



RESEARCH ARTICLE

MEASUREMENT OF MAGNETIC FIELDS FROM LIQUID CRYSTAL DISPLAY (LCD)  
COMPUTER MONITORS

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ARTICLE INFO

Article History:

Received 16<sup>th</sup> April, 2013  
Received in revised form  
21<sup>th</sup> May, 2013  
Accepted 18<sup>th</sup> June, 2013  
Published online 18<sup>th</sup> July, 2013

Key words:

Magnetic Fields,  
Liquid Crystal Display,  
Computer monitor,  
Health effects.

ABSTRACT

Computers have become ubiquitous in our everyday activity in recent years and have been object of study for eventual adverse health effect. In this paper, variations of the induced magnetic fields with distance from liquid crystal display (LCD) computer monitors have been investigated. A total of 10 different LCD monitors of different models were used for this study. The magnetic fields were measured using a Tri Field Gauss meter at 5cm steps from the screen up to 40cm. The results showed that the induced magnetic fields decreased as distance from the screen increased. It was also found that magnetic fields from the LCDs for desktop computers are lower than laptops. The induced magnetic fields were generally found to be very low and below the hazardous threshold of the International occupational and general public recommended exposure limit. Thus, there is no conclusive evidence from the study that the use of LCD computer monitors could be associated with health hazard such as spontaneous abortion.

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INTRODUCTION

The use of computer system has become almost inevitable throughout the world and very common in all spheres of life. However, the users usually encounter some electric and magnetic fields induced by the systems. The increasing use of the computers in working places and schools has raised the worry about possible health dangers [1,14,21]. In many homes, offices, classrooms, laboratories and industries, computer users spend long periods of time working with the computer system. Many individuals, who work with these systems, have reported various symptoms and job-related complaints, such as sight disquietude, muscle pains etc. The level of discomfort and complaints appears to increase with the time of computer use [15,18,19]. Several studies have been carried out to ascertain whether there are health hazards associated with the use of computer systems with monitors [2,3,6,7]. However, based on actual studies, there are quite a few plausibility that the use of computers causes permanent changes of eyesight or even damages of the eye itself [4,5]. Electric and electronic devices such as computers, transmission lines, television, radio, mobile communication system, as well as domestic electrical appliances emit both ionising and non-ionising radiation [6,13]. Most computer monitors now meet the requirement for reduced fields, so they can hardly be said to contribute to our daily exposure to magnetic field in the office [17,20].

The first computer monitors used cathode ray tubes (CRT). However, cathode ray tube computer monitors have been widely phased out for LCD, which has prompted this study. The main advantages of LCDs over CRT displays are that LCDs consume less power, take up less space and are considerably lighter. LCD also emits electromagnetic fields less than the CRT-type of monitors [14]. Non ionising radiation is found in a wide range of occupational settings and can pose a health risk to exposed workers if not properly controlled [9,10,11,12,15]. In light of the above, the measurement of magnetic

fields induced by liquid crystal display (LCD) monitors has been carried out. It should be pointed out that the induced electric fields are very low and are not measurable.

LCD Computer Monitor

LCD monitors as their name suggest, use liquid crystal display technology, making it far different from the ordinary CRT monitors [8]. An LCD is a thin and flat display device composed of pixels arrayed in front of a light source or reflector. The crystals are liquid chemicals that align perfectly when subjected to electrical fields; they allow light to pass through them. LCD monitors use this property by using electrical currents to align the crystals and allow varying levels of light to pass through and create the desired images and colours. To be more technical, the liquid crystals are sandwiched between two pieces of polarised glass substrate [8]. The fluorescent light source (cold cathode fluorescent lamp), also known as the back light, emanates light that passes through the first substrate. The electrical currents then cause the crystals to align, allow varying level of light to pass through to the second substrate. The end result is what we see on monitor screen [8,20].

