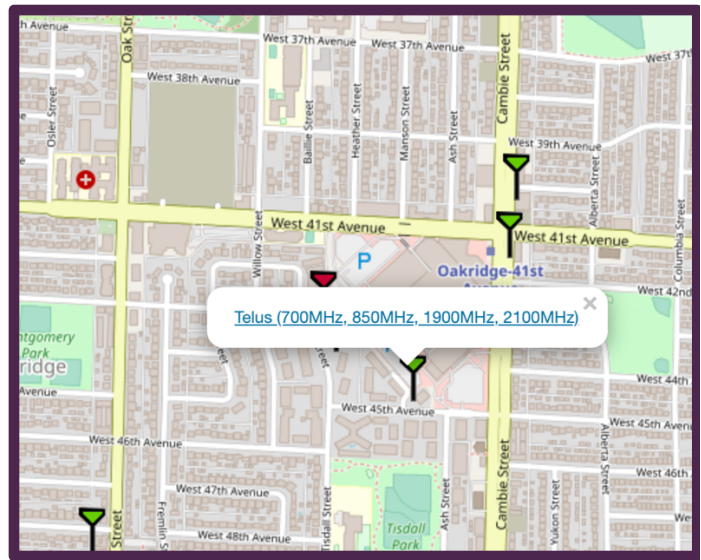


“Private Residence”
203-678 West 45th Avenue
Vancouver, BC



FORCE FIELD
EMF Solutions Inc.

EMF education, mitigation and harmonization

Electromagnetic Frequency (EMF) Report

prepared by Michael Kraus & Jasen Masek

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Summary

Dear XXX,

ForceField EMF Solutions is a Vancouver based company with the mandate to educate the general public as well as businesses around the reality of Electromagnetic Radiation and Pollution. We are a solutions-based company with the focus on mitigation and harmonization of frequencies that interfere with the natural occurring frequencies within the human body.

As a result of a potential health concern that you expressed in your home @ 678 West 45th relating to fatigue and sleep disorder, we conducted a EMF (Electro Magnetic Field) survey.

We would like to share our results with you as this might pertain to your health in relation to long-term effects of EMF-exposure in your environment/area. The intention behind this letter is to share relevant information and make you aware of possible effects on your body that you might or might not be aware of, or could be the cause of health issues that you are already experiencing.

The survey was conducted by one of our affiliate partners Jason Masek, of NOTOXCITY, a building biology consultant specializing in assessment and mitigation of electro-magnetic fields (EMF) and air quality. On February 11, 2020 we performed a “snapshot” measurement of non-ionizing electromagnetic fields, focusing on wireless devices and towers. We found common issues throughout your home that are not just specific to your home and are related to the proximity of wireless technology and electrical wiring.

It is important to note that FORCEFIELD works with the Building Biology Standards that are not connected to any government or country. The guidelines referenced throughout the report are largely based on a reputable summary of studies called the Bio Initiative Report (link: [Bio Initiative Report](#)) and the work of Dr. Martin Blank (link: <http://www.physiology.columbia.edu/MartinBlank.html>).

The health effects of EMFs can be summed up as inflammation and oxidative stress on your cells. Everyone is affected differently by these fields, depending on many factors such as auto immune function and hormone regulation. Some people can handle this stressor very well and others can develop health problems quickly. In the medical community, those who present with issues relating to EMFs are described as (EHS) Electro-Hypersensitive. Children, especially in developmental stages are at greater risk to the effects of EMF's and development of EHS.

The readings within your home, including sleeping area, according to Building Biology Standards, (NOT OFFICIAL GOVERNMENT or TELECOM INDUSTRY STANDARDS) are in the **EXTREME CONCERN CATEGORY**.

While this sounds alarming, simple and very cost-effective measures can be taken to significantly reduce the level of EMF's to protect yourself and your children. OUR INTENTION IS TO START A DIALOUGE AS TO HOW WE CAN EDUCATE THE PUBLIC AROUND THE HEALTH EFFECTS AND FIND SOLUTIONS FOR THE GREATER BENEFIT OF ALL.

Background

Chronic diseases and illnesses associated with non-specific symptoms are on the rise. In addition to chronic stress in social and work environments, physical and chemical exposures at home, at work, and during leisure activities are causal or contributing environmental stressors that deserve attention. It seems necessary now to take “new exposures” like electromagnetic fields (EMF) into account. Physicians are increasingly confronted with health problems from unidentified causes. Studies, empirical observations, and patient reports clearly indicate interactions between EMF exposure and health problems. Individual susceptibility and environmental factors are frequently neglected. **New wireless technologies and applications have been introduced without any certainty about their health effects**, raising new challenges for medicine and society. For instance, the issue of so-called non-thermal effects and potential long-term effects of low-dose exposure were scarcely investigated prior to the introduction of these technologies. Nevertheless, there is strong evidence that long-term exposure to certain EMFs is a risk factor for diseases such as certain cancers, Alzheimer’s disease, and male infertility. **It is very important to take the individual susceptibility into account. In the beginning, EHS symptoms occur only occasionally, but over time they may increase in frequency and severity.**

Common EHS (Electromagnetic Hyper Sensitivity) symptoms include:

- Headaches
- concentration difficulties
- sleep problems
- depression
- a lack of energy
- fatigue
- flu-like symptoms.

This EMF Guideline gives an overview of the current knowledge regarding EMF-related health risks.

The Bundespsychotherapeutenkammer (BPTK) study in Germany showed that mental disorders and especially burnout as a reason of inability to work increased seven-fold from 2004 to 2011. In Germany, 42% of early retirements in 2012 were caused by mental disorders, depression being the leading diagnosis. In Germany, psychotropic drugs are in third place for the prescriptions of all drugs. The consumption of methylphenidate (Ritalin, Medikinet, Concerta), a psychotropic drug prescribed as a treatment for **attention deficit hyperactivity disorder (ADHD) especially for young children and adolescents, has increased alarmingly since the early 1990s**. According to statistics of the German Federal Institute for Drugs and Medical Devices (Bundesinstitut für Arzneimittel und Medizinprodukte), prescriptions have increased even more dramatically since 2000 and reached a climax in 2012. In 2013, only a slight

decline in the number of prescriptions was observed. **Interestingly, the rapid increase in the use of methylphenidate coincides with the enormous expansion of mobile telecommunication and other related technologies**, posing an open research question.

In Germany, work disability cases and absence days due to mental health disorders more than doubled from 1994 to 2011 .

While there are various environmental influences, it is suspected that environmental conditions such as the increasing exposure of the population to electromagnetic fields (EMFs) play a causal role for EMF-related health effects, including exposure to radio-frequency radiation (RF), which emanates from, e.g. cordless phones (DECT), mobile phone base stations, and mobile phones (GSM, GPRS, UMTS, LTE), especially smartphones (4G, 5G), data cards for laptop and notebook computers, wireless LAN (Wi-Fi), wireless and powerline communication-based smart meters.

WE, AT FORCEFIELD EMF are concerned about the official governmental and industry standards around a subject that we cannot see, hear touch or smell.

Especially in context of the next generation 5G network, **WITH NO (ZERO) INDUSTRY RESERACH AROUND THE SAFETY OF 5G IN CONNECTION WITH HUMAN HEALTH** vs. 27,00 scientist globally warning of possible health impacts, it is important that we create an understanding of the reality of the situation to protect ourselves and future generations.

Worldwide statements on EMF exposure

The recommendations of the World Health Organization (WHO) regarding ELF electric and magnetic fields and RF radiation, compiled by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (20, 21), are based on currents induced in the body (ELF) and thermal effects (RF).

Thermal effects are defined as effects that originate in elevated temperatures from the absorption of electromagnetic energy. The specific absorption rate (SAR) is defined as the rate of absorption of electromagnetic energy in a unit mass of biological tissue. It is proportional to the incremental temperature increase in that tissue. Indeed, while a significant temperature increase must be avoided as it can be of immediate adverse health consequences (tissue necrosis, cardiac stress, etc.) exposures can be without (measurable) temperature increase either because of heat dissipation or because the exposure is too low to be associated with relevant heating. The latter type of exposure is termed non-thermal. Biological and health-relevant effects at non-thermal levels have been shown and discussed by many research groups all over the world. **The ICNIRP recommendations were adopted by the EU in its Council Recommendation of 1999, without considering long-term non-thermal effects.**

In contrast to the ICNIRP guidelines, the Russian safety standards, are based on non-thermal RF effects, which were obtained by several research institutes in the former Soviet Union during decades of studies on chronic exposures to RF. In contrast to the WHO headquarter in Geneva, **the International Agency for Research on Cancer (IARC), a WHO-affiliated specialized agency in Lyon, extremely low frequency magnetic fields (ELF MF) as possibly carcinogenic to humans (Group 2B) in 2002 and radio-frequency radiation in 2011.**

In August 2007 and December 2012, the BioInitiative Working Group, an international group of 29 experts with different competences, published two ground-breaking reports, calling for preventive measures against EMF exposure based on the available scientific evidence. The BioInitiative report 2012 includes sections on the evidence for effects on: **gene and protein expression, DNA, immune function, neurology and behavior, blood-brain barrier, brain tumors and acoustic neuromas, childhood leukemia, melatonin, Alzheimer's disease, breast cancer, fertility and reproduction, fetal and neonatal disorders, autism** and inadequacy of the current standards. As it is mostly neglected as a health hazard, the **European Environment Agency compared the risks of non-ionizing radiation (EMF) to other environmental hazards such as asbestos, benzene, and tobacco, urgently recommending to implement a precautionary approach regarding EMF.**

Since 2007 **the Highest Health Council of the Ministry of Health in Austria has recommended to take preventive action by reducing exposure levels from RF devices which may lead to long-term human exposure of at least a factor of 100 below the guideline levels of the European Commission** and by issuing rules on how to reduce one's individual exposure to RF radiation from mobile phones.

