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Performance Analysis of MC-CDMA Based Fixed Wimax Technology By RS Encoder For Different Modulation

B.vinodh kumar[1], Arulpugazhendhi.M[2], A.Arul[3],
[1,3]PG Student, [2]Assistant Professor,IFET College of Engineering,Villupuram

Abstract–
WIMAX(worldwide interoperability for microwave access) is next generation high speed wireless technology provides long distance transmission .Generaly WIMAX is OFDM based architecture standardised by IEEE 802.16.Our aim to analyse the performance of Wimax in MC-CDMA(multi carrier code division multiple access) for RS encoder under various modulation techniques.The performance is tested in matlab simulation.The simulation results shows significant performance improvement in MC-CDMA over OFDM and the comparism is based on BER performance under various modulation scheme for Reed solomon encoder.It is shown that wimax based MC-CDMA outperforms OFDM techniques.
Index terms - Wimax, RS encoder,OFDMA,MC-CDMA,BER

I. INTRODUCTION

WiMAX is similar to Wi-Fi but at very fast speeds provide long distance transmission.Wimax is further divided into types – fixed wimax and mobile wimax.Physical structure of fixed station and mobile station. Wimax standard is defined in IEEE 802.16. Wi-Fi typically provides local area network access covers a few hundred feet with speeds of upto 64 Mbps, a single WiMAX transceiver is expected to have a wide range of area that fixed wimax can provide internet service over 60 Km distance with a speed of 1 Gbps high data rate at motionless condition where 100 Mbps under vehicular condition. WiMAX uses Orthogonal frequency division multiple access (OFDM) as a multiple access technique.

The general objective of the next generation of wireless technologies will be multimedia services such as audio, video, internet services at high very high speed with high mobility, high capacity and high Quality of services.There are many techniques to fulfill this requirement.One of the most promising technique nowaday is OFDMA.OFDM is to split the signal bandwidth into a large number of multi subcarriers so that it can support high data rate transmission over frequency selective channel and intersymbol interference can be reduced by symbol interval.

A difference of OFDM is Multi-Carrier Code Division Multiple Access (MC-CDMA) which is an OFDM technique where the individual data symbols are spread using a spreading code in the frequency domain. The spreading code connected with MC-CDMA provides multi access technique as well as interference suppression.In recent years, MC-CDMA is considered as one of the promising modulation technique for 4G. Its advantages are based on the combination of OFDM with CDMA.CDMA provides multiple access capability.The principle of multi-carrier transmission is to convert a serial high rate data into multiple parallel low rate sub data. Since the symbol rate on each sub-carrier is much small than the initial serial data symbol rate so that the effects of ISI significantly decrease.

In this paper, Reed Solomon encoder is choosen as a platform for analyzing purpose .The rest of this paper is organized as follows. In Section II, block diagram of MC-CDMA is briefly described. In Section III, reed solomon encoder. In Section IV, the effectiveness of the proposed scheme is evaluated with simulation . In Section VI, the conclusions are given and performance is analyzed

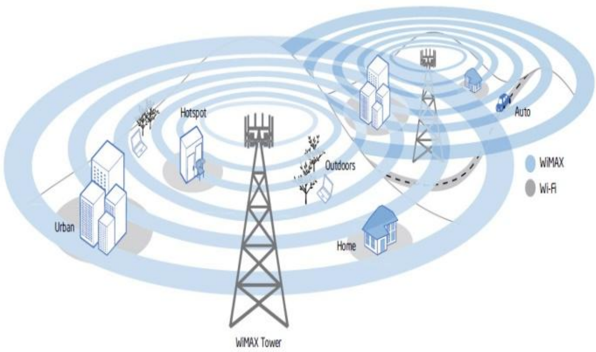

Fig 1. Wimax transmission

II. MC-CDMA BASED WIMAX

In transmitter,random discrete data is generated with a stream of input data bits. These discrete data are encoded , mapped and optionally interleaved. The modulated symbols and the corresponding pilot symbols are multiplexed to form a frame . The resulting symbols after framing are multiplexed and multicarrier technique . The

