MPR2: An Overview and Update

Electrical devices are a common and necessary part of everyday living. What is new is the evolution of attitude and opinion about their relative safety.

ERIC A. GEORGE, ESQ.
ERGONOMICS, INC.

INTRODUCTION

The study of magnetic and electric fields is not new to engineers. The properties of both have been known and used in electronics ever since the industrialization of society. Electrical devices are a common and necessary part of everyday living. What is new is the evolution of attitude and opinion about their relative safety. Through a series of studies conducted over more than 20 years, evidence of a potential health hazard has been found. Some studies, such as that conducted by Savitz et al. (1988), focused on a possible connection between magnetic fields and cancers such as leukemia, brain cancer, and soft tissue cancer in children.[1] The study involved children less than 15 years of age living in Denver, Colorado between 1976 and 1983. The overall scientific evidence may not be definitive, but studies such as this have prompted many to use the phrase "prudent avoidance" when recommending steps to mitigate this invisible threat.

MPR2 DRAFTING PROCESS

One of the more visible examples of equipment to come under scrutiny is the video display terminal (VDT). Not surprisingly, the computer industry successfully unified itself around a test procedure for this equipment. The procedure is entitled "Test Methods for Visual Display Units MPR 1990: 8 1990-12-01," and is more commonly known as MPR2.[2] It is a procedure which originated in Sweden and is followed worldwide in the research and development laboratories of computer manufacturers. MPR2 is currently finding its way into becoming an Institute of Electrical and Electronics Engineers, Inc. (IEEE) test procedure through P1140[3] as well as a European Computer Manufacturers Association (ECMA) test method.[4] This can be seen as a means of reinforcing the computer and electronic industries commitment to this testing. There are differences between test methods, but essentially both are patterned after MPR2.

Testing according to MPR2 is not a government requirement. It is very much customer driven. Today, manufacturers commonly offer low emission monitors in compliance with MPR2 guidelines. This is done in order to address both public relations and product liability concerns. Measurement and mitigation on the part of manufacturers have helped to clarify the sometimes nebulous advice given to consumers to be prudent and avoid sources of magnetic and electric fields.

The MPR2 draft process began in 1986, when the Swedish government took steps to address the anxiety and confusion experienced by many VDT operators. The anxiety did not center around the general hardware safety of the VDT, but instead concerned magnetic field emissions. Video displays became the focus of attention primarily because of their high profile and usage in the modern office. As a result, the Swedish government ordered the National Board of Measurement and Testing (MPR)* to develop a non-mandatory VDT testing procedure. This was done with the advice and assistance of the Swedish National Board of Occupational Safety and Health (ASS) and the Swedish Institute of Radiation Protection (SSI). Test method development was additionally supported by a reference group composed of scientists, academics, engineers and representatives of government. MPR1 was formally introduced in 1987 for a three-year trial period. This succeeded in supplying a temporary answer. Many companies at least familiarized themselves with the MPR1 test method while others put it into practice. As a result of public comment, the procedure was expanded and introduced in 1991 as MPR2.

A comprehensive test procedure, MPR2 covers magnetic, electric and electrostatic emissions. It also contains a section on visual ergonomics. MPR2 goes beyond MPR1 with the inclusion of ELF magnetic fields (5-2000 Hz) and the adoption of emissions guidelines. These guidelines at least can be used as a benchmark for the comparison of measurements. Electric and electrostatic field measurements also took on importance and were included. MPR2 officially came into being on January 1, 1991. In order to allow a smooth transition from MPR1 testing to MPR 2, either test method could have been followed until June 30, 1991 when MPR1 was phased out of existence. Today, little reference is made to MPR1 apart from its place in this historical chain of events.

