

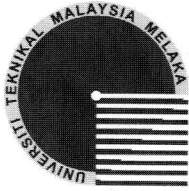
**MOBILE SIGNAL CANCELLATION DEVICE**

**MOHAMMAD FIRDHAUS BIN SULAIMAN**

This report is submitted in partial fulfillment of the requirements for the award of  
Bachelor of Electronic Engineering (Industrial Electronics) With Honours

Faculty of Electronic and Computer Engineering  
Universiti Teknikal Malaysia Melaka

May 2008



UNIVERSITI TEKNIKAL MALAYSIA MELAKA  
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN  
PROJEK SARJANA MUDA II

Tajuk Projek : MOBILE SIGNAL CANCELLATION DEVICE

Sesi Pengajian : 2007/2008

Saya MOHAMMAD FIRDAUS BIN SULATMAN  
(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (  $\checkmark$  ) :

SULIT\*

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD\*

(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

Man  
(TANDATANGAN PENULIS)

Alamat Tetap: No. 136, Taman Sri Wangi,

93050, Petra Jaya, Kuching  
Sarawak

Tarikh: 7 MAY 2008

Zahariah BT Manap  
(COP DAN TANDATANGAN PENYELIA)  
ZAHARIAH BT MANAP

Pensyarah  
Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer (FKEKK),  
Universiti Teknikal Malaysia Melaka (UTeM),  
Karung Berkunci 1200,  
Ayer Keroh, 75450 Melaka

Tarikh: 12/05/08

“I hereby declare that this report is the result of my own work except for the quotes as cited in the references.”


Signature :..... *Mb* .....

Author: .Mohammad Firdhaus bin Suaiman.....

Date: ..... 7 May 2008 .....

“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours. “

Signature

  
.....

Supervisor's Name

**ZAHARIAH BT MANAP** .....

Date

Pensyarah  
Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer / FKEKK  
Universiti Teknikal Malaysia Melaka (UTeM),  
Karung Berkunci 1200,  
Ayer Keroh, 75450 Melaka  
12/05/08

Dedicated to my beloved parents, Sulaiman bin Ahmat and Rasiah bt Hj Yusoff, my family.

## ACKNOWLEDGMENT

No task in this world can be completed alone. There are always several forces that push a goal into success. It would be naive to believe that a university student like me could break this principle. I would like thank Almighty Allah for the blessings he bestowed upon me, making every next step that much easier for me.

I also would like to thank my family, especially my parent for their constant support throughout the course of the project. I also like to thank all my friends at UTeM for their valuable suggestions and insights. A special thanks goes out to my faculty's staff as well, and the cooperative people there for allowing me to use their facilities such as oscilloscope, multimeter and RF board soldering facility, which would not have been otherwise available to me.

And, most of all, I would like to thank my supervisor, Puan Zahariah bt Manap, for her support and invaluable insight throughout the course of the project. Without the support that I received, I may not have been able to complete the project.

## ABSTRACT

Mobile Signal Cancellation Device is a device that can be used to prevent mobile phone from receiving and transmitting radio frequency signal within GSM range. The device will generate the same signal frequency but out of phase by  $180^\circ$ . The transmitted signal will effectively destruct or cancel the received signal from the antenna of the device. There is deterioration of mobile signal where signal interference may occur. Besides, there are some places where any incoming and outgoing call may irritate or disturbing the people around. The mobile signal also has been off limits in highly secure places where any incoming or outgoing data and information are strictly prohibited. The main objective of the project is to design and built a 900MHz frequency generator and a variable coverage transmitter. Both 900MHz frequency generator and variable coverage transmitter will be integrated to each other where finally, a cancellation device within 900MHz will be resultant. The outcome of the project is a device that will detect any incoming mobile signal and will transmit the same signal but in different phase by  $180^\circ$ .

