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WIMAX-802.16E MISO AND MIMO-OFDM SYSTEM WITH AWGN CHANNEL

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ABSTRACT

In the recent years WIMAX (Worldwide Interoperability for Microwave Access) technology is widely used for wireless communication system in many countries because it reach set of features with promising broadband wireless access networks. WiMAX is a wireless digital communications system, also known as IEEE 802.16 that is intended for wireless "Metropolitan Area Networks". WiMAX can provide broadband wireless access up to 30 miles for fixed stations, and 3-10 miles for mobile stations. It is the latest technology which is approved by IEEE 802.16 group, which is a standard for point-to-point and multipoint wireless networking. The MIMO-OFDM is a key technology for next-generation cellular communications as well as wireless Personal Area Network, wireless Local Area Network and broadcasting (DAB, DVB).In this paper an overview of (MIMO) multiple input-multiple-output system and technology is presented. Multiple antenna transmission technology or MIMO system can increase the overall system performance. Multiple Input Multiple Output (MIMO) wireless systems that use multiple transmit and receive antennas allow a gain in reliability and capacity. this paper analysis of the multiple antenna technologies like MISO, MIMO system under different combination of modulation technologies like BPSK, QPSK, with mobile wireless channel AWGN used and the results shows under the bit error rate versus signal to noise ratio.

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

INTRODUCTION

In the most recent decade , the communication industry has advanced more quickly , mobile technology and internet have been widely by population around the globe, as the demand for mobile broadband is growing and evolving, this quick change in the communication way and the way we get information is continue to accelerate. The wireless Communication services available at any time and place free people from the limitation of being attached to fixed devices. 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.

There are two WiMAX standard IEEE 802.16d-2004 known as Fixed WiMAX and IEEE 802.16e-2005 known as Mobile WiMAX. 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. WiMAX mainly operate in two frequency ranges, one is high frequency, which range from 11 – 66 GHZ also known as licensed frequency band and another one is low frequency, 2GHZ -11GHZ referred to as unlicensed frequency band. Wireless communication systems can be found all around the world today. In radio, multiple-input and multiple-output, or MIMO is the use of multiple antennas at both the transmitter and receiver to improve communication performance. MIMO technology has attracted attention in wireless communications, because it offers significant increases in data throughput and link range without additional bandwidth or increased transmit power. The WiMAX Network technology is an evolutionary one as it uses orthogonal frequency division multiplexing which makes transmission resist to fade and minimizes multipath effect.

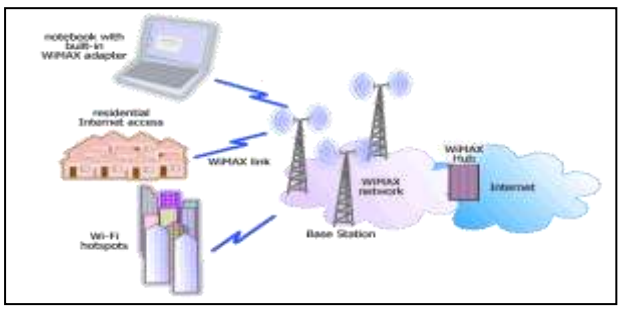

Fig. 1 WiMAX Network

WIMAX DIVISIONS

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. The WiMAX has two important standards/usage models.

A. Fixed WIMAX

802.16d was developed specifically for the fixed wireless application because it does not support mobility, the terminal devices or customer premise Equipment are not constrained by battery operation or small form for handheld operation. This gives up both ends of the link to allow for some symmetry in performance between the CPE and the base station, typically both the CPE and the base station can support high output power through the radio and antenna combined, the result is excellent over long distances. Fixed WiMAX is very robust against multi-path propagation because it used an air interface based on orthogonal frequency division multiplexing (OFDM), it is based on IEEE 802.16 and will initially operate in the 2.3 GHz, 2.5 GHz , and 3.4 to 3.8GHz spectrum bands.The IEEE 802.16-2004 standard is designed for fixed access usages models. This standard may be referred to as fixed wireless. Because it uses a mounted antenna at subscriber's site .The antenna is mounted to a roof or mast, similar to a satellite television dish .

B. Mobile WiMAX

The IEEE 802.16e standard is an amendment to the 802.16-2004 base specification and targets the mobile market by adding portability and ability for mobile clients with IEEE 802.16e adapters to connect directly to the WiMAX network to the standard .the 802.16e standard uses Orthogonal Frequency Division Multiple Access(OFDMA),which is similar to OFDM in that it divides the carriers into multiple sub carriers .OFDMA, however, goes a step further by then grouping multiple subcarriers into sub-channels. A single client or subscriber station might transmit using all of the sub-channels within the carrier space, or multiple client might transmit with each using a portion of the total number of sub-channels simultaneously The Mobile WiMAX air interface adopts the Orthogonal Frequency Division Multiple Access (OFDMA) Modulation scheme for improved multipath performance in non-line-of-sight environments.OFDMA user and transmits symbols using subcarrier can be assigned to one user to support high data rates.

