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Relationship between the height of the telecommunication tower and the intensity of radiation emitted from it

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Abstract

In recent years, due to technology advances human life are subjected to high level of Electromagnetic emission, Effects of the Electromagnetic Radiation (EMR) on the humans health is one most significant concern in the world. As a result of dense deployment of public mobile base stations, additional electromagnetic (EM) radiation occurs in the modern human environment. At the same time, public concern about the exposure to EM radiation emitted by such sources has increased. This work is designed to determine the level of radio frequency radiation generated by base stations, extensive EM field strength measurements were carried out for base station locations, and a detailed analysis of this location category was performed. Measurement results showed that the maximum recorded value of total electric field strength has occurred where the highest of the tower was bigger.

2. Introduction:

Wireless communication is based on radio wave propagation, similar to other commonly known forms of radio communication such as broadcast radio and television. These systems operate in designated frequency bands within the electromagnetic spectrum and health effects have been extensively studied for over 50 years [1, 2, 3].

The international scientific committee ICNIRP (International Commission on Non-Ionizing Radiation Protection) has set guidelines for human exposure to EMF. The guidelines include a substantial safety margin to assure that no adverse health effects are experienced when EMF levels are within the established limits [4] .For areas near transmitting equipment, persons would be regarded as members of the public for RF safety purposes. Clear procedures should be in place for such workers. Before entering a base station or antenna site, personnel must acquaint themselves with the up-to-date technical and safety information provided by their employer, the site management company, and any relevant local safety requirement. A risk assessment approach should be applied looking at all risks at the site. As far as EMF is concerned, due regard shall be taken to consider all RF sources in the immediate vicinity of the work location and access routes [5].

This document gives generic safety instructions which ensure, when followed that the worker's exposure to RF fields will be within the applicable safety limit [6, 7] among all RF transmitter equipments mobile towers and phone plays a central role. This comes from the facts that, unlike radio and television towers are distributed extensively inside cities and towns [8, 9]. This revue to study the nature and power of radiation emitted by them. The biological effects and the degree of safety of these towers need to be studied [10].This task is done in this work, where materials and methods are exhibited in section 3. Results, discussion and conclusion are in section 3, 4 and 5 respectively.

3.Materials and Methods:

The materials which were used in this work:

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

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 it have the following properties:

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, 10m, 15m, 20m, 25m, 30m, 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.

4. Results

One present and discuss the results and analysis of the radioactive power emitted from different towers with different highest in Khartoum state, A total amount of 120 samples were collected from the three companies at Khartoum state, a number of 40 samples were collected from ZAIN Company and similar samples were also collected from SUDANI and MTN company. These samples for each company were subjected to the radioactive power examination using international standard radiometers as well as the well established 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 highest of the towers used to measure them.

The radioactive power detected among these towers examined for each company and observed to be higher when the highest of the tower is bigger .This indicates that the lower tower is more safety to the biological units than the highest one.

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Table (3. 1):- Relation between the height of the tower (H) and intensity (I) for ZAIN towers at Khartoum state. (For constant horizontal distance 5m).

$H \pm 10^{-3} m$	13 m	15 m	20 m	21 m	22 m	25 m
$I \pm 1 mw \backslash m^3$	0.118	0.128	0.131	0.152	0.223	0.366

