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A Survey of Radiation Levels Associated with Mobile and Wireless Communication Technology Masts in Public Areas in Kaduna Metropolis

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ABSTRACT

This research work focused on carrying out study on the electromagnetic exposure emitted by mobile phone base stations in public areas in Kaduna metropolis. The work was done to determine the electric field strength, magnetic strength and power density at some distances from mobile masts owned by four network providers. The station dose rates were also measured around the masts. The EMF strength meter and Radiation Monitor Radex were instruments used for the work. The maximum electric field strength S, magnetic field strength H and power density measured in the work are 1.139 V/m, 0.00304A/m and 0.0085W/m^2 respectively. These measurements showed that the electromagnetic emitted from the masts are quite below the international standards. It therefore means, the population living or transacting business in Kaduna metropolis along the masts are not at risk of health hazards of EM radiated from the masts.

Keywords: Radiations, Electromagnetic, Power density, Masts, Dose.

INTRODUCTION

Mobile and wireless telecommunication technology is one of the fastest developing technologies in Nigeria. Over a period of less than 15 years, mobile telephone which operates under this technology is already in the hands of more than 600 million subscribers all over the world (Mohdy, 2003).

In Nigeria, over 50% of the population is subscribers to this (Zain, 2005). In addition to the voice data carried by the technology, there are also sophiscated packages offered to the user like e-mail access, internet browsing, video telephone, video games and play back, music download, etc. There are many companies, service providers, which came up with enticing packages for the subscribers leading to high demand of the technology.

Mobile and wireless communication network transmit radiations through different generations of technologies, not limited to 1G, 2G, 2,5G, 3g and 5G systems (ICNIRP, 2009).

Materials and Measurements of Electric Field Strength, Magnetic Power Density and Ionizing Dose Rate

A radiation monitor, Radex RD 1503 and RF EMF strength meter model 480836 are instruments used for measurement in this research. The RF EMF strength meter is a broadband isotropic instrument. It is designed to measure electric, magnetic field strength and power density of EMF of frequency of 50 MHz to 3.5GHz with specified frequency of 900MHz, 1800MHz and 2.7GHz (Aliyu and Ali, 2012,).

Measurements were taken at 0, 10, 20, 30, 40 and 50m from the masts starting from 50m to 0. The base of the mast served as the origin of the measurement. The dose rates were also measured at every point of four cycles based on the manufacturer of the equipment (Radex RD 1503) instruction. The dose rates were measured to ascertain the possibilities of emission of ionizing radiations from the base stations. The meters were held at 1.5m height above the ground level.