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.

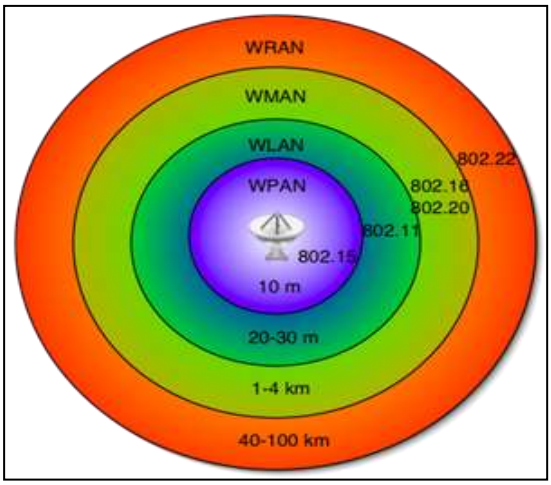

Fig.2: WiMAX Network scale

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.

MIMO

In wireless communication the propagation channel is characterized by multipath propagation due to scattering on different obstacle. The multipath problem is a typical issue in communication system with time variations and time spread. For time variations the channel is fading and caused SNR variations. For time spread, it becomes important for suitable frequency selectivity. In an urban environment, these signals will bounce off trees, buildings, etc. and continue on their way to their destination (the receiver) but in different directions. With MIMO,

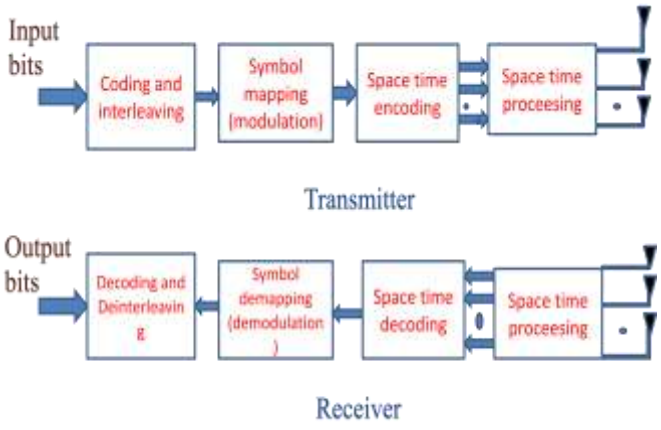

Fig. 3 MIMO Transmit and Receive system

All wireless devices use a particular part of radio spectrum. Air traffic radar, for example, operates between 960 and 1215 megahertz and cell phone between 824 to 849 megahertz. As growing number of wireless devices, the spectrum becomes congested every year. MIMO has potential to expand radio capacity and relieve the burden on existing bandwidth. By spreading the transmitted signal over the multiple paths, the MIMO technology increases the chances of signal reception at receiver. It also increases the range of operation.Multipath fading causes the distortion by scrambling the copy of the signals reaching the receiver via multiple paths on bouncing of the objects.

OFDM

OFDM is a modulation technique which offers quite a few interesting features to mitigate frequency-selective channel impairments. Huge bandwidth savings is possible due to the orthogonality among subcarriers. The high-data rate is divided into several low-data rate streams which modulate orthogonal subcarriers.. Advantage of OFDM system is the efficient channel estimation/equalization as the broadband frequency-selective channel is split into several flat-fading channels due to narrow- band subcarriers. Service providers can use granularity (due to several narrow band subcarriers) available to offers variety of data rate depending on the service types (e.g. data, voice, video, etc) and Quality of Service (e.g. reliability, priority, etc)

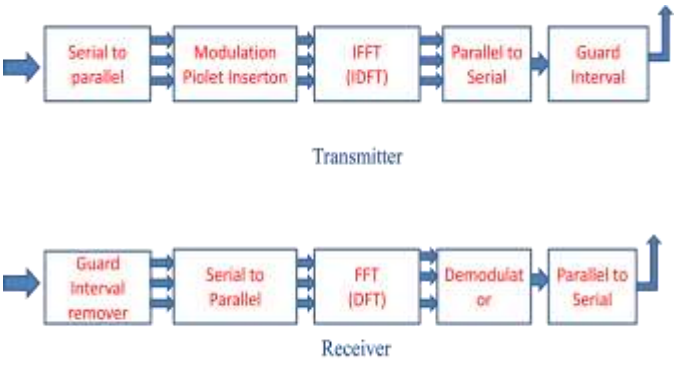

Fig-4 OFDM Transmit and Receive system

The Orthogonal frequency-division multiplexing (OFDM), is wide band digital communication technique that is based on block modulation.

