

Digital Enhanced Cordless Telecommunication or DECT phones

It is a 'work in progress' incorporating new information whenever time permits.

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Digital Enhanced Cordless Telecommunication or DECT phones

Most cordless phones sold in the last few years are made to the Digital Enhanced (previously also called European) Cordless Telephone (DECT) Standard. These offer an operating range up to a few hundred metres. Most allow a number of extra handsets which can be used as intercoms or for multi-person calls. DECT phones emit pulses of microwave radiation very similar to cellular phones. The frequencies used are between 1880 and 1930 MHz. A frequency band at 2,400 MHz is also being authorised.

Ordinary mobile phone systems are 'intelligent' and once the link is established the base station directs the handset to turn down its output to the lowest level adequate to maintain the call. In city areas and near to base stations this can be as low as 4 milliwatts peak power, half a milliwatt average. This does *not* happen with DECT cordless phones.

Cordless phones used to give off high levels of radiofrequency signals *only* when they were in use on a call. Most modern DECT phones now emit the same level of microwaves *inside* your house, or workplace as a small mobile phone base station *outside*, not just when the phone is in use, but *all the time*. In fact, DECT phones are responsible for 22.7% of our RF exposure according to the paper by Frei (2009). The person near the base unit may be subjecting themselves to over 6 volts per metre, and rooms nearby 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. Microwaves travel through walls with hardly any reduction in signal strength, so you could be exposed to RF from a colleague's DECT phone. If you have a 'hotspot' that is completely mysterious, next to a wall, you might want to check this. A DECT phone cable can also act as a re-radiator of microwaves.

With DECT cordless phones there are 100 bursts of 250 milliwatts of microwave radiation pulses next to the user's head every second. Increasing numbers of scientists believe that it is the regular pulsing that disrupts our brain's intercellular signalling which is responsible for many of the adverse health effects that people experience.

Radiofrequency (microwave) emissions

Holding a DECT phone to your head will always expose you to higher levels of microwave fields than you will ever experience (in public access areas) from a mobile phone base-station. Digital cordless phones and their base units emit pulsed microwaves and these can exceed the levels from an actual mobile phone in areas where the mobile phone service has good signal strengths.

A study by Tomitsch (2010) found that the highest levels of RFs in Austrian houses were caused by DECT phones which emitted more than 3 V/m compared with mobile phone base stations at 1.4 V/m, whilst Mamrot (2015) found the field levels near DECT cordless telephones base units were from 1.5 to 5.5 V/m.

A recent study by Havas (2010) found that the pulsed signals from DECT phones can affect heart rate. Increases in heart rate coincide with the switching on of a DECT and cease when it is unplugged. The arrhythmia and/or tachycardia experienced by the study respondents were at RF levels (0.6 V/m) well below the current guidelines. The symptoms were often accompanied by feelings of pain or pressure in the chest and anxiety that would appear and disappeared for no apparent reason. In a further replication study, Havas & Marrongelle (2013) found a few participants had a severe reaction to the radiation with an increase in heart rate; 7% were classified as being "moderately to very" sensitive, 29% were "little to moderately" sensitive. They added "*the protocol used underestimates reaction to electromagnetic radiation for those who have a delayed autonomic nervous system reaction and it may under diagnose those who have adrenal exhaustion as their ability to mount a response to a stressor is diminished.*"

The person near the base unit may be subjecting themselves to over 6 volts per metre. Haumann & Sierck (2002) reported levels of 3.7 V/m at 1 metre distance, and still 1.9 V/m at 2 metres away. The RF signals can travel through walls and ceilings too. The level can be over 1 V/m in rooms directly above. Adverse health effects have been found at these levels (Zwamborn 2003). If you use the phone close to its main base unit then you will be exposed to two separate doses of microwave radiation. If you have a base unit next to your bed or on your desk at work, you could be exposed for many hours to this level of radiation.

Many people who have measured the RF levels from their DECT phone, have immediately got rid of it (or them, in the case of multiple units) and returned to the 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.

There are now some low radiation cordless phones beginning to be available, such as the Siemens Gigaset [ECO-DECT Plus](#) range sold by EMFields.

