Buying an 'EMF safe' Property

This article is separated into 6 sections, each of which can be individually downloaded. It is a 'work in progress' incorporating new information whenever time permits.

Section 1

Introduction

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2. Powerlines and pylons; an easement; a wayleave; references; equipment for measuring powerfrequency electric and magnetic fields; summary of safety points to do with powerlines; powerlines worksheet (2 sides)

3. Substations and transformers; junction boxes; net currents; stray currents; references; equipment for measuring powerfrequency electric and magnetic fields; summary of safety points to do with substations and transformers; substations and transformers worksheet (2 sides)

4. Electrified railways; overhead lines; third rail; diesel; references; summary of points to do with railway lines; equipment for measuring electric and magnetic fields; meters for measuring microwave radiation; electrified railways worksheet (1 side)

5. Mobile Phone base stations or masts; what base stations may look like, including hidden ones; effect on house prices; distance from the source where the microwave radiation meets the ground; drums; TETRA antennas; amateur radio operator's equipment; equipment for measuring microwave radiation; summary of safety points to do with mobile phone base stations; Mobile Phone Base Stations worksheet (2 sides)

6. EMFs inside buildings (including flats and caravans); wiring; electrical appliances; caravans; summary of safety points to do with your home, school, office, etc.; equipment for measuring electric and magnetic fields; equipment for measuring microwave radiation; EMFs inside buildings worksheet (2 sides)

The need for more housing and potential EMF effects

The housing commission's report (BBC June 2013) recommended doubling the target of 100,000 new homes on publicly owned land, and it said builders should be made to start work within three years of acquiring planning permission. Planning permission was granted for 44,251 homes across England in July to September 2013 on 826 sites, according to figures from the Home Builders Federation (HBF). It said this was 31% higher than a year earlier. In November 2013 Clive Betts, Labour chairman of the communities and local government committee said only 100,000 homes were being built and at least 250,000 are said to be needed. The demand for new residential property has increased from 3.8 million households in 1996 to 24 million anticipated by 2021.

Under the National Planning Policy Framework, local authorities are required to work out future housing needs in their area, and then allocate sufficient land to meet it. This will have been made more difficult since the recent flooding of homes that have been built on flood plains.

The aim of the government is to remove obstacles to the building of new houses, and to speed up planning decisions. Stewart Baseley, executive chairman of the HBF, said "*The new system must provide enough viable land to build the number of homes the country needs. Continuing the current low level of house-building is storing up huge social and economic problems for the years ahead and the shortfall must be addressed*."

Using inner city brown-field land or 'adding on' to existing residential estates is one of the ways of extending the current stock of available housing, especially social housing. Many brownfield sites are crossed by powerlines that still service adjacent areas, even though the land immediately beneath and nearby has been cleared of previously existing buildings. This has the advantage that new building would have amenities already on site. Using brownfield sites also slows the urban spread into greenbelt land or into country areas.

Powerfrequency EMF exposure sources

Health risks due to exposure to EMFs in the home were first suggested in America by Nancy Wertheimer and Ed Leeper, in 1979, when they found a link between residential magnetic fields and the local incidence of childhood leukaemia. Since that time, international research has increased year by year, and the potential health risks have been identified as cancer (especially childhood leukaemia, probably the most studied illness because of the original findings), depression, suicide, brain tumours, miscarriage, Alzheimer's Disease and other forms of dementia, respiratory difficulties, ME and other immune system problems. Maternal residential proximity to sources of powerfrequency EMFs were associated with suboptimal foetal growth (de Vocht & Lee 2014). There is an article on "Powerfrequency EMFs and Health Risks" downloadable free of charge from the EMFields library which discusses this research in greater detail.

