Performance of BER in MIMO-OFDM System

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Abstract — **The Multiple Input Multiple Output (MIMO) multiplies capacity by transmitting different signals over multiple antennas and Orthogonal Frequency Division Multiplexing (OFDM), which divides a radio channel into a large number of closely spaced sub channels to provide more reliable communication at high speeds. An arrangement of using MIMO-OFDM system gives the solution for achieving efficient, high-quality service and high speed in the wireless communication system. This paper analyzing the BER performance of the MIMO OFDM and OFDM system for AWGN (Additive White Gaussian Noise) Channel using different number of subcarrier values. In this paper, simulation result presents the BER characteristic of the MIMO-OFDM system.**

Index Terms—**AWGN, BER, MIMO, OFDM**

I. INTRODUCTION

Orthogonal frequency division multiplexing (OFDM) is modulation and multiplexing technology, developed to meet the increasing demand for higher data rates in communication[1]. OFDM provides immunity to the frequency selective fading channels multipath, high spectral efficiency, and high power efficiency.Multi-carriers (MC) modulation is the key concept of OFDM technique. OFDM System used in Digital Audio Broadcasting (DAB), Digital Video Broadcasting (DVB), Digital subscriber Lines (DSL), and Wireless Local Area networks (WLANs), Wireless Metropolitan Area Networks (WMANs).An arrangement of combining OFDM with MIMO technology achieves high data rate and robust transmission. Therefore, MIMO-OFDM System takes advantage of multipath interference effect to increase user and data capacity. Multiple antennas at transmitter and receiver (MIMO) allow achieving high spectral efficiency high-quality service and high speed in the wireless communication system. MIMO-OFDM is the foundation for most advanced wireless local area network and mobile broadband network standards because it achieves the greatest spectral efficiency and, therefore, delivers the highest capacity and data throughput for broadband wireless systems a very promising approach is to combine the MIMO concept with multicarrier modulation techniques such as orthogonal frequency division multiplexing (OFDM) Multipath fading environment, performances of OFDM system in a wireless channel are severely degraded by random variations in the amplitude of the received signals as well as by the presence of inter-symbol interference(ISI) and inter-carrier-interference (ICI) which degrades the error probability (BER) for single-antenna OFDM systems.Which also limit the MIMO OFDM system performance.

In this paper, we analyse the performance of bit error rate (BER) of MIMO-OFDM system by using different subcarrier (N = 128,256) and simulation result shows the BER performance MIMO OFDM and OFDM system.

II. OFDM SYSTEM

In digital communications, information is expressed in the form of bits. The term symbol refers to a collection, in various sizes, of bits . OFDM data are generated by taking symbols in the spectral space using BPSK, QAM, etc, and convert the spectra to time domain by taking the Inverse Fast Fourier Transform (IFFT) in Transmitter and reverse process is done at receiver.

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Fig. 1 shows the block diagram of a OFDM system. In this, baseband modulated symbols are passed through serial-to-parallel (S/P) converter which generates N size of complex vector *X*. *X* is then passed through the IFFT block, which convert X into OFDM time signal per block of symbols. OFDM time domain signals are then passes through the P/S converter and the serially data are transmitted through channel. Channel adds the effect of noise that can be eliminated. After passes through channel the received signal are splits data into parallel form and FFT converts time domain signal into frequency domain and then converts signal into parallel form and recovered original data.

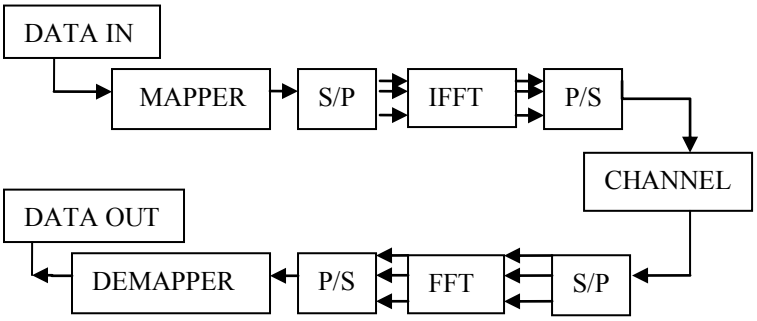

Figure 1 :- Block diagram of OFDM system.

