

STUDIES AND RESEARCH ON THAT ELECTROMAGNETIC FIELDS IN PUBLIC AREAS

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ABSTRACT

The society development in the new era of technologies led to increasing demands of electricity needs. For this reason, the distribution networks had extended significantly. A key factor affecting global warming is energy production and consumption. This affects the natural ecosystems and biodiversity, having adverse effects on human, animal and environment health. To keep pace with social evolution in every household the number of electrical and/or electronic devices have increased significant. All these devices lead to Complex Electromagnetic Radiations that are directly loaded into the environment, even in the places where people rest and sleep. The lack of information, research and depth analysis about electromagnetic emissions or radiation effects on human health on long time exposure, compels us to use the precautionary principle. As in any scientific work, we will present the results of measurements on electromagnetic radiation for several public places in different cities. For frequency measurements we focused on low and high frequency. The measurements reveal us, that in several places the values exceed legal limit admitted on long time exposure.

KEYWORDS: electromagnetic fields; radiation; Non-ionizing Radiation; Environment; human exposure

1. Aspects relating electromagnetic fields

Rapid rate industrialization using electrical power led to serious electrical networks extension on global scale. Electric power consumption and production are generating considerable pressures on the Environment, with negative impact on natural ecosystems and human health.

The variety of electric/electronic products and devices used in transport sector, trade market, industry, telecommunications, medicine, agriculture, education, domestic activities alongside with all electric networks are generating around us a bundle of electromagnetic fields (EMF).

An experiment without aim can be called, the submission of human populations to electromagnetic radiation in the last 80 years. Concerns arise from the lack of information about the effects on human health and/or the environment by radiations.

An electromagnetic field (radiation or electromagnetic waves) contains an electrical field (E) and a magnetic field (H), mutually perpendicular

and at the same time perpendicular on the propagation direction that oscillate sinusoidal from positive to negative (as value) with a f Frequency.

The distance between two maximum positive values (or negative) is called wavelength, inversely proportional with f Frequency.

The field may be divided in two main components: reactive component and radiant component. The reactive component refers to the energy stored near the source region being responsible for effects on humans.

The region is found around the source, till a distance of approximately $1/6 \text{ m} \sim 2 \text{ m}$ also known as close field region.

The measurements for close field are demanding, because even by introducing the inlet probe into the field, we are interfering significantly the field.

The reactive component is found at larger distances than one wavelength. The electromagnetic wave is described as a plane wave, with a constant

ratio between electric and magnetic field strength, also known as distant field.

This unique feature is important, because it make it possible to measure the component field (electric or magnetic) with a single measurement.

In between these two regions there is a transitional region, where the radiant component is prevailing.

As the wavelength is inversely proportional with frequency, the region may vary. Magneto electric fields are totally invisible, being all over around us.

There are two types of radiation: ionizing radiation (have the capacity to break the molecules) and non-ionizing radiations depending on the quantity of energy delivered.

In addition to the existing natural electromagnetic non-ionizing radiation fields (Earth's magnetic and electric field, lightning magneto electric fields, solar radiation) in which the living organisms have developed over decades and millennia, human activity by developing technologies over the last 40 years generated numerous sources of non-ionizing electromagnetic radiations with different frequency and intensities.

Although are classified by their frequency, the electromagnetic waves with frequency between 0-300 Hz in the academic literature are called extreme low frequency fields (ELF).

The main cause of their existence is the transmission and distribution systems of electric energy (including households, electrical or electronic equipment's).

Every day surround us various types of intermediate frequency radiation (IF 300 Hz – 100 kHz) such as: video displays, anti-theft devices, card readers, metal detectors, electro surgery; Radiofrequencies (RF) (100 kHz to 300 GHz) used in wireless communications such as GSM, UMTS, Wireless LAN and RFID for both mobile devices and base stations, hospital applications, radio and TV broadcasting.

