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Relationship between the Horizontal Distance from the Mast and the Intensity of Radiation Emitted from it

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ABSTRACT

The effects of exposure from electromagnetic radiations of wireless cellular transmission towers on human health have attracted the attention of many researchers. Different works have revealed the harmful of electromagnetic radiation exposure to human health based on distance from the source and period of exposure. As one stays closer and at a pro-longed period from the transmission sites, the possibility of being affected by the radiation source becomes higher. This work was designed and conducted on the basis of selection of the three major telecommunication companies' towers in Khartoum state, namely ZAIN, SUDANI and MTN. Generally, the measurements employed showed that bigger amount of radiations were detected right away closer to the tower and remain smaller when the distance from the tower is increased. The level of EMR is not that significant and still safe with reference to the recommendation of world health organization (WHO) and International telecommunication corporation (ITC). Therefore a non adverse obvious effect on the biological system is expected.

Introduction

There has been a dramatic increase in the use of mobile phone technology in the last decades. With wide spread benefits in many. Professional and private activities. In the parallel with this. The concern regarding the possibility of adverse health effects due to absorption of electromagnetic field by human also increase [1, 2].For several years, many research groups in deferent countries have been developing research projects on these subjects in the area of medicine biophysics, engineering, etc. also, the world health organization (WHO) has coordinated efforts including many countries to access the exiting scientific evidence of harmful health effects of non ionizing radiation (NIR) emitted from different communication equipment, such as the base station. Previous studies show no evidence of impacts of base stations to human health [3, 4, and 5].New studies suggest emitted from base station might double the risk on human health [6, 7, 8].The main focus of this work is on the electromagnetic radiation emitted from telecommunication towers and its impact on human health.

Materials and methods

The materials which were used in this work:

Radiations Measurements (EMF-Meter), Distance Meter, Camera, GPS, Computer programmers for data, NBM – 552 Broadband field meters is used in this work

Description of NMB – 552 Broad band field meter

The NBM – 500 series is the most accurate non-ionizing radiation survey system available. It provides the broadest frequency coverage of electric and magnetic fields. Beth flat response probes and probes shaped to international standards are available. All NBM probe can be used with any NBM-500 series meter and still maintain total calibration.

Properties of NBM – 552 Broadband field meter

I.Available with Isotropic probes to cover 100 kHz to 60 GHz.

II.Large graphical Display.

III. Intelligent Probe Interface with Automatic probe parameter detection.

IV. Fully automatic zeroing.

V. Extensive memory for logging of up to 5000 results.

VI. GPS Interface and mountable receiver for positioning data documentation (optional).

VII. Voice recorder for adding comments (optional).

Steps of the experiment

1. Selecting of outdoor area free from building and metals
2. Location of the intense meter device at the horizontal distance 5m, from the tower.
3. Increase the horizontal distance by (5m) and taking a second reading.
4. Repeat the reading 20 times by increasing the distance 5m each time.
5. Draw curve that relates Intensity (I) to the distance (X).
6. Compare the empirical curve with the theoretical relation.

Results

One present and discuss the results and analysis of the radioactive power emitted from the telecommunication towers in Khartoum, river Nile, and red sea, states. A total amount of 360 samples were collected from the three states, 120 samples

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from each. Within each individual state, a number of 40 samples were collected from ZAIN Company and similar samples were also collected from SUDANI and MTN companies. All these samples were subjected to the radioactive power examination using international standard radiometers as well as the well established NARDA measurements and technology. This is in an attempt to determine the radiation powers emitted from these towers as well as to contrast it to the distance used to measure them. In addition to determine the biological hazard at these towers.

Table 3. 1. Relation between horizontal distance (X) and intensity (I) for ZAIN towers at Khartoum state.

