Electro-Magnetic Field (EMF) Screening

European EMC Products Ltd

Low Frequency Magnetic Fields, effects on VDU's and human health

The effects of electro-magnetic interference on equipment and human health are a much-discussed topic. We are all continuously exposed to low frequency electro-magnetic fields (EMF), the most common manifestation of these are flickering computer screens or VDU's. With the rapid growth in the use of IT equipment in the office, it is no longer possible or acceptable to just move the computer to another part of the building that is unaffected.

How does EMF affect VDU's

The most commonly used VDU's are Cathode Ray Tube (CRT) displays. The CRT is an evacuated glass tube with a phosphorous coating on the screen and an electron gun that generates an electron beam. The beam is accelerated toward the screen by a high voltage electric field. The beam is scanned horizontally and vertically by controlled magnetic fields generated by deflection coils outside of the CRT around the electron gun. The horizontal scanning frequencies range from 15 kHz to 90 kHz, the vertical scanning frequencies from 50 Hz to 90 Hz. External 50 Hz magnetic fields generated by other electrical power equipment will, if high enough, modulate the magnetic field generated by the deflecting coils. For example if a VDU with a vertical scan rate of 60 Hz is affected by a 50 Hz field the resultant modulation will give rise to two new frequencies, 10 Hz (60 – 50) and 120 Hz (60 + 50). The human eye will detect the 10 Hz flicker. The horizontal scan will be similarly affected but as this will be of a far high frequency it is not normally noticeable. The table below shows the relationship between monitor size and field strength at which flicker becomes noticeable.

EMF Screening

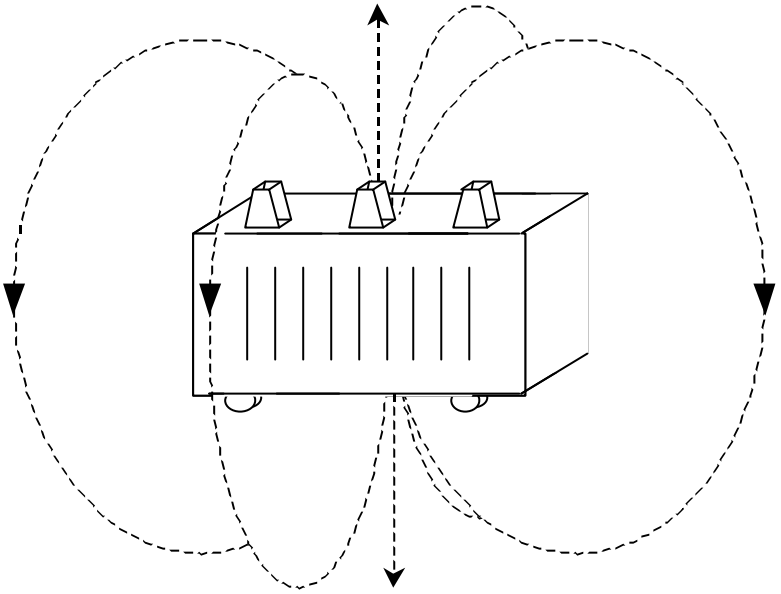
When the consideration of physical screening becomes the most practical of remedial actions this involves placing a physical barrier of shielding material between the source of interference and the affected area. The most commonly used materials are steel and high permeability Mu-metal.
EMF shielding works by diverting and deflecting the magnetic field away from the affected area. The design of a shield must take into account that a magnetic field will 'flow' around a partial shield, but as these fields decay rapidly with distance the extent of the shield needs to be large enough to take this into consideration. The most critical criteria when designing a shield is the level of attenuation required. Although different sizes and types of IT equipment and VDU's are affected by different levels of interference, experience shows magnetic fields in excess of 0.5 ìT (Micro Tesla) can cause VDU flickering and if the fields rise above 1 ìT most screens will be affected. Test levels for IT equipment as detailed in the EU EMC Directive *(EN 55024, Immunity of IT equipment)* is 1.25 ìT.
From the results of an EMF survey, or study are compared to an acceptable level the required attenuation can be determined.
Using the formula A = 20log(R/M) where A is the attenuation required in dB, R is the actual EMF level and M is the maximum EMF level acceptable.
For example a monitor susceptible to 0.8 ìT located in an actual field of 10 ìT will require 22 dB of attenuation.
Once this has been determined the type, thickness and extent of shielding material can be calculated. Particular consideration needs to be taken at floor / wall junctions as a poorly designed shield may solve a problem in one area but concentrate the magnetic field in an adjacent room causing a new problem in a different area.

