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Some aspects of home ecology: measuring the level of EMF from household appliances

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ABSTRACT

The results of domestic and foreign studies clearly indicate the high biological activity of EMF. In a residential environment, a person is exposed to electromagnetic fields from a variety of sources. The purpose of this work was to determine the level of EMF near various household appliances and develop appropriate safety recommendations. To achieve the goal, the following tasks were set: to measure the levels of electric field strength, the level of magnetic induction, to determine the distances to the devices at which the threshold values of EMF are not exceeded. Measurements of the intensity of electric and magnetic fields of industrial frequency 50 Hz were carried out from sources located in residential premises; a total of 26 EMI sources were examined. almost all household appliances are EMF sources, and some devices both in operation and in standby mode exceed the maximum permissible values of electric field strength and magnetic induction, indicated in GOST R 54148-2010 and San PiN 2.1.2.1002-00 (E = 25 V/m, V = 250 nT). The greatest concern is the proximity of the human body with such devices as a slow cooker, a vacuum cleaner, a radio receiver and a hair dryer. For example, the highest values of the electric field strength were noted for a bread maker, and magnetic induction for a vacuum cleaner. Based on the data obtained, it can be concluded that for the safe use of household appliances, it is desirable to be located at least 50 cm away from them. Devices that are not in use at the current time must be disconnected from the electrical network.

Key words: *Electromagnetic fields, SOEKS Impuls, Household electrical appliances, Electrical network, Security.*

Introduction

The introduction of an increasing number of electrical and electronic devices and devices has led to an increase in the intensity of electromagnetic fields (EMF) and caused such negative phenomena as “electromagnetic smog”, “electromagnetic pollution”, “magnetic web”, which, in essence, are new factors of influence for the human body (Faradzhev, 2021). The results of domestic and foreign studies clearly indicate the high biological activity of EMF (Daminova, 2015). The most sensitive to the effects of EMF are the nervous, immune, endocrine and reproductive systems of the body. The biological effect of EMF accumulates under conditions of long-term exposure, as a result, the development of long-term consequences, such as degenerative processes of the central nervous system, blood cancer (leukemia), brain tumors, hormonal diseases is possible (Prygov, 2009; Popova and Sebeleva, 2021) In a residential environment, a person is exposed to electromagnetic fields from a variety of sources, which by their localization can be divided into internal (located indoors – electrical wiring, televisions, computers, radiotelephones, mobile phones, vacuum cleaners, refrigerators, washing machines, microwave ovens, food processors, electric stoves) and external (located outside the building – high-voltage power transmission

lines, electric vehicles, transformer substations, cell towers, transmitting radio and television stations). Assessment of the actual levels of EMR exposure to humans from various sources in a residential and office environment seems to be a very urgent task, in solving which it is possible to develop competent and reasonable measures aimed at reducing the risks to human health from the effects of this factor. The purpose of this work was to determine the level of EMF near various household appliances and develop appropriate safety recommendations. To achieve the goal, the following tasks were set: to measure the levels of electric field strength, the level of magnetic induction, to determine the distances to the devices at which the threshold values of EMF are not exceeded.

Materials and Methods

Measurements of the intensity of electric and magnetic fields of industrial frequency 50 Hz were carried out from sources located in residential premises; a total of 26 EMI sources were examined. The measurements were carried out in real conditions of their operation in two modes – the mode of operation of the device and with a non-working device connected to the power supply network, which is in the so-called standby mode. The electromagnetic field indicator "SOEX Impulse" (LLC "SOEX-GLOBAL", Russia) was used for measurements. The device is designed to detect areas with elevated electric and magnetic fields. "SOEX Impulse" has the ability to determine the direction of the electromagnetic field. The device has 3 magnetic field sensors and 2 electric field sensors, the frequency of the measured fields is up to 2 kHz, the measurement speed is 500 ms. The measurements were carried out in accordance with GOST R 54148-2010 "Human exposure to electromagnetic fields from household and similar electrical appliances" (Gost, 2010) and included measurements of electric field strength (V/m) and magnetic field induction (nT) of industrial frequency 50 Hz. Measurements were made at the surface of the devices and at the measured distances determined in accordance with GOST R 54148-2010 (from 10 to 30 cm for different devices).