$x \pm 10^{-3} m$	5	10	15	20	25	30
$I \pm$ 1mw\m^3	0.366	0.264	0.230	0.182	0.126	0.100

$I\ (mw\backslash m^2)$

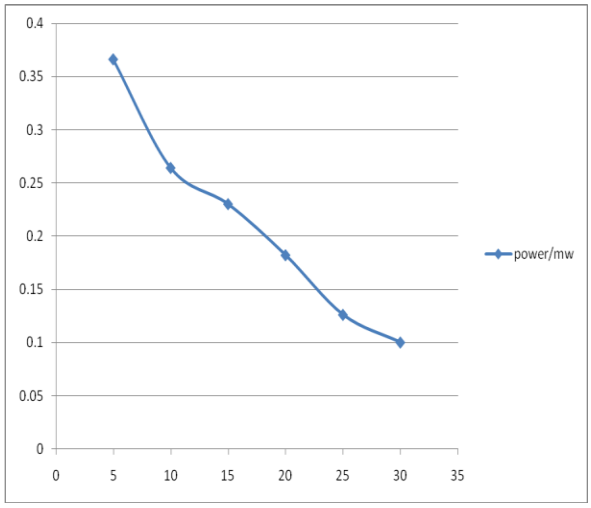

Figure (3. 1). Relation between (x) and (I) of mean for ZAIN towers at Khartoum state

Table 3. 2. Relation between horizontal distance (X) and intensity (I) for Sudani towers at Khartoum state.

$x \pm 10^{-3} m$	5	10	15	20	25	30
$I \pm$ 1mw\m^3	0.292	0.216	0.180	0.154	0.122	0.082

$I\ (mw\backslash m^2)$

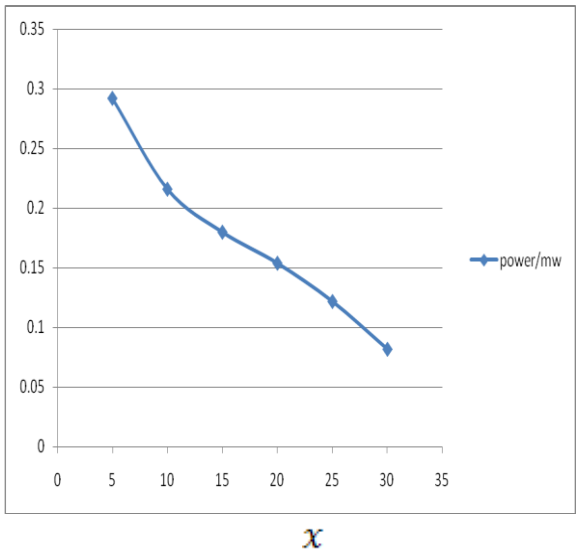

Figure 3. 2. Relation between (x) and (I) of mean for sudani towers at Khartoum state

Table 3. 3. Relation between horizontal distance (X) and intensity (I) for MTN Towers at Khartoum state

$x \pm 10^{-3} m$	5	10	15	20	25	30
$I \pm$ 1mw\m^3	0.357	0.246	0.193	0.157	0.111	0.076

$I\ (mw\backslash m^2)$

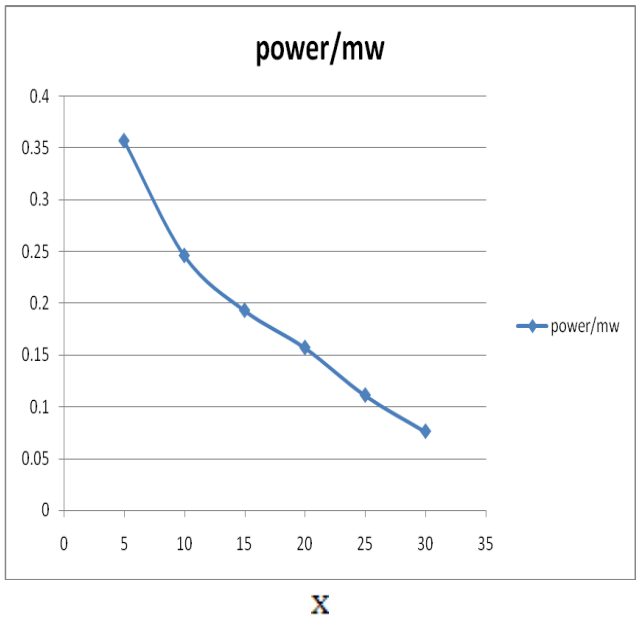

Figure 3. 3. Relation between (x) and (I) of mean for MTN towers at Khartoum state

