

Measurement of Magnetic Field Emitted From Electrical Equipments in CSE Laboratories of Daffodil International University Bangladesh

Md. Quamruzzaman¹, Shahina Haque¹, Munima Haque^{2*}

¹Department of Electronics and Telecommunication Engineering (ETE), Daffodil International University, Dhaka, Bangladesh

²Department of Electrical and Electronic Engineering (EEE), Southeast University, Dhaka, Bangladesh

*Corresponding Author: munima.haque@gmail.com

Abstract— The aim of this survey is to investigate whether the Electromagnetic Fields (EMF) emitted from various air conditioners and lab equipments affect the students, faculties and employees. There is a standard threshold value recommended by WHO for both electric and magnetic fields. Electro-Magnetic Field also named Non Ionizing Radiation is emitted from high power transmission lines, computer monitor/video display unit, radio waves of different frequencies, telecommunication, satellite, radar etc. which causes health hazards to living system and environment. There has not been much study performed in Bangladesh. The data were collected from Computer Science and Engineering (CSE) department lab at Daffodil International University in Dhaka, Bangladesh. Both threshold values of Electric and Magnetic fields were measured for various lab equipments and electric appliances. The maximum value of the magnetic field results showed that in some cases the magnetic field radiated from the different sources are greater than the threshold limit.

Index Terms— EMF, NIR, WHO, ELF, EF, MF, lab equipments, air conditioners.

1 INTRODUCTION

IONIZING radiation is the radiation of sufficiently high energy to cause ionization in the medium through which it passes. It may consist of a stream of high-energy particle (e.g. electron, protons, alpha particles) or short wavelength electromagnetic radiation (ultraviolet, X-rays, gamma-rays). Radiation, which does not cause any ionization of the media while passing through it, is known as non-ionizing radiation (NIR). Examples of non-ionizing radiation are ultraviolet, visible light, infrared, microwave and radiowave. Their energy is relatively low; it only manages to cause molecules to vibrate and induces heating effects.

Exposure to Extremely Low Frequency (ELF) electric and magnetic fields does produce biological effects. However, except for fields strong enough to induce current densities above the threshold for the stimulation of nerve tissue, there is no consensus as to whether these effects constitute a hazard to human health. Human data from epidemiological studies, including reported effects on cancer promotion, congenital malformations, reproductive performance and general health, though somewhat suggestive to adverse health effects, are not conclusive. Since magnetic field is more harmful than electric field, there must be a limit both in the residential and occupational levels between 0.2 to 0.3 μT or 2.5 mG. (This value is internationally recognized as standard limit in many countries). Also, for electric field this value is 25 V/m. It must be ensured that intensity of radiation in the body does not exceed the recommended maximum level (10 mW/cm², 195 V/m in U.S.A. and 0.1 mW/cm², 20 V/m in CIS). These human made electric and magnetic fields (typically 25 V/m and 2.5 mG or 0.25 μT) are substantially above the naturally occurring ambient electric and magnetic fields of 10⁻⁴ V/m and 10⁻¹³ T respec-

tively [1], [2].

Lower animals are reported to be very much sensitive to electromagnetic fields. It is observed that animals like rats make their living brooding holes away from the high electric field and bees block-up their hives in the chronic presence of NIR/EMF. As a consequence, scientists and health physicians in developed countries have become aware of the effects of NIR [3]. Their research and observations have brought out some remarkable results linking low level alternating electromagnetic fields with serious health hazards. There is also evidence that biological effect like immune deficiency, sensitive lymphocytes, disrupting DNA, cellular breakdown is being affected by NIR [4].

Much research has been performed in this regard. Most recently, Epidemiological survey of people working in EMF field exposed to high frequency have been investigated [5]. Also, research was performed for epidemiological survey on effect of EMF emitted by photocopy machines generally used in Dhaka city Bangladesh [6]. Survey was done on EMF emitted by Lab equipments in various labs of Southeast University in Bangladesh for possible health hazards [7]. A case study was done on EMF near high voltage transmission line [8]. Also, a review was done on Non Ionizing Radiation (NIR), its harmful effects especially from Mobile/Cell Phone and Towers [9]. An epidemiological survey was performed on Cathode Ray Tube (CRT) monitors used in Dhaka city [10]. An investigation was performed in finding the magnetic field emitted from various Lab equipments in Textile Labs in Southeast University Dhaka [11]. Measurement of EMF was also done on Pharmacy Lab equipments in Southeast University Bangladesh [12]. Magnetic Field measured from Electrical Appliances

