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THE MAPPING OF ELECTROMAGNETIC FIELDS IN THE ENVIRONMENT

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Abstract: Today's wireless time brings some comfort, but on the other hand the impact of electromagnetic fields is serious threat to people. Many studies dealt with the effects of electromagnetic fields on living organisms, but the results are not completely clear. General and scientific public is increasingly focused on the impact of electromagnetic fields on living organisms. This is closely related limit values for parameters characterizing exposure to electromagnetic fields, depending on the frequency range, as defined by the Ministry of Health Decree 534/2007 Z.z. on the details and requirements for sources of electromagnetic radiation and exposure limits citizens to electromagnetic radiation in the environment. This contribution therefore focuses on mapping the electric and magnetic fields in the environment. The environment was selected area with a higher concentration of people in Prešov. The mapping was performed in two frequency ranges from 1 MHz to 1 GHz and 1 GHz to 2 GHz.

Keywords: electromagnetic field, electric field strength, magnetic flux density

INTRODUCTION

In the current high-growth society we are increasingly draws attention to the concept of electromagnetic field. Increasingly, the term penetrates between the general public and there is also the fact that in normal general public concerned about the possible impact of electromagnetic fields on the human body.

In the professional and scientific community, research focuses precisely on the impact of electromagnetic fields on biological effects, but research results vary widely.

Electric, magnetic and electromagnetic fields that may have adverse biological effects can be called collectively called as electrosmog. These electromagnetic fields are preferable also called as electromagnetic pollution [1] [2] [3] [4].

Slovakia Plata acts to protect the public and workers against electromagnetic fields. Both acts are in line with the recommendations of the European Union. Protection of the population in the Slovak Republic is currently provided by Ministry of Health of the Slovak Republic no. 534/2007 Coll. specifying requirements for sources of

electromagnetic radiation and exposure limits citizens to electromagnetic radiation in the environment [2] [5]. Not exceeding the action values will ensure the limit values for exposure. In addition to binding legal documents, there are technical standards which are less strict and non-binding recommendations of the independent experts that are extremely severe.

HEALTH ISSUES AND RESEARCH

Since 1996, ongoing international project WHO that assessed the effect of changing static time of EM fields on human health, the environment. It was carried out by a large number of scientific laboratory studies. Some scientists these with the legal detrimental effect from exposure to low-frequency electromagnetic radiation, not their results are, however, different proven insufficient. Therefore, more attention is paid to high-frequency electromagnetic waves. Many studies have shown on the link between uses of mobile phones brain cancer. The International Commission for the Conservation Non-Ionizing Radiation (ICNIRP) warns of the possibility of developing cancer as a result of persistently high microwave radiation when using

mobile phones. The World Health Organization WHO in 2011, the inclusion of electromagnetic radiation in the radio-frequency spectrum as belonging to Group 2B done from the perspective of carcinogenicity, that as a possible carcinogenic. This classification awarded by the electromagnetic radiation of radio frequencies on the basis of studies confirming the increased risk of tumor Central nervous system based on supporting nerve tissue in the brain, spinal cord between users of mobile phones [6] [7].

In 1948, American introduced study possible links between exposures microwaves, testicular degeneration, cataracts in dogs. Another study published in 1953 focused on worker's radar stations on the issues of internal bleeding, leukemia, cataracts, headaches, brain tumor to heart disease. Published studies have led to secret military research dealing with microwave effects on people and the decision to limit the permitted quantity of received microwaves. Transmitter hurts once becoming the hills above the town village, or to high masts so that the download access to do their vicinity. In today's Statistical base stations of mobile networks of other wireless equipment from us only Remote meter. However, their performance Achieve tens to hundreds of watts. Almost every television transmitter of radio is the current point in the country of which we even placed a large bounty of different antennas used for the dissemination of radio and television signals of mobile services. In close vicinity of these transmitters may even radiation Occupational exposure limits often exceeded Therefore, work on antenna systems during shutdown Perform transmitter or at reduced power. Stanislaw Szmigielski over 16 years Club controlled the worker with radio devices, you'll see that those who are occupational exposure to radiofrequency microwave radiation were 14 times greater likelihood of developing chronic leukemia, 9-fold greater chance of developing acute leukemia six times higher, the probability of non-Hodgkin's lymphoma. The estimated average exposure value as were the people in the study were exposed to about 5 μW per square centimeter (50,000 mW/m^2). This level is common near a base station to the mobile networks of large television radio transmitters [6]-[8].

The incidence of cancer in the vicinity of radio transmitters has been studied in Korea. The results of various studies have shown an association between electrical magnetic polo at the potential of cancer. The authors of the study used Tajta regional ecological studies to confirm respectively refuted this association. 31 were observed in areas exposed to a low power transmitter 50kW, 11 Areas with a high transmitter output power from 100 to 1500 kW amplitude modulated areas, which corresponded to 42 radio transmitter. Cancer was confirmed in a 2 km radius of

each of the transmitters, which was confirmed by the Korean Health Organization in 1995. The authors of the study evaluated the difference between the rates of cancer, leukemia, lymphoma, breast cancer, brain within 2 km from the transmitter with high power and heading 2 km of low power transmitters. It was also selected four control area were located as close as possible in areas with high power transmitters are not at least 2 km from the transmitter. The study authors found no significant differences with regard to the occurrence of cancer in the area of high-low-power transmitters. However, a significant result recorded in 11 areas with high power transmitters, where the increased incidence of leukemia in two of these areas, incidence of brain cancer in areas prospers. Further studies should help with more detailed information in the field of cancer with a radio transmitter [6] [9].

