BER And Gain Analysis of IEEE 802. 16 Standard For Broadband Wireless Access (BWA) In 64-QAM Modulation Technique In 2x2, 3x3 And 4x4 Antenna Diversity

Abhishek Kumar[1], Jitendra Singh Dodiya[2]
[1]Dept of EC
[2]Assistant Professor, Dept of EC
[1, 2] VITM Indore (M.P.)

Abstract- *WiMAX (Worldwide Interoperability for Microwave Access) physical layer is basic of 3G and 4G wireless communication Technology. This technique gives rise to the advanced technique. So in this thesis we are going to estimate the BER and SNR analysis of Wi-MAX Physical layer in 2x2, 3x3 and 4x4 symmetrical antenna diversity like n transmit antennas and n receive antenna in 64-QAM modulation technique. For this first we made the MCCDMA system that is basically a multicarrier system for high speed data rate transmission. And finally we merge this system to MIMO diversity for multiple transmit and multiple receive antennas to enhance the capacity of system. So result shows that if we increase the antenna diversity we get lower BER at and higher SNR that leads to enhance the system capability. In this thesis for MIMO implementation ZF equalization technique is used for transmitting for multiple transmit antennas and OSTBC code is used to determining the signals without knowing the channel state information at the receiver end.*

Keywords- CDMA, OFDM, MISO, MIMO-MC-CDMA and MC-CDMA.

I. INTRODUCTION

After learning the performance estimation of MIMO-MC-CDMA w.r.t MC-CDMA [9] results confirm that MC-CDMA carry out well as contrast to MIMO MC-CDMA while the performance analysis of MIMO-MC-CDMA in unusual antenna diversity along with different modulation techniques [12-20] that stimulate us to study on convolution encoder by means of ZF detector in MIMO-MC-CDMA in unusual diversity of antenna seeing that in different modulation techniques. So there is profusion of extent of study for MIMO-MC-CDMA since we perceive lots of research scholars persons are working on the a assortment of detection schemes, a variety of diversity schemes, a assortment of number of equalizers execution by means of different encoding method, a multiplicity of number of FEC coding is used in MC-CDMA via means of MIMO, diverse space time encoding assessment, performance estimation in diverse channels, and so on. MIMO-MC-CDMA clutch a enormous operational area for researchers within there is abundance of scope for study in this area. If we are employing MIMO-MC-CDMA in function phase it can be erudite as the physical layer of WiMAX which is a superior expertise in wireless communication in addition contains plenty of variable furthermore researchable parameters for future study.

So in this concept we had from side to side the performance analysis of Wi-max physical layer in Rayleigh fading channel in assorted modulation techniques, in different antenna diversity technique in multi-user implementation through the ZF-STBC block encoding scheme is utilized in QPSK modulation technique which shows better results than preceding references.

II. THEORETICAL BACKGROUND

2.1. Wi-max physical layer

This particular chapter deals with the construction of the indispensable signal model for the downlink MIMO-MC-CDMA system, and also to current receiver model. These mainly consist of the chip moreover symbol level linear along with OSIC receivers.

2.1.1 Transmit Signal Model

Let us assume the singular lonely channel downlink MIMO-MC-CDMA sent model by with the help of Nu amount of users as displayed. The input signal data are mixed into Nt sub-streams and afterward every sub-stream is conceal as well as modulated for P symbols.

The un-coded symbol matrix derelict for user nu (nu = 1,2,...,Nu) is shown as

$$D_{nu} = (d^{1}{}_{nu} d^{2}{}_{nu} \ldots d^{Nt}{}_{nu})^{T} € C^{Nt*P} \qquad (2.1)$$

On that the column vector dntnu stant for the data stream i.e. transmitted from the nt-th antenna (nt = 1, 2, ... Nt), shown as

$$d^{nt}{}_{nu} = \left[d^{nt}{}_{nu,1} d^{nt}{}_{nu,2} \ldots d^{nt}{}_{nu,} P \right]^{T} € C^{p*1} \qquad (2.2)$$

Each of the users are allocated at a amazing spreading code. The spreading series of nu user cited as

$$c_{nu} = [c_{nu,1} c_{nu,2} \ldots c_{nu,G}] € C^{1*G} \qquad (2.3)$$

in which C cited as the spreading code of chip alphabet in addition to G confess the spreading code length. The spreading order is develop to wart the symbols of nu-th user in put in order to silhouette the chip-level transmit matrix

$$S_{n_u} = \left[s_{n_u,1} \quad s_{n_u,2} \quad \ldots \quad s_{n_u,N_s} \right] = D_{n_u} \otimes c_{n_u} \in C^{N_t * N_s} \qquad (2.4)$$

where Ns = P * G that shows to the total of subcarriers. The retaliate CDMA chips of every users are at the i-th subcarriers scrape by:

$$x_i = \left[x_i^1 \quad x_i^2 \quad \ldots \quad x_i^{N_t} \right]^T = \sum_{n_u=1}^{N_u} s_{n_u,i} \in C^{N_t*1} \qquad (2.5)$$

