UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FEASIBITY OF RF RECEIVED SIGNAL LEVEL FOR RF ENERGY HARVESTING : A CASE STUDY OF ALOR GAJAH AREA

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

by

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DECLARATION

I hereby, declared this report entitled Feasibity Of RF Received Signal Level For RF Energy Harvesting : A Case Study Of Alor Gajah Area is the results of my own research except as cited in references.

Signature: ....

Author : MUHAMMAD HAFIZZUDDIN BIN IDRIS

Date:

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 (Telecommunications) with Honours. The member of the supervisory is as follow:

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Supervisor : EN WIN ADIYANSYAH INDRA

Signature: ……………………………………………………

Co-supervisor: EN NURULHALIM BIN HASSIM

ABSTRAK

The effectiveness of the RF signal level received to produce RF energy: the case study of the alor elephant area is a research to show the availability during RF energy intake. The objective of this project is to show the availability during the RF energy intake and to produce a map of the RF energy harvest in the Alor Gajah area. (Dzulkifli, Kamarudin and Rahman, 2012) describe that the project lost a 24-hour spectrum view of the outdoor radio environment in Johor Bahru. It also receives data in the frequency band from 30 to 300 MHz. In addition, it is aware of how various services are used in the surrounding area and can identify groups who like to use low active or inactive rates. Ways to produce an RF energy harvest map is to identify the appropriate route to use and only use a spectrum analyzer as well as analyze the RF energy harvest map in the Alor Gajah area. In addition, it can produce RF energy harvest maps in the Alor Gajah area. There are 40 RF energy harvest map results with 10 different channels and 4 ranges.

ABSTRACT

Keberkesanan tingkat tanda RF yang diterima untuk menghasilkan tenaga RF: kajian kes kawasan alor gajah adalah satu penyelidikan untuk menunjukkan ketersediaan semasa pengambilan tenaga RF. Objektif projek ini adalah menunjukkan ketersediaan semasa pengambilan tenaga RF dan menghasilkan peta penuaian tenaga RF yang ada di kawasan Alor Gajah. (Dzulkifli, Kamarudin dan Rahman, 2012) menggambarkan bahawa projek itu kehilangan tinjauan spektrum 24 jam terhadap persekitaran radio luar di Johor Bahru. Ia juga menerima data dalam frekuensi pita dari 30 hingga 300 MHz. Selain itu, ia menyedari bagaimana pelbagai perkhidmatan digunakan di kawasan sekitar dan dapat mengenal pasti kumpulan yang suka menggunakan kadar aktif atau tidak aktif yang rendah. Cara-cara untuk menghasilkan peta penuaian tenaga RF adalah mengenalpasti jalan yang sesuai untuk dilalui dan hanya menggunakan spectrum analyzer serta menganalisis peta penuaian tenaga RF di kawasan Alor Gajah. Selain itu, ia dapat menghasilkan peta penuaian tenaga RF di kawasan Alor Gajah area. Terdapat 40 keputusan peta penuaian tenaga RF yang mempunyai 10 saluran dan 4 julat yang berbeza.

DEDICATION

I dedicate this project report to my parents, Mr. Idris Bin Basri and Mrs. Noraini binti Samsudin, my supervisor and my BEET classmates. Infinite thanks to my father and mother who always gave me encouragement and strongly supported my idea to implement this project. I do not forget, I would also like to thank my supervisor Mr. Win Adiyansyah Indra and co-supervisor Mr. Nurulhalim Bin Hassim and Dr. A K M Zakir Hossain, for the guidance, advice, encouragement, inspiration and attention given throughout the day for the development of my final project and writing this report. Finally, I would like to thank my BEET classmates who have always supported me in completing this project.

ACKNOWLEDGEMENTS

Special thanks to Allah S.W.T for His blissful and gift because giving me this ability to finish my Projek Sarjana Muda (PSM). This report is as a mark of my sincere appreciation to Unversiti Teknikal Malaysia Melaka (UTeM) for giving me this chance to further study on Bachelor’s Degree in Eletronics Engineering Technology (Telecommunication) in Faculty of Engineering Technology (FTK). I do not forget, I would also like to thank my supervisor Mr. Win Adiyansyah Indra and co-supervisor Mr. Nurulhalim Bin Hassim and Dr. A K M Zakir Hossain, for the guidance, advice, encouragement, inspiration and attention given throughout the day for the development of my final project and while writing this report entitled as The Feasibity Of RF Received Signal Level For RF Energy Harvesting : A Case Study Of Alor Gajah Area. With this continuous support and interest, they are guiding me to complete this project with full commitment and dedication. My gratitude goes to my beloved parents Mr. Idris Bin Basri and Mrs. Noraini binti Samsudin, my family and my friends that always give courage and support me to achieve the goal of my project.Thanks a lot to their moral support and care they had given to me up until this project done. Finally, I would also to say thank you a lot to all lecturer and staff who also involved directly or indirectly in helping me to completing this project. May your charity and goodwill will be blessed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The overall chapter presenting the introduction of the feasibity study of RF received signal level for RF energy harvesting : a case study of Alor Gajah area project overview. The chapter included the background study of the project and the stated problem statement. The study will lead the objective research and study scope where the project will be mentioned from the beginning until the final outcome of the project.

1.1 Background

The purpose of this project is to research, survey and observe the RF received signal level for RF energy harvesting. Subsequently, this review can identify the appropriate location of the highway connecting a place to detect RF received signal level for RF energy harvesting. In addition, the device are used to detect RF received signal level and to store such data are Agilent Keysight spectrum analyzer. This device is useful as it can scan, measure and analyze RF received signal levels for every radio frequency provided by the Malaysian Communications Multimedia Commission (MCMC).

1.2 Statement of the Purpose

The scope of this project is to search for available RF received signal level in Melaka especially Alor Gajah area. After that, the step is to drive test around Alor Gajah area , Melaka.

1.3 Problem Statement

The availability of very low power RF energy transmitted from telecommunication transmission towers made it difficult to harness energy for harvesting. Then, undetermined amount of RF received signal level in a semi rural area such as Alor Gajah area. Also, the absence of maps of RF received signal level in Malaysia especially Alor Gajah area. The solution is to produce the maps of RF received signal level in Alor Gajah area.

1.4 Objective

- To survey the location and determined the area of available concentrated RF power.
- To conducted drive test to determined the amount of RF received signal level in a semi rural area such as Alor Gajah area.
- To produce the maps of RF received signal level in Alor Gajah area.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, there are an overview regarding this topic where it's about the precious work and the literature study that were related on the project. This project was focusing on the RF energy and how it will transmit and received it. However, there will be an application that need to use to apply on this project. Then, on this chapter there will be an information and discussion about the application applied.

2.2 FEASIBITY STUDY OF RF RECEIVED SIGNAL LEVEL FOR RF ENERGY HARVESTING IN ALOR GAJAH AREA

Today, demand for wireless communications is growing as the competition grows .Antenna that collect RF power while rectifier can convert RF power to DC power. However, RF harvesting can cause problems with the system. One of the problems is the low power density produed by ambient RF energy. Therefore, the solution is to find the location and determine the area with available concentrated RF power. Alternatively, with the achievement of RF power onsumption at one frequency, it can evaluate the harvest at different frequencies, thus maximizing the accumulated power and DC output.

(Abood et al., 2013) had mentioned the method to get the measurement of RF spectrum. The tools are used in this project such as an Ultra Wideband Discone antenna, a spectrum analyzer, lab review and matlab software. This measurements are performed at different locations in an urban area in Kuala Lumpur.The results based on UHF TV, GSM900 and GSM1800 frequency bands in an urban area in Kuala Lumpur.

(Bouchouicha et al., 2010) have presented a study of feasibity to ambient RF energy harvesting techniques. Unfortunately power is very low and needs to be distributed at very large bandwidths. This proves that the restored power is not sufficient to charge the device directly but can only be stored in super or micro-capacity batteries. There are recommended methods for optimizing the recoverable DC power.

(Dzulkifli, Kamarudin and Rahman, 2012) described that the project losing a 24-hour spectral survey of the outer radio environment in Johor Bahru. It also receives data in band frequency from 30 to 300 MHz. Additionally, it recognizes how various services is used in the surrounding area and can identify bands that like the employment of low rates of active or inactive.

(Ho et al., 2017) mentioned the dual-band rectenna is formed from a dual-band antenna and a dual-band rectifier which operates at GSM bands like 900 MHz and 1800 MHz. It's been tested within the surrounding area and has shown that acne are able to do good odor similarly well as excellent frequency operation. It's possible to reap ambient electromagnetic energy to power low-power devices.

(Xu et al., 2017) presented the end-to-end throught maximization problem for optimal time and power allocation. To unravel this non-convex problem, we first must to turn it into a convex optimization problem and propose a time-resolved optimum algorithm and optimal power allocation (JOTPA) that solves a series of possible problems until convergence. Extensive simulations evaluate the performance of the EH-CRN with JOTPA in three special use scenarios and ensure the prevalence of JOTPA by comparing it with two other resource allocation algorithms.

(Soyata, Copeland and Heinzelman, 2016) presented an outline of passive Radio Frequency (RF) energy reception and power harvesting circuits for isolated communications and computing systems lacking access to primary power sources. However, the wireless embedded systems field is characterized by diversity within the application requirements and a corresponding diversity in design philosophy. Radio frequency power harvesting refers to the harvesting of the energy in a very wireless signal through an antenna to power an embedded device.

