

## Sources of RF inside the home

People's homes are rapidly filling with devices that use RF radiation to work. Sometimes we are unaware that this is the case, and inadvertently expose ourselves to quite high levels of microwave radiation. The authors believe that this is not good for most people and may provoke ill-health symptoms, making for a much poorer quality of life for many. See [Radiofrequency EMFs and Health Risks](#).

A family in Denmark installed a complete wireless electricity system in their home; WiFi on all their electrical switches, lamp points, etc. The family asked the installer and the Electricity Safety Council about RF radiation, and was told there was only RF when you turned the switches on or off, but there might be continuous radiation from the lamp points. The firm claims that RF levels are low, even though they admit they have never measured them.

A study by Viel (2009) suggested that people's personal exposure in their normal environment to RF radiation was 17% from digital cordless (DECT) phones, 14% from WiFi and 11% from radio transmitters.

### Mobile phones

One of the most common sources of radiofrequency radiation in the home is a mobile phone. Originally, the mobile phone was used primarily as its name suggests, when the user was mobile. However, many operators are now advocating the mobile phone as the only form of phone people will need. Not only are people using them in the house for their leisure conversations, but they are expecting to use their mobile phones to pick up work messages, catch up on answer services in the evenings and weekends, and with the advent of 3G, more leisure facilities are available to the mobile phone user (including music, films and games, etc.) to enjoy at home. This results in the need for higher levels of radiofrequency signals from base stations in order to penetrate building materials. For more details see the article [Mobile Phones](#) and [Children and Mobile Phones](#).

Most authorities and concerned individuals advocate the use of hands-free kits to shield RF when using a mobile phone. Wired hands-free kits can carry the RF down the wire and into your ear, offering some protection but not, we consider, enough. EMFields has a range of [airtube hands free kits](#) suitable for every phone.

Many people do not want an alternative to their mobile phone, they want to be able to use them for more and more purposes. The telecommunications companies encourage this, and the government benefits from increased tax revenues as a result. For those people who are expecting to be able to have a good enough signal to use their mobile phones inside their own homes, the companies have launched the femtocell, the family's own small mobile phone mast in the living room. The manufacturers say this is to avoid the problems of mobile phone reception interference, caused by *“wooden floors, under floor heating pipes, metal structures in walls, even fragments of metal in bricks”*. The femtocell plugs into your home broadband system, and according to the manufacturers, the signal is much stronger than the main mobile telephone network. You will then be able to abandon your fixed telephone. David James, director of service provider products at NETGEAR. *“Not only will this solution enable mobile operators to provide enhanced cellular coverage in the home, but it will also make it possible for consumers to access and control a range of home networking services via standard 3G phone handsets.”* Although Powerwatch, a consumer watchdog with regard to EMFs, may seem somewhat less than enthusiastic about this new initiative, if the

femtocell were programmed to switch off when not in use, for those who wish to have a mast in their own home, it may be preferable to having yet more powerful masts radiating everybody constantly.

## Digital cordless (DECT) phones

Another very common source of radiofrequency radiation in the home is the digital cordless phone. Older cordless phones used to give off high levels of radiofrequency signals *only* when they were in use on a call. Modern DECT phones now emit the same level of microwaves *inside* your house as a small mobile phone base station *outside*, not just when the phone is in use, but *all the time*. The person near the base unit may be subjecting themselves to over 6 volts per metre, and rooms near by and even rooms immediately above such base units can be exposed to levels of microwaves that are higher than we would recommend for health reasons. This may be especially important if you have a base unit next to your bed, bathing you in microwaves throughout the night.

Many people experience high levels of microwave pollution in their home from a digital cordless phone in the house or flat next door, or even nearby, because microwaves travel through walls with hardly any reduction in signal strength, and can travel for considerable distances. If you have a ‘hotspot’ that is completely mysterious, especially next to a wall, you might want to check this. Many people who have measured the RF levels they are exposing themselves to from their DECT phone, have immediately got rid of it (or them in the case of multiple units,) and returned to wired phones; or at least have used their cordless phone in a similar way to a pager, and used the main wired phone for their longer conversations.