As of February 2020, **27000 scientists from 172 countries** have signed an international Appeal, directed to the United Nations (UN) and WHO, calling for protection from non-ionizing electromagnetic field exposure. **The appeal addresses the scientifically proven effects on health and the inadequate international guidelines (ICNIRP)** to date and their use by the WHO. In addition, nine requests were made, including that: **"the public be fully informed about the potential health risks from electromagnetic energy and taught harm reduction Strategies"**.

Measurements of EMF's

The evolutionary development of the human species took place under the presence of the natural electromagnetic spectrum (Earth's magnetic field, Earth's electric field, spherical, Schumann resonance). Those influences have been part of our biosphere like the oxygen content in the air or the visible light spectrum, and they have been integrated into the biological functions. By now, nearly all non-ionizing parts of the electromagnetic spectrum are filled with artificial, technical EMF sources due to electrification and (wireless) communication technologies and are very rarely found in nature.

Electromagnetic spectrum Natural and artificial sources

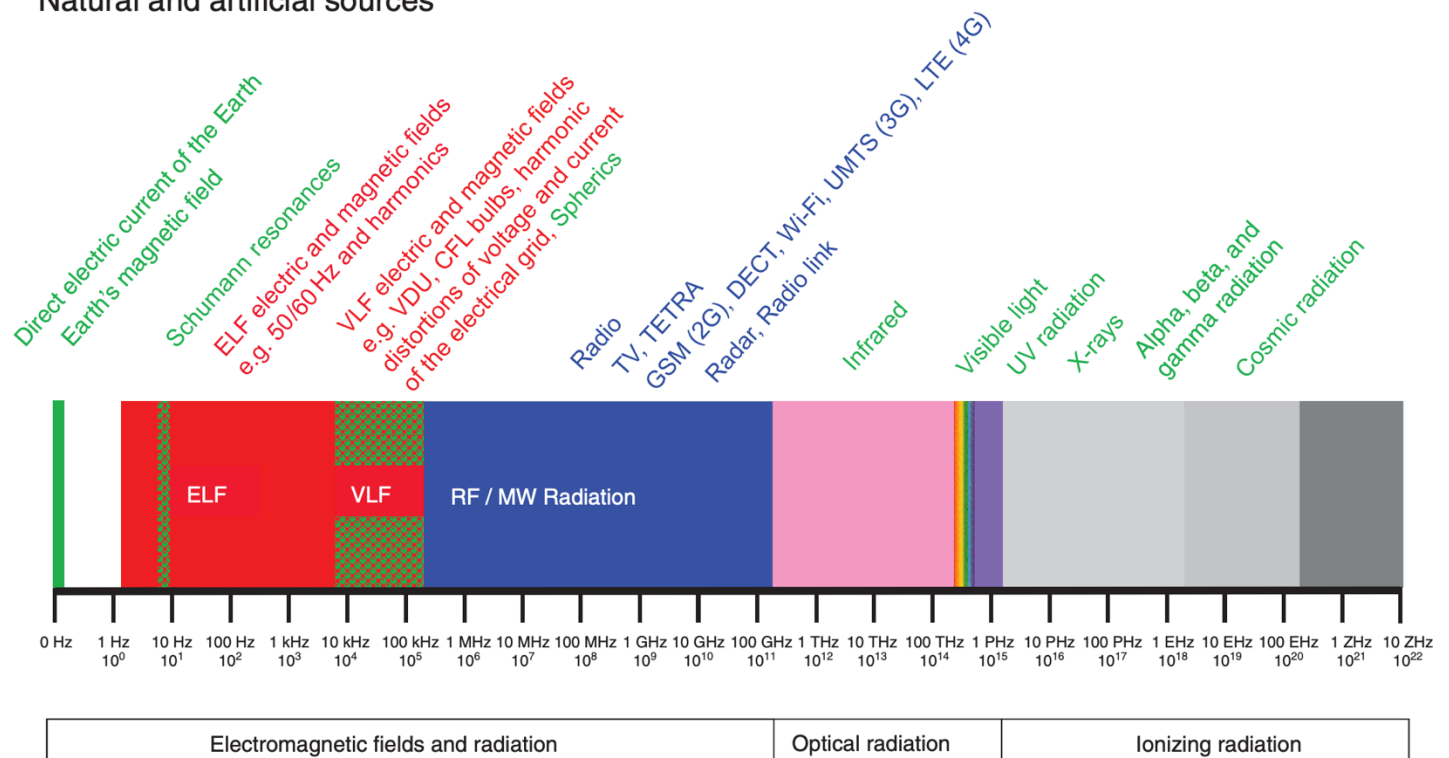
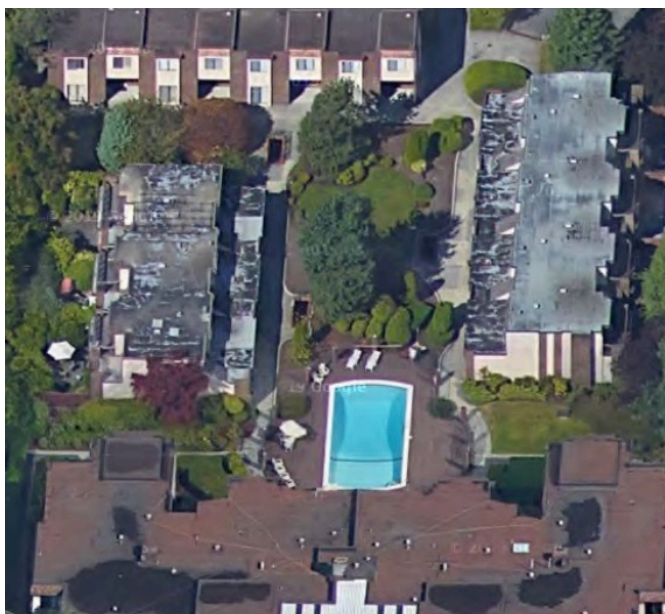


Figure 3: Examples of natural (green) and artificial (red and blue) EMF sources along the electromagnetic spectrum (256).

Your Report



Prepared for:	xxxx
Concerning:	678 West 45 th Ave Suite xxx Vancouver BC
By:	Jasen Masek EMRS, NotoxCity 778-384-6069 jasen@notox.city
Inspection Date:	Feb 11, 2020