CHAPTER 3 METHODOLOGY

This chapter will be covered on the methods used in this project in terms of the procedure needed to get the RF received signal level for RF energy harvesting in Alor Gajah area by using a spectrum analyser, GPS (Global Positioning System) and Ultra Broadband Antenna OmniLOG 30800.

3.1 Project Work Plan

The possibility of implementing this project in the allotted time can be achieved with the required capacity has been precise and smooth planning. The total amount of time required to develop and complete this project is 2 semesters or 30 weeks. In addition, this aspect of the project is very detailed in terms of the success of the desired results for Bachelor Projects (PSM) 1 and 2 with the operational strength required to avoid possible errors.

Therefore, there is a need to create a Gantt chart used to organize the time required to develop the project. The Gantt Chart is the type of chart used to be summarized and updated on all the progress of project activities during PSM 1 and 2. The Gantt Chart of this project will be presented in tables 1.1 and 1.2.

PROJECT ACTIVITY	Academic Week of Semester 1														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSM 1 Briefing								S							
Selection of supervisor and title registration								E							
Module (Report Writing-1)								M							
Module (Report Writing-2)								E							
Progress of PSM 1 title and synopsis								S							
Online meeting and discussion with supervisor								T							
Progress of PSM 1 title and synopsis								E							
Draft final report to supervisor								R							
Final report to supervisor															
Final report to panel								B							
								R							
								E							
								A							

								K							

Table 1.1

PROJECT ACTIVITY	Academic Week of Semester 1														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
BDP PSM 2 Brief								**S**							
Module (Methodology,Result,Discussion,Conclusion)								**E**							
Online weekly meeting with supervisor								**M**							
Physical meeting with supervisor								**E**							
Do drivetest								**S**							
Draft report to supervisor								**T**							
Final report to supervisor								**E**							
Final report to supervisor								**R**							
								B							
								R							
								E							
								A							
								K							

3.2 Hardware equipment

3.2.1 FieldFox Hardware RF and Microwave Analyzers

Figure 1.1 FieldFox Hardware RF and Microwave Analyzers

Figure 1.1 is FieldFox Hardware RF and Microwave Analyzers. It is a handheld combination analyzer device that can be performs a cable and antenna analyzer (CAT) spectrum analyzer ,vector network analyzer (VNA) or as an all-in-one combination analyzer. It also can captures the smallest interfering signals with wide-band, real-time analysis (RTSA). It can measures from 4 to 50 GHz with precision comparable to benchtop.

3.2.2 Car GPS Antenna Receiver

Figure 1.2 Car GPS Antenna Receiver

Figure 1.2 is car GPS Antenna Receiver. It is a device that help the GPS to get the strongest signal and collect the position quickly. It also easy to install on the roof of the car.

3.2.3 Ultra Broadband Antenna OmniLOG 30800

Figure 1.3 Ultra Broadband Antenna OmniLOG 30800

Figure 1.3 is Ultra Broadband Antenna OmniLOG 30800. It is specially developed as small and compact, broadband omnidirectional antenna. Despite its small size it covers an extremely wide frequency range of 300MHz to 8GHz. Within the most important frequency bands the antenna reaches very high gain up to 6.5dBi. It also fits to the FieldFox Handheld Spectrum Analyzers but it also can be used with any other

Spectrum Analyzer brand. The Antenna offers a heavy-duty 90° knuckle base with SMA connector. The knuckle base is freely adjustable into each position and fixed by two special ball pressure screws.

3.3 Software equipment

3.3.1 Google Earth Pro

Figure 1.4 Google Earth Pro

Figure 1.4 is Google Earth Pro. Data from Microsoft Excel (.csv) format (comma delimited) can be converted to kml file (.kml) using FieldFox Spectrum Analyzer. Google Earth Pro will display kml file in map form.

3.4 Outdoor measurements

3.4.1 Maps

Figure 1.5 Maps of Alor Gajah area in Melaka

Figure 1.5 is a maps of Alor Gajah area in Melaka. The place chosen to examine and observe the level of available RF received signal is the Alor Gajah district. It also covers nineteen mukim in Alor Gajah area such as Taboh Naning, Sungei Buloh, Melekek, Pegoh, Pulau Sebang, Tanjung Rimau, Padang Sebang, Kemuning, Tebong, Gadek, Machap, Malaka Pindah, Kelemak, Sungei Petai, Rembia, Beringin, Parit Melana, Belimbing and Durian Tunggal. Therefore, measurements are made on the route selected and measurements are taken between the 1 metre distance to the results.

3.5 Process flow chart

Flowchart is a types of diagram that can describe about the methods and explain about the process how the projects is function. A flowchart also can be characterized as a diagrammatic representation of an algorithm. In this part, Figure 1.6 will shows about the process how the projects is work and functions. The results of received RF energy harvesting can get by using the spectrum analyzer. Firstly, setup for drive test and prepare tools needed. Place the GPS (Global Positioning System) on the roof of the car and the antenna at RF input.Plug in the spectrum analyzer into the power source socket in a car. Setting the GPS in the spectrum analyzer and change it into the internal. Then recall the setting that has saved before in the spectrum analyzer. Setting the center RF level into -20dB. Also turn on the preamp in the spectrum analyzer. Change the time setting to a distance in the analyzer spectrum because it only records data in the distance setting. The resulted data get at the targeted area. Collect data and save the maps of RF received signal level. Lastly, analyse and compute the results of RF received signal level.

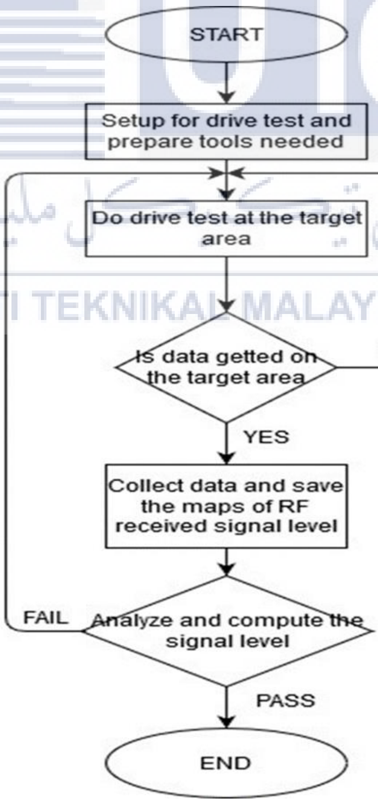


Figure 1.6 Process Flowchart

3.6 Summary

This part is explain more about the process and method that has been used for development of the project is The feasibity study of RF received signal level for RF energy harvesting : a case study of Alor Gajah area. Then, the researcher also explained about the hardware and software equipment that used in this project.

Therefore, this chapter can help the researcher to explain the content of the project in a more efficient ways. Basically, the process on this system can be view in the flowcharts of projects where it show in detail about the step that has been done to run this projects.

Finally, the work process had been stated clearly that the researcher had a proper guideline to complete the projects effectively based on the information above.

CHAPTER 4

RESULT AND DISCUSSION

This chapter will display the results and development of the map showing the RF received signal level found in Alor Gajah area using spectrum analyzer. In addition, the ways to obtain RF received signal level will also be described. Finally, a discussion of project results is also included in this chapter.

4.1 Hardware configuration

Figure 4.1.1 Tools

Figure 4.1.2 Car GPS receiver

Figure 4.1.3 Position receive the data

Figure 4.1.4 Record the data

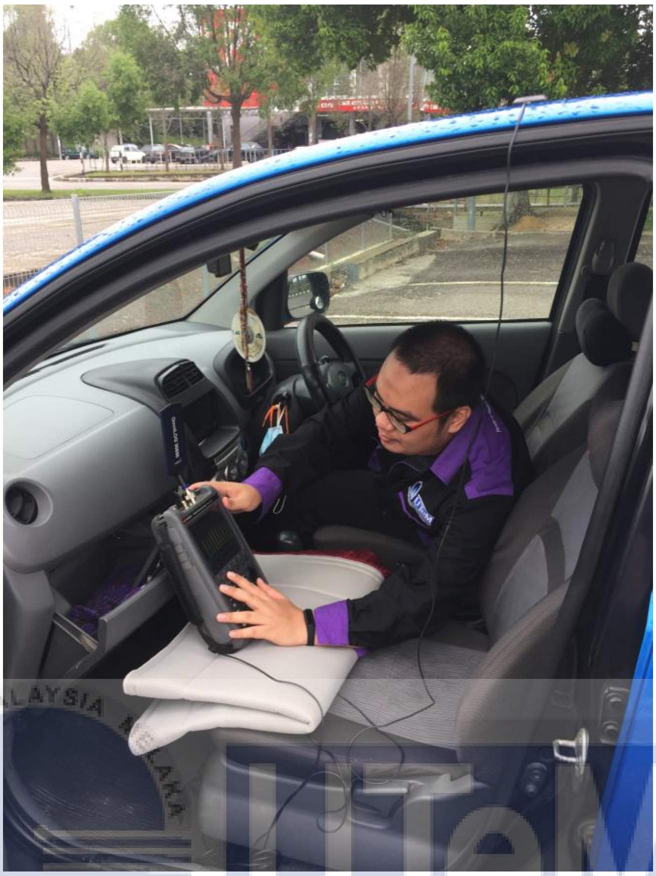


Figure 4.1.5 Position to get the data

Figure 4.1.1 is the equipment used during this project such as FieldFox Hardware RF and Microwave analyzers, car GPS antenna receiver and Ultra Broadband Antenna OmniLOG 30800. Figure 4.1.2 is the position of car GPS antenna receiver placed on the roof of the car to facilitate identification of the reaction which has been passed to produce a map of RF received signal level in the Alor Gajah area. Figure 4.1.3 is the position of the driver driving a car while taking data using a spectrum analyzer. Figure 4.1.4 is a vertical antenna condition to facilitate the process of data retrieval using spectrum analyzers. In addition, spectrum analyzers show 10 channel frequencies used in this project. Figure 4.1.5 shows the complete state of data retrieval and storage of the data into storage spectrum analyzers.

