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IMPACT OF RANDOM BROADCAST OF THE INTERNET ON HUMAN HEALTH: A FIELD STUDY ON AL-NAJAF CITY

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ABSTRACT

Demands of the Internet services have been increased and grown in the last one decade. Due to absence and weakness of the fiber optic infrastructure in some countries like Iraq. Thus, most of the Internet Service Provider (ISP) used alternative solutions such as wireless broadcasting via central towers based on free frequencies wireless devices (broadband). Concern on the spread of wireless internet services is growing, considering the lack of control and regulation of this technology, particularly with the plenty of reports of illnesses associated with Wireless Broadcasting and spread devices used for internet broadcast in homes and companies. In this work, we conducted field measurements in an Iraqi city that has more than 1250 towers within 28824 km2. This area is large but is mostly an empty desert, so the concentration of these towers is only about 500 km2. All towers use a free license frequency (5 GHz) to broadcast the internet. The present study took 63 days to finish. It started on 6th October and finished on 7th December. The obtained measurements were compared with international standards of wireless broadcasting for individuals and businesses. The main objective of this research is to verify an Electric Magnetic field (EMF) which is associated with Internet broadcasting from internet towers that do not exceed international standards. Therefore, Internet Broadcasting does not have negative effects on human health specifically to those who lived near the towers.

Keywords: Wireless broadcasting, Free license frequency; EMF; Standard for EMF exposure; Power density

1. INTRODUCTION

Electromagnetic fields(EMF) occur in the Earth naturally. These are non-ionizing radiations, which are very weak to break the bonds that hold molecules in cells together. In the last century, it dramatically increased with wide wireless broadcasting. EMF effects depend upon broadcast strength and frequencies [1]. The Internet is considered as a living requirement like electricity and telephone with the wide use of social networking and free calls. Internet service access depend on the availability of communication infrastructure like fiber optic. As a result of the absence or weakness of the infrastructure in some countries like Iraq, leading Internet service providers use alternative methods to provide Internet services, like using big tower with wireless broadcast devices [2]. Internet towers are spread in residential quarters without any criterion for broadcasting control. The distance between two towers are usually 50 meters only. Because of using free license frequency to broadcast the Internet which casing extremely interference in Internet signal that causes a weak signal that arrives at home. To solve this problem, Internet service providers use latest high power wireless devices to guarantee the delivery of best Internet signal without considering the side effects, especially on human health. Concern is growing due to EMF exposure associated with wireless broadcasting and its health effects related to emissions. No previous studies have assessed and evaluated the compliance with international standards. So the main questions are: 1) What are the international standards for the power density of the internet broadcasting? 2)Does the internet broadcasting from the internet towers exceed its own international standards? 3)Does This type of broadcasting affect the people who lived within the broadcast area. The current paper measures the power density associated with Internet wireless broadcasting excluding mobile broadcast. Al-Najaf city selected as a sample to measure EMF exposure. The author focused on intensely populated areas, which are nearly equal to 500 km2 with 1250 tower as in figure1. and figure2. The power density used as a standard for the result because it is recognized and used by international standard Organizations to check EMF exposure.

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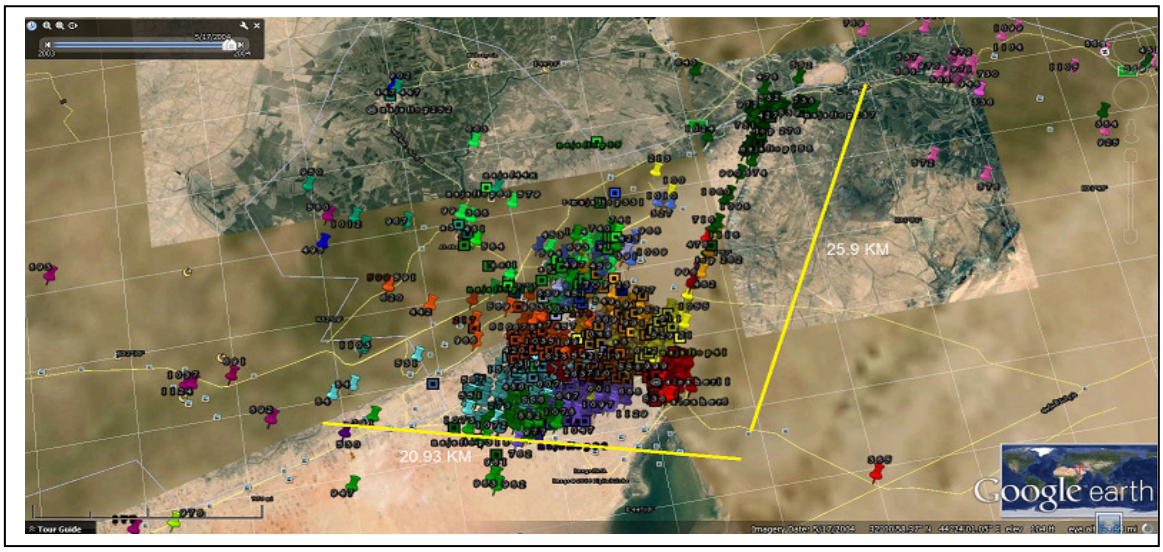