III.BER

In digital transmission, the number of bit errors is the number of received bits of a data stream over a communication channel that has been altered due to bit synchronization errors, noise, interference and distortion. The bit error rate or bit error ratio (BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval [2] . BER is often expressed as a function of the normalized carrier-to-noise ratio measured denoted Eb/N0 that is energy permit to noise power spectral density ratio, or Es/N0 that is energy per modulation symbol to noise spectral density. As the name implies, a bit error rate is defined as the rate at which errors occur in a transmission system.bit error rate can be define as:

BER = number of errors / total number of bits sent

If the signal to noise ratio is high and medium between the transmitter and receiver is good then the bit error rate will be very small-possibly insignificant and having no noticeable effect on the overall system However if noise can be detected, then there is chance that the bit error rate will need to be considered.

IV. Proposed Model

1) MIMO OFDM SYSTEM

MIMO communication uses multiple antennas at both the transmitter and receiver to exploit the spatial domain for spatial multiplexing and/or spatial diversity. Spatial multiplexing has been generally used to increase the capacity of a MIMO link by transmitting independent data streams in the same time slot and frequency band simultaneously from each transmit antenna and differentiating multiple data streams at the receiver using channel information about each propagation path[3].

A multicarrier system implemented using an inverse FFT (IFFT) to act as a modulator and an FFT to act as a demodulator. The transmitted data are the frequency domain coefficients and at the output of IFFT stage, we get time domain samples of MIMO OFDM signals. The time domain samples are passes through the channel and then the reverse process is done at receiver of MIMO OFDM System shown in figure 2.In a communication system, the receiver side BER may be affected by bit synchronization problem, attenuation, transmission channel noise, distortion, wireless multipath fading, interference, etc. Here, we use fixed ratio of SNR and analysis the BER value[7].

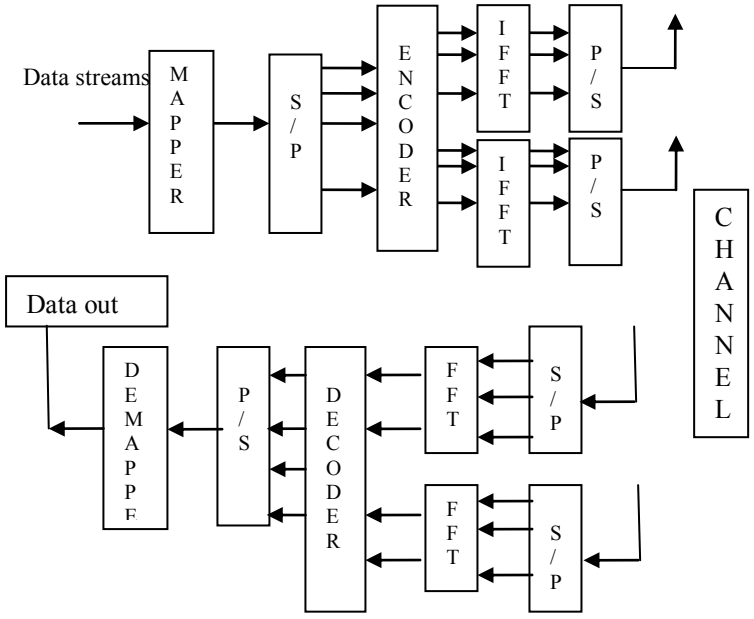

Figure 2:- Block diagram of 2X2 MIMO-OFDM System

V.SIMULATION RESULT

Simulation results are presented to evaluate the performance of BER of MIMO-OFDM system with more than one antenna at the receiver. To see effect of

number of subcarriers on BER performance, OFDM system and MIMO OFDM system model have been run for different number of subcarriers shown in figures below.

