Cars, planes & airports, trains, buses

Section 1

The Transport article is separated into 2 sections, each of which can be individually downloaded.

This is a 'work in progress' incorporating more information whenever time permits.

Section 1 includes

1. Cars

2. Planes & airports – security, inflight business and entertainment

3. Trains

4. Buses

5. Checking EMF levels, both low frequency and radiofrequency

6. References for subsections 1- 4

Section 2 includes

7. Electric vehicles – cars, hybrid cars, electric buses, fork-lift trucks, electric bikes

8. Mobile phones and transport; motorbikes

9. Traffic control: police radar guns, speed cameras, speed-limiting devices, traffic control sensors, other in-car devices, road trains

10. Travel problems for people with Electrical Sensitivity (EHS)

11. Checking EMF levels, both low frequency and radiofrequency

12. References for subsections 7-10

1. Cars

Electromagnetic fields (EMFs) in cars

Spending time in quite low levels of power frequency EMFs (e.g. 0.4 microtesla (μT) magnetic fields) are associated with an increased risk of developing a number of health problems, including childhood leukaemia. Other serious conditions that have been associated with EMF exposure are various types of cancers, ALS (a type of motor neurone disease), depression, miscarriage and other immune system problems.

Microwave (high frequency EMF) exposure is associated with sleep disorders, memory problems, and mood and behavioural changes.

The main problems reported by some car drivers are more immediate ones that include headaches, concentration problems, "groggyness" and unusual feelings of fatigue.

Powerfrequency fields

Different cars can expose you to very different levels of EMFs, and where you sit in the car can be critical, whether you are the driver or a passenger. The electrical and electronic equipment can disturb electrically sensitive people, especially in the front seats, where the fields are likely to be higher. People can feel worse when cars are stationary, with the engine idling. The smaller the car, that is the closer the engine is to the driver, the higher the EMF exposure is likely to be. Major magnetic peak pulses around 0.1μT occur during braking, and ABS systems tend to create higher magnetic fields. The more electronics are put into the wheel, like cruise control, the more exposure the driver has to deal with. Automatic windows make extra magnetic pulses.

We understand that several microtesla is common and over 100 microtesla has been measured.

Low frequency EMFs are generated by different engine and chassis parts. These include the alternator, and the cables which go from the alternator to the battery. These can produce high levels of EMFs, especially when you drive with full headlights at night. The starter motor and cables produce very high magnetic fields when you are starting the engine but these only last for a few seconds and are not a problem for most people.

We know that some models of BMW, Volvo, Mitsubishi, Audi, Renault, Mercedes, Jaguar, & Honda have had very high levels of low frequency magnetic fields measured inside. There was quite a lot of adverse publicity for Volvo when it was revealed that the V70, S60 and S80 subjected their drivers and some passengers to very high magnetic field levels of up to 18 microtesla. Sales of Volvo cars dipped after this was made public. Since then, Volvo has developed a €225 'fix' for concerned Volvo owners, but they are not actively marketing it as they don't want the subject discussed in public. If you are concerned, we suggest that you measure the fields in a particular type of vehicle - especially as models are continuously changing.

The problem is that the car battery is located in the boot/trunk and not under the bonnet with the engine. As cars have traditionally used the metal car body for the negative connection, they also do this when the battery is in the boot and only run one thick power feed wire (12, or 24 volts) from the alternator/charger unit in the front to the battery in the rear. Because the return current is distributed all throughout the vehicle body, the magnetic fields produced do not cancel and extremely large magnetic fields can be found around the cable.

Some upmarket cars, e.g. Jaguar, Mercedes, BMW, have electronic control units to change the angle and position of car seats under (even a part of) the driver's seat. These can give off high levels of magnetic fields, as will heated seats. Disconnect any electric seat warmers if there are any.

Do not put homoeopathic remedies near the car's wheel arches when transporting them, as they have been shown to lose their potency when exposed to varying magnetic fields.

