

THE RUSSIAN STANDARDS AND THE OPINION ABOUT INTERNATIONAL HARMONIZATION OF ELECTROMAGNETIC STANDARDS

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The problem of hygienic EMF standards as a factor of industrial and human being environment acquired the special urgency for the last years.

The main fundamental preventive direction ensuring optimization of conditions of the human being vital activity, because of constant increase of EMF level in the environment is the regulation of EMF levels of effect for workers and population.

1. To history of the EMF standards in Russia.

In this connection it is necessary to underline that 40 years ago, i.e. in 1958 in Russia (USSR) the first EMF standard in the range of 300 MHz – 300 GHz was authorized at the state level.

In this information I see the following important circumstance: we can trace dynamics of change of normative levels in Russia over the time of 40 years, that will reflect the degree of stability of our fundamental knowledges about biological effects of various EMF frequencies.

The first Russia standards were based on the results of clinicohygienic researches of the 50-ths, reinforced by the experimental data, having been available provided limitation of two rationed parameters - intensity and time of exposure with the determination of three limits: $10 \mu\text{W}/\text{cm}^2$ - for 8 h; $100 \mu\text{W}/\text{cm}^2$ - up to 2 h and $1000 \mu\text{W}/\text{cm}^2$ - up to 20 minutes for a working day.

Without discussing the role of the confirmed standards 40 years ago for the improvement of the working conditions, that is indisputable, it is necessary to underline that these standards for expired 40 years were not subjected to essential changes. Besides for the last 25 years the accumulated material has shown the reliability of these standards and, apparently, certain validity.

The following materials were used to validate the first standards

The results of clinicohygienic researches carried out at 10 of enterprises of electronic and a radioindustry of Russia, during which the condition of health of 1015 persons were evaluated (Savin B.M. et al.,1983). The clinicohygienic comparisons have shown, that the personnel working for the long time in the electronic industry (15-20 years), where microwaves intensity does not as a rule exceed $10 -100 \mu\text{W}/\text{cm}^2$ do not reveal somewhat essential changes in their health compared to that of the appropriate age groups.

The disturbance in the health condition which could be connected with the microwaves effect were detected among 2.6 % of the personnel at the enterprises of the radioindustry. In all cases we could speak about the experts with more than 15 years of experience who could be exposed to significant intensity in the past (up to $10 \text{ mW}/\text{cm}^2$ and above). The personnel with the experience less than 15 years, i.e. those who began their work after the realization of protective measures and were exposed to microwaves with the intensity up to $1000 \mu\text{W}/\text{cm}^2$ did not reveal occupational diseases.

At the first stage of standardization in Russia the results of the following researches were also used. Biological effects of 9 modes of EMF exposure were evaluated: 3 GHz, power

density from 0,25 up to 10 $\mu\text{W}/\text{cm}^2$ and time (T) of daily irradiation from 6 min. to 4 h. A large part of experimental researches were conducted in the form of chronic experience up to 4 months. Total quantity of animals (rabbits, rats, mouse), used in the researches exceeded 1160. The bioeffects of microwaves were evaluated on the base of functions of the central nervous and neuroendocrinal systems, unspecific and specific immunity, generative function and etc.

The results of the experimental researches have shown distinct dependence between microwaves bioeffects and the intensity of exposure. They have confirmed the earlier available data about the expressed biological effect of microwaves exposure to the power density of 4 mW/cm^2 and especially 10 mW/cm^2 . The effects of the indicated intensity provoked distinct changes of functional condition of the central nervous and endocrinal systems, immunity and etc. The changes arose at the early stages of exposure had shown for stability and had cumulative character. By transition to lower intensities (1 mW/cm^2) the decrease of biological activity of microwaves was observed. Microwaves of power density 250 $\mu\text{W}/\text{cm}^2$ during 4-hours exposition daily during 4 months provoked only easy functional shifts of separate parameters carrying adaptive character.

