Electric vehicles, mobile phones, traffic control, EHS

Section 2

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

<u>This is a 'work in progress' incorporating more information whenever time permits.</u>

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 – electric 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

7. Electric vehicles

Cars

Electric vehicles can produce VERY high magnetic fields from the large battery currents and the electric motor. Starting and stopping currents produce very high magnetic field pulses. This may become an increasing problem with car companies and customers seeking more environmentally friendly vehicles and looking at all electric, or dual fuel cars.

Many electric cars use VLF switching to control the motor's speed and power. We believe that magnetic fields in electric cars should be measured and published as a matter of priority.

The Nissan LEAF electric car has its features controlled by a smartphone. Air conditioning and cockpit temperature can be programmed; you can check the battery levels and set the vehicle to send a message to say it has full power if you left it charging. The navigation system provides an up to date list of public charging spots. The car has a 100-mile range and a top speed of 90 mph (Daily Mail 2010). The Nissan Leaf, in common with other electric vehicles, has limitations of battery efficiency in extremes of temperature. Both high and low temperatures reduce the range of travel, and greenhouse gas emissions can vary up to 22% due to temperature variation (Yuksel & Michalek 2015).

Wireless charging of electric vehicles has been introduced into Coventry and Birmingham. The charging starts automatically when the electric car is driven over a pad containing an induction coil which charges the coil in a pad in the body of the car.

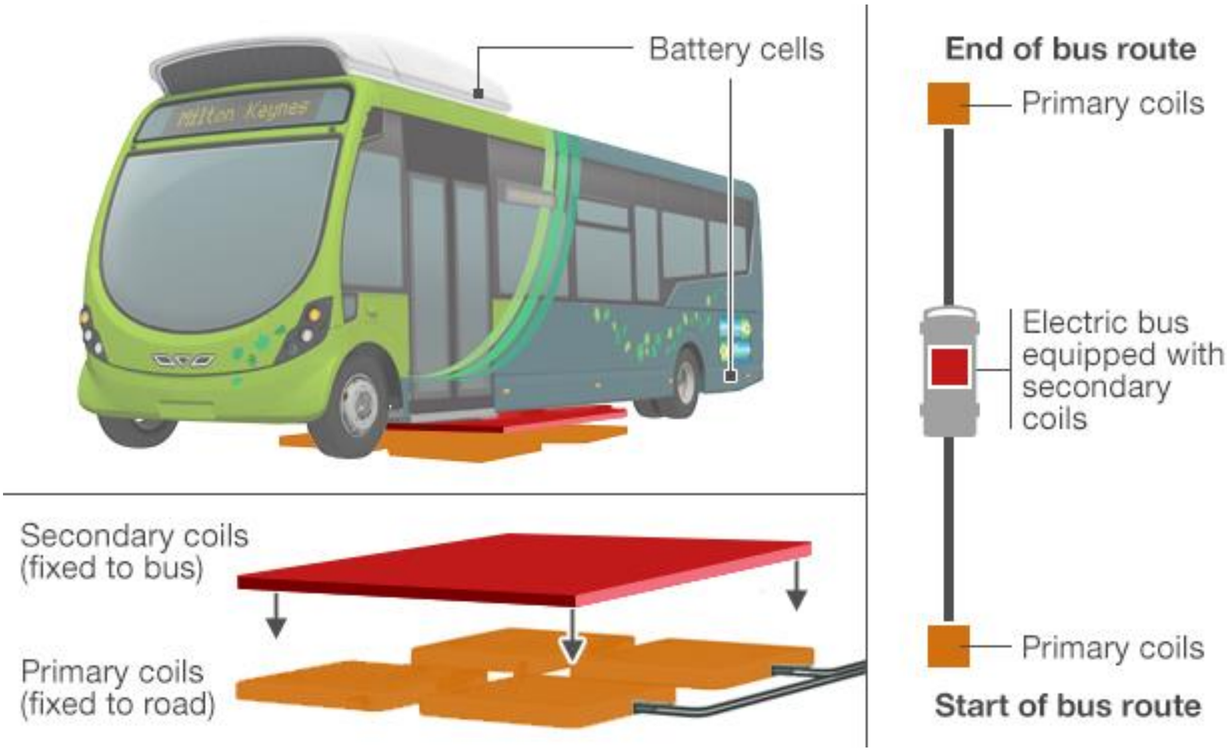
Controlled electric vehicle charging can reduce associated generation costs by 23%-34% in part only by shifting loads to lower-cost, higher-emitting coal plants. This shift results in increased costs of health and environmental damages from increased air pollution. We find that controlled charging of electric vehicles produces negative net social benefits but could have positive net social benefits in a future grid with sufficient coal retirements and wind penetration (Weis 2015).

