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Performance Analysis Result and Simulation Result of MC-CDMA Using BPSK Modulation

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***Abstract* - In electronics and communication system MC-CDMA(Multi Carrier Code Division Multiple Access) is very attractive choice for high speed wireless communication with bandwidth utilization and BER(bit error rate) performance.MC-CDMA is used in wireless communication to avoid the problem of ISI(intersymbol interference) and also exploit frequency diversity.MC-CDMA system is used to support multiple users with high speed data communications. This paper presents analysis of MC-CDMA system over the AWGN (Additive White Gaussian Noise) and Raleigh channel for different number of subcarrier and different number of users. This system MC-CDMA analysis is performed by simulating the MC-CDMA using MATLAB (Mathworks) program and this paper also presents a comparison between practical and theoretical results.**

***Keywords* - AWGN, BER, ISI, MC-CDMA, Rayleigh Fading Channel, SNR**

I. INTRODUCTION

MC-CDMA (Multicarrier Code Division Multiple Access) is used in electronic and communication system to improve the performance over multipath links. It is a modulation method that use multicarrier transmission.MC-CDMA formed by combining orthogonal frequency division multiplexing (OFDM) with code division multiple accesses.MC-CDMA is the combined form of CDMA and OFDMA. It gives the combine benefit of CDMA with natural robustness to frequency selective offered by OFDM. Implementation of MC modulation technique is known as multicarrier CDMA. Thus MC-CDMA is well suited for high data rates applications in frequency selective fading channels and after that a multiplexing technique used where number of users is simultaneously available to access a channel.

In this paper we gives the performance analysis result of MC-CDMA over the AWGN and Rayleigh Fading Channel and by analyzing BER w.r.t. signal to noise ratio(SNR),we shown that MC-CDMA performance is better than CDMA because its bit error rate is less than CDMA over Rayleigh Fading Channel.MC-CDMA is one representative of the MC technique. It has emerged as another feasible option for forward looking MC communications systems by exploiting the flexibility and potential offered by the combination of OFDM and CDMA[4]. With a surging increase in demand for personal wireless radio communications within the past decade, there is a growing need for technological innovations to satisfy these demands. Future technology must be able to allow users to efficiently share common resources, whether it involves the frequency spectrum, computing facilities, databases, or storage facilities[l].The multicarrier(MC) technique has grown an important alternative for wireless indoor communications

II. MC-CDMA SYSTEM

Multi Carrier code division multiple access (MC-CDMA) is a multiple access scheme used in OFDM based telecommunications system, allowing the system to support multiple users at the same time.MC-CDMA spreads each user symbol in the frequency domain[5]. That is, each user symbol is carried over multiple parallel subcarriers, but it is phase shifted (typically 0 or 180 degrees) according to a code value. The code values differ per subcarrier and per user. The receiver combines all subcarrier signals, by weighing these to compensate varying signal strengths and undo the code shift. The receiver can separate signals of different users, because these have different (e.g. orthogonal) code values.Since each data symbol occupies a much wider bandwidth (in hertz) than the data rate (in bit/s), a signal-to-noise-plus-interference ratio (if defined as signal power divided by total noise plus interference power in the entire transmission band) of less than 0 dB is feasible. There are many ways to describe the MC-CDMA, but generally it is described as DS-CDMA again modulated by an OFDM carrier, the number of sub-carriers depends upon the length of spreading code used with DS-CDMA[6]. One major difference between MC-CDMA and OFDM is the subcarriers in MC-CDMA at any instant transmits the one symbol but in OFDM each sub carrier transmit separate symbol, the efficiency of MC-CDMA is hidden in orthogonal sub carrier by which the overlapping spectrum of successive subcarriers can be separated other advantage comes from a wideband coverage of carriers and slower transmission time or larger transmission duration for each bit.MC-CDMA technique has some unique advantages over its root techniques (OFDM, DS-CDMA) Compared to Direct Sequence (DS) CDMA.

