A Review on WiMAX System Using Modulation Method

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ABSTRACT: A study in the field of Worldwide Interoperability for Microwave Access system (WiMAX) or communication system is much needed as communication services. Wi-max network are used Orthogonal Frequency Division Multiplexing (OFDM) with different adaptive modulation techniques. In this paper, we study the Mobile Wi-Max system performance by using turbo codes and setting the system parameters to achieve performance optimization. For different transmission conditions BER performance has been simulated. WiMAX system is that afterward generation broadband wireless technology that offers higher bandwidth compared to the opposite out there broadband wireless access technologies like Wi-Fi and ultra broadband family of standards. The simulation is based on the WiMAX physical layer which adopted an OFDM model in the transmitter and receiver. WiMAX system by using different modulation techniques like Binary Phase Shift Keying, Quadrature Amplitude Modulation and Quadrature Phase Shift Keying for modulator and demodulator. The signal is transmitted through the channel and it is received at the receiver end. Proposed algorithm probability of error, the lower order modulation scheme also has the lower BER at low SNR. Proposed algorithm minimizing BER at low SNR .Proposed approach is explained to facilitate the Wi-Max Mobile networks in terms higher data handling capacity and less noise susceptibility. MATLAB Tool is used to develop the OFDM model and analysis the performance of WiMAX system.

Keywords- Wireless Network**,** WiMAX, OFDM, Adaptive Modulation Techniques, BER, Binary Phase Shift Keying, Quadrature Phase Shift Keying, Trellis Encoder, interleaver.

I. INTRODUCTION

The growth of the use of the data networks lead to the requirement for new communication networks with higher data rates. The telecommunication business is additionally going to modification, with a requirement for a bigger range of services, like video conferences, or applications with multimedia system contents, wireless communication has permeated nearly all acts of human life. WiMAX stands for the worldwide interoperability for microwave access system. It's a telecommunications protocol that has fixed and mobile web access. WiMAX could be a wireless digital communications system, additionally called IEEE 802.16 that's supposed for wireless "metropolitan area networks". WiMAX will offer broadband wireless access up to thirty miles for mounted stations, and three – ten miles for mobile stations. Worldwide interoperability for Microwave Access could be a 4G technology and wireless communication normal

designed to supply 28to 40 megabit-per-second data rates. Error free transmission is one in all the most aims in wireless communications [1].Modern wireless communication system supply completely different services like oral communication, multimedia system services to the users. It needs high rate, this cannot be achieved by single carrier communication because it suffers from multipath fading, inter image interference. Thus Orthogonal Frequency Division Multiplexing (OFDM) is considered because of the higher candidate for recent technology because it provides high spectral efficiency, robustness against multipath fading, avoid inter image interference using cyclic prefix concept. As a result, OFDM has been chosen for prime rate communication, wide deployed in several wireless communication standards like DAB, DVB [2].
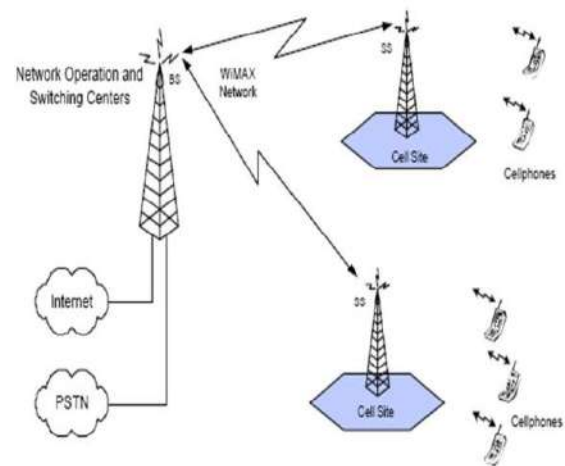

Fig 1 Wi-max communication System

Characteristics of IEEE 802.16: the characteristics of IEEE 802.16 system itself, and the problems of OFDM system which is sensitive to the timing and the frequency compensation. The OFDM system of the WiMAX adopts abruptly deliver mode, reliability, good efficiency and the High data rate is achieved between the transmitter and the receiver if they are ideally synchronized. The performance of the whole OFDM systems. Hence, before signals can be demodulated, OFDM symbols have to be time-synchronized and carrier frequency offsets compensated. This puts forward the very high request to the mode piece of the synchronization system. In order to realize the synchronization, it must adopt synchronization algorithm of smaller calculation quantity. In the meantime, it should have the higher examination of the first moment.