Hybrid cars

Many hybrid cars can give off high levels of magnetic fields. In 2007, the Prius had no fields over 0.08 microtesla (µT), and then only during hard acceleration or battery charging. Hybrid cars tend to have more pulses in the kHz range due to the switching between gas and electric operation. The Israeli government cancelled an order of 200 hybrid Toyotas for their police after measuring high levels of electromagnetic radiation from the batteries and electronic systems (August 2010). The Israeli government said that any more than 4 hours a day in the car would constitute a health risk. Toyota took legal steps to stop the Israeli government from releasing the radiation measurements. In the US purchasers of the Prius with solar roof cells are reporting headaches and nausea. The Prius is sensitising some drivers to EMFs, resulting in a more generalised ES.

Hareuveny (2015) looked at magnetic field exposure in hybrid cars. All four seats under various driving scenarios the fields were between 0.06-0.09 µT. Hybrid cars had an especially large percentage of measurements above 0.2 µT. These field levels were higher for moving conditions compared to standing while idling or revving at 2500 RPM and higher still at 80 km/h compared to 40 km/h. Fields in were higher at the back seats, particularly the back right seat where 16%-69% of measurements were greater than 0.2 µT. As our results do not include low frequency fields (below 30 Hz) that might be generated by tyre rotation, we suggest that net currents flowing through the cars' metallic chassis may be a possible source of magnetic fields.

Electric bus



The magnetic fields in the bus whilst it was charging were measured and the highest level was 0.304 µT (Tell 2014).

Fork-lift trucks

Men who drive electric fork-lift trucks as a job seem to be at greater risk of testicular and other cancers, especially where the batteries are under the driver's seat and the driver’s lower trunk is quite highly exposed for hours on end - especially to starting transients. Women drivers may also be at greater risk of developing colon and gynaecological cancers.

Electric bikes

E-bikes in China are the single largest adoption of alternative fuel vehicles in history, with more than 100 million e-bikes purchased in the decade previous to 2011. In 34 major cities in China, CO2 emissions were measured (Ji 2011) and though they vary, they are an order of magnitude greater for e-cars and conventional vehicles than for e-bikes. For most cities, the net result is that primary environmental health impacts per passenger-km are greater for e-cars than for petrol cars (3.6 x on average), lower than for diesel cars (2.5 x on average) and equal to diesel buses. E-bikes yield lower environmental health impacts per passenger-km than the three conventional vehicles investigated. The authors highlighted the importance of considering exposures, and especially the proximity of emissions to people, when evaluating environmental health impacts for electric vehicles.

8. Mobile Phones and transport

In a study by Joseph across 5 European countries (2010), the highest total personal RF exposure was measured inside transport vehicles (cars, trains and buses). This was mainly due to mobile phone handsets. The maximum SAR induced for mobile phone users in a vehicle is 5% higher than those in free space. The SAR values around the non-users body varied a lot in different situations and were higher than those in free space, in some circumstances (Leung 2012).

Car drivers have not been allowed, by UK law since 2003, to use a hand held mobile phone whilst driving. They must stop to do so, or they must use a hands-free kit. A study by Strayer & Johnston (2001) reported that, in a simulation experiment, those engaged in mobile phone conversations missed twice as many traffic signals as when they were not talking on the phone and took longer to react to the signals that they *did* detect. Most interestingly, there was no difference between hand-held and hands-free mobile phone users and it is thought that concentrating on a conversation with an unseen person is the main problem. He (2014) found that both speech-based communication and handheld text entries impaired driving performance by causing more variation in speed and lane position. Handheld text entry also increased the brake response time an increased variation in headway distance. In a review and meta-analysis by Ferdinand and Menachemi (2014) of the literature examining the detrimental relationship between driving performance and engaging in secondary tasks, they found that studies examining mobile phone use while driving were 16% more likely to find such a relationship.