It is harder if the phone belongs to someone else, such as a neighbour. You may decide your only course of action is to shield your family from the incoming radiation, see Section 4.

A DECT phone cable can act as a re-radiator of microwaves. We have been told by one person about their DECT phone, the cable for which entered the house through the bedroom of their daughter, before going to the downstairs base unit. As well as high fields in the base unit room, there were also concerningly high fields in the daughter’s bedroom being re-radiated from the cable.

If you feel that you cannot do without a cordless phone, buy a [low radiation phone](#) from EMFields. These phones emit very low radiation even with multiple handsets.

## Television

The Sky TV multiroom systems communicate with other television sets within the same home using RF at 2.4 GHz. This will add to your RF exposure.

## Lighting

Many fluorescent lights give off levels of RF than can affect people with electrical sensitivity (ES), and the new compact fluorescent (CFL) bulbs also can make people with other light sensitive conditions feel quite ill. Many LED bulbs, which have been suggested as an alternative to the old incandescent bulbs, radiate high levels of RF and are not suitable for people who react to this form of electropollution. EMFields has done a lot of research and testing and has developed a [range of low emission lighting](#), which includes [bulbs](#), [earthed lamps](#) and LED strips.

For more information, see the separate free article on Lighting and EMFs in the EMFields [library](#).

## Computer monitors

Old cathode ray tube (CRT) type screens used to give off high levels of electric and magnetic fields. Manufacturing guidelines have been introduced since the 1990s which means this is no longer the case and powerfrequency fields from a standard PC monitor are very low indeed at the front where the operator sits. Fields from the back and sides can be very variable and care should be taken to avoid sitting in this position, if you do not know what field levels you may be exposed to. For more information see our article [Computing Overview](#). For a meter that can measure powerfrequency fields, see <http://emfields.org/equipment/pro.asp>

## Wireless mice

Most wireless mice communicate using radiofrequency microwaves, it is worth finding an alternative if you are wanting to reduce your exposure to RF radiation. Some use infra red and are not a problem.

## Computer broadband connections

To connect to the internet without using a wireless system, you need one of two things: either a cable connection (via a company such as NTL) or a standard phone line. With dial-up internet the computer will use up the phone line, and you will not be able to use the telephone at the same time, unless you have a line (and a separate number) for each.

However, modern internet connections normally use a technology called ADSL (Asymmetrical Digital Subscriber Line). This technology needs to be enabled at your local telephone exchange. Contact your phone provider (for example BT) and ask them if they can provide broadband to your house - if so they are also likely to send a package containing all you need to connect your computer to the internet (modem, ADSL filter and cables). The modem enables the computer to connect, and the filter ensures that you can use the telephone at the same time as the internet (if you have only one line) without having either service compromised. In fact, BT now supplies broadband down all telephone lines, it just needs to be activated by the company. Unfortunately, that means that all landline telephone are likely to carry RF signals on the cable into the house, even if you have not activated the service.

Both cable and ADSL internet connections are entirely free of microwave EMF emissions, and we have no reason to believe they could be a risk to health.

It is very important however, if you are concerned about health effects from wireless communication devices, not to use one of the "Home hubs" or similar, to connect your computer to the internet. Home Hubs emit a lot of pulsing microwave radiation extending for quite some distance, the company claim over 100 metres 'line of sight', certainly up to 50 metres. They are the hub of choice by BT, given away free with most BT broadband subscriptions. Not only do they have wLAN, but they also have a high-power DECT unit transmitting all the time, even if you don't use the DECT facility. Home Hub 3 does not have a DECT facility, but it does have a BT Zone WiFi phone. The Home Hub 3 powers down its WiFi signal to a low background level when it is not actually in use.