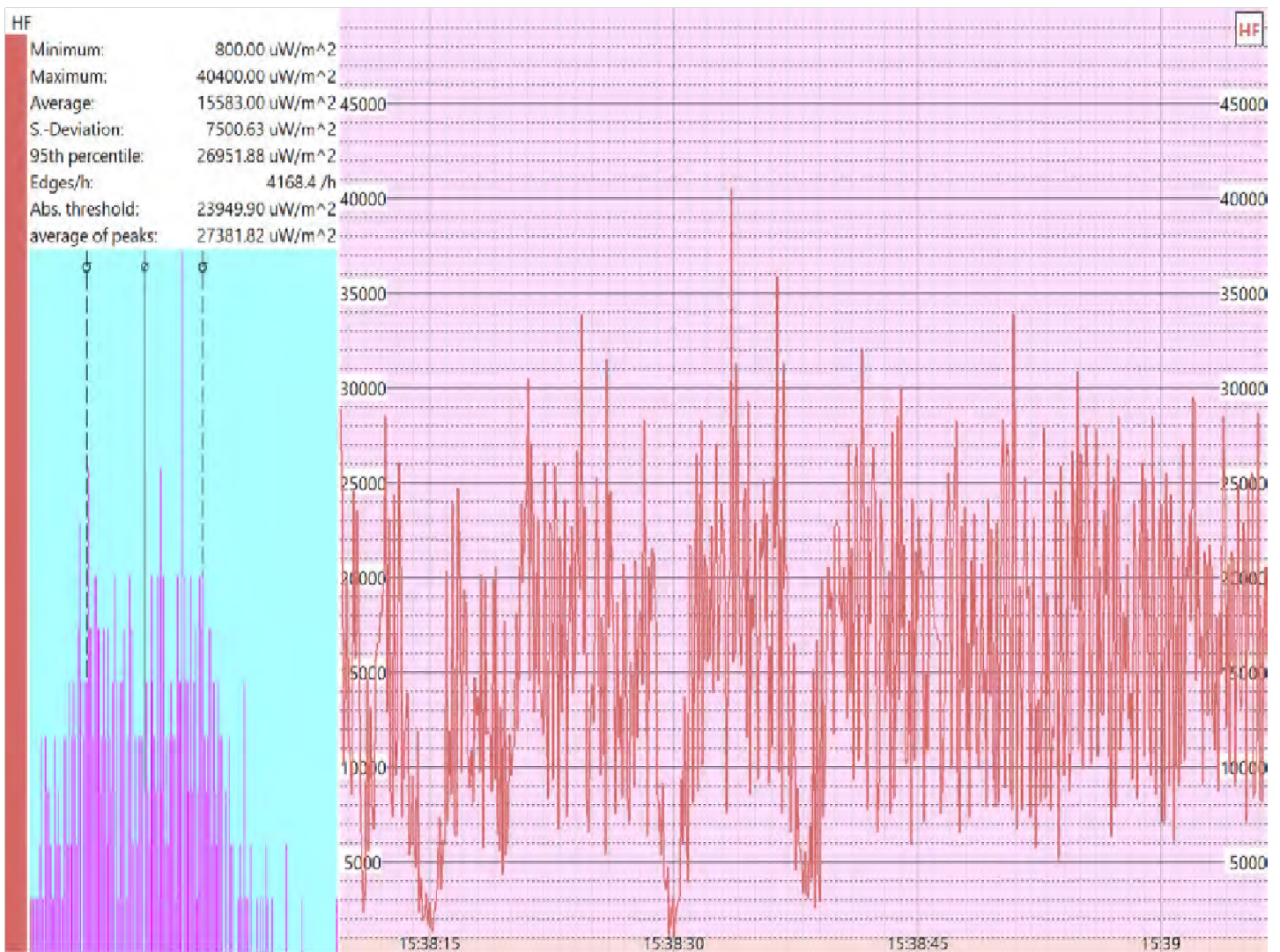
Limitations of the Assessment

Though we hope the included recommendations will lead to a healthier life, NotoxCity Building Biology Inc., and its representatives shall have no liability with respect to the recommendations made, actions taken or courses of conduct implemented based on the results. NotoxCity Building Biology Inc. shall not be liable with respect to the test results for incidental or consequential damages, lost profits or revenues to the fullest extent such liability may be disclaimed by law. We cannot make any claims regarding the presence or absence of indoor pollutants or contaminants other than those for which we tested. We can make no assumptions as to conditions present in areas of the building where we did not test. This assessment cannot be exhaustive given the limited cost and time devoted to it. Therefore, all problem areas may not be identified and hidden or developing problems could have gone undetected. Finally, please note that, due to the limited scope of this survey, results may not be suitable for litigation support. In no event, shall NotoxCity Building Biology Inc. liability exceed the amount paid to NotoxCity Building Biology Inc. by the client. The results relate only to the items tested. The discussions in this report are based only on single (one time) results and may not be repeatable if conditions in the home change or if the results are collected during a different period of time.

Log 95: Living Room

High Crest Factor: 300,000 $\mu\text{W}/\text{m}^2$

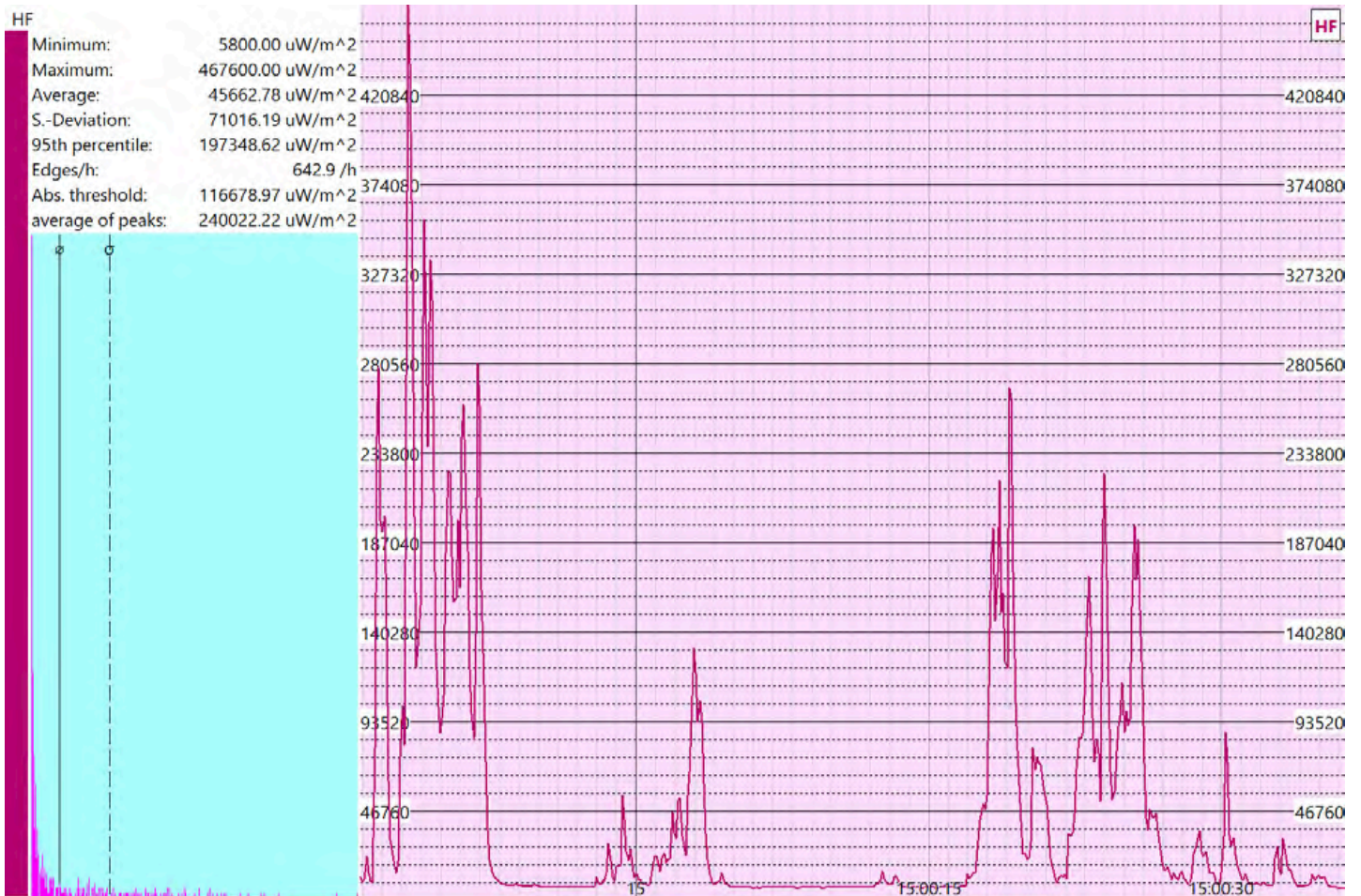
Below is a graph of the RF density in the living room it measured while walking around the room with a logarithmic antenna. The very high spikes are when the antenna was aimed at the Shaw modem/router. It is in the **extreme concern category**.



Log 80: Children's Bedroom

High Crest Factor: 248,000 $\mu\text{W}/\text{m}^2$

Below is a graph of the RF density in the bedroom. I moved around the room with a logarithmic antenna. The high peaks are aimed at the door and are caused by the internal WIFI. It is in the **extreme concern category**.