Oommen & Stahl (2005) and Atchley & Dressel (2004) suggested that holding a phone to the ear, and the subsequent reduced freedom of head movement, limiting visual awareness may be at least partly responsible. Törnros & Bolling (2005) conducted a study in which many aspects of driving were changed by mobile phone dialling and conversation which were likely to increase the risk of accidents.

Recent brain imaging suggests that having a conversation with a remote person uses the same part of the brain as that part which is involved in recognising events outside the vehicle. The car driver forms a visual image of the person or context at the end of the phone, which reduces their ability to be aware of the circumstances in which they are driving. We can usually temporarily 'switch off' other distractions, whilst needing to react to an external stimulus such as a busy roundabout, or heavy traffic flow on a motorway, and then switch back. When somebody else, unaware of the circumstances we are coping with is on the other end of the phone conversation, the switch is not under our control.

In Kuwait 51.1% of adult drivers always or almost always used a mobile phone when driving and 32.4% texted or sent SMSs (Raman 2013). In Mexico, 11% used a mobile phone while driving. People were more likely to use a phone if they were alone on major roads in non-taxi cars during the weekdays (Vera-López 2013). The odds of a driver using a handheld phone while traveling alone was over 4 times higher than for a driver traveling with passengers (Wundersitz 2014). Taxi drivers in Mekelle Town, Ethiopia were more likely to have a road traffic crash if they received a mobile phone call while driving (Asefa 2015).

However, any conversation (including with a passenger) was found to affect reaction time in a simulated condition (Consiglio 2003); even the ringing of a phone affected complex reaction time and quality of a performed task (Zajdel 2012). In a study by Haque & Washington (2014) the reaction times of drivers were more than 40% longer in the group using a phone. The impairment was almost double for those with provisional licences. A reduction in the ability to detect peripheral traffic events whist distracted presents a significant safety concern. Text messaging whilst driving has a negative impact on simulated driving performance. This impact appears to exceed the impact of talking on a mobile phone whilst driving. Participants responded more slowly to the onset of braking lights and showed impairments in forward and lateral control compared with a driving-only condition. Text-messaging drivers were involved in more crashes than drivers not engaged in text messaging (Drews 2009), 'heavy' texters being almost twice as likely to be involved in a collision resulting in orthopaedic trauma injuries. Thapa (2015) found the distraction and subsequent elevated crash risk of texting while driving linger even after the texting event has ceased.

Crash risk was strongly associated with heightened anticipation about incoming phone calls or messages among compulsive phone users (O'Connor 2013). Young (under 25), heavy (more than 30 texts a week), texters were nearly 7 times more likely to be involved in such an accident (Issar 2013). Cazzulino (2014) also found that young drivers were an at-risk group for distracted driving. Using a mobile phone whilst driving persists even when children are passengers in the car, putting them at risk (Roney 2013).

The increase of distracted driving behaviour has resulted in an increase in injury and death. A study by Hoff (2013) indicated that people fail to perceive the dangers inherent in distracted driving. 63% of drivers believed that they could drive safely while distracted, despite the fact that 9% of the drivers surveyed reported being involved in a car accident while distracted. The highest reported frequency of distracting behaviour included mobile phone use was 69% of study respondents. Despite the increased awareness on the dangers of texting and mobile phone use while driving, these specific activities were 2 of the most frequently observed distractions. Drivers less than 30 years old were texting/dialling more frequently than drivers aged 30-50 and more than 50 years old (Huisingh 2015).

In a study by Farmer (2015) monitored drivers were talking on a mobile phone 7% of the time, interacting in some other way with a mobile phone 5% of the time, and engaging in some other secondary activity (sometimes in conjunction with mobile phone use) 33% of the time. In another study by the same team (2015), drivers spent 11.7% of their driving time interacting with a mobile phone; primarily talking on the phone (6.5%) or simply holding the phone in their hand or lap (3.7%). The risk of a near-crash/crash event was approximately 17% higher when the driver was interacting with a mobile phone, due primarily to actions of reaching for/answering/dialling, which nearly triples risk.