The analysis of all data has allowed to establish that the parameters of effects characterizing the threshold of affect of the factor are 1 mW/cm^2 for $T = 120 \text{ min}$ ($S = 120 \text{ mW}/\text{cm}^2$ or $2000 \mu\text{W} \cdot \text{h}/\text{cm}^2$) and 10 mW/cm^2 for $25 \text{ min} > T > 6 \text{ min}$ ($4166 \mu\text{W} \cdot \text{h}/\text{cm}^2 > S > 1000 \mu\text{W} (\text{h}/\text{cm}^2)$).

Using the safety factor equal to 10 (which is quite sufficient in case of the factors not showing distinctly expressed cumulative properties) experimentally established allowable exposure will be: 100 $\mu\text{W}/\text{cm}^2$ for $T = 120 \text{ min}$ and 1000 $\mu\text{W}/\text{cm}^2$ for $T 25 \text{ min} > T > 6 \text{ min}$.

Based on the above mentioned data the following offers were formulated: 1) normative levels of effect 100 $\mu\text{W}/\text{cm}^2$ for $T 2 \text{ h}$; 2) under the certain permissible correlation between of the intensity and duration of EMF exposure the power density may be 200 $\mu\text{W} \cdot \text{h}/\text{cm}^2$.

2. System of a sanitary-hygienic standardization of electromagnetic fields in Russia.

In Russia the system of the standards on electromagnetic safety consists of State Standards (GOST) and Sanitary norms and regulations (SanPiN). These interconnected documents are mandatory for performance on the whole territory of Russia.

The EMF State Standards are included into the group of System of the standards of safety transactions - the complex of the standards containing demands, norms and regulations directed to the safety, health maintenance and serviceability of the person during transactions. They are the most general documents.

The commissioning State Standards executes State Committee on standardization of the Russian Federation.

The State Standards of Russia in the field of electromagnetic safety as on June 1, 1998 are indicated in table 1.

Table 1. State EMF Standards of Russian Federation (as on June 1, 1998)

	Number	The name
1.	GOST 12.1.006-84	Occupational safety standards system. Electromagnetic fields of radio frequencies. Permissible levels at work-places and requirements for control
2.	GOST 12.1.002-84	Occupational safety standards system. Power frequency electric fields. Permissible levels of field strength and requirements for control at work-places
3.	GOST 12.1.045-84	Occupational safety standards system. Electrostatic fields. Tolerance levels and methods of control at working places

The Sanitary norms and regulations regulate hygienic demands to more particular situations of irradiation and also to separate kinds of production. The Sanitary norms and regulations contain the same main items as the State Standards, however in more detail. As a rule, the sanitary norms and regulations are accompanied by the methodical instructions on realization of the control of electromagnetic conditions and protective measures.

The commissioning of the Sanitary norms and regulations executes the Ministry of Public Health of the Russian Federation.

At present 15 EMF sanitary norms and rules function in Russia. The main values of EMF permissible levels are presented in Fig. 1 – 8.

Fig. 1 Limit values for electrostatic field strength (workplace) according GOST 12.1.045-84

