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SIMULATION OF MIMO/SIMO SYSTEM WITH QPSK AND 8-QAM MODULATION OVER AWGN CHANNEL IN WIMAX 802.16E MODEL

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ABSTRACT

WiMAX is introduced by the Institute of Electrical and Electronic Engineers (IEEE) which is standard designated 802.16d-2004 (used in fixed wireless applications) and 802.16e-2005 (mobile wireless) to provide a worldwide interoperability for microwave access and it is a technology for point-to-multipoint wireless networking. In this paper work we are simulate WiMAX 802.16e model using QPSK and 8-QAM modulation techniques with combination of antenna system like MIMO and SIMO and input signal is transmitted through the AWGN channel. The all necessary conditions were implemented through the Matlab R2013a simulation. The simulation analysis has been done based on BER (Bit-Error-Rate) Versus SNR (Signal-to-Noise Ratio).

Keyword: WiMAX 802.16e, Additive White Gaussian Noise, Modulation, Channel, BER and SNR.

INTRODUCTION

The 802.16 Working Group of the "Institute of Electrical and Electronics Engineers" for technology development and standardization, the WiMAX Forum for product certification and the ITU (International Telecommunication Union) for international recognition. The WiMAX technology is expected to meet the needs of a large variety of users from those who are in developed nations wanting to install a new high speed wireless data network very cheaply with the minimum cost and time required. WiMAX has two important standards/usage models, a fixed usage model IEEE 805.16d [3]for fixed wireless broadband access (FBWA) and a portable usage model IEEE 805.16e for mobile wireless broadband access (MBWA) [4]. The WiMAX system is show in figure 1.

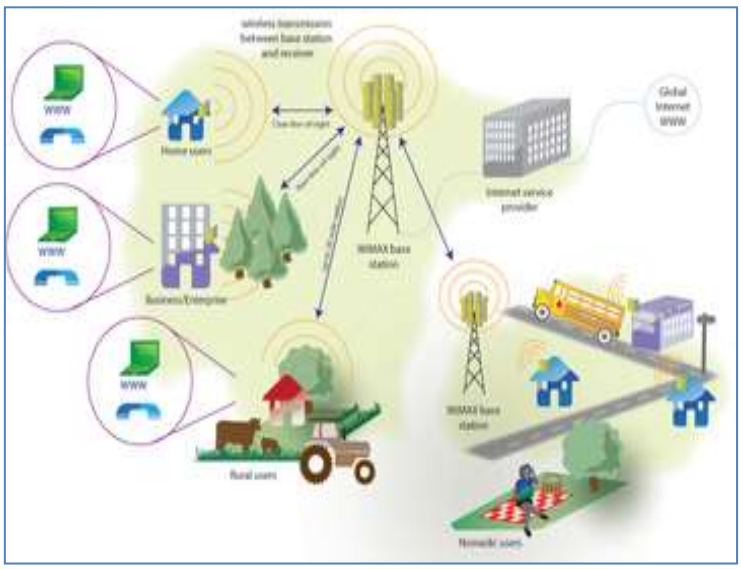

Fig.1: WiMAX System[5]

MIMO SYSTEMS FOR WIRELESS COMMUNICATION

MIMO systems are defined as point-to-point communication links with multiple antennas at both the transmitter and receiver. The use of multiple antennas at both transmitter and receiver clearly provide enhanced performance over diversity systems where either the transmitter or receiver, but not both, have multiple antennas. In particular, recent research has shown that MIMO systems can significantly increase the data rates

of wireless systems without increasing transmits power or bandwidth. The cost of this increased rate is the added cost of deploying multiple antennas, the space requirements of these extra antennas, and the added complexity required for multi-dimensional signal processing [1].

There are many ways to achieve the goals stated above (different MIMO techniques); each depends on the way the antennas are used and the channel model, some multiple antenna systems exist such as Single-Input Multiple-Output (SIMO), Multiple-Input Single–Output (MISO), and Space Time Coding but these are not MIMO systems [1]. Recent work in MIMO systems includes capacity of these systems under different assumptions about channel knowledge, optimal coding and decoding for these systems, and transmission strategies for un coded systems.

