International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Radiation Hazards from Base Station Emission: A Case Study of the Obio/Akpor Rivers state Nigeria

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Abstract: ***Analyzing the possible hazards from a GSM base station is very essential in our society today. The increasing need for GSM signal coverage in both cities and rural areas, has led to the proportional increase in the number of GSM base stations installed. The proximity of these GSM base stations to human residence became a thing of great concern to the public. In order to solve this problem, an android application (GSM signal monitoring) was used to obtain the level of radiation signals emitted at different distances from a GSM base station in Obio/Akpor area of Rivers state Nigeria. The values of signal power density obtained from sample sites of study, for the given period of time and was modeled with Microsoft excel 2013. The power density was also compared to the ICNIRP Guideline to ascertain compliance.***

Keywords: ICNIRP Guideline Base Station, RF,GSM ,radiation signals

1. Introduction

The use of mobile phone is fast growing and has contributed in the emergence of many base stations to meet required efficiency from the networks. Presently, there is much concern about the effect of electromagnetic exposure and radiofrequency (RF) radiation on the exposed organisms and human being around the base stations. (Markov and Kostarakis, 2007).

The conception of GSM technology started in 1982 when the European conference of Postal and Telecommunications Administrations created the "Group special mobile" (GSM) to develop a standard for a mobile telephone system that could be used across Europe. A memorandum of understanding was signed by 13 countries to develop a common cellular telephone system across Europe in 1987. Finally, the system created by SINTET led by Torleiv Maseng was selected (Biebuma and Esekhaigbe, 2010). Radiolinja lunched the first GSM network in Finland Swith joint technical infrastructure maintenance from Ericson. In GSM world, there are more than 3 billion GSM users worldwide and the largest single GSM market is China, with more than 370 million users (Friedhelm, 2002).

The use of GSM in Nigeria started in August 2001, with about 450,000 working lines. By the time of this research, Nigeria has about 140 million active GSM subscribers and this has changed the face of information and communication technology (ICT) in Nigeria. There were just two operators; Econet (now Airtel) and MTN. Today, it has increased, with Airtel, MTN, Globacom, Starcom, Reltel and Etisalat.
According to statistics from Nigeria Communications Commission (NCC) Nigeria Regulatory body, there were about 450,000 working lines from Nitel in 2001. In August in 2004, the GSM operators recorded over seven million subscribers. And in February 2009, Nigeria's total mobile subscriber's base hit 67 million (Esekhaige and Biebuma, 2010). All of these developments have led to increase of land requirement to install GSM base stations and other infrastructure associated with it.

Since the introduction of mobile phone in Nigeria the implication of RF radiation from the base station has been a subject of great debate and concern among Nigerians, upon which is the basis of this research.

Electromagnetic Radiation may be defined as an Emission from electrical equipment (Wiley, 2005). Some scientist and researchers, both in Nigeria and other countries said that radiation from GSM base stations are dangerous to health and some believed that, to date, human health have the relationship between exposure to radiation from base station for long period could cause different diseases like cancer, destroy reproductive organ, congenital anomalies, epilepsy, and persistent headache. In Nigeria, some of the GSM base stations are mounted or installed in a home of residence, markets, churches, etc. which is not supposed to be. With present technology, it is not possible to have mobile telephone without base stations and vice versa.

Base stations are sited in close proximity to inhabited areas, because; the farther, the equipment is located away from the users the poorer the quality of the communication. Furthermore, if the equipment is placed too far from the user, this will cause the phones to increase their output power in order to sustain the connection and thus decreasing the battery life and talk time (Bello, 2010). While about one billion people worldwide smoke tobacco three times as many now use mobile phones which has increased the number of base stations, smoking is responsible for about five million deaths each year and this means that hazardous effects from phones and base stations radiation could cause far greater deaths (Gutierrez, 2008).

Based on my introduction, I suggest that proactive and precautionary measures be taken to manage and contain the possible hazardous effects of the radiations from the base stations, on citizens or those living close to them.

2. Literature Survey

2.1 Converting Received Signal Strength (Power Density) (DBM) =tTo Power Density (W/M^2)

Due to the difficulty in measurement of SAR in body tissue from emissions of non-ionizing radiation from Base Stations, ICNIRP approved the use of reference levels of power density (w/m^2) in free space. To determine the effect of radiation from a Base Station, the reference signal strength measured value (dBm) must be converted to its equivalent power density value (w/m^2). GSM signal monitoring application used in this research work measures power density as Received Signal Strength Indicator (RSSI) in decibel-miliwat (dBm) with the respect to the distances in meters (m) from the transmitting GSM base station. The actual unit in of which power density is universally accepted is watt per metre square or in multiples like milliwatts per square centimetre (mW/CM^2) which is essentially the rate of energy flow per unit area (CCOHS, 2012). The conversion of the received signal strength indicator (RSSI) in dBm to its power density in watt/m^2 can be obtained in following equation 3.1.