MPR2 TEST METHOD

The MPR2 Test Method involves measurements in both band 1: 5 to 2000 Hz and band 2: 2 to 400 kHz. This is different from MPR1, which only tested to band 2. Another significant difference between MPR1 and MPR2 is the introduction of alternating electric field and electrostatic measurements. In order to give the reader a better understanding of MPR2 procedures the following summary is provided. For more detailed information, the actual testing document MPR 1990:8, 1990-12-1 (Test Methods for Visual Display Units), should be referred to, along with the MPR 1990:10, 1990-12-31 (User's Handbook for Evaluating Visual Display Units).[5] The User's Handbook has also been made available in English and is intended as a supplement to the test procedures.

There are five test methods which comprise the MPR2 emissions characteristics section: X-ray Radiation; Electrostatic Potential; Alternating Electric Field; Magnetic Field; and Electrostatic Discharge.

X-RAY RADIATION

This is a direct result of the collision of a focused electron beam on the inner glass of the CRT tube. The units of measure are the kerma rate in air displayed in units of gray per hour (Gy/h). When conducting the test, the background radiation in the test site shall not exceed 100 nGy/h. When no radiation is detected the results should be displayed as <100 nGy/h. Since X-ray levels do not exceed background in a normally operating CRT, this part of the emissions section is not given much importance. It is included in the test method for completeness of coverage.

ELECTROSTATIC POTENTIAL

The electrostatic potential is produced from the application of a positive voltage to the inner surface of the CRT screen. This causes electrons to accelerate onto the screen, which in turn produces light. Laboratory environmental conditions are important. The ambient temperature shall be 21 $\pm$ 2°C at a distance of 1 meter or more from the object to be tested. Humidity must also be kept at 20 $\pm$ 5% while the air velocity shall be <0.30 m/s within the test area. The total concentration for both positive and negative ions must be $< 1 \times 10^9$ ions m^3. The screen must also be washed with deionized water to lower conductivity to less than 10 m S/M.

The VDT is measured using a 0.5 x 0.5 meter measuring plate at a distance of 0.1 meters from the screen. The recommended value and lower measuring limit to be reported is ± 500 V in equivalent surface potential.

ALTERNATING ELECTRIC FIELD

Both static and time variable components are produced from VDT's and CRT's. The test method deals only with time variable electric fields. Electric fields in this context can be divided into two groups: (1) fields in the frequency range of 50 Hz to 2 kHz, which originate from the power supply and vertical refresh unit of the VDT and (2) fields in the frequency range of 15 kHz to 80 kHz, which would be the horizontal deflection unit of the VDT as well as the switch-mode power supplies. The electric field is measured in V/m which represents the true root-mean square (rms) value of the amplitude of the electric field strength at the measuring probe. The probe is a 300 mm disk of double-sided printed circuit board laminate. For ELF, alternating electric field readings are taken only in the front of the VDT at a distance of 0.5 m. VLF measurements are taken at 0.5 m distance not only at the front of the VDT but also on the sides and back (Figure 1). All measurements are considered valid if they fall within the following ranges—Band 1: 10 V/m to 1000 V/m and Band 2: 1 V/m to 100 V/m.

MAGNETIC FIELDS

Magnetic fields of VDT cathode ray tubes originate from deflection coils, the power supply, the high voltage transformer and product circuitry. The term magnetic field refers to the magnetic flux density as measured in Tesla and represents the true rms value of the amplitude of the magnetic flux density vector. The test method specifies two frequency ranges—Band 1: 5 Hz to 2 kHz, and Band 2: 2 kHz to 400 kHz. Before valid data can be collected, ambient levels cannot exceed 40 nT in Band 1 and 5 nT in Band 2. The testing surface is cylindrical. The test geometry requires 48 points of measurement using two three-axis coil meters; one meter is for Band 1, the other is for Band 2 (Figure 2). This eliminates all errors related to field direction. The operator need not be concerned with antenna orientation. At the center line, 16 points of measurement are taken by turning the VDT in 22.5 degree increments. The meter is then raised 30 cm from the center line and the process is repeated. The meter is then lowered 30 cm below the center line and the same procedure is followed. When readings are less than 200 nT in Band 1 and less than 10 nT in Band 2, results are reported as <200 nT and <10 nT, respectively.