Because there are other causes of these illnesses, it is not clear what role EMFs play in their development. Much of the research in the past 35 years into EMF health effects has concentrated on powerfrequency magnetic fields because they are easier to measure and it was thought they were more likely to interact with our bodies' cells. Most scientists believe that, although EMFs do not directly *cause* the illness in most cases, at least, living in fields above 0.2 microtesla may make a person develop cancer or another illness, when if they ***didn't*** live in this field level, their bodies would be able to repair themselves, or cope with the daily damage from other causes in a healthier way. Field levels above approximately 1.2 μT stop prescribed drugs like tamoxifen from working (Harland & Liburdy 1997, Blackman 2001, Girgert 2005, 2008).

The Brighton Argus reported in October 2006 that Adur District Council in Sussex turned down an application to build 6 houses because magnetic field levels of 0.4 to 1.1 microtesla had been

measured from the overhead powerlines. These gave council officers "cause for concern" leading to the rejection of the planning application. A nearby resident said "*The amount of people who have suffered illnesses around here is unbelievable. We can't prove it's because of the pylons but there have been an awful lot of problems health-wise for such a small estate.*"

Electric fields are increasingly being studied and the initial findings seem to indicate that they may be as hazardous to health as magnetic fields. This is hardly surprising as the bodies' internal communications are electrochemical and are likely to be affected by exposure to exogenous (external to the body) electric fields. The very high electric fields associated with high voltage overhead powerlines also cause air ionisation, charging toxic aerosols so that they become even more dangerous. Initial findings from Bristol University associate lung and skin cancer with exposure to such ionisation (Fews 1999a, 1999b).

There is evidence that when both magnetic and electric fields are high there may be an even greater risk of ill-health. Areas where it is important that EMFs are low are bedrooms, especially where the pillows are on beds, because EMFs affect an area of the brain, called the pineal gland, which works overnight to protect the body against illness, and affects moods. It is also a good idea to look at places like a favourite armchair, or in front of a computer or TV. Places like these where you sit or lie still for a longish period of time should have low EMFs. When you are sitting still and particular cells keep being interfered with by EMFs, there is an increased risk that the damage may not be able to be repaired. Cells tend to cope better with external fields if the person is moving around.

Radiofrequency EMF exposure sources

Certain pieces of equipment, such as digital cordless (DECT) phones, WiFi-enabled computers, modems, homehubs, laptops, mobile phones (including on standby), Wii games and games consoles, Tablets, etc. can give off radiofrequency levels that are associated with ill health effects throughout the home up to 24 hours a day.

Since the 1980s, the government has done what it can to encourage the growth of the mobile phone network. Mobile phone purchase and use is a major source of tax-revenue, exceeding that from alcohol and cigarettes combined. Mobile phone signal access covers most of the UK, with more masts in urban areas to serve the greater number of people using their phones in cities and towns. 2G, 3G, TETRA (the telecommunications system for the emergency services), LTE (4G) and more sophisticated mobile services as well as increased phone usage for communications and access to leisure services, added to the number of new masts. This proliferation of masts, followed by RF from WiFi, WiMAX, DECT phones, Tablets and games consoles added to the EMF exposure in virtually every home.

Radiofrequency EMFs from base stations in the community have been less studied, but indications are that a small percentage of the population is affected by low levels of RF in their homes, and as these levels rise, it seems that more people begin to report health problems. You can find more details in the article "Radiofrequency EMFs and Health Risks", downloadable free of charge from the EMFields library.

Children are more likely to be affected than adults because their cells are more rapidly dividing as they grow. Most children sleep for longer than adults, so if their bedplace is in high EMFs, their health may be affected. It is worthwhile taking particular precautionary action with regard to children's living environments.

Pets can also be susceptible to EMFs in the environment. They are, by and large, shorter lived, but there is enough evidence of e.g. dogs sleeping next to night storage heaters developing cancer, that it is worth while making adjustments for them, too.

However, not everybody seems to be susceptible to adverse health effects from EMFs. If, for example, a child statistically has a 1 in a 2000 chance of developing leukaemia, and because they live near an EMF source associated with an increased risk of developing this form of cancer, their risk level doubles (i.e. changes to 1 in 1000), there are still 999 chances out of 1000 that they will not develop leukaemia whilst living in this field. It is an increased risk, but far from a certainty.