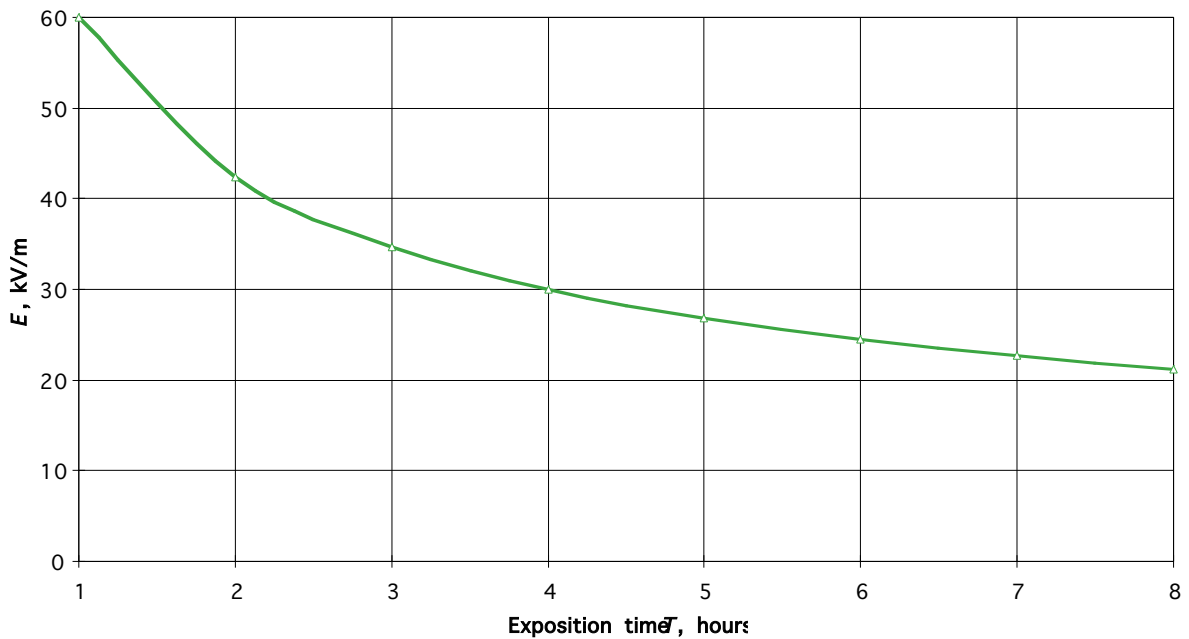


Fig. 2 Limit values for 50 Hz electric field strength (workplace) according GOST 12.1.002-84

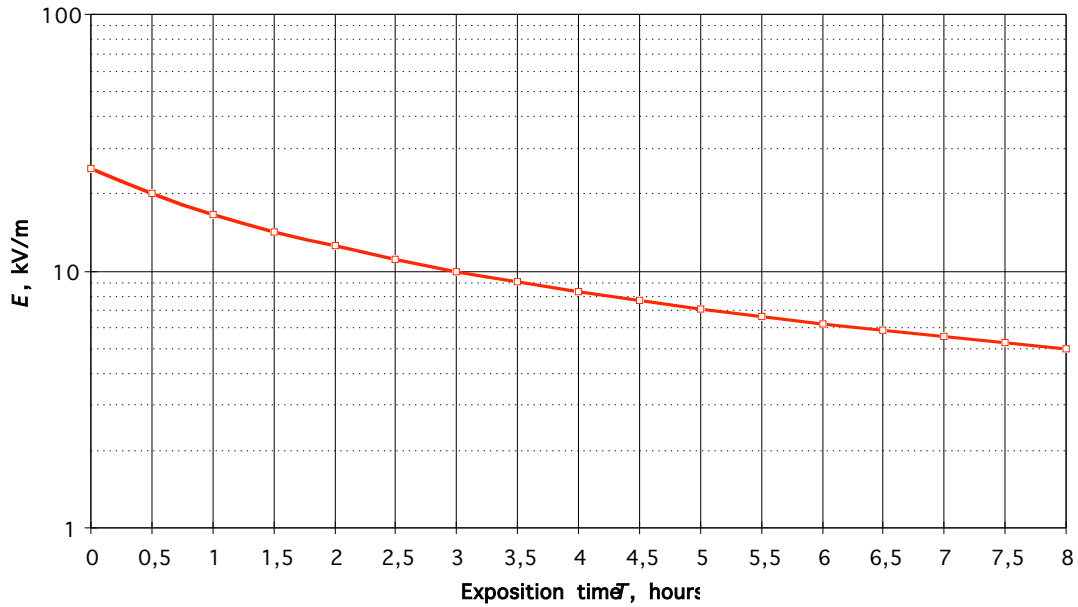


Fig. 3 Limit values for 50 Hz magnetic field strength (workplace) according SanPiN 3206-85