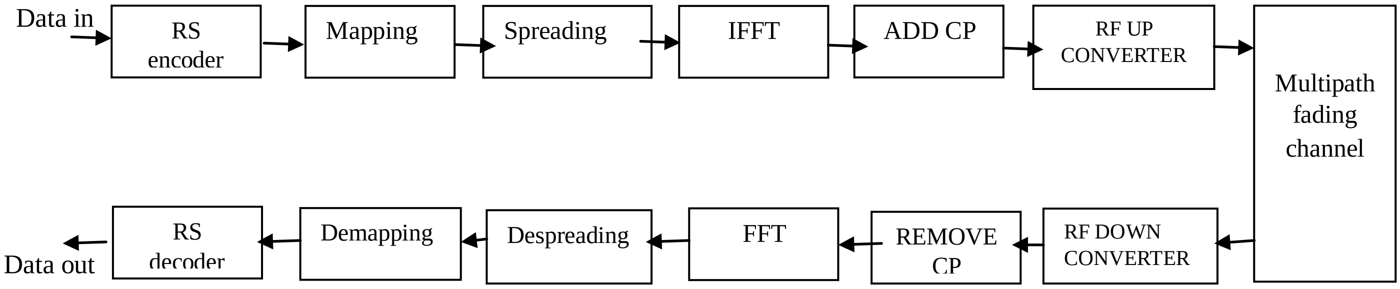

Fig 2. Block Diagram of Wimax for MC-CDMA

modulated signal is passed through inverese fast fourier transform(IFFT) that convert signal from frequency into time domain.Finally after cyclic prefix ,signal is forwarded to the high power amplifier through a physical interface with digital-to-analog (D/A) conversion.

The reception operation starts with receiving an analog signal from the high power amplifier trough SUI wireless channel The analog-to-digital converter (A/D) converts the analog signal to the digital signal. In receiver side , cyclic prefix is removed before passing through fast fourier transform.After multi-carrier demodulation and deframing, the extracted pilot symbols are used for channel estimation and synchronization. After optionally deinterleaving, despreading and demapping, the channel decoder corrects the channel errors to guarantee data reliability. Finally, the received data bits are forwarded to the higher protocol layer for processing. Now, it is suitable to analyze the spreading codes that can be used in MC-CDMA system. Various spreading codes exist which can be distinguished with respect to orthogonality, correlation properties, implementation complexity and peak-to-average power ratio (PAPR). The selection of the spreading code depends on the scenario and performance of MC-CDMA is enhanced more when spreading factor increases.

III. REED SOLOMON ENCODER

Reed Solomon(RS) codes are block based error correcting codes with a wide range of applications in digital communications,satellite communications and storage deices etc. The randomized data are arranged in block format before passing through the Reed Solomon encoder. The properties of Reed Solomon error correction code make them suitable to applications where errors occur in bursts. Reed Solomon error correction is a coding scheme which works by first constructing a polynomial from the data symbols to be transmitted, and then sending an Oversampled version of the polynomial instead of the orginal symbols .The error correction ability of any RS code is determined by (N – K) is that the measure of redundancy in the block If the location of the erroneous symbols is not known in advance, then a Reed-Solomon code can correct up to T symbols, where T can be expressed as T= (N – K)/2 where N is number of bytes after encoding ,K is number of data bytes before encoding and T is number of data bytes that can be corrected.

The input of the RS encoder block defined by simulation is specified to be a vector whose length is an integer multiple of l n' , being l the length of the binary sequences corresponding to elements of the Galois field . The function rsencoder , given in the appendix, performs the cited encoding. In the receiver, the function RS decoder performs the inverse operation and the output, a vector whose length is the same integer multiple of l n'. Therefore, the first step to implement is to divide the data vector in a number of blocks whose length fits the requirement quoted above. At the same time, it has to be taken into account that the number of data bytes before encoding k' , the number of overall bytes after encoding n' and the number of data bytes that can be corrected t' and they change for every modulation scheme .

IV.SIMULATION RESULTS

The performance of MC-CDMA based wimax is analysed under various modulation techniques such as quadri phase shift key(QPSK), 16 QAM,64 QAM with reed solomon encoder.Here performance is characteristed in terms of bit error rate which is the ratio of number of bits received with error divided by total number of bits is transmitted. Matlab version 2010b is used to analyze the performance of wimax.the results shows MC-CDMA outperforms ofdma in terms of bit eroor rate performance is shown in figure 3,4,5.The numerial results shows that MC-CDMA performs well compared to OFDM where 3db of performance difference in BER rate. The parameters are taken from standard IEEE802.16 which is designed for WiMAX. Here we choose Hadamard code with different spreading code lengths.

