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Investigation the Strength of Magnetic Fields Emitted From Home Electrical Devices

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ABSTRACT

The huge advance in electrical technology in the last decades cause an increasing in the number of electrical devices in our homes which cause an increasing in the presence of electric and magnetic fields that led to a negative health effects due to exposure to such fields . The aim of this research is to investigate the strength of magnetic fields emitted by some home electrical devices .Measurements were conducted by using the EMF TESTER (EMF 827). Results obtained shows *that* the practical measurements are consistent with the mathematical calculations. Comparison of these results with the standard guideline limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) shows that they lay within the acceptable limits and that means there is no health risk from exposure to these fields if the exposure is for a short and discontinues periods .

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INTRODUCTION

The production of electric and magnetic fields (EMFs) produced by power lines, transformers, service wires and electrical panels as well as by home appliances are associated with the generation, transmission and use of electric energy everywhere . So, In our everyday life, we expose to electromagnetic fields from different sources . So all the time we are exposed to such fields without knowing , what they are , how it generate and wither they effects our health or not .Many researchers have already embraced the enormous and wonderful effects of these fields on human health because of the association of electromagnetic fields with increased behavioral changes and health problems such as leukemia, cancer, and some serious disorders, (Feychting, M., F. Jonsson, 2003).

Electric and magnetic fields are invisible lines of force that surround all electrical devices, home wiring, power lines in the street and high voltage transmission lines. They are invisible lines of force created by electric charges, which produce two kinds of fields: electric and magnetic. EMFs exist almost everywhere. and the intensity of magnetic and electric fields minimizes as you move away from the source. EMF radiations come from both natural sources such as the sun or atmospheric and solar disturbances and from man-made sources including anything that generates, distributes or uses electricity (ICIRP, 2009). Because it is impossible to see the electromagnetic fields with the naked eye and their effects cannot be felt directly, people cannot attach adequate importance. So, it is important to spot the sources of magnetic field pollution in our homes to take necessary precautions to reduce its effect on our health.

In this work I will try to investigate the human exposure to electromagnetic field in homes at a low frequency (50 Hz) and I will focus on the magnetic field by calculating and measuring the magnetic field density (B) in the (bed room and kitchen) and identify the possible methods for reducing the EMF exposure levels in order to avoid its negative health effects.

1.1. Literature review:

There is no adverse psychological effects were observed in laboratory studies of people exposed to 50-Hz fields. In the other hand Some epidemiological studies have suggested increasing cancer risk associated with estimates of magnetic field exposure, such as (Sander, R., J. Brinkmann, 1982).

- Wertheimer and Leeper, in two studies in which one was examined the use of electric blankets and heated waterbeds (1986) and the other was examined ceiling cable electric heat (1989), that fetal loss increased when conception occurred during the months of increasing cold (October to January) for parents exposed to

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an EMF source during the night. Homes in which electric blankets and ceiling cables were not used did not show a seasonal pattern of fetal loss. Electric blankets can generate magnetic fields as high as 4 mT at a distance of 5 cm, and ceiling cable heating produces ambient magnetic fields of approximately 10 mT and electric fields of 10-50 V/m. Ambient fields in most homes, even those with baseboard heaters, tend to be less than 0.1 mT and 10 V/m (Ruppe, I., K. Hentschel, 1995).

- Liburdy *et al.* (1993) reported that women sleeping under electric blankets had disrupted melatonin production. The threshold for effect was between 0.2 and 2 uT, well within the range of the Wertheimer and Leeper (1986, 1989) studies. Melatonin has many functions one of which is the regulation of sex hormones, estrogen and progesterone, which are critical for full term pregnancies (Liburdy, R.P., T.R. Sloma, 1993).
- (Goldhaber *et al.* 1988) conducted a case control study of 1583 pregnant women who attended one of three gynecology clinics in Northern California during 1981 and 1982. They found a significantly elevated risk of miscarriages for the working-women who reported using video display units for more than 20 hr each week during the first trimester of pregnancy compared to other working women who reported not using video display units (Schuz, J. and A. Ahlbom, 2008).