2. Impact on the environment by electromagnetic fields

Through the interaction between living organisms and electromagnetic fields are generated negative influences such as electromagnetic pollution and benefits like human therapy's using electromagnetic waves.

A key factor responsible for destroying environment quality is electromagnetic fields. Long-time excessive exposure to electromagnetic fields in buildings and outdoor public places can cause illness on human and environment as well.

Is well known that electromagnetic fields are causing non-thermal dramatic effects to human cells, tissue and organs, but currently nobody takes consideration about long-time exposure.

Several experiments have confirmed that microwave radiations, magnetic and electric radiations at very low frequency are causing human body stress reactions. Stress is the precursor phase for human illness determining the immune system to perform its functions.

The human body has an extremely adaptable capacity, but submitting the body to permanent aggression day by day is leading him to weakness with unknown harmful effects on health. The symptoms observed are hard to be awarded to other environmental factors, which operate simultaneously across urban environment.

Living organisms feel any modification in the magnetic field. That is perfectly normal because living organisms have polar molecules which interact with electric fields. Physiological process can be affected by the magnetic field, depending on the type, value or time period of exposure.

The ionic component of living organisms (Sodium, Chlorine, Potassium) under variable magnetic fields give rise through induction to micro-currents influencing biochemical reactions.

The studies carried out in past 15 years have revealed that animal's exposure to electric and magnetic fields (sinusoidal or static) for short or long periods reduce the maximum nocturnal levels of melatonin from blood.

After more than 30 years of research, WHO (World Health Organization) have published various studies and revealed that those persons who live close to high-voltage power lines present an increased risk of contracting cancerous diseases, leukaemia, cardiovascular diseases, mental, nervous or emotional problems, depression or suicides problems.

BioInitiative report concluded that there is a reasonable suspicion risk based on clear evidence about the negative impact on the environment caused by the bio-effect and after prolonged exposure is capable to have effects on human health as well.

As regards to ELF, a new public safety limit for inhabited areas should be established for all new buildings. A lower limit should be established for areas where are children or pregnant women.

A limit value for precaution should be adopted, cumulative for radioactive radiation and internal RF-fields, with considerably lower limits admitted than those existing now.

The IARC (International Agency for Research on Cancer, part of the WHO) evaluated the risks for cancer due to radio frequency radiation (RF).

Epidemiological human studies highlighted a suspected increased risk of glioma and neuroma acoustic.

RF radiations were classified as Group 2B, a possible human carcinogen agent [2].

On the other hand, there are evidences showing that long-term exposure to some CEM's is a key risk factor for cancer, Alzheimer and male infertility [3].

In the case where scientific investigation is not conclusive, it is therefore appropriate to adopt the precautionary principle.

In these conditions, having the current rules and concerning we must think for a little bit where we are.

3. Equipment's used for measuring electromagnetic field

To measure the electric and magnetic fields values we used a NFA1000-3D Low Frequency Analyzer. The professional equipment is capable to measure simultaneous electric and magnetic fields at the same time.

Electric fields are generated by the present tension using the measurement unit in volts per meter (V/m). Magnetic fields are generated by flows of electricity in conductors, electric equipment's/devices and other metal pipes networks (water, gas network facilities). The unit used in the case is MilliGauss (mG) or MicroTesla (μ T).

The measuring instrument NFA 1000 carries out automatic measurement and detection in real time offering frequency values for networks (50 Hz or 60 Hz) and their harmonics up to 2 kHz

Measurement data is stored on a memory card slot SD for analysis. The time limits set up to record data is 10 data sets/second.

The device is capable to record simultaneously all values of the three axis fields and in addition it records the automatic field E on an extra channel.

The reading of the counter and the recordings can be directly compared with the values obtained from the Classifications Recommendation of organizations/experts in buildings biology.

Furthermore, harmonic 3D frequency is recorded:

- 100/120 Hz 3D - second ununiformed harmonic;

- 150/180 Hz 3D – third ununiformed harmonic.