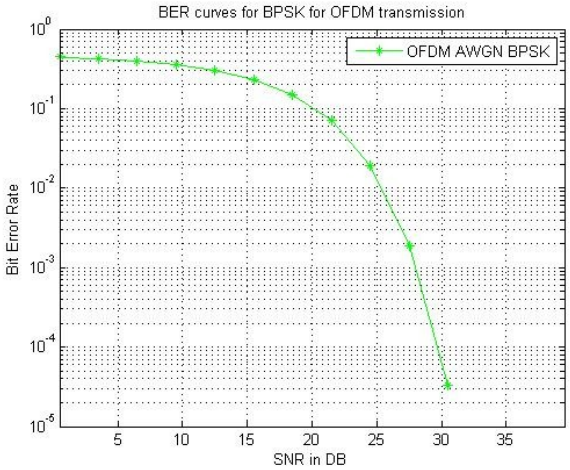

Figure 3 – Performance of BER in OFDM System for N = 128

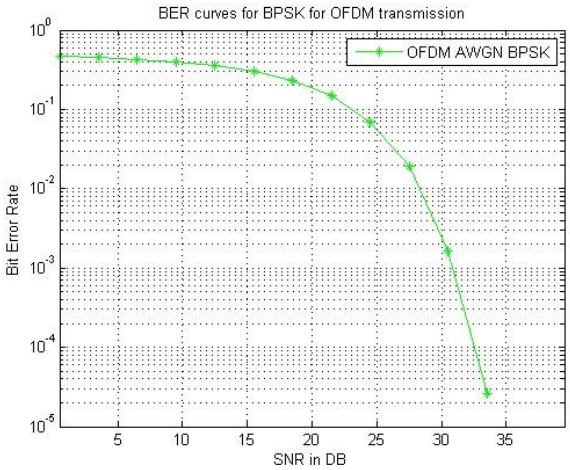

Figure 4 – Performance of BER in OFDM System for N = 256

Plot	Number of subcarriers(N)	BER of OFDM System
Plot-1	128	30
Plot-2	256	34

Table.1 Performance of BER in OFDM System

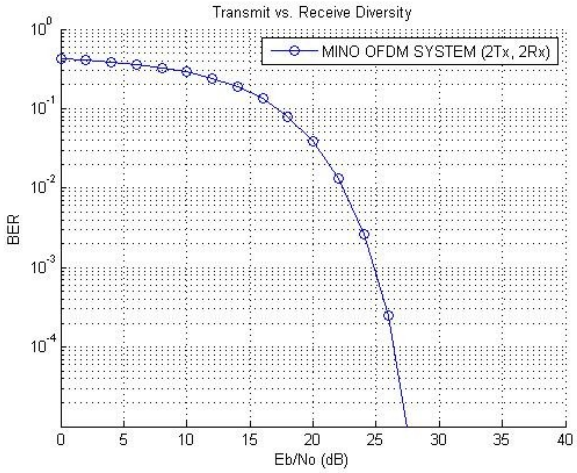

Figure 5 – Performance of BER in MIMO-OFDM System for N = 128

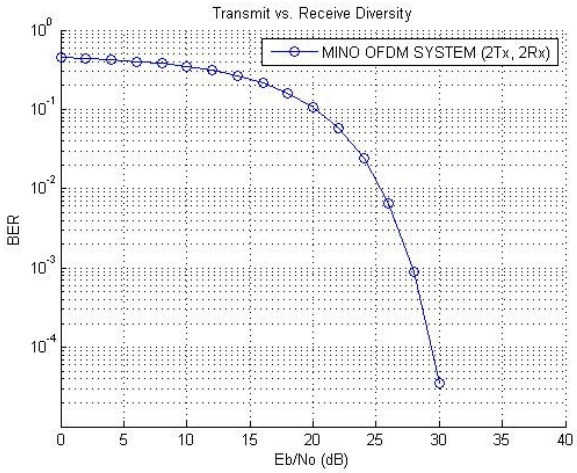

Figure 6 – Performance of BER in MIMO-OFDM System for N = 256

Plot	Number of subcarriers(N)	BER of MIMO OFDM SYSTEM
Plot-1	128	27
Plot-2	256	30

Table.1 Performance of BER in MIMO-OFDM System

VI CONCLUSON

In this paper, we presents BER performance of MIMO-OFDM System and analyse that the Multiple input Multiple output is a very attractive technique for Multicarrier transmission and become one of the standard choices for high speed data transmission over a communication channel. It has various advantages, but also has one major drawback i.e. Effect of noise within frequency selective fading channel.

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