'BT Fusion' rollout is planned to make use of private BT Home Hubs so that Fusion-enabled phones can make cheap voice-over internet protocol phone calls by logging onto Home Hubs in houses that they pass. There is no extra cost to the Home Hub home owner as they have a flat rate broadband connection, but it will increase the amount of microwave radiation in the home environment. It enables BT to roll out a cheap VoIP network with virtually no infrastructure costs.

It is worthwhile bearing in mind, if you are concerned about information security, that the security services can park in your street and get everything, every key press, that passes through a WiFi enabled Home Hub – they can bypass any security you set unless you personally encrypt data outside of the Home Hub connection.

For an alternative, ask in your local computer store for a non-wireless "router" - there are a number of brands that manufacture these, and they are secure, reliable and require very little setting up.

If you have purchased a router for your internet connection, then you will have a number of network "ports". These are the sockets at the back of the router that you plug the network cable from your computer into. You can have as many computers as you have ports provided you have a cable for each. The router will make sure that the machines can all share the internet at the same time.

### **Laptop computers**

Laptops with LCD or TFT screens give off very low EMFs. They do not need the strong low frequency magnetic fields of a traditional CRT monitor, however they use high-frequency fields for driving the back-illumination and also can emit significant levels of radio-frequency electric fields (30 kHz to 300 kHz) from the back illumination and scanning processes. EMFields sells an earthed laptop tray, so that you can use your laptop on your knee without exposing yourself to high levels of RF or low frequency electric fields. RF exposure is associated with male infertility problems.

### **Computer wireless LAN (local area network) broadband connections**

These systems give access to portable lap-top computers that may be used by different members of a household for different purposes, offering the apparent freedom to have fast access without needing to have a fixed source. Houses with such a system installed are sometimes referred to as 'wireless enabled homes'. Systems such as these fill the house with pulsing microwave radiation all of the time (even when the computer(s) is/are not in use), and we believe they should not be used at all.

Most modern laptops are WiFi enabled and many are also bluetooth enabled by default. Even if these facilities are not used, the laptop will be a source of RF radiation when in use. If you wish to disable these facilities, you will need to contact the manufacturer for instructions, as they can vary according to the model you have. You may need to disable the WiFi and the bluetooth facilities in different ways. They may be re-enabled by other software, so the RF radiation levels nearby should be checked from time to time.

### **dLANs / Homeplug devices**

The best way to achieve fast broadband access from more than one room is using two or more dLAN units, which can connect computers and laptops using the power circuitry in the building. The units are plugged into a standard power socket on the wall, and have a computer network port for attaching the laptop or computer to. Plug one into a socket near your router and connect it to the router with normal computer networking cable. The whole house should now be connected to the network, and you can use the other dLAN unit(s) in any room you would like to use your laptop in - just plug it in, turn it on, and connect the laptop via computer networking cable. EMFields sell dLAN units so that you can use your laptops anywhere in the house without using wireless devices.

DLAN units do add radiofrequency noise to the mains wiring, though the levels we have measured (a few tens of microvolts) are negligible in comparison with WLAN devices, and what increase in fields that we *did* see was only in very close proximity to the mains wiring (within a few tens of centimetres).

If you have an internet connection through a dLAN (through the house wiring, rather than a telephone or wireless system), it is important to earth the laptop even if you run it off batteries, as it will pick up and re-radiate electric fields from the house wiring through the dLAN connection. We have measured 400 V/m at the keyboard of one model. Or you could use an earthed tray.

## Microwave ovens

Russian researchers reported a decreased food value of 60 to 90% as a result of cooking foods in a microwave oven. They found significant decreases in vitamins B, C, & E, and essential minerals. Dr C Garcia-Viguera found that broccoli (and she believed other vegetables as well, though these were not specifically tested), lost 97% of its antioxidants (which protect against cancer) when microwaved. The process of vibrating the molecules produces free radicals which are associated with an increased risk of cancer. It is important if you choose to use this form of cooking that you heat the food and drinks to the point of needing to let them cool for two to three minutes at least afterwards in order to let any such free radicals be re-absorbed into the food. This will prevent the particles attaching to the mouth, oesophagus or stomach and potentially being a health hazard.

