Mobile Tower Radiation Protection System

Jabbar Slman Hussein
Collage of Engineering, University of Karbala
Jabbarsl74@yahoo.com

Abstract:

Clean environment is one of the most necessarily needs for Human life. So what about mobile effect and its towers pollution? It's effect on public health? Effect of huge groan of mobile networks. In counting of these dangers that will harm us from mobile towers in the far run, was the reasons for writing this research, came this study to look at the mobile towers and mobile effects possible health harm for the purpose of diagnosis of these effects and to suggest ways that can be used to avoid or minimize the risks.

Faraday Cage, is the solution suggested here, also there are many other solutions for this problem, a Faraday cage is a metallic enclosure that stops the entry or escape of an EM field.

Also, two experiments are accomplished, first one showing the effect of Faraday cage on preventing the EMR from mobile cellphone, and the second experiment gives the effect of Faraday cage on preventing the EMR from mobile tower EMR on human health listed in the research, that have been done by using conducting shell (grid) design according the EM wavelength used by three company's mobile working in Iraq, the result show good isolations.

Key words: Faraday cage, EMR, mobile, mobile towers.

الخلاصة:

البيئة النظيفة هي واحدة من اهم الامور الضرورية للحياة البشرية . ولكن ماذا عن تأثير تلوث الهاتف المحمول و أبراجها ؟ تأثيرها على الصحة العامة؟ تأثير النمو الضخم لشبكات المحمول، في فرز هذه المخاطر التي من شأنها أن تضرنا من أبراج الجوال في المدى البعيد، هذه التاثيرات وغيرها كان هو الدفاع لكتابة هذا البحث ، جاءت هذه الدراسة إلى إلقاء نظرة على أبراج المحمول و الهواتف المحمولة وآثار الضرر الصحي الممكن لغرض تشخيص هذه الآثار و تشير إلى الطرق التي يمكن استخدامها لتجنب أو تقليل المخاطر.

قفص فاراداي، هو الحل المقترح هنا ، أيضا هناك العديد من الحلول الأخرى لهذه المشكلة، قفص فاراداي هو العلبة المعدنية التي توقف دخول أو هروب الموجات(الضارة) من الحقل الكهرومغناطيسي. تم اجراء تجربتين توضح تاثير اشعاع الموجات الكهرومغاطيسية على صحة الانسان في هذا البحث، الاولى تجربة بسيطة توضح تأثير قفص فاراداي على منع اشعاع الموجات الكهرومغاطيسية من الهاتف النقال، والثانية توضح تأثير قفص فاراداي على منع اشعاع الموجات الكهرومغاطيسية من ابرج الهتف المحمول ،باستخدام شبكة صممتت وفقا لطول الموجي للموجات الكهرومغاطيسية EM المستخدمة من قبل ثلاثة شركات للهاتف النقال العاملة في العراق ، والنتيجة تظهر عزل جيد.

الكلمات المفتاحية: قفص فراداي، اضرار الموجات الكهرومغناطيسية، الهاتف النقال، ابراج الهاتف النقال.

1-Introduction

Mobiles and its towers produce electromagnetic wave radiation having terrible wellbeing impacts which can be partitioned into warm and non-warm. Warm impacts remain for warming impact which you see in the event that you utilize the telephone for long close to your head. Non-warm consequences for the body cells, qualities and the DNA and are much more unsafe than warm impacts. Long utilization of mobiles can prompt many impact, for example, migraine, absence of fixation, memory misfortune, rest unsettling influence, tinnitus (ringing in the ears) and expanded danger of mind malignancy. Mobile towers in your neighborhood can likewise give medical issues. The more wellbeing impacts noted incorporate barrenness, premature delivery, neurodegenerative scatters, heart issues and malignancy.

In this way, the human body is persistently presented to electromagnetic radiation of variable force which relies on upon the area inside the house or in open space. The human body is unpredictable one of some help parameters, similar to complex permittivity, thickness and its electrical conductivity [Foster & Schwan1996]. The EMR is known by its recurrence, their bearing and polarization qualities in free space and force of electric and attractive fields. The fields of the

tissues of natural body can responds to them and thusly, it is important to compute these fields for general evaluation of organic information acquired hypothetically. At the point when an EM field falls upon the human body, then it mostly enters into human body and it is lessened by human body tissues and some of it are consumed by body tissues (Kumar & Vats, 2011). The retention of electromagnetic radiation is relied upon to raise the body temperature (Mclntosh , 2005).

This warm impact shifts with the recurrence and the energy of the EM vitality. A measure of these warming impact is the particular ingestion rate or SAR, which has units of watts per kilogram (W/kg). The IEEE (IEEE , 2005) and numerous legislatures have made security limits for introduction to different frequencies of EM vitality in view of SAR, for the most part in view of ICNIRP Guidelines , (ICNIRP, 1998) which make preparations for warm harm .