European EMC Products Limited
Unit 8 : Saffron Business Centre : Elizabeth Way : Saffron Walden : Essex : CB10 2NL
Registered in England Number 3209118 : VAT Number 676 5479 78
Tel + 44 1799 523073 : Fax + 44 1799 521191 Email : info@euro-emc.co.uk : Web : http://www.euro-emc.co.uk

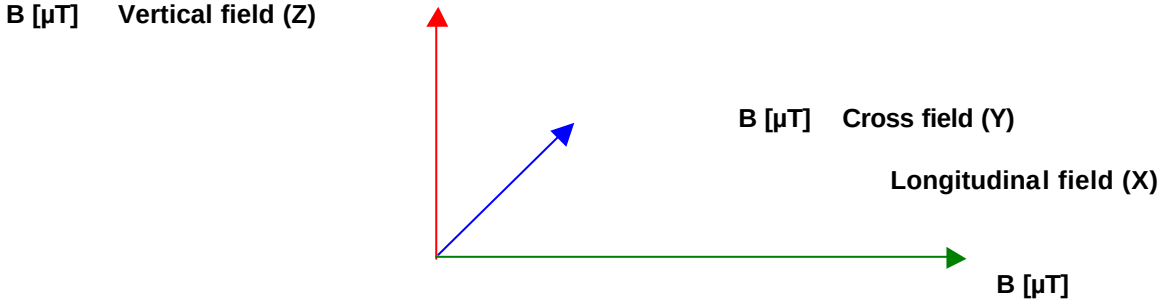
Electro-Magnetic Field (EMF) Screening

European EMC Products Ltd

All electro magnetic coils generate magnetic fields in all directions, see below:



For an effective EMF-Screen the stray magnetic fields in all directions need to be considered.

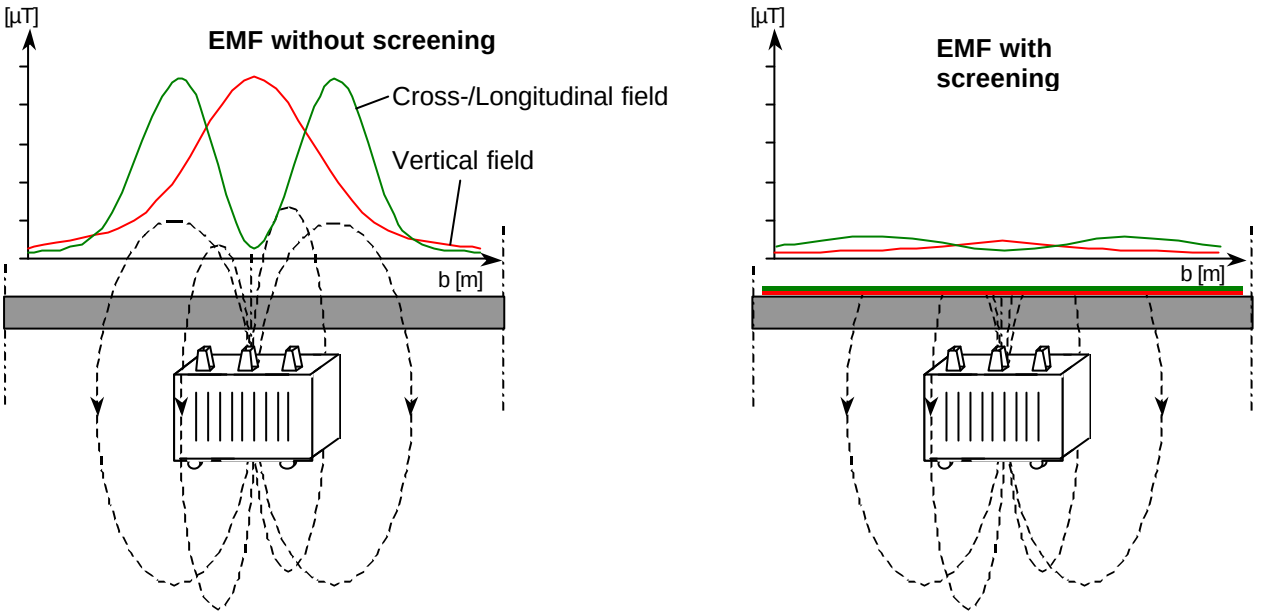


European EMC Products Limited
Unit 8 : Saffron Business Centre : Elizabeth Way : Saffron Walden : Essex : CB10 2NL
Registered in England Number 3209118 : VAT Number 676 5479 78
Tel + 44 1799 523073 : Fax + 44 1799 521191 Email : info@euro-emc.co.uk : Web : http://www.euro-emc.co.uk

Electro-Magnetic Field (EMF) Screening

European EMC Products Ltd

The diagrams below show the effects of an EMF screen.



Examples of EMF Screening

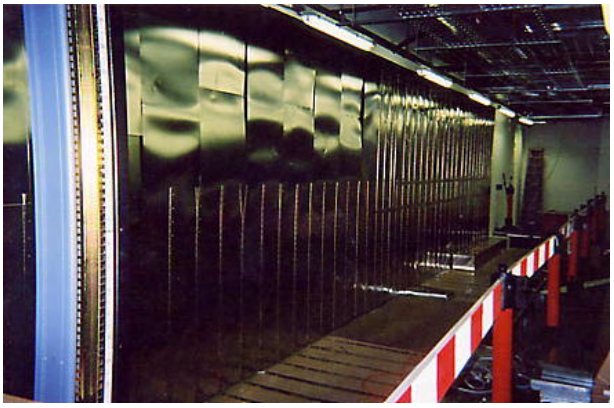
Complete sub station enclosed in EMF steel screening to prevent low frequency fields affecting living accommodation in housing to be built above.