Electrical hypersensitivity

Electrical hypersensitivity (EHS) is a condition whereby the person suffers ill-health effects in the presence of electric or magnetic fields. Proximity to powerlines, substations and cables is likely to make people suffering from this condition feel worse than the general population. Up to 20% of the population can develop a degree of electrical sensitivity, which can become a very serious and debilitating condition. Electrical hypersensitivity increases with continued exposure, and after a time, can become irreversible. See our article 'Electrical Hypersensitivity, a Modern Illness'.

How microwaves reflect off building surfaces and into buildings

It is not easy to work out what you may be exposed to from a microwave (RF) source. It gets even more complex, when, as is likely, more than one RF source is in the vicinity of the property.

RF radiation comes from a variety of transmitters, from radio and TV masts, mobile phone base stations, local radio operators, amateur radio users, digital cordless phones and wireless network systems (wLANs) which extend into neighbourhoods from individual houses, wireless street lighting systems, WiFi and WiMAX systems that enable laptop use 'on the move'.

Microwave radiation leaves its source in a 'more or less' straight line. When it encounters an obstacle it is not stopped (like light), it flows around to a certain extent (a bit like water, but not as flexible). It also reflects off the ground, so what you will experience will depend on the geography around you.

Building materials change the pattern. A little of the radiation is absorbed by building materials, some is reflected (a great deal in the case of metal obstacles, such as metal roofs or walls, metal advertising hoardings, road barriers, lorries, cars, metal downpipes, gutters and other structures on buildings and many other things you will find in most environments). The rest goes through the 'obstruction' as if it weren't there, depending on the material. Glass, for instance, lets virtually everything through. Most building materials let through less than glass, but still a significant amount. A study by Bürgi (2010) concluded that the modelling of the shielding effects by walls and roofs requires considerable simplifications of a complex environment.

Where there is metal (such as steel frames and joists) used in building construction these, too, are likely to influence the places where microwave radiation can be detected. Metal equipment within buildings, such as mirrors, metal lamps, etc. will also distort the fields.

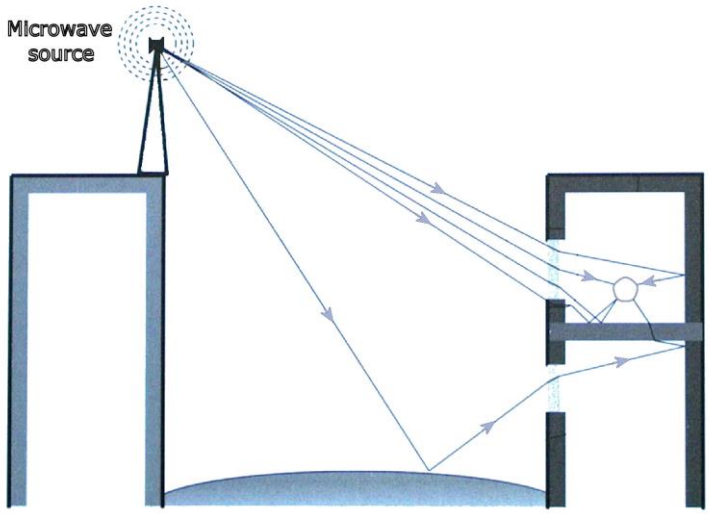
The level of microwave radiation that you may be exposed to can be quite complicated, and also depends on what other buildings surround the one you are in.

The ***simplified*** diagram below shows what could be experienced by people in a building with a mobile phone base station on the roof of a nearby building. In the diagram there is only one mast, and only the radiation from one antenna is what is shown. All base stations have more than one antenna, pointing in different directions, and subject to the same 'bounce' off buildings, the ground, and other objects as is shown for this one.

The bottom ray, in the diagram below, is shown bouncing from a ground floor surface and being reflected upwards through the window below and opposite.