in EEE Classrooms of Southeast University Bangladesh were performed [13]. Measurement of magnetic field emitted from electrical appliances in CSE Labs and classrooms of Southeast University, Bangladesh were also done [14]. Measurement of magnetic field Emitted from lab equipments and electrical appliances in ETE labs of Daffodil International University, Bangladesh were also performed [15]. Health effects of EMF emitted from cell phoned used by Southeast University students Dhaka, Bangladesh were also examined [16]. A survey of EMF emitted from air conditioners and switchboards in electrical and electronic engineering laboratories of Southeast University Bangladesh was also performed [17]. Epidemiological survey on effect of EMF emitted by cell phones used in Dhaka city Bangladesh has also been investigated [18].

There have been various papers published on EMF of radio, TV etc. but not much on Air Conditioners (AC). Since the invention of modern electrical air conditioning unit in 1902 by Willis Carrier, Buffalo, New York [19] there has been incredible increase in use of air conditioning in the world. In some cases it has been used in cooling the building, theatres, and for commercial purposes. Since air conditioner has been used for comfort, its demand has increased. After the invention of portable air conditioners, it has been easier to purchase one. Especially in tropical countries like Bangladesh, it is in high demand not only at offices, but at homes also. With the increase in the efficiency of the modern air conditioners as well as the attractive decrease in its price, offices and private homes have their own air conditioner systems. At Daffodil International University, nearly all the offices, labs and classrooms have air conditioners due to very hot and humid weather during the summer. The students spend around 7-8 hours each day in these classrooms and labs while the faculties and employees also do the same. The aim of this research is to investigate whether the EMF emitted from these lab equipments and air conditioners are within threshold values and also if the students and employees are safe from these equipments.

2 MATERIALS AND METHODS

A magnetic Science International MF meter was used for measuring the magnetic field values for the various air conditioners and switch board equipments. This is a single-axis gaussmeter to measure AC magnetic fields from power lines, home and building wiring, and appliances. Its single-axis detachable

probe have frequency range 33 Hz - 2000 Hz, maximum field of 50,000 mG with resolution 0.1 mGA [20]. Coghill Field Mouse for Biohazard Awareness was used for measuring the threshold values for both electric field (EF) and magnetic field (MF) around the instrument. The readings were taken to cover all around the equipment. The method followed was: at the center of the equipment (front side), right side, and left side of the equipment.

3 RESULTS

Findings at different EMF sources: All the readings were taken from different labs of Computer Science and Engineering (CSE) department, Daffodil International University, Dhaka. Readings were taken from various equipments in the laboratories.

3.1 EMF Measurements from lab equipments

In Table 1A and 1B, experimental data of EMF values measured for laboratory equipments were collected. Equipments of various categories were measured for their Electric field and Magnetic field threshold distances as well as the magnetic field values for (i) in front of the equipment measured from the center of the equipment (ii) at right side of the equipment and (iii) at left side of the equipment. Also, the maximum magnetic fields were measured for each AC of this lab. The threshold values for electric field ranged from 1 to 25 cm, while that for the magnetic field varied from 2 to 29 cm. The magnetic field maximum value given in mG. The magnetic field maximum value ranged from 15.9 to 98.2 mG for the given equipments.

Graphical representation of magnetic field maximum values taken from tables 1A and 1B are shown in Figure 1. For DC power supply and Pc-2: Dell cori 3, the magnetic field maximum values are nearly 100 mG. The lowest value is for Pc-1: Dell cori 3, which is less than 20 mG.

Graphical representation of electric and magnetic field threshold distance values taken from tables 1 A and 1B are shown in Figure 2. For all the equipments, the magnetic field threshold values are higher than the corresponding electric part. For Ac-2, the magnetic field threshold value is highest 29 cm, while the lowest value is for potentiometer, which is 2 cm. For Ac-2, the electric field threshold value is highest 25 cm, while the lowest value is for potentiometer, which is 1 cm.

Table 1A: EMF values measured for equipments in various CSE laboratories in Daffodil International University, Dhaka April 2017.

