 ISSN: 2277-5528
Impact Factor: 3.145

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT

WIMAX-802.16E MIMO $(2 \times 4 \; and \; 2 \times 8)$ SYSTEM WITH AWGN CHANNEL

Pratik Bhiwapurkar[1], Mukesh Patidar[2], Shyam Gehlot[3], Dr. Pragya Nema[4]
M. Tech. Scholar[1], Asst. Prof.[2], Prof.& HOD[3]
Department of Electronics and Communication Engineering
Lakshmi Narain College of Technology, Indore (M.P.) India

ABSTRACT

WiMAX which represents (World Interoperability for Microwave Access) is a major part of broad band wireless network having IEEE 802.16 standard provides innovative fixed as well as mobile platform for broad-band internet access anywhere in anytime. IEEE 802.16 standard has bandwidth of 2GHz-11GHz for fixed applications and 2-6GHz for mobile applications. It is considered the most interesting opportunity which is able to provide data throughput up to 70 Mbps and radio coverage distances of almost 50 kilometers, and to complete wired network architectures, ensuring a cheap flexible solution for the last-mile. It is the latest technology which is approved by IEEE 802.16 group, which is a standard for point-to-multipoint wireless networking. In this paper analysis of the multiple antenna technologies like SISO, MIMO system under different combination of modulation technologies like BPSK, QPSK, 8-QAM and 16-QAM with mobile wireless channel AWGN used and the results shows under the bit error rate versus signal to noise ratio.

Keyword: **- WiMAX, OFDM, MIMO, BPSK, QPSK, 8-QAM, 16-QAM, AWGN, BER, SNR.**

I. INTRODUCTION

The wireless broadband technologies are bringing the broadband experience closes to a wireless context to their subscribers by providing certain features, convenience and unique benefits. These broadband services can be categorized into two types; Fixed Wireless Broadband and Mobile Broadband. The fixed wireless broadband provides services that are similar to the services offered by the fixed line broadband. But wireless medium is used for fixed wireless broadband and that is their only difference. The mobile broadband offers broadband services with an addition namely the concept of mobility and nomad city. The term nomad city can be defined as “Ability to establish the connection with the network from different locations via different base stations” while mobility is “the ability to keep ongoing connections engaged and active while moving at vehicular speeds”. Examples of wireless broadband technologies are Satellite communication, Wireless LAN and WiMAX.

The standard for WiMAX is a standard for wireless metropolitan networks (WMAX) that has been developed by working group number 16 of IEEE 802.16, specializing in broadband wireless access. It is also supported by a wide number of industry companies. WiMAX technology will support traffic based on transport technologies ranging for Ethernet, Internet protocol (IP), and asynchronous transfer mode (ATM), the forum will only certify the IP-related elements of the 802.16 products. The WiMAX has two important standards/usage models, a fixed usage model IEEE 802.16d for fixed wireless broadband access (FBWA) and a portable usage model IEEE 802.16e for mobile wireless broadband access (MBWA).

II. WIMAX NETWORK CLASSIFIED

The functional distinctions between LANs, MANs, WANs, and GANs are blurring. This is due to several factors. The US Telecommunications Deregulation Act of 1996 allows long distance companies to enter the local telephone market, and at some point will allow the BOCs to enter the long distance market. The emergence of global telecommunications companies means that a single common carrier can interconnect buildings anywhere on the globe.

Historically, LANs have used protocols such as IPX/SPX to transfer data, while MANs, WANs, and GANs have used other protocols, such as X.55. LANs, MANs, WANs, and GANs are also converging this area, with WAN protocols such as TCP/IP and ATM being used on LANs. Figure 1 classification of WiMAX Network scale. Networks can be classified according their scale, that is, the geographical areas which they span.

