ILNAS

Institut luxembourgeois de la normalisation
de l'accréditation, de la sécurité et qualité
des produits et services

ILNAS-EN 50413:2008

Basic standard on measurement and calculation procedures for human exposure to electric, magnetic and electromagnetic fields (0 Hz - 300 GHz)

Norme de base pour les procédures de mesures et de calculs pour l'exposition des personnes aux champs électriques, magnétiques et électromagnétiques (0

Grundnorm zu Mess- und Berechnungsverfahren der Exposition von Personen in elektrischen, magnetischen und elektromagnetischen

12/2008

National Foreword

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EUROPEAN STANDARD **EN 50413**

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English version

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pour les procédures de mesures
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von Personen in elektrischen,
magnetischen und
elektromagnetischen Feldern
(0 Hz bis 300 GHz)

This European Standard was approved by CENELEC on 2008-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 106X, Electromagnetic fields in the human environment. The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50413 on 2008-09-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-09-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-09-01

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1 Scope

This European Standard gives elements to establish methods for measurement and calculation of quantities associated with the assessment of human exposure to electric, magnetic and electromagnetic fields (EMF) in the frequency range from 0 Hz to 300 GHz. The major intention of this Basic Standard is to give the common background and information to relevant EMF standards. This Basic Standard cannot go into details extensively due to the broad frequency range and the huge amount of possible applications. Therefore it is not possible to specify detailed calculation or measurement procedures in this Basic Standard. This standard provides general procedures only for those product and workplace categories for which there do not exist any relevant assessment procedures in any existing European EMF basic standard.

If there exists an applicable European EMF standard focused on specific product or workplace categories then the assessment shall follow that standard. If an applicable European EMF standard does not exist, but an applicable assessment procedure in another European EMF standard does exist, then that assessment procedure shall be used.

This standard deals with quantities that can be measured or calculated in free space, notably electric and magnetic field strength or power density, and includes the measurement and calculation of quantities inside the body that forms the basis for protection guidelines.

In particular the standard provides information on

- definitions and terminology,
- characteristics of electric, magnetic and electromagnetic fields,
- measurement of exposure quantities,
- instrumentation requirements,
- methods of calibration,
- measurement techniques and procedures for evaluating exposure,
- calculation methods for exposure assessment.

2 Normative references

Void.

3 Definitions

For the purpose of this document, the following terms and definitions apply.

3.1
action values
magnitude of directly measurable parameters, provided in terms of electric field strength (*E*), magnetic field strength (*H*), magnetic flux density (*B*) and power density (*S*), at which one or more of the specified measures in Directive 2004/40/EC must be undertaken. Compliance with these values will ensure compliance with the relevant exposure limit values (from 2004/40/EC)

3.2
antenna
device that serves as a transducer between a guided wave for example in a coaxial cable and a free space wave, or vice versa

3.3
basic restriction
restrictions on exposure to time-varying electric, magnetic, and electromagnetic fields that are based directly on established health effects (from ICNIRP guidelines)

3.4
contact current
current flowing into the body resulting from contact with a conductive object in an electromagnetic field. This is the localised current flow into the body (usually the hand, for a light brushing contact)

3.5
current density (*J*)
current per unit cross-sectional area flowing inside the human body as a result of direct exposure to electromagnetic fields, expressed in the unit ampere per square m (A/m^2)

3.6
electric flux density (*D*)
vector quantity obtained at a given point by adding the electric polarization ***P*** to the product of the electric field strength ***E*** and the permittivity of free space ε_0:

$$\boldsymbol{D} = \varepsilon_0 \boldsymbol{E} + \boldsymbol{P}$$

Electric flux density is expressed in units of coulombs per square m (C/m^2).

NOTE In vacuum, the electric flux density is at all points equal to the product of the electric field strength and the permittivity of free space: $D = \varepsilon_0 E$

3.7
electric field strength (*E*)
vector quantity obtained at a given point that represents the force (***F***) on an infinitely small charge (*q*) divided by the charge:

$$\boldsymbol{E} = \frac{\boldsymbol{F}}{q}$$

Electric field strength is expressed in the unit volt per m (V/m)

3.8
exposure
exposure occurs when there is an electric, magnetic or electromagnetic field at the same location as the person from an external source

3.9
exposure limit values
limits on exposure to electromagnetic fields which are based directly on established health effects and biological considerations. Compliance with these limits will ensure that workers exposed to electromagnetic fields are protected against all known adverse health effects (from 2004/40/EC)

3.10
far-field region
region of the field of an antenna where the radial field distribution is essentially dependent inversely on the distance from the antenna. In this region the field has a predominantly plane-wave character, i.e. locally uniform distribution of electric field and magnetic field in planes transverse to the direction of propagation

NOTE In the far-field region the vectors of the electric field *E* and the magnetic field *H* are perpendicular to each other and the quotient between the value of the electric field strength *E* and the magnetic field strength *H* is constant and equals the impedance of free space Z_0.

3.11
impedance of free space
the impedance of free space Z_0 is defined as the square root of the free space permeability μ_0 divided by the permittivity of free space ε_0

$$Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}} \approx 120\pi\ \Omega \approx 377\ \Omega$$

3.12
isotropic
qualifies a physical medium or technical device where the relevant properties are independent of the direction