ELECTROSTATIC DISCHARGE

The last test method part of the MPR2 Emissions Section is Electrostatic Discharge. There are a couple of sources for discharge. The surface potential of the VDT is a major contributor. As was the case with other portions of this section, environmental conditions must be followed with care. The ambient temperature must be 21 ± 2°C at a distance of 1 m or more from the test object

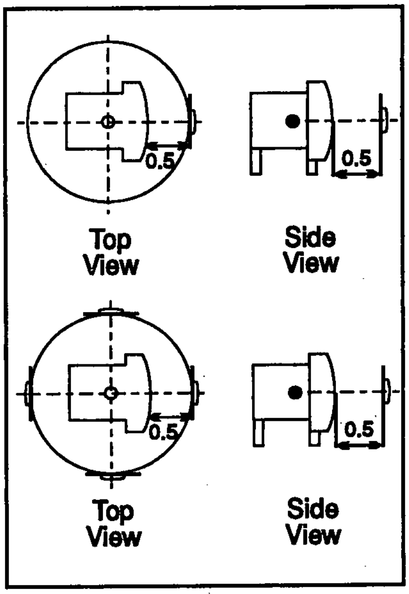

FIGURE 1. *Measurement Geometry for Band I and Band II.*

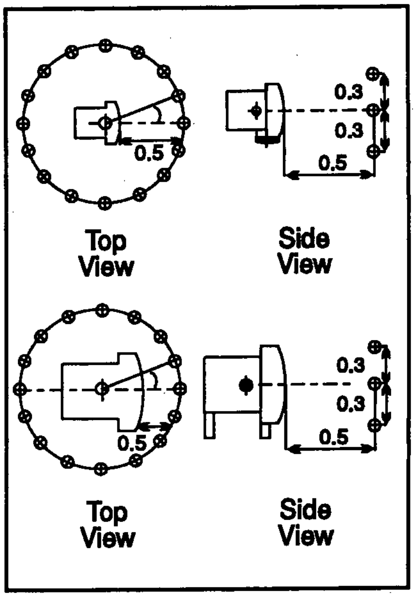

FIGURE 2. *Measurement Geometry for One Small and One Large Test Object (Distance in m).*

with a relative humidity of 20 ± 5%. The test object must also be in position at the test site at least 6 hours prior to testing. With a force of 1 N, the measuring probe covered with low resistance contact paste is pressed against the discharge point. The recommended resistance value should be between 10 and 500 M ohms.

PROPOSED LEGISLATION

Practically every topic has been litigated at one time or another. EMF and power lines have been the subject of recent cases involving alleged injury to body and property. The cases range from stray voltage affecting milk production in cows to personal injury cases where it was alleged that magnetic fields caused or promoted tumor growth. So far these cases have not authoritatively concluded that ordinary exposure to electromagnetic fields poses a significant health threat. However, the increasing number of court battles has promoted the introduction of legislation in all levels of government. Two pieces of legislation in particular have been in the public eye. One is the San Francisco VDT ordinance which focused on many safety issues affecting the VDT.[6] The other is H.R. 3953, which is a major funding bill for information dissemination and research, which is undergoing study in the U.S. House of Representatives.[7]

The San Francisco ordinance sought to establish a public policy on the part of the City and County of San Francisco "..which would provide public and private sector employees who operate video display terminals ... a safe and healthy work environment." The ordinance established an advisory committee to apprise the San Francisco Board of Supervisors of (1) adverse pregnancy outcomes, (2) long-term vision impairment, (3) musculoskeletal strain, and (4) protective measures, including workstation design, education and training, to alleviate adverse health and safety effects. Based upon this information, recommendations for rules and regulations would then be made to the Health Department. The ordinance also called for breaks in activity and included alternative activities to minimize repetitive motion in the workplace. This helped to address such issues as Carpal Tunnel Syndrome as well as eye and back strain. Additional research was also called for in the area of VDT radiation emissions. The advisory committee was to recommend methods employers could use to protect VDT operators and other employees from possible VDT non-ionizing radiation emissions. This included employee positioning with respect to office machinery geometry, shielding techniques and low emission terminals. The fate of this ordinance is still uncertain. It failed a challenge in a California Superior Court which decided that the City of San Francisco was preempted by the California Occupational Safety and Health Act from mandating health and safety rules for private businesses.

