

GSM DOWNLINK POWER DENSITY SURVEY
IN MERLIMAU AREA



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021



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**GSM DOWNLINK POWER DENSITY SURVEY IN
MERLIMAU AREA**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.

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Tajuk: GSM DOWNLINK POWER DENSITY SURVEY IN MERLIMAU AREA

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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Projek ini adalah mengenai Kajian Ketumpatan Kuasa Laluan Menurun di kawasan Merlimau. Tujuan utama projek ini adalah untuk meninjau ketumpatan kuasa laluan menurun GSM dengan menggunakan alat uji yang sesuai seperti penganalisis spektrum dan penggunaan aplikasi pemantauan telekomunikasi pada telefon pintar. Seterusnya, projek ini juga adalah untuk meninjau lokasi yang terbaik dan sesuai untuk menempatkan sistem pengambilan tenaga dengan melakukan pengujian dengan kaedah memandu pada kawasan tersebut. Akhir sekali, tujuan projek ini juga menghasilkan peta ketumpatan kuasa downlink GSM daripada data yang telah dikumpulkan untuk setiap 1-meter pada kawasan yang disasarkan.

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ABSTRACT

This project is about GSM Downlink Power Density Survey in the Merlimau area. The aim of this project is to survey the GSM downlink power density by using a test gear which is a spectrum analyzer and telecommunication monitoring software on the smartphone. Next, this project is also to survey the best and suitable location to place the energy harvesting system after doing a drive test. Lastly, the aim of this project is also to produce the map of GSM downlink power density using the collected data for every 1 meter for the targeted area.



DEDICATION

This project is dedicated to my beloved family members, my supervisor and co – supervisor and to all my friends who have given me the motivation and never-ending moral and physical support from the start until the end.



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TABLE OF CONTENTS

	PAGE
TABLE OF CONTENTS	x
LIST OF TABLES 1	
LIST OF FIGURES	2
LIST OF APPENDICES	5
LIST OF SYMBOLS	6
CHAPTER 1 INTRODUCTION	7
1.1 Introduction	7
1.2 Background study	7
1.3 Problem Statement	8
1.4 Objectives	8
1.5 Scope of work	9
1.6 Project contribution	9
1.7 Thesis structure	10
CHAPTER 2 11	
2.1 Introduction	11
2.1 Pervasive RF Energy Harvesting System (GSM900 and GSM1800)	12
2.2 Ambient RF Energy Harvesting	15

2.3	Design of RF Energy Harvesting System	17
2.4	Ambient RF Energy Scavenging: GSM and WLAN Power Density Measurement	20
2.5	Ambient RF Energy Harvesting Urban and Semi – Urban Environment	21
2.6	Comparative Analysis of Downlink Signal Level Emitted by GSM900, GSM1800, UMTS and LTE Base Station.	24
2.7	A survey on RF energy harvesting: Circuit and Protocol	26
2.8	Design of 377Ohm Patch Antenna for Ambient RF Energy Harvesting at Downlink Frequency of GSM900	26
2.9	Outdoor RF spectral survey: A roadmap for ambient RF Energy Harvesting	28
2.10	The ant and elephant: ambient RF harvesting from the uplink.	29
CHAPTER 3 METHODOLOGY		32
3.1	Introduction	32
3.2	Key Sight field fox microwave analyzer N9915A 9GHz	32
3.3	AARONIA AG Omni Log 30800 antenna.	34
3.4	GPS receiver antenna.	35
3.5	Google Earth Pro	36
3.6	G – Mon	37
3.7	Network Cell Info Lite	38
3.8	Report Flowchart	39

3.9	Project Flowchart	40
3.10	Project Gantt Chart	41
3.11	Expected Result	41
CHAPTER 4 RESULTS AND DISCUSSION		42
4.1	Introduction	42
4.2	Drive Test Platform	42
4.3	Collected Data	42
4.4	Software Implementation	43
4.5	Result for GSM900.	44
4.6	Result for GSM 1800.	51
CHAPTER 5		59
5.1	Conclusion	59
5.2	Recommmendation	59
REFERENCES		60
APPENDIX		62

LIST OF TABLES

TABLE	TITLE	PAGE
Table 1:	The test result for energy harvesting.	19
Table 2:	Total energy collected that shows 27.2mJ energy power.	32



LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1:	Simplify block diagram of typical wireless power transfer of RF energy harvesting system.	13
Figure 2.2:	A trial test in School of Engineering (Blk S), Nanyang Polytechnic, Singapore.	13
Figure 2.3:	Harvesting voltage versus time for harvesting a GSM 900 signal in School of Engineering (Blk S), Nanyang Polytechnic, Singapore.	14
Figure 2.4:	Measured RF power density versus time. (680MHz – 3.5GHz).	16
Figure 2.5:	The total RF power density measured versus time.	16
Figure 2.6:	A block diagram for RF energy harvesting.	17
Figure 2.7:	Schematic diagram for RF energy harvesting circuit system.	18
Figure 2.8:	Measured GSM900 summed power density levels as a function of distance to the nearest base station.	20
Figure 2.9:	Input RF power density measurement outside London Underground station.	22
Figure 2.10:	4 Largest RF power density in Greater London.	22
Figure 2.11:	Dc output power density for all harvester at ICL.	23
Figure 2.12:	Average value EMF for GSM900, GSM1800, UMTS and LTE.	24
Figure 2.13:	Indoor versus outdoor EMF levels and shows the GSM 900 measured value is higher than others with 2.82V/m.	25

Figure 2.14: LOS and NLOS of EMF levels.	25
Figure 2.15: Comparison between simulation and measured result.	27
Figure 2.16: Field measurement for GSM900.	27
Figure 2.17: Average RF power received outside the shopping mall.	28
Figure 2.18: Walking route	29
Figure 2.19: Drive test route	30
Figure 2.20: By using train route.	30
Figure 3.1: Key Sight Field Fox microwave analyzer N9915A 9GHz	33
Figure 3.2: Omni Log 30800 antenna.	34
Figure 3.3: GPS receiver antenna.	35
Figure 3.4: Google earth pro software.	36
Figure 3.5: G – Mon application for smartphone.	37
Figure 3.6: Network Cell Info Lite application for smartphone.	38
Figure 3.7: Report flow chart for thesis.	39
Figure 3.8: Project flow chart for drive test for GSM power downlink survey.	40
Figure 4.1: GSM900 power downlink in Merlimau area for Range 1 with -26.755dB.	44
Figure 4.2: GSM900 power downlink in Merlimau area for Range 2 with -36.0297dB.	45
Figure 4.3: GSM900 power downlink in Merlimau area for Range 3.	46
Figure 4.4: GSM900 power downlink in Merlimau area for Range 3 (Red).	46
Figure 4.5: GSM900 power downlink in Merlimau area for Range 3 (Dark Orange)	47
Figure 4.6: GSM900 power downlink in Merlimau area for Range 3 (Dark Orange &	

Yellow).	48
Figure 4.7: GSM900 power downlink in Merlimau area for Range 4.	49
Figure 4.8: GSM900 power downlink in Merlimau area for Range 4 (Yellow).	49
Figure 4.9: GSM900 power downlink in Merlimau (Green).	50
Figure 4.10: GSM1800 power downlink in Merlimau area for Range 1.	51
Figure 4.11: GSM1800 power downlink in Merlimau area for Range 2	52
Figure 4.12: GSM1800 power downlink in Merlimau area for Range 3.	54
Figure 4.13: GSM1800 power downlink in Merlimau area for Range 3 (Red).	54
Figure 4.14: GSM1800 power downlink in Merlimau area for Range 3 (Dark Orange).	55
Figure 4.15: GSM1800 power downlink in Merlimau area for Range 3 (Orange).	56
Figure 4.16: GSM1800 power downlink in Merlimau area for Range 4.	56
Figure 4.17: GSM1800 power downlink in Merlimau area for Range 4(Orange).	57
Figure 4.18: GSM1800 power downlink in Merlimau area for Range 4(Yellow).	57
Figure 4.19: GSM1800 power downlink in Merlimau area for Range 4(Green).	58

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix 1	Example Appendix	Error! Bookmark not defined.