1.2. Biological effects:

Some studies results showed that low-frequency MF induces currents within the human body which have a strength that depends on the intensity of magnetic field. If the amount of current is large then it may cause some biological processes such as:

- Contribute to miscarriage or birth defects.
- Promote the growth of cancer cells.
- Interfere with the cell processes and functions.
- Affect the function of the pineal gland and its hormone, melatonin.
- Influence the dopamine, opiate, and pineal systems, which in turn interact with the immune system (ICINRP, 2001).

1.3. Standard exposure limitations :

Many organizations have been established and issued guidelines for limiting EMF exposure that will provide protection against adverse health effects The major of these organizations is the International Commission on Non-Ionizing Radiation Protection(ICNIR) which issued its guidelines exposure limits (Huuskonen, H., M.L. Lindbohm, 1998) shown in table (1).

Table 1: EMF Exposure Standards Applicable in Europe and Elsewhere.

EMF	E (V/m)	B (μ T)
Occupational Exposure	10	500
General public Exposure	5	100

2. Methodology:

The investigation of magnetic fields will conduct in the following three steps:

- Mathematically calculating the electromagnetic flux density (B) for some home electrical at three ranges (10cm , 30cm and 60cm).
- Practically Measuring the electromagnetic flux density (B) for some home electrical devices at three ranges (10cm , 30cm and 60cm).
- Practically Measuring the electromagnetic field levels at four points in three samples of (bedroom and kitchen) .

2.1. Mathematical Calculations:

The magnetic flux density(B) can mathematically calculating using Amperes law which gives the magnetic flux density (B) as follows (Matthew N.O., Sadiku, 2012):

$$B = \frac{I \cdot \mu_0}{2\pi \cdot r} \quad (1)$$

Where :

B : Magnetic field (magnetic flux density), measured in *Tesla (T)*

I : Electrical current , measured in *ampere (A)*

r : distance from the source of EMF , measured in *meter (m)*

μ_0 : Permeability of free space, measured in *Tesla .meter/ampere (T . m / A)*

$\mu_0 = 4 \pi \times 10^{-7} \text{ (T . m / A)}$

The magnetic field in any point at home or work place can be calculated by superimposing the individual contribution of the current of each conductor based on Maxwell's equations as follows:

$$B = \frac{\mu_0}{4\pi} \int \frac{Idl \times (r)}{|r|^3} \quad (2)$$

Where:

I : Electric current .

r : distance between the observed point and the original conductor [m].

ϵ – Permittivity of space in which the field is calculated.

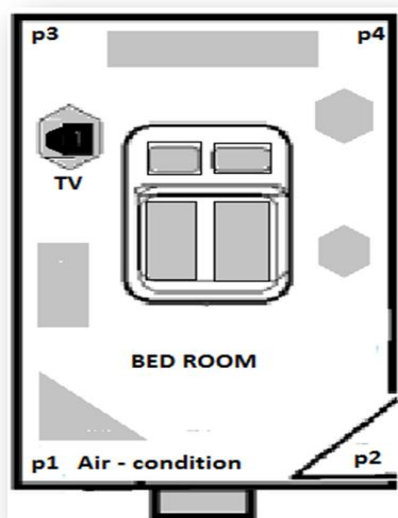


Fig. 1: Top view of the bed room.

Table 2: Mathematical calculations of magnetic field density(B) in (microTesla).

Electrical Device	B(μ T) at $r = 10$ cm	B (μ T) at $r = 30$ cm	B (μ T) at $r = 60$ cm
Air-condition	1.94	0.376	0.248
Electric oven	1.307	0.393	0.028
Electric mixer	1.119	0.376	0.083
TV	1.065	0.216	0.071
Refrigerator	0.443	0.212	0.062

2.2. Practical measurements :

The practical measurement have been conductd by using the EMF exposure tester (EMF-827) .This portable instrument is an EMF exposure level meter for measuring the magnetic fields in homes and workplaces at a frequency of (50 HZ) .

The practical measurements are carried out as follows:

- Measuring the magnetic field levels at four corners in bedroom beginning from (p1) , (p2) ,(p3) and (p4) as shown in fig.(1).
- Measuring the magnetic field level in the kitchen contains (electric oven, electric fan , refrigerator and electric mixer) at four points beginning from (p1),(p2) , (p3) and (p4) as shown in fig. (2).
- Measurement of magnetic field levels at three ranges (10cm, 30cm and 60 cm) from each of the electrical devices.