2-Portable Network Towers:

A phone system is a remote framework circulated over a region called cells, everyone served by at least one handset, known as a base station. In a phone system, everyone uses an alternate arrangement of frequencies from neighboring cells, to avoid obstruction and gives ensured data transmission inside every phone as in figure (1).

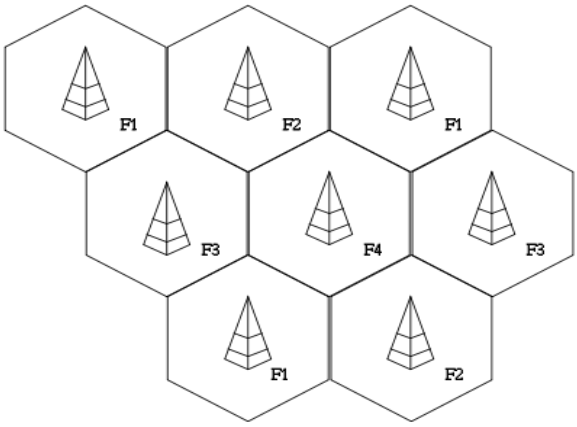

Fig.(1) cell of mobile network

At the point when include these cells that will give radio scope over an extraordinary geographic zone. This empowers countless handsets (e.g., cell phones, pagers, and so on.) to speak with each other and with settled handsets and versatile anyplace in the phone arrange, by means of base stations, regardless of the possibility that a portion of the mobiles are traveling through more than one cell amid transmission.

3- Cell Phone Networks Frequencies:

Diverse frequencies serve better for various employments. For field scope low frequencies, for example, 450 MHz, work well for exceptionally. Be that as it may, with GSM (900 MHz) is a reasonable answer for light urban scope. Additionally with GSM 1800 (1.8 GHz) the structure dividers will restricts its scope.

Higher frequencies have been chosen, that gives advantage with regards to limit, yet detriment with regards to scope, however it is a Pico cells %, covering e.g. one story of a building, it is conceivable, and the recurrence copy can be utilized for cells which are for all intents and purposes neighbors to each other. As a case, with CDMA2000, if 450Mhz recurrence is utilized, that is given: 48.9km cell span, 7521

km2 of cell region and 1 cell number, however with 2100Mhz, it gives: 12km cell sweep, 449km2 of cell territory and 16.2 cell counts (Farley , 2012).

4 - Cellphone Harm Example:

- From ICNIRP Guideline for Mobile, it's give (Kumar &Vats , 2012) :
  A - For GSM900 (935-960MHz): Pd=4.7W/m2
  B - For GSM1800 (1810-1881MHz): Pd=9.2W/m2
- If 940MHz taken (littlest Frequency utilized as a part of portable administrations),
  Control thickness (Pd) is 4.7W/m²
  Zone = 1.43 m²(length of human is around 5.6 ft)
- So the power got (Pr) by human body will be
  Pr = Pd x Area = 6.75 Watts in one sec.
- From above, In one day,
  Microwave vitality assimilated will be [6.75 Watts x (60secx60escx24hu)] = 583.2 KW-sec.
- Microwave stove: 700 to 1000 W, with say 60% proficiency, microwave control yield is say 500 W.
  So, a conclusion can be:
  This infers human body can be securely kept in a microwave stove for 1166 sec = 19 minutes for each day.

5 - Utilizing House surface as Mobile Tower Base:

The reasons of utilizing people groups building surfaces houses and as a base for the Mobile towers are as per the following:

- The versatile organizations utilize this approache to descend their costs, so this for monetary reasons,
- In remain on developing a Tower on earth, it is less demanding to put a Tower on a surface or building them.
- To serve more Mobil clients.
- There are more than one organization for the most part in any city, so the opposition is high.
- Usually the surface of Houses and building are rents from the building proprietors not to be purchased.
- With the low level of individuals' state and the Electrical issues, the Mobile organizations take that as an advantage for it.

6- What To Do (Kumar &Vats , 2012) :

A - if somebody lives near a portable tower:

• One can request that the administrators lessen the tower control transmission, or
• One can request that the administrators change the edge of the radio wire so that no house falls in the fundamental light emission reception apparatus, or
• Go for Shielding Solution (like Faraday Cage).

