

Modeling of Electromagnetic Exposure in Complex Dielectric Structures

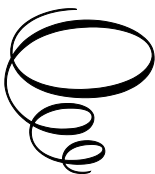
Modeling of Electromagnetic Exposure in Complex Dielectric Structures:

Exploring the Invisible

Edited by

Şaban Selim Şeker and Fulya Çallıalp

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I dedicate this book to my beloved daughter, Nur Zeynep Şeker.
—Prof. Dr. Şaban Selim Şeker

I dedicate this book to my beloved son, Alp Erol Kunter.
—Assoc. Prof. Fulya Çallıalp

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INTRODUCTION

This book has been created with immense dedication and hard work, reflecting our commitment to providing valuable insights into the complex and evolving subject of electromagnetic fields, health effects, and related technologies. Each chapter has been carefully crafted to offer a comprehensive understanding of key topics, drawing from extensive research, simulations, and expert knowledge. We have worked tirelessly to present the most accurate and relevant information, making it accessible to both experts and those new to the field.

The book delves into a wide range of critical issues, including the biological effects of RF and 5G millimeter waves, focusing on the specific absorption rate (SAR) and temperature distribution in human tissues such as the ear, mouth, breast, eye, and arm. It explores how these effects vary in different types of tissues, particularly in relation to health risks posed by mobile devices and wireless technologies. Additionally, the book examines the role of ground types in radio coverage and discusses the application of simulations in hyperthermia cancer treatment.

It is our sincere hope that this work will serve as a meaningful resource for all readers, whether they are researchers, practitioners, or individuals with a general interest in the subject. We aim for this book to not only expand knowledge but also spark further interest and curiosity in the impact of technology on human health and the environment. May it inspire critical thinking, foster informed discussions, and encourage ongoing exploration of these important topics.

CHAPTER 1

BRIEF REVIEW OF HEALTH EFFECTS OF RF AND 5G MILLIMETER WAVES

ŞABAN SELİM ŞEKER

Abstract

Health studies conducted on animals reveal that radiofrequency (RF) waves, as well as the millimeter waves used in the 5G system, cause changes in the body, manifested in structural alteration and disturbance in various functions of the organism, including the nervous, cardiovascular, immune, blood and other systems. While microwaves used in 4G cause thermal effects, millimetric waves used in 5G cause non-thermal effects only due to low wave penetration. Based on evidence obtained from various studies carried out by the USA National Toxicology program, the Italian Ramazzini study and the EU Reflex study, a growing number of scientists say that electromagnetic (EM) waves are “human carcinogen”. As is known, all processes in the human body involve electromagnetic waves. Brain activity, heartbeat, cell division and neuronal communication always use electrical energy. The activities of hormones and enzymes are regulated electrically. Millimeter waves used in the 5G system have weak penetrating ability, and are easily absorbed by humans, buildings, and trees. Therefore, 5G base stations need to be installed approximately at every 10 meters. This will result in millions of new base stations in addition to the present ones, and increase the electromagnetic pollution and health risks at least by a factor of 100. This article will discuss the health effects of RF and millimeter waves, including those used for 5G.

1. Introduction

The increasing use of electromagnetic (EM) devices in our society for a variety of purposes has caused growing concern about possible health hazards to human beings, damage to birds and insects, to earth’s

environment in general, as well as interference produced by EM fields or radiation. Pointing out and discussing this problem is not meant to cause alarm but to demonstrate the dangers involved so that the public can decide how much risk they are willing to take. This study will focus on the sources of radiation, and the hazards caused by them (The Blue Cross Blue Shield Report 2019; Müller 1997; Carlo 2001; Hardell 2000; Cell Phone Task Force Organisation 2020; Hardell 2006).

Extremely Low Frequency (ELF) fields, Radiofrequency (RF), and millimetre waves have very similar biological effects such as genetic effects, cancerogenesis, modification of cellular and molecular processes, effects on electrophysiology, behavioural changes, effects on the nervous system, alteration of the characteristics of the blood-brain barrier, modification of Calcium transport dynamics, effects on the cardiovascular system, generation of warm sensation at different parts of the body, modification of hormonal dynamics, effects on the immune system, changes in the metabolic rate, impacts on reproduction and growth, stress, etc. (Polk 1986). EM radiation effects depend on: frequency, fields and power intensities, size of victim, electrical properties of victim, distance from sources and duration of exposure.