Dialling or texting on a mobile phone, passengers, and in-vehicle sources resulted in an increase in likelihood of more severe injuries for young and mid-age drivers. Talking on a mobile phone had a similar effect for younger drivers but was not significant for mid-age drivers. For older drivers, the highest odds of severe injuries were observed with dialling or texting on a mobile phone, followed by in-vehicle sources and talking on the mobile phone (Donmez & Liu 2015).

A UK study (Sullman 2015) found that younger drivers are more likely to drive distracted (including talking on a handheld or a hands-free mobile phone), which probably contributes to their higher crash rates.

Centers for Disease Control and Prevention (2013) reported that the prevalence of talking on a mobile phone while driving at least once in the past 30 days ranged from 21% in the UK to 69% in the United States, and the prevalence of drivers who had read or sent text or e-mail messages while driving at least once in the past 30 days ranged from 15% in Spain to 31% in Portugal and the United States. In an observational study of driving distractions in Spain, younger drivers and to a lesser extent middle-age drivers, were more frequently observed talking on a handheld mobile phone, and texting or keying numbers. The authors (Prat 2015) suggested that a substantial number of the drivers, especially younger ones, were putting themselves at an increased risk of becoming involved in a crash by engaging in non-driving related tasks at the same time as driving.

In a study of driving behaviour in a traffic simulator (Stavrinos 2013), distraction (in most cases, text messaging) had a significantly negative impact on traffic flow, such that participants exhibited greater fluctuation in speed, changed lanes significantly fewer times, and took longer to complete the scenario. In turn, more simulated vehicles passed the participant drivers while they were texting or talking on a mobile phone than while undistracted. The results indicate that distracted driving, particularly texting, may lead to reduced safety and traffic flow, thus having a negative impact on traffic operations.

Taking some antihistamines has an added effect when a mobile phone is also being used on brake reaction time, and could increase the likelihood of having an accident (Tashiro 2005).

53% of new university students report that they text more than 50 times a day. 24% report they text more than 100 times a day. 73% report they text while driving, and 92% believe that texting affects their concentration while driving (Buchanan 2013).

Using any sort of phone while driving a vehicle slows the driver's reaction time by about as much as being just over the UK drink-drive limit. The government has issued a leaflet about driving with mobile phones, www.thinkroadsafety.gov.uk/advice/mobilephones.htm.

One of the few effects of using a phone (whether mobile or hands-free) in a car that is accepted by ***all*** researchers, is that it increases accidents. Recent estimates suggest that some mobile phone users use 60% of their mobile phone time when they are driving. Microwave exposure is not only associated with concentration problems, but also mood changes. Using phones in cars may be responsible for the increase in road rage as well as accidents. Asbridge (2013) found crash culpability was significantly associated with mobile phone use by drivers, increasing the odds of a crash for which they were responsible by 70%. The risk was especially high for middle-aged drivers.

In 2009 the National Highway Traffic Safety Administration (NHTSA) estimated that there were nearly 6,000 distracted driver fatalities and 515,000 injuries in the United States alone. Software is available to disable mobile phone use while driving, but using the advanced technology may require legislation along with a renewed sense of driver responsibility (Dildy Jr 2012). Teen drivers are most susceptible to the dangers of distracted driving, such as using a mobile phone, as is made evident in the over-representation of teens in distraction-related motor vehicle crashes (Adeola & Gibbons 2013).

Distracted drivers (including those distracted by the use of mobile phones) were found to be the cause of an increasing share of fatalities found among pedestrians and bicycle riders (Stimpson 2013).

Despite the proliferation of laws in the USA limiting drivers' mobile phone use, a study by McCartt (2014) found that it is unclear whether the restrictions are having the desired effects on safety. Distracted driving activities are common among drivers of child passengers. More than 75% of participants in a study by Macy (2014) reported mobile-phone related distractions. These were associated with the child riding daily in the family car, non-Hispanic white, and higher education.