B - For versatile, the next might be concerned:

- Keep separation and hold the cellphone far from body,
- Utilize a headset or ear bud,
- Utilize a wired headset
- Restrain the length of versatile utilize,
- Wherever conceivable, utilize message when contrasted with voice
- Utilize the phone with speaker mode
- Utilize headset with remote Bluetooth capacity,

- A cell phone will build its transmission control when the radio flag is feeble, locate a solid flag and dodge development and utilize your telephone with great gathering.
- Abstain from utilizing a cell phone while wearing metal-surrounded glasses or having wet hair where metal and water are great channels of radio waves,
- Sit tight for the call to be associated before begin talking and listening where the cellphone initially makes the correspondence at higher power and after that decreases energy to a suitable level, more power is emanated through call interfacing time
- Utilize a landline (wired) telephone, not a cellphone.
- While obtaining a cellphone read the SAR estimation of the cell phone.

7- Faraday Cage:

A Faraday shield is a walled in area made by material or by a work of such directing material. Such a fenced in area rejects outside static and non-static electric fields by going power through the work, that give steady potential drop on all sides of the nook. Since the variety in voltage is the measure of electrical potential, there is no present moves through the space or burying the shield. Faraday pens are created the English researcher Michael Faraday in 1836. (Encarta, 2009)

An external static electrical field makes the charges inside the pen's directing material be skimmed, with the goal that they cross out the EM's impact in the pen's inside. This is utilized, for instance, to shield electronic gear from the impact of EMR and in addition human from that impact.

The Faraday pens are spaces that are completely encased by at least one layers of a fine metal work. These metal work is grounded to scatter any streams produced from outside or inner EM fields, and in this manner they keep a lot of the EM obstruction.

The transmission or gathering of electromagnetic radiation, to or from any reception apparatus inside a Faraday shield is intensely weakened or obstructed by the enclosure. On the off chance that grounded is made for the Faraday confine, the charges will go to the ground (Bulletin , 2014) .

The energy of protecting of electric field (static) relies on upon the measurements of the conductive shield material. Where on account of a nonlinear electric field (differing one), and thus a shifting attractive field, the higher the varieties are (i.e., the higher the frequencies), the better the material opposes such infiltration, however on the opposite side, it more goes through enclosure of given size. Here, the protecting likewise relies on upon the electrical conductive properties of the shield conductive materials, the enclosure is produced using, and in addition their thicknesses. (Encarta , 2009 ; Wrobel , 2011) .

8 - Contextual investigations:

Case1:

A first exertion at execution the Faraday shield utilizing a mobile phone was accomplished utilizing a vacant jelly tin with metal sort squeezed out with the cellphone set inside as in figure (2). The blocked cellphone was dialed from another Mobile to check whether it rang. This technique worked adaptably with any cellphone and at any area. As observed from figure (3), that the MWR diminish step by step with the separation.

Fig.(2) Placing a phone in

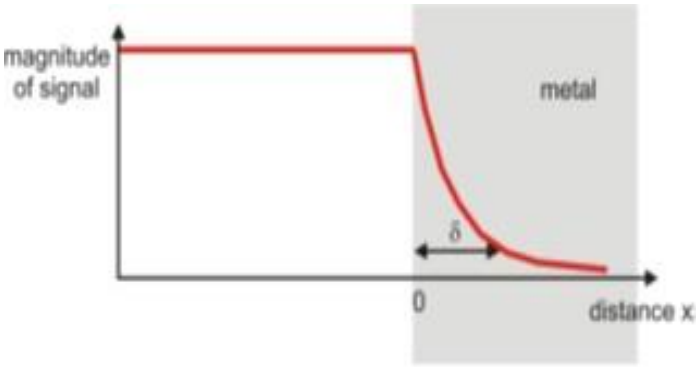

Fig.(3) The decrease of the magnitude of an electric field of a

For a cellphone EM wave, the frequencies and wavelength are given in Table (1),for the systems which work their own particular base stations in the Iraq.

Here, there are in our country, three main companies, Zain, Asiacell and Korak, there are other companies but the monished are the main companies. They are using GSM technology in their networks as in table (1) below with the frequencies and wavelengths showing.

Table 1. Table of cell phone organizations, frequencies and wavelengths in the Iraq. (Frequencycheck , 2016)

Organize	Frequency	Wavelength
1-Zain	GSM900	33cm
	GSM1800	17cm
2-Asiacell	GSM900	33cm
3-Korak	GSM900	33cm

Strangely, the Faraday shield still functions admirably if there are holes in the conductor, gives their most extreme distance across is `significantly littler' than the wavelength of the E.M. waves, as in the case 2 below.