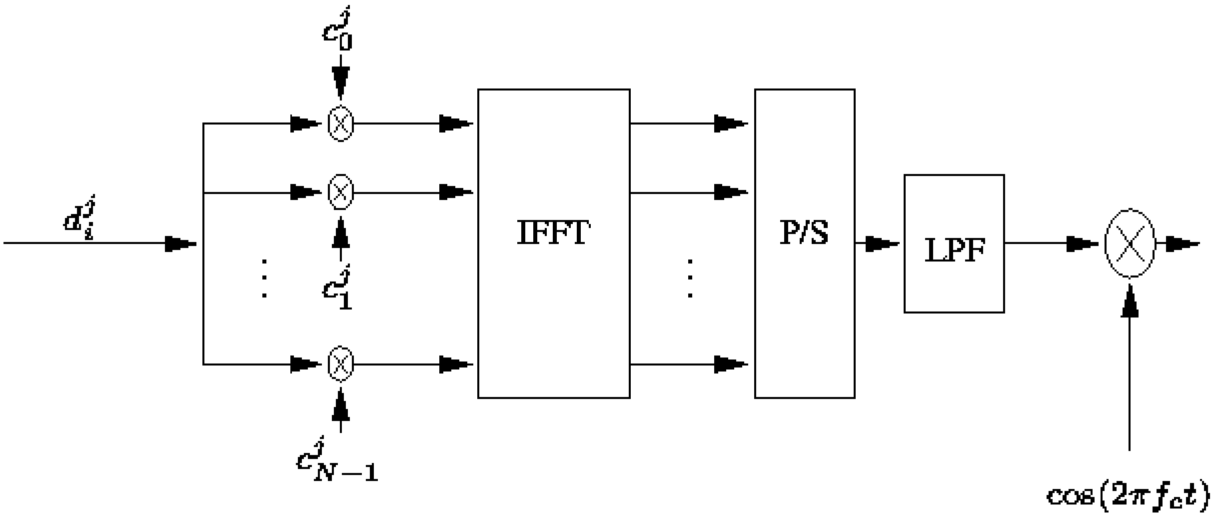

Figure 1

III. PROBLEM STATEMENT AND MAIN CONTRIBUTION

CDMA particularly in the downlink suffers from the frequency selective fading.There is the question arise that weather the implementation of the MC-CDMA can help to achivehigher data rate performance than CDMA over Rayleigh Fading Channel.In this paper we want to present the performance of MC-CDMAin AWGN channel and Rayleigh channel using BPSK modulation technique.We want to show through graph of performance of MC-CDMA using MATLAB programming.The main contribution of this paper is to compare the performance of CDMA and MC-CDMA by considering a bit error rate. After that we proceed with a simulation in MATLAB to verify that MC-CDMA perform better than CDMA in Rayleigh Fading Channel.

Problem Solution

In conventional CDMA, only one carrier signal is modulated and thus if the signal undergoes any multipath fading, then the total signal may be distorted. Multiple carrier modulation technique like MC-CDMA allows the receiver to receive information correctly even when some of subcarriers are affected by multipath fading [2]. In Figure 1, which is the block diagram of MC CDMA, each serial data symbol aj (i) of user j is converted to parallel data stream and then spread over frequency domain with an user defined spreading code gm where each spread is associated with a subcarrier and transformed into time domain by performing Inverse Fast Fourier Transform (IFFT).