4.2 Project Analysis

In this project, the purpose of this experiment is to analyze the map from RF received signal level in Alor Gajah area. In other words, the message is meant to indicate the place where the RF energy is harvested in the Alor Gajah area. The purpose of this analysis is very important to produce a map of RF energy harvesting in the Alor Gajah area.

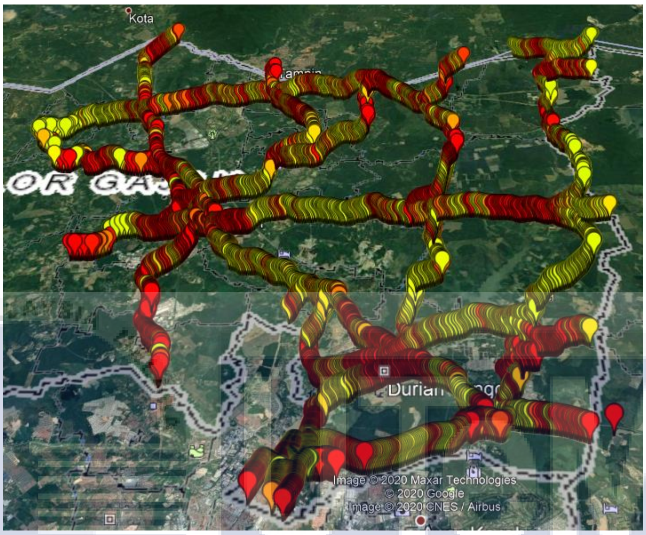
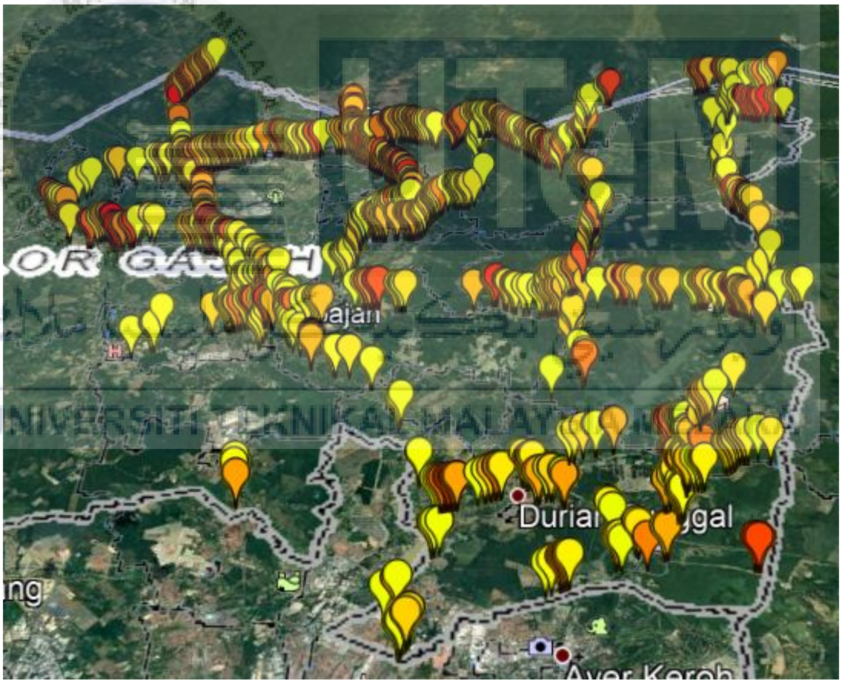


Figure 4.2.1 Map of RF energy harvesting in the Alor Gajah area.

Figure 4.2.2 Map of channel 1 range 1

Figure 4.2.3 Map of channel 1 range 2



Red	-50.34	-50.83
orange	-53.10	-53.37
yellow	-56.12	-57.79

Figure 4.2.4 Map of channel 1 range 3

Figure 4.2.5 Map of channel 1 range 4

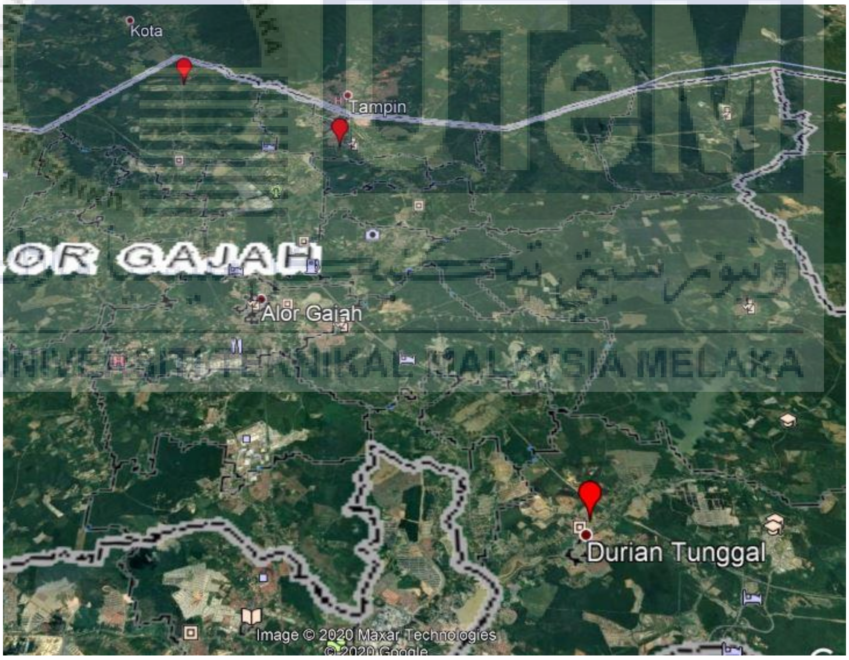
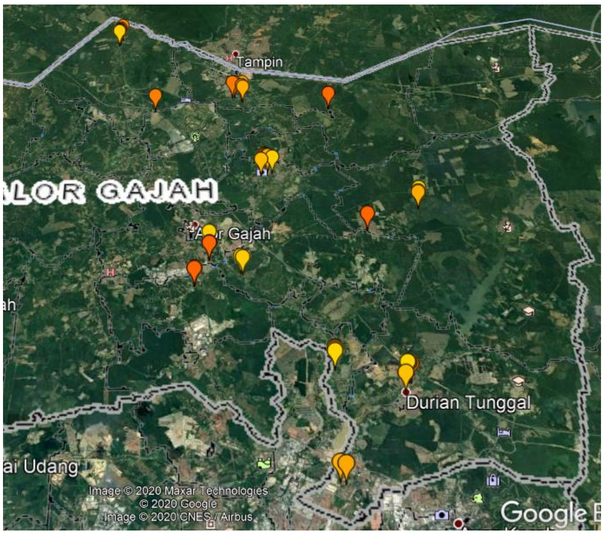