Log 93: Dining Room

High Crest Factor: 92,000 $\mu\text{W}/\text{m}^2$

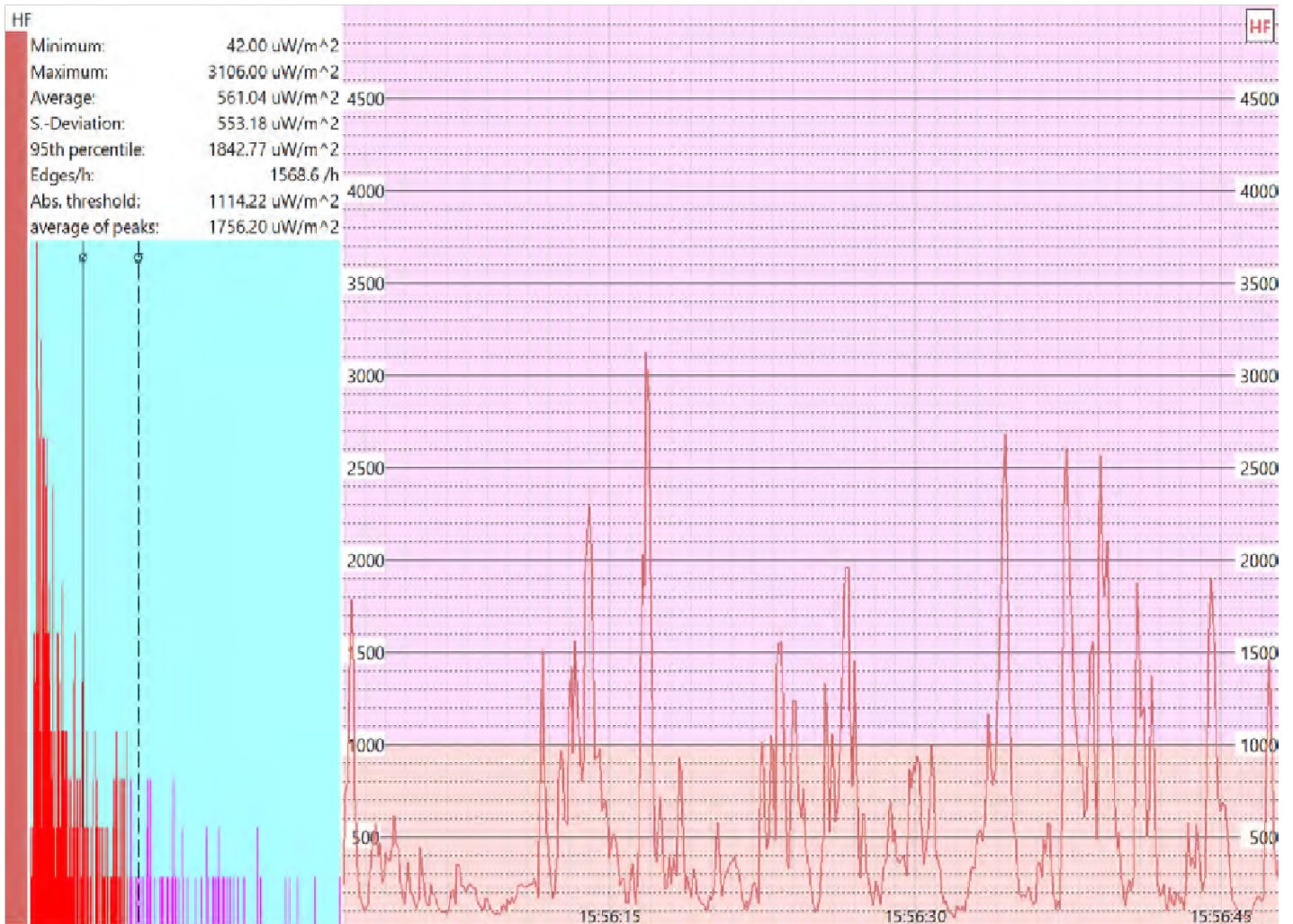
Below is a graph of the RF density coming from the old WIFI router on top of the fridge. Pointed at the router at the dining room table with a logarithmic antenna. The SHAW modem was off at the time. The quick drop off is where the router is turned off then a spike at the end when it was turned back on. It is in the extreme concern category



Log 92: Master Bedroom

High Crest Factor: 31,000 $\mu\text{W}/\text{m}^2$

Below is a graph of the RF density in the bedroom. I moved around the room and with a logarithmic antenna The high peaks are aimed at the door and are caused by the internal WIFI. It is in the **extreme concern category**.

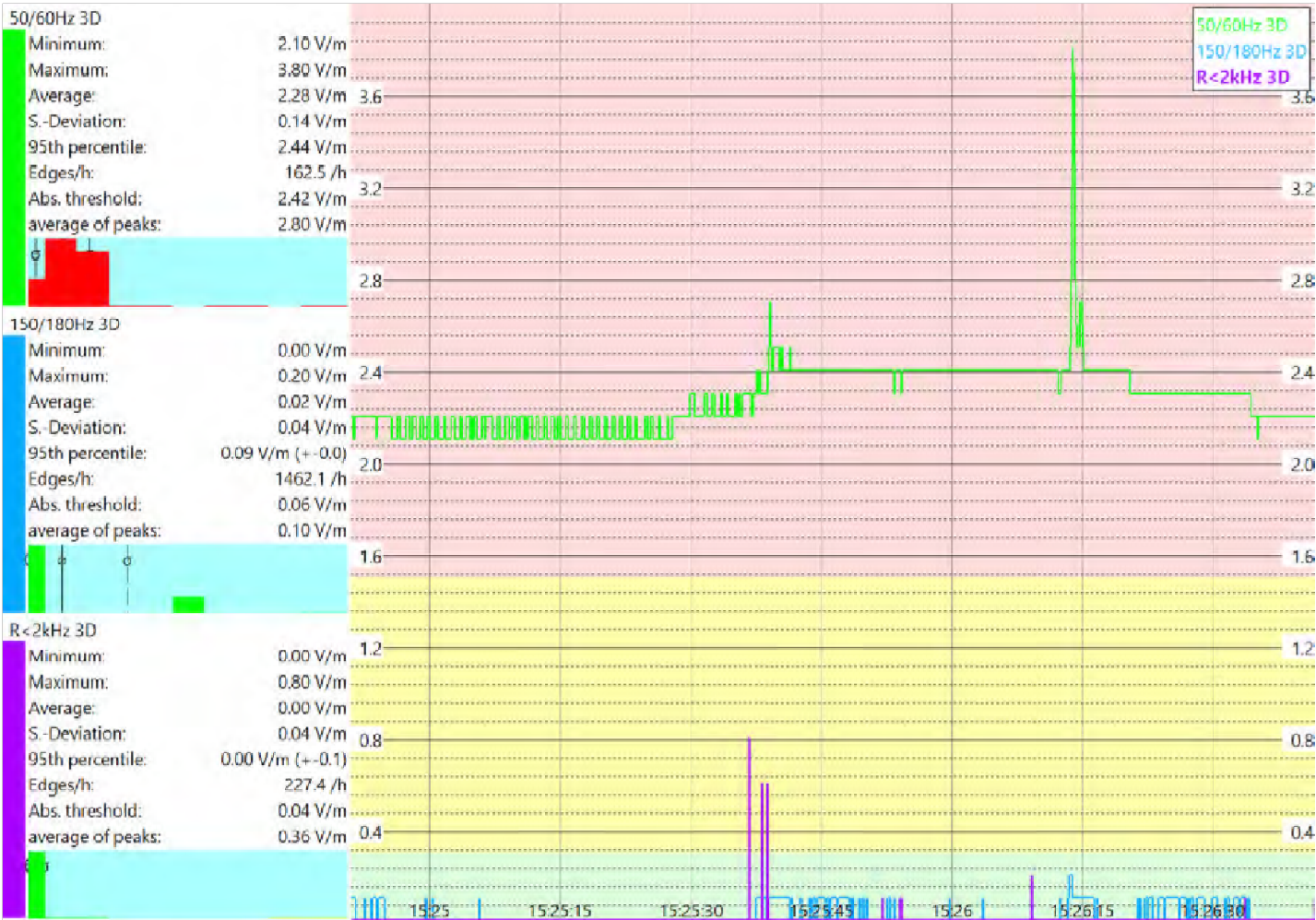


AC Electric Field Readings: (caused by voltage, difference measured point to point in volts/meter) 5Hz to 1MHz

Log 83 Dining Table

Below is a graph of the AC Electric field around the dining table. The green line shows the strength of that field utilizing the frequency of 60Hz. The electric field is in the **extreme concern category**.

Additionally, in this graph is Micro surge Electrical Pollution (dirty electricity) in purple and blue, which reaches the **extreme category** for building biology standards. **However, the average is in the slight concern category.**

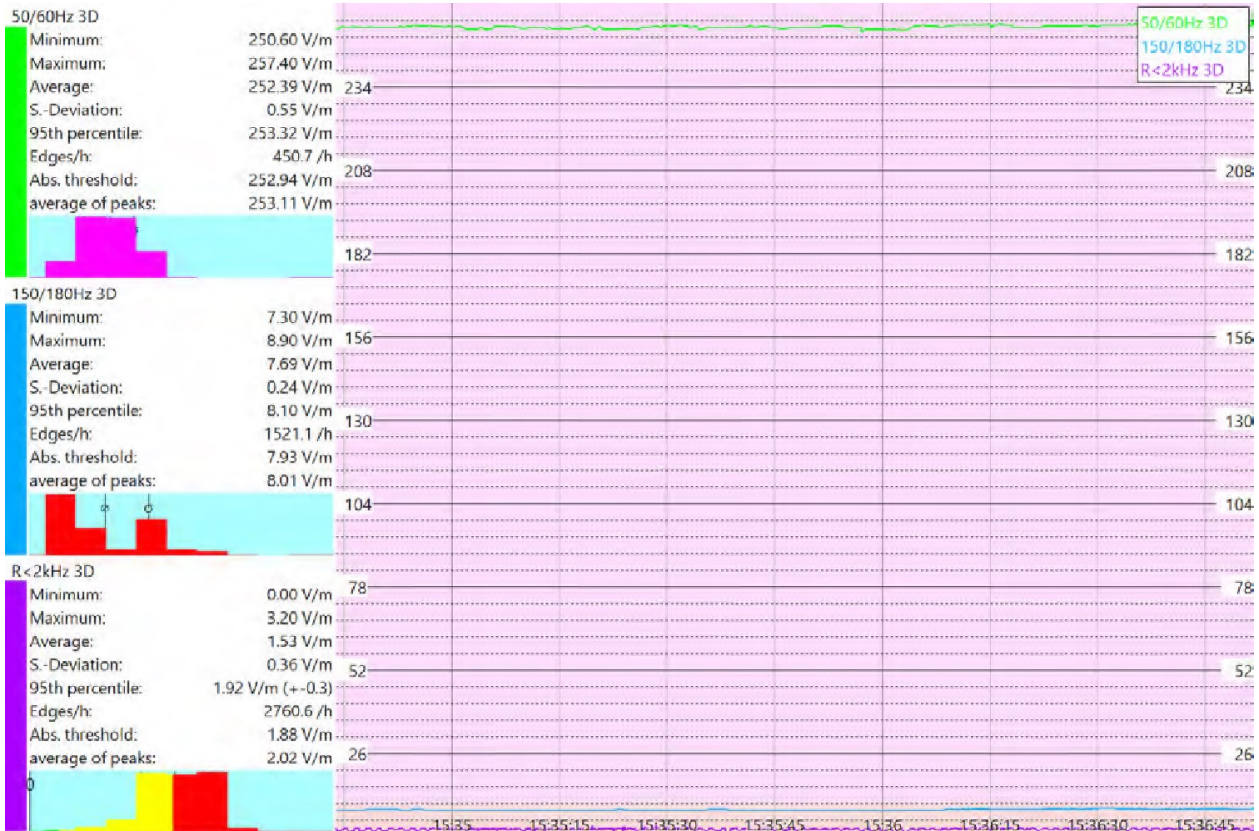


AC Electric Field Readings: (caused by voltage, difference measured point to point in volts/meter) 5Hz to 1MHz