On April 24, 2019, American health insurance association Blue Cross Blue Shield (The Blue Cross Blue Shield Report 2019) released a report titled "The Health of Millennials", which showed a sharp decline of health in the millennials. One of the probable reasons behind this alarming health decline from the millennial generation onward is the fact that they are the first generation exposed to EM radiation through their entire lives.

The biological effects of cell phone radiation prevent the body from repairing the damages in the DNA and reduce its resistance to disease. This could profoundly affect the metabolic and reproductive functions. According to the Swedish oncologist Lennart Hardell, studies with surveys conducted on several thousand cell-phone users have "proven that high-frequency electromagnetic radiation increases the risk of brain tumors" (Hardell 2000; Hardell 2006; Hardell 2009; Hardell 2005; Gandhi 1990; Hardell 2011; Hardell 2013).

2. Brief Summary of Studies on Biological Effects of RF Radiation

1) It was announced by WHO / IARC that the radiation emitted by RF Areas and therefore by cell phones and base stations was included in the

category 2B (Possibly Carcinogenic) on the cancer-causing list, with a press release no.208 on 31 May 2011 (www.powerwatch.org.uk, www.micro.wavenews.com). The warning associated with the ELF range of the electromagnetic spectrum had been classified by WHO already by 2001.

2) Standard values are the values determined by the International Non-ionizing Radiation Protection Committee (ICNIRP), which are accepted by the World Health Organization (WHO) (ICNIRP 1998). There are 208 references in the article, the most recent source being published in 1997. There are no resources given for cell phones and base stations; thus, the standards have no scientific basis for cell phones and base stations. Information obtained from lifeless, dead phantom models are used as a basis for the standard. Such a standard cannot protect living people! There are standards prepared for adult men and there are no special standards for women, the elderly and children. Standards are to protect against short-term damages in light of the current knowledge. Even if the measured values are below the standards, nothing can be said about the long-term effects. It is unscientific to claim that these standards will protect people. For example, the safety distance specified by ICINIRP for 900 MHz radiation is 68.75 times smaller than those specified by IEEE (The Institute of Electrical and Electronics Engineers).

3) According to the news in TIME magazine on 24.2.2003: The study by Prof. L. Salford from Lund University of Sweden concluded that:

Even at intensity levels 1000 times below the standard, neurons (brain cells) die after 2 hours of exposure.

Cell phone EM radiation relaxes the blood-brain barrier of mice and allows harmful substances to enter the brain.

Cell phones harm nearby people even if they don't use the phone themselves ("passive usage").

4) Some of the "non-thermal" effects of non-ionizing radiation that are not taken into account in the ICINIRP standard include leakage of the Blood Brain Barrier, death of neurons and damage in brain cells, Calcium flux attenuation, heart rhythm disturbance and cardiac arrest, formation of malignant and non-malignant brain tumors, damage to and death of sperm cells, effects on growth, defective birth and infertility, acoustic neuroma, dementia, leukemia and lymphoma, and permanent genetic effects passed on to future generations (Fisher 2007; www.bioinitiative.org/report/index.htm).

5) The EU REFLEX Research Report published in 2004 was made in 12 institutes of 7 EU countries with a 3 million Euro fund. According to this study, radiation in the frequency region used by mobile phones and base stations can cause DNA breaks and gene changes.

6) In the Bioinitiative Report, first published in the USA in 2007 (www.bioinitiative.org/report/index.htm), the biological effects of mobile phone frequencies and EM fields on different frequencies and the insufficiency of standards have been revealed as a result of research and the non-thermal effects of a new understanding in the world have been brought to the agenda. According to the report of the BioInitiative working group, which was newly published in 2012 and prepared by 29 authors from 10 countries since 2007, the radiation in EM fields and radio frequencies has increased significantly. The report examined more than 1800 new studies (between 2006-2011).

Some important results from this report can be summarized as follows:

Professor of Orebro University, Sweden. Lennart Hardell MD,

“Epidemiological evidence has said that radio-frequency radiation should be classified as carcinogenic in humans, and current ICNIRP, FCC / IEE standards cannot adequately protect the population. The Blood Brain Barrier suffers under 1000 times the limits set by the USA and ICNIRP.”

