

Mobile Phone - A Technical Evaluation On Electromagnetic Exposure And Specific Absorption Rate (SAR) For Human Safety.

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ABSTRACT: *Technology plays a significant role in our daily lives; no doubt, it has made our lives very easy with its unlimited advantages. Cell Phone is one of such device that has made our life so easy that we cannot even think of a world without it. This electronic device has multiple uses and functions. It has become an important part and parcel of our life. Without cell phones we usually feel incomplete. Trendy and stylish cell phones have become a part of fashion now days. But this very device emits electromagnetic radiation which is the emerging health concern of the 21st century. There is too great a risk that the ever increasing RF-based communications technologies represent a real danger to humans, especially because of their exponential, ongoing and unchecked growth. Every aspect of electrohypersensitive peoples' lives, including the ability to work productively in society, have healthy relations and find safe, permanent housing, is at stake. The DNA in living cells recognizes electromagnetic fields at very low levels of exposure; and produces a biochemical stress response. The scientific evidence tells us that our safety standards are inadequate, and that we must protect ourselves from exposure to EMF due to power lines, cell phones and the risk of many more known/unknown consequences. The issue of electromagnetic health hazards should be addressed seriously and appropriate measures to be taken while there is still time. In this paper, I tried to focus on the salient aspects of health hazards and intend to grow awareness amongst the common mass in the days to come.*

KEYWORDS: *Electrohypersensitive, Radiation, EMF, DNA, 5G Mobile, Health hazard, Microwave etc.*

1. INTRODUCTION

The invasion by wireless technologies into the social-sphere has led not to personal connectivity and communication as advertised—but to alienation and isolation, less face-to-face community and cohesiveness, a speeding up of social relations, and a sense of 'placelessness'. On the collective level, this mobile communication and electromagnetic infrastructure has led to more exposure, more vulnerable environment as the radio frequency increases generation wise. The introduction of high frequency mobile phone is the successive development of the generations:

- 1st generation (1G)
Analog phones; early 80's; 450 & 900 MHz, introduced in 1981.
- 2nd generation (2G)
Digital (Global System for Mobile Comm, or GSM); early 90's; 900 & 1800 MHz, 1992.
- 3rd generation (3G)
Universal Mobile Telecommunication System (UMTS), 2003; 1900-2200 MHz, introduced in 2001 and products expected in 2012-2013.
- 4th generation (4G)
Still relatively new; frequency 2000-8000 MHz, introduced in 2011.
- 5th generation (5G)
5th Generation Mobile (5G) Technology promises to revolutionize wireless phone service. This technology will provide consumers with these same abilities, but with an intuitive interface that actually learns about a consumer's preferences and buying habits.

Each new generation has operated at a higher frequency: and the more is the changing generation, the more is the power requirement. The distinguishing factor that the radiofrequency introduces heating from other means of heating is the rapidity of heating, the depth of penetration, and the existence of internal hot-spots, that can result in tissue damage long before the overall body temperature increases dramatically. Human brain is particularly susceptible to the occurrence of these hot-spots. Depending on the size of the head and the frequency of the radiation, regions of relatively high absorption can occur at or near the center of the brain. These effects are especially uncontrollable in the near-field during the use of mobile communication devices like cordless and cellular phones and very unpredictable due to the variable shape, size, and thickness of skulls. However, the main objectively measurable hazard of microwave radiation is injury to the eyes, especially damaging at frequencies above 800 MHz. Since the lens of the eye does not have an adequate vascular system for the exchange of heat, even a slight rise in temperature can cause protein coagulation, and opacities in the lens may form.

2. BRIEF HISTORY OF CELL PHONES

A cellular phone is a wireless phone that most people these days communicate with. It seems that not to long ago that people were still using house. In 1843 a man by the name of Michael Faraday studied to see if space could conduct electricity. This man led to the cell phone development. In the year of 1865 Doctor Mahlon Loomis, a dentist of New Work was the first person to communicate through wireless atmosphere. He came up with the idea of transmitting and receiving messages through atmosphere as a conductor. In 1973 Martin Copper came up with Motorola. He took the project and let the people of New York see it. In 1977 the first cell phone was made in Chicago. When it first came out 2000 people was given a free trial. Then other places started to make cell phones. When to cell phone first came out they were huge. The people did not know how to make the phone

any more compact. In 1988 the big company's started to make cell phones. There were over 54 places all over the world.

3. POSSIBLE HAZARDS FROM CELL PHONE

Cell phones emit radiofrequency energy, a form of non-ionizing electromagnetic radiation, which can be absorbed by tissues closest to where the phone is held. The amount of radiofrequency energy a cell phone user is exposed to depend on the technology of the phone, the distance between the phone's antenna and the user, the extent and type of use, and the user's distance from cell phone towers. 60% of the radiation emitted by a typical cell phone, (enough to cause heating), will be absorbed by the user's head.

3.1. Commonly Studied Health Risks:

- Possible association with cancer.
- Source of distraction while driving.
- Poor fertility/DNA damage in males.
- Miscarriage/morbidity in unborn children.
- CNS (migraine, vertigo, ALS, MS, epilepsy).
- Interference with pacemakers, hearing aids, and defibrillators.
- Exposure to radiation from cell phone towers.