Log 86 Blue bed

Below is a graph of the AC Electric field of the blue bed with an electrical device hooked up. The healing blanket was turned off and on and no change was found, however **the strength of the electric field is very extreme at 250 v/m (normal home is about 3 V/m)**. A serious consideration needs to be made as to the benefits vs radiation exposure. The green line shows the strength of that field utilizing the frequency of 60Hz. The electric field is in **the extreme concern category**.

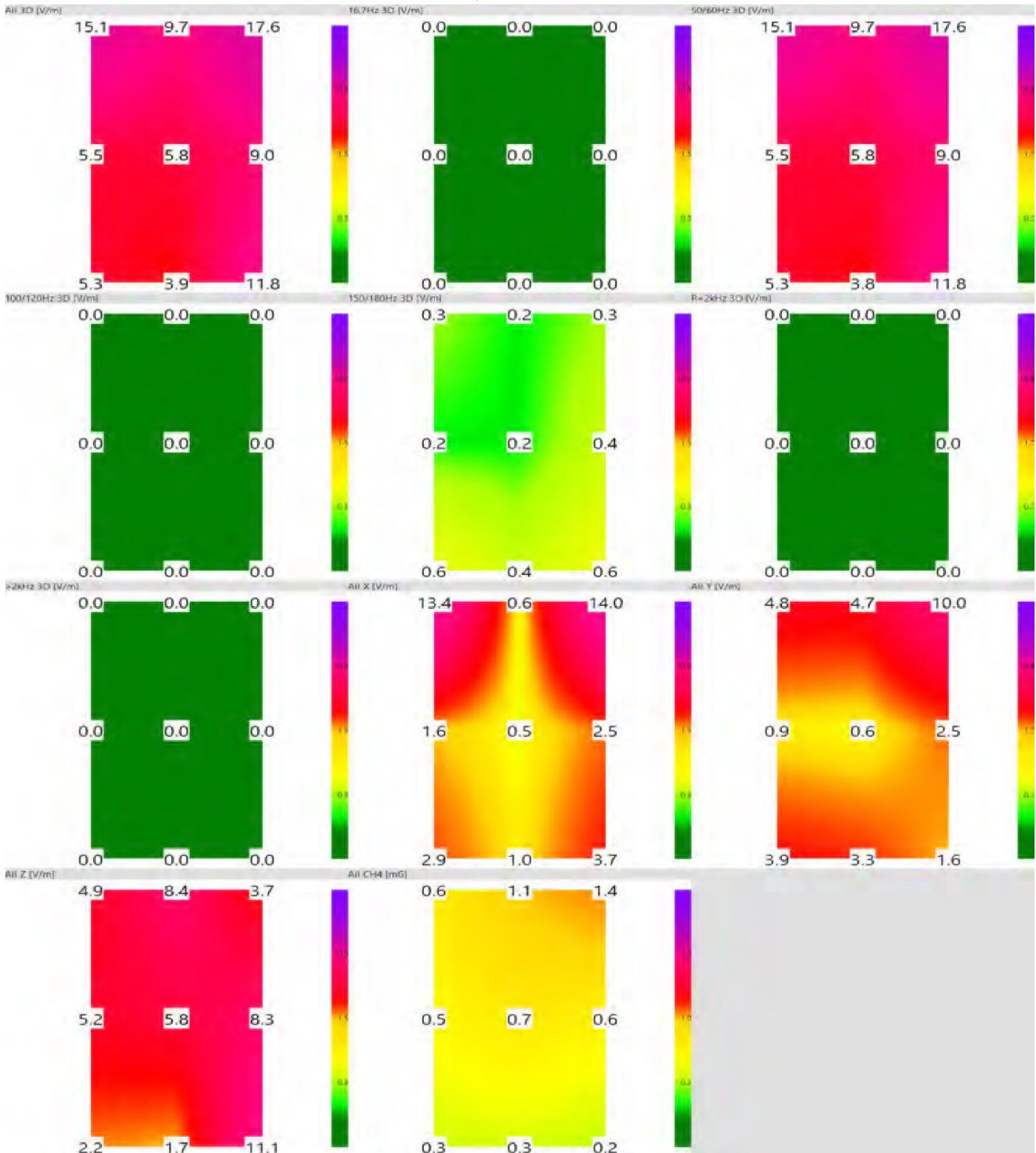
Additionally, in this graph is Micro surge Electrical Pollution (dirty electricity) in purple and blue, which **reaches the extreme category** for building biology standards.



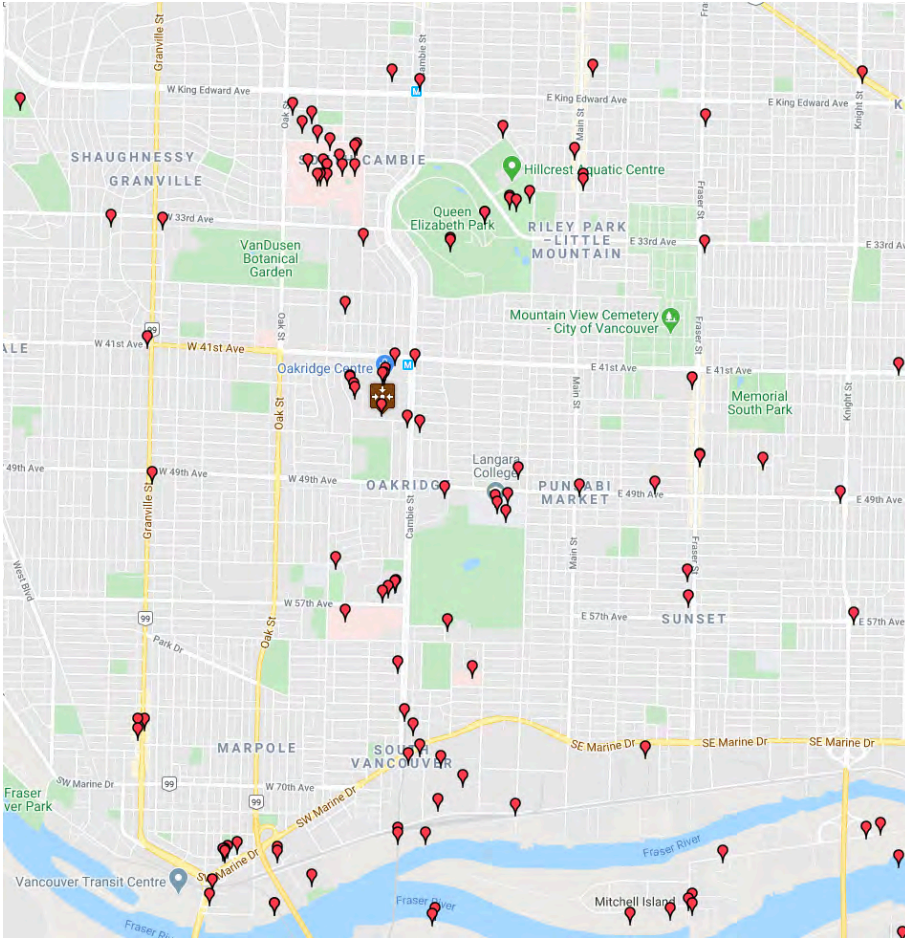
AC Electric Field Readings: (caused by voltage, difference measured point to point in volts/meter) 5Hz to 1MHz

Log 91 Master Bed

Below is a graph of the AC Electric field basement bed map between 5Hz and 1MHz. The meter was flat and facing up on the bed. It is almost all 60Hz electrical waves. The electric field is in the severe to extreme concern category. The majority of this field is caused by the voltage from the wall as well as any electrical devices near the bed.



