

Monitoring of Radiofrequency Radiation from Selected Mobile Phones

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Abstract: Investigation of possible presence of radiofrequency radiations from mobile at distance not less than 20cm was carried out within Covenant University, Ota, using ten different handsets. Radiation measurement was carried out using a cell sensor manufactured by Action Electronic, USA that is optimized to measure radiofrequency and extremely low frequency radiation. The average power density from the handsets was 0.10mW/cm² and 0.45mW/cm² with highest value from both NOKIA 1100 and SAGEM My X5 and lowest from SAGEM My X1 at distance not less than 20cm. These results show that those using handsets are exposed to radiation beyond the background levels but are within the limit set by the Federal Communication Commission (F.C.C).

Keywords:

INTRODUCTION

The total number of mobile phones subscribers in the world was estimated at 2.14 billion in 2005 (1). Another 80% of world population has mobile phone coverage as of 2006. This figure is expected to increase to 90% by the year 2010^[2]. At present, Africa has the largest growth rate of cellular subscriber in the world^[3]. The increase is due to availability of pay as you go services, and the convenience they offer over other modes of telecommunication. In addition, the subscriber does not have long-term commitment to the contract, not only in Africa but in other continents as well.

Concerns have been raised by a lot of researchers and non-governmental organizations about the possible exposure of consumers to the radiofrequency (RF) fields from mobile phones or the impact of radiation from their base stations on the health of those within its vicinity^[16]. The World Health Organization (WHO) stated that, if any adverse health effect is established from mobile phone use, it will be a global issue because developing countries are establishing this technology in preference to the more-expensive fixed lines system. Thus, a small impact on health could have a major public health consequence.

Radio-frequency radiation is one of several types of electromagnetic radiation. Electromagnetic radiation consists of waves of electric and magnetic energy moving together through space. The movement of electrical charges, generates these waves in the digital system, the information is sent via pulse-modulated signals of frequency between 870 and 995MHz^[15]. Human exposure of radiofrequency radiation is greatest

from mobile phone handsets because of the method of use with the transmitting antenna of the mobile phone handset close to the head. There is possibility that localized hot spots or energy deposition in the brain may occur as a consequence of internal reflections^[15].

Another area of worry about effects on the populations' health has been the radiation emitted by base stations. The antennas on the surface which communicate with the phone, in contrast to mobile handsets emit radiation continuously. Due to the attenuation of power with the square of distance, field intensities drop rapidly with distance away from the base of the antenna. Sintini *et al.*^[6] found a variety of health effects for people living within 300m of base stations fatigue, headache, sleep disruption and loss of memory. There is need to know the biological effects and health hazards incurring as a result of using mobile phone handset. The WHO defines health as state of complete physical, mental and social well being, and not merely the absence of disease or infirmity. A health hazard is a biological effect outside the normal range of physiological compensation that is detrimental to health or well being. The effects can be in two categories: Thermal effects and non-thermal effect. Effect of microwave radiation is dielectric heating, in which any dielectric material such as living tissue is heated by rotations of polar molecules induced by the electromagnetic field. In the case of a person using a cell phone, most of the heating effect may occur in the head surface, causing its temperature to increase by a fraction of a degree. It has been claimed that some parts of the human head are more sensitive to damage due to increase in temperature, particularly in anatomical structures with poor vasculature, such as

nerve fibres. Swedish Scientific team at the Karolinska Institute suggested that continuous use of a mobile phone for a decade or a decade or longer led to a small increase in the probability of getting acoustic neuroma, a type of brain tumor. Non-thermal effects have been observed by Pan-European study named REFLEX, which involves 12 collaborating laboratories. It was found compelling evidence of DNA damage of cells in-vitro culture, when exposed between 0.3 to 2 Watts/kg. There were indications, of cell changes, including damage to chromosomes, alterations in the activity of certain genes and increased rate of cell division.

Present knowledge of health effects on human from this frequency band is limited. Most researchers have reported the effect of radiofrequency radiation on laboratory animals and cell cultures. Salford *et al.*^[7] demonstrated that low levels of radiofrequency radiation could alter the blood-brain barrier in mice. Hocking^[8] has preliminary evidence of an effect by 830MHz radiofrequency radiation on endothelial cell culture. Lai *et al.*^[9] reported that rats exposed to low levels of radio frequency radiation have impaired learning. Kuster N. Swiss^[10] reported that people who have been occupationally exposed to these fields have complained of heavy feelings in the head, headaches, fatigue and poor memory more often than controls. Sin-Eng Chia *et al.*^[13] carried out study in Singapore community and found that headache was most prevalent symptom among mobile phone users compared to non-users. Leif G et al. observed neuronal damage in the cortex, hippocampus and basal ganglia in the brains of rats after exposure for 2hours to GSM mobile phone electromagnetic field of different strengths. The number of anecdotal reports of symptoms experienced by mobile phone users around the world is increasing. These symptoms include headaches, dizziness, warmth or tingling around the ear and face and difficulties concentrating^[8,11,12].

