www.emfields-solutions.com www.powerwatch.org.uk

EMFields Solutions Ltd in conjunction with Powerwatch

Reducing personal EMF exposure

This leaflet and information are written for the EMFields pocket PF5 meter which measures ELF and VLF EMFs from our use of mains electricity

Introduction

Our use of electricity generates power-frequency electric and magnetic fields (ELF EMFs) and increasingly higher (VLF) frequency fields as well. Many scientific studies over the last 40 years have shown that the incidence of childhood leukaemia doubles when background exposures exceed 0.4 microteslas (μT) (sometimes referred to as 4 milliGauss (mG)).

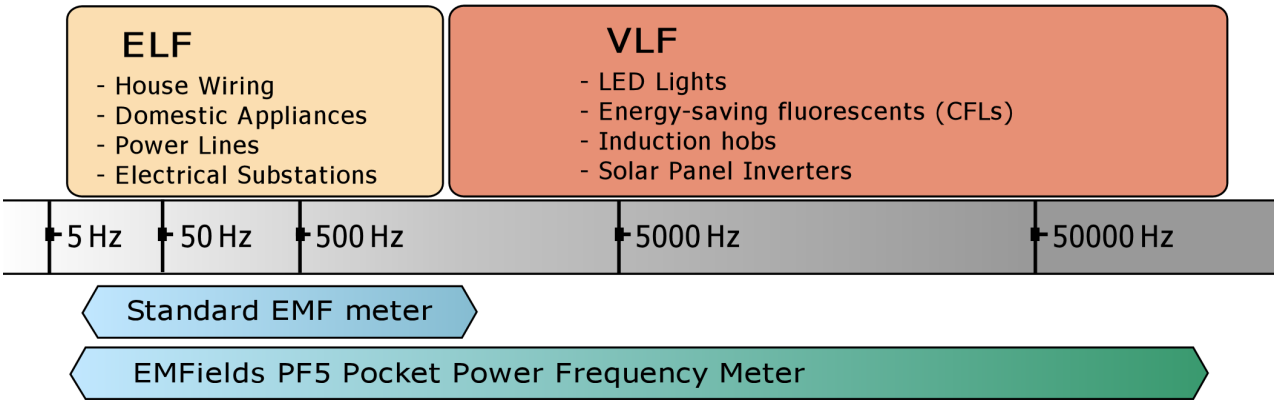
EMFs cannot be directly detected by our own senses though they can cause chronic adverse health effects (including headaches, extreme fatigue, etc). Measuring the fields is the only way to assess your exposure at home, school, work and during travel. If they are high, then it is usually possible to reduce your exposure.

In 2002 the World Health Organisation's International Agency for Research on Cancer (IARC) classified ELF EMFs as a Group 2B "possible human carcinogen". Leading researcher, Professor Anders Ahlbom, speaking at the 2008 ICNIRP / WHO international workshop on "Risk-factors for Childhood Leukaemia" said: "*There is relatively strong epidemiological evidence that ELF magnetic fields are a causal factor in the development of childhood leukaemia. The evidence is stronger than that for passive smoking and lung cancer*."

Exposure to ELF (3 Hz to 3,000 Hz) EMFs has been associated with various adverse health effects, including cancer (childhood leukaemia and adult brain tumours in particular), depression, some forms of dementia and motor neurone disease. An association between ELF EMFs and an increased risk of miscarriage has also been reported.

In recent times we have had a large increase in devices and appliances that emit VLF (3,000 Hz to 30,000 Hz) and even into the lower part of the LF band (30,000 Hz to 300,000 Hz). These have also been shown to be bioactive and many people get headaches and other symptoms when they are exposed to emitting appliances. Common sources include Induction Hob cookers, solar panel inverters for feeding power back into the mains (e.g. for FIT payments), energy-saving Compact Fluorescent Lamps (CFLs), some LED lights and many of the modern plug-type chargers and mains adapters.