## ABSTRAK

Alat Peranti Penghapus Isyarat Telefon ialah sebuah peranti yang digunakan untuk mengelakkan telefon bimbit daripada menerima dan menghantar isyarat panggilan GSM. Peranti ini akan menghasilkan frekuensi isyarat yang sama tetapi mempunyai perbezaan fasa sebanyak  $180^\circ$ . Isyarat yang dihantar akan menghapuskan isyarat yang diterima daripada antena peranti tersebut. Isyarat daripada telefon bimbit boleh mendatangkan kemalangan atau musibah pada waktu-waktu tertentu. Selain itu, terdapatnya lokasi-lokasi di mana panggilan telefon boleh mengganggu ketenangan dan ketenteraman orang awam dan sekeliling. Isyarat telefon bimbit juga dilarang di tempat yang mempunyai sistem sekuriti yang tinggi di mana sebarang maklumat dari luar atau dalam adalah dilarang sama sekali. Objektif utama projek ini adalah untuk merekabentuk dan menghasilkan penjana frekuensi 900MHz dan pemancar liputan pembolehubah. Kedua-dua penjana frekuensi 900MHz dan pemancar liputan pembolehubah akan disepadukan antara satu sama lain. Dan akhirnya, peranti pembatalan untuk 900MHz akan dihasilkan. Hasilnya, sebuah peranti yang mampu mengesan sebarang isyarat telefon bimbit dan akan memancar isyarat yang sama tetapi berlawanan fasa.



## TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	DECLARATION	iii
	DEDICATION	v
	ACKNOWLEDGMENTS	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENTS	ix
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
<b>I</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Introduction To Mobile Signal Cancellation Device	1
	1.2 Project Overview	2
	1.3 Objectives of the project	3
	1.4 Problem Statement	3
	1.5 Scope of Work	4
	1.6 Methodology	5
	1.7 Thesis Structure	6
<b>II</b>	<b>LITERATURE REVIEW</b>	<b>7</b>
	1.8 Operation Of The Device	7
	1.9 Mobile Canceling Technique	9

1.9.1	Type A Device: Signal Cancellation Devices	9
1.9.2	Type B Device: Intelligent Cellular Disablers	10
1.9.3	Type C Device: Intelligent Beacon Disablers	11
1.9.4	Type D Device: Direct Receive And Transmit Signal Cancellation Devices	12
1.9.5	Type E Device: EMI Shield – Passive Signal Canceling	13
1.10	The Frequency Issue	14
1.11	Superposition of Waves	15
<b>III</b>	<b>METHODOLOGY</b>	<b>16</b>
3.1	The Power Supply Section	17
3.2	Intermediate Frequency (IF) Section	19
3.2.1	Triangular wave generator	20
3.2.2	Noise Generator	21
3.2.3	Signal Mixer and DC Offset Circuit	22
3.3	Radio frequency (RF) section	24
3.3.1	Voltage Control Oscillator (VCO)	25
3.3.2	RF Power Amplifiers	27
3.3.3	Antenna	27
<b>IV</b>	<b>RESULTS AND DISCUSSION</b>	<b>30</b>
4.1	Device Designation	30
4.1.1	Power Supply Section Design	30
4.1.2	IF Section Design	31
4.1.2.1	Triangular Wave Generator	31
4.1.2.2	Mixer/ DC Offset	33

4.1.3	RF Section Design	35
4.1.3.1	VCO	35
4.1.3.2	RF Power Amplifiers	37
4.1.3.3	Antenna	40
4.1.4	Matlab	41
4.2	Results	42
4.2.1	Simulation	42
4.2.1.1	Triangular Wave Generator	42
4.2.1.2	Noise Generator	43
4.2.1.3	Matlab Simulation	44
4.2.2	Hardware	45
4.3	Discussion	47
<b>V</b>	<b>CONCLUSION</b>	<b>49</b>
5.1	Conclusion Of The Project	49
5.2	Future Suggestion	49
	<b>REFERENCE</b>	<b>51</b>