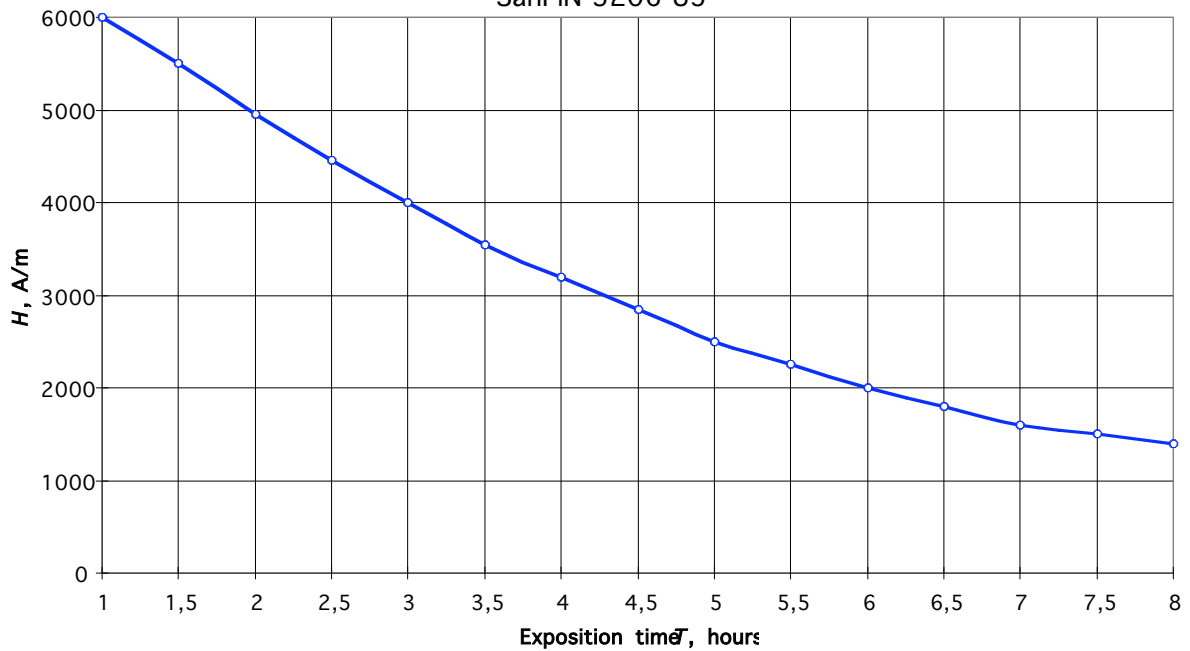


Fig. 4 Limit values for 50 Hz electric field strength (in public areas) according to SanPiN 2971-84