Characteristics of WiMAX following:
I. Wimax data rates 5.5 to 70 Mbps.
II. Wimax used Modulation scheme BPSK, QPSK, QAM.

III. It is used Mesh Topology and Frequency bands 2.4 GHz, 3.5GHz, 5GHz.
IV. Wimax used Physical layer Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), and Orthogonal Frequency Division Multiplexing.
V. The WiMAX normal is internationally accepted and therefore the normal is maintained and authorized by WiMAX forum covers fixed, portable and mobile deployments.
VI. It covers up to thirty miles however in practice, it covers only six miles.
VII. WiMAX media access management is intended to support a large variety of users, with multiple connections per terminal.

OFDM adaptative Technology: Orthogonal Frequency Division Multiplex (OFDM) may be a special case of multicarrier transmission, the adaptative OFDM technique is mentioned with differing kinds. The bit error chance of various OFDM subcarriers transmitted in time dispersive channels depends on the Frequency domain channel transfer operate. The occurrence of bit error is often focused in a very set of many light subcarriers, whereas within the alternative subcarriers usually, no bit errors are determined. OFDM divides a band channel into narrowband sub channels to mitigate ISI. The options of OFDM in multi user system are: In multiuser systems, these sub channels are often allotted among totally different users, Orthogonal allocation: Multiuser OFDM, Semi orthogonal allocation: Multicarrier CDMA, spatial techniques facilitate to mitigate interference between users, OFDM overlaps sub streams, Sub streams separated in receiver, Minimum sub stream separation is B/N, total biological warfare is B, Impaired by temporal order interference, frequency offset, and fading used by the CATV community and assigns a set of accessible carriers to every user [5].

Digital Modulation Techniques
1. ASK -Amplitude-shift keying (ASK) is a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave. In an ASK system, the binary symbol 1 is represented by transmitting a fixed-amplitude carrier wave and fixed frequency for a bit duration of T seconds. If the signal value is 1 then the carrier signal will be transmitted; otherwise, a signal value of 0 will be transmitted. Any digital modulation scheme uses a finite number of distinct signals to represent digital data. ASK uses a finite number of amplitudes, each assigned a unique pattern of binary digits. Usually, each amplitude encodes an equal number of bits. Each pattern of bits forms the symbol that is represented by the particular amplitude. The demodulator, which is designed specifically for the symbol-set used by the modulator, determines the amplitude of the received signal and maps it back to the symbol it represents, thus recovering the original data. Frequency and phase of the carrier are kept constant

2. FSK-Frequency-shift keying (FSK) is a frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier signal. The technology is used for communication systems such as amateur radio, caller ID and emergency broadcasts. The simplest FSK is binary FSK (BFSK). BFSK uses a pair of discrete frequencies to transmit binary (0s and 1s) information. With this scheme, the "1" is called the mark frequency and the "0" is called the space frequency.

3. PSK-Phase-shift keying (PSK) is a digital modulation process which conveys data by changing (modulating) the phase of a reference signal (the carrier wave). The modulation occurs by varying the sine and cosine inputs at a precise time. It is widely used for wireless LANs, RFID and Bluetooth communication. Any digital modulation scheme uses a finite number of distinct signals to represent digital data. PSK uses a finite number of phases; each assigned a unique pattern of binary digits. Usually, each phase encodes an equal number of bits. Each pattern of bits forms the symbol that is represented by the particular phase. The demodulator, which is designed specifically for the symbol-set used by the modulator, determines the phase of the received signal and maps it back to the symbol it represents, thus recovering the original data. This requires the receiver to be able to compare the phase of the received signal to a reference signal – such a system is termed

