



Faculty of Engineering

**900MHZ AND 1800MHZ MOBILE PHONE SIMULATION WITH
HUMAN HEAD AND HAND MODEL**

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TK
6564.4
C45
N269
2010

**Bachelor of Engineering with Honours
(Electronics & Telecommunication Engineering)
2010**



1000217237

UNIVERSITI MALAYSIA SARAWAK

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**900 AND 1800 MHz MOBILE PHONE SIMULATION WITH HEAD AND
HAND MODEL**

NASYITAH BINTI AHMAD KAMAL

This project report is submitted as a partial fulfillment of
the requirements for the degree of Bachelor of Engineering with Honors
(Electronics and Telecommunication Engineering)

Faculty of Engineering

UNIVERSITI MALAYSIA SARAWAK

2009/2010

This Final Year Project attached here:

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WITH HEAD AND HAND MODEL**

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Dedicated to my beloved family and friends

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ACKNOWLEDGEMENT

This project has been made possible as a result of the co-operation and support rendered by several individuals. While it is impossible to list down all of them, I am very grateful for their assistance.

Firstly, I would like to thank my supervisor, Ms. Kasumawati Binti Lias. Her comments support, and guidance has helped me throughout the course our project. Without her cooperation and dedicated work in keeping the project on track, I would not be able to complete the project easily and on time.

Thankfulness would like to give to my friends and family who give full supports to me either morally or financially. They had helped me in sailing through the many hard days in lives and studies all these while.

Finally, I express my gratefulness to in the individuals who involved direct or indirectly during the progress of this project.

ABSTRAK

Dalam era modenisasi ini, komunikasi memainkan peranan yang penting untuk menyebarkan dan menyampaikan maklumat kepada orang ramai melalui pelbagai saluran. Penggunaan alat komunikasi seperti telefon bimbit telah mendapat sambutan yang hangat ekoran daripada ledakan sains dan teknologi. Keadaan sedemikian telah menimbulkan isu kesihatan di kalangan masyarakat akibat daripada penggunaan telefon bimbit secara berleluasa yang berkait rapat dengan pendedahan terhadap radio frekuensi. Oleh itu, projek ini bertujuan untuk menyelidik kesan pemancaran oleh telefon bimbit terhadap manusia. Sasaran utama projek ini adalah untuk mencari nilai "Specific Absorption Rate" (SAR) melalui simulasi "Computer Simulation Technology" (CST). Projek ini menumpukan secara terperinci untuk SAR 1g dan 10g tisu otak. Dalam konteks ini, dua jenis telefon bimbit digunakan untuk kajian iaitu telefon bimbit berfrekuensi 900MHz dan 1800MHz. Dengan merujuk kepada hasil kajian, didapati bahawa nilai SAR bagi 1g dan 10g tisu otak tidak melebihi had yang ditetapkan oleh ICNIRP (International Commission on Non-Ionizing Radiation Protection), iaitu 2W/kg. Oleh yang demikian, kesimpulannya, penggunaan telefon bimbit tidak memaparkan kesan terhadap kesihatan manusia. Walaubagaimanapun, telefon bimbit mampu meninggalkan kesan sampingan dari segi biologi terhadap penggunanya seperti mual, sakit kepala dan penat.

ABSTRACT

Communication referred as an information transmission from one place to another place. The usage of mobile communication such as mobile phones had increased rapidly. With that, peoples concern about the health issues arise from the wide usage of mobile phones which are associated with the Radio Frequency (RF) exposure from the mobile phones. This project investigates the radiation effects of mobile phones towards human health. The main aim of this project is to determine the *Specific Absorption Rate (SAR)* values via *Computer Simulation Technology (CST)* simulation in order to indicate the effects of mobile phones towards human health. This project concentrates on the SAR value computation of 1g and 10g of brain tissue. Throughout this project, two types of mobile phones either with frequencies of 900MHz and 1800MHz are covered for simulation. According to the results, the SAR values obtained for 1g and 10g of brain tissue do not exceed the limit of threshold exposure, $2W/Kg$. Therefore it can be deduced that the mobile phones exhibit no adverse health effects towards human health. However, there are several temporary adverse health effects such as dizziness, headaches and fatigue. As a conclusion, the radiations of the mobile phones do not produce adverse health effects towards human health. Nevertheless, further investigations are required in order to provide concrete evidences on mobile phones radiation effects towards human health.

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ABBREVIATIONS

LIST OF NOTATIONS

2G	Second Generation Mobile Communication
3G	Third Generation Wireless Technology
4G	Fourth Generation Mobile Communication
ABC	Absorbing Boundary Condition
AMPS	Amplitude Modulation Pulse Synchronize
CDMA	Code Division Multiple Access
CST	Computer Simulation Technology
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMF	Electromagnetic Field
EMI	Electromagnetic Interference
EMW	Electromagnetic Wave
FDTD	Finite Difference Time Domain
GPRS	General Packet Radio Services
GSM	Global System for Mobile Communication
GUI	Graphic User Interface
IC	Integrated Circuit
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEGMP	International Expert Group on Mobile Phones
MCMC	Malaysian Communications and Multimedia Commission
MHLG	Ministry of Housing and Local Government
MMS	Multimedia Messaging Service
MOH	Ministry of Health Malaysia
MOM	Method Of Moment
MSC	Mobile Switching Center
NET	Nikkon Telegraph and Telephone
NIR	Non-Ionizing Radiation
NMT	Nordic Mobile Telephone
PDA	Personal Digital Assisstant
PEC	Perfectly Electric Conductor
RF	Radio Frequency