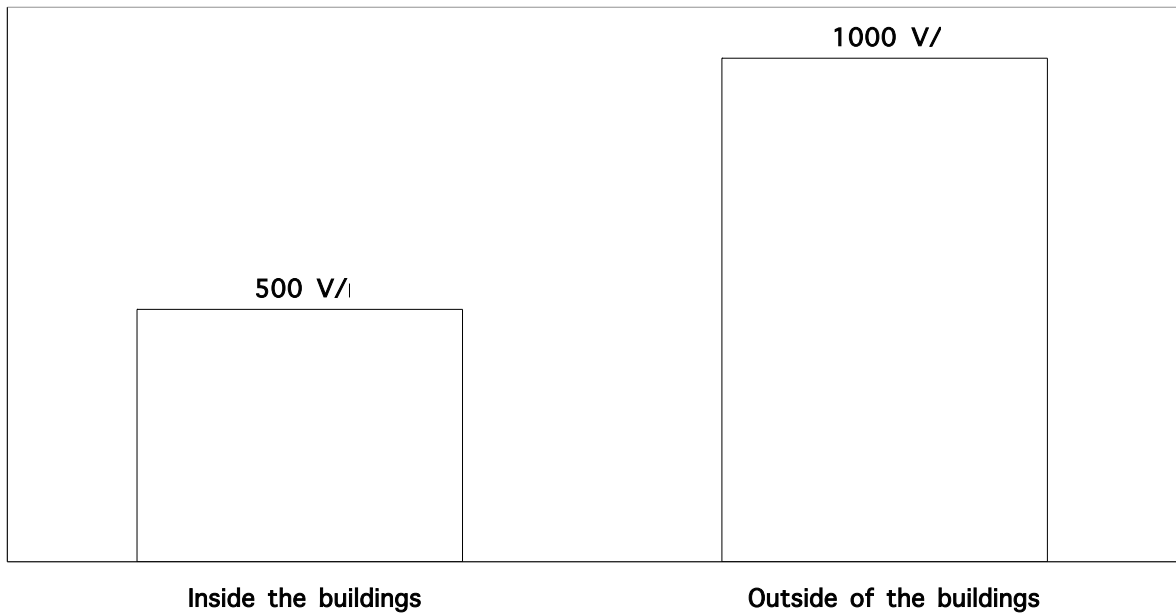


Fig. 5 Limit values for electric field strength (in workplace) according to GOST 12.1.006-84 and SanPiN 2.2.4/2.1.8.055-96

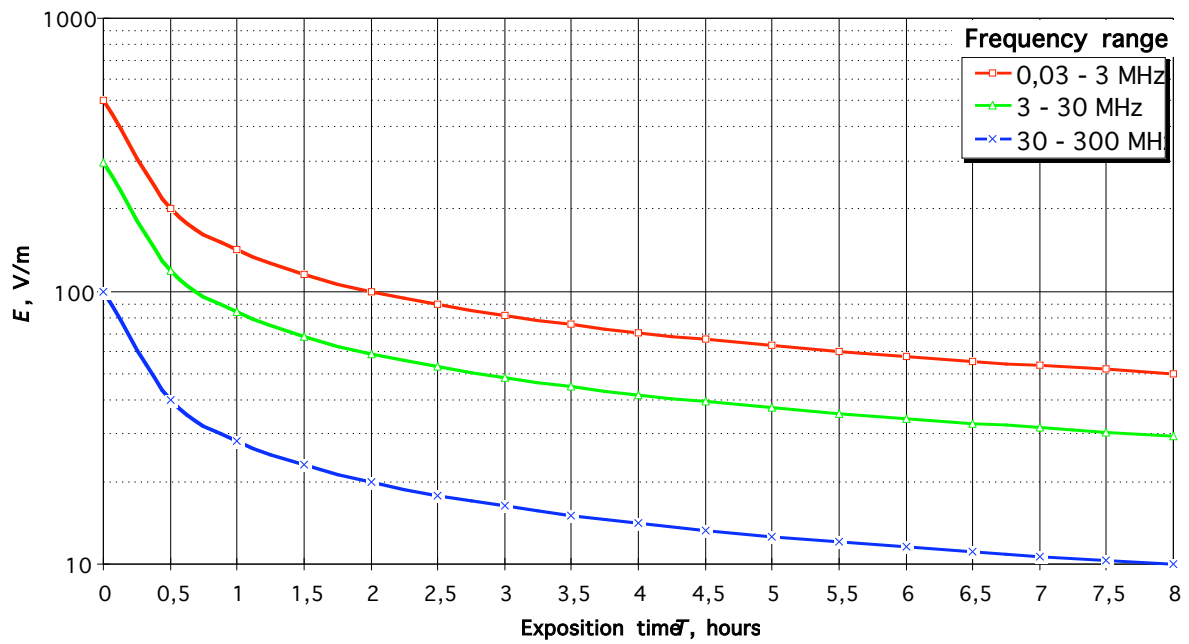


Fig. 6 Limit values for magnetic field strength (H) (workplace) according to GOST 12.1.006-84 and SanPiN 2.2.4/2.1.8.055-96