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.

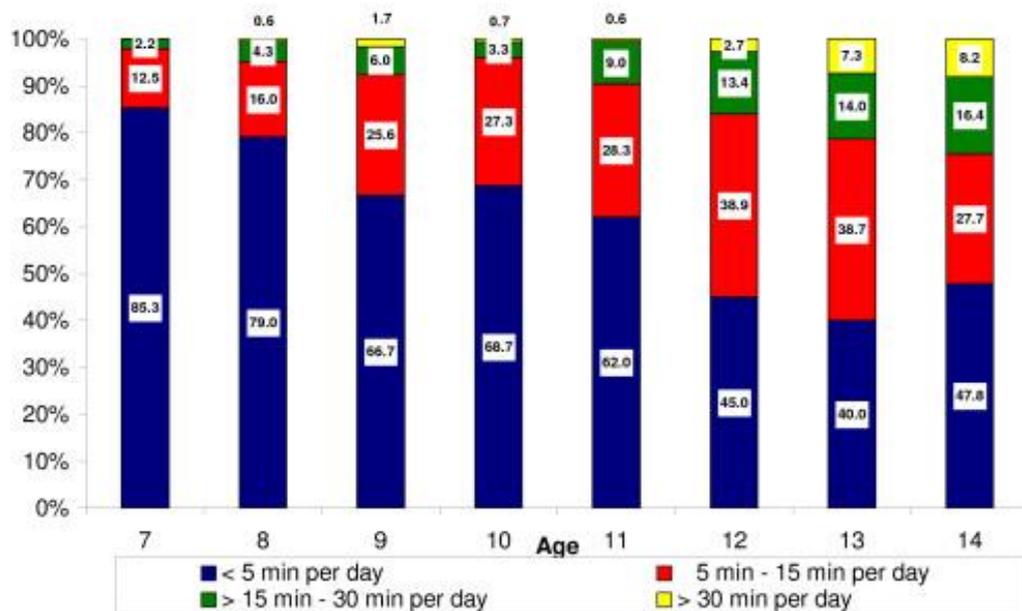
A woman in Israel (personal communication) felt ill and was avoiding certain rooms in her house without knowing why, but blaming the mobile phone masts she could see from her window. It got so bad she wanted to sell the house and move. When she measured the field levels with a meter, such as the ones you can hire ([Acoustimeter](#)) or buy ([Acoustimeter](#) or [Acousticom 2](#)) she found there was no radiation in the rooms from which she could see the masts. But in the kitchen, on the other side of the house, the meter was reading over scale. It turned out that the reason was a DECT phone in the kitchen, which wasn't even being used! As soon as she removed the DECT phone - no radiation. Now she doesn't want to sell her house anymore.

ELF EMF emissions

DECT phones also emit low frequency magnetic field pulses into the side of the user's head. They pulse at 100 Hz in step with the microwave pulses. Dr L von Klitzing (a medical physicist from the University of Lübeck) reported in 1999 that 100 Hz occurs within the human brain wave patterns. DECT phone emissions may interfere with this brain activity, in ways that are unclear without further research. He began to have infants brought to him who were perfectly healthy, but their heart beat started going crazy for no obvious reasons. As soon as the DECT cordless phone was removed from the bedroom or neighbouring apartment, the infant's heart beat went back to normal.

A 58-year-old man had been suffering from mild heart palpitations when he got a DECT phone. In a matter of weeks, they became severe, resulting in being rushed to hospital. He got rid of the DECT phone and has had no palpitations since.

The low frequency magnetic field pulses into the side of the user's head can be as high as 5 microtesla in strength. Childhood leukaemia has repeatedly been associated with low frequency magnetic field levels of over 0.4 microtesla. We do not recommend that children use cordless phones. The bar graph below is taken from a study by Söderqvist [2007](#) showing the usage of cordless phones by Swedish children aged between 7 and 14 years.



The base unit's mains adapter gives off high levels of low frequency fields, too, when the phone unit is plugged in, whether the phone is in use or not. Magnetic fields travel through adjoining walls in the same way as microwave radiation. If you decide to keep your cordless phone, it is important that you give careful consideration as to where the base unit is positioned. It should certainly be located well away from where you sit or sleep.

