Effect of Computer Generated Radiation & EMF Shielding Interference

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Abstract - Without electricity and magnetism we would be living in an earlier age, no electric motors or generators, no electric lighting or heating, no telegraph, telephone, radio, television, or radar, no electronic devices industry or medicine, no hand calculators and no computers. This paper describes electromagnetic effects especially generated by the computers and peripherals on the users and also shows some useful tips the users, how to reduce the effects of EMF or EMR and also discuss the EMF Shielding interface. Shielding is typically applied to enclosures to isolate electrical devices from the 'outside world', and to cables to isolate wires from the environment through which the cable runs. Electronic manufacturers are seeking a conductive coating for thermoplastics that delivers the equivalent shielding performance of electro less plating without the safety, environmental, and cost issues inherent in the plating process. Moreover, these coatings overcome the tradeoff of shielding effectiveness and performance properties that are commonly seen with traditional high-density coatings. The new coatings, based on a novel combination of epoxy resin, curative, and conductive fillers, are capable of self-assembling into a unique structure during curing. Electromagnetic Shielding effectiveness can be obtained from the transmission measurements of the load and the reference specimen and it equals the transmission of the reference (dB) minus the transmission of the load (dB) specimens, as indicated in. The reference and load specimens need to be of the same material and thickness. Therefore it is imperative that Shielding Effectiveness testing be performed using both the reference and load specimens. However doing so yields an insertion loss of 0 dB for reference; therefore the SE of the sample is the negative of the transmission of the load specimen. As a consequence, this practice does not provide accurate results for absolute SE measurements. Given the rapid development in commercial, military, scientific electronic devices and communication instruments, there has been an increase in developing materials that could shield against electromagnetic radiation to prevent interference. The current material options that provide effective shielding effectiveness are metals, metal powder, metal-fiber filled plastic polyacrylonitrile (PAN) Nickel Coated Reinforced Polymers (NCRP), aluminum structures, coatings nickels and copper metalized fabrics and more recently, Nano-reinforced polymers composites.

Keywords: NCRP, PAN, LVDS, EMI, EMR, EMF, Hz, mG, Gy, Tesla, Gauss, ELF, VLF, LWR, dB, LHWP, LSRP, LC, LACP, LVDS, epoxy

I. INTRODUCTION

"*Einstein's relativity, or space – time, concept tells us that there is no such thing as a pure electric or a pure magnetic field which retains its identity for all observers".*

- Albert Einstein

Without electricity and magnetism we would be living in an earlier age – no electric motors or generators, no electric lighting or heating, no telegraph, telephone, radio, television, or radar, no electronic devices industry or medicine, no hand calculators and no computers. Electricity is basic unit of modern life without electricity life modern world is not possible. One of the most important machines of modern life is Computer and computer requires electricity to run and electricity is a combination of current and magnetic field in other word electromagnetic field generated whenever and wherever flows of current. Electromagnetic radiation consists of electromagnetic waves, which are synchronized oscillations of electric and magnetic fields that propagate at the speed of light through a vacuum. The oscillations of the two fields are perpendicular to each other and perpendicular to the direction of energy and wave propagation, forming a transverse wave. Electromagnetic waves can be characterized by either the frequency or wavelength of their oscillations to form the electromagnetic spectrum.[1][2]

Electromagnetic waves are produced whenever charged particles are accelerated and these waves can subsequently interact with any charged particles. Electromagnetic radiation from a source penetrates surrounding area, creating an electromagnetic field (EMF). This EMF is strongest at the source and weakens with increasing distance until it becomes too small to measure.[3] The electric fields and magnetic field component of the EMF can be separately measured. The electrical field strength can be measured in Volts per meter (V/m) or as power density in milliwatts per square centimeter (mV/cm). The Magnetic fields can be quantified in mill gauss (mG) or microTesla (1 micro Tesla = 10 milliguass). The atomic energy or ionized radiation is often quantified in electron Volts (eV) but the absorbed radiation dose is measured in grays (Gy) [4]

II. COMPUTER GENERATED ELECTROMAGNETIC FIELDS

Computer generated electromagnetic radiation is a real health hazard. Many of us spend our working days in front of computer monitors, surrounded by electromagnetic equipment, each item emitting radiation because of duration of exposure – many hours every days (As shown in practical)

During the practical following observations are founds in Computer Lab:-

Sr. No.	No. of P-IV Computers	EMF Produced CRT Monitor 18" in micro gauss	EMF Produced by LCD Monitor in 18" in micro gauss
1	1	700 - 900	200 - 250
2	30	1800 - 2000	550 - 700
3	60	2200 - 2800	800 - 900
4	100	2800 - 3500	900 - 1000

Table 1 : Showing EMF produced by the Computers in Micro Gauss

This study conducted on 200 students during the academic year 2013-14 in different colleges Computer Labs (Containing around 30-100 computer in a lab area around 70 sq mt to 200 sq mt) and around 100 computer users in different organization, working hours around 6- 8 hours a day and working area around 5 to 100 sq.mt.)