Radiofrequency fields

Electronic dash panels will also produce high-frequency radiation, and more cars are being fitted with an in-built Bluetooth microwave communications system. This will talk to your mobile phone and any other Bluetooth-enabled electronic device. The effects on people are similar to other digital wireless LAN (local area network) systems. Radio-frequencies are also being used to sense the driver, electronic keytag in some cars, and other vehicle system functions.

Many upmarket, modern cars are being fitted with an in-built, continuously active, Bluetooth microwave communications system. This will talk to your mobile phone and RF CANBUS or any other Bluetooth-enabled electronic device. These expose the driver and front passenger to continually pulsing microwaves. We do not recommend the use of Bluetooth in cars and suggest you get these physically disconnected by your garage.

GPRS/GSM/GPS systems like LoCATe, V-SOL, Quartix, etc. regularly transmit pulsed radio signals using mobile phone technology whilst you are driving around. These systems help the police to locate the car quickly if it gets stolen. It is likely to be wired into a roof aerial, so does not bombard the car occupants with microwaves as much as a mobile phone in the car would. Microchips may be installed in all new cars to enable police to track speeding and other wanted vehicles.

Japanese drivers have been using in-car Internet access since 1997. In December 2009 it was revealed that Ford, Mercedes, BMW, Chrysler, General Motors & Cadillac are all offering in-car connectivity. Autonet Mobile, the producers of the hardware, say the system is designed to support several devices at once, enabling one passenger to update a Facebook page, whilst another is gaming online or watching YouTube videos, for example. It also incorporates a docking station so you can move it from one car to the next.

Apparently one-third of people surveyed by the Consumer Electronics Association want to check e-mail or have internet access in cars. Letting people log on will be a big selling point among people in their 20s, who were about 28% of the driving population in 2010, a nine-point increase from 2004. The system installed by General Motors, called Chevrolet Wi-Fi will create a WiFi hot spot 300 feet in diameter around the vehicle.

A new 'pay as you go' scheme is being trialled, in which cars will have black boxes installed allowing their movements to be tracked by satellite. The motorists will then receive a monthly or weekly bill varying according to when and where they have travelled. They may have to pay up to £1.30 a mile during peak periods on the busiest roads. It is not known whether this will replace existing motoring taxes or be introduced on top of them (Telegraph 2008). The take up of the 'black boxes' has been very low. The EU has ruled that by October 2015 all new cars and vans sold across Europe must be fitted with this technology (eCall) which is designed to help emergency services find crashed vehicles and to otherwise track drivers' movements. Some car manufacturers, including BMW and Volvo, already include eCall devices in their latest models. An SOS button near the dashboard linked to a SIM card, allows drivers to call 999 quickly. And if airbags are deployed it automatically sends a text message to emergency services with the car's location, as well as its unique vehicle ID number.

The RF emissions for other road users will be increased by a little, but it is not yet known what exposure will be experienced by 'black box' owners. Motorists will be unable to switch it off and it will be tested in MOT checks.

Other black boxes monitor driving to inform the driver about behaviour and help keep down the cost of insurance. This can be tempting to younger drivers. The 900 MHz and/or 1800 MHz is the

GSM modem mobile phone connection that transmits the car's behaviour back to the insurance company. So there will be a stream of data sent back, how often may vary between companies, but it is probably fairly frequent when the car is being driven. It is likely to be in the form of a short data-text-message (SMS type) every 5 or 10 minutes.

As it is basically a mobile phone in the vehicle that automatically transmits fairly frequently, it will adversely affect EHS people travelling in the vehicle. It will depend to a certain extent where it is mounted as to what RF levels it produces inside the car – it will also be higher in places with a poor quality mobile phone signal as the GSM modem will turn its power up to keep a connection with the nearest base station.

Some companies claim that they do not remotely monitor live data and just use the stored black-box data after any accident or police incident.

https://www.coverbox.co.uk/black-box-car-insurance/black-box-insurance-for-young-drivers-with-trust

The problem with tyres

Tyres are often the largest contributor to magnetic field exposure in most cars. These fields are caused by permanent magnetism in the radial steel bands within the tyre, generated in the manufacturing process and, to a lesser extent, permanent magnetism in the wheel hub itself. When the wheel rotates, the steel bands produce low frequency pulsing electromagnetic fields (usually below 20 Hz) that some people react adversely to. The fundamental frequency of the fields is determined by the tyre rotation rate and has a high harmonic content (Milham 1999).

