume-2, Issue-5, September-2012 ,pp.219-226.
[5] Xia, Pengfei, and Georgios B. Giannakis. "Design and analysis of transmit-beamforming based on limited-rate feedback." Signal Processing, IEEE Transactions on 54, no. 5 (2006): 1853-1863.
[6] Saswati Paramita, Sruti Suvadarsini Singh, Jyotiprava Mohanta, " Time and Frequency Synchronization in OFDM System " , International Journal of Advanced Computer Research (IJACR), Volume-4, Issue-16, September-2014 ,pp.856-865.
[7] Vikas Gupta, Ruby Tiwari, "Performance Analysis and Simulation Result of MC-CDMA for AWGN Channel and Rayleigh Based on SNR/BER", International Journal of Advanced Computer Research (IJACR), Volume-1, Issue-1, September-2011 ,pp.13-17.
[8] Manisha Rathore, Puspraj Tanwar, "Reduction of Co-Channel Interference in transmit/Receive diversity (TRD) in MIMO System", International Journal of Advanced Computer Research (IJACR), Volume-2, Issue-5, September-2012, pp.13-17.
[9] Pragya Gupta , Uday Pratap Singh, Vineet Richhariya, " Analysis and comparison of the 4-PSK and 8-PSK STTC over Rayleigh fading Channels for determining Performance", International Journal of Advanced Computer Research (IJACR), Volume-2, Issue-5, September-2012 ,pp.142-149.
[10] Zhou, Shengli, Zhengdao Wang, and Georgios B. Giannakis. "Quantifying the power loss when transmit beamforming relies on finite-rate feedback." Wireless Communications, IEEE Transactions on 4, no. 4 (2005): 1948-1957.
[11] Tarokh, Vahid, Nambi Seshadri, and A. Robert Calderbank. "Space-time codes for high data rate wireless communication: Performance criterion and code construction." Information Theory, IEEE Transactions on 44, no. 2 (1998): 744-765.
[12] G. J. Foschini, "Layered space-time architecture for wireless communications in a fading environment", Bell Labs Tech. J., vol. 1,no. 2.pp.41-59, 1996.
[13] K. Anitha, Umesharaddy, B.K.Sujatha, " FPGA Implementation of High Throughput Digital QPSK Modulator using Verilog HDL " , International Journal of Advanced Computer Research (IJACR), Volume-4, Issue-14, March-2014 ,pp.217-222.
[14] G. J.Foschini and M.J.Gans,"On the limit of wireless communications in a fading environment when using multiple antennas," Wireless Personal Commun. vol.6, no. 3, pp. 311-335, 1998.
[15] E.Telatar,"Capacity of multi-antenna Gaussian channels, "European Trans. Telecomm., vol. 10, no.6, pp.585-595, 1999.
[16] Jitendra Kumar Daksh, Ravi Mohan, Sumit Sharma, " Performance Analysis with Space-time coding in MIMO-OFDM Systems with Multiple Antennas " , International Journal of Advanced Computer Research (IJACR), Volume-3, Issue-10, June-2013 ,pp.126-129.
[17] Rishi Choubey, Ravi Mohan, Sumit Sharma, "A survey of BER Performance of Generalized MC DS-CDMA System", International Journal of Advanced Computer Research (IJACR), Volume-3, Issue-10, June-2013, pp.130-133.
[18] Jitendra Kumar Daksh, Ravi Mohan, Sumit Sharma, " A survey of Performance Analysis in MIMO-OFDM Systems " , International Journal of Advanced Computer Research (IJACR), Volume-3, Issue-10, June-2013 ,pp.91-94.
[19] Ashutosh K. Dubey, Yogeshver Khandagre, Ganesh Raj Kushwaha,Khushboo Hemnani, Ruby Tiwari, and Nishant Shrivastava," PAPR Reduction in OFDM by Using Modernize SLM Technique", WiMo/CoNeCo, CCIS 2011.
[20] George A. Ropokis, Athanasios A. Rontogiannis, and Kostas Berberidis, "BER Performance Analysis of Cooperative DaF Relay Networks and a New Optimal DaF Strategy", IEEE Transactions on Wireless Communications, VOL. 10, NO. 4, April 2011.
[21] Mohamed Samir, Ehab M. Shaheen and Ahmed Abd El Wahab," Performance Analysis of DS-CDMA System Using Fast Adaptive Filtering Under Different Jamming Techniques", IEEE 2012.
[22] Le, Son Thai, et al. "Bit Error Rate Estimation Methods for QPSK CO-OFDM Transmission." Journal of Lightwave Technology 32.17 (2014): 2951-2959.
[23] Zahed, Md, Ishtiaque Aziz, and S. P. Majumder. "Performance analysis of MC-DS-CDMA in the presence of carrier frequency offset and timing jitter over Rayleigh Fading Channels." Computer and Information Technology (ICCIT), 2013 16th International Conference on. IEEE, 2014.
[24] Kumar, Naresh. "BER analysis in Wavelet based SC-FDMA for LTE uplink transmission."

Advanced Computing & Communication Technologies (ACCT), 2015 Fifth International Conference on. IEEE, 2015.

[25] Zhang Jie, L1u Liang, Li Jin," Performance Analysis of Space Time Block Code in MIMO-OFDM Systems", IEEE 2011.

[26] Samundiswary and Selvia Kuriakose," BER Analysis ofMIMO-OFDM Using V-BLAST System for different Modulation Schemes", ICCCNT 2012.

[27] P. Mukunthan and P Dananjayan, "P APR Reduction based on a Modified PTS with Interleaving and Pulse Shaping method for STBC MIMO-OFDM System", ICCCNT 2012.

Ms. Shraddha Rawat hails from Bhopal and was born on 27-July-1988. She did her schooling from Bhopal Public Higher Secondary School, Bhopal and completed her graduation in stream of Electronics and Communication Engineering from RKDF Institute of Science and Technology, Bhopal with 71.8%. She is pursuing M.Tech in Electronics and Communication Engineering from RKDF Institute of Science and Technology, Bhopal ,under Rajiv Gandhi Proudhyogiki Vishwavidhyalaya , Bhopal, Madhya Pradesh.