Case 2:

Here, a building surface is taken that have a versatile tower (putted by portable organizations), and to ensure or to protect the people groups (living at that working) from the damages of the tower radiation impacts, a Faraday Cage must be utilized as just arrangement that should be possible, Faraday Cage is easy to build and not expansive, the accompanying focuses must be taken, as takes after:

- The electrical conductivity of confine materials must be considered in the insurance procedure.
- Holes of the lattice of the gage is must be not as much as the wavelength of the tower electromagnetic field.
- The lattice thickness must be adequate.
- The shield must be grounded
- Rule of thumb frequently utilized for Faraday shield to seize transmission is that the openings should be no more noteworthy than 1/10 of the wavelength of the signal. (vBulletin , 2014)

❖ For GSM900(935-960MHz) with PD=4.7w/m2: the Wave length is found by:

λ=c/f ……..(1)

λ: wavelength of the electromagnetic field, c:light speed, f:frequency,

λ=(3*〖10〗^8)/〖960*10〗^6 =0.3125m

- 1-Here the measurements between the work wires must be Under 0.3125m, as in Fig.(4)
- 2-This shield may take distinctive shape agreeing to the surface state of the building.
- 3-The enclosure must be grounded from one of the corners, for better outcomes.

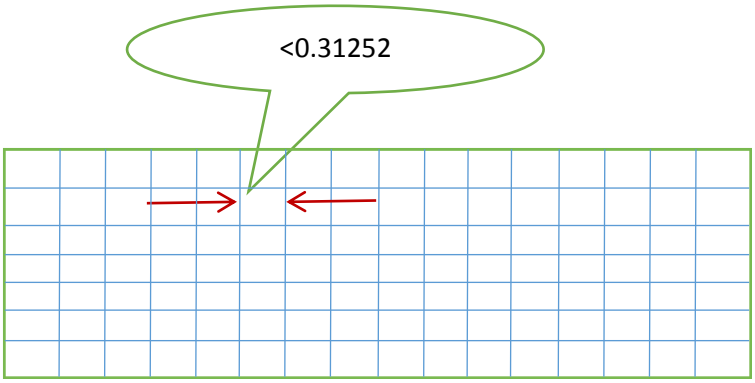

Fig.(4) Faraday grid space distance

Conclusions:

It may be concluded that no transmission tower should be located near the populated area. It is also suggested that nobody should reach near (4 m distance) to the transmission tower.

Rules and Laws that point out the operations of using Mobile Towers on the surfaces of the peoples building must be respected.

A simple mathematical calculation showing the harms of the EM radiation on human live near or under building have Mobile tower, gives that, human body can be securely kept in a microwave stove for 1166 sec = 19 minutes for each day?

Also, two experiments have been accomplished in this paper, the first one is a simple experiment showing the principle usage of faraday cage, that gives the way of preventing the EM wave from or to Mobile phone, where the second one is the practical usage of Faraday cage to protect the peoples living in a building with a Cellphone Tower on its surface, a mathematical calculation of who much is the space between grid lines is done showing for GSM900(935-960MHz), the grid line space is Under 0.3125m as can be done for any other frequency.

Faraday Cage is suitable to protect peoples from the bad effect of Mobile Tower radiations.

References:

Encarta , 2009 , **"Michael Faraday"**. . Archived from the original.

Foster K. R. & Schwan H. P. , 1996, **"Introduction, in Biological effects of electromagnetic fields"**, edited by C Polk & E Postow (CRC Press, Boca Raton, USA), pp 25-102.

Frequencycheck , 2016 , https://www.frequencycheck.com/carriers/asiacell-iraq

Girish Kumar, 2012," **CELL PHONE/TOWER RADIATION HAZARDS & SOLUTIONS"**, 2ndWorkshop, IIT Bombay Tel: (022) 2576 7436, gkumar@ee.iitb.ac.in

IEEE , 2005 ,**"Standard for Safety Level with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 300GHz"**. IEEE Std (IEEE). C95. Cite uses deprecated parameters (help)

International Commission on Non-Ionizing Radiation Protection ICNIRP (April 1998). **"Guidelines for limiting exposure to time-varying electric, magnetic,**

and electromagnetic fields (up to 300 GHz)". Health Physics 74 (4): 494–522. PMID 9525427. Cite uses deprecated parameters (help)

Kumar V. P. & Vats R. P. ,2011," **Harmful electro-magnetic environment near transmission tower"**, Indian J Radio Space

Leo Wrobel Aug 10 , 2011 , "**What is a Faraday Cage and How Could It Help**"?

Mclntosh R L, Anderson V & Mckenzie R J, 2005 , **"A numerical evaluation of SAR distribution and temperature changes around a metallic plate in the head of a RF exposed worker**", Bioelectromagnetics (USA), 23 pp 377-388.

Tom Farley, 2006 , **"Cellular Telephone Basics".** ,Privateline.com. 1 January 2006. p. 2. Retrieved 2 April 2012.

Vbulletin , 2014 , "**Holes in a Faraday Cage Powered**" by vBulletin® Version 3.8.7 Copyright ©2000 , vBulletin Solutions, Inc.