## LIST OF TABLES

<b>NO</b>	<b>TITLE</b>	<b>PAGE</b>
1.1	Mobile Operators and Bandwidth Frequencies	4
3.1	555 timer pin function	21
4.1	RF output of VCO from voltage tune	34

## LIST OF FIGURES

NO	TITLE	PAGE
1.1	Signal canceling coverage	5
2.1	Superposition Constructive	15
2.2	Superposition Destructive	15
3.1	General block diagram of Mobile Signal Cancellation Device	17
3.2	Block diagram of dual polarity power supply	18
3.3	Power supply circuit	19
3.4	Block diagram of IF section	20
3.5	555 timer in astable multivibrator configuration	20
3.6	Voltage across Cext	21
3.7	Noise Generator Circuit	22
3.8	Op-amp in summer configuration	23
3.9	IF Section Circuit	23
3.10	Block diagram of RF section	25
3.11	Internal circuitry of MAX2623	26
3.12	MAX2623 pin configuration	26
3.13	Typical biasing configurations for MAR4SM	27
3.14	Helical Antenna	28
3.15	RF section circuit	29

4.1	555 internal circuitry block diagram	32
4.2	Triangular wave generator schematic	33
4.3	Maxim 2623 Typical Connections	35
4.4	Typical biasing configuration for MR-4SM	38
4.5	MAR4SM design	39
4.6	T-Network Attenuator	39
4.7	Monopole Principal E-plane patterns	40
4.8	Monopole Principal H-plane patterns	40
4.9	Block diagram of the varying frequency oscillator	41
4.10	Triangular wave by 555 timer	43
4.11	Simulation of noise wave	44
4.12	Spectrum of the output signal	44
4.13	PCB of power supply section	45
4.14	PCB of IF section	46
4.15	PCB of RF section	46
4.16	Mobile Signal Cancellation Device	47
4.17	Expected results from the hardware device	48

## **CHAPTER I**

### **INTRODUCTION**

In this chapter, Mobile Signal Cancellation Device will be briefly introduced where this chapter will also include the general working operation of the device, the mobile signal canceling technique which consist five types of signal canceling techniques, and the brief discussion of the frequency of the signal that will be canceled by the device. The project overview, objectives, problem statement and a brief introduction of methodology also included in this chapter.

#### **1.1 Introduction To Mobile Signal Cancellation Device**

A mobile cancellation device is a device which transmits noise-induced signals at the same frequencies at which a GSM system operates, thus rendering mobile phones in the specified area unusable.

The rapid production of cell phones in recent years to all over the place status eventually raised problems such as their potential use to invade privacy, contribute to academic cheating, or even aid in corporate espionage. In addition public backlash was growing against the perceived disruption cell phones introduced in daily life. While

older analog cell phones often suffered from chronically poor reception and could even be disconnected by simple interference such as high frequency noise, increasingly sophisticated digital phones have led to more elaborate counter-measures.

Cell phone canceling devices are an alternative to more expensive measures against cell phones, such as Faraday cages, which are mostly suitable as built in protection for structures. They were originally developed for law enforcement and the military to interrupt communications by criminals and terrorists. Some were also designed to foil the use of certain remotely detonated explosives. The civilian applications were apparent, so over time many companies originally contracted to design signal cancellation devices for government use switched over to sell these devices to private entities. Since then, there has been a slow but steady increase in their purchase and use especially in major metropolitan areas.[1]

## **1.2 Project Overview**

Mobile Signal Cancellation Device is a device that used to prevent mobile phone from receiving and transmitting radio signals within GSM range. It is also can be known as denial-of-service attack. The device will generate signals with same frequency but different phase by  $180^\circ$  to cancel the detected GSM signals. It will effectively disable mobile phones signals within specific area. The device can be used in certain areas where a phone call is prohibited for its safety, health, silence and security due to its signal's interference and interruption. Mobile Signal Cancellation Device is mainly divided by 2 part which is; detector and transmitter. Detector is constructed by antenna while transmitter is constructed by triangle wave generator, mixer, noise generator, RF power amplifiers and VCO.