where xint refers to the united chip sent by means of the nt-th antenna in addition to that can be shown as

$$x_i^{nt} = \sum_{n_u=1}^{N_u} s_{n_u,i}^{nt} = \sum_{n_u=1}^{N_u} c_{n_u}, g(i) d_{n_u,p(i)}^{nt} \qquad (2.6)$$

where displayed the nu-th user sent chip by the nt-th antenna at i-th subcarriers. The joint chip order for each transmit antenna is bartered to time domain by using IFFT. The output signal during the IFFT seek the the same method as with the MC-CDMA. In addition to this, the channel is invoke to be the similar with the MC-CDMA system. Other belief does not have channel state information (CSI) at transmitter and so that optimal CSI at the receiver is achieved. It should be shown that if an inter-leaver is functioning for the purpose of MIMO-MC-CDMA system the act will be amend. Because of ensuing chips will be sent from interleaved subcarriers, which has more disparate channel gains. Though for shortness of presentation, the following study are referred for a system without interleaving. It can be able to be just amplify through an interleaved system, that is also used for the simulations.

2.1.2 Receive Signal Model

Let us think the receiver of the chosen user having a Nr received antennas. On obtaining the signal, frequent prefix (CP) is separated and FFT of size Ns is employed. The received signal model at the i-th subcarrier subsequent to FFT is depited as

$$r_i = H_i x_i + n_i \qquad (2.7)$$

in which the received signal is explained by

$$r_i = \left[r_i^1 r_i^2 \ldots\ldots r_i^{Nr} \right] € C^{Nr*1} \qquad (2.8)$$

The AWGN channel vector with σn2 power can be cited as

$$H_i = \left[h_i^1 \quad h_i^2 \quad \ldots \quad h_i^{N_t} \right] = \begin{bmatrix} h_i^{(1,1)} & \cdots & h_i^{(1,N_t)} \\ \vdots & \ddots & \vdots \\ h_i^{(N_e,1)} & \cdots & h_i^{(N_e,N_t)} \end{bmatrix} \in C^{N_e * N_t} \qquad (2.9)$$

$$n_i = \left[n_i^1 n_i^2 \ldots\ldots n_i^{Nr} \right]^T € C^{Nr*1} \qquad (2.10)$$

in which hi(nr,nt) explained the channel feedback via the i-th subcarrier along with the transmit antenna nt and the receive antenna nr (nr = 1,2,...,Nr), and ni represents the Nr * 1 AWGN noise vector via the i-th subcarrier. The received signal as via in equation 3.48 can be additional amplified to

$$r_i = \overbrace{h_i^{nt} s_{n_u,i}^{n_t}}^{desired} + \overbrace{\sum_{n_u' \neq n_t}^{N_t} h_i^{nt} s_{n_u,i}^{n_t'}}^{CAI} + \overbrace{\sum_{n_u' \neq n_u}^{N_t} h_i^{n_t} s_{n_u,i}^{n_t'}}^{MAI\,1} + \overbrace{\sum_{n_u' \neq n_u}^{N_t} \sum_{n_u' \neq n_t}^{N_t} h_i^{n_t'} s_{n_u,i}^{n_t'}}^{MAI\,2} + n_i \qquad (2.11)$$

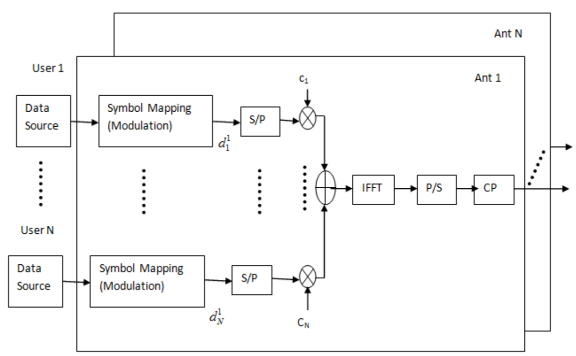

Figure 2.1. WI-MAX transmitter.

III. SIMULATION RESULTS AND DISCUSSION

Table 3.1 characterizes the simulated model parameters of BROADBAND WIRELESS ACCESS in 64-QAM modulation technique in different antenna diversity called symmetric antenna diversity. Figure.3.1. shows performance investigation of BROADBAND WIRELESS ACCESS in 64-QAM modulation scheme, Table 3.2 shows the BER as well as gain comparison in 64-QAM results shows that 4x4 antenna diversity have very low BER as well as high gain in comparison to all other modulation technique. This gain estimate is done in -5-dB SNR given that at 5-dB BER of 4x4 antenna diversity attained to 5-dB so high performance is attained in 4x4 antenna diversity. Figure.3.1 shows BROADBAND WIRELESS ACCESS in various number of antenna diversity. For 3G and 4G wireless communication to look up system recital we use BROADBAND WIRELESS ACCESS procedure for attaining high performance in 64-QAM modulation technique.