Figure 1: Mobile phone and exposure to human brain

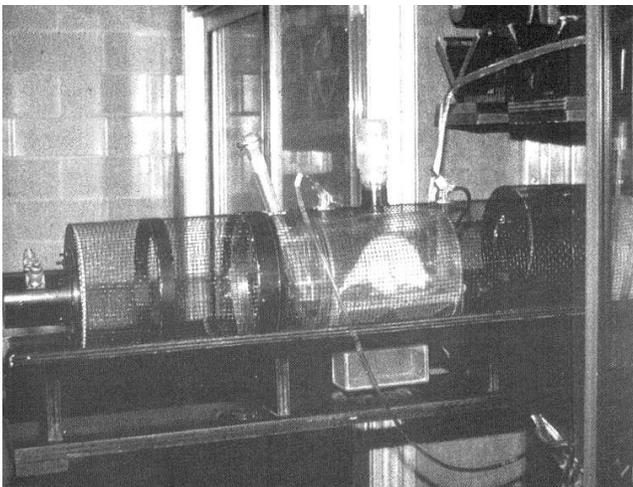


Figure 2: Testing of Rat where whole of Rat's body was subjected to radiation.

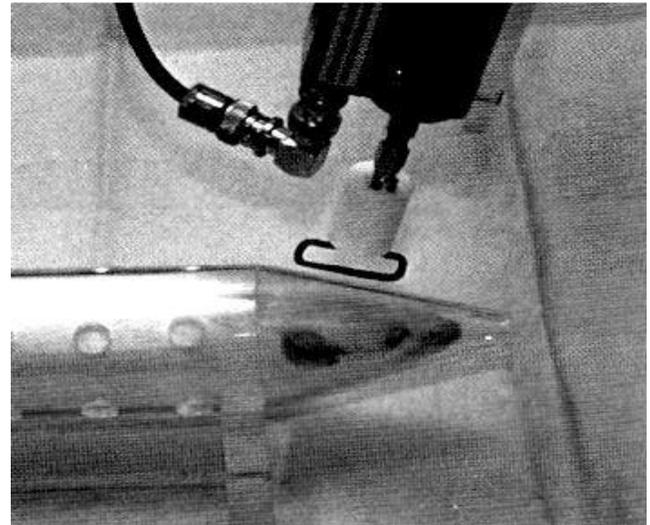


Figure 3: Testing of Rat using stealth technology, where only the head of the Rat is subjected to radiation, not the whole body.

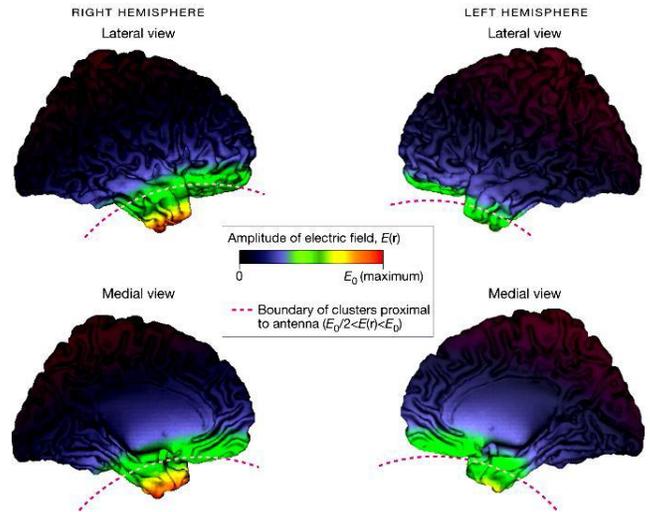


Figure 4: Amplitude of the Electric Field Emitted by the Right Cellular Telephone Antenna Rendered on the surface of the Human Brain.

In fig.5 E_0 indicates maximal field value. Clusters proximal to the antenna are inferior to the red dashed line.

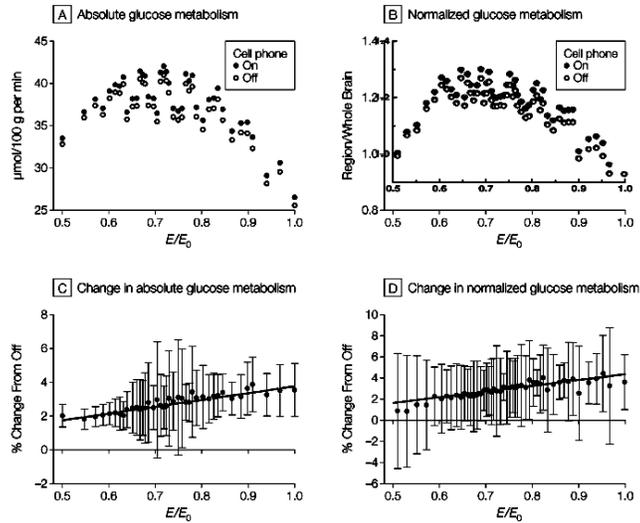
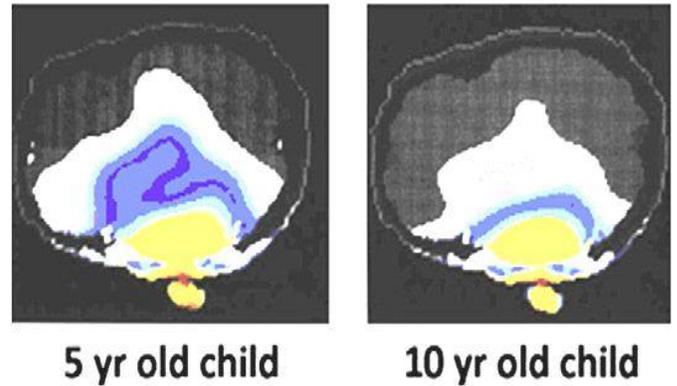


Figure 5: Effects of Cell Phone Radiofrequency Signal Exposure on Brain Glucose Metabolism.