Serial No.	Equipment info. (Machine #, Machine Model, made country,	Threshold dis. in front of the equipment measured from the center of the equipment (cm)	Magnetic Field (mG) in front of the eqpt.	Threshold dis. at right side of the equipment (cm)	Magnetic Field (mG) at right side of the equip-	Threshold distance at the left side of the equipment (cm)	Magnetic Field (mG) at left side of the equipment	Magnetic Field maximum (mG)
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	year made, Date of installation)	Electric field (EF)	Magnetic field(MF)		EF	MF	ment	EF	MF		
1	Pc-1: Dell cori 3 Model: S/N:CN-ONM-K39 72872-617,EU3I A00(made in China)	4	6	8.5	2	4	4.5	2	4	4.5	15.9
2	Pc-2: Dell cori 3 Model:CN-OXOT4K-72872-3 CN-C5LM REV A00	6	8	91.5	4	6	12.5	4	6	22.5	95.5
3	Ac-1 Model: O GENERAL	12	16	58.1	8	11	10.2	7	10	8.5	65.5
4	Newton's ring experiment kit (made in Bangladesh (BD))	10	14	21.2	5	8	11.4	5	8	18.2	76.6
5	Galvanometer (Made in BD)	4	7	16.3	2	4	10.9	2	4	7.5	22.9
6	Adapter (Made in BD)	10	12	49.4	4	5	56.4	4	6	55.4	48.3

Table 1B: EMF values measured for equipments in various CSE laboratories in Daffodil International University, Dhaka April 2017. (Continued from Table 1A)

Serial No.	Equipment info. (Machine #, Machine Model, made country, year made, Date of installation)	Threshold dis. in front of the equipment measured from the center of the equipment (cm)		Magnetic Field (mG) in front of the eqpt.	Threshold dis. at right side of the equipment (cm)		Magnetic Field (mG) at right side of the equipment	Threshold distance at the left side of the equipment (cm)		Magnetic Field (mG) at left side of the equipment	Magnetic Field maximum (mG)
		Electric field (EF)	Magnetic field(MF)		EF	MF		EF	MF		
7	Commutator (Made in BD)	14	16	24.2	4	7	19.2	4	8	28.2	43.7

8	Dc power supply (Made in BD)	18	24	85.7	8	12	46.2	8	10	31.2	98.2
9	Potentiometer (Made in BD)	1	2	25.5	1	2	21.4	1	2	22.6	25.5
10	Polarimeter: tube (20 cm) (made in BD)	2	3	76.2	1	2	28.6	1	2	29.8	80.5
11	Polarimeter: tube (10 cm) (made in BD)	2	4	70.2	1.5	2	29.4	1.5	2	31.2	90.5
12	Meter bridge (Made in BD)	9	12	12.2	6	8	14.2	6	8	16.4	21.2
13	AC-2 Model: KENSTAR	25	29	75.1	7	10	29.4	9	12	31.1	86.3