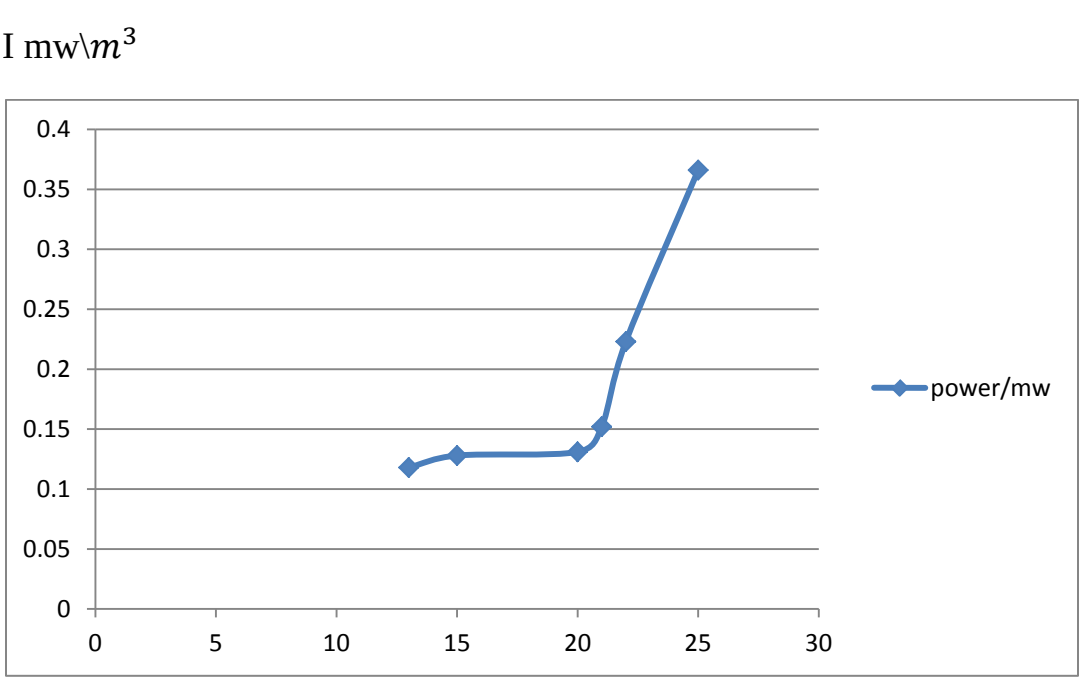
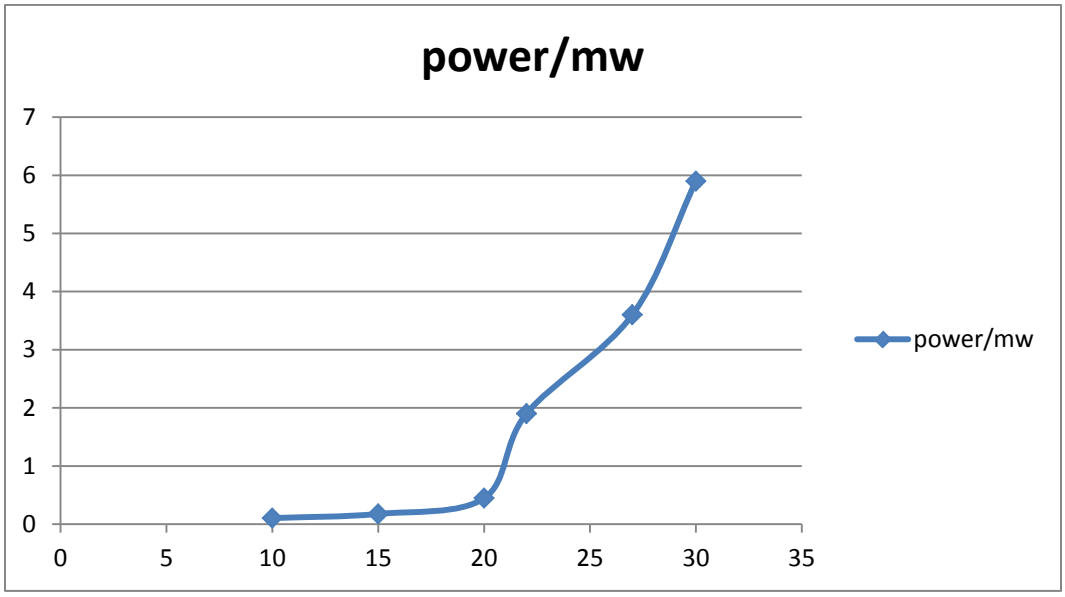


Figure (3. 1) the relation between the height of the tower (H) and intensity (I) for ZAIN towers at Khartoum state.

Table (3. 2):- Relation between the height of the tower (H) and intensity (I) for Sudan towers at Khartoum state. (For constant horizontal distance 5m).