- Children’s immune system not as well developed as adults.
- Longer potential for life time exposure for children than adults.



6. (a)

Fig. 5 is a measure of Absolute and Normalized Glucose Metabolism and Correlation between Estimated Electromagnetic Field Amplitudes. A and B, mean measures of absolute glucose metabolism ($\mu\text{mol}/100\text{ g per minute}$) and normalized glucose metabolism (region/whole brain; units cancel) in regions with increased metabolism during mobile “on” vs “off” conditions (see “Methods” for description of conditions) in the brain area within the spherical constraint, $E_0/2 < E(r) < E_0$ (where E_0 indicates maximal field value and $E(r)$ indicates amplitude of the theoretical electromagnetic field) and the $E(r)$ emitted by the antenna of the right cellular telephone.

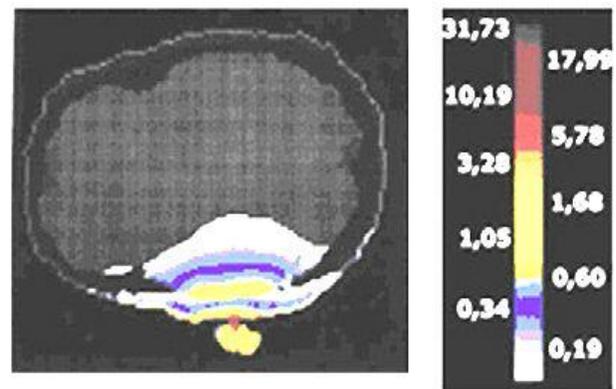
3.2. Likely Risks of Tumors:

- Astrocytoma – brain cancer (star-shaped tumor).
- Acoustic neuroma – benign tumor that affect sthe 8th cranial nerve (runs from brain to inner ear).
- Glioma – brain cancer that forms in the glial cells (surround and support nerve cells).
- Meningioma – slow-growing tumor that forms in the meninges (tissue surrounding brain and spinal cord).
- Testicular cancer.
- Non-Hodgkin’s lymphoma.
- Salivary gland tumors.
- Pituitary tumors.

3.3. Concerns about Kids & Phones:

Seem to be sound scientific reasons to monitor usage of cell phones by kids:

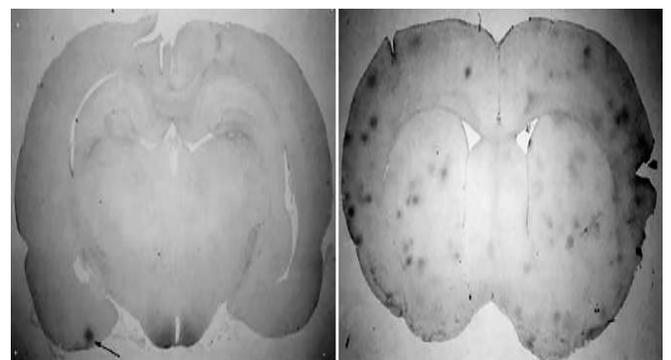
- Nervous systems are still developing.
- Brain tissue is more conductive than adults.
- More RF penetration due to smaller head size.
- Longer lifetime of exposure (first use typically well before 10).
- Children absorb more energy than adults for same phone.
- Tumors in mid brain is more deadly than those in temporal lobe.
- Children’s cell are reproducing more quickly than adults.



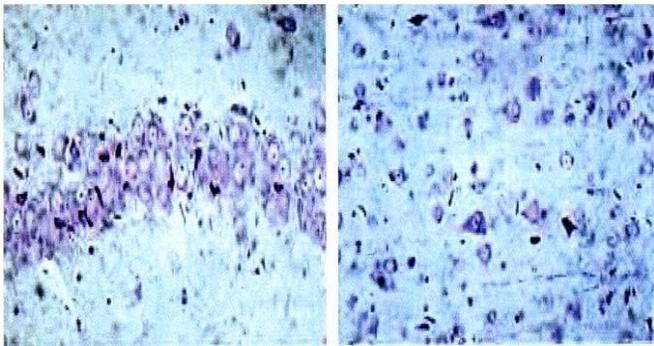
Adult

6.(b)

Figure.6 (a and b): Estimation of the absorption of electromagnetic radiation from a cell phone based on age (frequency GSM 900 Mhz) (on the right, a scale showing the specific absorption rate at different depths, in W/kg).



7(a)



7(b)

Fig.7 (a and b): Ratbrain, 50 days post 2-hour exposure to cellphones

Children case study: Hardell & Carlberg, *International Journal of Oncology* (2009): Case-control study 1997-2003.