$I\ (mw\backslash m^2)$

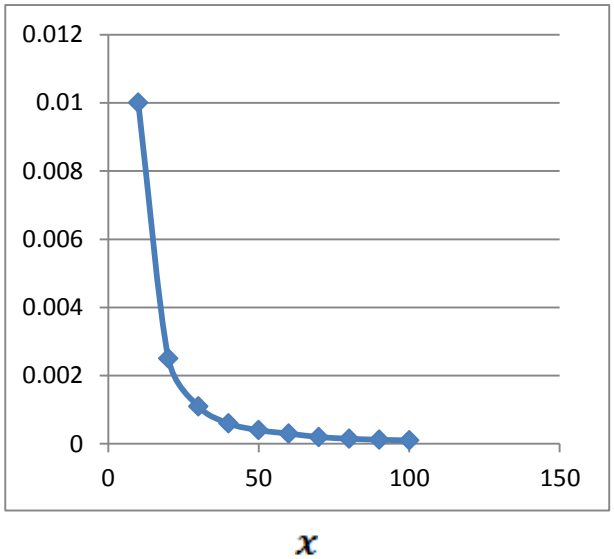

Figure 3. 4. The graph of distance (x) against the power density (I) for ZAIN tower in Khartoum state

According to Maxwell's equation, radiation intensity (I) emitted from towers takes the form

$$I = \frac{c_0}{(h \sin \propto + x \cos \propto)^2}$$

Where:

I = radiation intensity

x = horizontal distance from the tower

h = highest of the mast

In this experiment (h) was kept constant while (I) is kept to vary only with x to get approximate relation

$$I = \frac{1}{x^2}$$

Table 3. 4. Relation between horizontal distance (X) and intensity (I) for ZAIN Tower at Khartoum state.

x	10	20	30	40	50	60	70	80	90	100
I	0.01	0.0025	0.0011	0.0006	0.0004	0.0003	0.0002	0.00015	0.00012	0.0001

Discussion

In view of figure (1) for ZAIN towers in Khartoum state it's clear that the radiation intensity I fall down exponential. For distances 5, 10, 15, 20, 25, 30. The radiation intensity decreases from about 0.37 mw\m^2 down to 0.1 mw\m^2.Fortunately all these values are beyond the maximum permissible value (o.5 mw\m^2).The curve in figure (2) for sudani towers in Khartoum states shows also exponential decreases from 0.3 mw\m^2 down to about 0.08 mw\m^2).. It's clear that the intensity of radiation of sudani towers is less than that of ZAIN towers for all distances. Thus the intensities also are beyond that causes biological hazards. The curve in figure (3) for MTN towers in Khartoum states shows also exponential decreases from 0.36 mw\m^2 down to about 0.076 mw\m^2. Thus the intensities also are beyond the maximum permissible value. To see how intensity profile looks like for intensities at far distances beyond 30 m additional readings were made for ZAIN towers at Khartoum state.

For the curve in figure (4) one note that the maximum intensity is about 0.01 mw\m^2 at the point which are a way from base of mast by a distance of 10 m, and the minimum intensity is about 0.0001 mw\m^2. The intensity distance curve displayed in figures (1, 2, 3, 4) shows exponential decrease of intensity, or inverse relation between I and D. These relations are in conformity with the theoretical one exhibited in figure (4).

Conclusion

One of the most risk factors associated with the telecommunications towers in Sudan is the possibility of the adverse biological influences of the EMR emitted from towers. So far, there are no previous studies indicated the existence of these effects. As these biological effects are no longer yet proved, this study was designed and conducted to verify these effects. The results obtained indicated that the radiation level is beyond the permissive level. However there may be some limited biological effects due to these EMR with different levels depending on the companies studied. Based on the findings of this study, the EMR are not harmful to the biological units in the humans. However some preventive measures should planned and implemented to overcome the possible future risk by coating their antennas by one of a good conducting materials for making attenuator is that have small conductivity , these measures should be made according to the international regulations, based on the golden rule (prevention is better than cure).

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