MAPPING ELECTROMAGNETIC FIELD

Precisely for the reasons described above, this paper is focused on mapping smog in the environment. The place for measuring was chosen area with an increase in population and specifically in front of the theater in Prešov. Mapping was carried out in two frequency bands. The first band was from 1 MHz to 1 GHz and a second band was from 1 GHz to 2 GHz.



Figure 1. Environment - measuring location

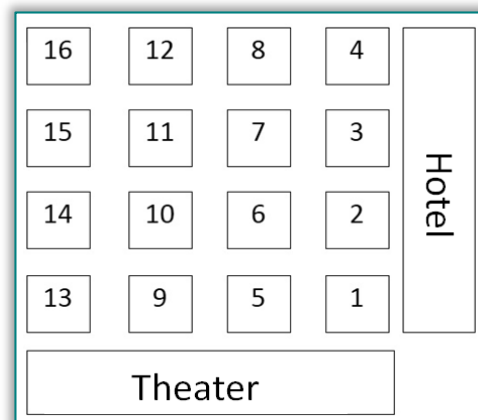


Figure 2. Grid of measurement points

The place of measurement is shown in Figure 1. The grid of measurement points is shown in Figure 2. The measurement was repeated ten times during the day, and then selected a maximum value for each measuring point.

THE RESULTS OF THE MAPPING SMOG IN THE ENVIRONMENT

The results of the mapping of the electromagnetic field can be seen in Figures 3-6. In Figure 3 you can see the map of the magnetic field H in the frequency range 1 MHz to 1 GHz, in units of mA / m. Figure 4 you can see the map of the magnetic field H in the frequency range from 1 GHz to 2 GHz in mA/m. In the Figure 5 you can see the map is the electric field E in the frequency range 1 MHz to 1 GHz in V/m. In the Figure 6 is a map shown the electric field E in the frequency range from 1 GHz to 2 GHz in V/m.

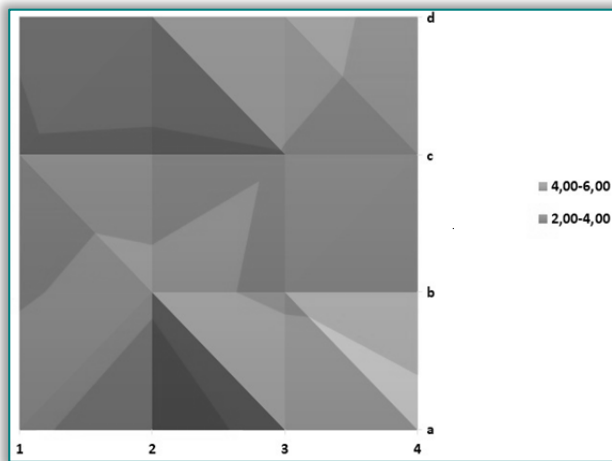


Figure 3. Magnetic field strength H in the frequency range 1 MHz to 1 GHz in $\mu\text{A}/\text{m}$

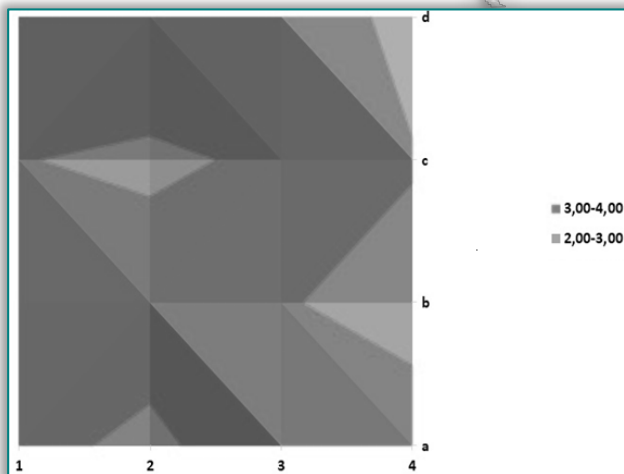


Figure 4. Magnetic field strength H in the frequency range 1 GHz to 2 GHz in $\mu\text{A}/\text{m}$

The results shown that the higher value of the magnetic field were measured in the frequency range from 1 MHz to 1 GHz. In the case of measuring the electric field intensity were higher values also measured in the frequency range from 1 MHz to 1 GHz. Higher values in

the lower frequency band were due to higher action of sources of electromagnetic radiation, especially from sources of radio waves, and also by mobile GSM devices operating in this frequency band. In the frequency range from 1 GHz to 2 GHz were measured levels of electromagnetic fields especially from mobile devices GSM1800.