- 2159 cases with brain tumors; 2162 population-based controls.
- Ipsilateral astrocytoma and acoustic neuroma after >10 years of use: OR = 3.3 and 3.0, respectively.
- Highest risk among users whose first use was before age

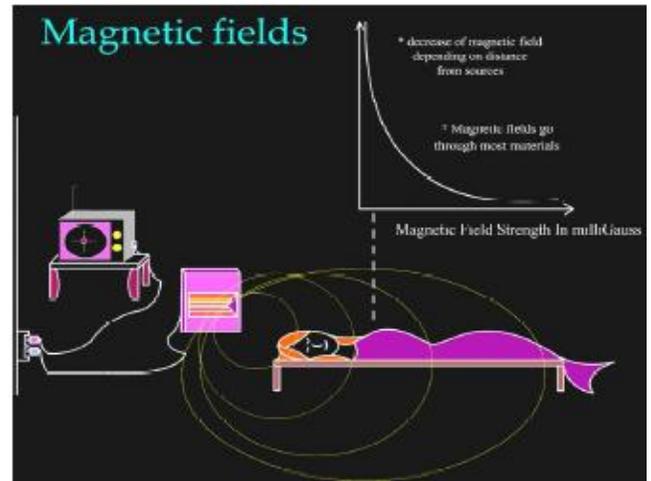


Figure 9: Magnetic fields from current flow

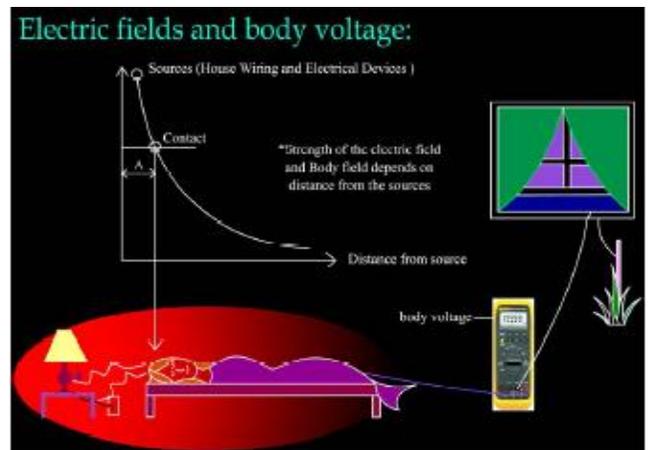


Figure 10: Electric fields from energized potential

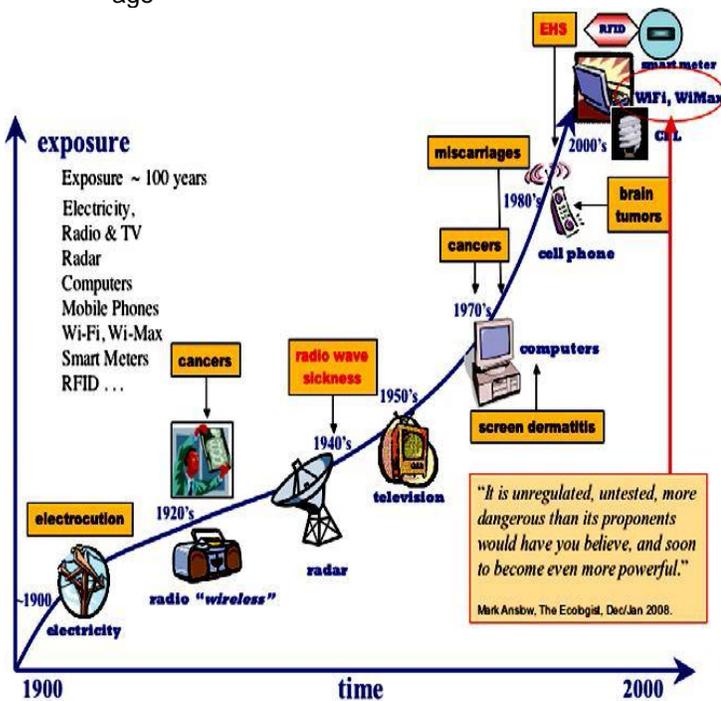


Figure 8: Technological Advances of Extremely Low Frequency (ELF) to Radio Frequency (RF)

4. RECENT STUDIES

4.1. National Library of Medicine Compilation (1995):

- 8/10 peer reviewed studies: Children living near transmission & distribution lines have a higher risk of leukemia, lymphoma & brain cancer (RR from 1.3 to 4).
- 24/30 peer reviewed occupational studies: exposed occupations had significantly higher risk of leukemia, lymphoma & brain cancer (RR from 2 to 10).

4.2. University of Toronto on Ontario hydro workers (*American Journal of Epidemiology*, July 10, 1996):

- Increased risk of Leukemia for both magnetic and electric fields.
- Risk highest for electric fields.
- Electric field was dominant risk factor.
- High exposure to both fields showed 11 times the risk of Leukemia.

4.3. Research animal studies:

- Dogs with lymphoma were 6X more likely to have lived in homes with fields over 2 mG.
- Monkeys: Circadian rhythm altered, serotonin & dopamine significantly depressed.

- c. Rats learn more slowly & make more mistakes.
- d. Mini Pigs: Night melatonin production reduced, significant loss in serum testosterone.

4.4. Henry Lai and Narendra P. Singh Study (January 2004):

- a. Magnetic field-induced DNA strand breaks in brain cells of the rat.
- b. 100 mG exposure to mice for 24 hours.
- c. Significant increase in single and double strand breaks in brain cells.
- d. In 48 hours, much larger increase of exposure.
- e. Effect is cumulative.
- f. Severe magnetic field exposure increases cell disintegration.

