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Analyses of SNR Threshold for Minimum BER in Various Modulations Schemes and Development Of an Adaptive Modulation Scheme

Manish Dangi
M.Tech. (Digital communication) Final Yr
Shrinathji Institute of Technology & Engineering
PO-Nathdwara, Dist-Rajsamand (Raj)

Dr. Mahesh Kumar Porwal
Professor - ECE Department
Shrinathji Institute of Technology & Engineering
PO-Nathdwara, Dist-Rajsamand (Raj)

Abstract –The WiMAX is much easier to deploy and have long range of coverage and easy to access and flexible. It is based on IEEE 802.16 standards that help to solve the connectivity problems. But the characteristic of channel is not constant from SNR point of view due to fading; it blocks the signal and creates several signal paths known as multi path. When SNR of channel is low we get higher BER at receiver. We can overcome this problem by switching between modulation schemes. But main problem is when to switch over to next modulation scheme.Various modulation schemes are being used as BPSK, QPSK, 16QAM & 64QAM.Adaptive modulated system is superior to fixed modulated systems, since it adopt best modulation order depending on instantaneous channel SNR. In adaptive modulation scheme system,SNR estimation is important as performance of adaptive modulated system depends on estimated SNR.

Our objective in this paper is to find at what SNR what modulation scheme will give least BER. This way we can later develop adaptive modulation scheme, which will give low BER noise at receiver in compromise with high quality of video.

I. INTRODUCTION

WiMAX is presented by the Institute of Electrical and Electronic Engineers (IEEE) which is standard assigned 802.16d-2004 and it is utilized in fixed wireless provisions and 802.16e-2005 (mobile wireless) to give an overall interoperability to microwave access. Presently telecom commercial enterprises are exceedingly concerned with the wireless transmission of information which can utilize different transmission modes like from point to-multipoint connects and a lot of more. It holds full mobile web access.IEEE 802.16e-2005 has been produced for versatile wireless correspondence which is focused around OFDM innovation and this empowers going towards the 4g portable later on [4]. In our theory work we fabricated a reproduction model focused around 802.16 OFDM PHY baseband and exhibited in distinctive recreation situations with diverse tweak methods, for example, BPSK, QPSK and QAM (Both 16 and 64) to discover the best execution of physical layer for WiMAX Mobile framework. All important conditions were executed in the reproduction as per the 802.16e OFDMA-PHY determination. The Orthogonal Frequency Division Multiplexing (OFDM) is used to transmit high data rate and can deal with multi carrier signal. It can minimize the Inter Symbol Interference (ISI) with better efficiency than other multiplexing techniques [5]. It is more probable enhanced Frequency Division Multiplexing (FDM) as FDM utilization guard band to minimize interference between different frequencies which squanders bunches of data transfer capacity yet OFDM does not contain inter-carrier guard band bands which handle the interference more effectively than FDM. Along these lines, this is the ideal decision for WiMAX as it can help to fulfill the prerequisites of productive utilization of spectrum and minimize the transmission cost. On top of that OFDM handles multipath impact by converting over serial data to a several parallel data utilizing Fast Fourier Transform (FFT) and Inverse Fast Fourier Transform (IFFT).The commotion channel AWGN noise, Rayleigh fading in channel, data randomization techniques, IFFT and FFT.The channel estimation subsystem extricates the pilot information embedded before transmission and contrast and unique pilot information [7]. In course of examination the estimator ascertains the change in increase and periods of pilot images and from these evaluated qualities the addition and period of information is balanced [7].

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Channel characteristic are varies frequently from SNR point of view. When SNR of channel is low we get higher BER at receiver. So wecan overcome this problem by using adaptive modulation scheme [1]. But main problem is when to switch over to next modulation scheme. We have to get SNR valves for each modulation scheme when BER is lower. That means to calculate rang of SNR of channel at which specific modulation scheme is to be used for lower BER. So we calculate SNR valves for all modulation scheme when BER is low. By doing this we will get SNR range where BER is low for each modulation schemes [2].

Main objective of this paper is to measure BER at different SNR of channel for each modulation scheme for estimation of SNR threshold for Adaptive modulation schemes [6].

II. METHOD AND MODEL

We developed our simulation model for investigating physical layer performance of IEEE 802.16e (WiMAX communication model) using Simulink tool of Matlab 2010.