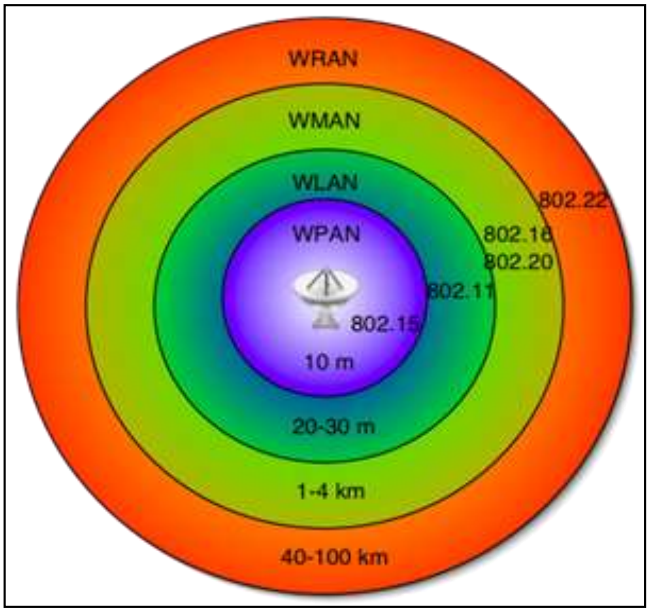

Fig.1: WiMAX Network scale

III. IEEE FAMILY OF STANDARD

The IEEE 805.16 standard contains the specification of Physical (PHY) and Medium Access Control (MAC) layer for BWA. The first version of the standard IEEE 805.16- 5001 was approved on December 5001 and it has gone through many amendments to accommodate new features and functionalities.

Table 1 Summary of 805.16 Radio Links [5]

Characteristics	**805.16**	**805.16a**	**805.16e**
spectrum	10-66 GHz	5-11 GHz	<6GHz
configuration	LOS	NLOS	NLOS
Bit rate	55 to 155mbps (58MHz Chan.)	<70 or 100 mpbs 50MHz channel)	Up to 15 Mpbs
modulation	QPSK 16-QAM 65-QAM	556 sub carrier OFDM using QPSK, (16, 65)QAM	556 sub carrier OFDM using QPSK, (16, 65)QAM
mobility	Fixed	Fixed	<75 mph
Channel bandwidth	50,55,58 MHz	1.55 to 50 MHz	5 MHz
Cell radius	1-5 miles	5-5 miles	1-5 miles

IV. 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.

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. 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.

A. MIMO system model

In MIMO systems, the transmit and receive antennas can both be used for diversity gain. Multiplexing exploits the structure of the channel gain matrix to obtain independent signaling paths that can be used to send independent data. A narrowband point-to-point communication system of Nt transmit and Nr receive antennas is shown in Figure 2. The transmitted matrix is a $Nt \times 1$ column matrix X, where Xi is the i^{th} component transmitted from the antenna i. Since each of the receive antennas detects all of the transmitted signals, there are N x N independent propagation paths, where there are transmit and receive antennas. This allows the channel to be represented as N x N matrix. Again using a 2 x 2 System as an example, the matrix below is obtained as in equation 1.

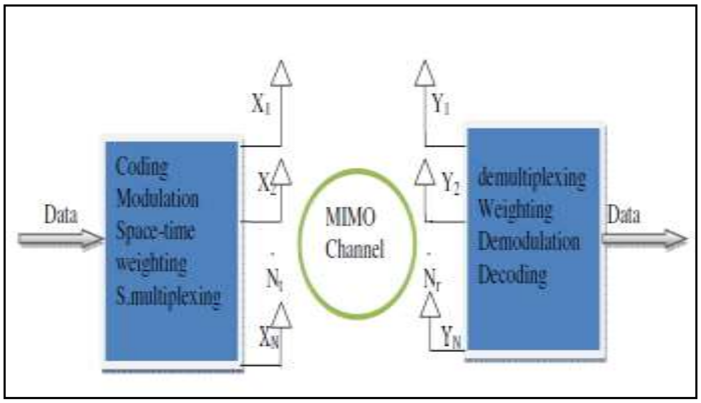

Fig. 2: MIMO Model

$$H = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \qquad (1)$$

Each of the elements in the channel matrix is define an independent propagation path. The transmitted signal can be represented as a vector, as can the received signal. Hence, the system can be represented as the following equation.