Usage of wireless devices such as mobile phones, laptops by pregnant women, alters the brain development of the fetus. This issue has been found to be linked to hyperactivity, learning and behavioural disorders in studies on animals and humans. The use of mobile phones and wireless laptops in stand-by mode can cause damage in the genetic material as shown in the studies.

It is certain that exposure to radiation even at very low intensity levels of electromagnetic fields and radio frequencies will have biological effects. Biological effects begin from the first minutes of exposure, whatever the source, e.g. cell phone, base station, WI-FI, etc.

7) Dr. George Carlo, a researcher working for US Cell phone companies, presented in his book some important findings about mobiles, as follows: Even at sub-standard SAR values; a) Cell phone usage doubles the risk of brain cancer. b) Acoustic neuroma formation can emerge in cell phone users from 6 years of usage onward. c) Evidence of genetic damage due to

exposure to mobile phones has been found in human blood (Carlo et al. 2001).

8) Although cell phones emit only low levels of radiation, they affect the electrically charged chemical substances that carry messages in the human brain and nerve cells. Electromagnetic fields cause movement, work and structural changes in molecules, cells and tissues (www.cellphonetaskforce.org; Saga et al. 2009).

9) The cell phone userbook of Motorola, the inventor of the mobile phone, contains the following information added in October 2010. All the works mentioned in Motorola's book are more than 10 years old. "Use earphones". Keep your mobile phone away from your body, especially the belly of pregnant women and young people.

A few animal studies have shown in laboratory animals that RF can accelerate the development of cancer even at low levels. In one study, the mouse exposed to RF has changed genetically and developed 2 times more tendency for some kinds of cancer formation than the non-exposed mouse.

Considering 20 types of tumors separately, a connection with the use of mobile phones and rare glioma, neuroepitheliomatous tumors have been found. Changes have been observed in cells after exposure to cell phone radiation. Some people who use cell phones have been diagnosed with brain cancer. Tumors are more likely to occur on the used side of the cell phone head. Make long calls with a wired phone or make calls with a mobile phone only if no wired phone is available.

10) Cell phones are the most hazardous among all radiation sources because of the following reasons:

They are used extensively by almost everybody, including children. More than 6 billion people around the world use it 24 hours a day. They are kept very close to the human body, and particular to the brain. There is no other radiation source, the usage time of which has been increasing day by day. The body has time to repair the damages caused by radiation generating devices that are used for short durations, the body can compensate for possible damages. However, when a mobile phone is used for long durations, very often the body is not given enough time to repair the damages. Damages caused by RF radiation are permanent and cumulative.

Cell phones can be potentially more harmful than smoking. Not everybody smokes, but nowadays almost everyone, from young to old, uses cell

phones. However, there is only very limited research (if at all) on the effects of cell phone radiation, for example, on the genesis of liver cancer. This is mainly because of the conflict of interest with the Telecom industry and all other sectors benefiting from wide-spread usage of wireless communication. This situation manifests itself as lack of funding and even active suppression of research on the impacts of electromagnetic waves on living beings. Therefore, such topics can mostly be published only in popular magazines rather than in scientific journals. In the 13.1.2015 issue of FORBES magazine, an article was published on the fact that exposure to Wi Fi is more dangerous, especially to children, than it was thought (Saga et al. 2009; Kheifets et al. 2005; www.igumed.de/apell.html).

11) The Italian Constitutional Court has ruled that long-term use of cell phone causes brain tumor and cancer risk. According to the report of Interference Technology magazine in 2005, Vatican Radio officials were asked to pay 10 days in prison for polluting the atmosphere with very strong electromagnetic waves and they were asked to compensate for the damage they caused ([http //www.reuters.com / article / 2012/10/19 / Italy-phones-id](http://www.reuters.com/article/2012/10/19/Italy-phones-id)).

12) A demonstration of how serious are the risks of electromagnetic pollution is the fact that in order to prevent accidental firing of intercontinental missiles, USA and the Soviet Union have decided to build a very special red telephone line between their presidents that is not affected by EM pollution.

