

Evaluation and Investigation of Okumura Cost 231 Hata and SUI Models for  
WiMAX Network in Suburban and Rural Areas

By

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KUALA LUMPUR

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EVALUATION AND INVESTIGATION OF OKUMURA, COST 231 HATA AND SUI MODELS FOR WiMAX NETWORK IN SUBURBAN AND RURAL AREAS

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Nowadays the demand for broadband Internet connections is growing. At the same time, ADSL-type accesses are increasing, but these technologies have limitations on bit rates and range, and do not allow for the flexibility of a wireless connection. In recent years, WiFi has revolutionized networks but we are already talking about a new technology: WiMAX, which is based on IEEE 802.16x standards. The main objective of our work is to calculate the path loss for the models: COST 231 Wi, ECC 33 (Okumura extended), COST 231 HATA and SUI, for a fixed WiMAX network. As well as we compared these models in term of path loss. Thus we have implemented a path loss simulation tool for a WiMAX network, which has as input radio transmission parameters, such as transmission frequency, height of the antennas and the distance. And as output the path loss values as well as the path loss graph for the different models, in rural and suburban areas. Thus we vary of the radio transmission parameters in order to determine the best possible values for antenna height for both transmitter and receiver as well as the best values for operating frequency. And finally we compared the models: COST 231 Wi, ECC 33 (Okumura extended), COST 231 HATA and SUI, in rural and suburban areas

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**APPROVAL**

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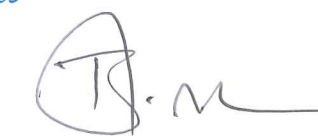
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**DECLARATION**

I declare that the project is my original work except for quotations, citations and which have been duly, acknowledge. I also declare that it has not been previously and is not concurrently submitted for any other degree at Infrastructure University Kuala Lumpur or any other institutions.

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## LIST OF ABBREVIATION

Abbreviation	Meaning
BS	Base Station
ECC	Electronic Communication Committee
FDD	Frequency Division Duplex
FSL	Free Space Loss
GIS	Graphical Information System
GSM	Global System for Mobile Communications
ITU	International Telecommunication Union
LOS	Line-of-Sight
MANs	Metropolitan Area Networks
MAC	Medium Access Control
MMDS	Multipoint Microwave Distribution System
NLOS	Non-Line-of-Sight
OFDM	Orthogonal Frequency Division Multiplex
OFDMA	Orthogonal Frequency Division Multiple Access
PL	Path Loss
et al.	(et alia); and others

## CHAPTER 1

### INTRODUCTION

#### 1.1 Overview

During last decade, the evolution of wireless networks and broadband technologies has captured the imagination and invention of industrialists around the world. Among the different technologies is WIMAX, which is based on IEEE 802.16x standards. This technology is characterized by high-speed data transmissions over the air. In addition, these features will help telecom operators to improve the quality of transmission. Planning is a very important phase for network deployment. Indeed, it is used to predict the necessary resources (equipment, frequency, and bandwidth) to serve a set of subscribers. It also allows managing the quality of transmission, by using path loss models.

In this study, we will put side by side and inspect few path loss models (Okumura Model, Cost-231Hata Propagation Model, and Stanford University Interim (SUI) model) for sub-urban and rural cases using WIMAX networks.

#### 1.2 Research Background

The name "WiMAX" was created by the WiMAX Forum, which was formed in June 2001 to promote conformity and interoperability of the standard, including the definition of predefined system profiles for commercial vendors. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless

broadband access as an alternative to cable and DSL". IEEE 802.16m or WirelessMAN-Advanced is a candidate for the 4G, in competition with the LTE Advanced standard. WiMAX refers to interoperable implementations of the IEEE 802.16 family of wireless-networks standards ratified by the WiMAX Forum. (Similarly, Wi-Fi refers to interoperable implementations of the IEEE 802.11

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