Figure 1:Internet Tower distributed across Al-Najaf city in Iraq

The project duration is from 6th October and finished on 7th December 2016.

2. RELATED WORKS

EMF exposure problem is one of the popular concerns studied by the researcher. Given that Internet wireless broadcast is relatively uncommon in the whole world, the researcher mostly focused on EMF exposure that result from telecommunication tower broadcasting, a few studies analysis and discuss EMF exposure in the vicinity of GSM antennas, and visualized protection zones based on different EMF limits[3], whilst, another studies respect to measurement and analysis the field strengths of communication towers [4][5]. Thors et at. 2016 exploiting the discovery of 5G mobile technology to exposure evaluations in the frequency range 10 GHz – 60 GHz[6]. Zhao et at.2016 analysis the exposure of electromagnetic field to mmWave phased arrays in mobile devices for 5G communication[7], Hillert et at. 2008 focus another the health effect like headache other Symptoms due to use of GSM technology which report some relation between headache after RF exposure [8].

3. INTERNATIONAL STANDARD FOR EMF EXPOSURE

Allowed international standards for wireless broadcasting for both people and occupation, considering the health effects, are obtained before deploying field measurements for Internet wireless broadcasting

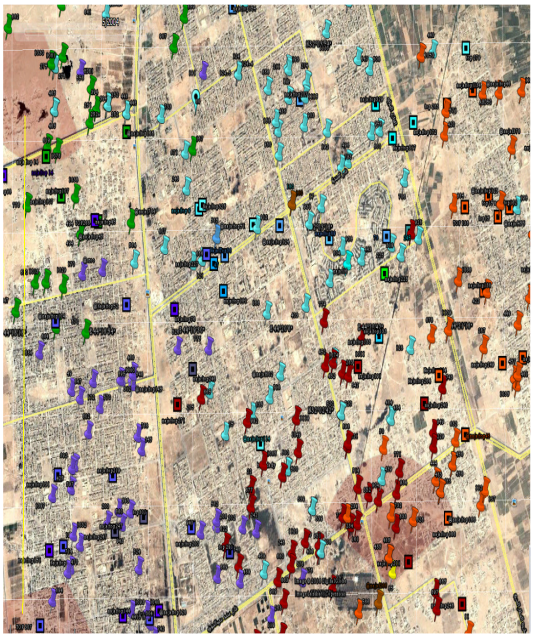

Figure 2: An enlarge image for Internet Tower distributed across Al-Najaf city in Iraq

3.1 SBM 2008 (Standard of Building Biology Testing Methods)

The SBM 2008 standard based on the precautionary principle is designed for sleeping areas associated with long-term risks [9]. This type of standard was divided into four categories depending on the EMF exposure danger. Table 1. shows these four categories.

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Table 1: Building Biology Evaluation Guidelines For Sleeping Areas SBM-2008

No Concern	Slight Concern	Severe concern	Extreme concern
<0.1 μW/m^2	0.1 μW/m^2 to 10 μW/m^2	10 μW/m^2 to 1000 μW/m^2	> 1000 μW/m^2

3.2 The US Federal communication commission FCC) standard

The FCC is an independent agency created to regulate interstate communications by radio, television, wire, satellite, and cable in the United States of America (USA) [10].The standards are specialized for both general population and Occupational. Because the current paper focuses on Internet broadcasting, we choose only the 5 GHz standard.

3.2.1 Maximum permissible for controlled exposure /Occupational power density = 50W/m^2.

3.2.2 Maximum permissible for uncontrolled exposure /General population power density =10W/m^2.

3.3 Salzburg Resolution

This standard is a Precautionary recommendation by leading scientists, for the total of all high frequency the limit value of 100 mW/m² is recommended [11].

3.4 Canada safety code

This standard limit is based on ongoing review of studies, both external and internal authoritative reviews of the scientific literature as well as Health Canada's own research. This standard is specialized for both general population and Occupational [12].

