

**Sudan University of Science
And Technology
College of Graduate Studies**

**Measurements of Radio Frequency of
Some Mobile Phones**

قياس الأشعة الراديوية لبعض الهواتف النقالة

**Dissertation Submitted in Partial Fulfillment of the requirements for the
M.Sc Degree in Nuclear Physics**

**By
Osman El gozoly El awad El jack**

**Supervised by
Dr. Mubarak Dirar Abdalla**

April 2010

Dedication

To my parents I want to be in their good imagine

Acknowledgment

Firstly I would to express my deeply thanks to Sudan Atomic Energy Commission Department of Radiation Safety Institute at the Ministry of Science and Technology, whom supported me with their labs and themselves, especially Mr. Rani who carried out the practical part of the research.

Thanks also are dedicated to Physics Department at College of Science at Sudan University of Science and Technology.

Thanks are due to the imposing Dr. Mubarak Dirar who honored me with his scientific experience and time till finishing of this work.

Thanks are also to my colleagues, and finally my great thanks to everybody whom I didn't mention who gave me spiritual push and advised me at any stage of my work.

Osman

Abstract

The output power emitted from 11 mobile phone beside the specific absorption rate was determined at different distances from the mobiles. It was found that the power distribution as a function of distance resembles that of the electric dipole antenna. The specific absorption rates for all mobiles are beyond the permissible level. The complete sheilding of the mobile by metal (AL) prevent the radiation completely , while partial shielding by (AL) does not make any effect.

Contents

Chapter 1

Introduction

1-1 Importance of Telecommunication systems	1
1-2 mobile phone biological effects	1
1-3 presentation of the thesis	2

Chapter 2

Propagation of Electromagnetic Radiation

2-1 Introduction	3
2-2 Measuring RF/MW radiation	4
2-3 The nature of Electromagnetic waves	4

Chapter 3

Mobile telecommunication systems

3-1 introduction	8
3-2 Analogue Total Access Communication System	8
3-3 Digital Global Systems for Mobile communications	8
3-4 Digital Universal Mobile Telecom System	10
3-5 Digital Enhanced Cordless Telecommunications	12
3-6 Digital Terrestrial Enhanced Trunk Radio System	12

Chapter 4

Biological Hazards of Non ionizing Radiation

4-1 Introduction	15
------------------	----

4-2 Non-ionising effects	15
4-3 Interaction of electromagnetic wave with biological tissue	17
4-4 Power density	19
4-5 Dosimetry and Densitometry of the telecommunication devices	20
4-6 Specific Absorption Rate (SAR)	22
4-7 Exposure standards	22
4-8 Physiological Effects	23
4-9 The thermal effect	25
4-10 Non thermal Effects	27
4-11 Exposures Produced by Cellular Telephones:	28

Chapter 5

Result and Disscussion

5-1Intdouction	29
5-2 Experimental procedures	29
5-3 Results	31
5-4 Discussion	44
5-5 Conclusion	45

List of Figures

Figure 5-1 LG CDMA	39
Figure 5-2 Nokia-2610GSM	39
Figure 5-3 Sony Ericsson GSM	40
Figure 5-4 Nokia 2630 GSM	40
Figure 5-5 LG 1319 GSM	41
Figure 5-6 Samsung CDMA	41
Figure 5-7 Samsung SDMA	42
Figure 5-8 Power density without attenuation	43

List of Table

Table 5-1 Relation between power density and SAR versus signal strength	31
Table 5-2 for NokiaCDMA	31
Table 5-3 for Nokia 2630	31
Table 5-4 for Nokia 1315 CDMA	32
Table 5.5 for Nokia N72 GSM	32
Table 5.6 for LG GSM	33
Table: 5.7 For Nokia 2610 GS	33
Table 5.8 For Sony Ericsson GS	34
Table 5-9 For Samsung CDMA	34
Table 5-10 For Nokia 6300 GSM	35
Table 5-11 For LG CDMA	35
Table 5-12 power Density and signal strength versus distance from the mobile, in this experiment the detector is placed at different distances from the mobile (Samsung CDMA) and the power beside the corresponding signal Strength are measured	36
Table 5-13 table of power density and signal strength versus distance and shielding material thickness , in this part the power density and signal strength for mobile (Samsung CDMA) are found at different locations and by using one slab metal shielding and two slabs.	37