Health problems

UMTS (3G) phones use a different form of modulation and people using these may experience different effects. As DECT phones are charged at normal call rates, many cordless phone users spend longer on their phone calls than mobile phone users.

Brain tumours

- We have only received a few adverse reports from users of the original *analogue* cordless telephones. There have not been many studies carried out on DECT telephones, but the research studies by Lennart Hardell and his team [Hardell [2003](#), [2004](#), [2005a](#), [2005b](#), [2006a](#), [2006b](#), [2006c](#), [Mild 2007](#)] have found a link between *digital* cordless phone use and an increased risk of developing brain tumours, both benign and malignant, and T-cell non-Hodgkin's lymphoma, especially in younger (20-29 years) age groups ([2004](#)). Ipsilateral (same side as the phone is held) tumours were especially implicated (Hardell [2002](#), [2003](#), [2009](#), [2013](#)). Most of the research shows that the longer the person has used the phone, the higher the risk. Professor Hardell commented "*The health risks from a DECT phone are the same as for a regularly used mobile. They are usually in rooms where people spend a lot of time and people tend to spend longer on them than they do on a mobile.*" The use of cordless phones increased the chance of developing an acoustic neuroma by 1.5 times (also Pettersson [2014](#)) which changed to more than 8 times with 20 years or more use. Carlberg ([2013](#)) found an increased risk of meningioma in those with the highest cumulative use of a mobile or cordless phone.

- Hardell (2011) reported that the incidence of cutaneous malignant melanomas has increased in Sweden. In the most exposed areas, temporal area, cheek and ear cumulative use of a mobile or cordless phone of more than 365 hours doubled the risk of melanoma in the group using the phone for more than 1-5 years, and highest risk was for first use no matter where the melanoma occurred.
- Schüz (2006) found no increase in risk of brain tumours as a result of sleeping with a cordless phone next to the bed, in fact, if anything it was slightly protective!
- Table from the Hardell 2006a paper, combining the results from 2005a, 2006b and 2006c.

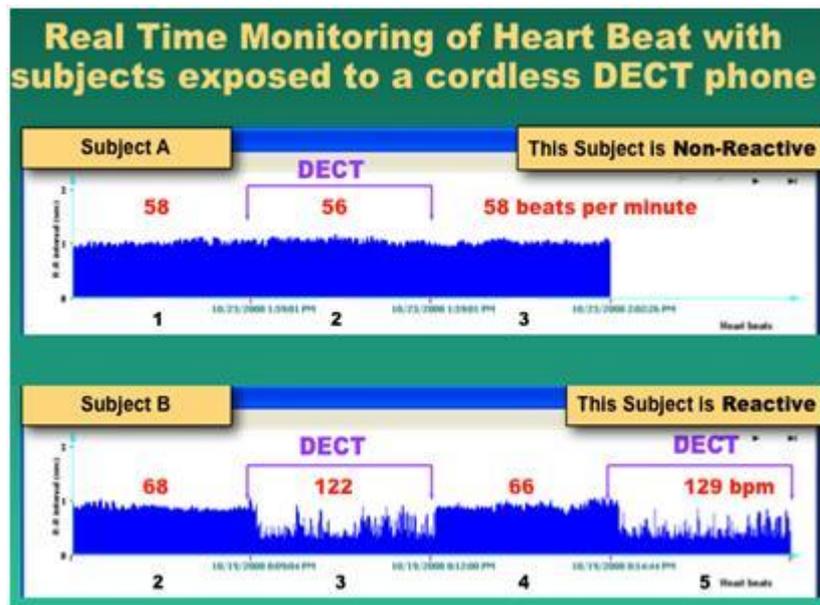
Use of cellular and cordless phones and odds ratio (OR) and 95 % confidence intervals (CI) for different tumour types.