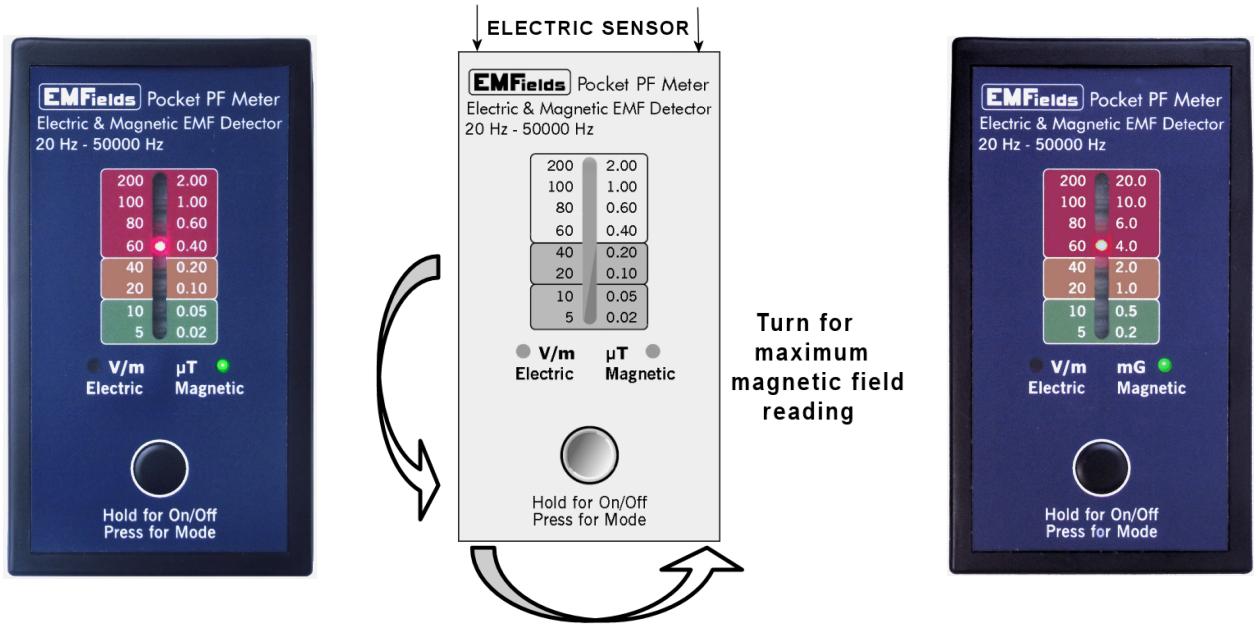
The EMFields PPF5 Pocket Power Frequencies Meter (ELF & VLF) is one of the few meters that covers the range 15 Hz to 70,000 Hz and measures both magnetic and electric fields. It is also the most cost-effective instrument to measure the electric field and this is very important at these low frequencies where the levels of electric and magnetic fields are not directly related, so you do need to be able to measure both.



Pocket PF5 MagneMeter – ELF / VLF Fields Meter

EXTRA INFORMATION AND GUIDANCE

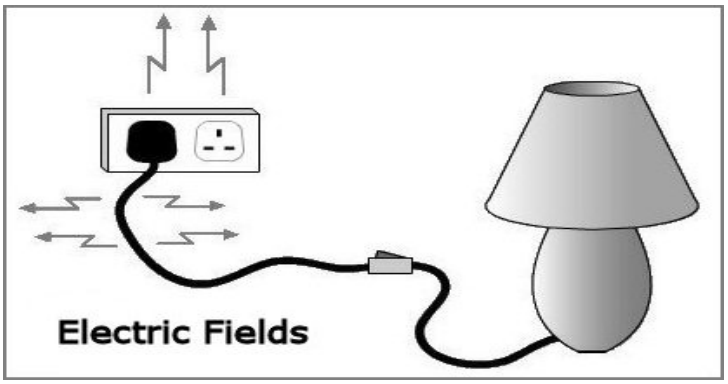
This is an instrument that measures the overall level of electric and magnetic fields at frequencies created by power lines, substations and underground cables, house wiring, and electrical appliances. It has an extended high frequency response so that it measures fields from induction hobs, CFL lamps and solar panel inverters.



The meter can be switched to display either the electric field or the magnetic field by pressing the on/off button for a short time. Holding it pressed for a few seconds turns the meter off.

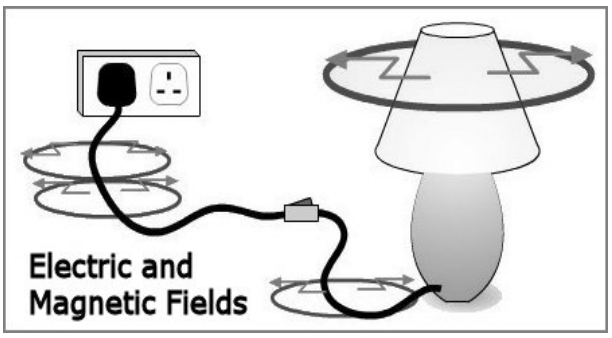
This picture shows electric fields from sockets and from the wire to the lamp, even though the light is not switched on.

The electric fields are present all the time electricity is present in the wire, even if the electricity is not actually being used.



This picture shows the electric and magnetic fields from the lamp when it is switched on. The electric fields now extend to the lamp.

Magnetic fields are also being produced by the current flowing along the wire and light bulb – although these usually reduce quickly as you get further away.



Electric and Magnetic Fields from plug transformer (mains adapter)

This illustration shows a common type of mains-adapter transformer that converts the 230 volt mains electricity to a lower voltage needed for many, usually portable, electronic devices. Once again, both electric and magnetic fields are emitted. The magnetic fields are considerable and can still be high up to half a metre away from the transformer.