RESULTS AND DISCUSSION

- Mathematical calculation results of magnetic field (B) in (micro Tesla) at thee ranges from some electrical devices at home are illustrated in table (2) .
- Practical measurement for (B) for these devices in (μ T) are shown in table (3).

- Practical measurements of (B) in bed room and kitchen in four points for three bedroom samples are shown in tables (4,5) and the graphical representation of these measurements are illustrated in figures (3,4) respectively.

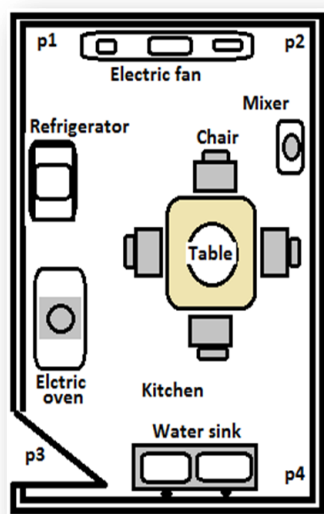


Fig. 2 : Top view of the kitchen.

Table 3: Practical measurement of magnetic fields (B) in (μT) .

Electrical Device	r = 10 cm	r = 30 cm	r = 60 cm
air-condition	2.206	0.473	0.023
electric oven	1.333	0.478	0.125
Electric mixer	1.021	0.208	0.041
TV	1.075	0.195	0.061
Refrigerator	0.329	0.133	0.032

Table 4: practical measurement of magnetic field levels in three samples of bedroom.

Bedroom No.	Magnetic field (B) at some points in the bedroom in micro Tesla (μT)			
	P1	P2	P3	P4
Bedroom No. 1	0.573	0.30	0.131	0.102
Bedroom No.2	0.513	0.271	0.181	0.121
Bedroom No.3	0.643	0.352	0.159	0.131
Average values	0.548	0.400	0.153	0.133

Table 5: Practical measurements of magnetic field (B) in three samples of kitchen.

kitchen No.	Magnetic flux density (B) in the kitchen in micro Tesla (μT)			
	P1	P2	P3	P4
kitchen No.1	0.971	0.879	0.608	0.175
kitchen No.2	0.671	0.843	0.510	0.201
kitchen No.3	0.844	0.772	0.589	0.215
Average values	0.862	0.854	0.585	0.184

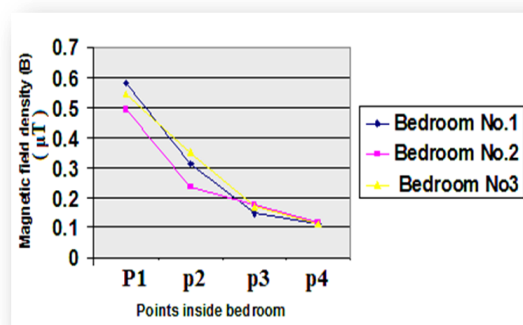


Fig. 3: Graphical representation for magnetic field strength (B) in the three bed room samples.

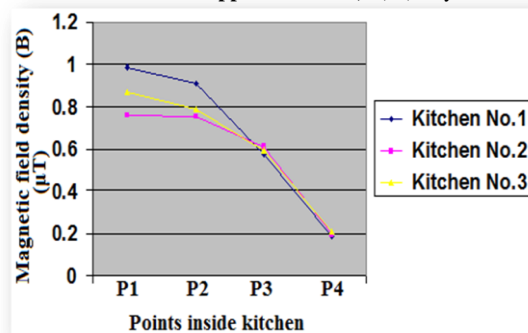


Fig. 4: Graphical representation of magnetic field (B) in three samples of kitchen.

