

UNIVERSITI TEKNOLOGI MARA

**SIMULATION OF PATH LOSS AND
LINK BUDGET BASED ON
STANFORD UNIVERSITY INTERIM
(SUI), COST-231 HATA AND
ERICSSON PROPAGATION
MODELS IN 4G LTE AND WIMAX
SYSTEM USING MATLAB**

MOHD DANIAL BIN ROZAINI

Thesis submitted in fulfillment
of the requirements for degree of
**Master in Telecommunication
and Information Engineering**

Faculty of Electrical Engineering

July 2015

ABSTRACT

In mobile communication system, 4G LTE coverage range is one of the crucial factors that have an effect on the quality of broadband access services. The first step in planning and designing cellular mobile systems is to predict and determine the path loss that suitable for certain environments. This paper focus on the comprehensive study of propagation path loss models in 4G LTE and WiMAX for urban and suburban regions. Simulation process was performed using MATLAB for three selected propagation model such as Cost-231 Hata model, Stanford University Interim (SUI) model and Ericsson model. Two carrier frequency, 1800MHz (1.8GHZ) and 2300MHz (2.3GHz) which are the operating frequency for Malaysian 4G service provider and a variation of distances in the range of 1 to 10 km were selected in the simulation process. SUI model shows the lowest path lost in both terrains while Cost-231 Hata and Ericsson model illustrates highest path loss. Therefore, SUI model is suitable to be implemented for 4G LTE and WiMAX system.

ACKNOWLEDGEMENT

*"In the name of ALLAH S. W. T, The Most Gracious and The Most Merciful. Peace be upon the Holy Prophet, Muhammad **»"*

Alhamdulillah, with the help and guidance of the almighty, I have managed to produce this piece of work, despite my own weakness and lack of design experience. I would like to take the opportunity to express my gratitude to my supervisor Assoc. Prof. Norhayati Ahmad and co-supervisor Puan Hasnida Saad for her initial suggestions, advice, guidance and invaluable help throughout the development of the project. Special thanks to my father and mother for giving me the moral support, encouragement and financial support. I would also like to extend my thanks to my friends who have shared their knowledge and help me a lot in doing this project.

TABLE OF CONTENTS

	Page
AUTHOR'S DECLARATION	i
SUPERVISOR'S DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ABBREVIATION/NOMENCLATURE	x

CHAPTER ONE: INTRODUCTION

1.1	Introduction	1
1.2	Background of study	3
1.2.1	Radio Signal Path Loss	4
1.2.1.1	Basic Signal Path Loss	5
1.2.2	Link Budget Concept	7
1.2.3	Propagation Model	10
1.2.3.1	Importance of Radio Propagation	12
1.2.4	4G LTE System	13
1.2.4.1	4G LTE Specification Overview	14
1.2.4.2	Main 4G LTE Technologies	15
1.2.4.3	Advantages and Disadvantages of 4G LTE System	17
1.2.4.4	4G LTE-Advanced (LTE-A)	19
1.2.5	WiMAX System	20
1.2.5.1	WiMAX Speed and Range	21
1.2.5.2	Advantages of WiMAX	22
1.2.5.3	WiMAX & WiFi Comparison	23

1.2.6	4G LTE and WiMAX Overview	25
1.2.6.1	4G LTE and WiMAX Similarities	25
1.2.6.2	4G LTE and WiMAX Differences	25
1.2.6.3	4G LTE Advantages Over WiMAX	26
1.2.6.4	WiMAX Advantages Over 4G LTE	26
13	Problem statement	27
14	Objective	28
15	Scope and limitation of study	28
16	Organization of thesis	29

CHAPTER TWO: LITERATURE REVIEW

2.1	Importance Of Selecting Right Propagation Model	30
2.2	Importance Of Predicting Path Loss	31
2.3	Urban And Suburban Path Loss Prediction	31
2.4	Effect Of Type Of Terrain On Path Loss Prediction	32
2.5	Effect Of Coverage Range On Path Loss Prediction	32
2.6	Cell Coverage Evaluation For LTE And Wimax	33
2.7	Comparison Of Path Loss Model In Wimax	33
2.8	Comparison Of Path Loss Model In LTE	34
2.9	LTE Network Planning Using Hata-Okumura and Cost-231 Hata Model	35
2.10	Empirically Based Path Loss Models for LTE Advanced Network	36
2.11	Analysis of Path Loss on WiMAX System	37
2.12	Suitable Propagation Model for 4G LTE-Advanced	38

CHAPTER THREE: METHODOLOGY

3.1	Introduction	40
3.2	Flow chart	41
3.3	Path Loss Simulation process	
3.3.1	Standford University Interim (SUI) model	43
3.3.2	Cost-231 Hata model	45