

**STUDY OF RAIN RATE AND RAIN ATTENUATION FOR FINDING  
THE OPTIMUM FREQUENCY USES BY MARITIME RADAR AT  
MALAYSIA**

This thesis is presented in partial fulfillment for the award of the  
**Bachelor of Engineering (Hons) Electronics (Communication)**  
**UNIVERSITI TEKNOLOGI MARA**



**MUHAMMAD REZZA BIN ALUI**  
**Faculty of Electrical Engineering**  
**UNIVERSITI TEKNOLOGI MARA**  
**40450 SHAH ALAM, SELANGOR**

**JULY 2012**

## **ACKNOWLEDGEMENT**

**With the name of ALLAH Most Gracious Most Merciful**

All praises and thanks be to Him, the Almighty and the Lord of the universe, without whose Bounty and Mercy the author would not have complete this final year project report. Alhamdulillah, finally the author managed to complete this project and its report within the period of given time although many problems occur during the processes to complete the project.

First and foremost, I would like to express my highest gratitude to my FYP Supervisor, Norbaiti Binti Sidik for the right guidance and encouragement given from the early phase of my FYP project to the end of the last stage of my project thesis. My great appreciation goes to my family who has supported me throughout the years. Their love and motivation provides me the spirit to complete this thesis successfully.

I also would like to express my gratitude to all friends who always besides me and never stop giving the motivations and encouragement during FYP process.

Last but not least, special thanks Maetrolorogy Malaysian Department and people around me who willing to give a hand during project thesis, May Allah bless all of you.

## **ABSTRACT**

Rain attenuation has long been recognized as the main source of atmospheric attenuation in terrestrial and satellite links. There are many rain attenuation prediction models that exist in the world. If the overseas model is applied to the design and operation of the domestic system such like radar or satellite, it can causes big error compared with real attenuation quantity in domestic environment. To estimate it more correctly, it should be developed appropriate model at domestic environment. This proposal report looks the comparison between the existing rain attenuation models with the measured model that is conducted at the domestic area. This study proposes which existing rain attenuation model is applicable to use at the domestic area according to the data from the measured model and apply it to indentify the optimum frequency use in the domestic area.

# TABLE OF CONTENTS

<b>CHAPTER</b>	<b>LIST OF TITLE</b>	<b>PAGE</b>
	<b>DECLARATION</b>	<b>I</b>
	<b>ACKNOWLEDGEMENT</b>	<b>II</b>
	<b>ABSTRACT</b>	<b>III</b>
	<b>TABLE OF CONTENTS</b>	<b>IV</b>
	<b>LIST OF FIGURES</b>	<b>VII</b>
	<b>LIST OF TABLES</b>	<b>VIII</b>
	<b>LIST OF ABBREVIATIONS</b>	<b>IX</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Problem statement	1
	1.2 Objective	1
	1.3 Scope of Work	2
	1.4 Organization of the thesis	2
	1.5 Summary of work	3
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>4</b>
	2.1 INTRODUCTION	4
	2.2 SPATIAL STRUCTURE OF RAIN	4
	2.2.1 Stratiform Rain	5
	2.2.2 Convective Rain	5
	2.2.3 Cyclonic Storms Tropical	5
	2.3 CLASSICAL DESCRIPTION FOR RAIN ATTENUATION	6
	2.4 RAINFALL RATE MODEL	10
	2.4.1 ITU-R Rainfall Rate Model	10
	2.4.2 Global Crane Rainfall Rate Model	14

	2.4.3 Rice-Holmberg Rainfall Rate Model	18
2.5	RAIN ATTENUATION MODEL	19
	2.5.1 ITU-R Rain Attenuation Model	19
	2.5.2 DAH Rain Attenuation Model	22
<b>3</b>	<b>METHODOLOGY</b>	<b>27</b>
	3.1 INTRODUCTION	27
	3.2 DEVELOPING ITU-R RAIN ATTENUATION MODEL CALCULATION	29
	3.2.1 ITU-R Model C Programming Pseudo Code	30
	3.3 DEVELOPING DAH RAIN ATTENUATION MODEL CALCULATION	31
	3.3.1 ITU-R Model C Programming Pseudo Code	32
	3.4 EXPERIMENTAL SET-UP RAIN ATTENUATION	32
	3.4.1 USM Rain Attenuation Measurement	32
	3.4.2 USM Rainfall Rate Measurement	34
<b>4.</b>	<b>RESULTS AND DISCUSSIONS</b>	<b>35</b>
	4.1 INTRODUCTION	35
	4.2 RESULT AND ANALYSIS OF RAINFALL RATE	35
	4.3 RESULT AND ANALYSIS OF RAIN ATTENUATION	37
	4.4 IMPLEMENTING THE DAH MODEL TO CALCULATE THE OPTIMUM FREQUENCY USE BY RAYAL MALAYSIAN NAVY	38
<b>5.</b>	<b>CONCLUSION</b>	<b>43</b>
	5.1 CONCLUSION	43