

MINISTRY OF THE ENVIRONMENT  
in agreement with:  
Ministries of health and communications

In view of law no. 249 of 31 July 1997, article 1 paragraph 6 section a) no. 15, which provides, inter alia, that the Ministry of the Environment in agreement with the Ministry of health and the Ministry of communications, having consulted the higher Institute for health and the national Agency for protection of the environment (ANPA), the thresholds of radio frequencies compatible with human health are established also taking into account community standards;

In view of the decree by the Ministry of the environment in agreement with the Ministry of health of 2 June 1997, published in the Official Gazette of 8 August 1997 which institutes the inter-ministerial working party with the task of arranging an organic regulatory text on protection from electromagnetic pollution and to provide a consultancy service during approval and drafting [this word is not quite legible] of the regulatory text itself, and during arrangement of further provisions;

Taking into account the wide and increasing use of sources of electromagnetic fields within the frequency band between 100 kHz and 300 GHz;

Having considered the requirement to establish, in the initial application of law no. 249 of 31 July 1997, article 1 paragraph 6 section a) no. 15, the limits for exposure of the population to electromagnetic fields within the band of frequencies above, provided that the state of activation of the decree is confirmed as valid after a period of one year, in order that any amendments and inclusions may be to it;

Having consulted the Higher Institute for Health and the National Agency for Environmental Protection;

In view of the favorable opinion expressed by the permanent Conference for relations between the State, the regions and the autonomous provinces, in the meeting of .....

DECREES

Art. 1

*(Field of application)*

1. The provisions of this decree establish the threshold limits of exposure of the population to electromagnetic fields connected to the operation and practice of fixed sources operating within the frequency band between 100 kHz and 300 GHz.
2. The limits of exposure to which article 3 refers, do not apply to patients exposed for medical treatments and to workers exposed for professional reasons.

Art. 2  
*(Definitions and units of measurement)*

1. The definitions of physical dimensions mentioned in the decree and the corresponding units of measurement are those shown in appendix A which, together with appendices B and C, is an integral part of this decree.

Art. 3  
*(Limits of exposure)*

1. In the event of uniform exposure to the electromagnetic field, the levels of electric, magnetic fields and of power density, measured over any period of six minutes, should not exceed the values in table 1:

Table 1

Limits of exposure for the population to electromagnetic fields			
Frequency f (MHz)	Effective value of intensity of electrical field E (V/m)	Effective value of intensity of magnetic field H (A/m)	Power density of equivalent plane wave (W/m <sup>2</sup> )
0.1 - 3	60	0.2	-
> 3 - 3000	20	0.05	1
> 3000 - 300000	40	0.1	4

2. In the event of electromagnetic fields generated by several sources the sum of the relative standardized contributions, defined in appendix B, should be less than the unit.

Art. 4  
*(Safety measures and quality objectives)*

1. The limits referred to in article 3 remaining fixed, when designing and implementing new installations and improving already existing installations, the intention should be to reduce exposure of the population to the relative irradiated fields.

2. In relation to asylums, schools, hospitals and nursing homes, the following values should not be exceeded, independently of the frequency: 6 V/m for the electrical field, 0.016 A/m for the magnetic field, and, for frequencies between 3 MHz and 300 GHz, 0.10 W/m<sup>2</sup> for power density.

3. Within the scope of their own authorities, the regions and autonomous provinces govern the installation and modification of radio communications plants in order to guarantee adherence to the limits referred to in article 3 above and to the values in the above section, attainment of any quality objectives and activities of control and supervision in collaboration with the Authority responsible for communications.

Art. 5  
*(Improvements)*

1. In housing areas or sites of working activity for workers not professionally exposed or in areas in any case accessible to the population where the limits established in article 3 above are exceeded, activities of improvement should be put into practice by the owners of the installations, following notification by the Regions or Autonomous Provinces on the basis of measures carried out during supervision.

2. The appropriate reduction to be developed within the scope of improvement activity should be carried out in accordance with appendix C.

Art. 6  
*(Entry into force)*

The decree enters into force after its publication in the Official Gazette of the Italian Republic.

Environment Minister    Health Minister    Minister for Communications

Appendix A  
(Definitions and units of measurement)

*Electrical field E:* an electrical field is defined as a vectorial field which, at any point of a given area of space, represents the relation between the force exerted on a test electrical load and the value of that load.

The unit of measurement of the electrical field within the S.I. system is the volt/meter (V/m).

*Magnetic field H:* a magnetic field is defined as a vectorial-axial quantity defined at any point of a given region of space such that its rotor should be equal to the density of the total electrical current, including the displacement current.