Figure 4.2.6 Map of channel 2 range 1



Red	-51.91	-51.89
orange	-52.56	-54.39
yellow	-57.62	-57.83

Figure 4.2.7 Map of channel 2 range 2

orange	-58.16
yellow	-60.09
green	-64.558

Figure 4.2.8 Map of channel 2 range 3

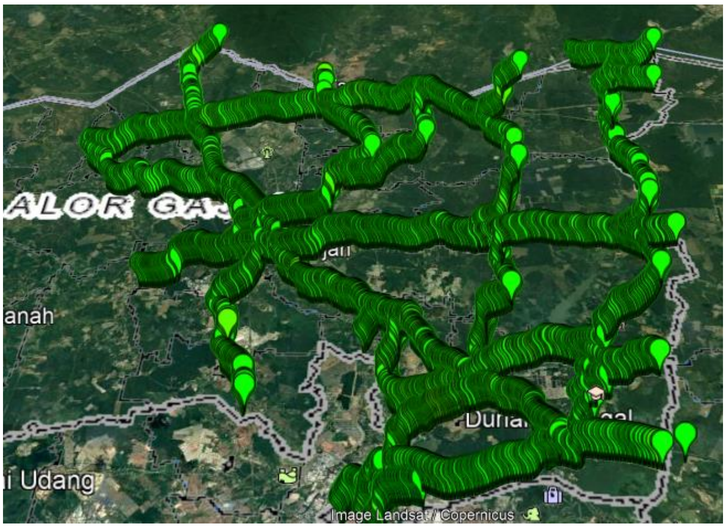


Figure 4.2.9 Map of channel 2 range 4

Figure 4.2.10 Map of channel 3 range 1

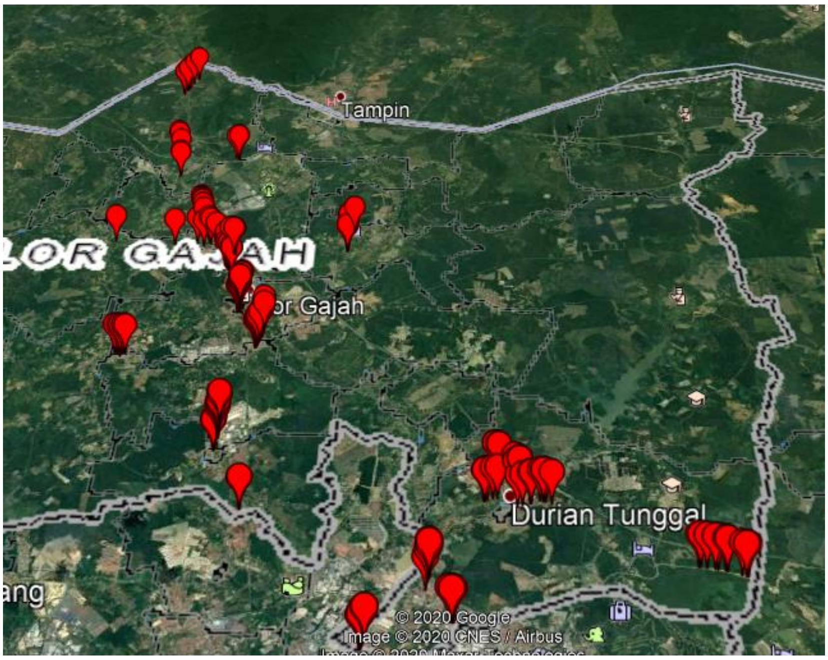
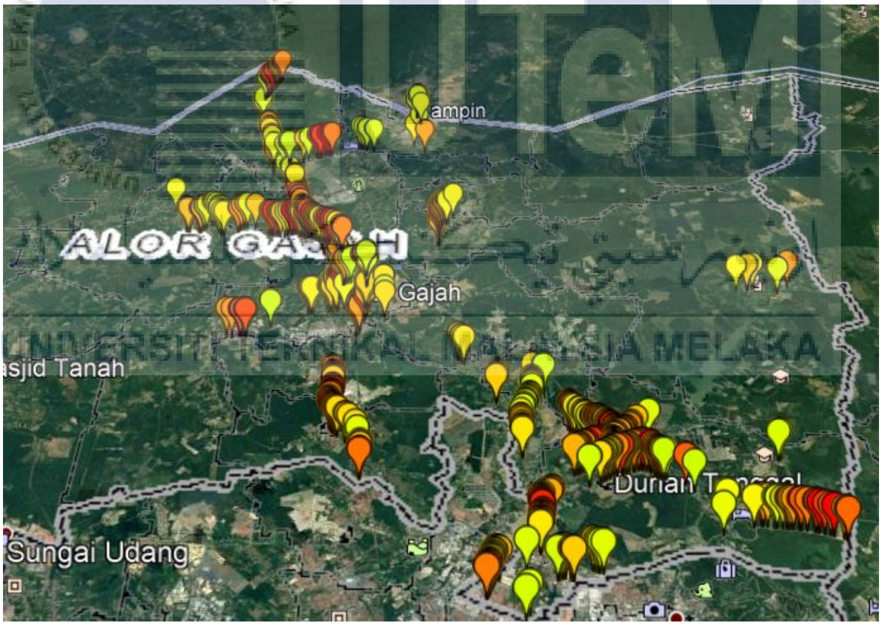