Nearby Towers:

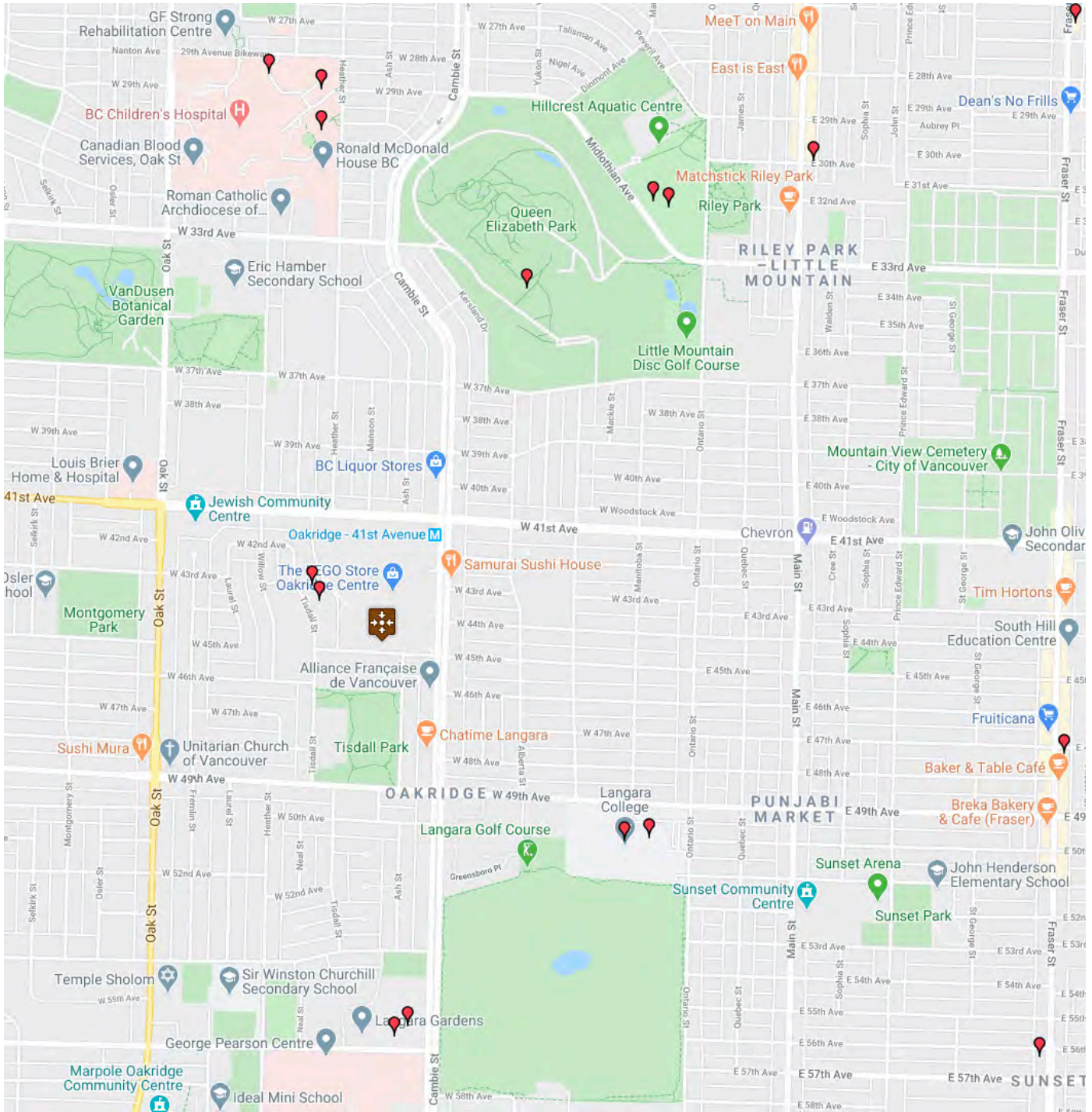


This is map of all towers near you. The brown square is your house. You are surrounded by many close towers. This map encompasses private towers, cell phone, high powered wireless systems.

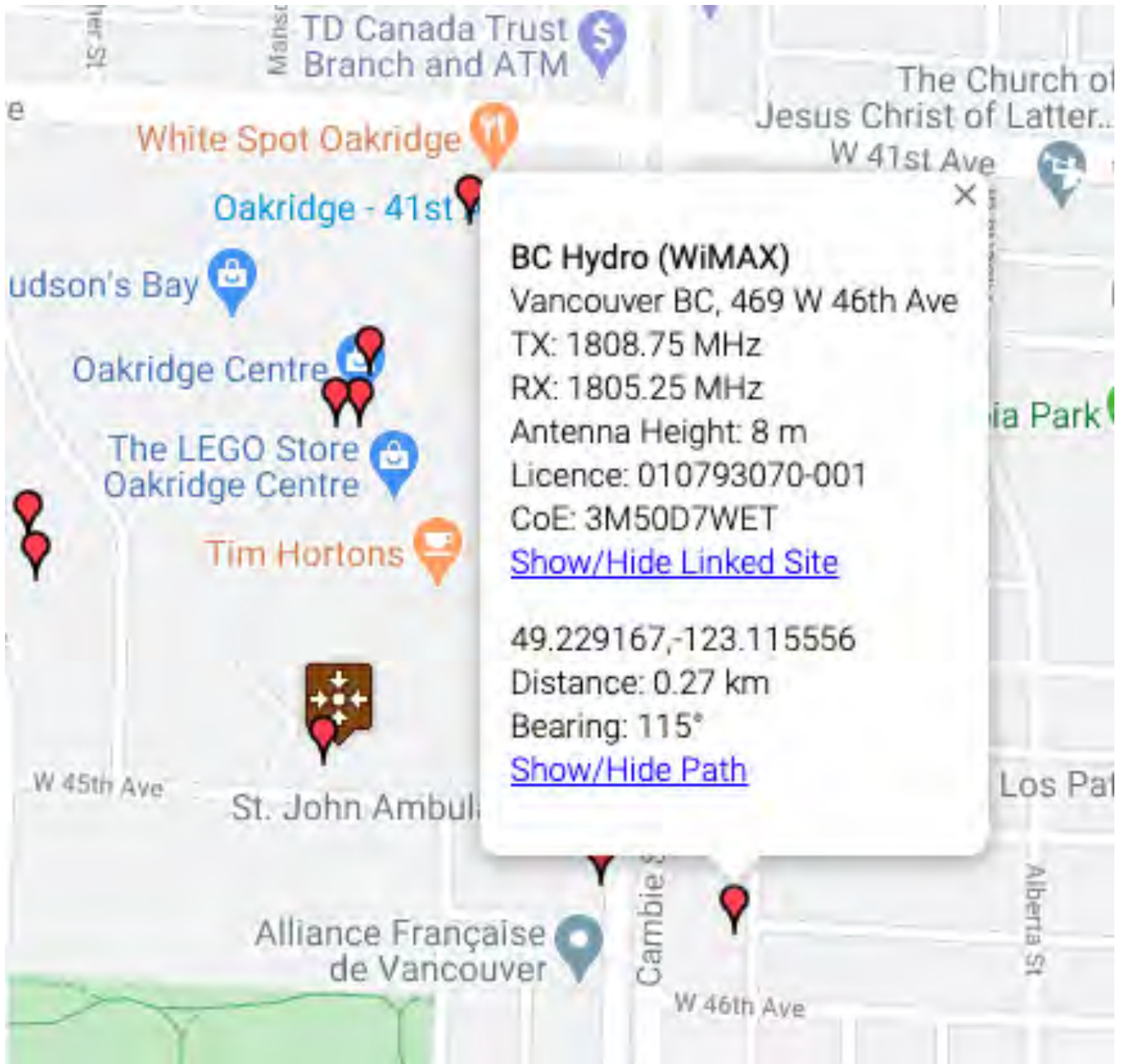
On the right is an example of some of the tower cells that are very close to your home. However, most of the towers are transmitting over you. With further evaluation we can look into mitigation techniques to reflect the frequencies.



This is a map of the towers where the frequencies are above the capabilities of the equipment. Most are owned by cellphone companies as a means to communicate data from tower to tower. The red points are the towers.



Here is the location of a nearby BC Hydro WiMax. There are is one every couple blocks.



How to read the measurements

Biological Concern Definitions for IBE Sleeping Room (Long Term Exposure) Standards:

The following terms below are the International Institute for Building Biology and Ecology standards for sleeping areas. They are relevant throughout your daycare.

NO CONCERN - Unavoidable, minimum imposed by our technological civilization, but often found in homes

SLIGHT- Biologically active, but no large concern for healthy people with intact immune system, without chronic diseases or special sensitivities. If client is not healthy, remediation must be done.

SEVERE- Unacceptable for all people, especially if multiple stress factors are acting together. Remediation must be done as soon as possible.

EXTREME- Unacceptable for all people. Remediation must be done quickly even without the presence of multiple stress factors.

