OUTDOOR PROPAGATION PREDICTION FOR WiMAX(802.16a) SIGNALS

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This work is dedicated to my beloved parents,
my sisters, my friends and all my
teachers who helped me to become who I'm.

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ABSTRACT

Wireless networks have emerged as a powerful architecture, capable of supporting the requirements of broadband wireless communication, with researches carried out all over the world to constantly improve the network performance and standards. Radio channel characteristics modeling is an essential in every network planning. This project deals with the performance of WiMAX networks in an outdoor environment while using the SUI channel models. The radio channel characteristics are analysed by simulations done using Matlab simulation tool. The overall system performance in terms of transmit power spectrum, receive power spectrum and bit error ratio (BER) are simulated using LabVIEW simulation tool. A qualitative performance of the system can be analysied with the help of constellation plots provided.

ABSTRAK

Rangkain tanpa talian telah muncul sebagai senibina yang berkeupayaan tinggi berkebolehan menampung keperluan komunikasi jalur lebar tanpa talian. Banyak penyelidikan dilakukan diserata dunia untuk mmperbaiki mutu rangkaian dan piawannya. Pemodelan cirri-ciri saluran radio amat penting dalam perancangan rangkaian. Projek ini mengkaji pencapaian rangkaian WiMAX persekitaran luar menggunakan model saluran SUI. Ciri-ciri saluran radio dianalisa oleh kaedah simulasi menggunakan perisian Matlab. Pencapaian keseluruhan sistem seperti *transmit power spectrum, receiver power spectrum*, dan *bit error ratio* (BER) disimulasi menggunakan persisian LabVIEW. Pencapaian kualitatif sistem dianalisa dengan bantuan *constellation plots* yang disediakan.

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LIST OF SYMBOLS.

WiMAX	-	Worldwide Interoperability for Microwave Access.
SUI	-	Stanford University Interim.
WMAN	-	Wireless Metropolitan Area Network.
LOS	-	Line of Sight.
NLOS	-	Non Line of Sight.
OFDM	-	Orthogonal Frequency Division Multiplexing.
SNR	-	Signal to Noise Ratio.
BER	-	Bit Error Ratio.
EM waves	-	Electro Magnetic Waves.
UTD	-	Uniform Theory of Diffraction.
ITU	-	International Telecommunication Union.
MMDS	-	Multipoint Multchannel Distribution Service.
BTS	-	Base Station.
C/I	-	Carier to Nose ratio.
W-I Model	-	Walfish Ikegami Model.
PSD	-	Power Spectral Density.
QPSK	-	Quadrature Phase Shift Keying.
GRF	-	Gain Reduction Factor.
LCR	-	Level Crossing Rate.
ADF	-	Average Duration of Fade.

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CHAPTER 1

PROJECT OVERVIEW

1.1 Introduction

Telecommunication has shrunk the world into a comparatively smaller one, where communications to far distances were once very costly and even impossible. With billions and billions of individuals being served by the telecommunication industry, a life without mobile phones, internet, facsimile etc, would be like living in Stone Age. With millions of researchers constantly working to develop a better technology and to widen the boundaries of telecommunication, the day to day use of telecommunication has become an essential tool for every man kind.

Customer satisfaction in terms of quality of service, cost, reliability etc, is one of the important challenges faced by the network operators, in order to keep their service distinct from other competitors. Apart from the researches carried out to develop new technologies, there are also few works carried out to improve the performance of the technologies currently being used and those that will be implemented in future.

Propagation prediction is process carried out before installing or developing a network in order to achieve better performance after the network is setup. This project work is carried out to predict the propagation of WiMAX (802.16a) signals in an outdoor environment. Propagation prediction is done to setup a WiMAX link between the Wireless Communication Centre and Kolej(student's hostel) 11, which would replace the current WiFi.

Apart from propagation, channel modeling is a very pragmatic endeavor, since a model is developed to adequately depict the system performance. Therefore, a designer needs to appropriately choose a model to address the design problem at hand. Failing to do so will result in poor design, poor coverage, impaired system performance, and dissatisfied customers. Thus we can see how crucial the choice and application of the appropriate propagation models is in order to ensure proper system performance before the roll out.

1.2 Objective

To study about the WiMAX and to understand about the technologies behind WiMAX that makes it capable of in non-line-of-sight situation. To study about WiMAX (802.16a) signals and to predict its propagation in an outdoor environment using the Stanford University Interim (SUI) models.

To study about the six SUI models and to provide an understanding about the same. LabVIEW simulation tool was to simulate the system performance. MATLAB will also be used for simulation.

1.3 Scope

The SUI model is a collection of six channel models SUI 1 to SUI 6. Every model is different from the other. The user decides which model can be used based on the terrain type of the area under study. The classification is done in such a way that, the terrain is classified into three types and every type is given two SUI models that will be suitable.

The project requires one to learn in detail and understand about the properties of WiMAX focusing more on how WiMAX works in a non-line of sight situation and also to have knowledge of different SUI models, propagation models and channel modeling.

LabVIEW simulation tool will be used to simulate the performance of the system. Different parameters of the transmitter, receiver and the channel can be varied and the output can be verified for every set of inputs. The simulation results will be available in terms of the received power spectrum, BER performance and constellation plot.

1.4 Methodology.

The mothodology of the project begins with studying in detail about WiMAX, electromagnetic wave propagation, and also about the six SUI channel models. Also to research in detail about how the SUI channel models were developed. Thn finally, simulate the models using Matlab and LabVIEW simulation tools to analyze the channel and the system performance.

1.5 Thesis Structure.

This thesis consists of 7 main chapters. The first chapter consists of a general introduction, the scope and objective of the project and also the flow of this thesis.

Chapter 2 is an introduction about WiMAX. The chapter discusses in detail about the capabilities and e features of WiMAX.

Chapter 3 studies about the electromagnetic wave propagation and the losses encountered by the wave on its journey to the receiver after its transmission from the transmitter.

Chapter 4 discusses about the past works that were succesfully carried out in this area of research.

Chapter 5 discusses about the SUI models.

Chapter 6 consists of a collection of collection of screen shots abtained from the simulation results and its analysis.

Chapter 7 is a conclusion for this project. The chapter also has proposal for future works.