13) There are various reasons why children are more easily affected by RF fields from mobile phones than adults. Children typically spend longer time with their mobile phone. Children are physiologically more severely affected by the RF fields because their nervous and peripheral systems are still under development, and because their brain tissues have higher water and ion concentrations than adults such that they are more RF-conductive. Due to these reasons, the results of RF studies on adults are not applicable to children (Kheifets et al. 2005; www.igumed.de/apell.html; Milham et al. 2001; Kheifets et al. 2005; ICNIRP 2011). According to some researchers (Müller 1997), the increasing violence in the society has some correlation with the increase of EM fields in the environment at various frequencies.

14) Proofs of long-time effects of EM radiation on human beings have been presented for the first time in 2010 in Dr. Devra Davis's book "Disconnect" (Devra 2010).

15) A very extensive study has been conducted by researchers for more than ten years on behalf of the US Department of Health, the results of which were published in November 2018. Within the realm of this study, scientists from the "National Toxicology Program" made nearly 7,000 rats and mice subject to life-long mobile phone radiation exposure for 9 hours per day. To the surprise of the researchers, the outcomes demonstrated not only damage in the DNA strands of the brain cells of irradiated mice, but also significantly more malignant tumors on the nerve cells of the heart muscle in irradiated male rats as compared to their non-irradiated conspecifics. The number of brain tumors was found to be 3% higher than in the control group.

16) The Italian Ramazzini Institute announced on 22.3.2018 that they had found the same results as in the study carried out on behalf of the US Ministry of Health.

3. Biological Effects of Mobile 5G Communication

The EM waves used in 5G are in the 20-60 GHz frequency range and called millimetric waves because their wavelengths are around 1-10 mm. One of the most important drawbacks of millimetric waves is that they cannot easily pass through buildings or obstacles, and are easily absorbed by plants and rain, etc. Therefore, 5G base stations have a shorter propagation range than the lower generation communication systems. This implies that 5G cellular network needs to use smaller cells, and install base stations more densely. Due to their small size, these base stations can be easily mounted on lighting poles or on the roofs of buildings (www.microwavenews.com; www.ehtrust.org; Hong et al. 2017).

Since 5G is newly developed, the human species, as well as the whole planet, will be exposed to millimeter waves at such a scale for the first time. The health effects of 5G will be non-thermal because the millimetric waves radiated by 5G systems do not sufficiently penetrate the body to cause thermal effects. Let us remember that the EM standards are prepared only for thermal effects. Since SAR value above 10 GHz is meaningless, evaluations are based on power density alone.

Current smartphones emit a maximum of 2 Watts and normally operate at less than 1 Watts of power. On the other hand, a 5G phone contains dozens of tiny antennas, all working together to track and aim at a narrowly focused beam radiated by the nearest cell tower. The US Federal Communications Commission (FCC) has adopted rules permitting the effective power of

those beams to be as much as 20 Watts, that is, ten times more powerful than the levels permitted for current phones.

Just like in the present-day experimental applications, each 5G base station will contain hundreds or thousands of antennas emitting multiple laser-like beams simultaneously at all cell phones and user devices in its service area. This technology is called “multiple input multiple output” (MIMO). FCC rules permit the effective radiated power of a 5G base station beam to be as much as 30,000 Watts per 100 MHz of spectrum (or equivalently 300,000 Watts per GHz of spectrum), which is tens to hundreds of times more powerful than permitted for the current base stations.

Imagine 20-Watt FCC standard power passing through the human body! To prevent this, 5G phones place metal shielding between the faceplate on one side, and the antenna and circuits on the other side.

Think of an operational microwave oven and what it does to a bowl of water: it boils the water by loosening the connections between the water molecules. But a 60 GHz wave, which is within the frequency spectrum of 5G, takes it one step further by exciting the oxygen bonds within the water molecules at their resonance frequency and eventually breaking them. This has severe implications for all living beings with a respiratory system. So, 5G not only distorts the original structure of water, which constitutes 60-65% of the human body, but its 60 GHz component polarizes and radically alters the oxygen, which has a most critical role in our organism. Now that the system is active in Bath / the UK, breathing difficulties, heart palpitations and confused thinking are already being reported, just like in Wuhan, China.