$$Y = HX + n \qquad (2)$$

Where Y is the received signal vector, H is the channel Matrix, X is the transmitted signal vector, and n is the noise. The transmitted signals in the vector Y are complex signals, as the channel matrix values and the received signals in vector X. The complex form in each of the elements in the vectors represents the power of the signal and its phase delay. The complex form of the elements of the channel matrix ‘H’ represent the attenuation and phase delay associated with that propagation path.

V. SIMULATION RESULTS

Performance results of Different combination of $M \times N$ System The basic min of this thesis is to analyze the performance of WiMAX (OFDM - $M \times N$ systems) based on the different simulation parameters consider and obtain simulation results. We investigated the BER Vs SNR plot by using AWGN channel. The performance of WiMAX model analysis on used the following parameters as shown in table1.

Table 1: Performance of IEEE 802.16e Physical layers Parameters

Parameters	Value
Communication Channel	AWGN
Modulation Techniques	BPSK, QPSK, 8-QAM and 16-QAM
IFFT (Input port size)	256
CC Code Rate	1/2
Radio Technology	OFDM
Used Scheme	Alamouti
System (Single and Multiple)	SISO, SIMO, MISO and MIMO

Model	WiMAX 802.16e
Calculation Parameters	BER V/s SNR
Simulation-Used Tool/Software	Matlab (R2013a)

A. Performance of $\mathbf{2 \times 4}$***MIMO system over AWGN channel***

In this analysis we are used in AWGN (Additive White Gaussian Noise) and different modulation schemes used like BPSK, QPSK, 8-QAM and 16-QAM. The performance of used New scheme Alamouti with combination of MIMO (multiple input and multiple output). The simulation results are shown in figure 3 and the result analysis are shown in table 1.

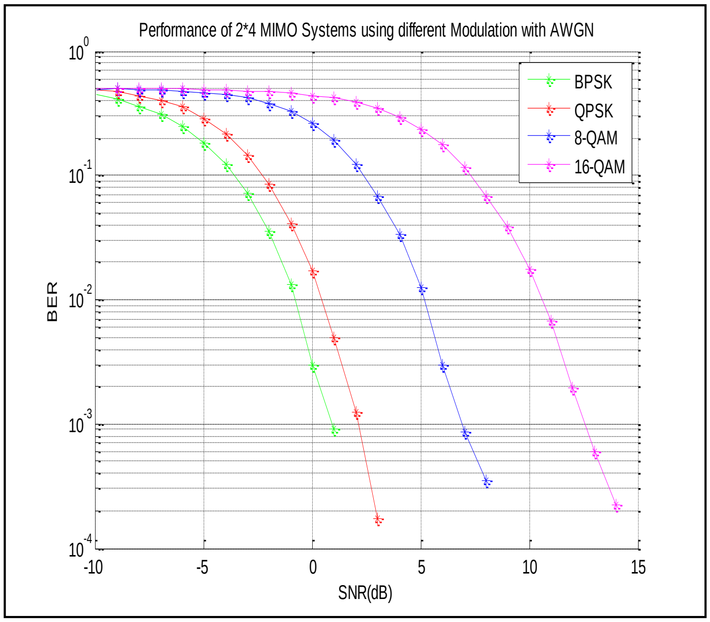

Fig. 3: Performance analysis of $\mathbf{2 \times 4}$ ***MIMO system using different modulation techniques with AWGN channel***

.

B. Performance of $\mathbf{2 \times 8}$***MIMO system over AWGN channel***

We are consider same parameter in table 1,the simulation results 2×8 MIMO system are shown in figure 4.