4. BPSK: In BPSK Binary phase shift keying, the phase of a continuing amplitude carrier is switched between two values according to the two possible signals M1 and M2 like binary one and zero severally. This modulation is that the strongest of all the PSKs since it takes the best level of noise or distortion to create the demodulator reach an incorrect call. It is, however, only ready to modulate at one bit/symbol then is unsuitable for prime data-rate applications. BPSK is functionally equivalent to 2-QAM modulation. The BPSK signal is equivalent to a double sideband suppressed carrier amplitude modulated wave. Therefore a BPSK signal is often generated using a balanced modulator. Demodulation in BPSK Receiver needs the reference of transmitter signal so as to properly conform section, thus it's necessary to transmit carrier alongside signal. It needs complex and costly receiver circuitry. It offers sensible BER for low SNR giving power efficiency.

5. QPSK - quadrature phase Shift Keying: quadrature phase Shift Keying has double the information measure efficiency of BPSK. For each single modulation symbol, 2 bits are transmitted. The section of carrier takes on four equally spaced values like zero, π/2, π, 3 π/2.The two modulated signals, every of which might be thought-about to be a BPSK signal, are summed to supply a QPSK signal. QPSK transmitters and receivers are further difficult than those for BPSK. However, with trendy physical science technology, the penalty in value is very moderate. Like BPSK, there are section ambiguity problems at the receiving end, and differentially encoded QPSK is usually used in practice e [6].

II. EXISTING WORK

It is existing work based on BPSK transmitter is used along with Additive white Gaussian noise (AWGN) channel and BPSK receiver. The PSK modulation scheme for SDR is proposed to pick the constellation size that offers the best reconstructed signal quality for each average SNR. The audio signal transmission quality is evaluated and the performance of the linear modulation is compared [7]. It shows for a given SNR, simpler modulation schemes tend to have higher quality, giving lower bit rates. BPSK has higher quality for given SNR as compared to other modulation schemes. Therefore, it is used as the basic mode for each physical layer. It has the maximum coverage range among all transmission modes.

In [8] Jagdish D. Kene et al**.** have presented Turbo code gives relatively better performance as compare to convolutional codes. Turbo code offers an impressive cryptography gain terribly near Shannon limit for AWGN channel to achieve maximum throughput (Typical Wi-Max application). The objective of this paper is to study the Mobile Wi-Max system performance by using turbo codes and setting the system parameters to achieve performance optimization. For various transmission conditions BER performance has been simulated. Finally for the performance optimization of mobile Wi-Max system the effect of various Decoding algorithms, Frame size and Code rates are considered for simulation to evaluate the system performance. Improvement achieved within the options of Mobile Wi-Max system for a specific choice of set of parameters has been reported.

In [9] Bogdan Iordache et al**.** have presented the characteristics of modulation techniques and determined the figure of merit for each particular modulation in context of SDR. The wireless standard IEEE 802.16, WI-MAX is used for analysis which uses modulation techniques like QPSK, QAM-16 on OFDMA carrier support. The transmitter and receiver are considered ideal and Additive white Gaussian noise is introduced by channel. The maximum transmitted power is constant, regardless of the used modulation. It shows that higher SNR are needed to draw out the signal at intervals identical BER because the modulation ranges of bits per image will increase. In Fig.1 the Bit Error rates verses Signal-to-Noise Ratios for different modulation techniques are presented.

In [10] Kahveci S**.** Have presented Performances of Zigzag coding with high-level modulations on Wi-MAX system. The Wi-MAX which is a technology of OFDM base provides wireless communication from one-point to multi-point. In this study, for fixed and mobile Wi-MAX systems performance analysis of different modulation types and Zigzag encoder schemes is investigated. One of the important advantages of the error correction codes has no need re-transmission of data packets. The results of proposed Zigzag-coded modulation show that they have a good performance at least other techniques.