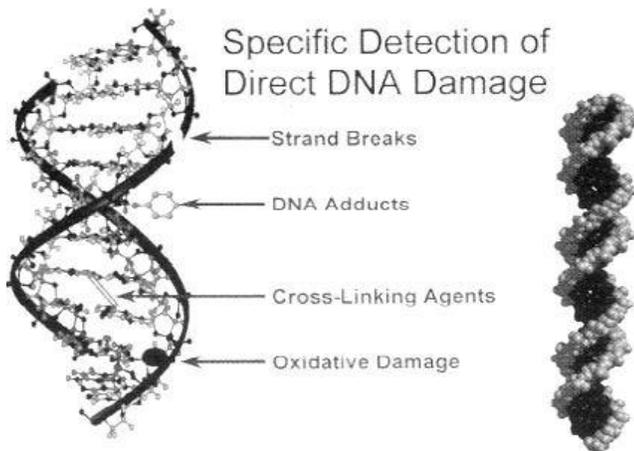


Fig 11: DNA breakage

5. SPECIFIC HEALTH CONCERNS

5.1 Cancer / Tumors

Studies have been conducted suggesting that rats that have been exposed to microwaves similar to the sort generated by mobile phones but more powerful, showed breaks in their DNA which could indicate an adverse effect. Also, mice exposed to radiation for 18 months developed brain tumors. Though of course, these studies are not concrete proof.

5.2. Blood Pressure

It was observed that people using cell phones were prone to high blood pressure. Again, there isn't any concrete evidence of the same.

5.3. Pregnancy

A study at the University of Montpellier in France was carried out on 6000 chick embryos and suggested that the heavily exposed chick eggs were five times less likely to survive than the control group. This study raised questions about possible effects on pregnant women but it has not yet appeared in peer-reviewed scientific literature or been reproduced, so its findings are difficult to assess.

5.4. Headaches, Heating Effects, Fatigue

A study brought out that longer the people used mobile phones, the more likely they were to report symptoms such as hot ears, burning skin, headaches and fatigue. The study did not include a control group (that is people who do not use

mobile phones, to make a comparison); therefore the symptoms reported could have been caused by any number of other factors in the mobile phones users' environment, such as working with computers, stress, driving or reading.

5.5. Memory

There have been various studies into the connection between mobile phones and memory loss. A study looked into the effect of radiofrequency (RF) on the section of rats' brains that is linked with the memory. The results showed that RF could modify signals in the cells in a part of the brain that is responsible for learning and short term memory.

5.6. Posture (holding phone between raised shoulder and ear):

Some researchers claim that holding a mobile phone between the raised shoulder and the ear could have a damaging effect on muscles, bones, tendons and discs. These problems would apply equally to a cordless phone or a landline phone as to a mobile phone and are the effect of bad posture.

5.7. Mobile Phones and Children:

Because of their smaller heads, thinner skulls and higher tissue conductivity, children may absorb more energy from a given phone than adults.

5.8. RADIATION AND NUCLEAR SAFETY - STUK STATEMENT: Policy consideration, January 7, 2009.

- Parents are recommended to advise their children to use rather SMS messages than mobile phone calls.
- Parents may restrict the number of their children's mobile phone calls and their duration.
- Parents are recommended to guide their children to use a hands-free that minimizes the exposure of head significantly. When using a hands-free it is recommended to keep the mobile phone at least a few centimeters away from the body.
- It is not recommended to use mobile phones in weak fields.

6. DAMAGE DUE TO EM EXPOSURE

The sources emitting electromagnetic fields for mobile phones are in the radiofrequency range from 10 MHz to 10¹⁰ GHz. These frequency range is of non-ionizing level. The exposure of the general public in the tropical countries due to these sources is well below the international recommendations given by International Commission on Non-Ionizing Radiation Protection (ICNIRP).

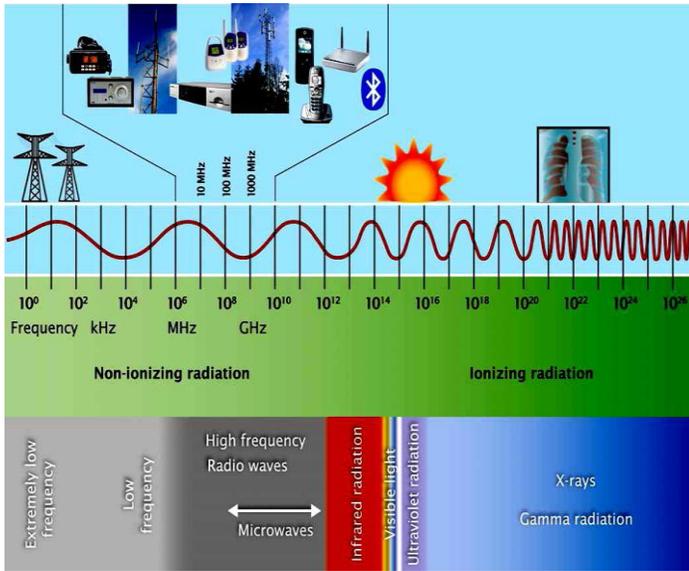


Figure 12: The electromagnetic spectrum illustrating typical sources in the high frequency range.

It is well documented in the global scientific community that exposure to electromagnetic fields above a certain level is harmful. ICNIRP published exposure guidelines in 1998 aimed at preventing such harmful health effects [ICNIRP, 1998]. The ICNIRP guidelines are derived by applying a safety factor of 50 (for general public exposure) to the lowest level of exposure resulting in an observed significant biological effect. All of the well-established adverse health effects from electromagnetic fields are caused by a temperature rise in affected tissues. The ICNIRP guidelines are therefore aimed to prevent adverse tissue heating; compliance with the guidelines for the general public ensures that the maximum temperature increase is a few tenths of one degree centigrade. Recently, the ICNIRP reconfirmed their 1998 guidelines in the radiofrequency area until further notice [ICNIRP, 2009].