Figure 4.2.11 Map of channel 3 range 2



Red	-49.43	-50.55
Orange	-54.13	-56.49
Yellow	-57.91	59.116
Green	-60.65	-60.74

Figure 4.2.12 Map of channel 3 range 3

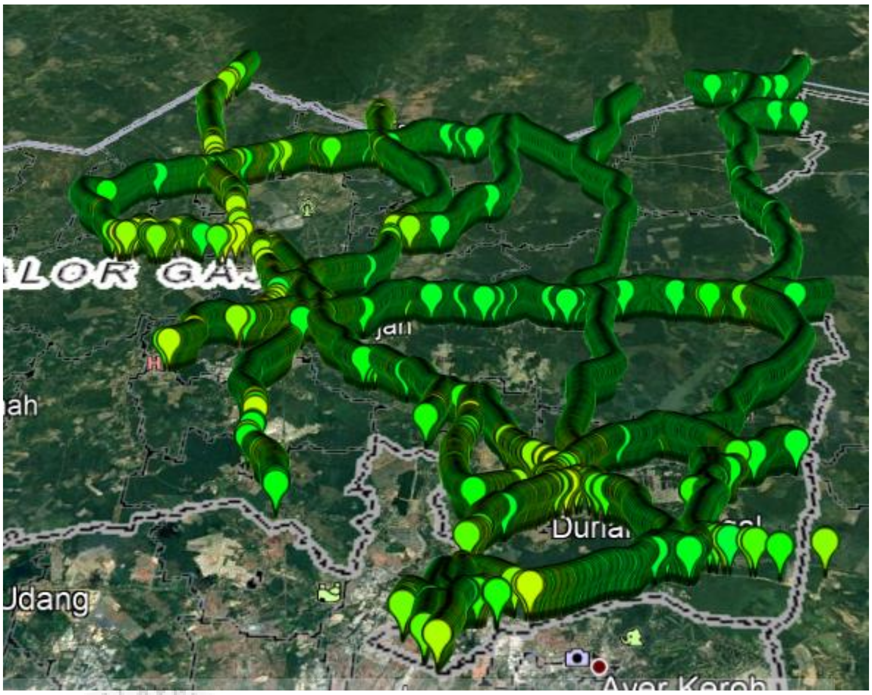


Figure 4.2.13 Map of channel 3 range 4

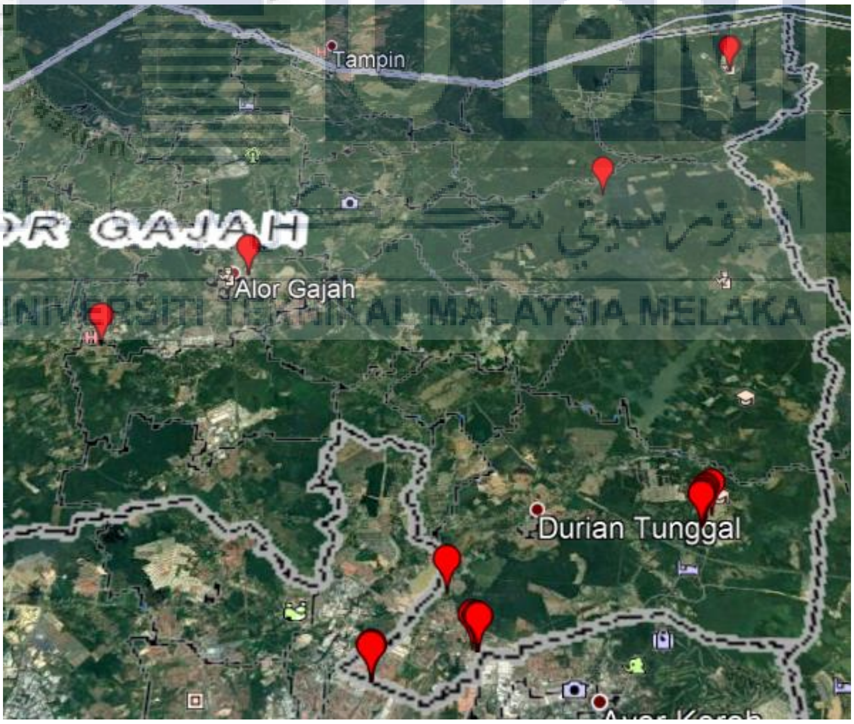


Figure 4.2.14 Map of channel 4 range 1

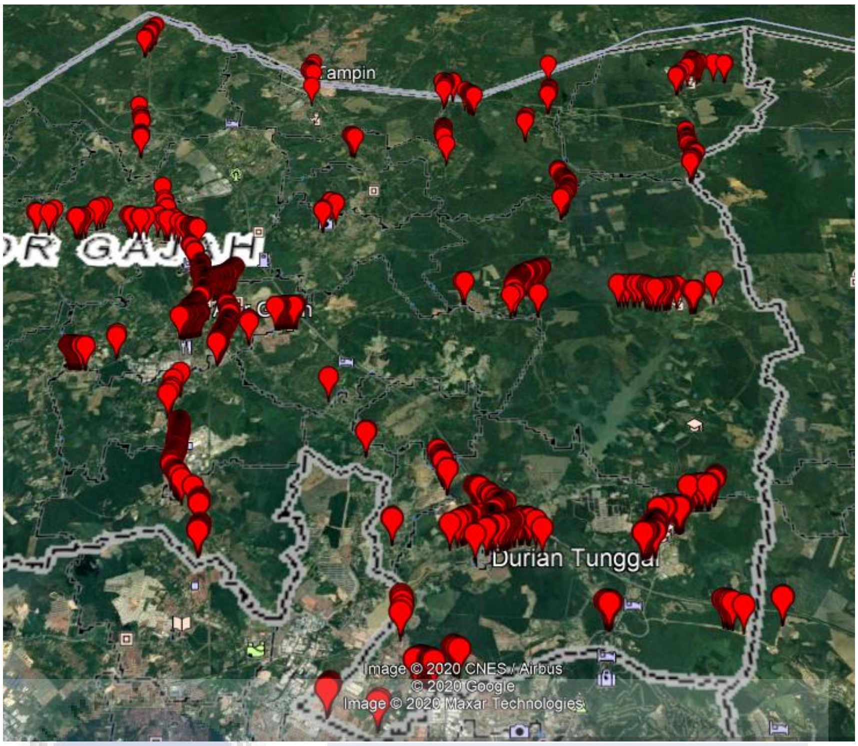
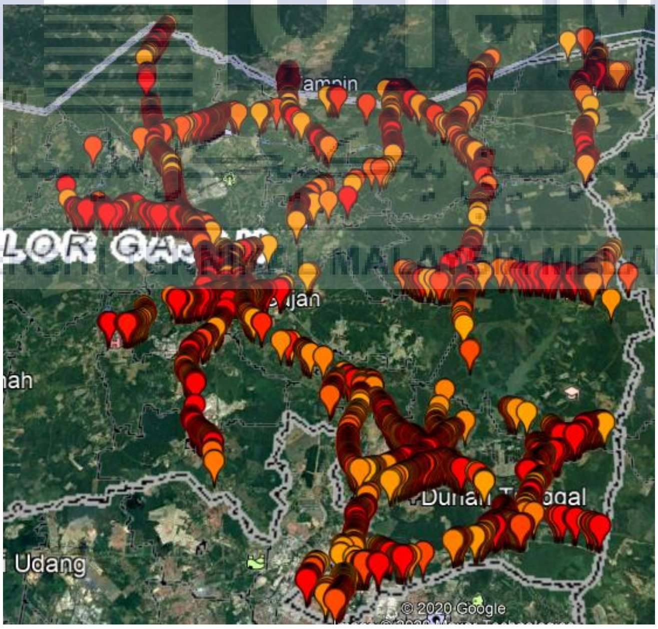