Study period	>1 year latency		>5 years latency		>10 years latency	
	OR	CI	OR	CI	OR	CI
CNS 1997–2003						
- All	1.3	(1.1–1.5)	1.6	(1.3–1.9)	1.9	(1.2–2.9)
- Benign, all	1.2	(1.01–1.4)	1.5	(1.2–1.9)	1.6	(0.9–2.7)
- Meningioma	1.1	(0.9–1.4)	1.5	(1.1–1.9)	1.8	(1.01–3.2)
- Acoustic neuroma	1.5	(1.04–2.0)	1.6	(1.02–2.6)	1.3	(0.4–3.8)
- Malignant, all	1.3	(1.1–1.6)	1.6	(1.2–2.1)	2.1	(1.2–3.5)
- Astrocytoma, grade I-II	1.4	(0.9–2.3)	1.9	(1.03–3.5)	1.8	(0.6–5.9)
- Astrocytoma, gr.III-IV	1.5	(1.1–1.9)	2.1	(1.5–2.9)	2.7	(1.5–5.0)
Non-Hodgkin lymphoma 1999–2002						
NHL -B-cell	1.0	(0.8–1.3)	1.0	(0.7–1.3)	1.1	(0.6–1.8)
NHL -T-cell	1.4	(0.6–2.9)	2.5	(1.1–5.6)	3.2	(1.05–9.5)

Another study by Hardell (2013b) found confirmation of previous results of an association between cordless phone use and malignant brain tumours. This provides support for the hypothesis that RF-EMFs play a role both in the initiation and promotion stages of carcinogenesis.

Carlberg & Hardell (2014) found a decreased survival time for glioma patients who were long-term users of cordless and mobile phones.

Heart problems



Source: Magda Havas

This is an image depicting how quickly a heart can be impacted by microwave radiation. In the two cases, the radiation is from a cordless phone. Cordless phones emit the same radiation as mobile phones. Note that instantly, subject B's heart rate *almost doubled* on each exposure to the cordless phone radiation.

A study by Havas (2010) showed immediate and dramatic changes in both heart rate and heart rate variability associated with microwave exposure from a cordless phone at levels well below the public exposure guidelines in Canada and the United States.

Other health effects

All types of microwave exposure at the sort of levels received as a result of handset use have been shown to produce genetic damage inside blood cells.

The health effects of low-frequency magnetic fields include suppression of important blood chemicals and reversing the action of the common breast cancer treatment drug Tamoxifen, as well as the association with clinical depression, some forms of organic dementias, brain tumours, miscarriages and immune system dysfunction. Immune system effects have also been found as a result of the RF exposure (Mina [2016](#)).

Almost as many regular DECT users complain of headaches, earaches, extreme fatigue, concentration and memory loss as those who react to GSM / PCN (2G) digital mobile phones. Mortazavi ([2007](#)) found a significant association between the use of DECT phones and concentration or attention disorders. Fragopoulou ([2012](#)) reported that long-term radiation from DECT phones as well as mobile phones altered significantly the expression of 143 proteins. Several neural function related proteins, heat shock proteins and cytoskeletal proteins are included as well as proteins of brain metabolism. The authors concluded *"the observed protein expression changes may be related to brain plasticity alterations, indicative of oxidative stress in the nervous system or involved in apoptosis and might potentially explain human health hazards reported so far, such as headaches, sleep disturbance, fatigue, memory deficits and brain tumour long-term induction under similar exposure conditions."*

Very little research has been done into the possibility of breaches in the blood-cerebrospinal fluid barrier. In one study (Söderqvist [2009](#)), the use of DECT phones was associated with higher serum transthyretin (TTR) levels, another possible indicator of the effects on thyroid levels.

A 45-year-old bookkeeper from Jersey had two cordless phones in her house when she began to question the technology. She got rid of them *“and within 24 hours I felt a sort of pressure in my head go.”* But the real change was in her 6 year-old son, who had been having sleep problems, feeling sick after coming home from school and was temperamental. When she got rid of the phones *“he became calmer and slept much better.”*

Professor Hardell claims that *“We can expect an increase in diseases such as Alzheimer’s and Parkinson’s due to neurological damage and tumours.”*

Behaviour Changes

Guxens (2013) found that children exposed to prenatal phone use (both mobile and cordless phones) were about twice as likely to be reported by their teachers as having overall behaviour problems at age 5.