Electromagnetic fields are usually highest (they can exceed 2 microtesla) in the front foot wells and some people find they feel better in the back of the car - though not in vehicles where the rear seats are almost over the rear wheels. You can get fabric banded/reinforced tyres but they are not as strong as steel banded radials. The answer is to de-magnetise (degauss) the wheels and tyres just as ships were demagnetised during the last war to avoid magnetic mines. Unfortunately large portable demagnetisers are rare these days, though they have centres in Switzerland. Degaussing the tyres reduces the fields to low levels, but the fields increase gradually over time after degaussing. When you change your car tyres, you may find that the new ones are more highly magnetised than the old ones and this may need to be borne in mind with regard to where you sit or whether de-gaussing may be needed.

The tyre-generated fields are below the frequencies detected by most magnetic field meters, and failure to detect them could compromise exposure assessments associated with epidemiologic studies.

Lights

The indirect blue light exposures in vehicle headlights up to 1.25 lx do not cause unintentional chronodisruption via melatonin suppression (Lerchl 2009). Blue light around 464 nm is most effective usually in suppressing melatonin.

Electric shocks from the metal body of the car

Many people are concerned that they get electric shocks when getting out of their car. Such shocks occur after you slide across synthetic seat covers as you prepare to get out of the car, generating static electricity, which the driver or passenger then discharges by touching the metal body of the car. This is normal, but can be somewhat unpleasant. It can easily be prevented by

holding onto the metal of the car, perhaps the roof or the door pillar as you get out. This prevents static build-up, so there is no sudden discharge.

When your car lock doesn't work

The Dolphin TETRA mobile communications system is known to be able to interfere with vehicle electronic locks and alarms. This is because the Government issued Dolphin with frequencies very close to those used by car-locking and alarm systems. Unfortunately, car electronics are unable to reject the relatively powerful and pulsing Dolphin signals which therefore end up 'jamming' some cars' electronic locking systems. There were about 1000 Dolphin TETRA base stations around the UK. The Dolphin network failed to attract enough customers and was sold cheaply to UK Broadband during 2004. The future of these base stations is now in question but some areas are likely to remain active and may be sold to users such as bus, transport and security companies.

Some types of equipment on Ministry of Defence property give off microwave radiation. Fylingdales has been in the news because it was creating signals which interfered with car-locking devices, resulting in problems with people getting into their cars to leave.

Visitors to Windermere (Windermere Daily Mail February 2010) found that their cars would neither lock nor unlock when close to a restaurant using a wireless order taker. The frequencies used by the key fobs and the order machine were similar enough to interfere with the comparatively weak signal from the cars' key fobs. The restaurant's devices were reprogrammed to avoid the problem.

US security researchers found that the computer systems used to control modern cars were easily subverted. They showed how to kill a car engine remotely, turn off the brakes so the car would not stop and make instruments give false readings. They concentrated on the electronic control units (ECUs) scattered throughout modern vehicles which oversee the workings of many car components. Individual control units typically oversee one subsystem but ECUs communicate so that many different systems can be controlled as the situation demands (BBC 2010).

In July 2014, the UK government announced that driverless cars will be allowed on public roads from January 2015. UK engineers have been experimenting with driverless cars, but concerns about legal and insurance issues have so far restricted the machines to private roads. Changes will be made to the Highway Code, which applies to England, Scotland and Wales. It is not clear how the developing new technologies used by a range of manufacturers will impact on the EMFs experienced both within vehicles and next to the roads where these new vehicles will travel.

2. Planes and airports

Air travel, like most aspects of modern living is becoming ever more changed by the advent of new technology, and it is surprising how RF polluted the cabins of most aircraft are.

More ‘gadgetry’ is being imposed on the travelling public either for security checks or for inflight business and entertainment.