According to the standard limitation set by the ICNIRP shown in table (1), the mathematical and practical measurements are approximately identical and they have been shown quite normal exposure to magnetic field $B < 100 \mu\text{T}$. The average of exposure level in (bed room and kitchen) are illustrated in tables (4,5) and graphical representation of measurement levels illustrated in figures (3,4). It is observed that the highest exposure to magnetic field is found in kitchen (point $p_1 = 0.971 < 100 \mu\text{T}$). The lowest exposure is found in the bed room at (point $p_4 = 0.102 < 100 \mu\text{T}$). The reason of high magnetic field exposure in kitchen is because it contains many electric electrical devices such as electric fan, electric oven, refrigerator and electric mixer,. However, all the mathematical calculations and practical measurements levels are lays within the exposure limits set by ICNIRP ($< 100 \mu\text{T}$), and they don't pose any risk to health. So from results obtained and discussion, we can conclude the following :

- Because the magnetic field in the points closer to the electric oven and refrigerator in the kitchen are higher than fields in the other points, it is strongly recommended to be away as possible from these appliances when working with them in kitchen to avoid the negative health effect of the exposure.
- In the bed room we can see that the magnetic field in the points closer to the air-condition is higher than fields in the other points. Naturally, the magnetic fields rose up to the levels that may be effect the human health when moved towards the air-condition and decreased when moved away from it, so it is strongly recommended to be as possible away from the air-condition at least (2m) to avoid the negative health effect of high levels of EMF exposure.

4. Recommendations:

For reducing the EMF levels in the places in which we spend most our times where we live, first thing that must be taken into account is reducing the distance from the source of such fields and how much time we spend. So, expanding the distance between ourselves and the sources of EMF is the easiest way to reduce EMF exposure levels .

The following steps will help us to reduce EMF exposure levels at our homes:

- Move as possible any electrical devices away from your bed.
- Stand away from operating electrical devices that use a lot of electricity especially those with motors .
- Sit a way from away from TV and at least an 40 centimeter from the desktop computer screen.

Conclusion:

Today electromagnetic field radiations are everywhere .This may be consider as a huge pollution for a life beings as well as for a human health so the peoples are affected by interior and exterior electromagnetic fields that exist in nature, as well as the EMF created by themselves . Therefore, we must take a possible precautions against the adverse effects of these devices.

In this work the magnetic field measurements are carried out in two ways mathematical calculation and practical measurement. The results are studied individually. The comparison of these results with the standard exposure limits set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) shows that the measurement levels are lay within the acceptable levels($< 100 \mu\text{T}$) ,so they may be don't cause any risk to human health if the exposure is for short and discontinues periods .

REFERENCES

- Feychting, M., F. Jonsson, L. Pedersen, A. Ahlbom, 2003. Occupational Magnetic Field Exposure and eurodegenerative Disease. *Epidemiology*, 14(4): 413-9.
- ICIRP, 2009. Guidelines on Limits of Exposure to Static Magnetic Fields. *Health physics* 96(4): 504-514.

Sander, R., J. Brinkmann, B. Kuhn, 1982. Laboratory studies on animals and human beings exposed to 50 Hz electric and magnetic fields. CIGRE, International Congress on Large High Voltage Electric Systems, Paris, 1–9 September; CIGRE , 36-01.

Ruppe, I., K. Hentschel, S. Eggert, S. Goltz, 1995. Experimentell Untersuchungen zur Wirkung von 50Hz Magnetfeldern Schriftenreihe der Bundesanstalt für Arbeitsmedizin, Fb11.003.

Liburdy, R.P., T.R. Sloma, R. Sokolic and P. Vaswen, 1993. ELF magnetic fields, breast cancer and melatonin: 60 Hz fields block melatonin's oncostatic action on ER positive breast cancer cell proliferation. Journal of Pineal Research, 14: 89-97.

Schuz, J. and A. Ahlbom, 2008. "Exposure to Electromagnetic fields and the risk childhood leukemia". Published, 132(2): 202-211.

ICINRP, 2001. International Commission on non Ionizing Radiation Protection Standing Committee on Epidemiology: Ahlbom A, Cardis E, Green A, Linet M, Savitz D, Swerdlow A. Review of the Epidemiology Literature on EMF and Health. Env Health Perspect; 109(Sup 6): 911-33.

Huuskonen, H., M.L. Lindbohm, J. Juutilainen, 1998. Teratogenic and reproductive effects of low-frequency magnetic fields. Mutat .Res., 410: 167183.

Matthew N.O., Sadiku, 2012. Elements of Electromagnetics , PDF download, from: 4shared date.