Changes in animals and insects

Bees worldwide have been involved in a disappearing act called “colony collapse” disorder, heavy losses being reported in 24 US states, Greece, Italy, Poland, Portugal, Spain and increasingly, the UK. There have been a number of theories as to why this may be happening. There are a number of reasons, including the increase in microwave radiation now affecting the environment all over the world. Some researchers in Landau University in Germany subjected hives of honeybees to DECT base unit radiation and compared the bee behaviour to ones in hives that were not irradiated. Hardly any bees returned to the hives irradiated after an absence of 45 minutes, whereas about two thirds of the non-irradiated bees returned within this time. The weight of honeycomb from the radiated hives was 20% less. Experiments dating well back to the last century have documented the phenomenal sensitivity of honeybees to electromagnetic fields.

In a personal communication in April 2010, we heard that many dogs and cats have been dying of tumours and in each case the owner confirmed the presence of a DECT cordless phone in the kitchen which is generally where the animals spent most of their day.

Reported in a veterinary practice:

- 1) A dog with lameness in the forelegs and the rear leg for 6 months. There was no further lameness following the removal of the cordless phone. Relapse occurred when the dog went to a family that had a cordless telephone in the home for the holiday period. There was a spontaneous cure 3 days after return into a home that was now free of disturbing influences.
- 2) The dog’s owner: Headaches and severe joint pains (elbow, shoulder joint and finger) for 7 years; without the DECT phone, most of this woman’s symptoms disappeared completely after 2 months.
- 3) A cat with chronic pain in the lumbar region which makes walking difficult and makes jumping up onto chairs impossible. The telephone was removed one and a half years later, the muscles in the lumbar region relaxed and the cat was soon able to jump up onto chairs again.
- 4) Horse with chronic lameness originating from the right subtalar joint. When the home DECT phone was removed the horse’s symptoms subsided within a few days.
- 5) The horse’s owner had severe upper jaw pain below the right eye which was almost unbearable, which developed after the purchase of the DECT phone. After removal of the phone, her pain progressively lessened after 2 days and then completely disappeared.
- 6) Dog with chronic diarrhoea, blood sample showing clear hypothyroidism; the cordless phone was removed, the dog became healthy, and the thyroid gland started functioning properly again.

- 7) Cat with severe hair loss. 3 months after the removal of the DECT phone, the cat had a shiny fur coat.
- 8) Horse with sudden and painful swellings in the right hip area; removal of the DECT phone, and the horse begins to work again quite normally and is taken to exhibitions.
- 9) Guinea pig with acute lameness of the hind leg, living in the room with the DECT transmitter. This was replaced with a traditional landline and there has been no relapse.
- 10) Large cross-breed with acute lameness in the hind quarters and a rash. There was immediate improvement after removing the DECT phone and a wLAN.
- 11) Cat with a skin complaint on the outer ear for a year. A few days after the removal of the DECT phone, the skin wound began to heal and then completely recovered. A second cat has been less aggressive since then. Another 2 cats were fighting constantly. After the DECT phone was switched off, their behaviour quickly became "much, much better".

Many more examples of improvements in animals' and owners' health and behaviour were described after removal of DECT phones.

Manta found ([2013](#)) free radical increase in the ovaries of flies after exposure to DECT radiation from the base unit when not in use.

Neighbours

In flats, terraced or semi-detached houses, a neighbour's DECT phone can result in high levels of microwave radiation in your property. If you have a 'hotspot' that is completely mysterious, next to a party wall, you might want to check this. Your neighbour may be prepared to change their phone or move it away from the party wall, or, if they refuse to do anything about it, you may want to shield your family from the incoming radiation (see our article, in 6 freely downloadable sections - Radiofrequency Protection for you and your family).

Restrictions

Warnings found in the instruction pamphlet that accompanies the DECT cordless phone state: "Make sure it is at least 1 metre away from other electrical products to avoid interference." It seems that possible interference with brain functioning is not considered as important as interference with electrical gadgetry.