A 2019 European Parliament Report notes:

- ♦ “The 5G radio emission fields are quite different to those of previous generations because of their complex beam formed transmissions in both directions. Although fields are highly focused by beams, they vary rapidly with time and movement and so are unpredictable.” Because of this, the report concludes that, “It is not possible to accurately simulate or measure 5G emissions in the real world.”
- ♦ 5G will massively increase the exposure to radio frequency (RF) radiation additional to the radiation from the presently existing 2G, 3G and 4G telecommunication networks. RF radiation has been proven harmful for humans and the environment. The deployment of 5G constitutes an experiment on humanity and the environment that is defined as a crime under international law.
- ♦ The planned density of radio frequency transmitters is impossible to envisage. It is estimated that, in addition to millions of new 5G base

stations on Earth and 20,000 new satellites in space, 200 billion transmitting objects will be part of the Internet of Things (IOT) (Hyland 2001).

If the telecommunications industry's plans for 5G come to fruition, no person, no animal, no bird, no insect and no plant on Earth will be able to avoid full-time exposure to levels of radiation that are tens to hundreds of times greater than what exists today, without any possibility of escape anywhere on the planet. These plans for 5G threaten to provoke severe and irreversible effects on humans and permanent damage to all of the Earth's ecosystems.

There are at least five companies proposing to provide 5G from space with a combination of 20,000 satellites in low- and medium-earth orbit that will blanket the Earth with powerful, focused, steerable beams. Although the amount of satellite-emitted energy that will reach the ground will be less than that emitted from ground-based antennas, the former will irradiate regions of Earth not reached by other transmitters and will be added on top of the ground-based 5G transmissions from billions of IoT devices.

Even more importantly, the satellites will be located in Earth's magnetosphere, which exerts a significant influence on the electrical properties of the atmosphere. The alteration of Earth's electromagnetic environment may constitute an even greater threat to life than the radiation from ground-based antennas.

The Earth, the ionosphere and the lower atmosphere form the global electric circuit in which we live. It is well established that biological rhythms of living beings (as has been shown for humans, birds, hamsters, and spiders) are controlled by Earth's natural electromagnetic environment and that the well-being of all organisms depends on the stability of this environment, including the electrical properties of the atmosphere. Ionospheric disturbances can alter blood pressure and melatonin and cause "cancer, reproductive, cardiac and neurological disease and death" (Müller 1997; German Federal Agency for Radiation Protection 2006; Milham 2010a; Milham 2010b).

3.1 Some effects of 5G frequencies that do not exist at the other frequencies

- ♦ Betzalal and his colleagues [Betzalal et al. 2018] have shown that there exists a coil-like structure on the surface of the skin, which

behaves like a receiver antenna in 5G and THz bands. Exposure to millimeter waves increases the Specific Absorption Rate (SAR) of the sweat glands on the skin. This alters perspiration and causes stress.

- ◆ Le Quement [Le Quement 2012] has shown that millimeter waves used by 5G affect the genes.
- ◆ Feldman and his colleagues [Feldman et al. 2008] have shown that human skin behaves at smaller millimeters of wavelengths like an array of helical antennas.
- ◆ The power of the base station is shared by the connected customers at any given time. When fewer customers are connected, much more power will be directed to each customer. Consequently, for example, people connected to 5G at midnight (when there are fewer customers) will be exposed to much higher powers.
- ◆ When electromagnetic waves enter the body, they typically force electrical charges to move and thus induce electrical currents. But when small pulses from phased array antennas enter the body, moving charges start acting like antennas and re-radiate the pulses, thus sending the radiation even deeper into the body. These re-emitted waves are called Brillouin precursors. They are important when the power or phase of the wave changes rapidly, as is the case in 5G. Therefore, the claim that millimetric waves cannot enter the body because their wavelengths are very small is wrong.
- ◆ There are more than 400 nuclear power plants all over the world, providing 17% of the electricity needs worldwide. In Australia and England, scientists have made a social research study about how much energy will be needed for 5G and IOT. The actual energy and data cost of IOT is still not clear. According to a study, the greenhouse emissions (approximately 2% of all emissions) produced by data servers are as high as those generated by the whole aircraft industry. The electricity demand of the servers will significantly increase in the future. Requirements such as heating and cooling systems and back-up power systems will increase the need for power. According to one estimate, by 2020, the number of devices connected to the system will reach 30-50 billion, thus increasing the demand for electricity approximately by 20%. This means at least 400 new nuclear power plants.
- ◆ The particles in clouds in the atmosphere have sizes close to the wavelengths of millimeter waves, which induce in these particles electrical charges and lead to the formation of artificial clouds. This phenomenon disturbs and disrupts the natural dynamics.