The present study is aimed at establishing the possible presence of radiofrequency radiation from mobile phones beyond the background radiation is within the recommended level for environmental monitoring and control purposes.

MATERIALS AND METHODS

Different model of mobile phone handsets were collected from some member of staff of Covenant University for the measurement. The mobile phones are: Nokia 1100, 3210, 3310, 1112, 8310; Sagem My X1, My X5, My 100X; Siemen's MC60 and Sony Ericsson Z530i. Cell sensor manufacture by Action Electronics was used to measure the power density in different locations around the head while holding a

mobile phone that is transmitting for each model. Cell sensor was used to measure the radiation from the handsets at various distances not less than 20cm from the handset. This was done between five and thirty minutes.

RESULTS AND DISCUSSIONS

The results obtained are shown in Table 1. This displays the radiation emitted by the handset at distance not less than 20cm from the cell sensor. The results shown are the measured parameter of power density expressed in milliWatt per square centimeter (mW/cm^2). In order to have a clearer comparison of the different levels of radiation emitted by the handset, a plot of power density in minutes against each model of handset is shown in figure 1. The results obtained in this work have confirmed the presence of radiation levels from the 10-handset models investigated. This is based on the fact that, the average levels of radiation from each model is above the background levels. The radiation levels from the handset range from 0.45 to 0.10 mW/cm^2 at 20cm from the cell sensor. Measurements were taken also when recharging the handset batteries the display unit went to the maximum indicating very high radiation, this could be as a result of combination of extremely low frequency with the radiofrequency radiation.

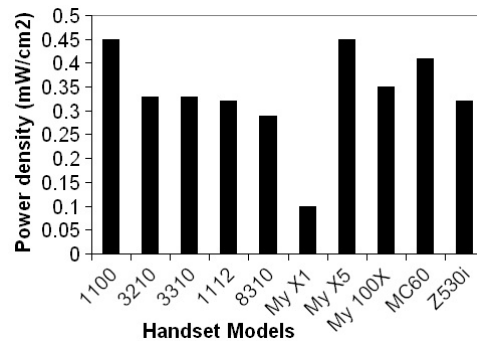


Fig. 1: Variation of power density among different handset models

There are slight variations in the measured radiation for the different handset models monitored. This may be due to different materials used in the manufacturing of these handsets. Despite the presence of these radiation levels from all the investigated handset models, the users are still within the (F.C.C.) recommended power density limit of 0.57mW/cm². But when compared with the Australian standards of 0.20mW/cm² is only SAGEM My X1 that is within the limit.

Table1 : Power density from different handset Models at Distance not less than 20cm

Brand	Handset Model	5 Minutes	10 Minutes	15 Minutes	20 Minutes	30 Minutes	Mean radiation (mW/cm ²)
NOKIA	1100	0.60	0.42	0.42	0.40	0.40	0.45
	3210	0.48	0.45	0.42	0.18	0.10	0.33
	3310	0.45	0.40	0.40	0.20	0.20	0.33
	1112	0.38	0.38	0.38	0.22	0.22	0.32
	8310	0.40	0.38	0.28	0.20	0.20	0.29
SEGEM	My X1	0.12	0.10	0.10	0.10	0.10	0.10
	My X5	0.60	0.42	0.42	0.40	0.40	0.45
	My 100X	0.58	0.40	0.38	0.20	0.20	0.35
SIEMEN'S	MC60	0.58	0.48	0.40	0.30	0.30	0.41
SONY	Z530i	0.40	0.35	0.35	0.25	0.25	0.32
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Conclusion: This work has confirmed the presence of radiation levels from the mobile phone handsets beyond the background radiation levels. The highest power density of 0.45mW/cm² was obtained in NOKIA 1100 and SAGEM My X5, which is less than F.C.C. limit of 0.57mW/cm², but greater than the Australian standards. The SAGEM My X1 handset is considered as safest handset with respect to non-ionizing radiation, since it emits the lowest amount of radiation. From the finding it can be concluded that mobile phone handsets produce health effect due to the radiation that is beyond the background. Also care should be taken by the populace in handling the handset a lot of people use their phone when charging humans should desist from this habit as this increase the rate of exposure to radiation. There is need for this nation to have specific standard for limiting exposure to radiation from handsets by disallowing those that are beyond the nation standard from being imported to this nation, so as not to expose the populace to the health effect associated with these radiations.

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