In the same year as Dr von Klitzing's report, the Professional Association of Building Biology Consultants in Germany demanded the ban of DECT cordless phone technology.

It is also worth remembering that DECT phones will not work if you have a power cut.

Legal implications

An employee of the National Public Insurance Institute in Italy has been awarded an 80% disability pension by a judge who said their brain tumour was caused by hours of occupational use of a DECT and a mobile phone. The employer is to pay all court costs. This judgement makes it possible for employees in Italy to insist on the supply of a corded phone and to advise their employer that they are legally liable for future damages should they insist on the use of a cordless phone. This ruling, if challenged in court, may apply to other EU countries. The Consumer Centre in South Tirol advises everyone to insist on a written declaration regarding the use of telecommunication equipment which expressly states that the employer takes all responsibility for any future medium or long term consequences.

Try to persuade your employer to return to wired phones or buy a low radiation phone. Ensure that if you have more than one handset you buy a phone that continues to emit low radiation with multiple handsets. Many only offer this facility if you have one handset only.

Low EMF Cordless phones

EMFields has a number of [Cordless phones](#) that emit very low levels of EMF when in use, and none when the phone is not being used for a call.

The normal DECT Standard requires a base unit to transmit a signal at full power 24-7 even when you are not actually making phone calls. The pulsing transmissions are quite powerful and can still measure several volts per metre up to about 5 metres from the unit. It is like having a small mobile phone mast inside your home. Even if you live near a mobile phone base station, a normal DECT unit inside your home is likely to expose you to higher levels of pulsing microwaves!

Siemens have produced a range of DECT compatible phones that turn off their transmitters when a call is not being made. The Gigaset ECO-DECT units have adaptive power control and their unique Plus version allows the units to stop transmitting when no telephone call is taking place. There are a few other makes that can turn down their power slightly, but they still irradiate you 24-7.

References:

Carlberg M & L Hardell 2014 - *Decreased survival of glioma patients with astrocytoma grade IV (glioblastoma multiforme) associated with long-term use of mobile and cordless phones* Int J Res Public Health 11(10):10790-805 PMID: 25325361

Carlberg M et al 2013 - *Meningioma patients diagnosed 2007--2009 and the association with use of mobile and cordless phones: a case--control study* Environ Health 12(1):60 PMID: 23870102

Fragopoulou AF et al 2012 - *Brain proteome response following whole body exposure of mice to mobile phone or wireless DECT base radiation* Electromagn Biol Med 31(4):250-74 PMID: 22263702

Frei P et al 2009 - *Temporal and spatial variability of personal exposure to radio frequency electromagnetic fields* Environ Res 109(6):779-85 PMID: 19476932

Guxens M et al 2013 - *Maternal cell phone and cordless phone use during pregnancy and behaviour problems in 5-year-old children* J Epidemiol Community Health 67(5):432-8 PMID: 23386674

Hardell L et al 2013b - *Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use* Int J Oncol 43(6):1833-45 PMID: 24064953

Hardell L et al 2013 - *Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997-2003 and 2007-2009 and use of mobile and cordless phones* Int J Oncol 43(4):1036-44 PMID: 23877578

Hardell L et al 2011 - *Case-control study on the use of mobile and cordless phones and the risk for malignant melanoma in the head and neck region* Pathophysiology 18(4):325-33 PMID: 21764571

Hardell L & M Carlberg 2009 - *Mobile phones, cordless phones and the risk for brain tumours* Int J Oncol 35(1):5-17 PMID: 19513546

Hardell L et al 2006a - *Tumour risk associated with use of cellular telephones or cordless desktop telephones* World J Surg Oncol 4:74 PMID: 17034627

Hardell L et al 2006b - *Pooled analysis of two case-control studies on use of cellular and cordless telephones and the risk for malignant brain tumours diagnosed in 1997-2003* Int Arch Occup Environ Health 79(8):630-9 PMID: 16541280

Hardell L et al 2006c - *Pooled analysis of two case-control studies on use of cellular and cordless telephones and the risk for benign brain tumours diagnosed in 1997-2003* Int J Oncol 28(2):509-18 PMID: 16391807