MATERIALS AND METHOD

In this study, results were taken by direct measurements of magnetic fields of low frequencies from LCD computer monitors. This was done using a Tri Field metre that measures magnetic field in milli Gauss, (mG). The residual magnetic field within the Laboratory was measured and recorded as 0.0mG after which the computer was put on and allowed to stay on for five (5) minutes for equilibrium before measurement. Measurements were carried out on ten (10) LCD computer monitors of different sizes. Five (5) of which were desktop and (5) laptops respectively. All the measurements were taken at the direction normal to the screen. The distance was varied at 5cm interval up to 40cm from the front of the screen. At each point, the induced magnetic field is measured and recorded against that

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**Table 1. Magnetic Fields from LCD (Desktop) Computer Monitors**

| Distance from screen (cm) | Magnetic Field (milliGauss, mG) |      |      |      |      | AX (MEAN) mG |
|---------------------------|---------------------------------|------|------|------|------|--------------|
|                           | A1                              | A2   | A3   | A4   | A5   |              |
| 5                         | 6.50                            | 4.40 | 5.45 | 4.50 | 5.20 | 5.21         |
| 10                        | 2.80                            | 2.20 | 3.00 | 2.40 | 2.50 | 2.58         |
| 15                        | 1.40                            | 1.20 | 1.30 | 1.20 | 1.50 | 1.32         |
| 20                        | 0.50                            | 0.10 | 0.50 | 0.50 | 0.80 | 0.48         |
| 25                        | 0.10                            | 0.05 | 0.10 | 0.10 | 0.10 | 0.09         |
| 30                        | 0.08                            | 0.01 | 0.05 | 0.05 | 0.05 | 0.05         |
| 35                        | 0.02                            | 0.00 | 0.01 | 0.01 | 0.01 | 0.01         |
| 40                        | 0.00                            | 0.00 | 0.00 | 0.00 | 0.00 | 0.00         |

\* A1 – A5 represent different desktop LCD monitors; product differences are ignored

**Table 2. Magnetic Fields from LCD (Laptop) Computer Monitors**

| Distance from screen (cm) | Magnetic Field (milliGauss, mG) |       |       |       |      | BX (MEAN) mG |
|---------------------------|---------------------------------|-------|-------|-------|------|--------------|
|                           | B1                              | B2    | B3    | B4    | B5   |              |
| 5                         | 12.10                           | 10.50 | 12.50 | 11.20 | 9.80 | 11.22        |
| 10                        | 10.00                           | 9.50  | 10.10 | 10.00 | 8.50 | 9.62         |
| 15                        | 7.00                            | 6.20  | 7.20  | 6.50  | 5.80 | 6.54         |
| 20                        | 4.20                            | 3.80  | 4.10  | 4.00  | 3.20 | 3.86         |
| 25                        | 2.20                            | 2.00  | 2.20  | 2.10  | 1.80 | 2.06         |
| 30                        | 1.50                            | 1.45  | 1.50  | 1.50  | 1.20 | 1.43         |
| 35                        | 1.20                            | 1.10  | 1.10  | 1.20  | 0.50 | 1.02         |
| 40                        | 0.50                            | 0.45  | 0.40  | 0.40  | 0.05 | 0.36         |

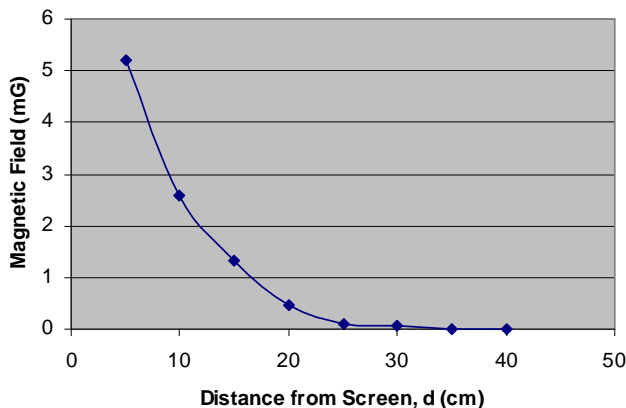
\*\* B1 – B5 represent different laptop LCD monitors; product differences are ignored

distance, and analysed thereafter. This was repeated for all the computer monitors used for this study.