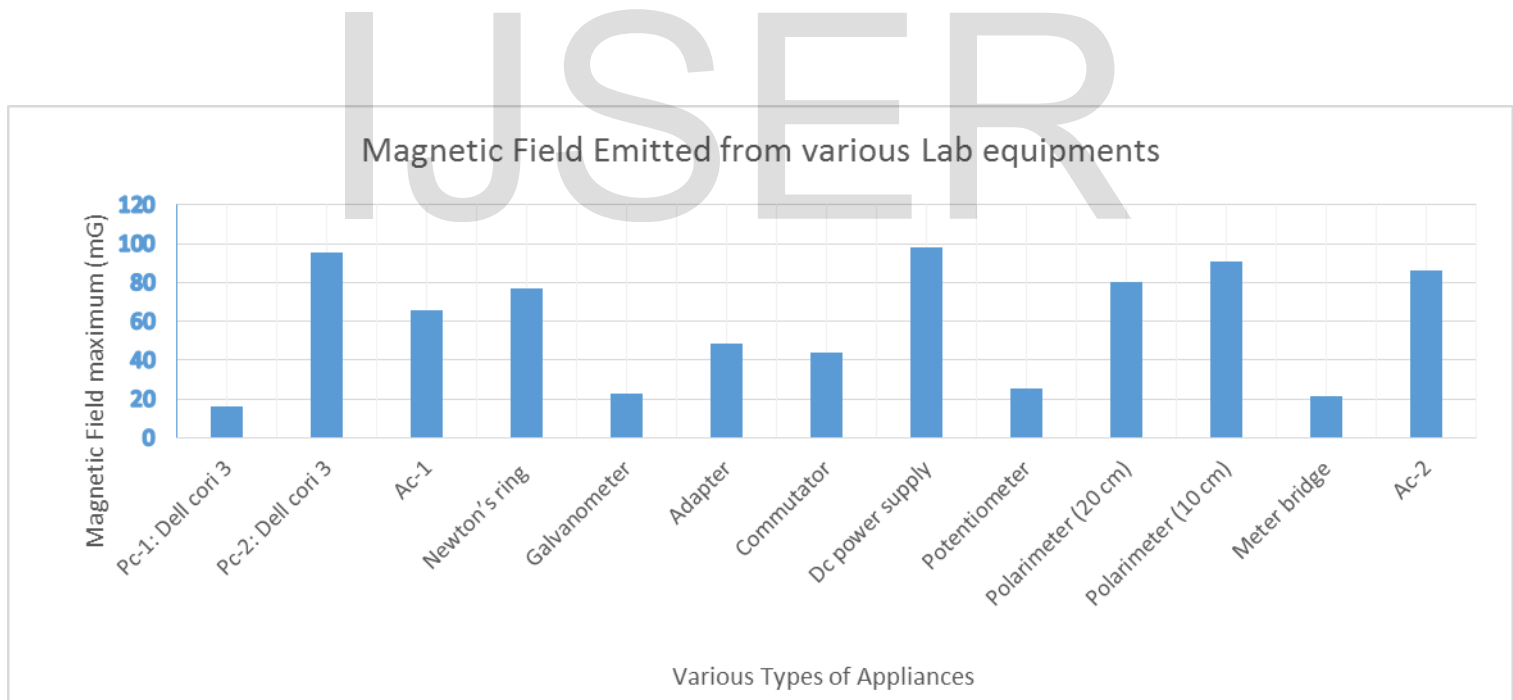


Figure 1: Graphical representation of magnetic field maximum values (mG) from Tables 1A and 1B

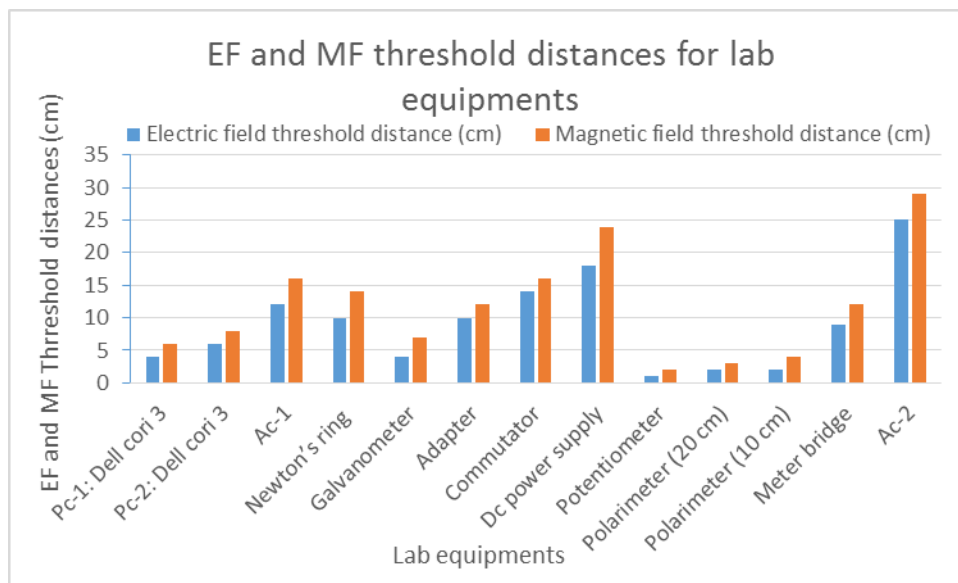


Figure 2. EF and MF threshold distances taken from the center of the equipment for various lab electric appliances in CSE labs in DIU, Dhaka. Data taken from tables 1A and 1B.

4 DISCUSSIONS

It was found from the results that the magnetic field values are higher in some cases. Because of the nature of the wiring both in the ceiling and floor, all the rooms had higher magnetic field value. Students work on an average of 3-4 hours a day in this laboratory. We have in mind to include labs and classrooms from this and other departments of Daffodil International University for the study to continue.

There has been an increase of use of the air conditioners in Bangladesh for the last few years in various offices and organizations to increase the working efficiency of the employees. For this reason, the load shedding of electricity has increased tremendously for the last few years due to excessive air conditioner used in offices, organizations and private homes for comfort living.

5 CONCLUSION

From the above laboratory results, it has been found that in some cases the magnetic field has crossed threshold value. The electric field also has a higher threshold value in some of the equipments. Also, the magnetic field maximum exposure was nearly 100 mG in one case. Wiring must be done according to the building code 2012. As the locations of air conditioners were on the wall near to the roof, therefore because of this height (distance) students they do not possess that much hazards as it should be. It is hoped that this survey will be helpful as a preventive health measure for students and employees of Daffodil international University.

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