We use channel estimation in this model for to adopt modulation scheme in OFDM. For channel estimation some bits are transmitted along with message signal. These bits helps to calculate the SNR of channel. We use feedback channel to use appropriate modulation

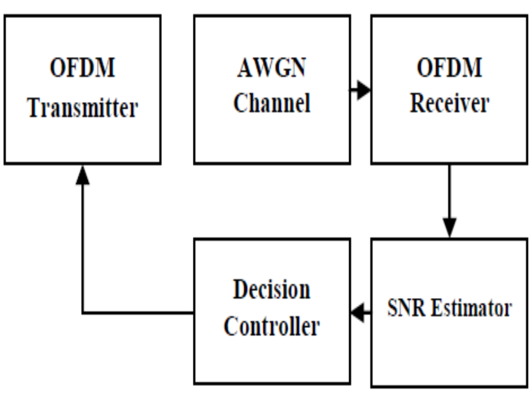

Fig1 Block diagram of model

III. SIMULATION MODEL

In this model at transmitter data is transmitted at fixed

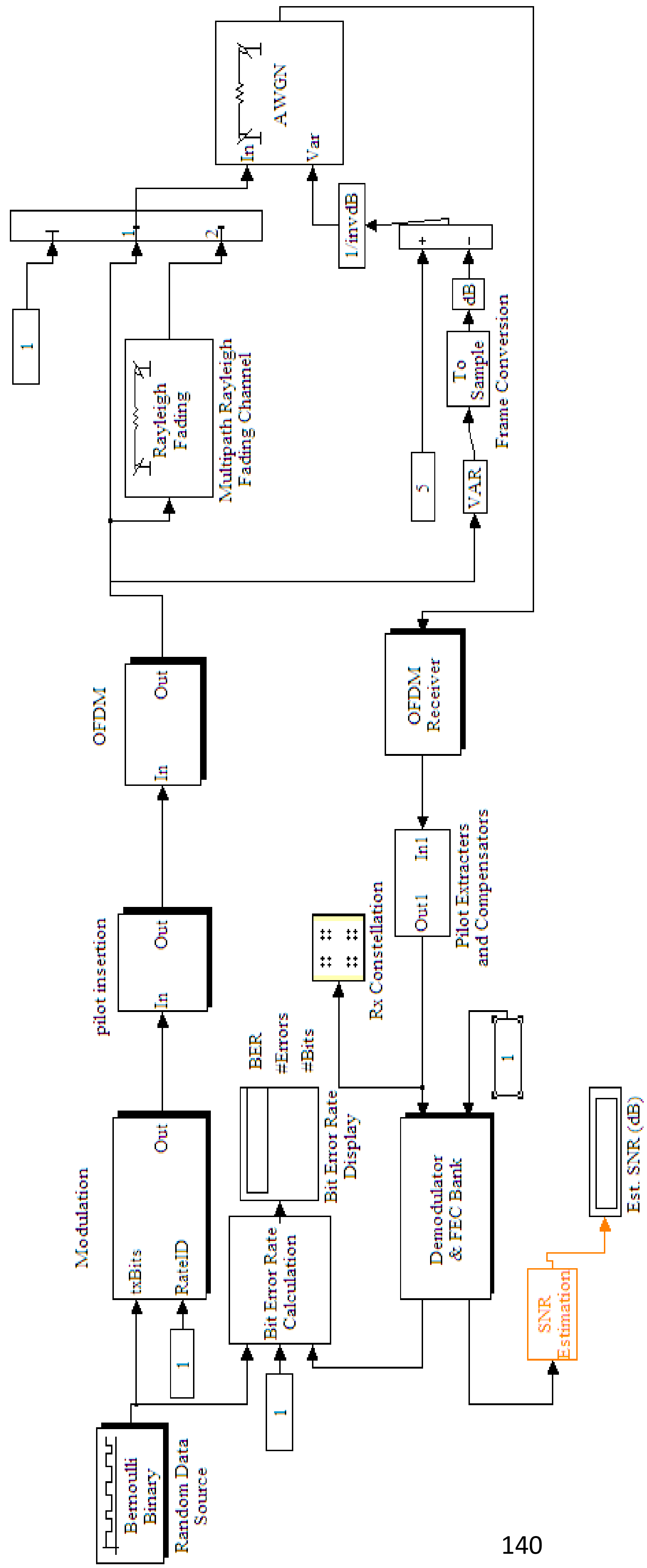

Fig2 Simulation model

The output of fading channel is passing through the AWGN block .We change the SNR of block from 5 to 30 for every modulation scheme and o/p of AWGN is demodulated and finally given to the error rate calculation block. We have taken different modulation scheme named as BPSK, QPSK ½, QPSK ¾, 16QAM 1/3, 16 QAM 2/3, 64QAM2/3, 64QAM3/4 and our result consist of scatter plots, BER values at different SNR for energy modulation scheme.