IEEE FAMILY OF STANDARD

The IEEE 802.16 standard contains the specification of Physical (PHY) and Medium Access Control (MAC) layer for BWA. The first version of the standard IEEE 802.16- 2001 was approved on December 2001 and it has gone through many amendments to accommodate new features and functionalities.

Table 1 Summary of 802.16 Radio Links [5]

Characteristics	802.16	802.16a	802.16e
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

SIMULATION RESULTS

Performance results of Different combination of $M \times N$ System analyze the performance of WiMAX (OFDM - M × 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 table2.

Table2 : Performance of IEEE 802.16e Physical layers Parameters

Parameters	Value
Communication Channel	AWGN
Modulation Techniques	BPSK, QPSK
IFFT (Input port size)	256
CC Code Rate	½
Radio Technology	OFDM
System (Single and Multiple)	MISO, MIMO
Model	WiMAX 802.16e
Calculation Parameters	BER V/s SNR
Simulation-Used Tool/Software	Matlab (R2013a)

In this analysis we are used in AWGN (Additive White Gaussian Noise) and different modulation schemes used like BPSK, QPSK, . The performance of used scheme Alamouti with combination of MIMO. The simulation results are shown in figure 6 and the result analysis are shown in table 2

A. Performance of 2 × 1MISO system over AWGN channel

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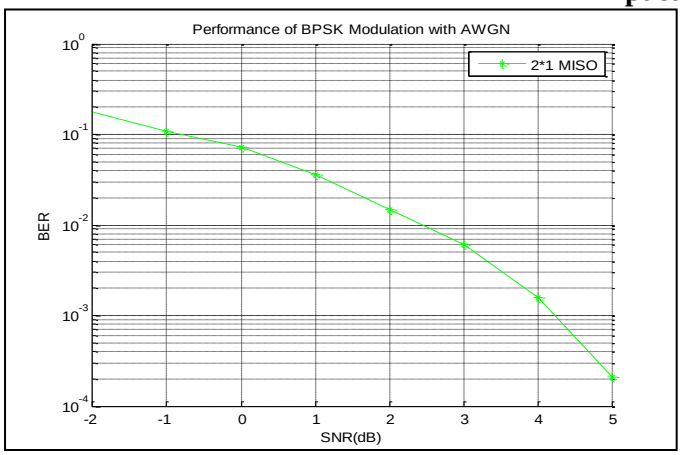

Fig 6. Performance analysis of 2×1MISO system using BPSK modulation technique with AWGN channel

B. Performance of 2×2MIMO system over AWGN channel

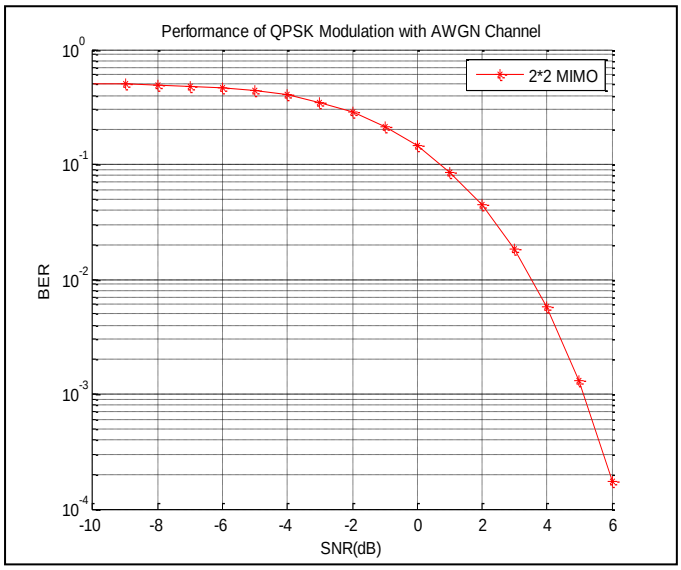

Fig 7. Performance analysis of 2×2MIMO system using QPSK modulation technique with AWGN channel

CONCLUSION

A MIMO-OFDM modulation technique can achieve reliable high data rate transmission over broadband wireless channels 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 .

Future wireless technologies will provide unique and A MIMO-OFDM modulation technique can achieve reliable high data rate transmission over broadband wireless channels. We developed a program in MATLAB R2013a, to study MIMO-OFDM systems behavior under different conditions. single identification globally If MIMO technology stands on it promises that day is not far when the James Bond style video conversation will be reality? Future wireless applications demands for high data rates and high link quality

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