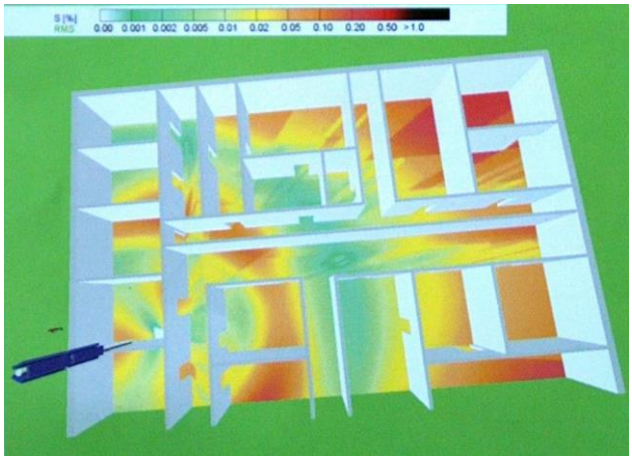
The diagram does not show where the rays reflect off the building and return to enter the windows (and to a certain extent the walls) of the building on which the base station stands. It also only shows the microwaves entering through the windows and not the building materials, as the inclusion of these as well would make it too complicated to interpret.

People in buildings near a source of radio-frequency radiation will be exposed to levels of microwaves that are unpredictable. They will come from 'line of sight' direction, but also from reflections from many places depending on the surroundings. All computer programmes predicting exposure are grossly simplified and do not reflect a true picture of the reality of exposure.



A base station radiating a nearby property, based on a diagram in 'Antennas & Propagation' by Simon Saunders (ISBN 0 471 98609 7)

A person in the top floor of the building on the left, would be affected by 'hot spots' of radiation, as shown in the plan below. These spots are unpredictable and may not be where you may expect to find them.



The floor directly underneath the base station (at the front left) showing the levels of radiation experienced by occupants of the various rooms. The most exposed room is at the top right, at the corner furthest from the base station position. Diagram from http://www.fgf.de/english/fgf/index.html

People on other floors are likely to be exposed to reflected radiation from the ground, and other buildings nearby. This is impossible to predict. Most software programmes intended to do so,

exclude details of buildings, topography and nearby parked vehicles and other reflective surfaces because of the complexities of including them.

Generally "rules of thumb" with regard to microwave radiation are pretty useless in practice. If you have a free-standing mast, across open ground (no trees) to a row of buildings, then some rules of thumb can be applied, but it would depend on the beam shape, down-tilt of the antennas, height of the antennas and the distance between the antennas and the buildings. At 200 metres from a typical 15 metre mast, there may not be much difference with height. On a 24 floor block of flats at that distance, then the higher floors would have lower microwave levels and floor 0 to about 15 would be similar, with maybe floors 3-5 having slightly higher levels than the others. The levels would be very difficult to predict and would depend on the microwave reflectivity of the ground surface. There would be much higher levels if it were tarmac or concrete compared to the levels if it were reasonable length grass. As regards close masts, then the closer you are to the level of the antennas, the higher the radiation level is likely to be. If you are at the same height, or slightly lower, then you are likely to be in the main beam and hence have high levels.

There is really no alternative to measuring your exposure as predicting it without measuring could be very inaccurate, either overestimating or underestimating levels significantly.

The only way to know for certain whether you are being exposed to microwave radiation that may be affecting your health is to measure it using an Acoustimeter, Acousticom 2 or another suitable microwave measuring instrument.

Impact on property value

The questions you may then ask could include "Is this a good investment?" "Will this EMF source affect the value of my property?" "Is this a place that is safe, both for myself and my family?" "Could the proximity of this EMF source actually affect our chances of *having* a family?"

In February 2008 we heard that in a small development of houses, where some were being sold for £695,000, others were being sold for £495,000 and they had a 132kV powerline running directly over the gardens of the lower-priced houses.

The Telegraph online on 14 July 2013 said about pylons: They are not just unsightly but, in many people's eyes, a health risk. "*I always mentally knock off around 30 per cent when I am valuing properties with pylons in the close vicinity*," says Jonathan Harington of Haringtons UK. That is the equivalent of £72,000 off the value of the average property." The percentage impact attributed to pylons is perhaps the worst of all.