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RESULTS ANALYSIS

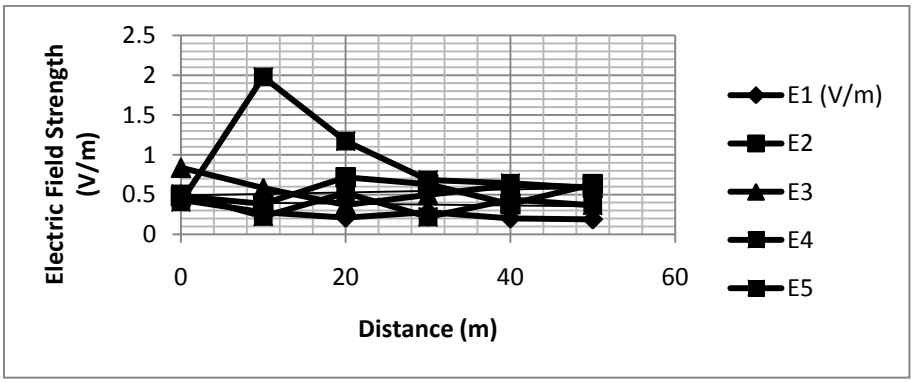

Fig1. *Network provider A, Electric Field Strength E*

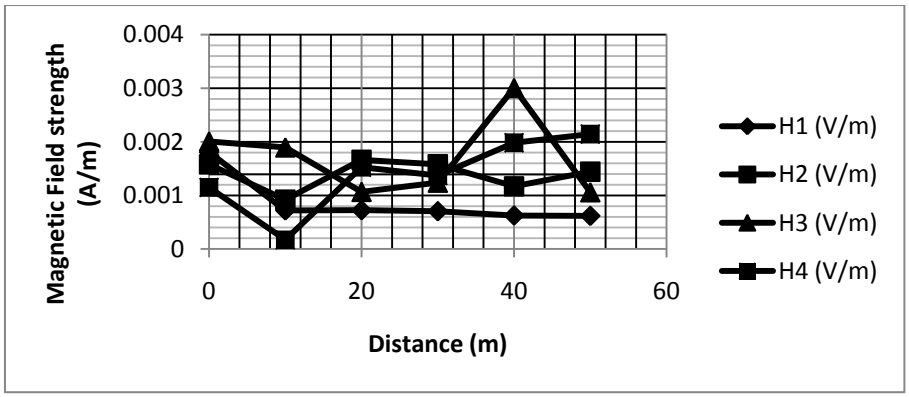

Fig2. *Network provider A, Magnetic Field Strength H*

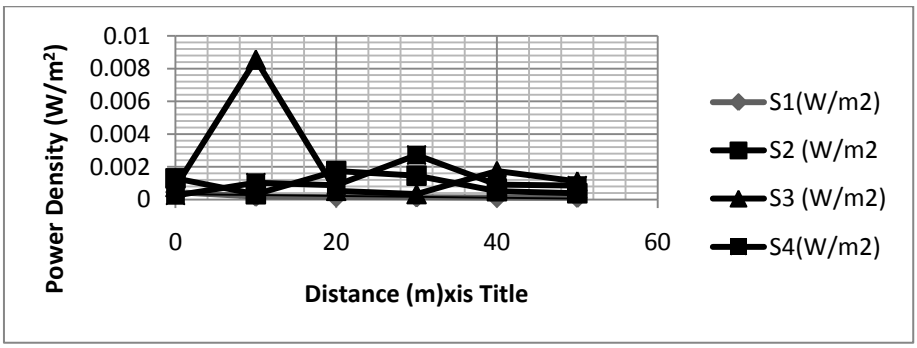

Fig3. *Network provider A, Power density S*

The measured values of E, H, and S are presented in figures 1, 2, and 3 respectively by the network provider A. The maximum value of E measured is 0.1898V/m at 10m from the base station, the maximum value of H measured is 0.003004A/m at 40m from the base station and that of S is 0.00855 W/m^2 at 10m from the base station.