Microwave radiation can be reflected from metal surfaces. Although passengers can quite legally use a mobile phone in a car, it is not a good idea. All the people in the car, including the driver and any children, will not only be radiated by the phone being used, but also by radiation reflected off the metal surfaces of the car. This will also happen when the phone is in standby mode, as it will be communicating (at full power) with base stations as you travel through different areas to ensure continuity of signal. This can happen as frequently as several times a minute, especially in areas of uncertain or poor signal strength.

One way of preventing microwave exposure being increased by reflections off the inside of cars is to install a hands-free kit with an aerial outside the car. Aerials inside the car will be nearly as bad as no aerial at all.

One man, in a personal communication, says "*I had an aerial for the handsfree, by the window, also acting as a tax disc holder (professional handsfree installation). I used to feel a bit ill while driving even with the phone on standby, and thought the aerial might have some part to play. Having moved the aerial to the roof outside, the illness (kind of headache) seems to have disappeared, and the level on the (microwave) monitor is medium when a call is in progress (was high field). I also have a fibreglass bodied car (with glass sunroof) and the levels were high all the time wherever the phone was placed, though I expect the signals bounce off the body etc. The signals from the masts can be picked up while driving past masts at speed on the motorway.*"

If you really HAVE to use a phone in a car or on a train or bus, it is best to hold the phone as close as possible to the nearest window. Remember that when the phone is partially screened from the base station (by the car or train body) then it will work at a much higher power than if you used it in the same place but outside the vehicle.

Motorbikes

The prevalence of mobile phone use among motorcyclists in Mexican cities was 0.64% (Pérez-Núñez 2014); it was highest among motorcyclists not using a helmet (1.45%) and those riding on 1-lane roads (1.6%).

9. Traffic control

Police radar guns

There are two methods by which police determine whether a motorist is speeding. They can direct a microwave beam from a radar gun, or they can use a laser (infrared light) speed gun. This isn't a hazard for passing motorists but there have been reports of increased cancer incidence in the police officers who regularly hold the radar guns. In 1998, Finkelstein found an increase in testicular cancer and melanoma skin cancer among police officers working with traffic radar.

Speed Cameras

People have reported reacting to average speed cameras, but it is unclear what the mechanism of interaction may be, as most cameras use infra-red lights and cameras and image analysis. Neither RF nor microwaves are used.

Speed-limiting devices

New speed-limiting devices will use satellite positioning to check a vehicle's location and when its speed exceeds the limit, power will be reduced and the brakes applied if necessary (BBC report December 2008). The government's transport advisers claim the technology would cut road accidents with injuries by 29%. There would also be a positive impact on emissions and fuel consumption. As long as this technology is optional, and people with ES can opt out of its use, any RF exposure using satellite positioning, will be very small and only affect the car's occupants during transmission, which could be continuous. The satellite emissions themselves will be very small to the general public.

A spokesman for road safety charity Brake said: "*Ideally Brake would like to see compulsory mandatory ISA* (Interactive Speed Adaptation devices) introduced in the UK to physically stop drivers from breaking the speed limit."

In Lancashire, motorists were given free sat navs which inform them of speed limits. It was suggested that drivers sometimes speed when they are simply unaware that the limit has changed. Campaigners at the institute of Advanced Motoring (IAM) reckon that sat nav systems could reduce road deaths and injuries by as much as 29% on the county's rural roads. It was felt that, if successful, insurance companies may reduce premiums for drivers.

Traffic control sensors

Car sensors for traffic control usually use under-the-road magnetic field induction loops which are not an EMF hazard. Temporary traffic lights use microwave doppler units which point directly at the passing cars and usually in through the windscreen of the first car in the queue. Unless you make a habit of stopping in this position, this will not be a problem for most people as the power in the microwave beam is very low. It can, however, affect electrically sensitive people.

Other in-car devices

We have heard about a small in-car device that gives advance warning of traffic congestion on motorways and other large roads. Its name is suffixed by '1800', the frequency it receives as the carrier for this information. The device itself is just a receiver, and does not present a hazard. We expect that the transmitters will, by and large, use already existing mobile phone masts by the side of roads. However, the more gadgets we have that use microwave-transmitted information, the more our air is polluted by high-frequency electrosmog.