Hardell L et al 2005a - *Use of cellular or cordless telephones and the risk for non-Hodgkin's lymphoma* Int Arch Occup Environ Health 78(8):625-32 PMID: 16001209

Hardell L et al 2005b – *Case-control study on cellular and cordless telephones and the risk for acoustic neuroma or meningioma in patients diagnosed 2000-2003* Neuroepidemiology 25(3):120-8 PMID: 15956809

Hardell L et al 2004 – *Cellular and cordless telephone use and the association with brain tumours in different age groups* Arch Environ Health 59(3):132-7 PMID: 16121902

Hardell L et al 2003 - *Further aspects on cellular and cordless phones and brain tumours - An update on their earlier study.* Int. Journal Oncology, 22:399-407, 2003 PMID: 12527940

Hardell L et al 2002 – *Case-control study on the use of cellular and cordless phones and the risk for malignant brain tumours* Int J Radiat Biol 78(10):931-6 PMID: 12465658

Haumann T & P Sierck 2002 – *Non-stop pulsed 2.4 GHz radiation inside our homes* 2nd International Workshop on Biological Effects of Electromagnetic Fields 7-11 October 2002

Havas M & J Marrongelle 2013 - *Replication of heart rate variability provocation study with 2.4-GHz cordless phone confirms original findings* Electromagn Biol Med 32(2):253-66 PMID: 23675629

Havas M et al 2010 – *Provocation study using heart rate variability shows microwave radiation from 2.4 GHz cordless phone affects autonomic nervous system* Published in Non-thermal effects and mechanisms of interaction between electromagnetic fields and living matter: 273-300

Havas M et al 2010 – *Microwave Radiation Affects Autonomic Nervous System* Eu J Oncology Library Vol 5

Mamrot P et al 2015 – *[Electromagnetic fields in the vicinity of DECT cordless telephones and mobile phones]* Med Pr 66(6):803-14 PMID: 26674167

Manta AK et al 2013 - *Reactive oxygen species elevation and recovery in Drosophila bodies and ovaries following short-term and long-term exposure to DECT base EMF* Electromagn Biol Med 33(2):118-31 PMID: 23781995

Mild KH et al 2007 – *Pooled analysis of two Swedish case-control studies on the use of mobile and cordless telephones and the risk of brain tumours diagnosed during 1997-2003* Int J Occup Saf Ergon 13(1):63-71 PMID: 17362659

Mina D et al 2016 – *Immune responses of a wall lizard to whole-body exposure to radiofrequency electromagnetic radiation* Int J Radiat Biol 92(3):162-8 PMID: 26853383

Mortazavi SM et al 2007 – *Prevalence of subjective poor health symptoms associated with exposure to electromagnetic fields among university students* Bioelectromagnetics 28(4):326-30 PMID: 17330851

Pettersson D et al 2014 – *Long-term Mobile Phone Use and Acoustic Neuroma Risk* Epidemiology 25(2):233-41 PMID: 24434752

Schüz J et al 2006 - *Radiofrequency electromagnetic fields emitted from base stations of DECT cordless phones and the risk of glioma and meningioma (Interphone Study Group, Germany)* Radiat Res 166 (1 Pt 1):116-9 PMID: 16808597

Söderqvist F et al 2009 – *Mobile and cordless telephones, serum transthyretin and the blood-cerebrospinal fluid barrier: a cross-sectional study* Environ Health 8:19 PMID: 19383125

Söderqvist F et al 2007 – *Ownership and use of wireless telephones: a population-based study of Swedish children aged 7-14 years* BMC Public Health 7:105 PMID: 17561999

Tomitsch J et al 2010 – *Survey of electromagnetic field exposure in bedrooms of residences in lower Austria* Bioelectromagnetics 31(3):200-8 PMID: 19780092

Zwamborn Prof. A P M et al 2003 - *Effects of Global Communication system radio-frequency fields on Well Being and Cognitive Functions of human subjects with and without subjective complaints. The report is on www.ez.nl/beleid/home_ond/gsm/docs/TNO-FEL_REPORT_03148_Definitief.pdf.*