Brendan Clouston, a Canadian telecoms tycoon put his Eilean Aigas estate in Inverness-shire on the market in 2012 with an asking price of £15 million. Three years later, the 4-storey mansion is due to go on auction for a price in excess of £3 million, if it is not sold before. It is thought that part of the reason behind the drop in value is the construction of the Beauly to Denny power line which runs through the estate. Mr Clouston spent a lot of money on lawyers to fight the proposals. He was prepared to pay for the line to be undergrounded. But his objections were unsuccessful (Telegraph June 2015).

A study by Sims & Dent (2005) showed that house prices were reduced by up to 18% for a property within 150 metres of a powerline, and 20% within 50 metres. The price was reduced by up to 26% if a pylon could be seen. Visible substations and cables also reduced the value of a property.

In Belgium, the following offers were made by the Belgian grid company, Elia,

- If you lived within 60 metres of a proposed 370 kV planned powerline, you received either 25% of your house value or you could sell it to the power company

- If you lived between 60 and 75 metres, it was 20% and no purchase offer
- If you lived between 75 and 100 metres it was 2.5% and no purchase offer.

This seems to be in a 2012 agreement with 'farmers', which might mean only those whose land is crossed by the line (REVOLT news 391 March 2015).

There are many reports that the European guidelines recommended by the International Commission for Non-Ionising Radiation Protection (ICNIRP) are inadequate to protect sections of the general population who may be vulnerable. In 2001, the World Health Organization's International Agency for Research on Cancer classified ELF EMFs as in group 2B, possibly carcinogenic to human beings. In June 2007, the Special Eurobarometer on Electromagnetic Fields, revealed that most EU citizens do not feel they are adequately protected by authorities against the potential health risks posed by EMFs. More than two thirds of people interviewed said they were not satisfied with the information on EMFs, while one third felt they are not informed at all.

If you are unsure, you are not alone.

In the face of uncertainty, measure and take action if necessary

This article in six sections has been written to help prospective purchasers or people wanting to rent a home to be able to gather information together quickly. If you have more time, you might like to look at the other articles referred to. Many people are asked to decide quickly in order for a sale or rental agreement to progress smoothly. This document helps summarise some of the informed scientific recommendations as to what precautions may be appropriate for the majority of the general population. It is, however, a subject in which fierce debate still continues, and opinions change as new research and findings move our knowledge forward.

This article is made up of different sections which look at a number of different sources of EMFs which may be relevant to you: Powerlines and pylons; substations and transformers; electrified railway lines; mobile phone base stations; flats and multi-occupancy buildings; and internal EMFs.

For homes in the UK that have high background magnetic field levels, about one-third come from high-voltage overhead powerlines, one-third from faulty house wiring and equipment in the house and about one-third from electricity substations and mains voltage cables under the street. Richman (2014) looked at 29 field audits in residential properties in Canada. It was found that low-cost reduction strategies were effective, on average reducing exposure by 80% for high-intensity EMF metrics. The authors felt that the results could encourage an industry movement to design for low-exposure to EMF in a residential context.

Radiofrequency radiation in people's homes comes primarily from mobile and cordless phones, computer wireless access to the internet (WiFi), cordless phones and mobile phone base stations. RF radiation can often extend into a person's home from equipment owned by a neighbour.

In buildings which are separated into flats, bedsits, or maisonettes, the EMF situation is complicated further as you may be exposed to EMFs from your own equipment and use of equipment, and also by those of your neighbours next door, above and below. In some properties, there are even substations incorporated into the building itself.

We talk you through the process of what to look for, from where, and what it means, in a step-by-step way, so that you should have an answer on which to base your decision very quickly. The timescales people have to make decisions are often pretty short.

Most sections have a short summary, a reminder of the steps, and a worksheet which contains a checklist to photocopy and take with you when you visit a property, with reminders about what to look for, distances to measure, questions to ask, etc.

With this, you will have what you need to check your new house, flat, school or nursery for your children, even workplace, to identify potential problems from EMFs or to give you peace of mind.