H.R. 3953 is a bill which at the time of this writing is still undergoing changes in the U.S. House of Representatives.[6] It is a 60 million dollar funding measure which would establish a national electromagnetic field research and public information dissemination program. An Electromagnetic Fields Interagency Committee, headed by the U.S. Department of Energy, would be formed, making this the first major federal government attempt to address this issue. Hearings on H.R. 3953 were held to consider all relevant testimony. An important area of coverage is 60 Hz cycles but other frequencies in both the ELF and VLF bands were proposed.

CUSTOMER REQUESTS

Since legislation is effectively nonexistent, it is important to look at what companies are forced to do in order to stay competitive. Many manufacturers are testing to MPR2 to protect market shares for their products and to position themselves against any potential liability. This may be considered prudent since no one can definitively state the final outcome of this controversial issue.

Until this matter is settled and all can look back with the benefit of hindsight, many businesses are developing programs of information dissemination and are voluntarily reducing the emission levels of products and work environments.

CERTIFICATION TO MPR2

Some companies are looking to have their products tested and certified to adopted specifications. At this time, only the computer industry is getting close to having a coordinated testing and certification program. There are two laboratories which have been certified by the recognized body to test to MPR2. There are several laboratories including manu-

facturers which have sought or will be seeking certification. For complete information on MPR2 and for laboratory certification information, SWEDAC can be contacted directly. The appropriate contact is:
MPR2 Certification
Ms. Merih Malmqvist
SWEDAC
Swedish Board for Technical Accreditation
Box 878
S-501 15 Boras
Sweden
Tel.: 011-46-33-17-7700
Fax: 011-46-33-10-1392

CONCLUSION

MPR2 has made it possible for a whole industry to focus on a problem of potentially enormous importance as a fairly unified body. Through the concerted activities of industry and government, the ELF/VLF issue will undergo much scrutiny and be the subject of debate for some time to come. MPR2 enables computer manufacturers to compare results and better share technology used to mitigate any possible dangers. Other industries are only beginning to find their way toward a more cohesive approach to measurement. The computer industry can for the most part be described as a test case. Organizations such as the Electronic Industry Association (EIA) and the National Electrical Manufacturers Association (NEMA) have been looking with great interest at the work pioneered by computer manufacturers.

REFERENCES

1. Savitz, D.A., Wachtel, H., Barnes, F.A., John, E.M., Tvdrik, J.G. Case-control Study of Childhood Cancer and Exposure to Magnetic Fields. *Am. J. Epidemiol.* 128:21. 1988.
2. Test Methods for Visual Display Units MPR 1990:8, 1990-12-01.
3. IEEE Draft Standard P1140/D9 "Standard Procedures for the Measurement of Electric and Magnetic Fields from Video Display Terminals (VDTs) from 5 Hz to 400 kHz.
4. European Computer Manufacturers Association, Procedure for Measurement of Emissions of Electric and Magnetic Fields from VDT's from 5 Hz to 400 kHz. ECMA/TC20/92/26(supersedes TC20/91/71).
5. User's Handbook for Evaluating Visual Display Units MPR 1990: 10, 1990-12-31.
6. San Francisco Video Display Terminal Worker Safety Ordinance, Article 23.
7. H.R. 3953SC: National Electromagnetic Fields Research and Public Information Dissemination Act.

***ERIC A. GEORGE** is an attorney and is associated with Ergonomics, Inc., the U.S. distributor for Combinova AB, Sweden, manufacturers of precision magnetic and electric field test equipment. He can be reached at Ergonomics, Inc., P.O. Box 964 Southampton, PA 18966. Tel: 215-357-5124. Fax: 215-364-7582.*