Sometimes transformers are built into radios and music players and are actively emitting magnetic fields all the time the player is plugged into the mains, even when it is not actually in use.

Most modern mains adapters do not use a mains-frequency transformer but use higher-frequency switching circuitry that give off VLF electric and magnetic fields.

Measuring Magnetic Fields

Be careful to measure any electrical appliances in bedrooms, especially mains-adapters. They can give off very high fields and it is very unwise to have a transformer plugged into a socket near the bed. A magnetic field is produced whenever an electrical current flows. The larger the current, the higher the magnetic field produced.

We recommend that you check the magnetic fields the following way:

1. To determine the background level from external sources, switch everything off – ideally at the main switch. Measure it at a peak time (usually between 5.00 and 7.00 pm in residential areas). It is unlikely that you will be able to reduce this unless it is due to a 'stray' current (see below).
2. Switch the power on again. Plug a significant load (e.g. a kettle or fire) into a socket in the lounge. The room centre reading should not increase by more than 0.02 µT when this is switched on.
3. Repeat (2) with the appliance plugged into a socket in each room in the house in turn. Measure the field level, especially on the beds.
4. Check any lights with two-way switching such as a stair light. Check first with the light switched on using one switch and then with it switched on using the other switch. Take the measurement somewhere in the centre of the house. The magnetic field levels should not increase.
5. Note that the meter needs to be stationary or only moving slowly when taking readings. If the meter is moved quickly it will give spurious transient readings due to the meter sensor coil moving in the Earth's static geomagnetic field.

It is worthwhile measuring the magnetic fields from electric storage radiators when they are charging (after midnight) and next to electricity meter cupboards – please note that magnetic fields go through normal building walls.

If the outward and return currents are equal and are flowing in the same cables (wire bundle), as they should be, then the magnetic fields produced in your house and workplace should be negligible other than close to electrical appliances and devices. If they are high then we recommend that you download and read our free guide 'Your low EMF home-1-House Wiring' from our EMFields website under /Information/articles/.
Also at: http://www.powerwatch.org.uk/library/getfile.asp?articleID=131&sourceID=2

Net and Stray currents

If the reading significantly increases during the tests in 2, 3 or 4 above, then there is a fault in the house wiring causing high magnetic fields by unbalanced current flow. A qualified electrician should be called to carry out a full test and repair of the wiring.

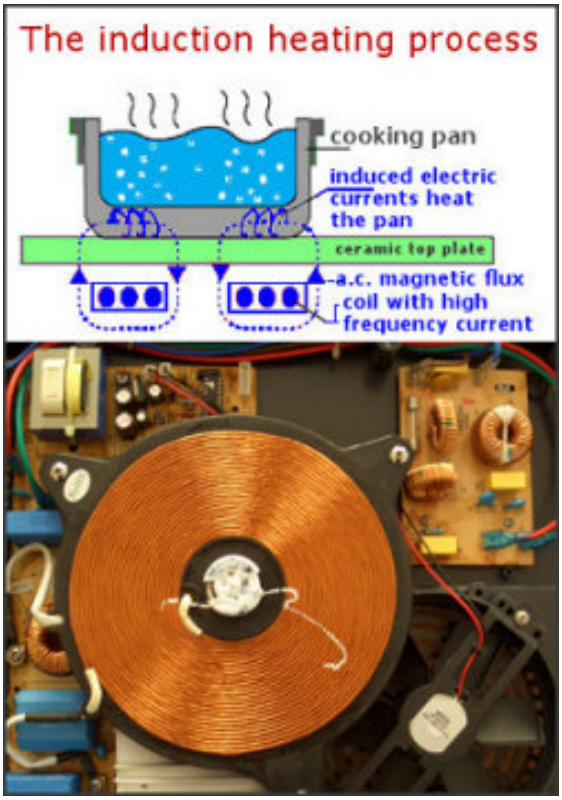
Magnetic fields from external overhead and underground cables can be very high. They only reduce with distance from the source: the higher the current, the further away you have to be before the magnetic field is at background levels.

Some properties have high levels of magnetic fields as a result of faults having developed in underground cables from the electricity substations. These produce unbalanced (net or stray) currents. If your background magnetic field is higher than about 0.1 μT (1 mG), the fields are likely to be due to net or stray currents which can affect a few houses, or even a few streets.

'Stray' current can even enter the house on metal water (or gas) pipes and return through the electricity earth. Measure the field near to these pipes where they enter the house. If the reading rises significantly then there is information in our article 'House wiring and EMFs' explaining how you can minimise those 'stray' currents.