$H \pm 10^{-3}m$	10 m	15 m	20 m	22 m	27m	30 m
$I \pm 1mw\backslash m^3$	0.104	0.176	0.447	1.9	3.6	5.9

I mw\m^3



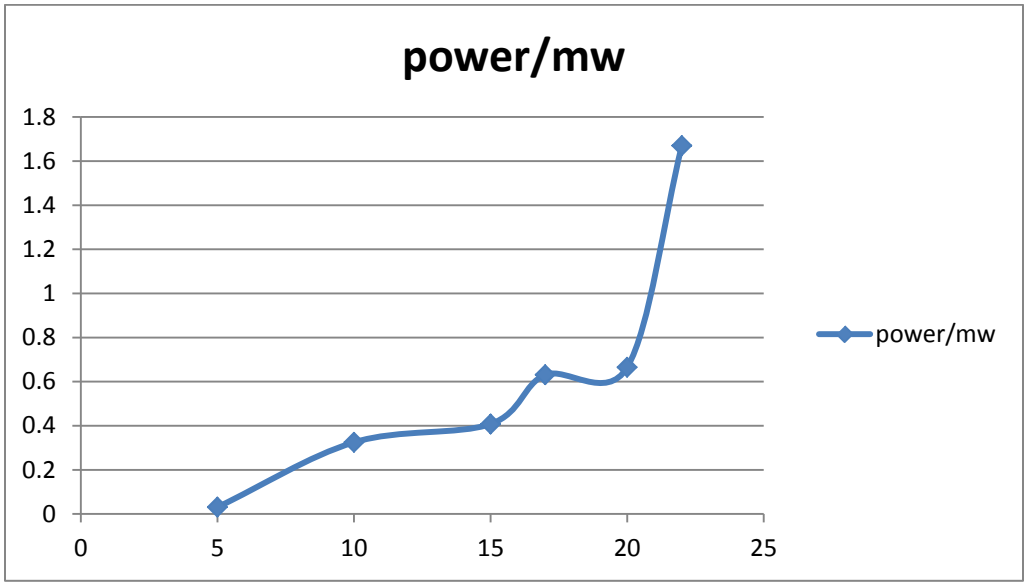
H (m)

Figure (3. 2) the relation between the height of the tower (H) and intensity (I) for Sudan towers at Khartoum state.

Table (3. 3):- Relation between the height of the tower (H) and intensity (I) for MTN towers at Khartoum state. (For constant horizontal distance 5m).

$\mathbf{H} \pm 10^{-3}m$	5 m	10 m	15 m	17 m	20 m	22 m
$\mathbf{I} \pm \mathbf{1mw\backslash}m^3$	0.031	0.325	0.408	0.631	0.665	1.67

I mw\m^3



H (m)

Figure (3. 3) the relation between the height of the tower (H) and intensity (I) for MTN towers at Khartoum state.

Table (3. 4):- Relation between the height of the tower (H) and intensity (I) for random towers at Khartoum state. (For constant horizontal distance 5m).

$H \pm 10^{-3} m$	10 m	15 m	20 m	25 m	30 m	35 m
$I \pm 1 mw \backslash m^3$	0.030	0.121	0.311	0.515	0.850	1.450