Figure 4.2.15 Map of channel 4 range 2



Red	-51.72	-51.82
Orange	-53.07	-53.68
Yellow	-55.46	-55.92

Figure 4.2.16 Map of channel 4 range 3

Orange	-57.20	-57.28
Yellow	-58.13	-59.06
Green	-62.54	-64.39

Figure 4.2.17 Map of channel 4 range 4

Figure 4.2.18 Map of channel 5 range 1

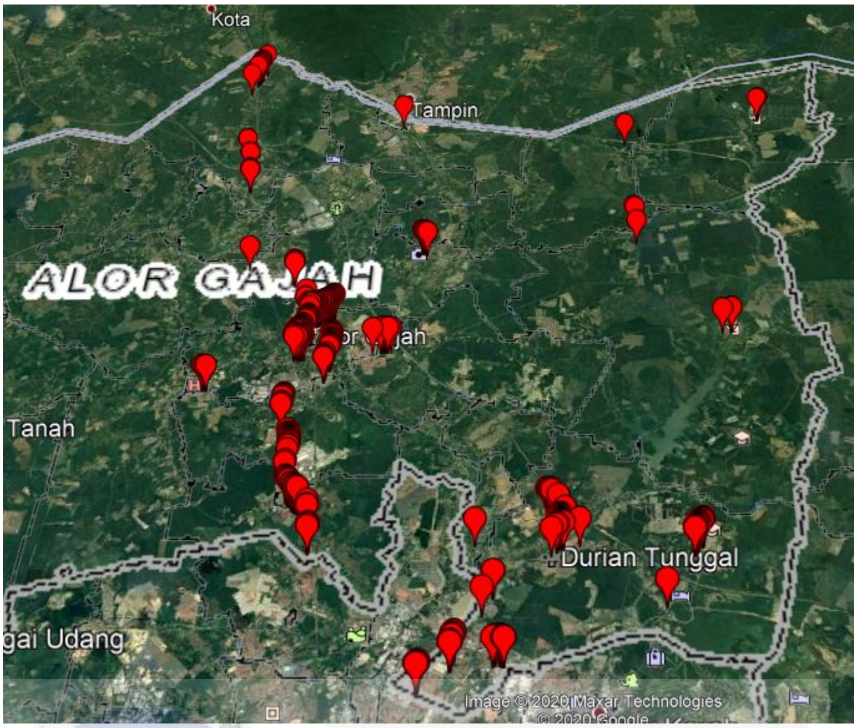


Figure 4.2.19 Map of channel 5 range 2

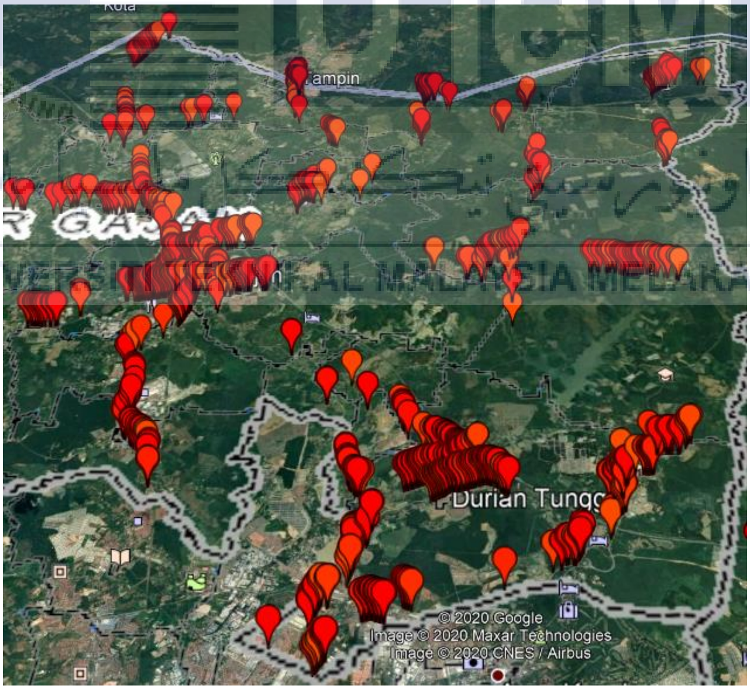


Figure 4.2.20 Map of channel 5 range 3

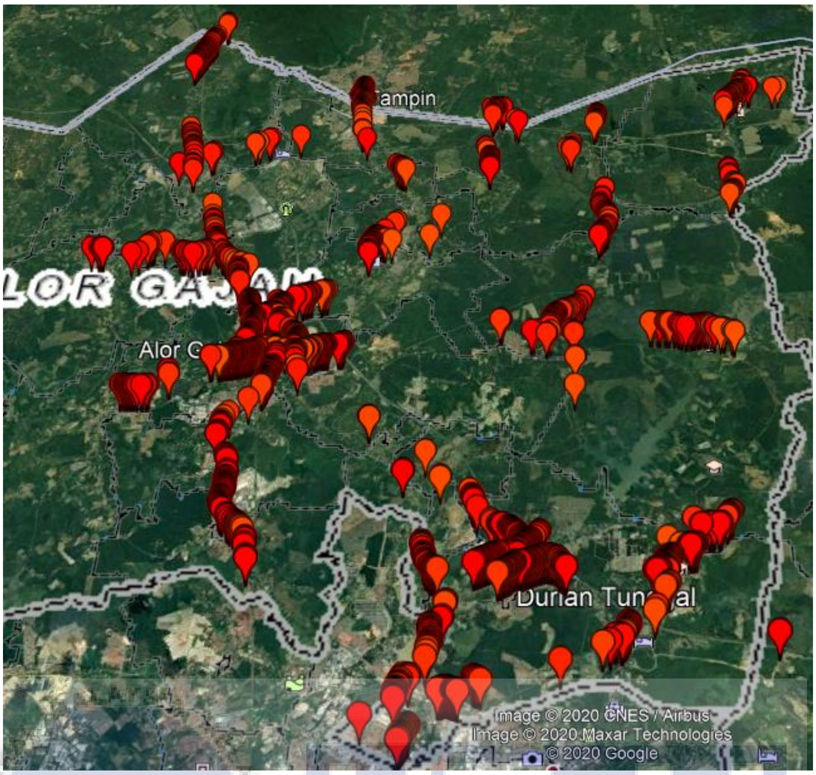


Figure 4.2.21 Map of channel 5 range 4

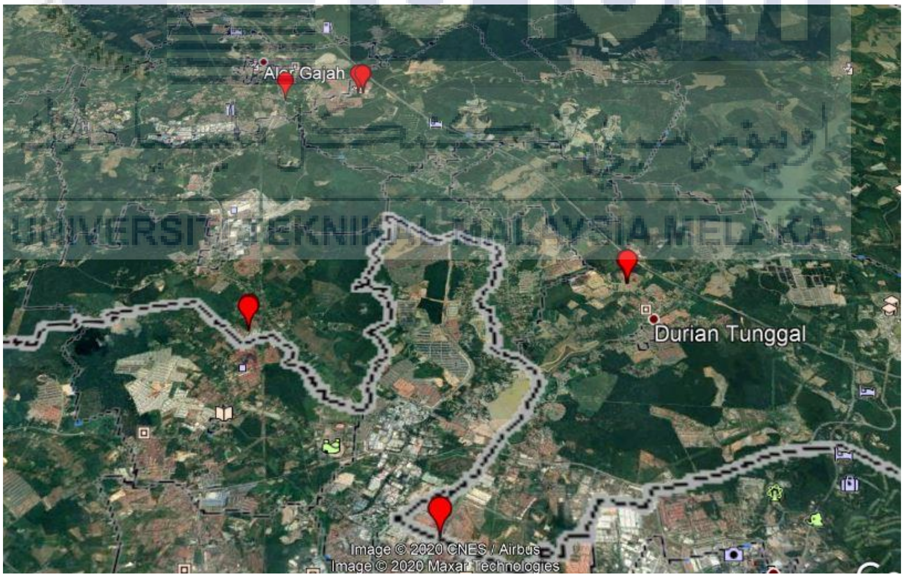


Figure 4.2.22 Map of channel 6 range 1

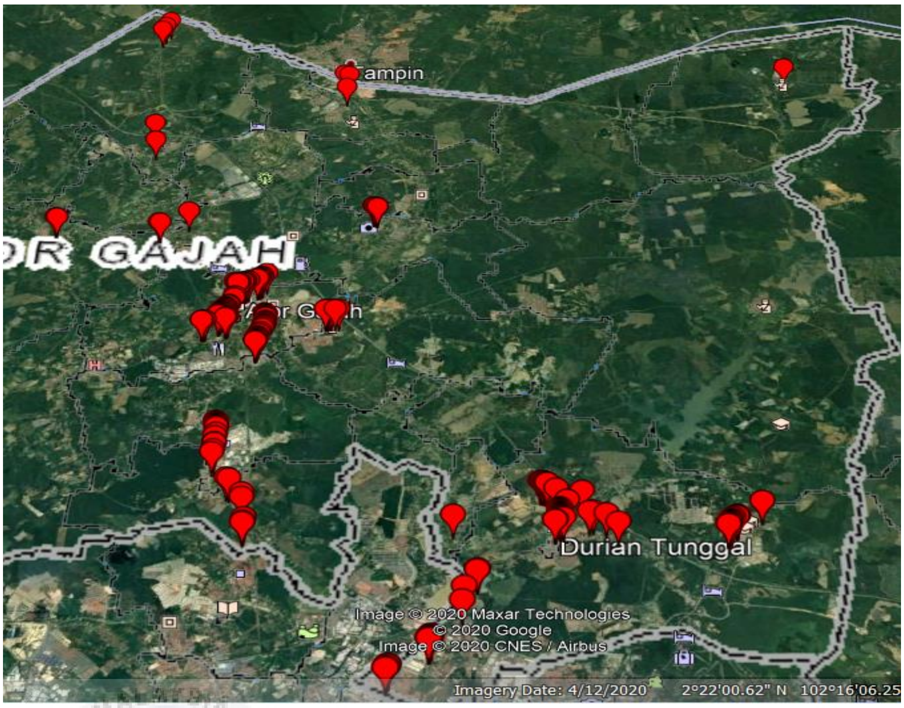
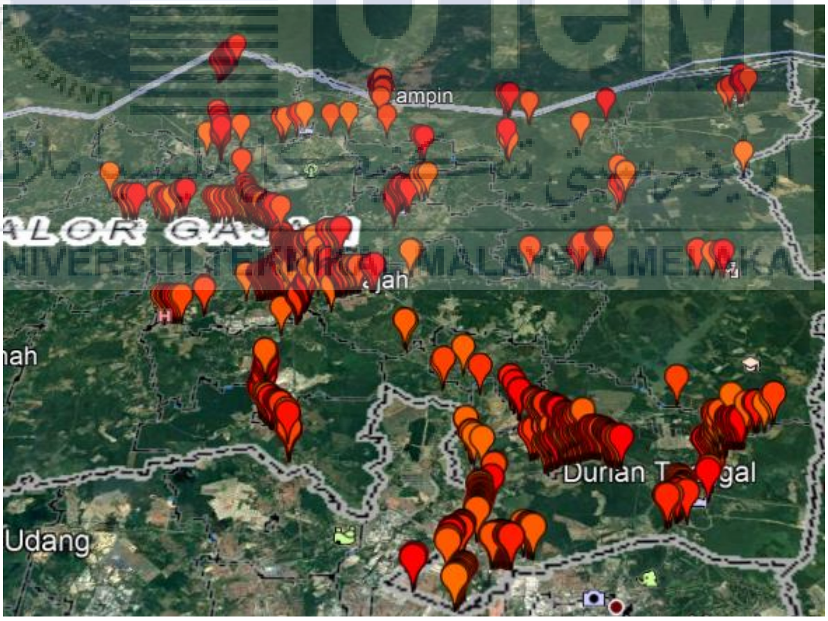


Figure 4.2.23 Map of channel 6 range 2



Red	-45.17	-48.029
Orange	-52.81	-53.42

Figure 4.2.24 Map of channel 6 range 3

Orange	-54.932	-54.93
Yellow	-57.30	-57.80
Green	-59.14	-60

Figure 4.2.25 Map of channel 6 range 4

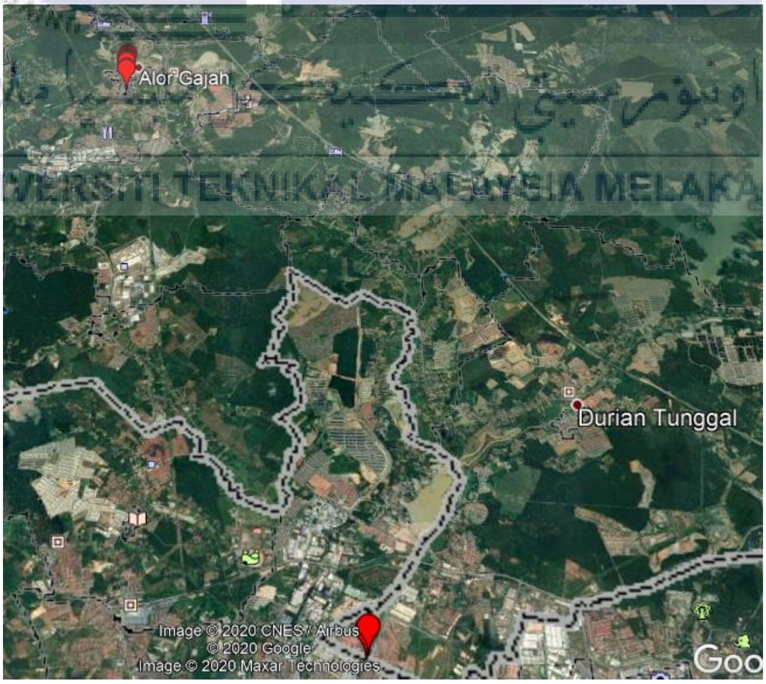


Figure 4.2.26 Map of channel 7 range 1

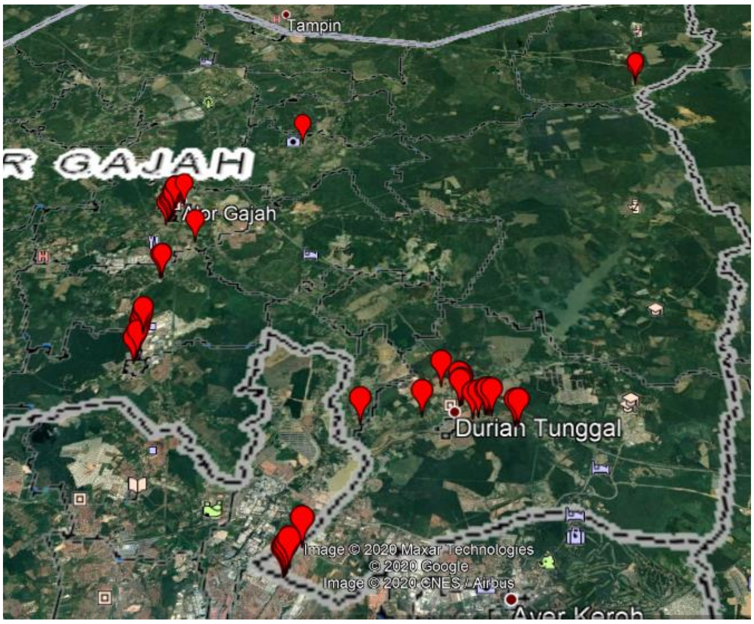
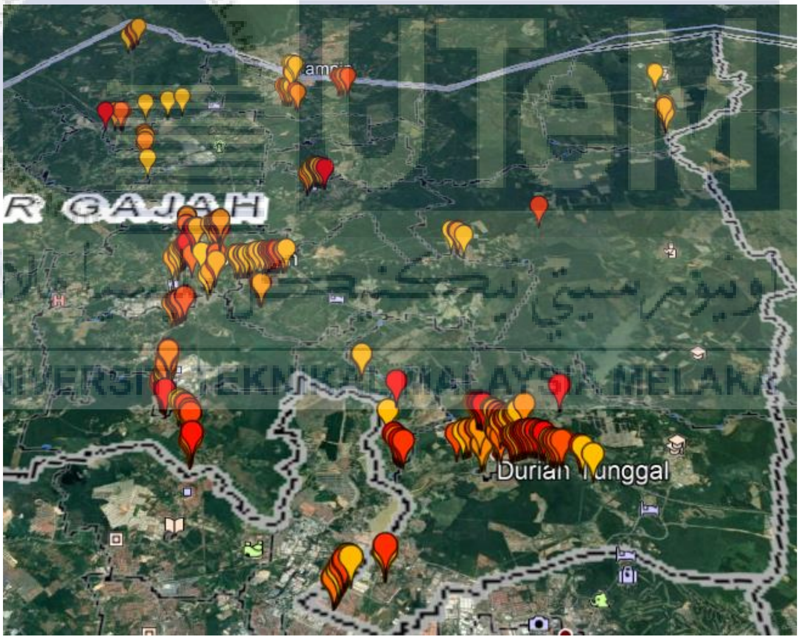