COMMUNICATION CHANNEL

In wireless communication, the data are transmitting through the wireless channel with respective bandwidth to achieve higher data rate and maintain quality of service. The transmitting data has to take environmental challenge when it is on air with against unexpected noise. That's why data has to encounter various effects like multipath delay spread, fading, path loss, Doppler spread and co-channel interference. These environmental effects play the significant role in WiMAX Technology to implement an efficient wireless channels. **a.** Additive White Gaussian Noise (AWGN), **b.** Rayleigh Fading Channel, **c.** Rician Fading channel, **d.** Stanford University Interim (SUI).

A. Additive White Gaussian Noise (AWGN) Channel

The simplest radio environment in which a wireless communications system or a local positioning system or proximity detector based on Time of-m flight will have to operate is the Additive-White Gaussian Noise (AWGN) environment. Additive white Gaussian noise (AWGN) is the commonly used to transmit signal while signals travel from the channel and simulate background noise of channel. The mathematical expression in received signal:

$$r(t) = s(t) + n(t) \quad (1)$$

That passed through the AWGN channel where $s(t)$ is transmitted signal and n(t) is background noise. In AWGN channel adds white Gaussian noise to the signal that passes through it. It is the basic communication channel model and used as a standard channel model.

SIMULATION OF M × N SYSTEM WITH AWGM

The simulate of the WiMAX 802.16e model based on the different simulation parameters are consider and obtain results. We investigated the BER V/S SNR by using AWGN channel with modulation techniques (QPSK and 8-QAM). The performance of WiMAX model analysis on used the following parameters as shown in table 1.

Table 1: Performance of IEEE 802.16e Physical layers Parameters

Parameters	Value
Model	WiMAX 802.16e
Used Simulation Tool	Matlab (R2013a)
Communication Channel	AWGN
Modulation Techniques	QPSK, 8-QAM and 16-QAM
System (Single and Multiple)	MIMO and SIMO
IFFT (Input port size)	256

A. Simulation of QPSK Modulation with AWGN channel

The performance of used New scheme Alamouti with combination of MIMO and SIMO. The simulation results are shown in fig. 2 and the result analysis are shown in table 2.

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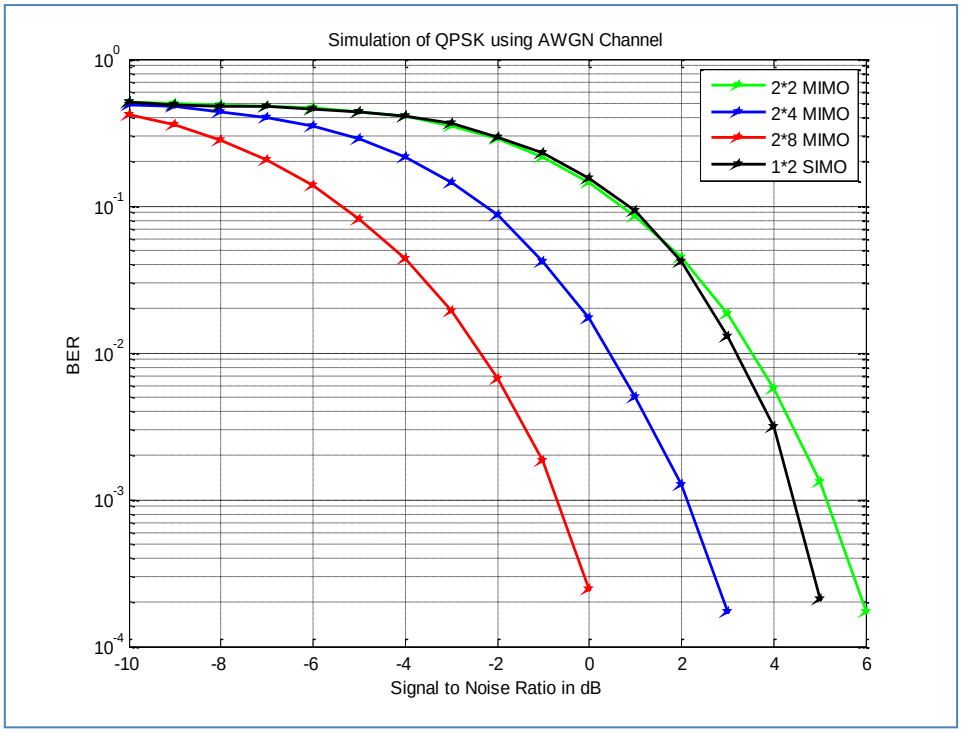