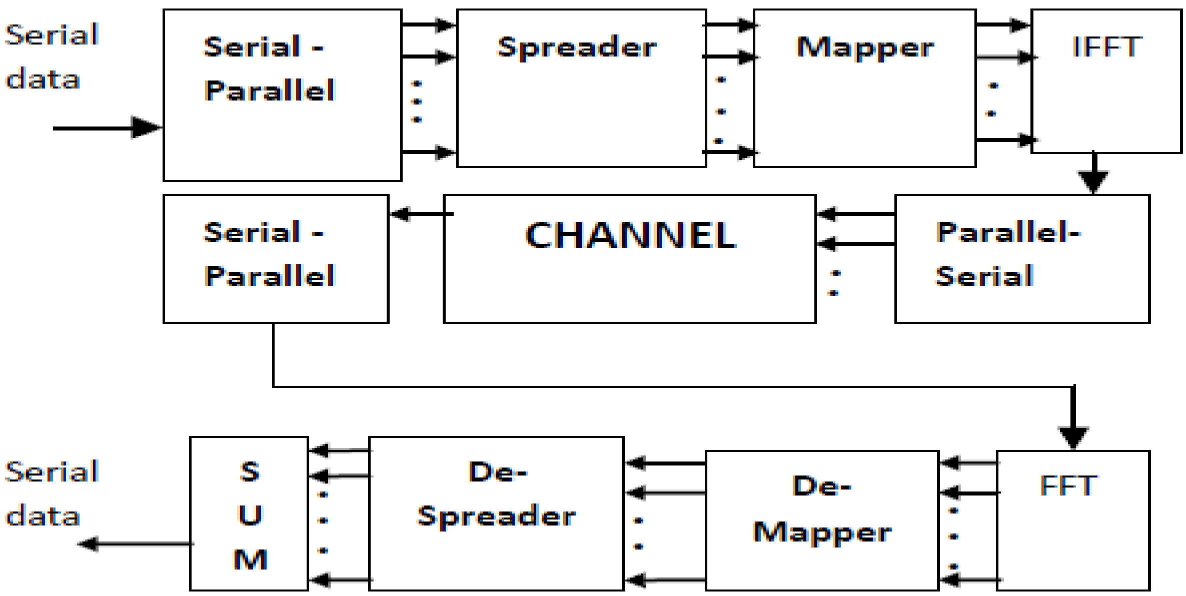

Figure 2 General MC-CDMA system block

Finally, the signal is converted back to serial and modulated to send through the communication channel which is mathematically defined in (1). At the receiver, data are converted to parallel streams and each block with spread signals is decomposed by Fast

Fourier Transform (FFT) into subcarriers and transformed into frequency domain for despreading to recover original data The transmitted signal for j^{th} user is written as

$$s_{MC}^{j}(t) = \sum_{i=-\infty}^{\infty} \sum_{m=1}^{G_{MC}} a^{j}(i) g_{m}^{j} . \cos\{2\pi(f_0 + m\Delta f)t\} \ldots\ldots (1)$$

Where $\Delta f = 1/T_s$ is the subcarrier. g_m is the spreading code at m subcarrier and $a^j(i)$ is the original data stream at time i[3].

The equation models the MC-CDMA transmitter for Coherent Binary Phase Shift Keying (CBPSK). Dividing a single carrier signal to multiple subcarrier signals means that data are actually divided in to several parallel data streams or channels, one for each subcarrier. Each subcarrier signal is then modulated with low symbol rate such that the total data rate of these subcarrier signals will be equal to conventional single carrier data rate. The main idea behind this technique is that a signal with long symbol duration time is less effected by multipath fading as compare to signal with short symbol duration, like in CDMA [2].

IV. SIMULATION RESULT

Bit error rate is defined of a communication system as the ratio of number of error bits and total number of bits transmitted during a specific period. It is the like hood that a single error bit occur within received bits, independent of rate of transmission[7].There are many ways to reducing BER.At first we considered most commonly channel that is AWGN(Additive White Gaussian Noise) channel. In this using MATLAB for computing the bit error rate with BPSK modulation from theory and simulation.