Also concerning is that terrorists could use on-board WiFi to hack into flight systems and crash passenger planes, according to the Government Accountability Office (GAO) in the US, as reported in the Mail online (April 2015).

Mobile phone use had been banned on planes because the strength of a handset's signal interfered with an aircraft's instrumentation. Changed technology has enabled the signal to be weakened, because it only has to reach a transmitter at the back of the aircraft. The transmitter is

switched on by the cabin crew after the plane reaches 3,000 feet, creating an onboard network, routed via satellite to another network on the ground (Daily Telegraph June 2008).

The changes that are taking place may make it increasingly impossible for people with ES to use airport facilities or to travel in modern planes.

Brian tells his story:

"I have become highly electrosensitive and cannot travel on air flights with in-seat entertainment – cheap charter flights are generally OK, interestingly enough."

Security

In order to detect passengers attempting to carry suspect items on board planes, metal and X-ray detectors are used for security checks. It is not just passengers who will be exposed to high levels of electromagnetic fields (EMFs), but also the airport staff who spend time near the machines.

Airport security systems have been found to interfere with implanted medical devices, with sometimes serious repercussions (Hours 2013).

Whole-body scanners which use frequencies in the terahertz (THz) part of the EMF spectrum are increasingly used, as they can reveal the presence of non-metal weaponry. A consortium of European universities reported on research carried out between 2001 and 2004 on THz radiation (Terahertz Bridge, 2004). They concluded that THz radiation could damage cells in the body. There is not enough evidence as yet to determine what effects these changes may be and who may be vulnerable.

Alexandrov (2010) found that resonant effects allow Terahertz waves to unzip double-stranded DNA, creating bubbles in the double strand that could significantly interfere with processes such as gene expression and DNA replication.

Inflight business and entertainment

The personal lights above the seats in a plane are often high-frequency fluorescent lights and can be sources of significant electric fields. Fluorescent lights are often associated with the triggering of ES. It can make people feel very uncomfortable and even ill.

Some planes have in-flight video screens built into the back of each seat. These are a source of high-frequency fields both for the people watching the screen and for those whose seat it is fitted into.

Inflight mobile phone technology is now available to passengers, as is WiFi. Plane companies are installing a picocell base station – effectively, a small mobile phone mast – onboard the aircraft. This will increase RF exposure to all passengers.

There are also signals from various plane transponders mounted under the fuselage which make their way up into the cabin at surprisingly high levels. Many also have an emergency Iridium phone system that is internally active all the time they are in the air, with active handsets at both ends of the plane using a pulsed cordless phone-like signal all the time to link with the Iridium communications rack.

Bmi has been trialling passenger availability of texting for mobile and PDAs, and internet access through laptops fitted with GSM data cards. According to a spokesperson from OnAir, the company providing the service, *"The proximity of the miniature phone mast, or picocell, to passengers' mobile phones means that handsets will emit only a low signal, so potential for interference with the aircraft's avionics are kept to a minimum."* No guarantees about non-interference with passengers' biology though. The company is also working with Ryanair, Air France, TAP Portugal and a number of carriers in the Middle East and Asia.

It is important to identify sources of EMFs and monitor the potential health changes in travellers, whether they are family, friends, work colleagues, etc. While we accept that security measures help us all to travel more safely, it may be that some of the inflight facilities are not worth the added risk, and it may be that lobbying for low EMF exposure flights, at least in some areas of the plane, will benefit more than the increasing number of people suffering with EHS.

3. Trains

People on trains can be exposed to static and alternating magnetic fields which are higher than background levels in most homes and many workplaces (Chadwick & Lowes 1998). Electric trains have the highest magnetic field exposure. Some have public locations that exceed the ICNIRP public exposure investigation value of 360 microtesla in the UK, and still 100 microtesla in the rest of Europe. Train drivers who had the greatest exposure, were nearly five times more likely to develop myeloid leukaemia and three times as likely to develop Hodgkin's disease than station managers, the workers with the lowest exposure (Röösli 2007).