The harmonics frequencies are integral multiples of fundamental frequency supply, (ex: for a harmonic frequency of 50 Hz third rank the frequency will be 150 Hz).

Graphic colour assignment corresponds to standards for biological measurement of buildings SBM2015) [5]:

- Green for no concerns;
- Yellow for light concerns;
- Red for sever concerns;
- Purple for extreme concern.

4. Measurements results

The measurements were done in two different cities, different in size and development.

The measurements were done reached on foot, with a relative constant speed, at different hours, repeating the route in the same way.

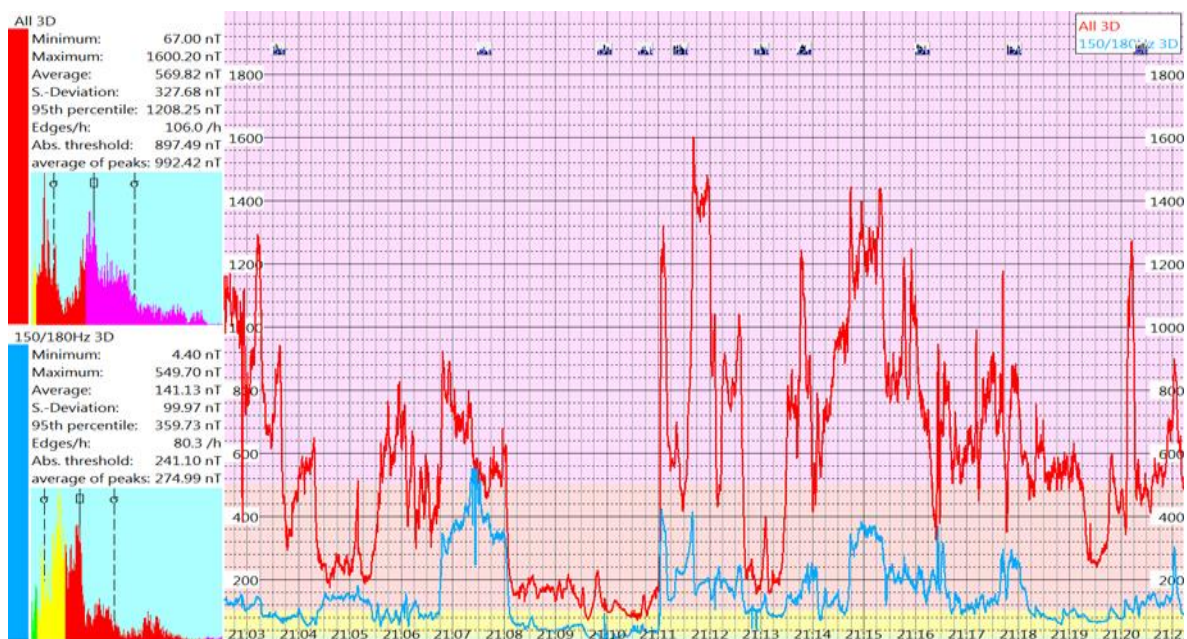


Fig. 1. Graphic results at Grivița Boulevard area



Fig. 2. Measurement surface Grivița Boulevard between Gheorghe Duca Boulevard and Grant Bridge