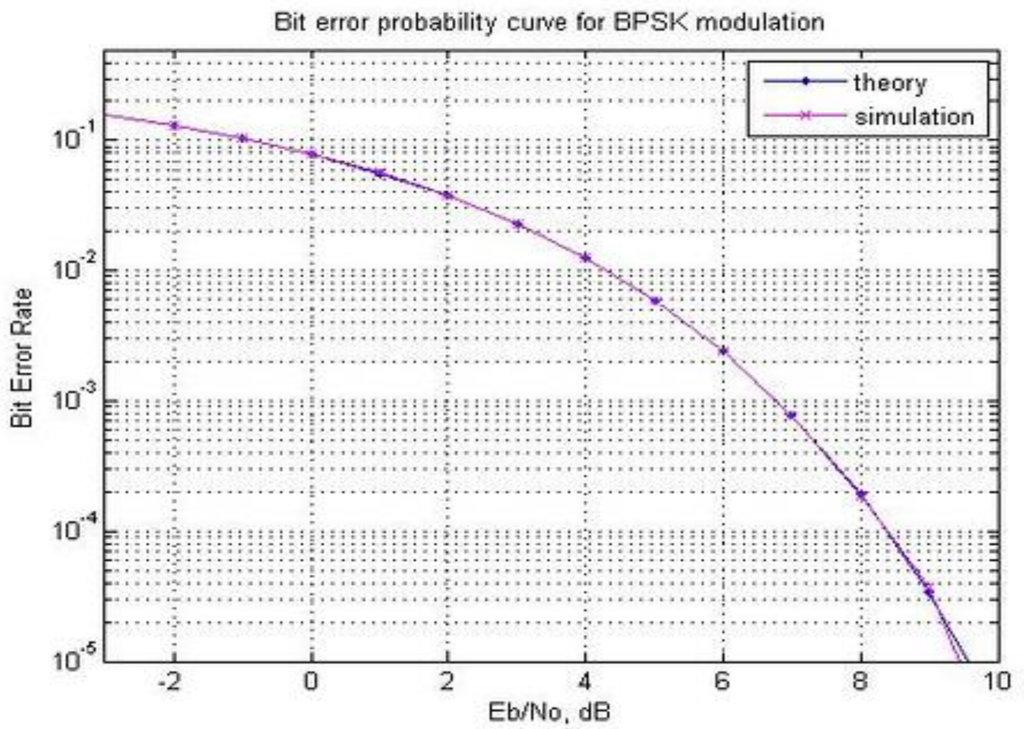

Figure 3 BER curve for BPSK on AWGN Channel

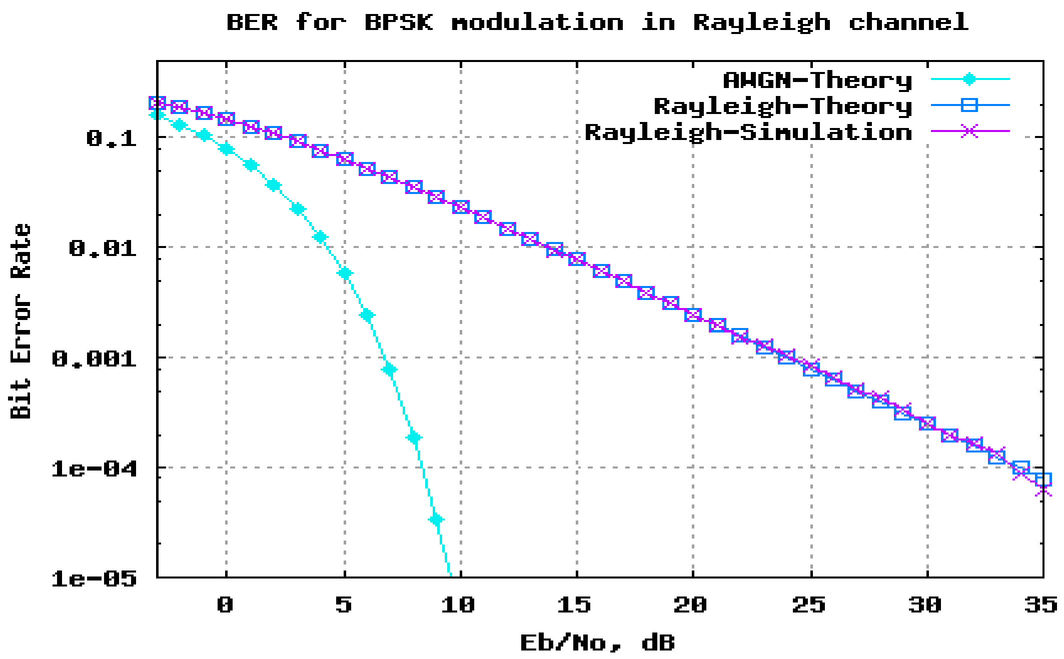

Figure 4 BER curve on Rayleigh Channel

V. CONCLUSION

In this paper we analyze that MC-CDMA and CDMA technologies and simulated its BER performance over Rayleigh Fading Channel in MATLAB and want to try the performance of MC-CDMA in AWGN channel and Rayleigh channel using BPSK modulation technique.As we shown in the graph that as Eb/No increases the BER decreases.

REFERENCES

[1] Simulation Based Performance Analysis Of MCCDMA And CDMA Over Rayleigh Fading Channel, Mohammedfaisal, Jiauddin,Iqbalhasanhaider,(IJIDCS) International Journal On Internet And Distributed Computing Systems. Vol: 2 No: 1, 2012.

[2] A. M. Tulino, L. Li and S. Verdu, "Spectral efficiency of multicarrier CDMA," *IEEE Transactions on Information Theory*, vol. 51, pp. 479- 505, Feb. 2005.

[3] Y. Kim, and I. Song, “Multicarrier CDMA System with Adaptive Subchannel Allocation for Forward Links,” *IEEE Transactions on Vehicular Technology*, vol. 48, pp. 1428-1436, Sep 1999.

[4] Performance Analysis AndSimulation Result Of MC-CDMA For AWGN Channel And Raleigh Based OnSNR/BER,Mr.Vikasgupta, Ms.Ruby Tiwari.