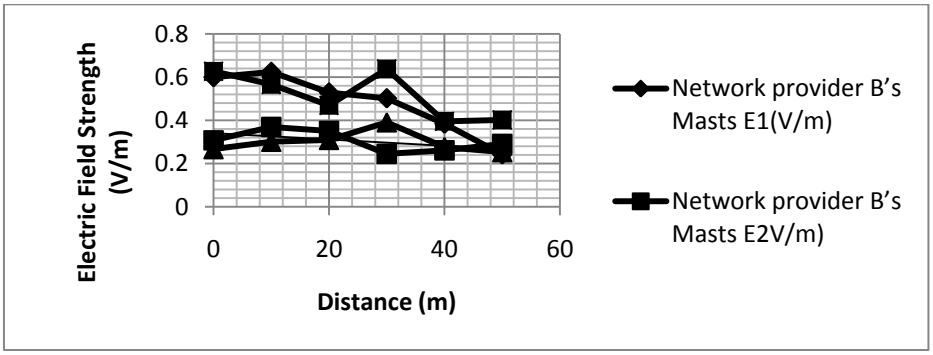

Fig4. *Network provider B, Electric Field Strength, E*

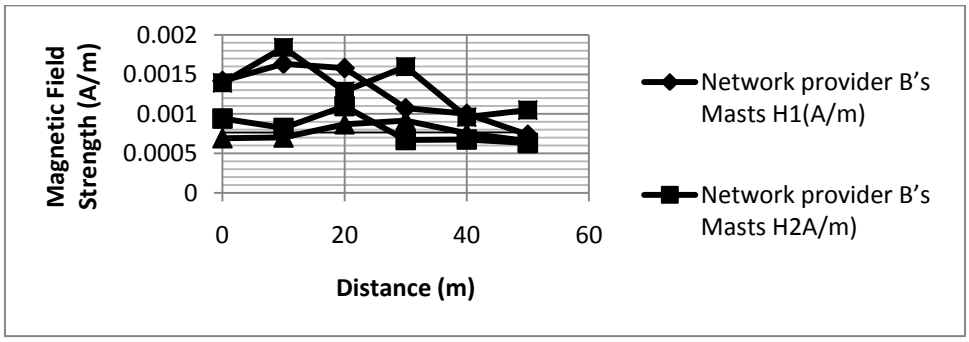

Fig5. *Network provider B, Magnetic Field Strength H*

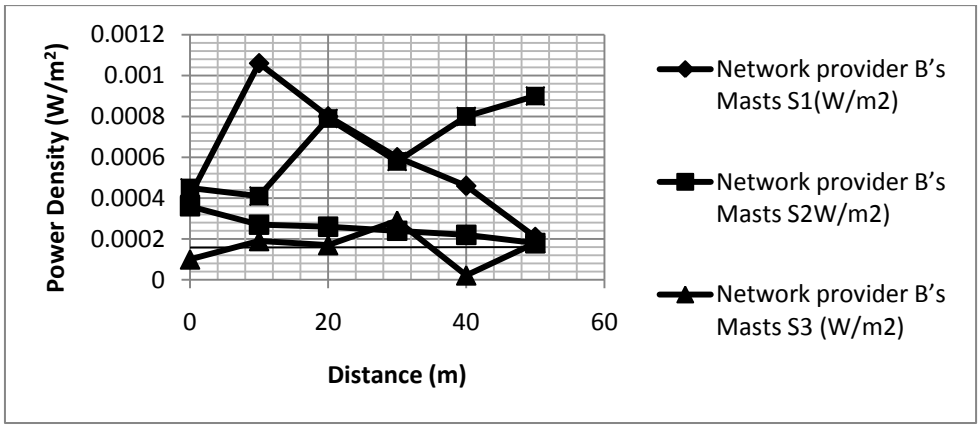

Fig6. *Network provider B, Power Density*

The measured values of E, H, and S are presented in figures 4, 5, and 6 respectively by the network provider B. The maximum value of E measured is 0.6373V/m at 100m from the base station, the maximum value of H measured is 0.001842A/m at 40m from the base station and that of S is 0.00106 W/m^2 at 10m from the base station.

