MEASUREMENT OF ELECTROMAGNETIC RADIATION FROM 30 MOBILE PHONES AMONG SOME STUDENTS OF LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY, NIGERIA

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Abstract

This study investigates the measurement of the electromagnetic radiation (EMR) exposure from thirty (30) brands of mobile phones used by some students of Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The measurement was carried out using a Cell Sensor purposely designed for the measurement of EMR. The mean power density obtained from the thirty mobile phones range from 0.11 to 0.58 mW/cm^2 with the highest value obtained from Techno T501 and the lowest from Sagem My X1. The results obtained showed that there is need to develop new safety standard that will protect the public from the heating effect result from the use of mobile phone.

Keywords: Electromagnetic radiation, mobile phones, Cell Sensor, TechnoT501, Sagem My X1

Introduction

Mobile phones are electronic devices used for mobile telecommunications over a cellular network of specialized base stations. It offers full communication and transfer link when the user moves from one base station to another. As the user moves from one area to another, the base station commands the mobile phone and a station site with signal, to switch on to a new frequency in order to keep the link.

Mobile phones have reached many parts of the world since its introduction in the 1980s. It has gone from being expensive devices that were mainly used by the business elite to being communication tools used by the general population. The use of mobile phones is now so extensive that in some countries the number of phone subscriptions outnumbered the country population and more than half the population uses mobile phones. As of 2015, there were 7.4 billion mobile phones users globally, though the actual number of users is lower as many users own more than one mobile phone for different purposes such as for business and personal use.

The deregulation of mobile phone market in Nigeria has led to wider coverage of the nook and cranny of the country by the network provider mainly MTN Nigeria, Airtel, Globacom and 9ja mobile operating on the 900/1800 MHz spectrum. As of February 2018, the phone users in Nigeria are approximately 149 million mobile subscribers and almost twice the figure reported by Nigeria Communication Commission (NCC) as at October 2011.

The effect of mobile phone radiation on human health is the subject of recent interest and study, as a result of the enormous increase in mobile phone usage globally. The type of radiation emitted from mobile phones is electromagnetic radiation. Electromagnetic radiation (EMR) is present in mobile phones because they use radio frequency (RF) waves to make and receive calls. RF radiation is an example of EMR consisting of waves of electric and magnetic energy moving together through space. These waves are generated by the movement of electrical charges.

The frequency at which mobile phone operates depends on the manufacturer, design specification, geographical location and several other factors. Human exposure to RF is the greatest from mobile phones because of the method and frequency of use by the owner as the transmitting antenna of the phone is usually held around 2 cm from the user's head, thereby exposing the tissues of the head nearest to the phone antenna. There is thus the possibility that an energy deposition in the tissues of head may occur as a consequence of internal reflection (Usikalu and Akinyemi, 2007). This energy is emitted as a microwave in the direct vicinity of the user's head, thereby causing great concern about the safety of this technology.

Several researches, both epidemiological and experimental, in non-human animals and in humans have been conducted on effect of the RF radiation, and found an association between mobile phone uses and certain kinds of brain and salivary gland tumours. With the effect of RF radiation from mobile phone in mind, concern has continued to grow rapidly about the exposure to RF fields from sources that are used for mobile telecommunications, radars, radio and television broadcast, medical and industrial applications (Repacholi, 2001). Much of

these concerns arise because modern mobile technologies are introduced without provision for the safety of public within the scientific community about possible health consequences.

Among other effects is the double deoxyribonucleic acids (DNA) breakage which is among the fundamental disturbing findings. This was attributed to be an indication that there may be a significant risk of developing cancer, tumours, foremost brain tumours in the user of the mobile phone. A study by Salford *et al.* (2003) reported for the first time the evidence for non-thermal microwave exposure. Khurana *et al.*, 2009 concluded that cell phone usage for at least ten years approximately doubles the risk of being diagnosed with a brain tumour on the same ('ipsilateral') side of the head as that preferred for cell phone use. One study of past mobile phone use cited in the report showed a 40% increased risk for gliomas (brain cancer) in the highest category of heavy users reported average of 30 minutes per day over a 10year period.

WHO (2011) reported that the use of mobile phone may represent a long-term health risk by classifying mobile phone radiation as possibly carcinogenic to humans after a team of scientists reviewed studies on mobile phone safety. However, the safety standards only protect from the heating effect of the microwave radiation known as thermal effect, and it is impossible to have cell damage without the heating effect and without the cell damage, there is no health risk. This heating effect occurs whenever any dielectric material like the living tissue of the head is heated by means of the rotation of polar molecules in an electromagnetic field. Each time an individual uses a mobile phone, the heating effect occurs at the surface level of the head and then the temperature around the region increases causing the blood flow to increase due to excessive heat. Studies have shown that if the microwave does not cause a temperature increase in the human head of more than 1^0C, the microwave exposure is deemed safe.