We analyzed different scatteringplot obtains for each modulation scheme. We have shown scatter plot at different SNR vary from 5 to 30 at an increment of 5dB without considering Rayleigh fading [3].We can see that scattering of the symbol reduces as noise power decreases and we can say that we are decreasing at higher SNR.

In Model our input data is random data source generated using Bernoulli generator block having sample time 8.3333e-008 and sample per frame 864.The Bernoulli generator block pass to the monitor it consist of 3 main operations conclusion coding,interleaving and modulation using PSK mapping. Data generated from Bernoulli generator is padding by zero's to construct the frame 64 prior to encoding [3].

The encoder consist of the poly2trellis structure having specification.It represent that, this encoder will generate to 2 encoded schemes as per the octal number representation of 177,133 XOR gate connection [8].

In this way after encoding, we get the packet of bits 1048 that is double of size of packet bits. For interleaving, the number of subchannel are taken as 16 with Ncbps=192 and Ncpc=1.These interleaving signals are pass through the BPSK modulation having the output packet size.

Parameters used in Simulink design are as follows

FFT size =256

Band width=10 MHz

Fs=11.2 MHz

Right guard interval=27

Left guard interval=28

Data subcarrier=192

Pilot subcarrier=8

Null subcarrier=56

Cyclic prefix=1/8

Channel B.W. for fixed WiMAX= 3.5 MHz

Symbol time=64 micro sec

Symbol duration=72micro sec

Guard time spacing=15.625 kHz

After modulation, signal is pass through multipath simulinking path specification in model. The o/p of fading channel is passing through the AWGN block. We have change the SNR of block from 5 to 30 for every modulation scheme and o/p of AWGN is demodulated and finally given to the error rate calculation block.

We have taken different modulation scheme named as BPSK, QPSK ½, QPSK3/4, 16QAM1/3, 16 QAM ¾, 64QAM2/3, 64QAM3/4 and our result consist of scatter plots, BER values at different SNR for energy modulation scheme [3].

IV. RESULT AND DISCUSSION

We have developed simulation model of WiMAX where channel estimation is done. Motive of this paper and model is to range of SNR for each modulation scheme and define thresholdfor SNR for each modulation scheme so it can be used in adaptive modulation scheme.

So in our result we can see BER at different SNR of channel for different modulation schemes, for both with fading and without fading. Now we get the range of SNR for each modulation scheme to achieve least BER at receiver for adaptive modulation scheme.

BER at different SNR:

Table1: Performance of system with OFDM without fading

SNR	5	10	15	20	25	30
BPSK	**0**	**0**	**0**	**0**	**0**	**0**
QPSK1/2	**0.0541**	**0**	**0**	**0**	**0**	**0**
QPSK3/4	**0.3296**	**0.00067**	**0**	**0**	**0**	**0**
16QAM1/2	**0.4875**	**0.2175**	**0.09634**	**0**	**0**	**0**
16QAM3/4	**0.495**	**0.4323**	**0.01349**	**0**	**0**	**0**
64QAM2/3	**0.4976**	**0.4922**	**0.3755**	**0.0075**	**0**	**0**
64QAM3/4	**0.5013**	**0.4999**	**0.4493**	**0.04266**	**0**	**0**

Table2: Performance of system with OFDM with Fading

SNR	5	10	15	20	25	30
BPSK	**0.3034**	**0.4372**	**0.5164**	**0.5429**	**0.552**	**0.3789**
QPSK1/2	**0.4928**	**0.5063**	**0.4988**	**0.5004**	**0.3486**	**0.4939**
QPSK3/4	**0.498**	**0.4978**	**0.5006**	**0.4978**	**0.3914**	**0.4285**
16QAM1/2	**0.498**	**0.5005**	**0.497**	**0.4977**	**0.506**	**0.4997**
16QAM3/4	**0.528**	**0.4963**	**0.502**	**0.4993**	**0.5023**	**0.5032**
64QAM2/3	**0.4999**	**0.5006**	**0.4994**	**0.4999**	**0.4999**	**0.5009**
64QAM3/4	**0.4999**	**0.4985**	**0.5015**	**0.5034**	**0.5019**	**0.5003**

Table 3: Range of SNR for each modulation scheme

SNR Range	Modulation scheme
5-9	BPSK
10-14	QPSK½
15-19	16QAM1/2
20-24	64QAM2/3
25-30	64QAM3/4

V. CONCLUSION

In this paper we design a Simulink Model for WiMAX for estimation of range of SNR of channel for each modulation scheme which offer minimum range of BER at receiver. In this model we changed SNR valve by manually we increase of 5 dB at per step. By this model we check BER for each modulation scheme at different SNR of channel and finally based on our observation we get range of SNR for each modulation scheme to achieve least BER at receiver.

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