Figure 4.2.27 Map of channel 7 range 2



Red	-48.24	-48.68
Orange	-54.04	-53.49
Yellow	-56.41	-56.73

Figure 4.2.28 Map of channel 7 range 3

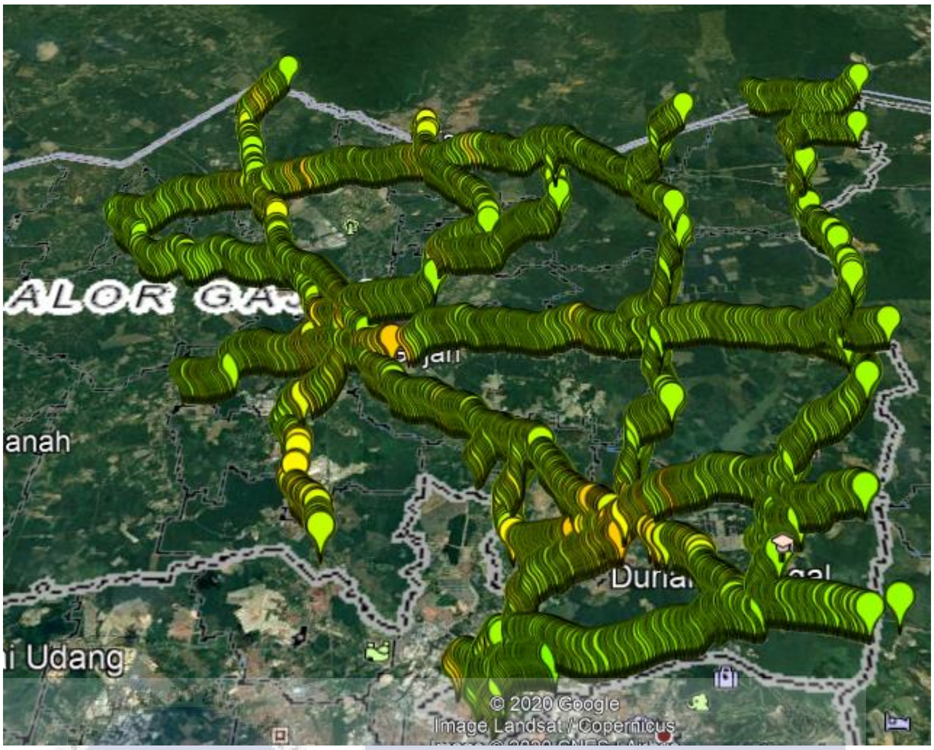


Figure 4.2.29 Map of channel 7 range 4

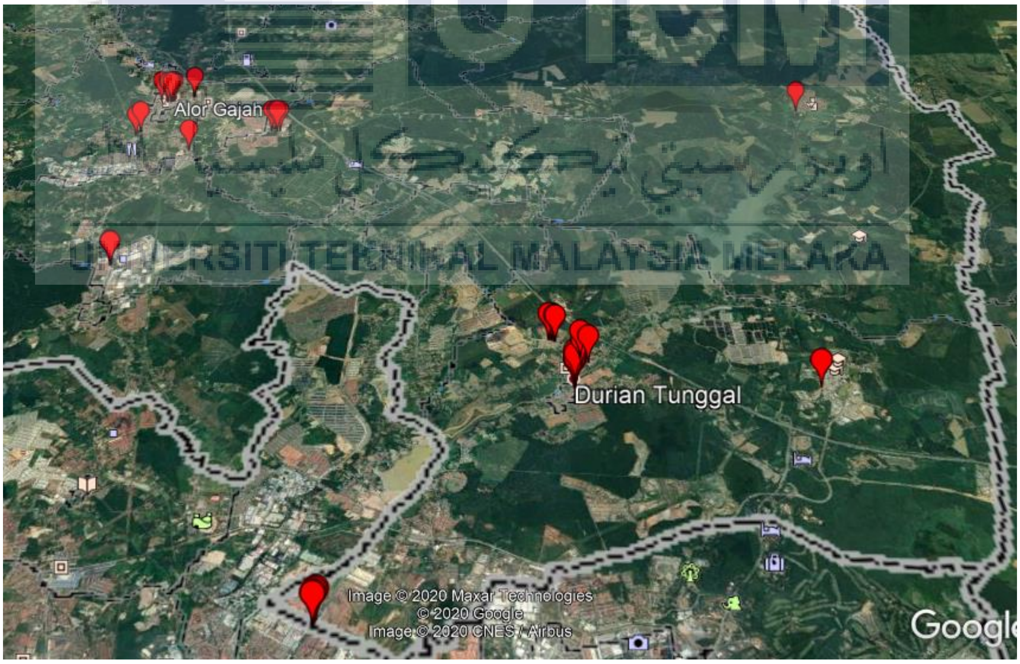


Figure 4.2.30 Map of channel 8 range 1

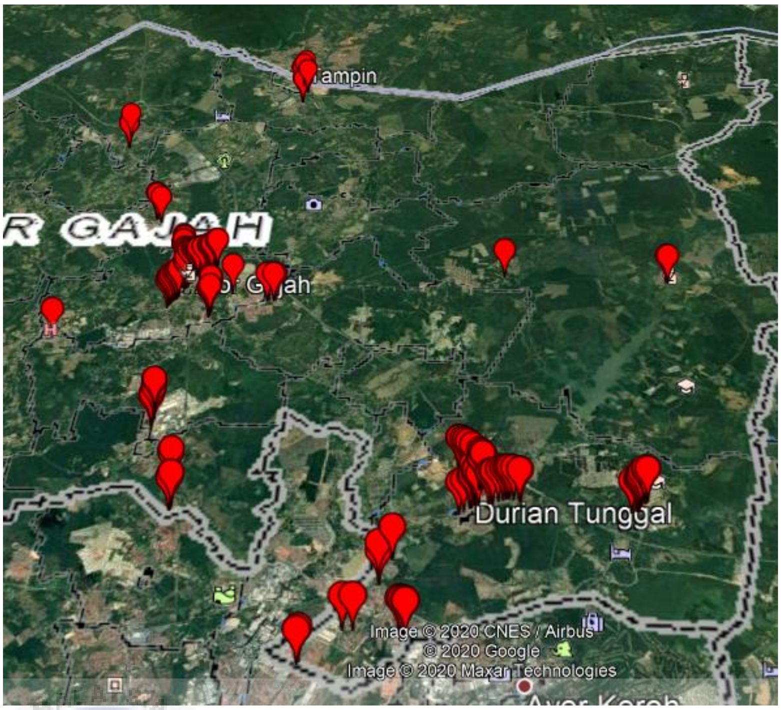
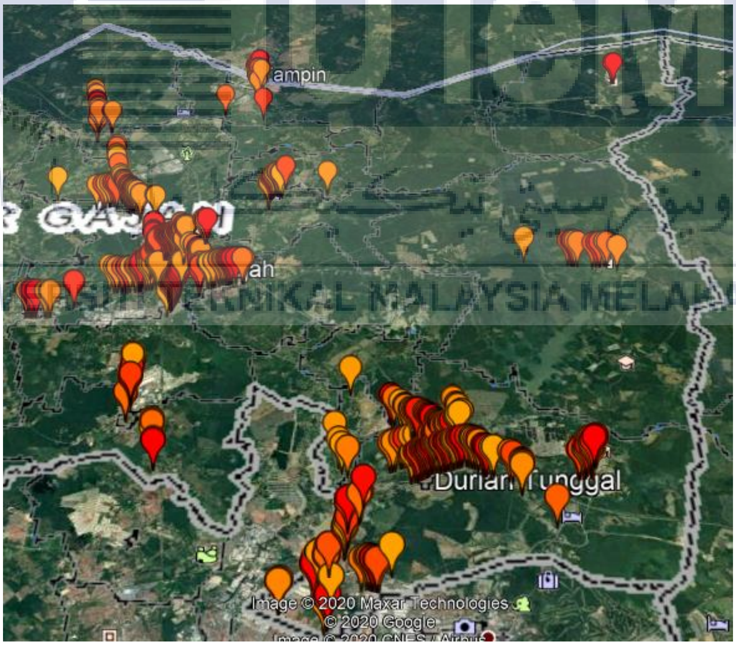