There are also several reports in literature of the contributions of the various types of handsets to the radiation exposure (Rothman *et al*., 1996; Usikalu and Akinyemi, 2007; Samkange-Zeeb and Blettner, 2009; Amuda *et al*., 2012). Thus, this study measures the electromagnetic radiation exposure from mobile phone by some students of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria.

Materials and Method

Thirty various brands of mobile phones in market and in use by some students of Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria. The brands of the mobile phones considered are: Nokia C3-00, Nokia 6170, Nokia 2700, Nokia 1650, Nokia C2-00, Nokia 1280, Nokia 1508i, Nokia 1600, Nokia E71, Nokia 3230, Nokia 101, Nokia 1616, Nokia 5030, Nokia 1661, Nokia Q9, Techno T82, Techno T501, Techno T390, Blackberry 9630, Blackberry Storm, Blackberry Bold 2, Visafone ZTE, Sagem My X1, Sagem My X2, Samsung E250, Itel 0.45, Sony Ericsson Satio, LG IP-400, LG IP-300.

Measurements were carried out using Cell Sensor (Fig. 1) Model Number FL3319, a product of Technology Alternative Cooperation based in Miami, USA. The Cell Sensor was used to measure the power density of the radiation from the various brands of mobile phones being

investigated at different locations in LAUTECH area and the readings were taken while holding each brand of mobile phone that is transmitting or receiving. Control measurement was carried out in the laboratory by placing the sensor on a table with the distance between the sensor and the mobile phone around 20 cm. The duration of the measurement ranges from five to thirty minutes.

Fig. 1: Cell Sensor Meter

Results and Discussion

The results obtained from the measurement of power density for each brand of mobile phone investigated are presented in Table 1. The results show the variation of power density at a distance of not less than 20 cm between the cell sensor and each brand of phone. From the results, it is seen that the power density ranges from 0.11 to 0.58 mW/cm^2. The little variation recorded in the measured radiation from the different brands of mobile phones assessed may be attributed to the different constituent of materials used in manufacturing the phones.

With this result, the power densities obtained for the mobile phones examined have values that exceeded the Australian Standard of 0.2 mW/cm^2 except for Sagem My X1 but fall within the Federal Communications Commission (FCC) recommended limit of 0.57 mW/cm^2 except for Techno T501 which is slightly higher than the recommended value. This result is in agreement with the results reported in literatures. The use of Techno T501 for long period of time may cause heating effect that may damage tissues of the potential user and cause diseases to such individual.

Table 1: Power density variation for different brand of mobile phones at distance not less than 20 cm

Mobile Phone	Brand	5 Mins	10 Mins	15 Mins	20 Mins	25 Mins	30 Mins	Mean Radiation (mW/cm^2)
Nokia	C3-00	0.30	0.30	0.28	0.26	0.24	0.24	0.27
	6170	0.45	0.43	0.43	0.41	0.41	0.39	0.42
	2700	0.45	0.45	0.43	0.43	0.41	0.41	0.43
	1650	0.35	0.33	0.32	0.27	0.25	0.25	0.30
	C2-00	0.25	0.23	0.23	0.23	0.18	0.18	0.21
	1280	0.45	0.45	0.42	0.42	0.42	0.40	0.42
	1508i	0.35	0.35	0.32	0.32	0.32	0.30	0.37
	1600	0.30	0.30	0.30	0.26	0.26	0.26	0.28
	E71	0.45	0.41	0.41	0.37	0.37	0.35	0.39
	3230	0.35	0.33	0.31	0.31	0.29	0.29	0.29
	101	0.40	0.40	0.38	0.36	0.34	0.32	0.30
	1616	0.40	0.40	0.38	0.36	0.34	0.32	0.30
	5030	0.40	0.38	0.38	0.38	0.36	0.36	0.34
	1661	0.50	0.50	0.48	0.46	0.46	0.44	0.42
	Q9	0.35	0.35	0.33	0.31	0.29	0.29	0.27
Techno	T82	0.45	0.42	0.42	0.39	0.39	0.36	0.41
	T501	0.60	0.60	0.58	0.58	0.56	0.56	0.58
	T390	0.35	0.33	0.31	0.31	0.31	0.30	0.32
Blackberry	9630	0.35	0.32	0.32	0.29	0.29	0.27	0.31
	Storm	0.25	0.25	0.23	0.21	0.21	0.19	0.22
	Bold 2	0.50	0.47	0.46	0.44	0.41	0.41	0.45
Visafone	ZTE	0.30	0.30	0.28	0.26	0.26	0.26	0.28
Sagem	My X1	0.12	0.11	0.10	0.10	0.10	0.10	0.11
	My X2	0.32	0.32	0.30	0.30	0.30	0.28	0.30
Samsung	E250	0.32	0.32	0.32	0.30	0.30	0.30	0.31
Itel	0.45	0.43	0.43	0.43	0.40	0.40	0.42	0.42
Sony Ericsson	Satio	0.40	0.38	0.36	0.34	0.34	0.32	0.30
LG	IP-300	0.20	0.20	0.27	0.29	0.25	0.27	0.26
	IP-400	0.30	0.30	0.27	0.27	0.27	0.27	0.28

