SLOVENSKI STANDARD
SIST EN 50413:2021

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Nadomešča:
SIST EN 50413:2009
SIST EN 50413:2009/A1:2014

Osnovni standard za merjenje in izračunavanje izpostavljenosti ljudi električnim, magnetnim in elektromagnetnim poljem (0 Hz–300 GHz)

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

Grundnorm zu Mess- und Berechnungsverfahren der Exposition von Personen in elektrischen, magnetischen und elektromagnetischen Feldern (0 Hz bis 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 Hz - 300 GHz)

Ta slovenski standard je istoveten z: **EN 50413:2019**

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Supersedes EN 50413:2008 and all of its amendments and corrigenda (if any)

English Version

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

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European foreword

This document (EN 50413:2019) has been prepared by CLC/TC 106X “Electromagnetic fields in the human environment”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2020-09-23
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2022-09-23

This document supersedes EN 50413:2008 and all of its amendments and corrigenda (if any).

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

1 Scope

This document provides general methods for measurement and calculation of quantities associated with human exposure to electromagnetic fields in the frequency range from 0 Hz to 300 GHz. It is intended specifically to be used for the assessment of emissions from products and comparison of these with the exposure limits for the general public given in Council Recommendation 1999/519/EC, and those given for workers in Directive 2013/35/EU, as appropriate. It also is intended to be used for assessment of human exposure to electromagnetic fields in the workplace to determine compliance with the requirements of Directive 2013/35/EU.

This standard deals with quantities that can be measured or calculated external to the body, notably electric and magnetic field strength or power density, and includes the measurement and calculation of quantities inside the body that form the basis for protection guidelines. In particular the standard provides information on:

— definitions and terminology,

— characteristics of electromagnetic fields,

— measurement of exposure quantities,

— instrumentation requirements,

— methods of calibration,

— measurement techniques and procedures for evaluating exposure,

— calculation methods for exposure assessment.

Where an applicable electromagnetic field standard specific to a product or technology exists it is expected to be used rather than this document. EN 62311:—, Table 1 gives a list of relevant standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Council Recommendation 1999/519/EC of 12 July 1999, *on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), Official Journal, L199, of 1999-7-30, p.59-70*

Directive 2013/35/EU of 26 June 2013, *on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields). Official Journal, L179, of 2013-6-29, p. 1–21*

EN 61786-1:2014, *Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to 100 kHz with regard to exposure of human beings - Part 1: Requirements for measuring instruments (IEC 61786-1:2013)*

EN 62232:2017, *Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure (IEC 62232:2017)*

EN 62311:—,[1] *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz) (IEC 62311:—)*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

[1] Under preparation. Stage at time of Formal Vote: FprEN 62311:2019.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
action level
operational levels established for the purpose of simplifying the process of demonstrating the compliance with relevant ELVs or, where appropriate, to take relevant protection or prevention measures specified in this Directive

[SOURCE: Directive 2013/35/EU]

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
restriction on exposure to electromagnetic fields that is based directly on established health effects and biological considerations

[SOURCE: Council Recommendation 1999/519/EC, modified]

3.4
contact current
current flowing into the body resulting from contact with a conductive object in an electromagnetic field

Note 1 to entry: The contact current is expressed in ampere (A).

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

Note 1 to entry: The current density is expressed in ampere per metre squared (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:

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

Note 1 to entry: Electric flux density is expressed in coulombs per metre squared (C/m^2).

Note 2 to entry: 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: $\boldsymbol{D} = \varepsilon_0 \boldsymbol{E}$.

3.7
electric field strength
E
vector field quantity ***E*** which exerts a force ***F*** equal to the product of ***E*** and the electric charge *Q* of the particle on any charged particle at rest:

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

Note 1 to entry: Electric field strength is expressed in volt per metre (V/m).

[SOURCE: IEV 121-11-18]

3.8
electromagnetic fields
EMF
static electric, static magnetic and time-varying electric, magnetic and electromagnetic fields with frequencies up to 300 GHz

[SOURCE: Directive 2013/35/EU]

3.9
exposure
phenomenon occurring whenever and wherever a person is subjected to external electromagnetic fields or to contact current

[SOURCE: EN 50499:—]

3.10
exposure level
value of the quantity used to assess exposure

3.11
exposure limits
guideline or restriction values on exposure that are given in international or national standards, guidelines or directives on human exposure to electromagnetic fields

Note 1 to entry: For Directive 2013/35/EU, the exposure limits are the action levels and the exposure limit values and also the other specific requirements in that Directive to avoid other risks related to workplace exposure to electromagnetic fields.