RFIC	Radio Frequency Integrated circuit
SAR	Specific Absorption Rate
SAM	Standard Anthropomorphic Model
SMS	Short Message Service
TDMA	Time Division Multiple Access
UMTS	Universal Mobile Telecommunications system
WAP	Wireless Application Protocol
W-CDMA	Wide Band Code Division Multiple Access
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Introduction

The first commercial launch of cellular telecoms was launched by NET (Nippon Telegraph and Telephone) in Tokyo Japan in 1979 [1]. The introduction of cellular phone began to grow rapidly and the users of cellular phone increase from years to years. The technology of cellular phone also known as mobile phone began to proliferate until it became portable and held hand phone. Nowadays, the using of mobile phone not only limit for call and messaging (SMS) but it is also used for other services such as, Bluetooth and Internet access.

Up to the year 2007, the population of mobile phone user are more than 0.4 billion users in China. This shows that mobile phones become most widely spread technology and commonly used electronic devices with the increasing number of users. In China only, the rate of brain cancer of male suffers in city has increased 100% and the rate of female suffers in city has increased 50% [2]. With the widespread from public, many researches and studies had been observed.

However, in order to get specific outcome on the usage of mobile phone towards human, the continuous researches are essential. Many researchers from establish organizations such as Royal Society of Canada and Institute of Electrical and Electronics Engineering have start to documentation their research for these problems. The aim of this project is to study whether the mobile phone have a big effect to the user or not. In other to achieve this, prototype or simulation is important. In this project, Computer Simulation Technology (CST) is use to calculate the specific absorption rate (SAR).

1.2 Problem Statement

Until now, mobile phones radiation proves to have two main effects which are thermal effect and non-thermal effect (also called biological effect) [3]. The thermal effect bring by mobile phone is research more because its concern has been recognize by the world. Investigation and research still going on until now and there is still no strong evidence that these devices give thermal effect or non-thermal effect towards human especially on their health. This project is carrying out in way to investigate the SAR (specific absorption rate) of the mobile phone towards human health.

1.3 Project Objectives

The objectives of this project are:

- **To expose the student on how to use the Computer Simulation Technologies (CST).**

These objectives may help students in the future. They will become more knowledgeable about this simulator software and having no problem to use another version of this software.

- **To simulate the 900 MHz and 1800 MHz of mobile phone using the head and hand model.**

The SAR values measurement emphasize on the 900 MHz and 1800 MHz of mobile phone. For the head model, 1g and 10g human brain tissue will be utilized.

- **To investigate the effect of mobile phone towards human by getting the SAR (specific absorption rate) value.**

The effect of mobile phone towards human will be determined from the SAR value. If the SAR values exceed 2W/kg, the mobile phone will give an effect towards human.

1.4 Project Scope

This project involves 900MHz and 1800MHz mobile phone simulation with Human Head and Hand Model. It involves the simulation on Specific Absorption Rate (SAR) value towards human head. This project use Computer Simulation Technologies (CST) as a software in order to simulate the mobile phone with human head and human hand.

Radiation from the mobile phone not only effect on the human brain, it also effect the electric charge in the human cell body. The exposure of the radiation towards human body makes the biology of it system totally disturbed. The effect of the mobile phone casing and the antenna towards human will be discussed in this project. From the simulation, the radiation pattern of the mobile phone can be determined. To transmit out the SAR simulation, planar antenna of mobile phone with 900MHz and 1800MHz is going to be used. The power of mobile phone for each case will be 0.6W. The experiment includes current density, return loss, power loss, and farfield.

1.5 Project Outlines

The final year project report covered all the process of the project starting from its idea development, software simulation, and report writing. For the report, it will be divided to five chapters which are introduction, literature review, methodology, result with discussion and the conclusion of this project.

Chapter 1: Introduction

This chapter will introduce the background, problem statement and objectives of the project. Besides, it also provides the scope of the project. On the other hands, the project outlines are also detailed under this chapter.

Chapter 2: Literature Review

This chapter summarizes and reviews onto the overall studies and researches that are related to the project. In this context, preliminary literature search included mobile phone technology, existing issues and researches related to the effects of mobile phones towards human health.

Chapter 3: Methodology

This chapter discusses the methodology development and focuses on the use of the CST (Computer Simulation Technology) in order to obtain the SAR (specific absorption rate) measurement. The first part of this chapter will concentrate on the CST. The final part is then focus on the modelling of mobile phone and human head.

Chapter 4: Results, Analysis and Discussion

This chapter exhibits the results and data obtain from the SAR simulation process. It carries out analysis and discussion onto the data. It also examines whether the simulation results fulfilled the predicted or expected results as mention in the early part of the project. The problems facing through out of the project are also discussed. Besides, different approaches and testing in order to examine the project in achieving its objectives are listed in details in this chapter.

Chapter 5: Conclusion and Recommendation

This chapter will summarize the overall finding of the project. In addition, further works that can be implemented for future improvement of the project is discussed in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Mobile phone or also known as cellular phone is a small or portable device that has become one of the most successful inventions in this world. Until 2007, the population of the mobile phone consumers have reached to 2.6 billion [4]. The devices allow peoples from over the world to communicate to one another without the limitation. This short range devices are not only use for voice communication, but it also provide additional services such as Short Messaging Services (SMS), email, packet switching for Internet access, Bluetooth, Infrared, camera with video recorder and Multimedia Messaging Service (MMS).