### **1.3 Objectives of the project**

To successfully complete this project, there are several objectives that must be completed. Each objective brings significant result and addition that will affect the project. The objectives are as follows:

- 1) To design and built 900MHz frequency generator.
- 2) To design and built a variable coverage transmitter.
- 3) To integrate the frequency generator and the transmitter.
- 4) To provide a cancellation device within 900MHz range

### **1.4 Problem Statement**

There are 3 situations of places where a phone call would be particularly disruptive and prohibited for its dangerous, safety and effects to the other equipment, peoples and other cause. The first situation of places is where required silent and quiet atmosphere. Any phone call may disturb and annoyed other peoples around the call receiver for its ringing tone, light of mobile's screen. The phone call may disturb honor of some places for its worship. For examples at cinemas, lecture rooms, libraries and sites of worship. The phone call also useful at the place where any signal interference from mobile phone may cause something worst to happen. The signal of mobile could be dangerous in certain location which may cause explosion. Besides, the mobile signal also can interfere with signal from medical equipment in some places where the equipment is used. Signal interference also can corrupt plane system which can jeopardize all the passengers and cabin crews. The device also can be used at the places of highly restricted security level area. Any incoming and outgoing information are strictly prohibited. Any discussion and conversation is completely private and only the certain party will involved. The device can be use to prevent any eavesdropping and information transfer from inside to outside or vise versa. This is quite useful in any highly security system like military or governmental affair.

## 1.5 Scope of Work

There are 3 main mobile operators in Malaysia. The mobile signal bandwidth frequencies are as follow:

Table 1.1 Mobile Operators and Bandwidth Frequencies

Mobile Operators	900 MHz	1800MHz
	X	X
Celcom	X	X
Digi		X

The main focus for this project is to cancel the one of bandwidth frequency, 900MHz.

The device is expected to have ability to reach range depends on its power. When low power is supplied, the smaller range of the device will cover. While the higher power is supplied to the device, the longer range that the device will cover. The range can be as large as a football field.

The ranges of the device also depend on the local environment. Whenever the signal of the device that emits from the antenna of the device move through obstacles like hills or walls of a building, the obstacles will reflect some signals from moving through it. It will affect the range of the device.