LIST OF SYMBOLS

D, d	-	Diameter
F	-	Force
g	-	Gravity = 9.81 m/s
I	-	Moment of inertia
l	-	Length
m	-	Mass
N	-	Rotational velocity
P	-	Pressure
Q	-	Volumetric flow-rate
r	-	Radius
T	-	Torque
Re	-	Reynold number
V	-	Velocity
w	-	Angular velocity
x	-	Displacement
z	-	Height
q	-	Angle

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter is an overview of the energy harvesting system. The problem statement is defined. Next, followed by an appropriate procedure to implement the objectives of this survey with a specific scope.

1.2 Background study

The purpose of this project is to complete a survey and observe the highest power density measurement for the GSM downlink power. Then, this survey can identify the most suitable location to install an innovative system for energy harvesting. The data collection for this survey will be obtained by using the Agilent Keysight spectrum analyser. This equipment is very useful for this research because it can scan, measure, and analyse the power density for every radio frequency identified per the frequency allocation provided by Malaysian Communications Multimedia Commission (MCMC).

1.3 Problem Statement

Nowadays, the use of wireless devices has grown significantly in different applications, such as mobile phone, especially the smartphone. Every telecommunication company of these modern devices will provide their technology with the ability to connect the internet.

The problem statements for this survey are as follows., The RF power density from the cell tower is sometimes wasted. This excess power actually can be harnessed by converting it into DC power to be used by low power devices. In addition, It was discovered that no GSM Downlink RF power mapping been done in Merlimau area especially for energy harvesting purpose.

1.4 Objectives

The main objectives of this study are:

- i. To survey the GSM downlink power density.
- ii. To produce the map of GSM power downlink.
- iii. To identify the best or suitable locations to place an energy harvesting system.

1.5 Scope of work

The scope of this project are the functional limitations that will make sure that project is goes the correct way to achieve the end goal. The monitoring and surveying of the GSM downlink power density of the base station will be done by using portable test gear device which is the Keysight FieldFox Microwave Spectrum Analyzer with 9GHz capability. The drive test will be done within area surrounding Merlimau in the district of Jasin, Melaka.

The purposes of this survey is to record the highest power downlink at various cell towers around Merlimau area. The identified locations can then be used to assemble an energy harvesting devices with the suitable antenna and rectifier. In order to achive this, the data needed to be collected by doing the drive test. Data will be collected at every 1-meter interval with the specific area to obtain exact location of highest power density for GSM downlink signal wave. Preparation of GSM setup for drive test and the GPS antenna is also a must for this drive test survey. Getting accurate GPS coordinates will identify the ideal location for energy harvesting devices placement which will be done by a later project.

1.6 Project contribution

This survey will be very useful for both the industry and the state because it can identify possible replacement for the current conventional power. It is indeed a source of green energy. There is no wastage of energy. When connected to a rechargeable battery, this system will helps to lengthen the operating life for devices since the storage battery can be recharged during sleep mode. Furthermore by using this harvesting system, there is no need to get the battery checked and replaced regularly.

1.7 Thesis structure

This thesis consists of 5 chapters in total. The content is show below:

Chapter 1 was about the Introduction that consist of 7 main subjects which are introduction, objective, problem statement, scope of work, project contribution and thesis structure.

Chapter 2 was about the literature review. In this chapter was a summarization and explanation about the similar and past research from the journal that shown almost the same result and usage of the equipment and tools.

Chapter 3 was about the Methodology, this chapter will explain the equipment that is used in this survey which consist of both hardware and software. These applications also relate this survey with the theoretical capability of the equipment and software. More than that, this chapter also show the report flow chart, project flow chart, Gantt chart and expected result of this survey.

Chapter 4 was the result; this chapter will explain all about the output from data collected for this survey. Basically, this chapter will show the graph diagram which are histogram graph and scattering graph.

Chapter 5, in this chapter was about the Conclusion and possible future work, this explained whether the objective had been successfully completed and provide the recommendations for improvement of this survey.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, there are some of the articles from the Scopus site and IEEE Xplore that had been investigated based on the scope of this project. This research focuses on the RF energy harvesting or energy scavenging for GSM downlink power density and the application of other equipment which is a high-efficiency antenna to capture the signal wave and suitable rectifier to convert the AC signal into DC supply. The suitable articles about the RF energy harvesting, had been found to assist in the process to complete and finish this project. There are 10 journals identified about the RF energy harvesting.