3.4.1 Power density reference level in uncontrolled environment = $0.02619f^{0.6834}$

3.4.2 Power density reference level in Controlled environment = $0.6455f^{0.5}$

3.5 ICNIRP International Guidelines (1998)

The main objective of this standard is to establish guidelines to limit EMF exposure, and provide protection against known adverse health effects. This standard dependable in most of the world countries (like the USA and Iraq)this standard specialized for both general population and Occupational [13].

3.5.1 Occupational exposure power density=50 W m^{-2}

3.5.2 General public exposure power density=10 W m^{-2}

3.6 Belgium

This standard is based on WHO[14] Equivalent plane wave power density (W/m^2) = 2.5

3.7 China

This standard is based on WHO[15]

3.7.1 Exposure Limits (1st grade standard) < 10 mW/cm^2.

3.7.2 Exposure Limits (2nd grade standard)< 40 mW/cm^2.

Note: The 1st-grade standard applies to human living environments; the 2nd-grade standard applies to places where people do not live or work for the long-term period.

4. METHODOLOGY

The SRM-3006, as shown in figure 3 (Selective Radiation Meter), is handheld with receiving antenna which is displayed the RF exposure was used for safety analysis and environmental measurements. The SRM-3006 uses a combination of analog and digital signal processing. We used SRM-3006 to measure power density in different locations in Al-Najaf city based on the density of towers. The distance between tower and place of measurement is chosen according to [16].

Figure 3: SRM-3006Selective Radiation Meter

Figure 4 below is one of the towers used for Internet broadcast, which contain many of the Internet broadcast devices

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Figure 4:. Internet broadcast tower.

5. HEALTH HAZARD ASSOCIATED WITH RADIATION WIRELESS TRANSMISSION

During the last years, exposure to man-made electromagnetic fields increased with technology advancement and with popular use of especially wireless broadcasting technologies like mobile and Internet broadcasting. Currently, everyone is exposed to a complex EMF, both at work and home. Despite the publication of more than 25 000 articles over the past 30 years, the World Health Organization (WHO) concluded that current evidence does not confirm the existence of any health consequences from exposure to low-level EMF. However, some gaps in knowledge about biological effects exist and compel further research [17].
In this section, we explain the relationship between EMF exposure and some diseases.

TABLE 2:Common Devices Used For Internet Broadcasting

No	Device	Gain (dBi)	Max power consumption (W)
1	Nanostation M5	13	5.5
2	Nanobridge M	22 or 25	5.5
3	NanobeamNBE-M5-400	8	25
4	PowerBridge M5	8	25
5	Powerbeamm5	8	25
6	Power Station 5	6.5	25
7	ROCKET M5	8	26-30

5.1 Effects on general health

To date, no scientific evidence relates symptoms such as anxiety, headaches, nausea, loss of libido, and fatigue to EMF exposure.

5.2 Effects on pregnancy outcome

The WHO and other organizations have reported no relation between adverse outcomes such as malformations, low birth weight, spontaneous abortions, and congenital diseases to EMF exposure.

Cataracts Animal studies do not validate the relation between general eye irritation and cataracts with EMF exposure

5.3 Electromagnetic fields and cancer

While the WHO stated that the results of the relation between EMF and cancer have inconsistencies, they have not found any significant risk increase for any type of cancer in children or adults. Some studies suggest minimal increases in risk of childhood leukemia with exposure to EMF in the home, but no causal relation exists between exposure to the fields and disease [17].Another study in German city, which monitored 1000 person who had lived around phone, towers for 10 years. This study found that people who lived within 400 meters had more prone to diagnosed cancer three times higher another people who lived further away [18].

5.4 Studies With dissenting opinions

Study for animals [19]: This study found that mice that were exposed to EMF had progressively fewer newborns, and within 5 matings became irreversibly infertile. Autopsy of dead cows exposed to EMF indicated heart and blood circulation problems with internal bleeding from several organs.

6. Common devices used for broadcast

The broadcast devices evolved gradually especially to reach farther distance and solve the interference problem. In this section, we review most of the transmitter devices used for Internet broadcast [20].

7. Result and discussion

Many of the points have been tested in different parts of Al-Najaf city, especially in areas that contain high-density Internet towers. The location and power density reading of each point are stated in tables below. The results in these tables were selected and obtained on two different days

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and at peak times as samples of the results obtained during the study period.