III. HEALTH DANGERS TO COMPUTER USER

Study on health Effect on Computer Users at the distance around 3-5 feet of monitors, study conducted on students in computer labs

Sr. No.	Computer Operation Time	Effects	Effects in %age of users	Remarks
1	5 – 30 minutes	No effects are found till date	-	Study on Students in Computer Labs
2	½ - 1 hour	Eye irritation	30 - 35%	
3	1 -2 hours	Eye irritation, dry eyes & headache	40%	
4	2-3 hours	Eye irritation, dry eyes and headache	45%	
5	3-4 hours	Eye irritation, dry eye, headache, irritated	50-55%	
6	4-5 hours	Irritation, Loss of Concentration, Eyesight weakness & Double vision,	60%	Computer users in different organizatio n
7	5 -6 hours	….+ Irritation, Loss of Concentration, Sleeplessness, Neck & Shoulder Problems	65%	
8	6-7 hours	…..+ Stomach & low Sperm related problem found	Indigestion & Low sperm count found in 30% computer user	
9	7-8 hours	…..+ Stomach related & low Sperm count problem found	Indigestion & Low sperm count found in 30% computer user	

Table 2: Shows study on Students / employee in different organization[15][16]

IV. STUDY CONDUCTED IN INFERTILITY CENTERS AND NURSING HOME

(Age group between 30-45 years, No of Patients 50)

Sr. No.	Industry / Fields	Number of patients	%age of patients
1	Field worker /Labor Class	03	6%
2	Defense and related field	05	10%
3	Shopkeeper and Business man	09	18%
4	Service / Administrative Class	13	26%
5	CSE/ IT / Electronics/Electrical	20	40%

Table 3: Shows study on infertility rate

This study clear cut shows that working service class, Computer and related fields shows more infertility patients than other working class and it indicate that from clerk, computer operator and any other working position in the office having computer for their office daily disposals and both classes spends almost 6 to 8 or more hours daily in front of computer, this survey give clear indication that Computer having some effects on computer user health and their reproductive system. In most of cases we found that in male having low sperm count problem and in women periods disturbance related problems are found.

This study also shows that the growth of infertility centers / Hospitals are also increasing in many folds after the development of Computer Industry. This growth time also give indication that there is some relationship between increase infertility problems in computer / mobile users and increase of infertility centers.

V. HARMFUL HEALTH EFFECTS OF EMF RADIATION (AS PUBLISHED IN VARIOUS JOURNALS)

- Low Sperm Count found in Laptop Users [23]
- Miscarriage [24]
- Asthma (15% asthma cases are found who living near to the high power transmission than others.[25]
- Salivary Gland Cancer[26]
- Protein Changes in Skin [27]
- Brain Tumor [28]
- Excited Brain Cells[29]
- DNA Damage [30]
- Brain Cell Damaged[31]
- Aggressive Growth in Leukemia Cells [32]

Some General effects of Computer[15][16]

- Loss of Concentration
- Loss of spelling remembering Power
- Loss of Writing Power
- Loss of manual arithmetic calculation

VI. ELECTROMAGNETIC SHIELDING AND PROTECTION

EM shielding (electromagnetic shielding) is the practice of surrounding electronics and cables with conductive or magnetic materials to guard against incoming or outgoing emissions of electromagnetic frequencies (EMF). EM shielding is conducted for several reasons. The most common purpose is to prevent electromagnetic interference (EMI) from affecting sensitive electronics. Metallic mesh shields are often used to protect one component from affecting another inside a particular device. In a smart phone, for example, a metallic shield protects electronics from its cellular transmitter/receiver. Radiation shields (RS) in mobile phones also decrease the amount of radio frequency energy that might be absorbed by the user. To increase the security of air gapped systems, EM shielding is advised. Conventionally, physical isolation and a lack of external connectivity have been considered adequate to ensure their security. However, proof of concept attacks have demonstrated that acoustical can be enabled by exploiting the electromagnetic emanations of the system's sound card. Air-gapping is used in the military, government and financial systems like stock exchanges. The measures are also used by reporters, activists and