- ◆ The foundation cost of the 5G / IoT market is estimated as 7 trillion USD.
- ◆ Modern EM weapons use millimeter frequencies.
- ◆ While there are now around 3 thousand satellites in space, 20,000 low orbit satellites for 5G will expose even the smallest area of the Earth to radiation. A typical communication satellite needs 1-1.5 kWatts for operation. We can easily calculate the power above us.
- ◆ 5G will not only take the current mobile system to a much higher level, but also control machines, devices and objects (IOT), as well as human-to-human communication. 5G is a unified platform and does much more than 4G.
- ◆ 5G threatens weather prediction: According to a recent paper in the journal NATURE (Devra 2010; Rössli et al. 2010), widespread 5G coverage will prevent satellites from detecting change in water vapor, which is used by meteorologists to predict weather change and storms (www.igumed.de/apell.html 2006; www.microwavenews.com; Saga et al. 2009).

3.2 Important information about 5G and small cells

- ◆ The overall radiation that will be emitted from millions of small cells will result in a huge amount.
- ◆ The millimeter waves have a propagation range of 3-100 meters, requiring the base stations to be launched much more densely than conventional mobile communication bases.
- ◆ According to the estimation of the FCC of the USA, millions of small cells and base stations will be built in front of homes, street lights, bus stops, and trash boxes.
- ◆ 5G will bring an additional mobile radiation load to our environment, while the existing 2G, 3G and 4G mobile communication systems will be maintained.
- ◆ The 5G antennas and base stations are arbitrarily installed on lighting poles, buildings etc. and can hinder the services of municipalities and utility providers. Non-governmental organizations and citizens are not given the right to criticize and object to 5G. Objections of owners and inhabitants of buildings and facilities where antennas and base stations are installed are taken into consideration, while automatic approval is given to companies.
- ◆ The petitions by scientists from all over the world to the United Nations and the European Parliament remained futile.

- ◆ Cumulatively, everyday exposures pose a very severe public health risk. Research has established the risk of cancer increase, altering brain development and damages to sperm. 5G mobile technology has not been tested for its long-term effects. Children are more at risk than adults in this regard.
- ◆ Studies have shown that real estates in the neighborhood of base stations lose 20% of their value.
- ◆ A safe alternative to most 5G applications is available. Instead of antennas in front of their homes, houses in many parts of the world are connected to fiber optic cables. Fiber optic cabling is safe, very fast, secure, reliable, more private, has high capacity, produces no radiation and health effects, is more energy efficient than 5G, does not require antennas and cell towers, and causes no harm to the environment.

3.3 Why 5G cell towers are more dangerous than older cell towers

- ◆ 5G emits “ultra high frequencies”. The higher the frequency, the shorter the wavelength, which means that more waves hit our bodies in the same amount of time. Previous cellular generations emit waves at 1-6 GHz frequency range. 5G cell towers may emit frequencies as high as 300 GHz.
- ◆ 5G technology requires “ultra high intensity”. Since the shorter length millimeter waves (MMV) used in 5G do not travel as far (or through objects), the current number of cell towers cannot provide reliable cell signal. It is estimated that for 5G a mini cell tower will be needed every 2 to 8 houses. All these combined will greatly increase our radiation exposure.
- ◆ In RF radiation, the closeness of the source to the body is a more important factor than the power level of the radiation. Radiation dissipates with distance. In other words, exposure to a low-powered source right next to someone is more dangerous than exposure to a more powerful source at a long distance.
- ◆ The threat also increases with the duration of the exposure.
- ◆ 5G is the worst in both ways: we will have more sources around us, and closer to us.