In [11] Lee M. Garth et al**.** has proposed Novel Orthogonal Codes for Spectrally-Encoded OFDM Systems in Fading Channels. In this paper, a unique orthogonal spreading code has been planned for spectrally- encoded (SE) OFDM, a.k.a., spread-time (ST) OFDM with capricious pulse form. It has been shown that it is possible to retain the orthogonally of the code in the presence of tail truncation by time windowing and in a general multipath fading channel during which users expertise completely different frequency property simply by modifying the user code words. Simulation results show that the proposed codes can achieve single user performance when the code length is twice the number of user.

In [12] Paz Portela et al. have presented Performance Comparison between the Air Interfaces of LTE and Mobile Wi-MAX. Shown that there is no doubt nowadays that Orthogonal Frequency Division Multiplexing (OFDM) is the dominant technology in the area of mobile wireless access. The objective of this work is to analyze and compare the performance and spectral efficiency of 3GPP Long Term Evolution (LTE) and mobile Worldwide Interoperability for Microwave Access (Wi-MAX). Both technologies (based in OFDM) are the dominant options to provide mobile broadband access today.

In [13] Rakesh Kumar Jha et al. have conferred an inspiration of our worldwide ability for Microwave Access network performance for QoS watching and optimization resolution for Bachelor of Science (Base Station) with transmission application. In the communication sector, the optimal objective is to equate quality and cost. Due to its large coverage area, low cost of deployment and high speed data rate. WiMAX is a promising technology for providing wireless last-mile connectivity. Physical and MAC layer of this technology refer to the IEEE 802.16e standard, which defines 5 different data delivery service classes that can be used in order to satisfy Quality of Service requirements of different applications, such as VoIP, videoconference, FTP, Web, etc. In this paper we have made six scenarios. Here two types of MAC layer QoS are used and they are UGS and rtPS having application of Voice over IP (VoIP) and MPEG respectively in this paper we have made six scenarios. Also the traffic priority for UGS is high as compared to rtPS. In every situation the quantity of fastened nodes (Fixed Subscriber Stations) and Mobile nodes (Mobile Subscriber Stations) are totally different. To cover more nodes or if nodes are outside the coverage area more than one BS are required.

In [14]Askar S et al. have presented "Performance evaluation of IEEE802.16-2004 WiMAX with fixed high fading channels,", WiMAX (Worldwide Interoperability for Microwave Access) is a promising technology which can offer high speed data, voice and video service to the customer end, which is presently, dominated by the cable and digital subscriber line (DSL) technologies. The performance assessment of WiMAX systems is dealt with. The biggest advantage of Broadband wireless application

(BWA) over its wired competitors is its increased capacity and ease of deployment. This work are to model and simulate the fixed OFDM IEEE 802.16d physical layer under variant combinations of digital modulation (BPSK, QPSK) over diverse combination of fading channels

In [15] P Omprakash ET. Al. present an Adaptive modulation enables a WiMAX system to optimize the throughput based on propagation conditions. IEEE802.16 (WiMAX) system support BPSK, QPSK, 16-QAM and 64-QAM and the access scheme is OFDM. This paper presents the performance of different variants of transmission control protocols with different modulation schemes when density of mobile nodes changes.

III. EXPECT OUTCOME

To research in the field of wi-max system and identify various challenges. The WiMAX technology to make it more secure, robust and give the customer more reliable service. Our objective is a higher data handling capacity and with the reduction in noise susceptibility and low noise.

IV. CONCLUSION

This paper has given an analysis of the modem modulation techniques that are used in the most recent wireless standards, like IEEE - 802.11, IEEE - 802.16 additionally called WiMAX. The WiMAX technology is extremely quick and advances technique used for mobile functions. This technology provides varied protocols and options as compared to older technologies. The WiMAX system supported OFDM model using adaptative modulation schemes was with success developed using Mat lab software system. AMT allow amendment the signal accent system betting on the SNR scenario of the link that supplies freedom to the WiMAX system to choose either PSK or QAM. The WiMAX system doesn't want a fixed scheme that's planned for the worst case things whereas cyclic prefix is additional so as to reduce the inter symbol interference that occurs in multipath channels and to enhance the bit error rate. WiMAX technology is considered one amongst the most prominent solutions capable of supplying a Broadband Wireless Access in metropolitan areas. This paper concludes the options and characteristics of WiMAX and also the protocol IEEE 802.16 is additionally represented.