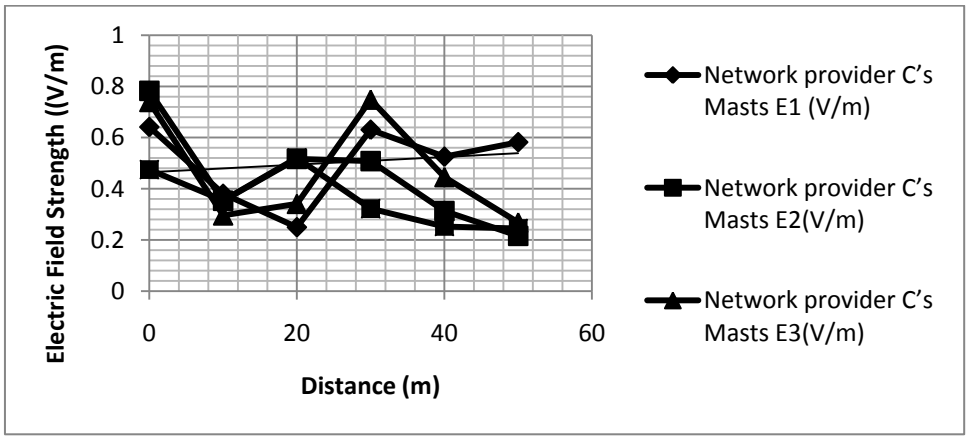

Fig7. *Network provider C, Electric Field Strength*

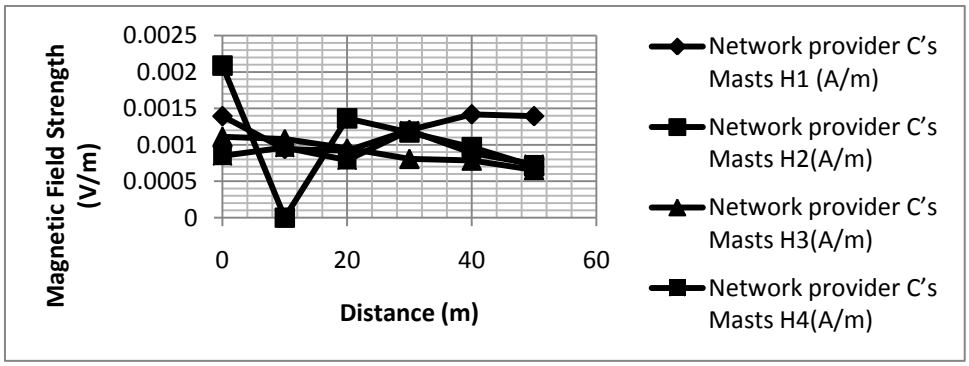

Fig8. *Network provider C, Magnetic Field Strength*

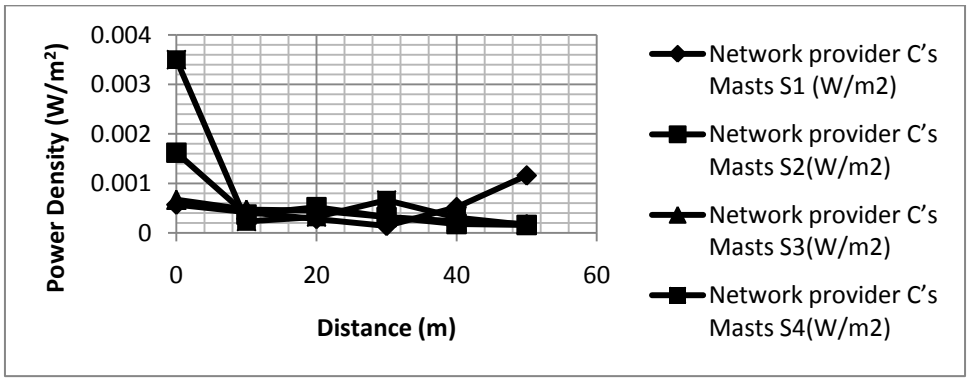

Fig9. *Network provider C, Power Density*

The measured values of E, H, and S are presented in figures 7, 8, and 9 respectively by the network provider C. The maximum value of E measured is 0.7825V/m at the base station, the maximum value of H measured is 0.002088A/m at the base station and that of S is 0.0025 W/m^2 at the base station.