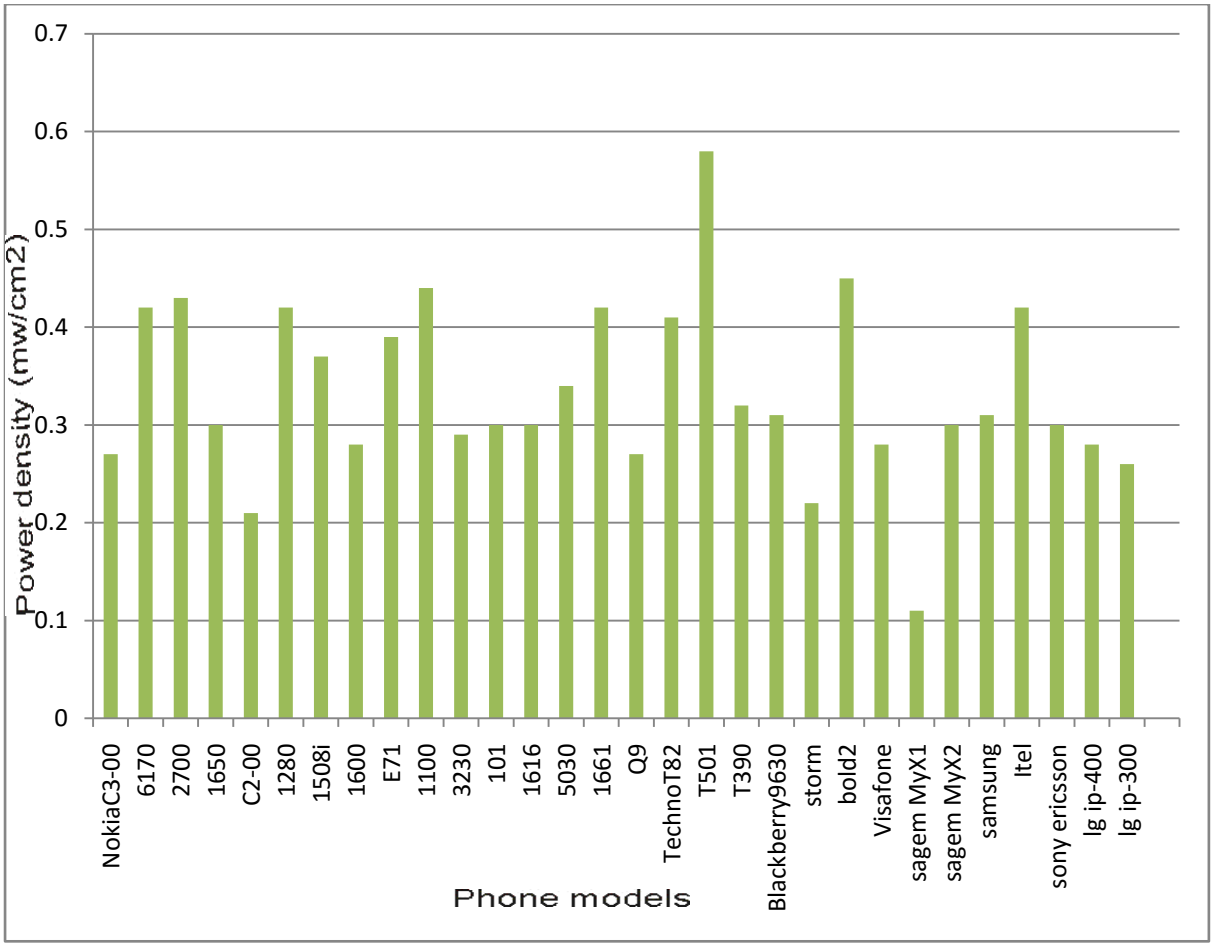

Fig. 2: Variation of power density with handset model

Conclusion

This study measured the power density of the radiation from various thirty brands of mobile phones used by some students Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria using a Cell Sensor. The power density measured for the mobile phones range from 0.11 to 0.58 mW/cm^2 with Sagem My X1 measured to have 0.11 mW/cm^2 as the lowest power density while Techno T501 has the highest power density of 0.57 mW/cm^2. These sets of values fall within the recommended range of values. The results obtained showed that there is need to develop new safety standard that will protect the public from the heating effect result from the use of mobile phones.

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