Results and Discussion

The results of the measurements are shown in Table 1. As can be seen from the presented data, almost all household appliances are EMF sources, and some devices both in operation and standby mode exceed the maximum permissible values of electric field strength and magnetic induction, indicated in GOST R 54148-2010 and SanPiN 2.1.2.1002-00 (E = 25 V / m, V = 250 NT). The greatest concern is the proximity of the human body with such devices as a slow cooker, a vacuum cleaner, a radio receiver and a hair dryer. For example, the highest values of the electric field strength were noted for a bread maker, and magnetic induction for a vacuum cleaner. In our work, a pattern was confirmed, revealed earlier in the works of other researchers (Gubernsky *et al.*, 2016, 2017), that some devices emit more in standby mode than in operating mode (this feature was fixed for the magnitude of magnetic induction in the bread maker).

Table 1. Investigation of EMF sources by the SÎÅÕ Impulse device.

Device	Safe distance to the device in operation mode	Safe distance to the device in standby mode	Note
		Kitchen	
Refrigerator	Does not exceed even on the surface	Does not exceed even on the surface	From all sides except the back
Freezer compartment	Does not exceed even on the surface	Does not exceed even on the surface	From all sides except the back
Dishwasher	25 cm	25 cm	In operation mode: E about 340 V/m — on the surface of the front panel B is about 80 nT from the top, 1300 nT from the front In standby mode: E about 75 V/m, at the surface — 430 V/m

Table 1. *Continued ...*

Device	Safe distance to the device in operation mode	Safe distance to the device in standby mode	Note
Luminaire	50 cm	Not provided	E is about 46 V/m, on the surface - E is about 790V/ m.
Multicooker	40 cm	30 cm	Standby mode: E about 45 V/m — on the front panel, on the surface of the front panel E about 234 V/m. Operating mode: E about 33 V/m — on the front panel, at the surface of the front panel E about 795 V/m, B is about 2313 nT.
Ñlothes washer	Was not checked	On the surface	E is about 221 V/m.
Breadmaker	30 cm	30 cm	In operation mode: E is about 31 V/m — on the front panel, at the surface - E about 1744 V/m, B is about 1870 nT. In standby mode: E is about 27 V/m, at the surface - E is about 700 V/m, B is about 3600 nT.
		Hall	
Luminaire	40 cm	Not provided	E is about 126 V/m, at the surface - about 860 V/m.
Radio receiver	15 cm	Not provided	E is about 51 V/m, at the surface E is about 331 V/m, B is about 2783 nT.
Network filter	25 cm	Not provided	E is about 73 V/m, on the surface E is about 205 V/m.
Table lamp	15 cm	Not provided	E is about 130 V/m, at the surface - E is about 686 V/m.
		Children's room	
Laptop	30 cm	30 cm	In standby mode:E about 85 V/m, at the surface - E is about 100 V/m. In operation mode: E about 140 V/m, at the surface — 171 V /m, B is about 2095 nT.
Network filter	30 cm	Not provided	E is about 30 V/m, at the surface - E is about 1094 V/m, B is about 3300 nT
Luminaire	20 cm	Not provided	E about 333 V/m — on the surface.
Hairdryer	15 cm	Not provided	E is about 100 V/m, B is about 545 nT, at the surface - E is about 935 V/m, B is about 17513 nT.
Sewing machine	30 cm	Not provided	E is about 94 V/m, at the surface - E is about 411 V/m.
Table lamp	40 cm	Not provided	E is about 60 V/m, at the surface - E is about 230 V/m.
		Bedroom	
Monitor	20 cm (E about 55 V/m, surface - 150 V/m)	18 cm	E is about 333 V/m .
Nettop	0 cm	Not provided	E is about 225 V/m on the surface.
Luminaire	20 cm	Not provided	E is about 85 V/m.
Network filter	40 cm	Not provided	E is about 99 V/m. On the surface: E is about 926 V/m, B is about 366 nT.
Electric iron	30 cm	Not provided	E is about 123 V/m, at the surface - E is about 471 V/m

Table 1. *Continued ...*

Device	Safe distance to the device in operation mode	Safe distance to the device in standby mode	Note
		Corridor	
Luminaire	40 cm	Not provided	E is about 95 V/m, at the surface - E is about 317 V/m.
Electric shield	5 cm	Not provided	B is about 1212 nT, at the surface — 2596 nT.
Recirculator	35 cm	At the surface - E is about 108 V/m	E is about 69 V/m, at the surface - E is about 920 V/m, B is about 3454 nT.
Vacuum cleaner	30 cm	25 cm	In standby mode - E is about 42 V / m, at the surface 255 V / m. In operation mode: E about 30 V /m, B is about 2900 nT, at the surface - E about 885 V / m, B is about 27400 nT.

Conclusion

Based on the analysis of the results obtained, the following conclusions can be formulated:

1. For the safe use of household appliances, it is desirable to be located at least 50 cm away from them.
2. Devices that are not in use at the current time must be disconnected from the electrical network.

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