A Japanese study by Watanabe ([1998](#)) also found that approximately 30-40% of vitamin B12 was lost in foods cooked by microwaves. B12 deficiency is one of several factors that can cause dementia.

There seems to be a growing body of evidence that suggests that human breastmilk or baby formula is changed if heated in a microwave. Vitamin content is reduced and amino acids are altered and become poisons to both the nervous system and the kidneys (Dr Lita Lee of Hawaii, reported in the *Lancet*, December 1989). Paediatrician R Quan and colleagues at Stanford University found that the changes in milk resulted in potentially destructive bacteria ([1992](#)). We do not recommend a microwave oven for the cooking or heating up of any baby foods.

Claire Nelson received a top science prize from the American Chemical Society for research demonstrating that subjecting common plastic wrap to microwave cooking would produce DEHA (diethylhexyl), an identified carcinogen, and transfer it into the food. Dr Edward Fujimoto of Castle Hospital demonstrated that the combination of fat, high heat and plastic could produce dioxins, very potent carcinogens.

Susan Brewster, Associate Professor of Food Chemistry at the University of Illinois, worries about the possibility that certain plasticizers could act as endocrine disruptors, which means they can potentially mimic or compete with human hormones. If they do, then that could affect such things as fertility or someone's risk of getting cancer.

Microwaves are generated for the cooking process. Most microwave ovens are well sealed, so that very little microwave energy goes through the special glass, or around the door seals when it is new. The manufacturers recommend that the ovens are checked annually, especially to detect faulty door seals. Current regulations require that a microwave oven leak no more than 1 milliwatt per square centimetre (mW/cm<sup>2</sup>) when it leaves the factory, and 5 mW/cm<sup>2</sup> after a period of use. We believe these levels to be too high to be really safe and that microwave ovens should be used with great caution. Even when the microwave oven is working correctly, the microwave levels within the kitchen may be higher than those from any nearby mobile phone base station.

We recommend that you keep *at least* a metre away from a microwave oven when it is working. Children, pregnant women and people with a poor immune system should preferably keep out of the kitchen whilst the oven is on.

## **Baby monitors**

All wireless baby monitors should be kept at least 1 metre away from the cot. We would strongly recommend that only low-band (35 to 50 MHz) analogue baby monitors (using frequency modulation that does not pulse) should be used. Many monitors use DECT phone technology which operates at 1.89 GHz or 2.4 GHz. 2.4 GHz is the microwave oven frequency. These are identifiable by the large number of claimed channels (usually at least 30 and often up to 120), which DECT automatically switches between. These emit sharply pulsing bursts of microwave radiation 100 times every second all the time they are turned on.

We have had various reports by parents that their babies did not sleep well and cried a lot when they used DECT monitors but were all right when the baby monitor was not used. When they tried a cheaper analogue monitor, the infant slept as well as they did without the DECT monitor.

We believe that baby monitor mats that check temperature, heartbeat, breathing, etc., should only be used if you have medical reasons to believe that your baby might be in danger of sudden infant death. When used with a wireless baby alarm they carry high levels of microwave radiation (up to 6 volts per metre) right into the cot.

Digital sensor pads transmit significant levels of microwaves into the baby's body when placed under the mattress as suggested (one person measured 4 V/m in the cot). They exchanged it for an analogue type and the child began to sleep better, after having been very fractious during the night. We recommend that you use these pads only with great caution and only if no alternative is available.

We do not recommend the use of wireless video baby monitors that allow you to see your baby on your TV or a portable TV monitor. They run at 2.4 GHz – the microwave oven frequency. Since this has to transmit video and sound, it is likely that it would have a higher power output. The manufacturers note that these cannot be used in conjunction with computer wireless networks due to interference. If you really need that level of baby watching, then have a proper *wired* CCTV system installed

Please note that your baby/infant in a room with a wireless baby monitor will usually be exposed to stronger signals than  $1000 \mu\text{W}/\text{m}^2 = 0.6 \text{ V}/\text{m}$  average, which has been identified in some European studies as increasing the number of people reporting a variety of adverse symptoms, see [Radiofrequency EMFs and Health Risks](#).