High-speed electric multiple unit (EMU) trains generate high-frequency electric fields, low-frequency magnetic fields, and high-frequency wideband electromagnetic emissions when running. Potential human health concerns arise because the electromagnetic disturbances are transmitted mainly into the car body from windows, and from there to passengers and train staff. Niu (2016) conducted a series of tests of the on board electromagnetic field distribution on several high-speed railway lines. While results showed that exposure was within permitted levels, the possibility of long-term health effects should be investigated.

Most trains are WiFi enabled so that travellers can use their laptops for business or leisure whilst in the train. This will make such a form of transport very difficult for people who are ES (electrically hypersensitive). Virgin trains was fined in 2010 for missing two deadlines to provide WiFi services as stipulated in its franchise agreement. Apparently over one third of business passengers stated that access to WiFi was a key benefit of travelling by train. Apparently there were technical difficulties because the signal needed for WiFi is weakened by the high metallic content in the windows. It is unclear whether the 'quiet' carriages ban the use of mobile phones only, but allow laptop internet access.

Most railway stations offer online internet access for use by business passengers waiting for trains on platforms or in the waiting areas. There is a charge for the service that may put off people wanting to use the system to watch video or play games or music, but many may decide to use the system to pass the time.

Exposure from a mobile phone was highest during train rides. In fact, the impact of one's own mobile phone on personal RF-EMF measurements was not observable because of high background uplink radiation from other people's mobile phones (Urbinello & Röösli 2012). 'Second-hand' exposure can be considerable, as train carriages act like 'Faraday cages' reflecting much of the RF radiation. All passengers, including infants, pregnant women and those without mobile phones may be exposed to considerable levels of radiation from others' mobiles. The Israeli Environmental Protection Ministry found that *"when 25% of the passengers in one train carriage used their mobiles, all the passengers are exposed to a level of radiation higher than the limit of 0.8 W/Kg"*. So the other 75% who are not using their mobiles are also being exposed to levels which exceed the legal safety limit for heating.

GSM levels were about 100 times higher than in cars. Smart phones, including the iPhone4 and the Blackberry Bold 8800, which can operate on 4 RF bands, emit more radiation in stand-by than older phones.

London Underground

The system mobile phone operators have developed to enable people to use their phones whilst in the Underground uses power cables to re-radiate microwave signals (leaky feeders) in order to get a signal to mobile phone users, adding to everybody's general exposure to microwaves.

4. Buses

In 2008, a pan-European research project, led by the University of Applied Sciences in Osnabruck, Germany installed on-board environmental sensors, cameras and GPSs in buses. The buses transmit data wirelessly, over mobile phone networks, WiFi and WiMAX, to traffic control centres.

The sensor systems could be used to detect fog and ice on the roads, as well as analysing traffic conditions and giving alerts about smog conditions. Most large cities where this type of system would be deployed, already have very extensive camera systems, inductive loops and

environmental sensors networks in place to analyse traffic and weather, but the information provided by buses is considered to be a useful supplement.

Japanese school buses

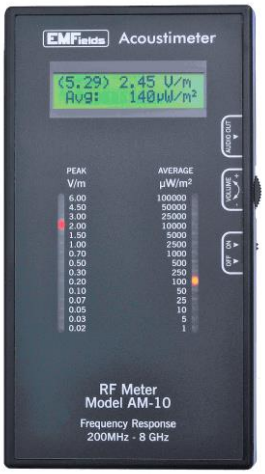
Determined not to miss any opportunity for study, Japanese school buses now provide workstations for the pupils.

5. Checking EMF levels, frequency and radiofrequency

A study by Urbinello (2014) found that the highest total RF-EMF exposure levels occurred in public transports (all public transports combined) with arithmetic mean values of 0.84 V/m in Brussels, 0.72 V/m in Ghent, and 0.59 V/m in Basel.

The meters shown below can all be bought from EMFields www.emfields-solutions.com.

The Acoustimeter or Acousticom 2 can identify any microwave levels. The EMFields Pocket Power Frequency Meter (PF5, available in either microtesla or milligauss versions) can be used to check powerfrequency EMFs.



Acoustimeter

Acousticom 2

Pocket PF5

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