Cars and trains can expose you to very high magnetic fields, especially over the wheel arches. If you have to commute over long-distances, it is worth measuring the fields you are exposed to in different seats and choose one carefully, particularly if you are likely to be pregnant. American research links exposure to abruptly changing magnetic fields (common in electric trains), with miscarriages, especially in the first 3 months of pregnancy.

Our article 'House wiring and EMFs' contains a lot of practical information on this subject. If you wish to read about the research into power-frequency electromagnetic fields and the health effects that have been associated with different levels of exposure, you can find more information in the free library articles on our website. There is some general information on the site, some on the FAQs part with more detail in the longer library articles.



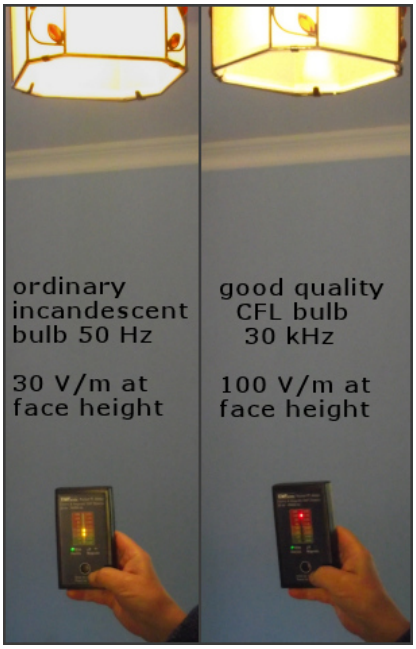
Measuring Electric Fields

Electric fields are present all the time there is electricity on a wire or cable. All sorts of nearby things affect the electric field, e.g. people, items of furniture, so it is impossible to estimate the levels and you need to measure them at the places people spend much time (e.g. on beds, favourite chairs, etc).

To measure Electric Fields, set the readings switch to "Electric". Ensure you are holding the meter near its bottom end (near the push switch) as how you hold it can affect readings. The electric field sensor is inside the top edge of the instrument. Move the meter to the desired area and hold it still for a few seconds so it can settle.

Electric field readings should be taken at least 25 cm from walls or other large surfaces. The meter is calibrated to read electric fields that your body will experience when it is being held. The electric field readings will be inaccurate when the meter is put down on a surface and not held in your hand.

Whilst identifying sources of high electric fields can be difficult, there are some general rules of thumb you can follow to narrow down the possibilities. Inside a building, most electric fields will be due to the building wiring, as electric fields generated outside are normally stopped by the building's wall materials.



Modern energy-saving CFL lamps usually emit significant VLF electric fields as do some LED lamps

Electric field readings near metal radiators (particularly upstairs) may show as being unusually high. This is usually not a problem with your plumbing / radiators. Instead it is likely to be because your body is acting as a conductor between the mains wiring under the floor (for the downstairs lights) and the earthed radiator. To measure the fields as they are naturally, stand on something insulated (such as a plastic sheet, box or stool).

Electric field measurements around the bed should be taken holding the meter whilst lying or kneeling on the bed.

The electric field level often rises towards the ceiling, mainly due to the fields from light fittings and lighting circuit wiring. Some common wiring styles used for lighting circuits produce high fields near the ceiling and light switches.

Electric fields can be reduced by re-wiring using screened cable.

If this is not practicable, a "demand switch" can be fitted. This disconnects the circuit wiring from the mains electricity when nothing is switched on. It can particularly help to reduce electric fields during the night. It becomes ineffective as soon as something is switched on.

In most domestic sitting and sleeping areas it is usually possible to keep electric fields below 20 volts per metre (V/m), ideally below 10 V/m, and in houses with wiring in good condition it is unusual to find levels above 60 V/m more than 50 cm away from electrical switches, sockets, lights, appliances and live cables/wires.

Our article 'House Wiring and EMFs', freely downloadable from our website www.emfields-solutions.com contains much practical information.

It is also available at:
http://www.powerwatch.org.uk/library/getfile.asp?articleID=131&sourceID=2

What to do if your electric or magnetic fields are high

If, as a result of taking the measurements you find the fields are high, what can you do to reduce your exposure?

The places you spend most time are the most important ones to keep exposure low. Remember that magnetic fields travel through walls, so it is important to check what is on the other side of the wall behind the bed, or behind a favourite chair.

Make sure the EMFs on the bed are low; that there are no electrical appliances (including mobile phones, transformers, etc.) near the bed. They should all be switched off overnight, or ideally moved out of the bedroom altogether. Computers, TVs, games consoles and all electric and electronic toys should be monitored.

If your readings suggest a 'stray' current is affecting magnetic field levels in the house, our house wiring article explains how to remove it. If you detect a fault in the house wiring as a result of the tests carried out above, the article will help an electrician remedy the fault.

Many of the free articles in the articles library on our website will help inform your decisions.

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