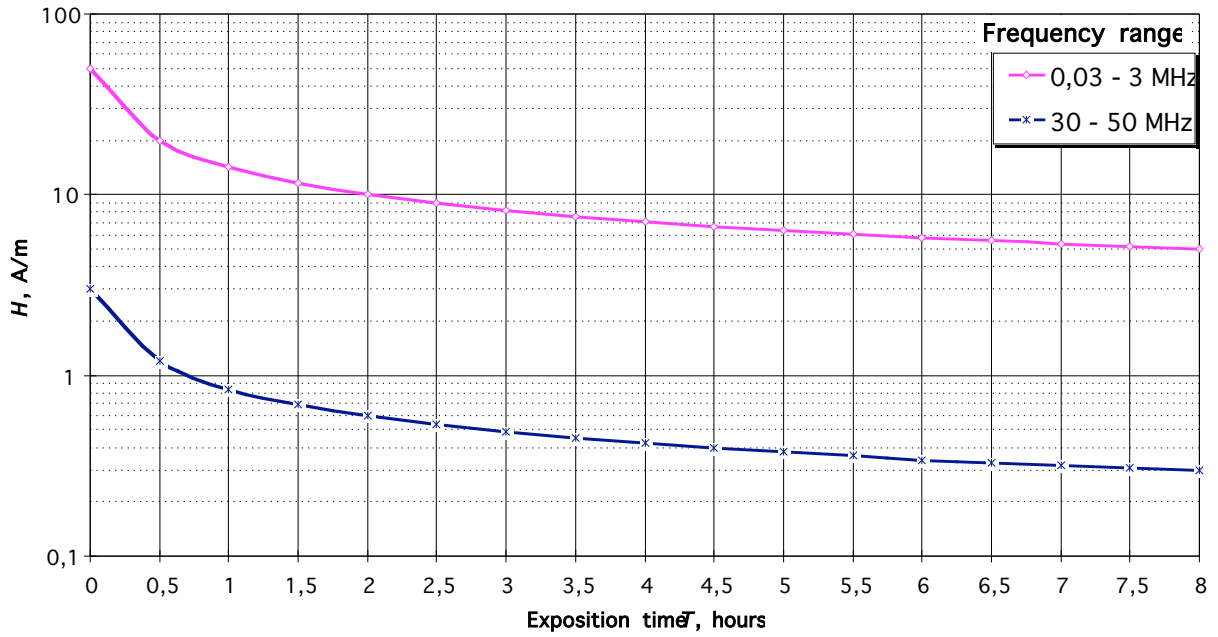


Fig. 7 Limit values for power flux density (S) in the frequency range 0,3 - 300 GHz (workplace) according to GOST 12.1.006-84 and SanPiN 2.2.4/2.1.8.055-96