7. BASIC RESTRICTIONS AND REFERENCE LEVELS

The biological relevant parameter describing the effects of electromagnetic fields in the frequency range of interest (30 MHz – 6 GHz) is the specific absorption rate SAR (dimension: power/mass). It is a measure of the power absorbed per unit mass. The SAR may be spatially averaged over the total mass of an exposed body or its parts. The SAR is calculated from the r.m.s. electric field strength E inside the human body, the conductivity σ and the mass density ρ of the biological tissue:

$$SAR = \sigma \frac{E^2}{\rho} = c \frac{\partial T}{\partial t} \Big|_{t \rightarrow 0+}$$

The specific absorption rate describes the initial rate of temperature rise $\partial T / \partial \tau$ as a function of the specific heat capacity c of the tissue. A limitation of the specific absorption rate in terms of basic restrictions prevents an excessive heating of the human body by electromagnetic energy. As it is sometimes difficult to determine the SAR directly by measurement (e.g. whole body averaged SAR), a set of more

readily measurable reference levels in terms of external electric E and magnetic field strength H and power density S , derived from the SAR limits, is defined. The limits for E , H and S have been fixed so that even under worst case conditions, the basic restrictions for the specific absorption rate SAR are not exceeded. The reference levels may be exceeded if the exposure can be shown by appropriate techniques to produce SAR values below the corresponding basic restrictions.

7.1. SAR Limits:

The comparison between the measured data and the exposure limits defined in the ICNIRP (International Commission on Non-Ionizing Radiation Protection). Guideline is made using the spatial peak SAR; the power level of the device under test guarantees that the whole body averaged SAR is not exceeded. Having in mind a worst case consideration, the SAR limit is valid for general public exposure and for exposure times longer than 6 minutes [ICNIRP 1998]. ICNIRP (International Commission on Non-Ionizing Radiation Protection) published its recent guidelines covering the frequency range up to 300 GHz [in 1998]. In 1999 this guidelines were adopted by the European Union in terms of the European Council Recommendation [1999 519 EC]. According to Table 1 the SAR values have to be averaged over a mass of 10 g (SAR10g) with the shape of a cube.

Standard	Status	SAR limit [W/kg]
ICNIRP 1998	Guidelines	2.0

Table 1: Relevant spatial peak SAR limit averaged over a mass of 10 g.

8. PORTECTION AGAINST SAR

The “safe exposure” limits for low-level radiation absorbed from cell phones operating at their highest possible power level—known as the Specific Absorption Rate (SAR)—“does not adequately protect” most people who use cell phones, especially children who absorb more cell phone radiation than adults, according to an article published online this week in the journal, Electromagnetic Biology and Medicine. The “specific absorption rate” or SAR, a common benchmark that measures the rate of radiofrequency energy our body gets from the phone. The lower the number, the lower the radiation exposure. For a phone to be certified by the FCC and sold in the U.S., for example, its maximum SAR level must be less than 1.6 watts per kilogram. According to the Cellular Telecommunications Industry Association (CTIA), SAR or specific absorption rate is “a way of measuring the quantity of radio frequency (RF) energy that is absorbed by the body.” The SAR level listed in our chart represents the maximum SAR level for the phone.

- North American Standard. The SAR limit for mobile phones used by the public is 1.6 watts/kilogram (W/kg) averaged over one gram of body tissue.
- European Standard. The SAR limit for mobile phones used by the public is 2.0 watts/kilogram (W/kg) averaged over ten grams of body tissue.

- In order to compare relative radiation of different mobile phones, you can only compare phones using the same measurement.

The SAR levels of some of the mobile phones are shown below:

8.1. Lowest radiation levels:

- LG Quantum (AT&T): 0.35 watts per kilogram
- Casio EXILIM (Verizon Wireless): 0.53 W/kg
- Pantech Breeze II (AT&T, AT&T GoPhone): 0.55 W/kg.
- Sanyo Katana II (Kajeet): 0.55 W/kg
- Samsung Fascinate (Verizon Wireless): 0.57 W/kg.
- Samsung Mesmerize (CellularONE, U.S. Cellular): 0.57 W/kg.
- Samsung SGH-a197 (AT&T GoPhone): 0.59 W/kg.
- Samsung Contour (MetroPCS): 0.60 W/kg.
- Samsung Gravity T (T-Mobile): 0.62 W/kg.
- (tie) Motorola i890 (Sprint); Samsung SGH-T249 (T-Mobile): 0.63 W/kg.