[SOURCE: EN 50499:—]

3.12
exposure limit value (ELV)
limits on exposure to electromagnetic fields which are based on biophysical and biological considerations, in particular on the basis of scientifically well-established short-term and acute direct effects, i.e. thermal effects and electrical stimulation of tissues

Note 1 to entry: Compliance with these limits will ensure that workers exposed to electromagnetic fields are protected against known adverse health effects (from Directive 2013/35/EU).

3.13
far-field region
region of the electromagnetic field of an antenna wherein the predominant components of the field are those which represent a propagation of energy and wherein the angular field distribution is essentially independent of the distance from the antenna

Note 1 to entry: In the far field region, all the components of the electromagnetic field decrease in inverse proportion to the distance from the antenna.

Note 2 to entry: For a broadside antenna having a maximum overall dimension D which is large compared to the wavelength λ, the far field region is commonly taken to exist at distances greater than $2D^2/\lambda$, from the antenna in the direction of maximum radiation.

[SOURCE: IEV 712-02-02]

3.14
high frequency fields
electromagnetic fields of frequency 10 MHz ≤ f ≤ 300 GHz

3.15
impedance of free space
Z0
square root of the free space permeability μ_0 divided by the permittivity of free space ε_0 for a plane wave,

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

3.16
intermediate frequency fields
electromagnetic fields of frequency 100 kHz ≤ f ≤ 10 MHz

3.17
isotropic
qualifies a physical medium or technical device where the relevant properties are independent of the direction

3.18
induced current
I
current induced inside the body as a result of direct exposure to electromagnetic fields

Note 1 to entry: Induced current is expressed in ampere (A).

3.19
low frequency field
electromagnetic field of frequency 1Hz ≤ f < 100 kHz

3.20
magnetic flux density
B
vector field quantity which exerts on any charged particle having velocity v a force ***F*** equal to the product of the vector product ***v*** x ***B*** and the electric charge q of the particle:

$$\boldsymbol{F} = q\,(\boldsymbol{v} \times \boldsymbol{B})$$

Note 1 to entry: The magnitude of the magnetic flux density is expressed in Tesla (T).

[SOURCE: IEV 121-11-19, modified]

3.21
magnetic field strength
H
vector quantity obtained at a given point by subtracting the magnetization ***M*** from the magnetic flux density ***B*** divided by the permeability of free space μ_0:

$$\boldsymbol{H} = \frac{\boldsymbol{B}}{\mu_0} - \boldsymbol{M}$$

Note 1 to entry: Magnetic field strength is expressed in ampere per metre (A/m).

Note 2 to entry: In a vacuum, the magnetic field strength is at all points equal to the magnetic flux density divided by the permeability of free space: $\boldsymbol{H} = \boldsymbol{B} / \mu_0$.

3.22
modulation
process of modifying the amplitude, phase and/or frequency of a periodic waveform in order to convey information

3.23
near-field region
region generally in proximity to an antenna or other radiating structure, in which the electric and magnetic fields do not have a substantially plane-wave character, but vary considerably from point to point

Note 1 to entry: The near-field region is further subdivided into the reactive near-field region, which is closest to the radiating structure and that contains most or nearly all of the stored energy, and the radiating near-field region where the radiation field predominates over the reactive field, but lacks substantial plane-wave character and is complex in structure.

3.24
permeability
μ

property of a material which defines the relationship between magnetic flux density *B* and magnetic field strength *H*

Note 1 to entry: It is commonly used as the combination of the permeability of free space (μ_0) and the relative permeability for specific materials (μ_r):

$$\mu = \mu_r \mu_0 = \frac{\boldsymbol{B}}{\boldsymbol{H}}$$

where

μ_r is the relative permeability of the material

μ_0 is the permeability of vacuum

Note 2 to entry: The permeability is expressed in henry per metre (H/m)