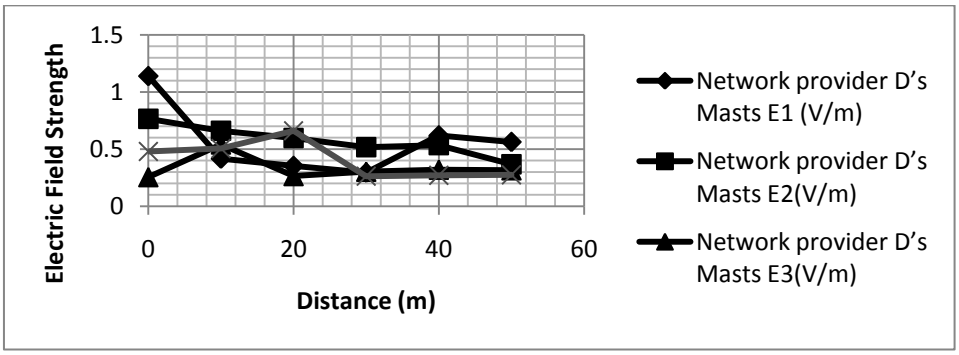

Fig10. *Network provider D, Electric Field Strength*

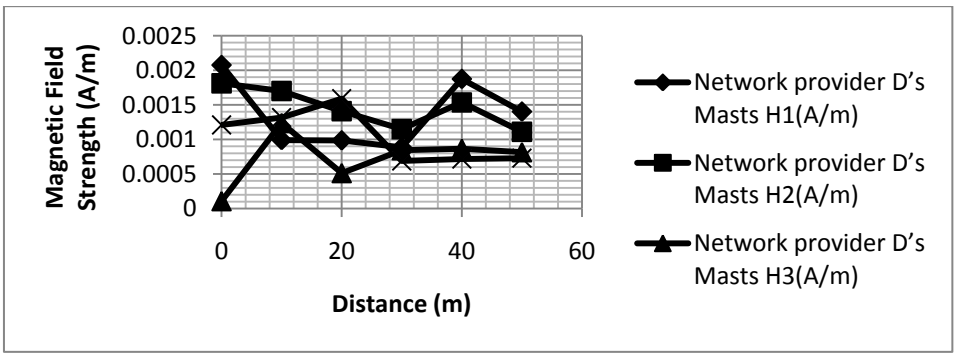

Fig11. *Network provider D, Magnetic Field Strength*

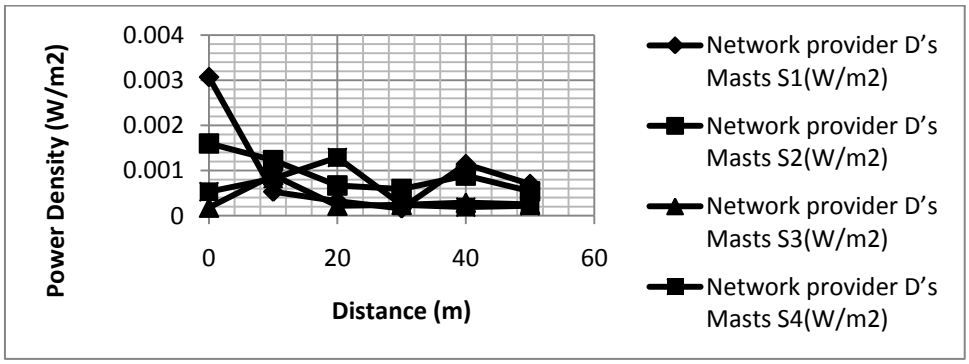

Fig12. *Network provider D, Power Density*

The measured values of E, H, and S are presented in figures 10, 11 and 12 respectively by the network provider D. The maximum value of E measured is 1.139V/m at 10m from the base station, the maximum value of H measured is 0.002075A/m at 40m from the base station and that of S is 0.00307 W/m^2 at 10m from the base station.

The patterns represent a sinusoidal wave form. In general, the patterns of E, H and S are the same in an increase, decrease and increase form. This is due to the influence of radio frequencies resulting from in wave crests and troughs as can observed in the above figures. The strength of the wave is found to be higher at distances closer to the masts than at farther distances. The radiation dose rates did not have definite patterns as the measurements of radiation rates were only at 50m away from the masts. The measured rates were compared with background rates measured (this ranges 0.13 to 0.27μS/h) in other parts of Kaduna free of radiation from mobile and wireless communication. The measured radiation rates from the masts are the same with that from the background radiation from the other parts of Kaduna metropolis. This means that telecommunication masts contribute no ionization radiation to the environment.

In other to compare the measured values of S with the ICNIRP and IEEE exposure standards, the percentage ratios of the maximum values of the measured power density to the international exposure limit (PR) were calculated. The highest PR is 0.0677% and the lowest is 0.0049. Comparing the highest value of the dose rates obtained with the maximum dose rates an individual is supposed to absorb per year, the measured dose rates are very low.

CONCLUSION

This research has established that electric field strength and magnetic field strength are beamed out from masts of mobile and wireless telecommunication technology. This is in agreement with other researchers (Andrew, 1999 and Adeyemi, 2010,). The radiofrequency emission from these masts as measured are low and fall within the exposure limits set by international bodies such as ICNRP and IEEE. The work has also shown that no measurable ionizing radiation components are associated with the frequency emissions. Therefore, the population who live, work or transact business within the vicinity of the mobile telecommunication masts are safe from EMF and ionizing radiation emissions.

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