



# EMFs.info

## Electric and Magnetic Fields

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### Effects on equipment

There are several types of equipment that can be affected by fields. However, the fields required are usually rather higher than those commonly encountered in the environment.

- **Credit cards, railway tickets etc** have information encoded on a magnetic strip. This can be corrupted by magnetic fields above about 10,000  $\mu\text{T}$ . Such fields almost never occur at 50 Hz, but a problem can arise with static fields such as those from magnetic catches on handbags.
- Some **cars with electronic control systems** have been found to be susceptible to interference from power-frequency magnetic fields above about 2,000  $\mu\text{T}$ . Again, such fields are rare at 50 Hz. This tends to be more of a problem at higher frequencies.
- There is no direct effect of EMFs on **bicycles** but riding a bicycle under a high-voltage power line can produce a microshock.
- **Quartz watches** with analogue dials use a small stepper motor to drive the hands. This stepper motor can be driven by a suitably oriented external power-frequency magnetic field of about 1000  $\mu\text{T}$  or greater, causing the hands to rotate 100 or more times faster than normal. The effect is spectacular but has not been found to cause any damage to the watch.
- Power-frequency electric and magnetic fields constitute a possible source of interference with the operation of some types of implanted **cardiac pacemakers** or other active implants. Interference has been reported in certain models of implanted cardiac pacemaker with electric fields above about 1.5 kV/m and with magnetic fields above about 100  $\mu\text{T}$  at 50 Hz, though interference would not usually occur at fields as low as these. Most pacemakers are designed to 'fail safe' by reverting to fixed-rate operation when they sense the presence of interference above a certain level. The field strengths necessary to induce such behaviour vary from one pacemaker model to another but are generally higher than the fields encountered in the environment. There has been no recorded case in Britain of a patient coming to any harm as a result of fields produced by the power system. The UK Department of Health, Medical Devices Agency, does not consider that transmission-line electric or magnetic fields constitute a significant hazard. More detail on EMFs and implanted medical devices.
- Magnetic fields may, in some circumstances, affect the steadiness of the image on **visual display units (VDUs)** which use cathode-ray tubes. This can occur if the frame frequency of the VDU is close to but different from the power frequency (50 Hz). The effect is to cause the image to wobble at a frequency which depends on the difference between the frame frequency and the power frequency. Some VDU models may typically be sensitive to fields of 0.5 microtesla, although liquid-crystal, plasma and other modern display technologies are virtually immune from such problems. Limited amelioration can be achieved by careful orientation of the VDU and by screening. Screening magnetic fields is, however, difficult; even using high-permeability alloys such as "mumetal", worthwhile screening factors still require large amounts of the screening material. More on screening fields.
- A **fluorescent tube** works by an electric field inside the tube causing a discharge, and this electric field can come either, as normally, from applying a mains voltage across the tube, or from the electric field produced by a power line. So fluorescent tubes will produce a visible glow under a power line, though usually it is only visible after dark as it is much weaker than the light they normally produce. The current through a fluorescent tube under a power line would probably be 20 – 200 microamps ( $\mu\text{A}$ ) depending on the field. This is much less than a person can normally perceive, so you can hold the tube yourself under the power line without it hurting. (For comparison, a 10 W tube at 230 V draws 40 mA – 200 times greater). You can sometimes also make a fluorescent tube produce visible flickers by holding one end and rubbing your foot on a carpet to generate static electricity, though again, this needs to be done in a dark room.

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