Figure 4.2.31 Map of channel 8 range 2



Red	-49.86	-50.35
Orange	-52.87	-53.73
Yellow	-55.49	-55.67

Figure 4.2.32 Map of channel 8 range 3

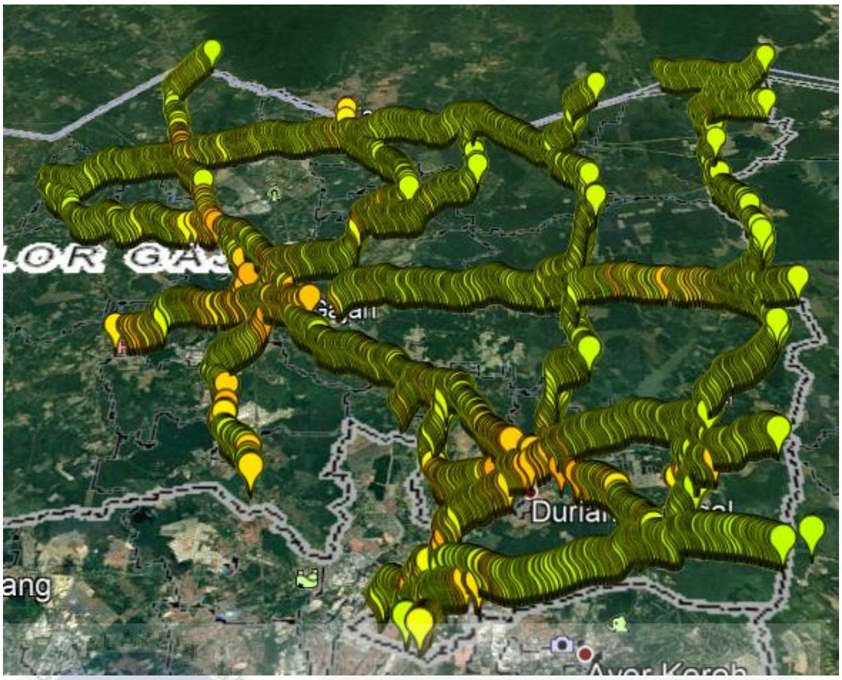


Figure 4.2.33 Map of channel 8 range 4

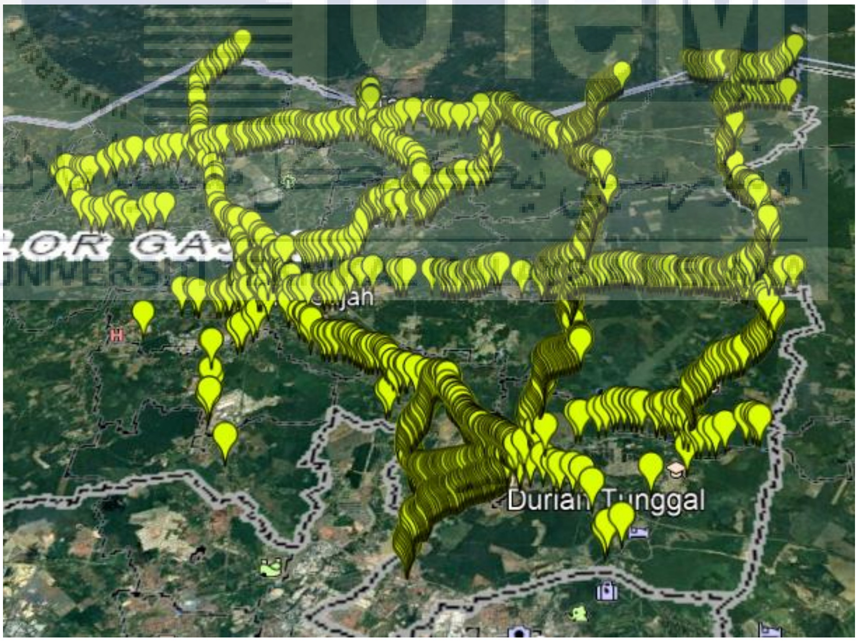


Figure 4.2.34 Map of channel 9 range 1

Figure 4.2.35 Map of channel 9 range 2

Figure 4.2.36 Map of channel 9 range 3

Figure 4.2.37 Map of channel 9 range 4

Figure 4.2.38 Map of channel 10 range 1

Figure 4.2.39 Map of channel 10 range 2

Figure 4.2.40 Map of channel 10 range 3

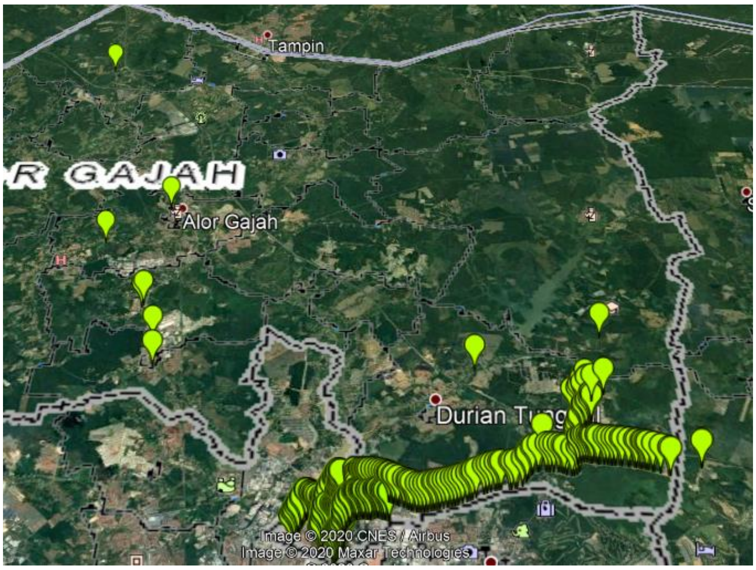


Figure 4.2.41 Map of channel 10 range 4

Firstly, Figure 4.2.1 that show the map of received RF signal level in Alor Gajah area. Figure 4.2.2 and Figure 4.2.3 is channel one range one and two has the good channel power of RF received signal level in Pulau Sebang, Tebong, Kampung Tebong, Kamung Hutan Percha, Kemuning, Taman Clonlee, Tanjung Rimau, Malaka Pindah, Durian Tunggal and Machap compared the channel one range three and four. Channel one use the frequency of 630 MHz and bandwidth of 320MHz. Figure 4.2.6 is channel two range two that has get the good result in Taboh Naning, Pulau Sebang and Durian Tunggal compared the range two, three and four. Channel two use the frequency of 750.5 MHz and bandwidth of 95 MHz. Figure 4.2.10 is channel three range one that get the best result in Taboh Naning, Kelemak and Durian Tunggal compared the range two,three and four. Channel three use the frequency of 851.5 MHz and bandwidth of 55 MHz. Figure 4.2.14 is channel four range one has get the good result of RF received level in Tebong, Kelemak, Durian Tunggal and Kampus Induk UTeM. Channel four use the frequency of 920 MHz and bandwidth of 100 MHz.

Second, Figure 4.2.18 is channel five range one has the good result in Kampus Induk UTeM, Durian Tunggal, Kelemak, Bandar Alor Gajah, Taman Permai and Rembia. Channel five use the frequency of 1.795 GHz and bandwidth of 200 MHz. Figure 4.2.22

is channel six range one has a good result of RF received signal level in Kelemak, Malaka Pindah, Rembia and Durian Tunggal. Channel six use the frequency of 2.045 GHz and the bandwidth of 300 MHz. Figure 4.2.26 is channel seven range one has the good result of RF received signal level in Bandar Alor Gajah and Durian Tunggal. Channel seven use the frequency of 2.35 GHz and bandwidth of 150 MHz. . Figure 4.2.30 is channel eight range one has the good result of RF received signal level in Bandar Alor Gajah, Durian Tunggal, Taman Merak, Kampus Induk Utem, Malaka Pindah, Kelemak and Sungei Petai. Channel eight use the frequency of 2.595 GHz and bandwidth of 250 MHz. Channel nine get all of the four range is green. Channel nine use the frequency of 3.5 GHz and bandwidth of 300 MHz. Channel ten get range one and two is yellow while range three and four is green. Channel ten use the frequency of 3.8 GHz and bandwidth of 260 MHz.

4.3 Discussion

In this project, the main focus is to produce the maps of RF received signal level in Melaka. It will display all the data from the power channel (dBm) based on the set frequency. In addition, users in Melaka, especially sitting in the Alor Gajah district, know the type of signal that is strong in their area. Therefore, telecommunications can identify upgrading communication towers to towers that can emit strong signals such as 4G and at best 5G in areas that do not have strong internet coverage.

CHAPTER 5

CONCLUSION AND FUTURE RECOMMENDATION

5.0 Introduction

In this chapter, the overall development and performance of feasibity of RF received signal level for RF energy harvesting in Alor Gajah area is discussed. This chapter also discuss about the achievement of the project objectives and emphasizes on the overall performance as well as evaluation and briefly outline the feasibity of RF received signal level for RF energy harvesting in Alor Gajah. Giving recommendations and propositions to the future work in the terms of, how to further improve and produce the maps of RF received signal level in another place.

5.1 Conclusion

In conclusion, this project can be added appropriate channels that are suitable for RF energy harvesting such as GSM, TV and other channels related to RF energy harvesting to produce a map of RF received signal level. In addition, the scale of the project is expected to be extended to the entire state of Melaka to produce a map of RF received signal level in Melaka. Therefore, with the cooperation of agencies related to the field of communication such as the Malaysian Communications and Multimedia Commission (MCMC), this project can be carried out throughout Malaysia to produce a map of RF energy received signal level in Malaysia.

5.2 Recommendation of Future Work

It is possible that the level of RF signal received for RF energy intake will display a map of RF received signal in the Alor Gajah area. It is very useful to users about places that have a strong signal according to their respective frequencies such as GSM, Wi-Fi and others. In addition, telecommunications can use the map to identify suitable places to develop the latest communication infrastructure. To upgrade this project, it is expected to provide a map of RF received signal level throughout the state of Melaka and will be extended to the whole of Malaysia. This project should add channels related to RF energy harvesting to produce a map that should show all channels.

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