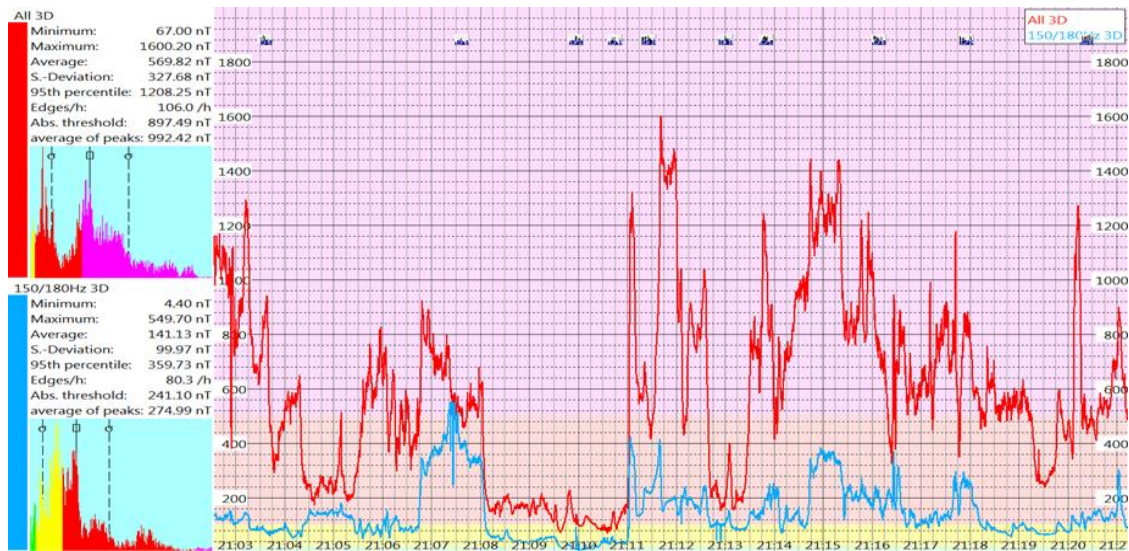


Fig. 3. Graphic results at Grănicerilor Boulevard area

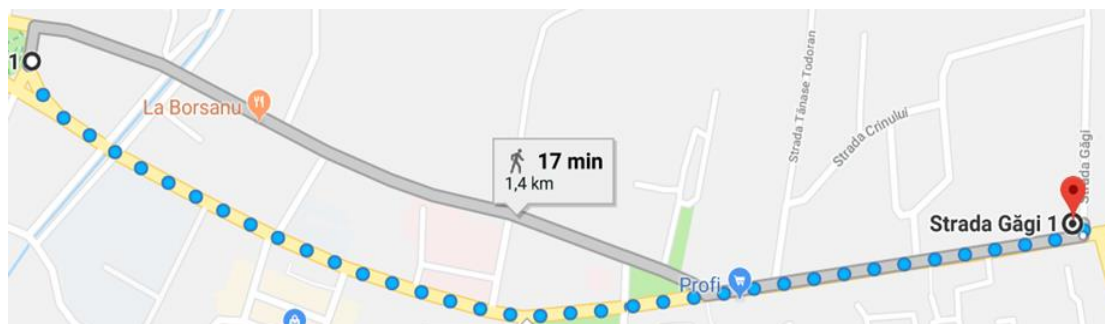


Fig. 4. Measurement surface Grănicerilor Boulevard

5. Conclusions

The measurements done in high traffic density shows that some electromagnetic fields values do exceed the accepted limits. The reason for exceeding the limit is the position of the: electric networks, switchboards, transformers or other electromagnetic devices too close to urban areas.

In this particular case is necessary to place warning signs, and second to build protection panels against electromagnetic fields.

References

- [1]. ***, Rev Environ Health., 31(3), p. 363-97. doi: 10.1515/reveh-2016-0011, 1 sep. 2016.
- [2]. Belyaev I., Dean A., Eger H., Hubmann G., Jandrisovits R., Kern M., Kundi M., Moshammer H., Lercher P., Müller K., Oberfeld G., Ohnsorge P., Pelzmann P., Scheingraber C., Thill R., *Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses*, Europaem EMF.
- [3]. ***, *Ergänzung zum Standard der baubiologischen Messtechnik*, Institut für Baubiologie + Nachhaltigkeit IBN Richtwerte, SBM-2015 Baubiologische Richtwerte, Baubiologie Maes.
- [4]. ***, www.bioinitiative.org, 2007.
- [5]. ***, www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf.
- [6]. ***, www.gigahertz-solutions.de/en/custom/index/sCustom/74.