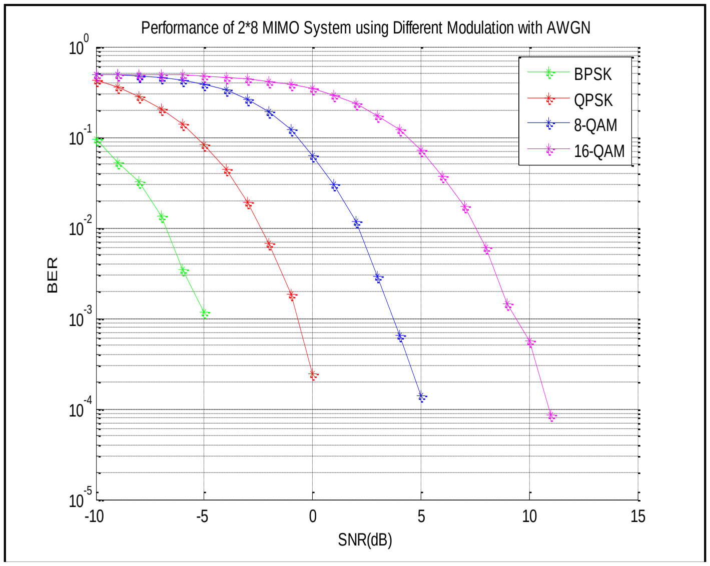

Fig. 4: Performance analysis of $\mathbf{2 \times 4}$ ***MIMO system using different modulation techniques with AWGN channel***

VI. CONCLUSION

Multiple-Input Multiple-Output (MIMO) systems offer considerable increase in data throughput and link range without additional bandwidth or transmit power by using several antennas at transmitter and receiver to improve wireless communication system performance. At the same time, Orthogonal Frequency Division Multiplexing (OFDM) has becoming a very popular multi-carrier modulation technique for transmission of signals over wireless channels. The performance is displayed in figure 3 in terms of the BER verses SNR logarithmic plot. This plot we analysis the 16-QAM, SNR is increased 5.8 dB on BER at 10^{-3} as compared to 8-QAM and Modulation Techniques at a constant signal power, and the performance is displayed in figure 4 in terms of the BER verses SNR logarithmic plot. This plot we analysis the 16-QAM, SNR is increased 6.2 dB on BER at 10^{-3} as compared to 8-QAM and Modulation Techniques at a constant signal power.

REFERENCES

I. Mukesh Patidar, Rupesh dubey "Performance Analysis of WiMAX 802.16e Physical Layer Model" 2012 IEEE.
II. Koffman I., Roman, V., "Broadband wireless access solutions based on OFDM access in IEEE 802.16" Communications Magazine, IEEE, Vol.40, Issue. 4, April 2002, Pages 96-103
III. ETSI TS 102 177 Version 1.3. February 2006, "Broadband Radio Access Networks (BRAN); Hiper-MAN; Physical (PHY) Layer".
IV. Muhammad Nadeem Khan, Sabir Ghauri, "The WiMAX 802.16e Physical Layer Model", University of the West of England, United Kingdom.
V. Madan Lal "BER Performance of Different Modulation Schemes for MIMO Systems" IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.3, March 2011.
VI. IEEE Computer Society, "IEEE standard for information technology - telecommunications and information exchange between systems - local and metropolitan area network-specific requirements part 11: Wireless LAN medium access control and physical layer specifications", IEEE Std 802.11, June 2007.
VII. IEEE 802.162004, "IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed Broadband Wireless Access Systems", 1 October, 2004.
VIII. Gede Puja Astawa "Performance Analysis of MIMO-OFDM Using Convolution Codes with QAM Modulation" International Scholarly and Scientific Research & Innovation 7(12) 2013.
IX. Koffman I., Roman, V., "Broadband wireless access solutions based on OFDM access in IEEE 802.16" Communications Magazine, IEEE, Vol.40, Issue. 4, April 2002, Pages 96-103.
X. IEEE 802.16e-2005, "IEEE Standard for Local and Metropolitan Area Networks, part 16, Air Interface for Fixed and Mobile Broadband Wireless Access Systems", IEEE Press, 2006.