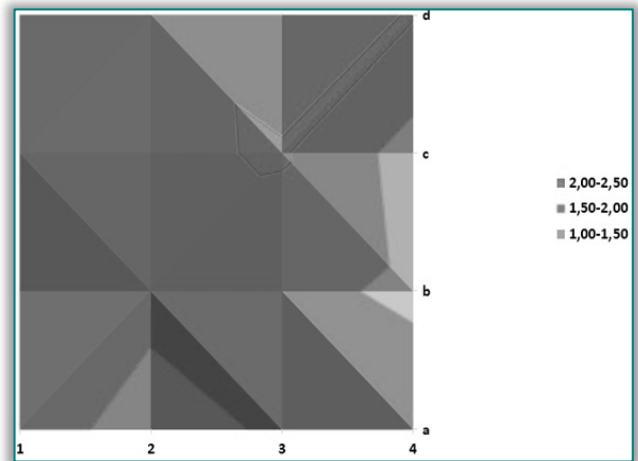


Figure 5. Electric field intensity E in the frequency range 1 MHz to 1 GHz in mV/m

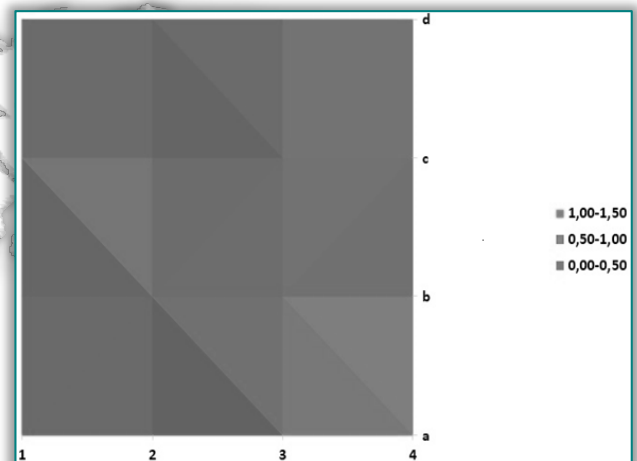


Figure 6. Electric field intensity E in the frequency range 1 GHz to 2 GHz in mV/m

CONCLUSION

This paper was aimed at mapping the electromagnetic fields in the environment. Since almost every environment is effect by electromagnetic field. The paper focused on the environment with a higher people frequency.

From measurements it indicates the value of the electric and magnetic fields were higher in the frequency range from 1 MHz to 1 GHz than in the frequency range 1 GHz to 2 GHz, due to a greater influence of source (radio waves and mobile GSM900) just at a lower frequency range.

The measured values were compared with Ministry of Health Decree 534/2007 and at no point or value exceeded. On the contrary, they were very low.

Acknowledgement

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References

- [1] Durpok, J., MORISKE, H-J. and N. Englert, "GESÜNDER WOHNEN — ABER WIE?: Praktische Tipps für den Alltag," Berlin: KOMAG mbH, 2005. [online]. [citované 2015-07-07]. Available on: <<http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/2885.pdf>>.
- [2] Burrell, L. "What Is Electromog?," 2010. [online]. [citované 2015-01-21]. Available on: <<http://www.electricsense.com/143/what-is-electromog/>>.
- [3] Dujava, C. - Kolcunová, I. - Pavlík, M.: Meranie elektromagnetických polí v okolí vzdušných distribučních vedení, Elektroenergetika, Vol. 8, No. 2, 2015, ISSN: 1337-6756.
- [4] Liptai, P.: Meranie elektromagnetického tienenia kombinovaného materiálu a možnosti jeho využitia. Fyzikálne faktory prostredia. Roč. 5, č. 2 (2015), s. 45-48. ISSN 1338-3922.
- [5] Liptai, P.: Metodika merania a hodnotenia vysokofrekvenčných elektromagnetických polí základňových staníc mobilných operátorov v obývaných oblastiach. Ukraine - EU. Modern Technology, Business and Law. Chernihiv National University of Technology, 2016 pp. 306-309. ISBN 978-966-7496-71-5.
- [6] WHO označila rádiové elektromagnetické žiarenie za možno rakovinotvorné [online Available on:<http://www.dsl.sk/article.php?article=10988>
- [7] ICNIRP STATEMENT, On the "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)" [online]. Available on:<http://www.icnirp.org/cms/upload/publications/ICNIRPStatementEMF.pdf>
- [8] ICNIRP SCI REVIEW, Mobile phones, brain tumors, and the interphone study: where are we now [online]. Available on:<http://www.icnirp.org/cms/upload/publications/ICNIRPSCIreview2011.pdf>
- [9] Ha, M. - Lim, HJ. - Cho, SH. - Choi, HD. - Cho, KY.: Incidence of cancer in the vicinity of Korean AM radio transmitters [online]. Available on:<http://www.ncbi.nlm.nih.gov/pubmed/15859510>
- [10] Pavlík, M. et al.: Measuring of Dependence of Shielding Effectiveness of Wet Materials on The Frequency of Electromagnetic Field in the High Frequency In: Acta Electrotechnica et Informatica. Roč. 13, č. 3 (2013), s. 12-16. - ISSN 1335-8243



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