There is always an element of risk attached in any decision, especially when the science is uncertain. You may reject a house because of a nearby pylon, and buy one on a reclaimed landfill site giving off toxic fumes instead!

The SAGE-2 (Stakeholder Advisory Group on ELF-EMF) report sent to the Health Minister on the 8th June 2010, made the following recommendations for precautionary measures concerning distribution systems:

- Distribution Network Operators (DNOs) to investigate instances of high EMF exposures when notified of them
- DNOs investigate and repair broken neutrals
- Use plastic gas and water pipes for new build
- Insert plastic sections in metal gas and water pipes when work is being done anyway
- Develop awareness within DNOs, by training of relevant staff, of how elevated exposures can be an indication of system problems
- Arrange components in the substation in the lowest-exposure layout reasonably practicable
- Reasonably practicable efforts be made to site substations distant from homes etc
- New and refurbished substations to have compact design where reasonably practicable
- DNOs make reasonably practicable effort to balance loads on three-phase final distribution circuits
- Site plant rooms away from occupied rooms
- Use separate-neutral-and-earth cables for risers in high buildings
- Use compact risers in high buildings

These recommendations were never implemented.

Where are powerlines and mobile phone masts?

Powerlines

National Grid own the 400kV, 275kV and some of the 132kV lines. They are mainly overhead, with a few (or sections of some) undergrounded. You can find some information from their website see: http://www2.nationalgrid.com/uk/services/land-and-development/planning-authority/electricity-network-overhead-lines and http://www2.nationalgrid.com/uk/services/land-and-development/planning-authority/electricity-network-underground-cables/ .

The local electrical distribution companies will own the rest of the 132kV lines and those with voltages lower than these. To find your local company, see the Energy Networks Association page at http://www.energynetworks.org/info/faqs/who-is-my-network-operator.html

They will normally supply a paper plan of these for the locality around your house (at a charge). These will usually be photocopies/prints of their plans on large sheets of paper (A1 or A0). It is not considered to be publicly available information, but they usually will supply the details for the area you live in. Outside your immediate area is highly unlikely, in our experience.

The low voltage lines, 400v (3-phase) and 230v (single-phase), which often result in the highest residential magnetic field levels, have plans which can be a nightmare to interpret. They will almost certainly include historical cabling (that may be present, or may have been replaced), engineering shorthand and inaccuracies. They are where the company thinks the cables are likely to be (though they may not be if the people who dug the trenches many years ago decided otherwise). Plans for newly built areas should be accurate.

1:10,000 (6 inches:mile) Ordnance Survey maps have overhead lines down to 11kV. Some 1:25,000 (2.5 inches:mile) maps also show overhead lines down to 11kV. Standard 1:50,000 scale maps usually only show 132kV, 275kV and 400kV overhead lines.

Some lengths of powerlines in eight Areas of Outstanding Natural Beauty (AONB) are being considered for undergrounding. These are the New Forest, Brecon Beacons, the Peak District, Snowdonia, an AONB in Dorset, Tamar Valley, North Wessex Downs and High Weald.

Mobile Phone Masts

Try http://www.sitefinder.ofcom.org.uk and type in the postcode or street name that you are interested in. The site is maintained by 'Ofcom' (a Government Regulatory Agency) and is updated 3-monthly (more or less).

Mast information is not added until it is integrated into the system and the information is passed on by the operator to the people who enter it onto the website. This process leaves a lot of leeway for errors creeping in. Information about masts in the planning stage, in the process of getting approval, or under appeal, or masts that have not yet been integrated will not be included.

There has been a legal wrangle going on between Ofcom and the telecommunications operators which has meant, we believe, that the sitefinder site information has not always been reliably updated. It is therefore becoming increasingly inaccurate.

Private radio frequency transmitters (amateur radio operators, taxi firms, etc.) are not included, neither are the new digital broadcasting systems, though you will be able to pick up radiofrequency signals from these sources with an Acoustimeter or Acousticom 2.

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