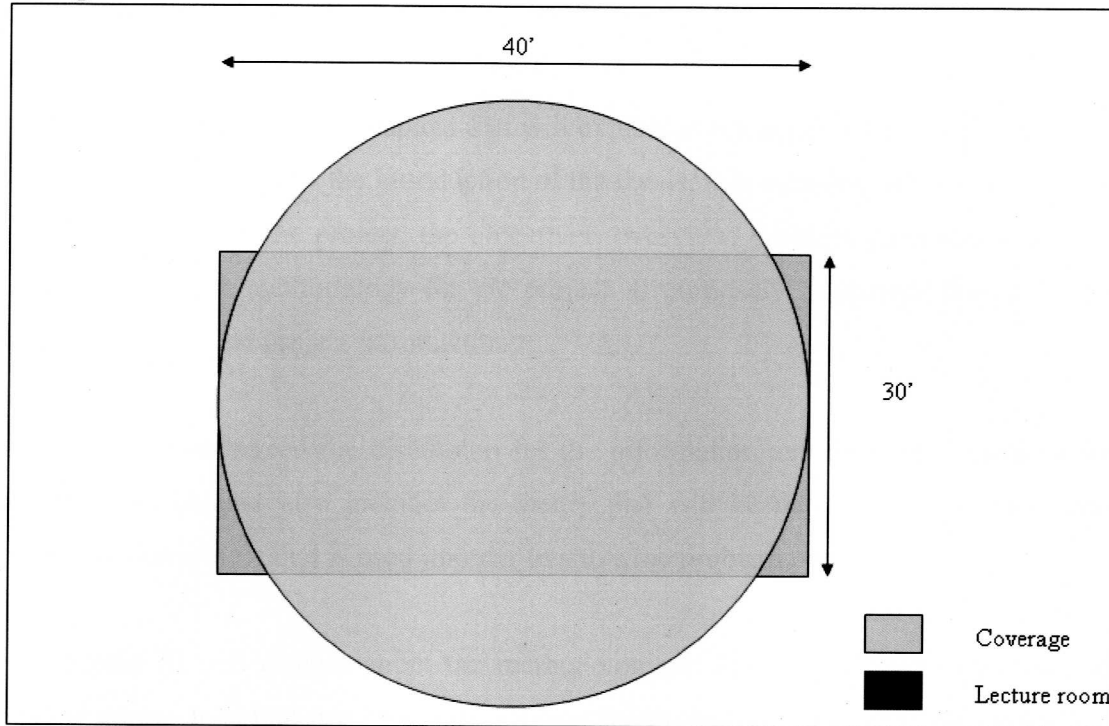


Figure 1.1 Signal canceling coverage

As for the project, the device will cover about the width of a lecture room that is 30' x 40'.

## 1.6 Methodology

The device consists of several blocks which represent the main function or purpose of circuits inside the device. The tower transmit represent the signal from the tower that transmit the mobile signal and will be received by the transceiver of each mobile station or mobile user. It received by antenna from the device. As soon the 900MHz signal detected or received by the antenna, the signal generator will start the operation. The signal generator will generate the same frequency of the received signal, which is also 900MHz. The 900MHz generated signal will be inverted by 180° using the signal inverter. The signal inverter consist an inverting amplifier. The inverted 900MHz will eventually cancel the signal received by using the concept of destructive superposition.

## 1.7 Thesis Structure

The thesis contains five chapters that will explain every detail aspect for this project. The first chapter contains the introduction of the thesis. It is including a brief description and introduction for the project, the objectives, overview, problem statement and short explanation of the methodology for the project. It purposely to provide the reader an understanding of the project introduction

Chapter II embraced the discussion for the information and research related to the project. This chapter also includes the theory that will be the basic, perspective and method of the project that is used in order to solve the problem occurs.

Chapter III will discuss about the methodology of the project. Every method and method approached that use during developing the project will be stated and elaborated deeply.

Chapter IV will discuss briefly about the results or the calculation that been used for the designing the circuit involved. The result that been gained also been analyzed in the discussion section

The final chapter contains the conclusion of the project with the suggestion for the future project for the level improvement. The conclusion made based on project achieving and learning experience gained from the starting until the end of this project.

## **CHAPTER II**

### **LITERATURE REVIEW**

A literature review is very important to tackle all the theories needed to make the project possible. The section will include the operation, canceling techniques, the frequency issue of the devices. Also the section will tackle the principle of superposition waves which contains superposition constructive and destructive.

#### **2.1 Operation Of The Device**

Canceling devices overpower the cell phone by transmitting a signal on the same frequency as the cell phone and at a high enough power that the two signals collide and cancel each other out. Cell phones are designed to add power if they experience low level interference, so the signal cancellation device must recognize and match the power increase from the phone.

Cell phones are full-duplex devices, which mean they use two separate frequencies, one for talking and one for listening simultaneously. Some signal cancellation devices block only one of the frequencies used by mobiles, which has the effect of blocking both. [2]

The phone is tricked into thinking there is no service because it can receive only one of the frequencies. Less complex devices block only one group of frequencies, while sophisticated signal cancellation devices can block several types of networks at once to head off dual-mode or tri-mode phones that automatically switch among different network types to find an open signal. Some of the high-end devices block all frequencies at once, and others can be tuned to specific frequencies.