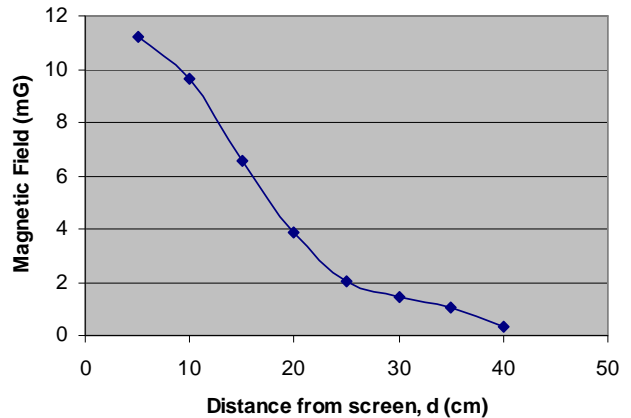
**RESULTS AND DISCUSSION**

The induced magnetic fields from computer monitors of LCD type were measured and results recorded in Table 1-2 above. The distribution of the measured induced magnetic fields for LCD monitors at 5.00cm distance from the front of the screen has a maximum value of 6.50mG and minimum value of 9.80mG. At 15cm distance from the screen, the magnetic field has become trace and insignificant and negligible at 40cm. Also the distribution of the measured induced magnetic field rate for Liquid Crystal Display (LCD) was found to be higher for laptop LCD computer than the desktop LCD computer. Figure 3 shows that the induced field from laptop is 2 times greater than that of the desktop. Generally, all results obtained are very low, below International Standard permissible limit and thus confirm that LCD computer monitors emit less or no magnetic field than video display units of other type like CRT [14].

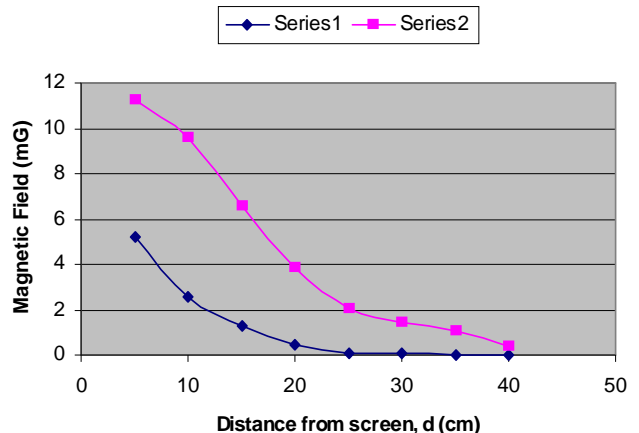
**Fig 1: Magnetic Fields from LCD (Desktop) Computer Monitors**



**Fig 2: Magnetic Fields from LCD (Laptop) Computer Monitors**



**Fig 3: A Comparison of the mean value of Magnetic Field from LCD screens of Desktop and Laptop**



\*\*\* Series 1 represents desktop; series 2 represent laptop

## Conclusion

This study has shown that LCD computer monitors emit magnetic field. A total of 10 LCD computer-monitors of different product both desktops and laptops were investigated using the Tri Field Gauss metre. The results have shown that induced magnetic field of laptop liquid crystal display monitors are greater than the desktop type. In general, the measured magnetic field results obtained are very low and below the recommended limits established for the protection by the non-ionising radiations emitted by video display units (VDU). Thus, there is no evidence from this study that the use of LCD computer monitors could be traced to adverse health effect like spontaneous abortion, cancer etc. Meanwhile, caution should be applied especially for prolonged exposure.

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