Table 3:power density reading for multiple places in Al-Najaf city at 10-09-2016

Place (Latitude)	Place (Longitude)	Time of reading	Power density nw/cm^2
32° 00'03.97"N	44°21'41.46"E	08:42AM	412.4
32° 00'28.65"N	44°20'04.32"E	09:27AM	417.6
32° 01'06.03"N	44°20'00.04"E	10:09AM	425.3
32° 01'19.34"N	44°20'27.53"E	10:52AM	438.5
32° 02'32.29"N	44°19'48.61"E	11:36AM	441.9
32° 02'56.29"N	44°21'58.25"E	12:12PM	449.9
32° 03'55.82"N	44°20'34.28"E	12:55PM	429.7
32° 03'09.45"N	44°21'11.94"E	01:24PM	411.2
32° 04'59.57"N	44°16'40.7"E	02:02PM	422.1
32° 05'10.63"N	44°19'59.88"E	02:43PM	428.9

Table 4:Power density reading for multiple places in Al-Najaf city at 21-12-2016

Despite concerns that we suffered from these towers and possibly non-compliance with international safety standards, we note that the power density of wireless transmission of the Internet did not exceed the limit of any of the internationally approved standards. Also, this type of transmission has a minimal effect compared with other transmissions at the same range of frequency (2–6 GHz). As shown in table 5. The power density emitted by each one of CDMA mobile communication nearly equivalent to total power density emitted by Internet towers in any of the measurement places.

Table 5: power density reading for CDMA towers in one place in Al-Najaf city at 21-12-2016

Mobile company name	Place (Latitude)	Place (Longitude)	Power density
KALIMAT	31°58'24.73"N	44°26'8.81"E	353 nw/cm^2
FANOOS	31°58'24.73"N	44°26'8.81"E	453 nw/cm^2
CENTRAL	31°58'24.73"N	44°26'8.81"E	451 nw/cm^2

Place (Latitude)	Place (Longitude)	Time of reading	Power density nw/cm^2
31°56'34.18"N	44°25'42.72"E	09:01AM	405.6
31°57'46.50"N	44°23'5.40"E	09:51AM	410.4
31°57'26.38"N	44°24'6.55"E	10:21AM	413.6
31°58'03.76"N	44°22'54.62"E	10:59AM	423.8
31°58'24.73"N	44°26'8.81"E	11:24AM	433.2
31°58'34.61"N	44°19'56.68"E	11:51PM	439.9
31°59'09.59"N	44°19'20.91"E	12:33PM	440.2
31°59'56.41"N	44°25'8.61"E	01:09PM	429.1
31°59'29.69"N	44°19'46.30"E	01:42PM	418.7
31°59'31.68"N	44°21'32.31"E	02:03PM	428.4

The power density of point (31°58'24.73"N, 44°26'8.81"E) for the Internet towers less than power density of FANOOS mobile company, It is less than 35% of total power emitted by these three mobile companies. When compared results that obtained measuring power density for the Internet towers with other types of towers like radio and television transmission towers or mobile communication towers. we found that the effects of internet towers is not more than 0.2% of power density associated regarding to radio and television towers[22], whilst it less than 0.125% of power density associated with communications towers that have a single carrier and a single operator[23]. on the other hand, the mentioned results does not exceed 0.008% of the communications towers that have 5 carriers and 3 operators[23].

8. CONCLUSION

generally, the widespread use of communications towers (especially the internet towers) moreover reports of the existence of relationship among these towers and many diseases, like cancer, this lead to use all possible potentials to confirm the existence of these relationships, especially that most of the studies focus on mobile towers without look at the internet towers, which has spread in recent years. This paper aims to obtain the measurement of power density for different places of Al-Najaf city within the area equal to 500km^2, which contain nearly 1250 towers using modern broadcast devices. The distance between towers reached 100 meters in some cases. Although wireless Internet broadcast is widespread, the resulting power density does not exceed the threshold set by most international organizations specializing in this domain, which depends on Iraqi CMC and The Ministry of Science and Technology. The power density does not reach 0.1 mW/cm2, which is considered by one Spanish study [21] as cause of sleep disturbances, headaches, appetite loss, irritability, difficulty concentrating, etc. Interference is the only problem generated from Internet broadcasting using free frequencies. The interference forces the ISP to find new devices with much power to deliver Internet signal to users, which means EMF exposure intensity may increase. This problem can be solved if the fiber optic infrastructure is built as soon as possible, or specific controls are developed for the distributed Internet towers and frequencies to prevent the ISP in the same area to use same frequency channel. Compliance with the laws must be ensured for the installation of towers on buildings that have

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concrete roofs with height of 15 meters at least and not more than 50 meters. The installation of towers above the surface of the apartment buildings, hospitals, health centers, kindergartens, schools and universities as well as the development of the wall metal from the base of the tower to a distance 6 meters must not be allowed.

9. FUTURE WORK

Future research will be focused on compare between indoor wireless broadcasting and outdoor wireless broadcasting and Search on which one is the most influential on a human.

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