Research Paper

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Assessment of Radio Frequency Radiation in The Far- Field of Selected Mobile base Station in Ijebu-Ode,Ogun State, Nigeria.

Science

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ABSTRACT

The Assessment of RF radiation in the far-field from selected mobile base station in Ijebu- Ode ,Ogun State, Nigeria has been carried out using a handheld three-axis radio frequency meter (EMF meter) for measurement of Electric field, Magnetic field and Power density. The meter is a broad band device for monitoring high frequency radiation in range of 50 MHz to 3.6GHz. It is used in three-axis (isotropic) measurement mode. The power density of RF radiation within a radial distance of the range 25- 150m was measured with the RF meter. The average values of the Specific absorption rate for the general public were estimated and the values gotten were compared with International commission on Non-ionizing radiation. The values of the Power density and the SAR for the sixteen base stations selected for the study are within the range of 0.228μW/m2 -20860.μW/m2 and 0.20μW/Kg- 175μW/Kg.These values are quite lower than the limit by International Commission on Non –ionizing Radiation Protection (ICNIRP) which is 0.08W/Kg for the whole body average SAR and 4.5W/m2 for 900MHz and 9.0W/m2.This shows that there is no significant health risk for the general public that are always the vicinity of the Far field of the selected base stations for the various mobile service provider the area.

INTRODUCTION

There has been an exponential growth in the use of mobile communication services over the years and this growth is expected to continue in the future with the introduction of the 3rd Generation (3G) mobile technologies. Accompanying this growth is the unavoidable increase in the number of base station sites which generate fears in the minds of the public because of the possibly feared health impacts. The area of study is densely populated with a population of 209191.The Latitude is 649'0.012"N and Longitude is 355'59.998"E . There are lots of schools both at the tertiary institution, primary and secondary levels located in the area. All the base station selected for the research work are located either close to schools, residential areas, banks, shops where on daily basis has influx of the population in the vicinity of the mobile mast for various service provider. The study area has the highest number of tertiary institution located in the state. This suggest that many of the students may be subscribing to any of the service provider which will result to more mast being sited close to where the students are staying for extended coverage by the service providers. The area very close to an RF antenna is referred to as the "near field." The area farther away from the antenna is referred to as the "far field." Safety Code 6 defines the "near field" as a three-dimensional space, generally close to an antenna or other radiating structure, in which the electric and magnetic fields do not exhibit substantially plane-wave characteristics, but vary considerably from point to point.

From a practical standpoint, this means that determining exposure in the near field zone is far more complex and variable, and only special techniques or extensive measurements can reliably determine what that exposure will be. In contrast, the far field zone is an area in which the field characteristics are more orderly and the field has a predominantly plane-wave character. The far field is the field of interest to the public since the probability of the populace being in the vicinity of the field as they go about their daily activities is significant.

The research is aimed at determining the Specific absorption rate for the general public in the far field of the masts for the various service provider viz: MTN, GLOBACOM, ETISALAT, AIRTEL and MULTILINK.. The result of the study may attempt to alleviate if possible the fear of health effect of the electromagnetic radiation on the general populace living near base station masts and it will also serve as a baseline from which future survey of EMF in the area selected for the study because to the best of the knowledge of the researcher, there had not been such study in the area. Lastly, it will also contribute to the existing body relating to exposure to EMF.

ICNIRP restrictions on the effects of EM exposure are based on established health effects and are termed basic restrictions [20]. Depending on the frequency, the physical quantities used to specify basic restrictions on EM exposure are current density, Specific absorption rate (SAR) and power density. In the frequency range of 10 MHz to a few GHz (including 900MHz and 1800MHz cellular phone frequencies), SAR is the main physical parameter. The SAR considers the power absorbed per unit of tissue mass and is most used for high-frequency radiation, such as the radiation resulting from telephone systems. Specific absorption rates (SARs) are generally expressed in watts per kilogram (W/kg) of tissue. The SAR measurements are averaged either over the whole body, or over a small volume of tissue, typically between 1 and 10 g of tissue. The SAR isused to quantify energy absorption to fields typically between100 kHz and 10 GHz and encompasses RFR from devices such as cellular phones up through diagnostic MRI (magnetic resonance imaging).Specific absorption rates are a more reliable determinant and index of RFR's biological effects than are power density, or the intensity of the field in space, because SARs reflect what is actually being absorbed rather than the energy in space.

Absorption of RFR depends on many factors including the transmission frequency, the power density, distance from the radiating source, and orientation toward the radiation of the system. Other factors include the size, shape, mineral and water content of an organism. Children absorb energy differently than adults because of differences in their anatomies and tissue composition. Their bodies are still developing and may be more susceptible to damage from cell phone radiation. For instance, radiation from a cell phone penetrates deeper into the head of children (Gandhi et al. 1996; Wiart et al. 2008) and certain tissues of a child's head, e.g., the bone marrow and the eye, absorb significantly more energy than those in an adult head(Christ et al. 2010). The same can be presumed for proximity to towers, even though exposure will be lower from tower under most circumstances than from cell phones. This is because of the distance from the source. Available experimental evidence indicates that human body cannot regulate itself under a permanent temperature increase of more than 1_ C, which corresponds to a whole-body SAR value between 1-4 W/kg under 30min EM exposure for resting humans. From this 4 W/kg value, a general public, continuous exposure limit of 0.08 W/kg is derived with a safety factor of 50.

METHODOLOGY

A handheld three-axis radio frequency meter (EMF meter) was used for measurement of electric field, magnetic field and power density of radio frequency radiation from mobile base stations.

The meter is a broad band device for monitoring high frequency radiation in range of 50 MHz to 3.6GHz. It is used in three-axis(isotropic) measurement mode and five digits LCD display offers mV/m, V/m, μA/m, mA/m, A/m, μW/m^2, mW/m^2 and μW/cm^2. Display revolution of 0.1V/m, 0.1μW/m2, 0.001μW/cm2 and 0.001μW/m2. The meter measure electric field(E) and convert it to magnetic field(H) and power density(PD) i.e. power per unit area which is express in watt per meter square(W/m^2).Most of the base stations at least three antennas and maximum of twenty-seven antennas on it. Measurement was taken at an interval of 25m – 150m at a sub interval of 25m range respectively from the base station. The meter was set to measure the average maximum electric field, magnetic field and power density at each measurement. Measurements were taken by pointing the EMF meter to the antenna at arm's length and 1.5m away from the sea level (Ismail et al 2010). The maximum average value of the measured electric field, magnetic field, and power density were taken and recorded when the meter was stable for five (5) minutes. Precautions were taken as much as possible so that values are not influenced by other sources of RF Radiation. The researcher also makes the EMF meter stable to reduce excessive field strength value due to electrostatic charges.

The Specific absorption rate for the general public was calculated using the formula by Lester et al (2005).

$$SAR = \frac{P_d \times B_s}{W}$$

Where P_d is the Power Density

B_s is the Body surface Area(2.102899 m^2 or 20,128.99cm^2

and W = Human Weight(60 kg)

The researcher ensured the avoidance influence use of hand-set around during the collection of data as much as possible.