8.2. Highest radiation levels:

- Motorola Bravo (AT&T): 1.59 W/kg
- Motorola Droid 2 (Verizon Wireless): 1.58 W/kg
- Palm Pixi (Sprint): 1.56 W/kg
- Motorola Boost (Boost Mobile): 1.55 W/kg
- Blackberry Bold (AT&T, T-Mobile): 1.55 W/kg
- Motorola i335 (Sprint): 1.55 W/kg
- HTC Magic (T-Mobile): 1.55 W/kg
- Motorola W385 (Boost Mobile, U.S. Cellular, Verizon Wireless): 1.54 W/kg
- Motorola Boost i290 (Boost Mobile): 1.54 W/kg
- (tie) Motorola DEFY (T-Mobile); Motorola Quantico (U.S. Cellular, MetroPCS); Motorola Charm (T-Mobile): 1.53 W/kg

Some other high-profile phones fared somewhere in the middle on the rankings. The SAR level of the Apple iPhone 4 was 1.17 W/kg (for the AT&T model; the Verizon model wasn't listed). Exposure levels for the dozens of BlackBerry models varied widely. A study on NOKIA phones reveals that most of the NOKIA products comply with the permissible SAR limit and the company claims that they have already included the SAR level of all the handsets in their respective manuals.

[1]. GENERAL AWARENESS

Using the SAR measurement standard, we now also have a non-profit organization called the Environmental Working Group (EWG) that has published an important online consumer guide reporting in excess of 1,000 cell phones. In addition to knowing our current or new cell phone's SAR rating, the EWG also recommends eight safety tips to help you easily and immediately lower your cell phone radiation exposure. The tips are:

• BUY A LOW-RADIATION PHONE

Look up your phone on EWG's buyer's guide. (Your phone's model number may be printed under your battery.) Consider replacing your phone with one that

emits the lowest radiation possible and still meets your needs.

• USE A HEADSET OR SPEAKER

Headsets emit much less radiation than phones. Choose either wired or wireless (experts are split on which version is safer) using our cell phone headset guide. Some wireless headsets emit continuous, low-level radiation, so take yours off your ear when you're not on a call. Using your phone in speaker mode also reduces radiation to the head.

• LISTEN MORE, TALK LESS

Your phone emits radiation when you talk or text, but not when you're receiving messages. Listening more and talking less reduces your exposures.

• HOLD PHONE AWAY FROM YOUR BODY

Hold the phone away from your torso when you're talking (with headset or speaker), not against your ear, in a pocket, or on your belt where soft body tissues absorb radiation.

• CHOOSE TEXTING OVER TALKING

Phones use less power (less radiation) to send text than voice. And unlike when you speak with the phone at your ear, texting keeps radiation away from your head.

• STAY OFF THE PHONE IF POOR SIGNAL

Fewer signal bars on your phone means that it emits more radiation to get the signal to the tower. Make and take calls when your phone has a strong signal.

• LIMIT CHILDREN'S PHONE USE

Young children's brains absorb twice the cell phone radiation as an adult's. EWG joins health agencies in at least 6 countries in recommending limits for children's phone use, such as for emergency situations only.

• SKIP THE "RADIATION SHIELD"

Radiation shields such as antenna caps or keypad covers reduce the connection quality and force the phone to transmit at a higher power with higher radiation

Here are five more tips as well from Barton Publishing. The EWG's guide allows us to search for your specific make and model – so long as it's in their database – and we can also find cell phones by cell phone carrier and cell phone manufacturer. You can access the EWG's full cell phone radiation guide. The five are: Use the speakerphone option. It keeps the phone away from your head. You want at least a few inches of distance. [This] dramatically drops radiation exposure. A foot or more is better.

- Use the speakerphone option. It keeps the phone away from your head. You want at least a few inches of distance. This dramatically drops radiation exposure. A foot or more is better.
- Don't wear your phone on a belt clip or keep it in your pocket. If the mobile emits radiation, it still emits whether held up to your ear or hip.
- Consider getting a Bluetooth wireless earpiece.. Manufacturers claim the radiation from the Bluetooth

technology is 100 to 200 times less intense than a typical cell phone held to the ear.

- Find out about ferrite beads. This is an inexpensive clip you put on the wire of a headset. The wire itself is suspected of emitting radiation and the ferrite absorbs and neutralizes the radiation.
- Reintroduce yourself to landline [telephones].

10. PIECE OF PRACTICAL ADVICE TO LIMIT EXPOSURE TO ELECTROMAGNETIC RADIATION EMITTED FROM CELL PHONES

The Case for Precaution in the Use of Cell Phones Advice from University of Pittsburgh Cancer Institute Based on Advice from an International Expert Panel, available at www.preventingcancer.org.

- Do not allow children to use a cell phone, except for emergencies. The developing organs of a fetus or child are the most likely to be sensitive to any possible effects of exposure to electromagnetic fields.
- While communicating using your cell phone, try to keep the cell phone away from the body as much as possible. The amplitude of the electromagnetic field is one fourth the strength at a distance of two inches and fifty times lower at three feet. Whenever possible, use the speaker-phone mode or a wireless Bluetooth headset, which has less than 1/100th of the electro- magnetic emission of a normal cell phone. Use of a hands-free headset may also reduce exposures.
- Avoid using your cell phone in places, like a bus, where you can passively expose others to your phone's electromagnetic fields.
- Avoid carrying your cell phone on your body at all times. Do not keep it near your body at night such as under the pillow or on a bedside table, particularly if pregnant. You can also put it on "flight" or "off-line" mode, which stops electromagnetic emissions.
- If you must carry your cell phone on you, it is preferable that the keypad is positioned toward your body and the back is positioned toward the outside of your body. Depending on the thickness of the phone this may provide a minimal reduction of exposure.
- Only use your cell phone to establish contact or for conversations lasting a few minutes, as the biological effects are directly related to the duration of exposure. For longer conversations, use a land line with a corded phone, not a cordless phone, which uses electromagnetic emitting technology similar to that of cell phones.
- Switch sides regularly while communicating on your cell phone to spread out your exposure. Before putting your cell phone to the ear, wait until your correspondent has picked up. This limits the power of the electromagnetic field emitted near your ear and the duration of your exposure.