Building Biology Precautionary Guidelines (SBM-2015) for Sleeping Areas (Long Term Exposure)

	NO CONCERN	SLIGHT CONCERN	SEVERE CONCERN	EXTREME CONCERN
Microwatts per square meter $\mu\text{W}/\text{m}^2$	< 0.1	0.10-10	10-1000	> 1000
YOUR READINGS				31,000 -300,000

Bio Initiative Report Precautionary Guidelines (2007-2012) www.bioinitiative.org/

Dr. Martin Blank – Columbia University

Biologically Based Precautionary Levels 1000 $\mu\text{W}/\text{m}^2$

Canada and USA Government Guidelines (1999,2009,2015)

In Canada, guidelines for Radio Frequency Wave exposure lay under the jurisdiction of Health Canada, Safety code 6 was developed in 1999 and offers federal guidelines for safe RF exposure levels. These limits are in the range of 2,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$ or 200 to 1000 $\mu\text{W}/\text{cm}^2$ and are based solely on the short-term thermal effects or heating of body tissue. There are no Canadian or USA biological exposure guidelines for long term exposure to Radio Frequency Radiation. Since these guidelines are based on short-term acute exposure we still do not have guidelines that protect the public from long- term low level exposure.

RF International Guidelines:

Please note that is only for the 1800MHz range, technology is typically now much higher in frequency. Your readings of the cell towers still fall below the standards of Canada but are above many of the other locations.

International Radio Frequency “RF” Exposure Limts for 1800 MHz Range
(Cell phone, Wifi,Smart Meters, etc.)

Location	Reference	Exposure Time	Limit Based On	uW/m2	V/m
Most of Western Europe	IEEE C95.1-1999	30 minutes	Thermal/Heating	10,000,000	61.4
USA	(FCC) IEEE C95-1-1999 and ICNIRP	30 minutes	Thermal/Heating	10,000,000	61.4
Canada	Safety Code 6, Table 5 (2015)	6 minutes	Thermal/Heating	4,393,278.40	40.7
Russia	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100,000	6.14
China	UDC 14.898.5 GB 9175-88	3 hours +	Biological Effects	100,000	6.14
Italy	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100,000	6.14
Most of Eastern Europe	Sanitary Norms and Regulations 2.2.4/2.1.8.055-96	3 hours +	Biological Effects	100,000	6.14
Switzerland	Ordinance of Protection from Non-ionizing Radiation (NISV)	Long Term	Precautionary	100,000	6.14
Toronto Board of Health, Canada	Proposed 1999	Long Term	Precautionary	100,000	6.14
Bio Initiative Report	Bio-Initiative Report 2007	Long Term	Biological/Precautionary	1000	0.614
Salzburg Resolution on Mobile Telecommunications	Preventative public health protection, Salzburg, June 7-8 2000	Long Term	Precautionary	1000	0.614
European Parliament	Resolution 1815, Strasburg, May 27, 2011	Long Term	Precautionary	106	0.2
European Academy for Environmental Medicine (EUROPAEM)	EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF realted health problems and illnesses DOI 10,1515/reveh 2016-0011	Long Term	Precautionary	100	0.0614
Building Biology Guidelines (Sleeping Areas)	SBM 2008 – Level of No Biological Concern	Long Term	Precautionary	0.1	0.00614
Natural Cosmic Radiation	MAES 2000	Long Term	Natural Exposure	0.000001	6.14E-08
Average Indoor Urban Exposure Vancouver, Canada	NotoxCity Building Biology	Long Term		200-5000	0.3-1.4

EMF exposure reduction – Preventing exposure to radio-frequency radiation (RF)

- Keep mobile phone/smartphone and cordless phone calls short; use the speakerphone function or a handsfree kit.
- Avoid wearing the mobile phone/smartphone close to the body.
- Deactivate all non-essential wireless mobile phone apps, which cause periodic radiation exposure.
- Keep mobile phones/smartphones in “airplane mode” whenever possible or deactivate mobile data, Wi-Fi, Bluetooth and near field communication (NFC) in the smartphone settings.
- Disconnect (unplug) the power supply of all DECT cordless phone base stations. So called “ECO Mode” or “zero-emission” DECT phones are only conditionally recommended because the exposure by the handset is still present. A “traditional” corded phone is recommended instead.
- Disconnect (unplug) the power supply to all Wi-Fi access points or Wi-Fi routers. Many LAN routers now come equipped with additional Wi-Fi. Call the provider of the LAN router and ask to have the Wi-Fi deactivated. It is usually also possible to do so online by following the provider’s instructions.
- In case of external RF radiation sources, rooms – especially bedrooms – facing away from the source should be chosen.
- Avoid powerline communication for Internet access (dLAN) and instead use a hardwired Ethernet cable (LAN).
- Avoid exposure to RF radiation (e.g. wireless devices like, home entertainment, headsets, baby monitors, computer games, printers, keyboards, mouse, home surveillance systems) at home, in offices, and in cars.
- Avoid exposure to energy-efficient lighting (compact fluorescent lamps as well as some LEDs generate high frequency transients). These types of lamps can be replaced with incandescent or line-voltage halogen incandescent lamps until good-quality lighting (energy efficient) lamps become commercially available.

Preventing exposure to ELF electric and magnetic fields

- Move the bed or desk away from the wiring in the walls and power cords. A minimum distance of 30 cm (1 ft) from the wall is recommended.
- As magnetic fields can pass through walls, make certain that there are no magnetic sources immediately beneath or above a bed or in an adjacent room.
- Another simple complementary action is to disconnect the power supply to the bedroom (turn off circuit breaker or fuse) for the nighttime while sleeping; try it for a test phase of, e.g. 2 weeks. In general, this measure is not always successful because circuits of adjacent rooms contribute to the electric field levels. ELF electric field measurements are required to know exactly which circuit breakers need to be disconnected. The benefits should be weighed against the potential risk of accidents; therefore, the use of a flashlight for the test phase should be recommended.
- Disconnect the power supply to all non-essential electric circuits, possibly in the entire apartment or house. (N.B. See note above.) – Avoid using an electric blanket during sleep; not only turn it off, but also disconnect it.
- Avoid extended exposures close to running electric motors. As a first step, keep a minimum distance of 1.5 m (5 ft). As a second step, establish a safe distance based on magnetic field measurements. Preventing exposure to static magnetic/static electric fields.
- Sleep in a bed and mattress without metal.
- Avoid sleeping close to iron materials (radiator, steel, etc.)
- Wearing synthetic clothing and, e.g. rubber-soled shoes and not regularly being in contact with the earth can result in build up of static electricity. Cotton clothing and leather-soled shoes will help avoid static electricity.

EMF exposure reduction – second steps

As a second step, EMF measurements and mitigation measures should be carried out. Typical examples are:

- Measure the ELF electric field in the bed. Based on the measurement results, install automatic demand switches in those circuits that increase the exposure.
- Measure the ELF electric field at all other places that are used for extended periods at home and at work. If necessary, choose lamps used close to the body with a shielded electric cable and a grounded lamp fixture (metal). Especially in lightweight construction (wood, gypsum board), electrical wiring without grounding (two-slot outlets) might have to be replaced with grounded electrical wiring or shielded electrical wiring. In special cases, shielded wiring and shielded outlets may have to be installed in the whole building.
- Measure the ELF magnetic field close to the bed, e.g. for 24 h. If net currents are detected, the electrical wiring and grounding system of the building must be corrected to reduce the magnetic fields.
- Install a residual current device (RCD) or ground-fault circuit interrupter (GFCI) to prevent electric shocks (safety measure).
- Measure radio-frequency radiation and mitigate high exposure levels by installing certain RF shielding materials for the affected walls, windows, doors, ceilings, and floors. For example, in a multiunit setting (condominiums or high-rise apartments, townhomes), proximity to neighbors can contribute to in-home exposure.
- Measure dirty electricity/dirty power (electric and magnetic fields in the VLF frequency range) and identify the sources in order to remove them. If this is not possible, appropriate power filters in line with the source may be used.

Mitigation including environmental factors:

The primary method of treatment should mainly focus on the prevention or reduction of EMF exposure that is reducing or eliminating all sources of EMF at home, in school and in the workplace.

Beside EMF reduction, other measures can and must be considered. These include a **balanced homeostasis in order to increase the “resistance” to EMF.** There is increasing evidence that a main effect of EMF on humans is the reduction of their oxidative and nitrosative regulation capacity. This hypothesis also explains observations of changing EMF sensitivity and the large number of symptoms reported in the context of EMF exposure.

Measures that enhance the immune system and reduce stress in combination with detoxification will promote EHS recovery. It should be stressed, that psychotherapy has the same significance as in other diseases. Products that are offered in the form of plaques and the like to “neutralize” or “harmonize” electrosmog should be evaluated with great restraint.

Psychological stress generated by a lack of understanding or support by family, friends and physicians can exacerbate the symptoms of EHS as can stressing about exposure. For rapid recovery, the treatments need to apply to the body, mind and spirit of the individual.