$$P_{watt} = 1 \times \frac{10^{\frac{p(dBm)}{10}}}{1000} \quad (3.1)$$

Where P_{dBm} is the measured Received Signal Strength Indicator (RSSI) in decibel miliwat (dBm) and Pwatt is the power density in watt per meter square.
By applying equation 3.1, for all the values measured and recorded in table 3.2 was obtained with the values of mean received power density in Watt/M^2

2.2 Problem Definition

Since siting a base station must be in close proximity of about 300m to the signal, the major issue of concern now is the Radio frequency (RF) emission from the base stations. Due to the fact that RF can be a absorbed into human bodies, which may produce health challenges such as viral and infectious diseases; Cardiac arrhythmia, heart attack and heart diseases; Neurological effects, including sleep disturbance, learning difficulties, depression etc.; Cancer, especially brain tumor and leukemia, the severity of it effect is dependent on the intensity of exposures. About the thermal effect there is no controversy: however, the non-thermal effects have become the bone of contention between researchers, the mobile phone operators, communities etc. From scientific point of view, brain and heart use electromagnetic signal, charged ions, voltage-gated channels and ion regulated gap junctions; all of which can be interfered with by external electromagnetic fields in relation to health. Hence from studies and researcher results, it is observed that there is extremely strong evidence to conclude that mobile GSM base stations are risk factors for: Also from studies, most Nigerians has little or no information about the possible effect of the radiation from base stations on human and some service providers do not take the precautionary measures for installation. Based on this I say management of radiation hazards, should be through precautionary measures to avoid eventualities in the future.

3. Methodology / Approach

In this study, Obio/AkporArea was considered. A base station sites in Obio/Akpor were chosen because the population of the urban center. In the location, spectral measurements were taken in spots where high level of broad band RF exposure are high. Since buildings, trees and other solid objects may significantly absorb, reflect or scatter the RF signals; measurements can be made at spots that maintained a direct line-of-sight with the antenna of the RF source. These procedures ensure that irrelevant measurements are avoided and only data of the worst case scenarios are captured.

3.1 Tools used

The following tools were used in this analysis:

- Measuring tape calibrated in meters: this was used to measure the distance between the base station and the nearest residential building.
- An Android mobile phone with android version 4.0; with GSM Signal Monitoring Software installed.

3.1.1 The Speed Measuring Tab

The tab contain charts of upload and download speed. The speed is measured for GSM/UMTS/ LTE networks as shown in figure 3.4

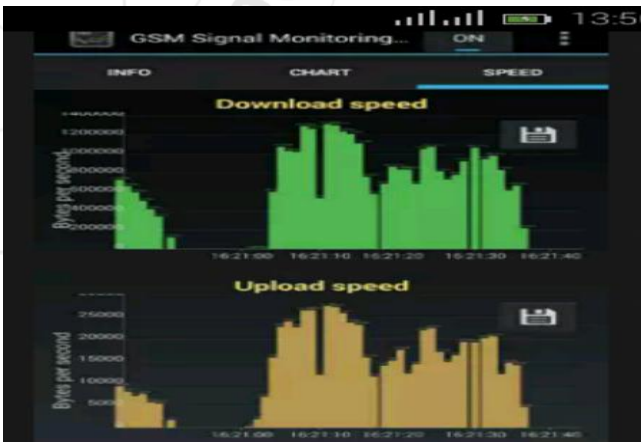

Figure 3.4: Software's Speed Measuring Tab (screen shot from a base station at delta park uniport).

4. Results & Discussion

This chapter illustrates the results obtained from the analysis of radiation hazards from at the base station in Obio/Akpor as obtained. Since the measurement of the radiation of a non-ionizing emission is very difficult, measure RSSI and

converting it to power density became the surest path, which is essentially the rate of energy flow per unit area (CCOHS, 2012). The results of the experiment whose methods were outlined in chapter 3 are presented and necessary graphical analysis was done using Microsoft excel 2013.

5. Conclusion

The analysis of radiation hazards from a GSM telecommunication base station was carried out successfully, the results of the analysis of the research was obtained with the use of an android application- GSM signal monitoring. The research results of radiated power density of the sampled base stations were plotted. The distance of separation between the base stations of this study and the receiving instrument of measurement is the nearest residential building. The excel plot shows that the radiated power density measured was high from 0 to 15m distance from the Base Station transmitter. The level of radio frequency radiation measured was confirmed to be high within 0m to 10m distance from Base Station transmitter with measured power density of 10nW/m2 to 0.125nW/m2 respectively. Therefore, it will not be safe to reside within 10m radius from the Base Station transmitters considering the present transmitting power density level. The outcome of the study shows a high level of compliance of the ICNIRP guidelines by the of the communication operator in Obio/Akpor.

6. Future Scope

In other to provide more concrete evidence of the harmful effects of the RF radiation, medical test examination should be conducted on a sample of people of different age limits who have been living within 20m from a GSM transmitting base stations for up to ten years. This is to verify whether there is a long-term effect on the people living close to the base station and other radio frequency radiating devices. Also, further studies should be made on the effect of the radio frequency radiations on our ecosystem and other living things putting into consideration the microbes, in our environment.

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