The unit of measurement of the magnetic field within the S.I. system is the ampere/meter (A/m).

*Electromagnetic power density S:* this is the electromagnetic power which flows through the unit of surface, normally in the direction of propagation. In the distant field S is linked to the effective value of the electrical field E.. and to the effective value of the magnetic field H.. by the formulae:

$$S = \frac{E_{eff}^2}{h} = hH^2 \text{ where } h = 377 \text{ } \Omega \text{ is the impedance of the free space}$$

The unit of measurement of electromagnetic power density in the S.I. system is the watt/square meter (W/m<sup>2</sup>).

*Sequence f:* number of cycles of periods in the unit of time.

The unit of measurement of frequency in the S.I. system is the hertz (Hz); frequently used also are the multiples kilohertz (1 kHz = 10<sup>3</sup> Hz); megahertz (1 MHz = 10<sup>6</sup> Hz); gigahertz (1 GHz = 10<sup>9</sup> Hz).

*Mean of the temporal interval (t<sub>1</sub>, t<sub>2</sub>):* for a size p(t) variable in time this is given by the formula:

$$P = \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} p(t) dt$$

*Effective value:* for a periodic size a(t) effective value is defined by the formula:

$$A_{eff} = \sqrt{\frac{1}{T} \int_t^{t+T} a^2(t) dt}$$

*Plane wave:* is a distribution of propagative electromagnetic field, where at any point the sectors of electrical field and magnetic field are perpendicular towards each other and they lie on perpendicular planes in the direction of propagation.

*Region of distant field:* region of space, sufficiently distant from the source, in which the electromagnetic field has a distribution with the characteristics of the plane wave. Extension of this region depends on the maximum linear D dimensions of the radiant element and the wave length λ of the field emitted. It is assumed that the region of distant field begins at a distance from the source greater than the quantity r equal to the larger of the quantities λ and D<sup>2</sup>/λ.

## Appendix B

### Methods of carrying out measurements and assessments

In order to ascertain the limits referred to in article 3, the intensities of electromagnetic fields may be determined by means of calculations or by measurements.

Measurements are in any case necessary whenever calculations give values of electrical or magnetic field which exceed 1/3 of the above limits.

In the event of discordance between values calculated and values measured, the value measured is taken. Measurements of values of electromagnetic fields referred to in article 3 should be carried out according to the I.E.C. standards and in the absence of these, they should be carried out according to good technical standards issued by international organizations for this purpose, or indicated by the Organizations and Associations, including foreign ones, of acknowledged authority.

### Standardized values of measurements

Where there are several sources, the overall limit of exposure is 1, which is obtained as the sum of standardized contributions of the individual sources: these contributions are determined by dividing the square of the measured value of the electrical field or magnetic field by the square of the corresponding threshold value or by dividing the power density by the corresponding threshold value, for frequencies between 3 MHz and 300 GHz. The procedure to be followed for appropriate reduction is described in Appendix C.

## Appendix C

### Reduction in compliance with the standard

Reduction of contributions of electromagnetic fields generated by various sources, which converge at a given point in exceeding the limits of exposure referred to in art. 3, should be carried out in the following way: indicate  $E$  the electrical field of the  $n$ th source,  $L$  the corresponding limit taken from table 1,  $D$  the power density of the source and  $D_{Li}$  the corresponding limit taken from table 1; the standardized contributions which the various sources produce at the point in consideration are calculated in the following way:

$$(1) \quad C_i = E_i^2/L_i^2 \text{ or } C_i = D_i/D_{Li} \text{ (for frequencies } F > 3 \text{ MHz)}$$

If the sum

$$(2) \quad C = \sum_i C_i$$

exceeds the unit, the limits of exposure are not satisfied and the various signals  $E_i$  are therefore reduced so that  $C \leq 1$

From all the contributions  $C_i$  to be standardized the signals which give a contribution less than 5/1000 indicated conventionally with the following formula should be excluded:

$$\sum_k A_k$$

Hence (2) may be written:

$$C = \sum_j E_j^2 / L_j^2 + \sum_k A_k$$

Putting in (3)  $C=1$ ;  $E_j' = \sqrt{a}E_j$  you get:

$$(4) \quad 1 = \sum_k A_k = \left( \sum_j \frac{E_j^2}{L_j^2} \right) \quad \text{being } E_j$$

values of electrical field reduced appropriately and  $a$  is the coefficient of reduction.

By substitution you get:

$$(5) \quad 1 = \sum_k A_k = a \left( \sum_j \frac{E_j^2}{L_j^2} \right)$$

You get  $a$  and the new values, appropriately reduced, in the electrical fields  $E_j' = \sqrt{a}E_j$