In summary, the following treatment and accessibility measures appear advantageous, depending on the individual case:

- **Reduction of EMF exposure:** This should include all types of EMF exposures relevant to the person, especially during sleep, at work and in school.
- **Control of total body burden:** Besides the reduction of EMF exposure, the reduction of the total body burden by various environmental pollutants (home, workplace, school, hobby), food additives, and dental materials is indicated. – Reduction of oxidative and/or nitrosative stress Reactive oxygen species (ROS) and reactive nitrogen species (RNS) are free radicals naturally produced in cells. Scavengers guarantee the balance between the production of free radicals and the rate of their removal. Many biologically important compounds with antioxidant (AO) function have been identified as endogenous and exogenous scavengers. Among the endogenous AO, we distinguish between enzymatic AO (catalase, glutathione peroxidase, glutathione reductase, superoxide dismutase) and non-enzymatic AO [bilirubin, ferritin, melatonin, glutathione, metallothionin, N-acetyl cysteine (NAC), NADH, NADPH, thioredoxin, 1,4,-bezoquinone, ubiquinone, uric acid]. They interact with exogenous dietary and/or synthetic AO (carotenoids, retinoids, flavonoids, polyphenols, glutathione, ascorbic acid, tocopherols). The complex regulation and use of these substances is the therapeutic challenge.
- **Regulation of intestinal dysfunction:** Endogenous and exogenous scavengers act synergistically to maintain the redox homeostasis. Therefore, dietary or natural antioxidants play an important role to stabilize this interaction. Treatment of a leaky gut, food intolerance, and food allergy is a prerequisite for maintaining redox homeostasis (274) and also requires special knowledge and experience. –
- **Optimizing nutrition:** Bioactive food is the main source of antioxidant components such as vitamin C, vitamin E, NAC, carotenoids, CoQ10, alpha-lipoic acid, lycopene, selenium, and flavonoids For instance, the regeneration of vitamin E by glutathione or vitamin C is needed to prevent lipid peroxidation. The dietary antioxidants only can have beneficial effects on the redox system if they are present in sufficient concentration Alpha-lipoic acid acts directly and indirectly as a scavenger of free radicals including, singlet oxygen, superoxide, peroxy radicals, and the breakdown radicals of It has been shown that the number of free electrons in micronutrients determines how effective they are. In organic food, the number of free electrons is higher than in conventionally produced food Especially in the case of food intolerances, the tailored substitution of micronutrients in the form of supplements is necessary.
- **Control of (silent) inflammation:** Elevated nitric oxide levels and the reaction with superoxide always leads to elevated peroxynitrate levels, which induce ROS levels as no other substance does (NO/ONOO- cycle). As a result, the nuclear factor κB (NF-κB) is activated, inducing inflammatory cytokines such as tumor necrosis factor α (TNF-α), interleukin-1β (IL-1β), interleukin-6 (IL-6), interleukin-8 (IL-8), and interferon gamma (IFN-γ) and activating various NO synthases Tocopherols), carotenoids at low concentration levels vitamin C , NAC, curcumin resveratrol , flavonoids have shown to interrupt this inflammatory cascade at various points. –

- **Normalization of mitochondrial function:** Mitochondrial function may be disturbed in two ways. First: the high amount of free radicals may block production of adenosine triphosphate (ATP), leading to muscle pain and fatigue. Second: in the case of silent (smoldering) inflammation, the demand for more energy is elevated by 25%, causing a high consumption of ATP. In this case, NADH, L-carnitine, and CoQ10 are essential for ATP synthesis. Due to the lack of ATP, the stress regulation of catecholamines especially norepinephrine (NE) is reduced because catabolism of NE by S-adenosylmethionine is ATP dependent. Furthermore, stress regulation has a high demand for folate, vitamin B6, and methylcobalamine. Genetic polymorphisms of COMT and MTHFR influence the individual need for those substances.
- **Detoxification In humans:** The accumulation of environmental toxins has an individual profile of many different inorganic and organic chemicals, which make up the total body load (292). Among the inorganic substances, metals and their salts play the dominant role and might be of importance to patients with EHS. Elemental mercury (Hg⁰) and other heavy metals such as lead (Pb) accumulate in the brain (293), especially at chronic low dose exposure. They may have toxic effects and can induce various immune reactions. Whereas no specific active substance generally exists for the detoxification of chemicals, there are two groups of substances with more specific effects that can be used for the detoxification of metals.
 1. Substances with nonspecific physiological effects: glutathione, NAC, alpha-lipoic acid, vitamin C, and selenium.
 2. Chelating agents for detoxification of metals (296–298): the most important chelating agents are sodium thiosulfate 10%, DMPS (2,3-dimercapto-1-propanesulfonic acid), DMSA (mesodimercaptosuccinic acid), and EDTA (2,22,23,232- ethane-1,2-diyldinitrotetraacetic acid). It should be noted that these substances should be used only by those designated as experts in this particular field. –

Adjuvant therapies

- **Drinking water:** For detoxification reasons, a higher intake of high-quality drinking water with low mineral content and no CO₂ is needed. The intake quantity should range from 2.5 to 3.0 L (10–12 8-oz glasses) daily.
- **Light:** Most of the people in central and northern Europe are depleted of vitamin D. Sufficient natural daylight exposure during the vitamin D-producing months (spring to fall) is one important factor. At the same time, prevention of actinic damage to the skin is necessary. In addition to natural sunlight, light therapy and low-level lasers can promote healing, reduce inflammation, promote circulation, and enhance cellular ATP production.
- **Sauna:** Sauna and therapeutic hyperthermia is an adjuvant therapy for the detoxification of almost all xenobiotics. These therapies have to be carefully used. An interaction with detoxifying drugs takes place. Sauna helps to regenerate tetrahydrobiopterin from dihydrobiopterin, which is essential for the metabolism of catecholamines and serotonin (299). However, not all saunas are alike. Traditional saunas or infrared saunas with low electric and low magnetic fields that do not use toxic glues and chemically treated wood are recommended
- **Oxygen:** A part of patients with EHS suffer from mitochondrial dysfunction. Sufficient natural oxygen is helpful. As both hypoxia and hyperbaric oxygen can produce oxidative stress, hyperbaric oxygen therapy should only be performed if the patients are treated with sufficient antioxidants at the same time.
- **Exercise:** The optimal amount of exercise is still being debated. A person's physical capacity should be assessed by ergometry in order to prescribe an individual exercise regime. Environmental medicine experience indicates that for sick

people only low-impact aerobic exercise should be used. In general, start with a workload of 20–30 watts that often can be finished at 60–70 watts. Exercise on an ergometer allows better control of the consumption of energy compared to walking or running. No fatigue should result from exercising, at least after half an hour.

- **Sleep:** Sleep problems are very common in patients with EHS. Sleep disturbance is associated with a reduced melatonin level. In the case of chronic inflammation, the activation of IDO (indolamine-2,3-dioxygenase) reduces the production of serotonin and, in turn, it also reduces melatonin levels. EMF exposure might block the parasympathetic activity while sympathetic activity persists. Concerning sleep disturbances, any therapy has to follow the pathogenic causes. Optimal sleep is necessary to save energy and to regulate the functions of the immune and neuroendocrine systems.
- **Protection from blue light Wavelengths of visible light below 500 nm are called “blue light”.** Low doses of blue light can increase feelings of well-being, but larger amounts can be harmful to the eyes. In natural daylight, the harmful effects of “blue light” are balanced out by the regenerative effect of the red and infrared content. The escalating use of electronic light sources – such as fluorescent tubes and compact fluorescent lamps (CFL), computer screens, laptops, tablets, smartphones, and certain LED bulbs – has increased our exposure to “blue light”, which at this level is suspected of playing a role in the development of age-related macular degeneration and circadian misalignment via melatonin suppression, which is associated with an increased risk of sleep disturbance, obesity, diabetes mellitus, depression, ischemic heart disease, stroke, and cancer. Extended exposure to artificial “blue light” in the evening should therefore be limited. Antioxidants, especially melatonin and blue light screen filters (could be helpful).
- **Exposure to the natural electromagnetic fields of the Earth:** Most people in urban centers are disconnected from the Earth’s natural grounding/magnetic fields by walking with rubber-soled shoes, wearing synthetic clothing, driving in metal boxes with rubber wheels, and living and working in concrete buildings that are permeated with artificial electromagnetic fields and radiation. Spending time in the woods, walking barefoot along a beach, lying on the grass, sitting on rocks, or strolling outside after a rain shower help ground a person and help balance the often enhanced positively charged ions that are associated with ill health.
- **Dental medicine** Dental medicine still works with toxic or immunoreactive materials, e.g. mercury, lead oxide, gold, and titanium. Environmental dental medicine demands that these materials not be used). The removal of toxic dental materials must take place under maximum safety conditions (avoid inhalation!). The elimination of particularly heavy metals from the body might be indicated. In general terms, endoprosthetic materials should be inert with respect to immunoreactivity. Based on our current knowledge, zirconium dioxide seems to be a neutral material. However, mechanical abrasion of the coated surface by the dentist should be avoided. Immunotoxic metals show a similar pathophysiology with respect to oxidative stress, mitochondriopathy, and inflammation.
- **Lifestyle coaching:** Lifestyle coaching may include balanced exercise, nutrition, reduction of addictive substances, change of sleep habits, etc. and stress reduction measures (reduction of general stress and work stress), as well as methods to increase stress resistance via, e.g. autogenic training, yoga, progressive muscle relaxation, breathing techniques, meditation, tai chi, and qigong.