European EMC Products Limited
Unit 8 : Saffron Business Centre : Elizabeth Way : Saffron Walden : Essex : CB10 2NL
Registered in England Number 3209118 : VAT Number 676 5479 78
Tel + 44 1799 523073 : Fax + 44 1799 521191 Email : info@euro-emc.co.uk : Web : http://www.euro-emc.co.uk

Electro-Magnetic Field (EMF) Screening

European EMC Products Ltd

EMF steel screening installed on the floor and columns of an IT suite to prevent interference from HV cables under the floor.



EMF screening using mu-metal to prevent interference from an adjacent plant room on IT equipment, steel could not be used due to weight constraint.

EMF Surveys

Where a EMF problem is visible or suspected an EMF survey will be required to establish the location and magnitude of the problem. A survey for low frequency EMF should normally be carried out when the affected area is in use, ie typical levels of power is being used. The results of the survey will:

Identify the source or sources of interference
Quantify the level of interference
Identify potential solutions

European EMC Products Limited
Unit 8 : Saffron Business Centre : Elizabeth Way : Saffron Walden : Essex : CB10 2NL
Registered in England Number 3209118 : VAT Number 676 5479 78
Tel + 44 1799 523073 : Fax + 44 1799 521191 Email : info@euro-emc.co.uk : Web : http://www.euro-emc.co.uk

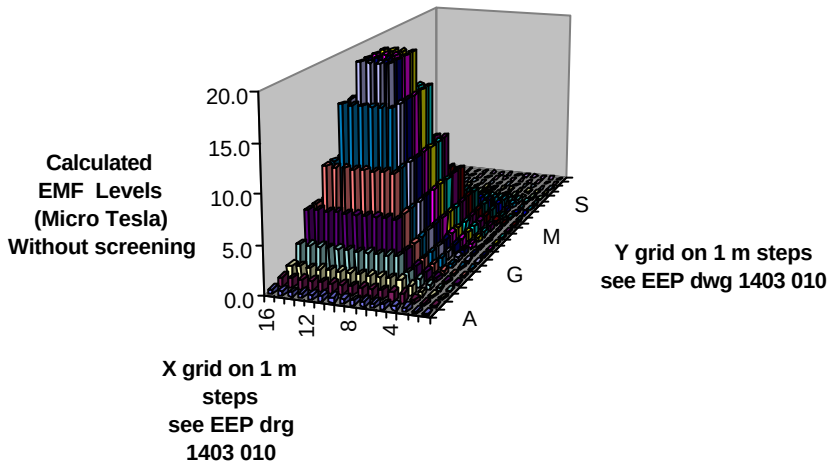
Electro-Magnetic Field (EMF) Screening

European EMC Products Ltd

EMF Studies

Potential EMF problems can in many circumstances be anticipated and avoided by careful layout of cables and electrical equipment. If this is not possible an EMF study can be carried out to calculate the theoretical levels of magnetic fields that will be generated. These study results can be used to determine whether EMF screening or other remedial measures are required.
Below is an example of the calculated magnetic fields from an electrical sub station below an IT room.

Appendix 1: Level 3 - Calculated EMF ~~without~~ screening



EMF and Health

The earth's magnetic field is a polarised field and humans are able to live without negative effects from this direct DC type field. However the long term affects of exposure to alternating AC type fields is not clearly understood. These effects have, and continue to be, the subject of much discussion and study that so far have produced no conclusive results. Perhaps as a result of increasing cynicism over official reassurances on health issues some companies, and official bodies take the view that a precautionary principle is applicable. The Swedish Government is generally considered to have taken the pro-active approach. For example if a 220 kV power transmission line was planned through a suburban area guidelines are available that compare the additional costs to reduce the magnetic field, such as installing a split phase line with the comparative expenses incurred by additional medical and social costs associated with a potentially elevated incidence of cancers. Although these guidelines are not legally enforced they ensure consideration is taken at the planning stage.
The safe level for long-term exposure to magnetic fields is a source of debate. The guideline level suggested by the UK National Radiological Protection Board (NRPB) for unlimited exposure is 174 ìT. When this is compared to 0.2 ìT used by the UK Childhood Cancer Study Investigators as the mean level used when studying any association between exposure to EMF and development of

childhood leukaemia illustrates the gulf between what is 'officially' safe and the worries of many individuals.
As with computer screen flicker the same principles can be applied to reducing or alleviating EMF problems for health reasons.

Quality
EEP are registered to BS EN ISO 9001: 1994 Registration number FS 38901 for the DESIGN, ASSEMBLY, SERVICING OF RF SHIELDED STRUCTURES AND EQUIPMENT INCLUDING EMI SHIELDING AND THERMAL MANAGEMENT MATERIALS; GAS TIGHT DOORS; AND SPECIALISED MOBILE ELECTROMAGNETIC PULSE PROTECTION CONTAINERS.