3.4 Research results demonstrate the following health effects of 5G

- ◆ Effects on the skin: Unlike 4G radiation, more than 90% of millimeter waves are absorbed in the epidermis and dermis layer.
- ◆ Effects on the eye: Thermal effects pass under the surface of the eye and cause damage, such as cataracts, at different levels.
- ◆ 5G radiation causes cancer by affecting the defense system, as well as the tissue and the functioning of the organs.
- ◆ Effects on the immune system.
- ◆ Effects on cell growth rate and affects the normal activities of humans.
- ◆ Increase in the resistance of bacteria to antibiotics.
- ◆ Effects on the health of plants. Plants are more affected by 5G than humans.
- ◆ Effects on the atmosphere.
- ◆ Effects on the ecosystem. Extinction of insects, bees, birds etc.
- ◆ 5G is potentially the most dangerous among known cellular communication technologies because it uses pulsed waves, as opposed to the continuous waves used by earlier technologies.
- ◆ It is being planned to send 5G millimeter radiation with high penetration capacity from space. In this case, no radiation-free place will be left on earth where one can live safely.
- ◆ No regulations and security standards exist for 5G.
- ◆ 5G radiation damages sperm.

4. 5G and the Internet of Things

Internet of Things (IOT) consists of communication networks and computer systems that connect objects to each other. There are many experts who say these are time bombs in terms of security because malevolent people who may hijack this system can take control of a house, a building or even a whole city.

With the arrival of inexpensive IoT devices, with the connection of billions of new machines, sensors, security cameras, devices and even our brains, attacks on systems will increase and cyber-security will be almost impossible. Hundreds of new IoT products such as driverless cars, coffee machines, dresses, smart meters, smart toothbrushes, and smart diapers are being added to the list every day. These devices emit environmentally harmful electromagnetic radiation all day everyday. The global Risks

Report 2018 has declared IOT as the world's third largest risk after cybersecurity and natural disasters/extreme weather conditions. The report warns the world. With the growth of the IoT market, attacks on targets will increase exponentially. Attacks before IoT involve the stealing of personal information such as credit cards etc. With IoT, attacks can become much more effective and destructive. For example, they can crash aircrafts, stop or run cars, change election results, manipulate medical devices etc. There are endless possibilities of committing murder from a distance. IoT allows attacks that could not have been imagined before.

On 9/13/2017, 180 scientists and doctors from 35 countries requested 5G technologies to be stopped, especially until they were proven to be safe for children and pregnant women. 5G and IoT will greatly increase the electromagnetic fields around us. The USA's national toxicology program has proven the correlation between brain cancer and mobile phones. Millions of scientific studies since 1960 have demonstrated the harmful effects of low and high frequencies. Nature cannot protect itself against pulsed and modulated radiation that changes billions of times per second.

Some harms that 5G and IoT can cause in humans, the environment and the whole world can be summarized as follows:

- ◆ Health damages
- ◆ Loss of privacy of the private life
- ◆ Astronomical amount of electronic communication
- ◆ Cyber-security risks
- ◆ Disturbance of natural dynamics
- ◆ Boost in the energy requirement
- ◆ Materials needed for IoT and 5G technologies will require new resources and can give rise to international problems
- ◆ Emergence of ethical problems associated with over connectivity and loss of privacy
- ◆ Huge increase in electromagnetic pollution
- ◆ Severe alterations in the gray matter of the brain and brain functioning due to increased usage of 5G communication devices
- ◆ Increased addiction to online activities
- ◆ Loss of real-life social skills due to boosted presence in virtual reality
- ◆ Increased suicide rates as a result of increased isolation due to mobile communication technologies

5. Conclusion

On the basis of the scientific findings summarized above, the following conclusions can be drawn with regards to 5G and the technologies that it will facilitate:

- Humanity, as well as the whole planet, is being made subject to an unprecedented experiment without any right to object or to resist.
- Legal decisions on these technologies are trusted to those who benefit from it, while the victims are deprived of their most natural right to protect their lives.
- The public is being systematically misinformed about the related issues, and those who dare to criticize are presented as narrow-minded and paranoid people.
- These technologies are presented as the one-and-only direction of “progress”, while safer and environmentally friendly alternatives are being hidden or diluted.
- If immediate precautions are not taken, 5G can trigger a disastrous chain reaction in all aspects of life and lead humanity to a dystopic future.

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