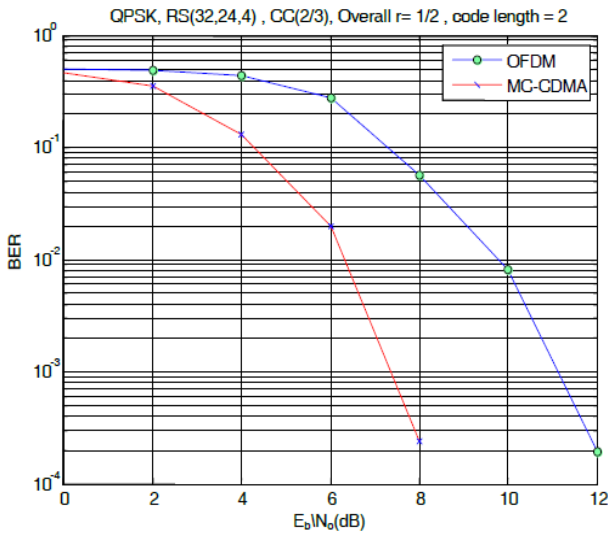

FIG 3. QPSK modulation for OFDM &MC-CDMA

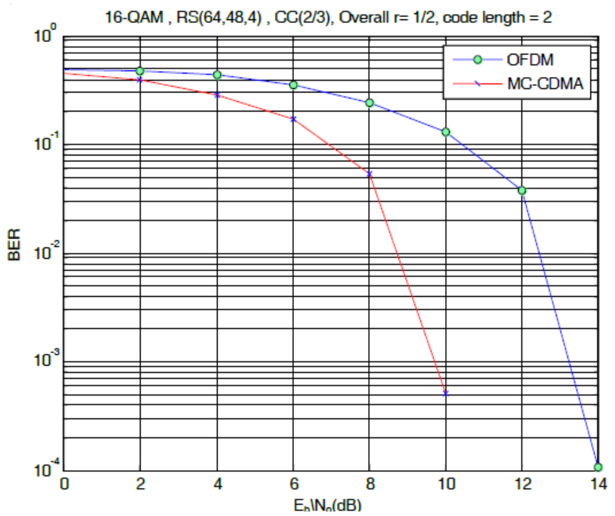

FIG 4 16QAM modulation for OFDM &MC-CDMA

V. CONCLUSION

Wireless technologies are currently limited to some services although it offers high mobility, high data rate and QoS wireless technologies will offer new alternatives. Offering a trade-off between coverage, data rate, and mobility with a generic air interface architecture is the primary goal of the next generation of wireless systems (4G). Besides the introduction of new technologies to cover the need for higher data rates and new services, the integration of existing technologies in a common platform is an important objective of the next generation of wireless systems .The simulation result based on different technique for BER calculation was observed in the simulation. The modulation techniques used in the WiMAX are QPSK, 16-QAM and 64-QAM respectively. The results shows MC-CDMA outperforms OFDMand performance also improved.

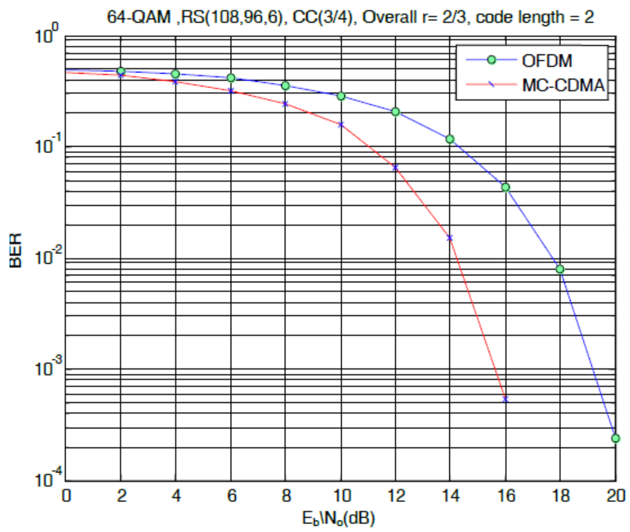

FIG 5. 64QAM modulation for OFDM &MC-CDMA

REFERENCES

[1] Thenmozhi1, K., Varadarajan, R. and Prithviraj, V. (2006) MC-CDMA promises wireless broadband beyond 3G, India :Electronic Engineering Times-Asia.

[2] WiMAX Forum (2006), Mobile WiMAX – Part 1: A Technical Overview and Performance Evaluation, WiMAX Forum.

[3] Nee R., V. and Prasad, R. (2000) OFDM for Wireless Multimedia Communications, 1stedition , London : Artech House Publishers.

[4] Proakis, J. (1995) Digital Communications , 2nd Edition, New York : McGraw-Hill.

[5] J. Cimini, L. (1985) Analysis and Simulation of a Digital Mobile Channel Using Orthogonal Frequency Division Multiplexing, IEEE Trans. Commun., vol. 33 No. 4: pp. 665-675.

[6] International Engineering Consortium (2003) , http://www.iec.org/online/tutorials/smart_ant/topic01.html. Smart Antenna Systems,

[7] MIMO-OFDM Wireless Communications with MATLAB -2010 Wiley publcations

[8] B. Kamali, . (2012) Understanding Wimax : An IEE-802.16 Standard-Based Wireless technology, IEEE Trans. Commun., vol. 31 No. 5: pp. 23-27.

[9] R. Raulefs, A. Dammann, S. Sand, S. Kaiser, and G. Auer, "Rotated Walsh-Hadamard Spreading with Robust Channel Estimation for a Coded MC-CDMA System," EURASIP Journal on Wireless Communications and Networking, pp.74–83, 2004.

[10] L. Nuaymi, WiMAX: Technology for Broadband Wireless Access.Chichester, U.K.: Wiley, 2007.

[11] Amendment to IEEE Std. 802.16-2009, IEEE Std. 802.16m-2011,May 2011.

[12] http://archive.org/28/items/AnalysisAnd SimulationOfMccdmaSystemForWimax TechnologyIeee802.16/ thesis