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Performance Evaluation of WIMAX System Using QPSK Simulation and Rayleigh (NLOS) Multipath with Added AWGN

Joydev Ghosh[1], Abhishek Dey[2], Somnath Yadav[3]
[1]The New Horizons Institute of Technology, Research and Development Lab. Durgapur, W.B, India
[2]Bengal College of Engineering and Technology, Electronics and Comm. Engg. Dept. Durgapur, W.B, India
[3]The New Horizons Institute of Technology, Research and Development Lab. Durgapur, W.B, India

Abstract
In modern world, wireless communication systems are involved in every part of life. WiMAX is the upcoming wireless system which uses IEEE standard 802.16.By using WiMAX technology we can overcome the limitations of the existing wireless communication like short coverage area, lack of security and low data rate. In my thesis, initially I analyzed the basic concept of WiMAX. Then we have work on the improvement BER at different SNR of WIMAX system using MATLAB simulation.
Keywords-Wimax; QPSK; NLOS; AWGN.

I. Introduction

WiMAX, the Worldwide Interoperability for Microwave Access, is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access. It is a wireless digital communications system that is intended for wireless "metropolitan area networks". Existing "Area Networks" for wireless communications:

•***Personal (PAN),*** up to a few meters. It requires simple "thumb like" transmitters' receivers.
Typical: Bluetooth.

•***Local (LAN),*** up to 300m. It requires simple "box like" devices. Typical: Wi-Fi (IEEE802.11)

•***Wide (WAN),*** up to a few miles. It requires towers and cellular technology. Typical: W-CDMA, CDMA 2000, UMTS …

IEEE 802.16 (WiMax) are possible future technologies for WAN.

The IEEE has divided the WiMax system into two groups.

1) Fixed WiMax (IEEE 802.16d-2004)
2) Mobile WiMax (IEEE 802.16e-2005)

1) Fixed WiMax: **-** Fixed WiMax supports fixed and nomadic applications. This is operating in frequency band of 2 GHz to11GHz and provides the transmission rate upto 75 Mbps for the distance of approximately 30 miles (50 kms). In this type of WiMax a Single-Carrier (SC) modulation technique is used.

2***) Mobile WiMax:***-Mobile WiMax (IEEE 802.16e-2005) supports fixed, nomadic, mobile and portable applications. This is operating in frequency band of 2 GHz to 6 GHz and provides the data rate up to 75 Mbps over a distance of approximately 10 miles (15kms). In mobile WiMax, Multi-carrier modulation technique (Orthogonal Frequency Division Multiplexing) is used at physical layer.

II. Simulation Analysis

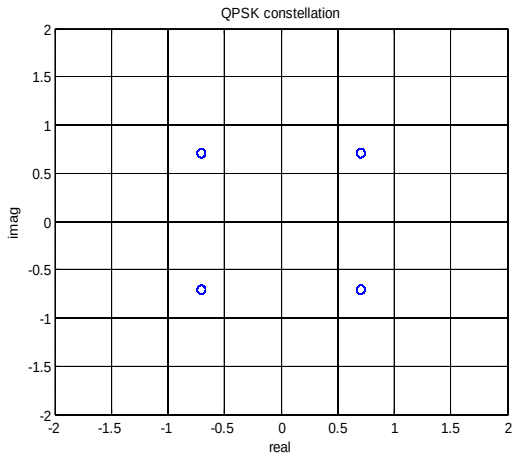

Fig.1 QPSK constellation

The purpose of this m-file is to show a baseband simulated version of QPSK with Gray coding (Rayleigh multipath and AWGN added) which may give valid results (still trying to figure out if this program is correct-multipath so subjective) .when compared to theoritical/simulated AWGN QPSK analysis SER and BER.The simulation assumes a single channel (no diversity or FEC codes other than Gray) perfect system with perfect synchronization and no intersymbol interference. The program contains no Root Raised Cosine or Raised Cosine filters as they would just add delay.

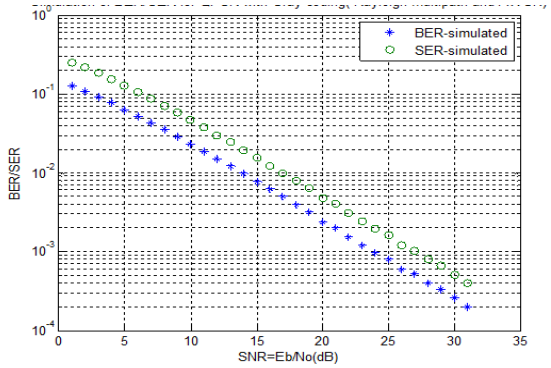

Fig.2 Simulation of BER/SER for QPSK with gray coding(Raleigh multipath and AWGN)

I hope it will be useful to others to play with and give a basic understanding of the problems encountered in the channel with various types of multipath. What this all proves is that you need at least 17 dB of fade margin at 10-3 BER with Rayleigh multipath when comparing only with AWGN at SNR of 7 to 8dB .

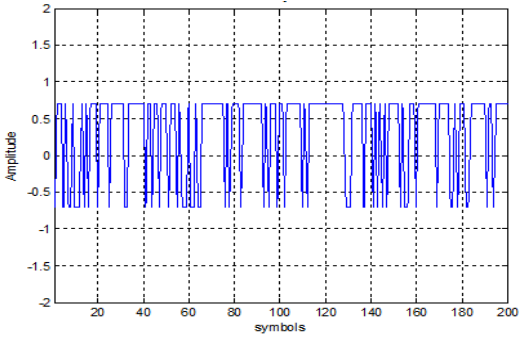

Fig.3 QPSK symbol

Of course we can lower this with antenna diversity, FEC codes etc. The resulting QPSK symbol is complex-valued, where one of the two bits in each QPSK symbol affects the real part (I channel) of the symbol and the other bit the imaginary part (Q channel).

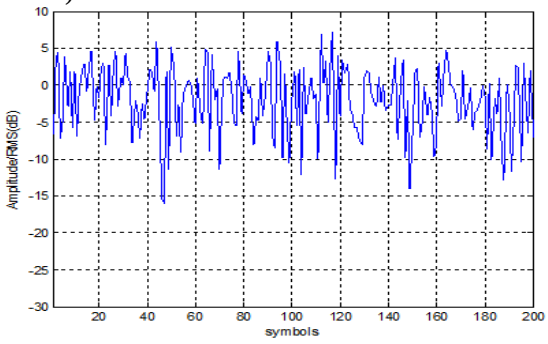

Fig.4 Rayleigh fading envelope (vari-ance=0.5)

Each part is subsequently modulated to form the complex-valued QPSK symbol.

III. Simulation Result

Each part is subsequently modulated to form the complex-valued QPSK symbol. This simulation is performed using MATLAB R2010a on an Intel(R) core(TM) i3 CPU M370 @2.40 GHz processor using Windows 7 home basic operating system.

Input:

b = bits {0, 1} to be mapped into QPSK symbols

Output:

d = complex-valued QPSK symbols 0.70711 + 0.70711i, etc

IV. Conclusion

The range and the Non Line of Sight (NLOS) ability of WIMAX make the system very attractive for users, but there will be slightly higher BER at low SNR.WIMAX defines a selectable channel bandwidth from 1.25 MHz to 20 MHz. In this paper, we have studied the improvement BER at different SNR of WIMAX system

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