human rights organizations working with sensitive information. Electromagnetic shielding that blocks radio frequency electromagnetic radiation is also known as RF shielding.
The shielding can reduce the coupling of radio waves electromagnetic fields and electrostatic fields. A conductive enclosure used to block electrostatic fields is also known as a Faraday Cage.[6] The amount of reduction depends very much upon the material used, its thickness, the size of the shielded volume and the frequency of the fields of interest and the size, shape and orientation of apertures in a shield to an incident electromagnetic field.[7] A Commercial conductive gold film, AGHT-4, with thickness of 0.18 mm, with 4.5 Ohms/ Square surface resistively was used to calibrate the SE tester. In the case of a sample with thickness t, conductivity σ, complex permeability μ.[5][8].

Using newly developed SE tester, the transmission readings without material between the flanges. It can be observed that reading of – 20dB and 0 dB were obtained with and without attenuator, respectively, indicating good performance of the SE tester with an expected impedance match of 50 Ω. The results indicate proper operation up to ≈ 11 GHz, which closely corresponds to the expected resonance frequency for a radial transmission line mode in the space between the flanges. Consequently, the newly developed simple EMI – SE tester seems to perform satisfactorily up to 11 GHz.

VII. MAJOR EMF SHIELDING TECHNIQUES

- Shielding by reflection
- Shielding cloth
- Shielding paint
- Plastic lining
- Window film
- Unplug

VIII. COMPUTER GENERATED EMF EFFECTS ARE EASILY AVOIDABLE / CONTROLLED.[15][16]

1 The distance between monitor and users eyes must around 3 to 4 feet
2 CPU / Cabinet must be on the floor or floor level
3 Display unit must be LCD / LED
4 Avoid wireless mouse and any wireless internet connection
5 Use wired internet connection
6 Computer and printer must be connected through wired only
7 Position your UPS at least 1.5 meter away from your working chair
8 If possible you landline networking instead of Wi – Fi
9 If you can't avoid the EMF exposure try to keep it short.
10 Keep distance at least 400 meter from high power transmission & cell phone Tower for living near to power lines.
11 Keep distance about 10 meter from electrical transformer.
12 Today cell phone is the need of hours please use for short time as possible as it is too harmful than any other EMF exposure because it is near to the brain and heart always.
13 The most important recommendation to all the computer users is take break of 5-10 minutes after every one hour use of computer

IX. SOME MAJOR STEP TAKEN BY FRANCE GOVT.

Wi-Fi has recently been banned in childCare facilities in France in order to protect children against exposure to electromagnetic waves.

X. CONCLUSION & FUTURE SCOPE

The objective of this paper / research is to identify the electromagnetic effects on computer user's health and how to reduce these effects and how to reduce the radiation effects of the electronic devices such as display units and other peripherals.[12] The basic idea behind this research is to identify the effects of EMF on computing and computer users. In computing the parallel computing shows high effects of EMF rather than the sequential computing. EMF also effects on video data processing at extremely low frequency of electromagnetic fields and

how to reduce the effects of EMF on Video Data Processing especially of parallel Processing or distributed Processing by using the shielding effectiveness.[13][14]

Future work consists on researching the EMI characteristics of numerous nano reinforced materials and developing an understanding of the SE mechanism involved in nano reinforced materials. I suggest the following research topics:

- Use of light through Fiber optics instead of Electricity.
- In-depth analysis of RF signals emitted by typical computers and their peripherals, including keyboards.
- Determination of likely interception ranges for various classes of attackers.
- Development of new protective counter-measures, both hardware and software.
- Development of any type to system which would reduce the energy gap of the semiconductor used in the development of Integrated Circuits.
- Testing of existing counter-measures together with development of offensive tools (unfortunately you need a gun to test bullet-proof glazing).
- Development of free, open-source software, protocols and modulation schemes for using plain computer equipment for wireless communications.
- Propagation of compromising emanations in power and telephone lines.
- Vulnerability and protection of equipment against active electromagnetic attacks.
- RF3P is a new, parallel, driven frequency electromagnetic solver based on the finite – element technique.

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