Microchips may be installed in all new cars to enable police to track speeding and other wanted vehicles.

A young man who wanted to reduce his large car insurance premium fitted a box into his car that would allow the car insurance company monitor his driving times (he had agreed not to drive between 11 p.m. And 5 a.m., the time when many young drivers have accidents) and the box would communicate with his insurer if he drove when he was not supposed to.

The new car tracking devices that may be introduced in order to impose car tax according to road use is basically a GPS box (see above) with a GPRS interface to the mobile phone network. It radios back the position every time the car moves about 100 metres. There is no external antenna and the unit is usually dashboard mounted so the driver is sitting next to a series of phone calls being made almost continuously whilst driving along.

Road trains

The BBC reported in November 2009 that 'road trains' are to be trialled in Europe in an attempt to cut fuel consumption, journey times and congestion. The lead vehicle would be handled by a professional driver, leaving the following vehicle occupants free to relax. Each vehicle would have its own control and software monitoring system. The 'platoons', which are likely to include trucks and cars, will be active so vehicles can join and leave as they need.

An alternative system to achieve these goals by wiring up motorways with wireless sensors would be too expensive.

If this system is implemented on UK roads, all cars may come fitted with wireless potential to be a part of the road train system, in an attempt to reduce fuel consumption and excess speeding, adding to the RF exposure experienced by passengers.

There are plans to set up Intelligent Transport systems throughout Europe. The benefits include less congestion and fewer accidents. *"If you're driving on an icy road, in future your car will automatically give this information to other drivers who use the same road,"* said a spokesperson for the public-private partnership ERTICO-ITS which is developing intelligent transport systems and services.

Halgamuge (2010) measured the electromagnetic fields in trams, trains and hybrid cars and found them to be lower than ICNIRP exposure limits.

10. Travel for people with EHS

People with EHS are likely to be much more affected by EMFs in cars, sometimes making it almost impossible for them to travel in them. As a general rule, the cars giving most problems are likely to be new, expensive ones, especially those with RF CANBUS, or Bluetooth-enabled systems, or with their batteries in the rear. Another source of problems in one person's case, was the sampling device for climate control in cars. It was only by disabling this that he was able to tolerate car journeys. If the car is producing high EMFs, driving can be all but impossible for an electrically sensitive driver. They may well experience loss of coordination and fatigue that can result in dangerous driver error. One person sold his £50,000 BMW because he believed it aggravated his electrical sensitivity. He drives his wife’s 12-year-old Nissan instead.

The older and less sophisticated (cheaper) cars may be able to be tolerated, though magnetised wheels and tyres can be a problem in all vehicles.

One person found that a Vauxhall Vectra had been equipped with wireless sensors to detect whether the child seat was in place in the front passenger seat in order for the air bag to be disabled. It made her feel very ill.

A person who has been studying the condition of EHS and its consequences for some years, found that a significant proportion of those she was in contact with had suffered damage to the back, often from car accidents. This jarring to the spine led to an imbalance in the cranial fluid cushioning the brain which was felt to result in a decreased ability of the brain to deal with external stimuli. When faced with such a stimulus, the three layers of tissue around the brain go into spasm. It is not clear what effect this would have on general biological functioning, but it may well explain some of the differences in symptoms experienced by some EHS sufferers.

Possibly extra care could be taken with respect to EMF exposure for some time after such an event in an individual's life, to avoid the development of EHS. However, there may not be an instant reaction in the body's internal electromagnetic communication network to a traumatic incident such as a car accident, and other types of provocation may be needed for EHS to manifest.

Choose your car carefully, preferably using a meter (see subsection 11) to determine the field levels, and keep journeys as short as practicable in cars when you are unaware of the field levels you may be exposed to.

Boarding

Boarding areas are difficult. Disability helpers at airports should be able to fast track people if needed.

Anyone looking to fly on US commercial carriers within the USA should ask for 1) a plane without WiFi; 2) entry at the airport with a check-in procedure that takes the person to a non WiFi area (supposedly British Airways has done this) 3) possible partitioning of aircraft for phone use in one section.

11. Checking EMF levels, low frequency and radiofrequency

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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