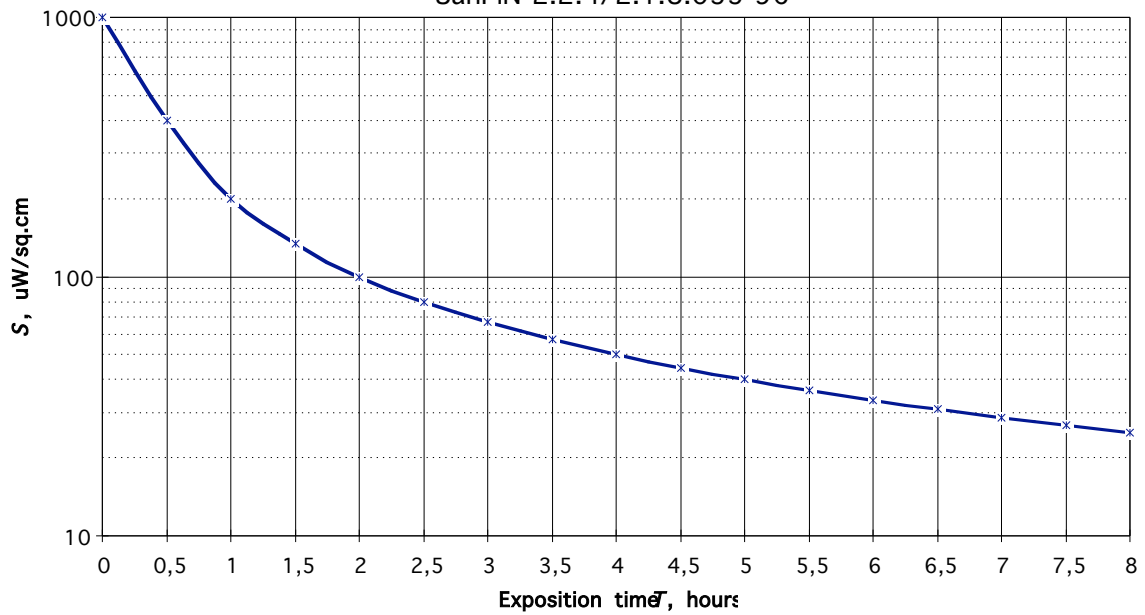
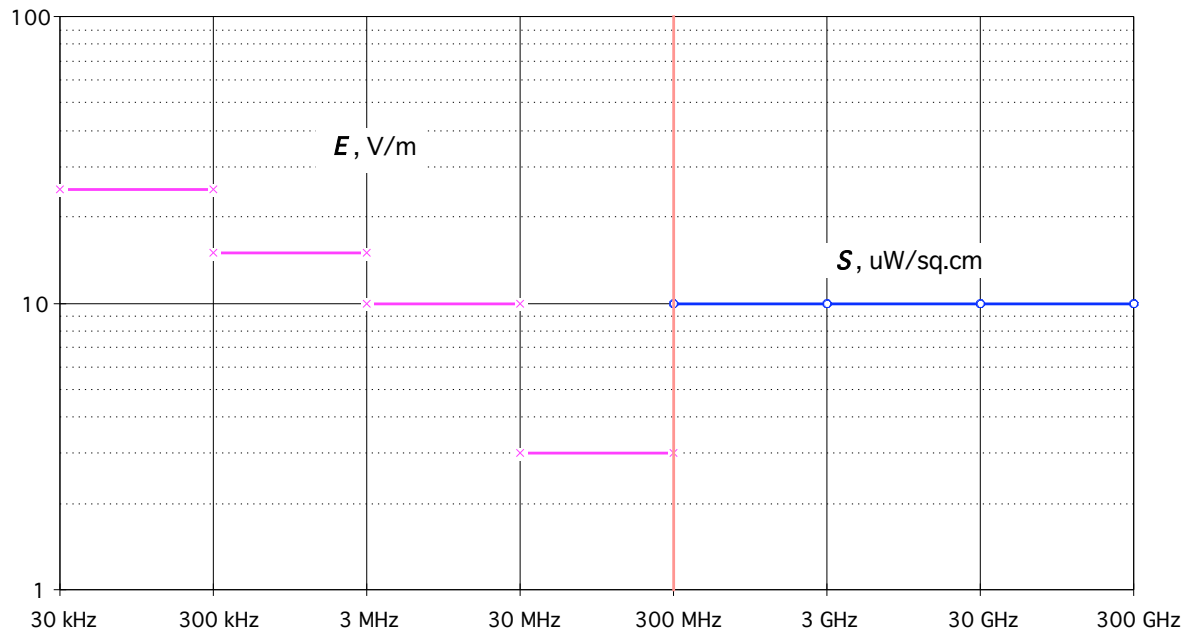


Fig. 8 Limit values for electric field strength and power flux density (public areas) according to SanPiN 2.2.4/2.1.8.055-96