Table.3.1. Summary of simulated model constraint.

No. of bits transmitted by user	1560
No. of transmitting and receiving antennas	2x2,3x3,4x4,5x5,6x6
Modulation Schemes	64-QAM
Signal detection scheme	Zero forcing
Channel	Rayleigh Fading Channel
Signal to Noise Ratio	-10dB to 20 dB
CP Length	1280
OFDM Sub-carriers	6400
No. of bits transmitted by user	1560

Table.3.2. Performance analysis of wi-max physical layer in various number of antenna diversity in terms of gain w.r.t 2*2 antenna diversity at -5dB SNR:

Antenna Diversity in QPSK	**BER**	**Gain w.r.t 2 by 2 in dB**
4x4	0.2735	2.258
3x3	0.2899	1.75
2x2	0.3547	0

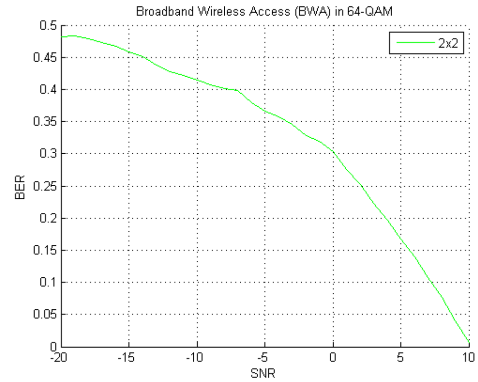

Figure.3.1. BER analysis of 2by2 wi-max physical layer in 64-QAM.

Above results shows OSTBC 64-QAM modulation technique performance estimation in 2by2 antenna diversity that represents the superior results that the BER completed at 10dB of SNR that present enhanced error handling capabilities correspond to MIMO-MCCDMA systems.

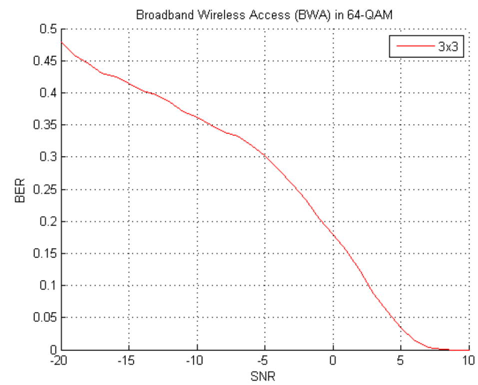

Figure.3.2. BER analysis of 3by3 wi-max physical layer in 64-QAM.

Above graph illustrate the 64-QAM modulation technique for 3 by 3 antenna diversity, the performance estimation that represents the superior results that the BER finished at 7 dB of SNR that offer better error handling capabilities than 2 by 2 represented by 3 by 3 MIMO-MCCDMA systems.

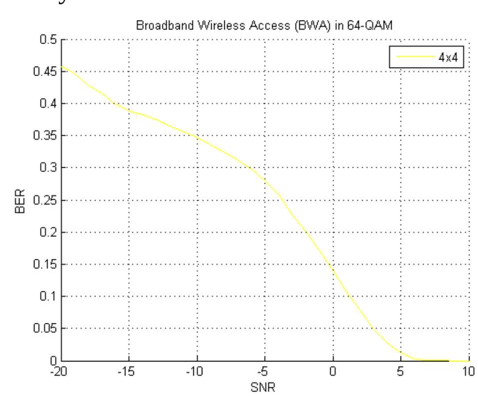

Figure.3.3. BER analysis of 4by4 wi-max physical layer in 64-QAM.

Above graph illustrate the 64-QAM modulation technique for 4 by 4 antenna diversity, the performance estimation that represents the greater results that the BER finished at 6dB of SNR that offer better error handling capabilities than 64-QAM represented by 3 by 3 MIMO-MCCDMA systems.

IV. CONCLUSION

Results provides evidence the qualified assessment of BER and Gain Analysis of IEEE 802. 16 standards for Broadband Wireless Access (BWA) in 64-QAM Modulation technique in Different Symmetrical Antenna Diversity that according to the proportional analysis for distorted modulation techniques which prove that as higher order antenna diversity is superior than before after that there is increase in BER. This proposition aims to weaken bit error rate which is correspond to 64-QAM modulation at 4x4 antenna diversity arrangement at the gain of 2.258dB with approbation to 2by2 antenna diversity that prove that the gain of 4x4 diversity is finer as contrast to former antenna diversity technique with a slighter quantity of error. For 3G, 4G and 5G communication higher order antenna diversity is make use of that surround BER up to 5dB, that means errors are apart in 4x4 at 5dB of SNR that marks by means of 64-QAM Wimax Physical layer system. In conclusion 64-QAM MIMO-MC-CDMA present optimized output as match up to the other diversities in 4x4 diversity practice that is mainly employed for 3G & 4G wireless communication.

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