Fig. 2: Simulation results of QPSK modulation with AWGN Channel

Table 1: Performance analysis of QPSK with AWGN Communication

System	Modulation/Channel	BER	SNR
2×2 (MIMO)	QPSK with AWGN Communication	10^{-3}	5.1 dB
1×2 (SIMO)		10^{-3}	4.6 dB
2×4 (MIMO)		10^{-3}	2.2 dB
2×8 (MIMO)		10^{-3}	0.7 dB

B. Simulation of 8-QAM Modulation with AWGN channel

The simulation results are shown in figure 3 and the result analysis are shown in table 3.

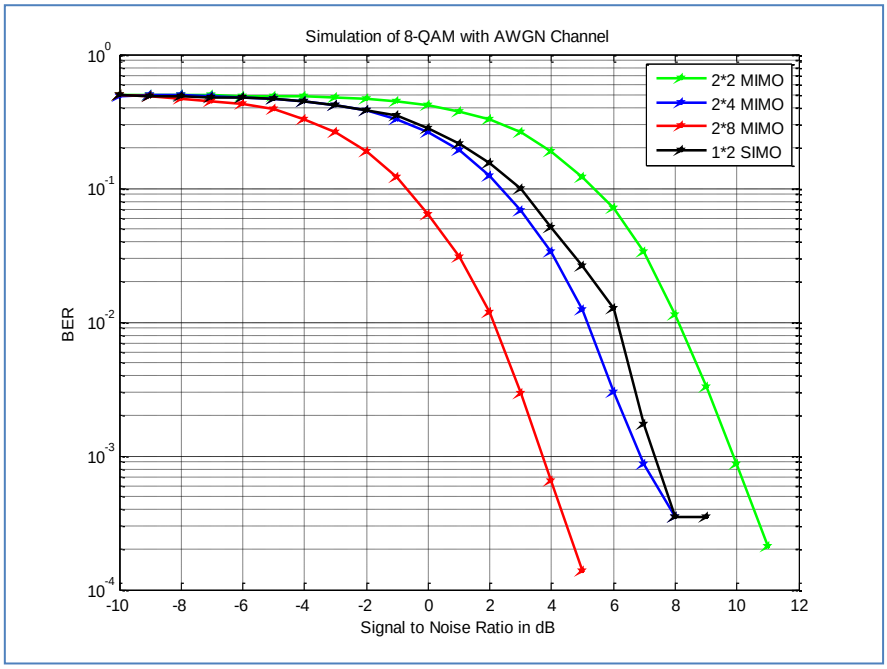

Fig.3: Simulation results of 8-QAM modulation with AWGN Channel

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Table 2: Performance analysis of QPSK with AWGN Communication

System	Modulation/Channel	BER	SNR
2×2 (MIMO)	8-QAM with AWGN Communication	10^{-3}	9.9 dB
1×2 (SIMO)		10^{-3}	7.2 dB
2×4 (MIMO)		10^{-3}	6.8 dB
2×8 (MIMO)		10^{-3}	3.8 dB

CONCLUSION

In the first analysis, we have used the alamouti scheme with communication AWGN channel and different modulation techniques. The performance is displayed in figure 2 in terms of the BER verses SNR logarithmic plot. This plot we analysis the 2×2 MIMO Systems, SNR is increased 0.5dB on BER at 10^{-3} as compared to 1X2 SIMO Systems. In second analysis, we have also used the alamouti scheme with (additive white Gaussian noise channel) and 8-QAM modulation techniques. The performance is displayed in figure 3 in terms of the BER verses SNR logarithmic plot. In the table 3, we observed the MIMO 2×2 systems, SNR is increased 2.7dB on BER at 10^{-3} as compared to 1×2 SIMO System. This project future implemented using fading channel.

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