## **Alarm buttons**

A type of personal alarm called a TeleAlarm has been found to transmit high levels of RF from the base unit which can not only radiate the user, but also neighbours.

## **Children's games**

The latest-generation games consoles are all wirelessly enabled. These all have the capability to have wireless controllers, and have either integrated or add-on WiFi. Some modern handheld consoles also have WiFi built in.

WiFi-enabled devices give off similar strength EMFs as an average mobile phone mast would give at under 100m, so we consider it prudent to take a precautionary approach and avoid prolonged use of WiFi enabled devices.

One correspondent told us *“We have recently purchased an Xbox 360 and we only allow our children restricted use of the equipment. I noticed that even after 10 minutes my sons both start rubbing their eyes and their faces look like someone who's been sat at a computer all day without any breaks. My eldest has to take himself off into the kitchen because he can't look at the TV screen without it becoming worse. They both sit at least 8.8 feet away, normal TV is fine, I have a 100Hz flat screen cathode set but it only seems to happen when they play these games”*.

Bluetooth used in Wii uses 2.4 GHz, the same as WiFi and DECT phones. One person's grandson's Xbox caused their RF detector to register strongly even when the console was switched off. It is not possible to stop the RF unit transmitting without unplugging the mains lead or switching off at the mains socket. Using the Xbox switch left the RF unit still emitting at full power. When questioned the Xbox customer service spokesperson said *“We regret to inform you but this is the way that the console is designed. It will not be possible to prevent it from emitting microwave signals.”*

## **Burglar alarms**

Active microwave sensors are sometimes used in both domestic and commercial buildings. These usually give out low level microwaves all the time and so we do not recommend their use. If you already have them in your system then you should contact your supplier and discover how to turn off the microwave transmitters in the sensors when you are moving about in the building and the alarm is not required as they are otherwise often energised 24 hours a day, even when the alarm is apparently turned off.

People in the garden may also be exposed continuously.

## **'Smart' utility meters**

There are major discussions taking place with regard to the rollout of smart meters. The situation is somewhat complex and we refer you to our separate article entitled [Smart meters](#) for details.

## **Hearing aids**

Hearing aids are often sensitive to microwaves, especially digital pulsing ones such as are emitted by GSM mobile phones and base stations. These can cause buzzing noises and a high pitched whine. WLANs can cause clicking / scratching sounds, as can some 3G mobile phone systems. The hearing aids should be protected by good design, but often aren't. It is a defect in the hearing aid. Older aids were particularly prone to these problems but some new models still seem to have the problem.

Microwave systems have a microwave transmitter attached to the television set or hi-fi. The receiver is in the headset worn by the person listening. The headsets are safe, but the transmitter gives off high radiofrequency fields. You should sit a reasonable distance away from the transmitter unit.

## **De-humidifiers**

Apparently some de-humidifiers (Kenmore Elite is one) use RF transmissions to indicate when the water container needs emptying. This transmission occurs every 5-6 seconds and is only

disabled when the de-humidifier is unplugged. Switching it off leaves it transmitting at the same rate.

It is difficult to keep track of all the new products being brought on to the market that use wireless technology. We have included most of the ones we know about, but this list gets outdated quite quickly.

The only way to know for sure what your exposure is and whether you can do anything to protect yourself and your family, is to measure the RF field levels with a suitable instrument and research the best ways to protect yourself, should you decide to do so.

The next section covers the instruments that are hired or sold by EMFields. There is information about what you can do to reduce your exposure, and some of the products available screen both the home and the individual.

This article is available to download, free of charge, from [www.emfields.org](http://www.emfields.org)