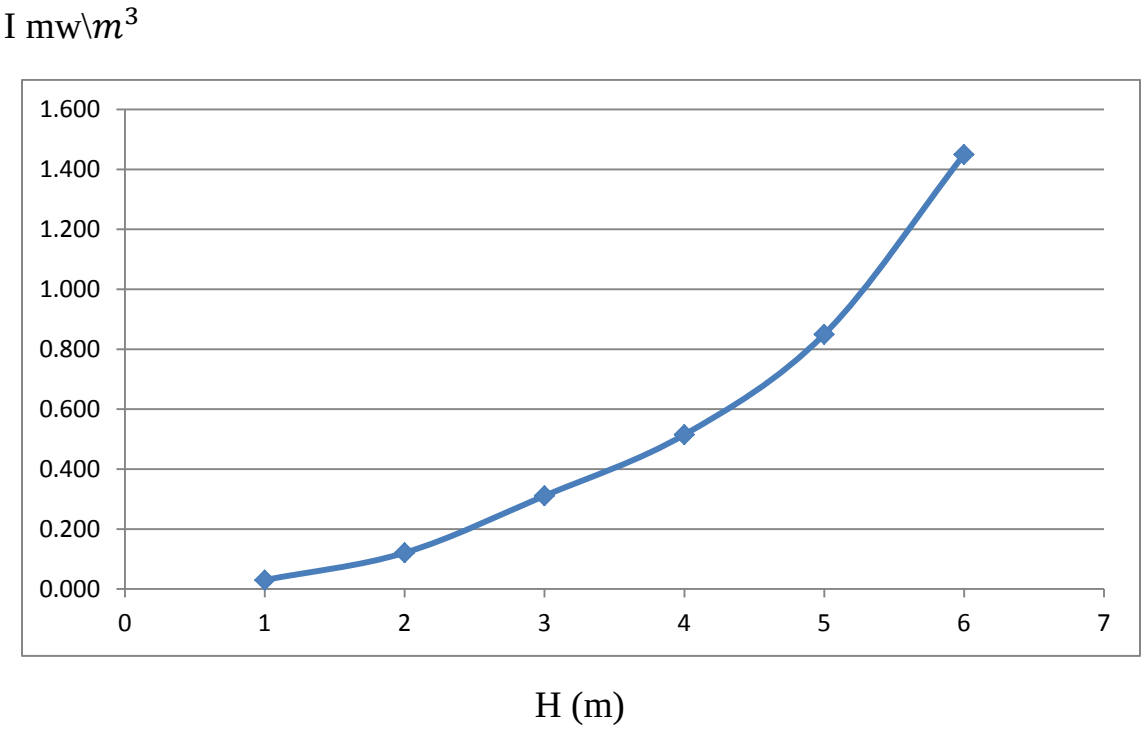


Figure (4): Theoretical relation between I and H

5. Discussion

In view of figure (1) for ZAIN towers in Khartoum state it's clear that the radiation intensity (I) falls down exponential. For height 13 m, 15 m, 20 m, 21 m, 22 m, 25 m, the radiation intensity increases from about 0.118 mw\m2 down to 0.366 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 state shows also exponential increases for the height 10 m, 15m, 20 m, 22 m, 27 m, 30m from 0.104 mw\$m^2$ up to about 5.9 mw\$m^2$).. It's clear that the intensity of radiation of sudani towers is more than that of ZAIN towers for all distances. Thus the intensities emitted from the towers which have the height 22m, 27m, and 30m, are beyond that causes biological hazards. The curve in figure (3) for MTN towers in Khartoum state shows also exponential increases for the height 5 m, 10 m, 15 m, 17 m, 20 m, 22 m, from 0.031 mw\$m^2$ up to about 1.67 mw\$m^2$. Thus the intensities emitted from the towers which have the height 17m, 20m, and 22m also are beyond that causes biological hazards. To see how intensity profile looks like for intensities at big highest beyond 30 m additional readings were made for ZAIN towers at Khartoum state. The intensity distance curve displayed in figures (1, 2, 3,) shows increase of intensity, or direct relation between (H) and (I), which is in conformity with the theoretical relation in Figure (4).

6.Conclusion

The increase in demand for cellular phones results in massive deployment of cellular towers that radiate signals travelling hundreds of meters to establish contact with individual cell phones. This deployment can be noticed in close proximity to even where people live and conduct their lives like schools, hospitals, markets, and dense populated areas. The radiation
From these towers may be associated with health problems to humans. A number of literatures have claimed that the closer and the longer one stays to the radiation source, the more prone one becomes to health.
The field strength measurements were carried out for base station height relation with intensity, and a detailed analysis of this highest category were performed. Measurement results showed that the maximum recorded value of radiation has occurred where the height of the tower was bigger. However the maximum intensity for all towers is beyond permissible level

In addition, future project should focus on extending this work to other states in Sudan to provide spatial estimates of RF field strength for use in health impact assessment.

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