- Avoid using your cell phone when the signal is weak or when moving at high speed, such as in a car or train, as this automatically increases power to a maximum as the phone repeatedly attempts to connect to a new relay antenna.
- When possible, communicate via text messaging rather than making a call, limiting the duration of exposure and the proximity to the body.
- Choose a device with the lowest SAR Possible (SAR = Specific Absorption Rate, which is a measure of the strength of the magnetic field absorbed by the body). SAR ratings of contemporary phones by different manufacturers are available by searching for "SAR ratings cell phones" on the internet.

11. SOME CELL PHONE GUIDELINES

11.1. Try to avoid:

- Talk on your cell phone at religious sites/institutes
- Talk on your cell phone in class (you're disturbing us, too!)
- Talk about your mother when there are mothers around you.
- Talk about your kids when there are kids around you.
- Talk and eat.
- Talk when there is a home phone less than 1 foot away from you.
- Talk on the bus at the top of your lungs (we all have to ride with you at least a few more stops - have pity on us!)
- Talk to your old boyfriend when your new boyfriend is around.
- Talk to your old girlfriend when your new girlfriend is around.
- Talk to your parents and then pretend to lose the connection so you don't have to talk to them anymore!

11.2. Try to follow:

- Text message whenever possible.
- Learn how to text message with normal capitalization - not ALL CAPS.
- Surf the web on your own time - not in the middle of a conversation.
- Turn your cell phone to silent/vibrate when you are in church.
- Turn your cell phone off when you are at the movies (or at least don't check the messages - we can all see that screen light up!).
- Figure out how to turn your cell phone to silent/vibrate (nobody wants to hear 'My Boo' or 'Drop it Like It's Hot' because you can't operate your phone).
- Ask people if they want their picture taken.
- Show people the pictures you took - don't post them as your wallpaper because they look so 'crazy'.
- Offer your cell phone to people who are lost, whose car is broken down or who need you to call their cell phone so they can locate.
- Transfer your phone book to your new phone - stop calling everybody every time you get a new phone because their phone number is in the 'old' phone

12. END RESULTS

The American Cancer Society (ACS) states that the IARC classification means that there could be some risk associated with cancer, but the evidence is not strong enough to be considered causal and needs to be investigated further. Individuals who are concerned about radiofrequency exposure can limit their exposure, including using an ear piece and limiting cell phone use, particularly among children. The National Institute of Environmental Health Sciences (NIEHS) states that the weight of the current scientific evidence has not conclusively linked cell phone use with any adverse health problems, but more research is needed. The U.S. Food and Drug Administration (FDA), which is responsible for regulating the safety of machines and devices that emit radiation (including cell phones), notes that studies reporting biological changes associated with radiofrequency energy have failed to be replicated and that the majority of human epidemiologic studies have failed to show a relationship between exposure to radiofrequency energy from cell phones and health problems. The U.S. Centers for Disease Control and Prevention (CDC) states that, although some studies have raised concerns about the possible risks of cell phone use, scientific research as a whole does not support a statistically significant association between cell phone use and health effects. The Federal Communications Commission (FCC) concludes that there is no scientific evidence that wireless phone use can lead to cancer or to other health problems, including headaches, dizziness, or memory loss. According to the World Health Organization (WHO) there is no scientific basis to link EHS symptoms to exposure to an electromagnetic field [WHO, 2005]; therefore, there are no ill-effects from mobile phone use. An Australian researcher who worked on the report with 30 other experts says more research is needed before any real link can be made between mobile phone use and cancer. "Really, what it's saying is there is an observed association between using a mobile phone and a higher risk of brain cancer," Professor Bruce Armstrong from the University of Sydney told the ABC.

13. CONCLUSION

For the past several years theories and concerns have churned about the radiation levels in cell phones. There has been speculation that cell phones can cause radiation poisoning leading to brain or mouth tumors. People who have gotten brain or mouth tumors from unseen cell phone radiation give off have used their devices for a time period of ten years or more. However there are companies that have lobbyist whose sole purpose is to convince the general public that cell phone radiation is not a concern. "CTIA, the wireless industry lobbying association stated "scientific evidence has overwhelmingly indicated that wireless devices do not pose" a health hazard". Although there is not concrete evidence whether or not cell phones are linked to cancer, some countries have taken preliminary precautions. What I suggest is to keep your cell phones SAR level to come at or under 1.6 W/kg and follow the tips given in this paper. There is accumulating evidence that cellphones that operate on GSM networks emit significantly more radiation than do cellphones operating on CDMA networks. The modulation pattern is different for CDMA and GSM phones, and some scientists think GSM pulse modulations may have adverse biological effects. Cell phone radiation is an obstacle our generation must come to face so we don't have a rise of cancer in years

to come. Certain wireless Bluetooth cuts down on the time you hold the cell phone to your head therefore slightly reducing radiation effects. If you do not like the idea of having a wireless Bluetooth the other option would be to switch to a cell phone with low radiation signals to better your chances of not getting cancer. In this era not having a cell phone is prehistoric, over four billion people worldwide own one, but even though there is a slight possibility of getting some sort of radiation poisoning at least we have the information to help make better decisions about your wireless needs.

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