3. General principles to the approach to EMF standardization in Russia.

- The threshold principle of injurious to health is used as the basis of EMF limits
- The position "damage-favour" is considered through the concept of risk.
- Such EMF permissible value limits are accepted for the certain resources with usual daily EMF irradiation regimes which do not lead to diseases or health deviations among the population (irrespective of age or sex) which can be detected by modern methods during the period of irradiation or long after it was over.
- The EMF exposure should not provoke in the person even temporary disturbance of homeostasis including reproductive function, and also the effort protective and adaptation-compensator mechanisms neither in the nearest, nor in the remote period of time. It means, that EMF limits are the fractional quantity from minimal level of EMF which is capable to provoke some reaction in the human being.

4. Common and different the approaches to working out EMF standards between some European countries, USA, ICNIRP and Russia.

Common point of view:

- 1) A safety factor equal to 10 - to provide an additional safety margin and elimination of biological uncertainty.
- 2) There are separate limitations for occupational personnel and for general public.

Differences:

First of all, NCRP US recommendation (1981) about unit-mass time averaged rate of energy absorption (SAR) as the meaningful dosimetric quantity. Up to now in Russia we use "a power load" - total flow of energy dropping per unit of an irradiated surface during irradiation time in hours.

2. There are traditional differences in the philosophy of the estimation of any measurable effect, which is considered for determination of EMF danger: a) the effect to which the organism of a human being can adapt or b) only those selected effects that can be considered pathological.

3. The role of modulation is underestimated by some scientists in some countries. These effects were not considered adverse for the following reasons: inability to relate them to human health; the narrow range of effective modulation frequencies and the effects are reversible. At present we have results which are contrary to this point of view (Grigoriev Y., 1996; Aphrikanova L., Grigoriev Y., 1996; Grigoriev Y., Stepanov B., 1998; Choy et al., 1986).

4. There is another system of consideration and affirmation of the standards in Russia. The National Commission on Protection against non-ionizing radiation was absent in Russia till August 1998. Only in September 1998 ICNIRP in the limits of NCRP was established (chairman - professor Yu. Grigoriev). Up to now to developing sanitary norms and rules were sent to the Institute of Occupational Health (RAMS). After that they are sent to the Commission of RF Ministry of Public Health and after that they were where authorized before the confirmation by RF Ministry of Public Health itself.

5. There are various requests to selection and evaluation of published reports for the substantiation of the standards. ICNIRP Guidelines are not accepted in Russia yet.

6. There are differences in the values between the allowable occupational exposure levels and that for the public.

Our suggestions:

1. To develop uniform criteria for the evaluation of the EMF danger and evaluation of an individual radiosensitivity (to draw these approaches nearer).

2. It is necessary to take into account chronic long-term irradiation with the evaluation of the remote effects, cumulation capability.

3. To determine degrees of danger for the modulated EMF irradiation.

4. To develop the approaches of the evaluation of energy absorption for local and total irradiation, depending on wavelength, polarization, irradiation in open and shielded space.

5. It's necessary to continue the methodology of conducting epidemiological and medico-hygienic researches.

6. Further development of approaches to transfer the experimental data obtained on animals to the human being. For example, is it possible to transfer the data obtained on mice or rats during long term irradiation of the whole body to using modulated EMF irradiation mode of the cellular phone? However only the head brain of the user of cellular phone is subjected to EMF irradiation.

7. Intensive studies of danger of new sources EMF on the human being, for example, of mobile communication.

8. To introduce the system of an evaluation of the data to use them during the development of standards (ICNIRP Guidelines) in Russia.

9. It's necessary to carry out common work on co-ordination of terms.

10. It's necessary to organize a temporal joint working group of scientists from European countries, USA and Russia under ICNIRP or WHO to adapt and unify the possible approaches to harmonization the International Standards.

Thus, this is our point of view on the possibility of harmonization of the International EMF standards taking in consideration the accumulated experience in Russia.

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