To cancel a mobile signal, a device that broadcasts on the correct frequencies is needed. Although different cellular systems process signals differently, all cell phone networks use radio signals that can be interrupted. GSM, used in digital cellular and PCS-based systems, operates in the 900-MHz and 1800-MHz bands in Europe and Asia and in the 1900-MHz (sometimes referred to as 1.9-GHz) band in the United States. Signal cancellation devices can broadcast on any frequency and are effective against AMPS, CDMA, TDMA, GSM, PCS, DCS, iDEN and Nextel systems. Old-fashioned analog cell phones and today's digital devices are equally susceptible to canceling.[2]

Disrupting a cell phone is the same as canceling any other type of radio communication. A cell phone works by communicating with its service network through a cell tower or base station. Cell towers divide a city into small areas, or cells. As a cell phone user drives down the street, the signal is handed from tower to tower.

A canceling device transmits on the same radio frequencies as the cell phone, disrupting the communication between the phone and the cell-phone base station in the tower. It's called a denial-of-service attack. The signal cancellation device denies service of the radio spectrum to the cell-phone users within range of the canceling device.[2]

Older signal cancellation devices sometimes were limited to working on phones using only analog or older digital mobile phone standards. Newer models such as the double and triple band signal cancellation devices can block all widely used systems

(AMPS, iDEN, GSM, etc) and are even very effective against newer phones which hop to different frequencies and systems when interfered with. As the dominant network technology and frequencies used for mobile phones vary worldwide, some work only in specific regions such as Europe or North America.[1]

The power of the signal cancellation device's effect can vary widely based on factors such as proximity to towers, indoor and outdoor settings, presence of buildings and landscape, even temperature and humidity play a role.

There are concerns that crudely designed signal cancellation devices may disrupt the functioning of medical devices such as pacemakers. However, like cell phones, most of the devices in common use operate at low enough power output (<1W) to avoid causing any problems.[1]

## **2.2 Mobile Canceling Technique**

There are many different approaches to canceling a cellular device in a specific area but the five main approaches used or being developed are described in the RABC (Radio Advisory Board of Canada) Mobile & Personal Communications Committee's (M&PCC) meeting of June 22, 1999. These techniques are as discussed below:[3]

### **2.2.1 Type A Device: Signal Cancellation Devices**

This type of device comes equipped with several independent oscillators transmitting 'canceling signals' capable of blocking frequencies used by paging devices as well as those used by cellular/PCS systems' control channels for call establishment.

When active in a designated area, such devices will (by means of RF interference) prevent all pagers and mobile phones located in that area from receiving

and transmitting calls. This type of device transmits only a canceling signal and has very poor frequency selectivity, which leads to interference with a larger amount of communication spectrum than it was originally intended to target.

This technique could be implemented without cooperation from PCS/cellular providers, but would negatively impact PCS/cellular system operation. Once canceling begins, escalation to counter-canceling may result, either by deliberate action or by autonomous response of power control systems within a PCS/cellular system.

One other area of concern is the raising of the general RF noise floor in the neighborhood as a result of a Type “A” device. Many communication systems are required to work in all types of buildings under very low signal conditions and the raising of the noise floor by various canceling transmitters in the same band and vicinity could make the difference between receiving or not receiving a crucial message.[3]

### **2.2.2 Type B Device: Intelligent Cellular Disablers**

Unlike signal cancellation devices, Type “B” devices do not transmit an interfering signal on the control channels. The device, when located in a designated ‘quiet’ area, functions as a ‘detector’. It has a unique identification number for communicating with the cellular base station. When a Type “B” device detects the presence of a mobile phone in the quiet room; the ‘filtering’ (i.e. the prevention of authorization of call establishment) is done by the software at the base station.

When the base station sends the signaling transmission to a target user, the device after detecting simultaneously the presence of that signal and the presence of the target user, signals the base station that the target user is in a ‘quiet’ room; therefore, do not establish the communication. Messages can be routed to the user’s voice-mail box, if the user subscribes to a voice-mail service. This process of detection and interruption