REFERENCES

[1]. Deepak Pareek, "WiMAX: Taking Wireless to the MAX," Auerbach Publications, 2006.

[2]. Jiang T., Wu Y., "An Overview: Peak-to-average power ratio reduction techniques for OFDM signals‖, IEEE Transactions on Broadcasting, vol. 54, no. 2, pp. 257–268, Jun 2008 .

[3]. R. Prasad, "Introduction" in OFDM for Wireless Communications Systems, London, United Kingdom: artech House, 2004, pp. 11-14.

[4]. Kumar, "Introduction to Broadband Wireless Networks" in Mobile Broadcasting with WiMAX: Principles, Technology and Applications, New York, USA: Focal Press, 2008, pp. 24-50

[5]. S. J. Vaughan-Nichols, "Mobile WiMAX: The Next Wireless Battleground," in IEEE Comp. Soc. Mag. vol. 41, Jun. 2008, pp. 16-18.

[6]. Rajesh R. Bhambare, Dr. Rajeshree D. Raut, "A Survey on Digital Modulation Techniques for Software Defined Radio Applications", International Journal of Computer Networks and Wireless Communications, ISSN: 2250-3501, Vol.3, No3, June 2013.

[7]. Muhamad Islam, M. A. Hannan, S.A. Samed , A. Hussain, "Bit-Error- Rate for modulation technique using software defined Radio", International conference on electrical Engineering and Informatics,5-7August 2009,Malaysia,pp.445-447.

[8]. Jagdish D. Kene Dr. Kishor D. Kulat, "Performance Optimization Of Physical Layer Using Turbo Codes: A Case Study Of Wi-Max Mobile Environment", International Conference on Emerging Technology Trends in Electronics, Communication and Networking, IEEE, 2012.

[9]. Aldrian Tarniceriu, Bogdan Iordache, "An Analysis on Digital Modulation Techniques for Software Defined Radio Applications", Semiconductor Conference, 2007, International CAS Oct. 15, 2007, Volume 2, pp.571-574.

[10]. Kahveci, S., "Performances of Zigzag coding with high-level modulations on Wi-MAX system," Signal Processing and Communications Applications Conference (SIU), 2012 20th, vol., no., pp.1, 4, 18-20 April 2012.

[11]. Amir R. Forouzan, Lee M. Garth, "Novel Orthogonal Codes for Spectrally-Encoded OFDM Systems in Fading Channels, 2011.

[12]. Paz Portela, N.A.; Rodriguez Diaz, B., "Performance Comparison between the Air Interfaces of LTE and Mobile Wi-MAX," Latin America Transactions, IEEE (Revista IEEE America Latina), vol.11, no.4, pp.1001, 1006, June 2013.

[13]. Rakesh Kumar Jha, Idris Z. Bholebawa, Upena D. Dalal," Location Based Performance of WiMAX Network for QoS with Optimal Base Stations (BS)", Wireless Engineering and Technology, Volume 2, No.3, July 2011.

[14]. Askar, S. Raweshidy H.S. ,"Performance evaluation of IEEE802.16-2004 Wi-MAX with fixed high fading channels," Wireless and Microwave Technology Conference (WAMICON), 2011 IEEE 12th Annual , vol., no., pp.1,6, 18-19 April 2011. 0.2,pp. 91-93, 2006.

[15]. P Omprakash, R Sabitha ," Performance Analysis of TCP Over Wimax", Electronics Computer Technology (ICECT), 2011 3rd International Conference on ,Volume 6 2011.