[5] PERFORMANCE ANALYSIS OF MCCDMA SYSTEM IN RAYLEIGH CHANNEL AND AWGN CHANNELUSING BPSK MODULATION TECHNIQUE, Mr.V.Satish, Mr.K.Suresh, Ms.B.Swati, International Journal Of Engineering Research And Applications (IJERA) ISSN: 2248-9622 Www.Ijera.Com Vol. 1, Issue 4, Pp. 2025-2029

[6] An Overview of Multi-Carrier CDMA”, Prasad, Ramjee et al., IEEE 1996, pp. 107-114.

[7] Performance Of Adaptive MC-CDMA Detectors Inrapidly Fading Rayleigh Channels, Dimitris N. Kalofonos, *Member*, *IEEE*, Milicastojanovic, *Member*, *IEEE*, And John G. Proakis, *Life Fellow*, *IEEE*,IEEETRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 2, NO. 2, MARCH 2003.

[8] BER ENHANCEMENT OF MIMO-CDMA BASED ON SPACE-TIME BLOCK CODES P. Sreesudha, M. Vijayalakshmi, Dept. Of ECE, GNITS, Hyderabad, India.

[9] Evaluation Of CDMA System Performance In Wireless Telecommunication ,Md. Younus Ali, M. M. Ashiqurrahman, S.M. Shamsulalam, *And* Rajiv Kumar Mistry, IJCIT, ISSN 2078-5828 (PRINT), ISSN 2218-5224 (ONLINE), VOLUME 02, ISSUE 02, MANUSCRIPT CODE: 1200107

[10] Pallavi, P.; Dutta, P.; "Multicarrier CDMA Overview with BPSK Modulation In Rayleigh Channel," *IEEE Transactions on* , vol., no.,pp.464-469,July 2010.