



SLOVENSKI STANDARD

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Ugotavljanje izpostavljenosti delavca elektromagnetnemu sevanju in ocena tveganja na mestu oddajnika

Determination of workers' exposure to electromagnetic fields and assessment of risk at a broadcast site

Ermittlung der Exposition von Arbeitnehmern gegenüber elektromagnetischen Feldern und Bewertung des Risikos am Standort eines Rundfunksenders

Détermination de l'exposition des travailleurs aux champs électromagnétiques et évaluation des risques sur un site de radiodiffusion

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Determination of workers' exposure to electromagnetic fields and assessment of risk at a broadcast site

Détermination de l'exposition des travailleurs aux champs électromagnétiques et évaluation des risques sur un site de radiodiffusion

Ermittlung der Exposition von Arbeitnehmern gegenüber elektromagnetischen Feldern und Bewertung des Risikos am Standort eines Rundfunksenders

This European Standard was approved by CENELEC on 2017-12-25. 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 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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EN 50496:2018 (E)

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European foreword

This document (EN 50496:2018) 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) 2018-12-25
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2020-12-25

This document supersedes EN 50496:2008.

The main changes included in the EN 50496:2018 with respect to EN 50496:2008 are consequential to the replacement of Directive 2004/40/EC by Directive 2013/35/EU.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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EN 50496:2018 (E)**1 Scope**

This European Standard provides methods for assessing compliance with the requirements of the Directive 2013/35/EU at a site operating one or more broadcast transmitters.

This standard covers the frequency range up to 40 GHz.

Users of this standard are invited to consult the national legislation in order to identify the national regulations and requirements. These national regulations and requirements can have additional requirements that are not covered by this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50413, *Basic standard on measurement and calculation procedures for human exposure to electric, magnetic and electromagnetic fields (0 Hz - 300 GHz)*

EN 50420, *Basic standard for the evaluation of human exposure to electromagnetic fields from a stand alone broadcast transmitter (30 MHz - 40 GHz)*

EN 50475, *Basic standard for the calculation and the measurement of human exposure to electromagnetic fields from broadcasting service transmitters in the HF bands (3 MHz - 30 MHz)*

EN 62226-2-1, *Exposure to electric or magnetic fields in the low and intermediate frequency range - Methods for calculating the current density and internal electric field induced in the human body - Part 2-1: Exposure to magnetic fields - 2D models (IEC 62226-2-1)*

EN 50527-1, *Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices — Part 1: General*

EN 50527-2-1, *Procedure for the assessment of the exposure to electromagnetic fields of workers bearing active implantable medical devices — Part 2-1: Specific assessment for workers with cardiac pacemakers*

EN 50647, *Basic standard for the evaluation of workers' exposure to electric and magnetic fields from equipment and installations for the production, transmission and distribution of electricity*

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 L 199 of 30 July 1999)

Directive 2013/35/EU of the European parliament and of the council 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) (20th individual Directive within the meaning of Article 16 of Directive 89/391/EEC)

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 levels

action levels (ALs)' means 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 Directive 2013/35/EU

Note 1 to entry: For electric fields, 'low ALs' and 'high ALs' means levels which relate to the specific protection or prevention measures specified in Directive 2013/35/EU.

Note 2 to entry: For magnetic fields, 'low ALs' means levels which relate to the sensory effects ELVs and 'high ALs' to the health effects ELVs.

3.2

AIMD

Active Implantable Medical Device

3.3

antenna

device that serves as a transducer between a guided wave (e.g. coaxial cable) and a free space wave, or vice versa

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3.4

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 complicated in structure.

3.5

broadcasting service

radiocommunication service in which the transmissions are intended for direct reception by the general public

Note 1 to entry: This service can include sound transmissions, television transmissions or other types of transmission, e.g. data.

3.6

broadcast site

site operating one or more broadcast transmitters

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EN 50496:2018 (E)**3.7****contact current**

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

Note 1 to entry: This is the localized current flow into the body (usually the hand, for a light brushing contact).

Note 2 to entry: Shocks and burns can be the adverse indirect effects.

Note 3 to entry: Contact current relates to a short-term effect and cannot be time-averaged.

3.8**induced current**

current flowing inside a human body resulting directly from an exposure to an electromagnetic field

3.9**employer**

any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment (Directive 89/391/EEC)

3.10**exposure limit values (ELVs)**

limits on exposure to electromagnetic fields in Directive 2013/35/EU established on the basis of biophysical and biological considerations, in particular on the basis of scientifically well-established short-term and acute direct effects, i.e. thermal effects (SAR, Power density) and electrical stimulation of tissues (internal electric field):

— health effects ELVs: ELVs above which workers might be subject to adverse health effects, such as thermal heating or stimulation of nerve and muscle tissue;

— sensory effects ELVs: sensory effects ELVs apply to frequency ranges of 0 Hz to 400 Hz (magnetic and electric fields) and 0.3 GHz to 6 GHz (pulsed signals) and above which workers might be subjected to transient disturbed sensory perceptions and minor changes in brain functions

3.11**local safety instruction**

safety instructions relating to a specific broadcast site and containing the information specified in Clause 8:

— it needs to include all the necessary safety-related indications and, if applicable, point out the possible risk of exposure to electromagnetic fields where these are at levels above the worker action levels;

— it could include all the necessary safety-related indications and, if applicable, point out the possible risk of exposure to electromagnetic fields where these are at levels above the limits for the general public

3.12**magnetic flux density**

magnetic flux density (**B**) is a vector quantity resulting in a force that acts on moving charges. The magnitude of magnetic flux density (**B**) is expressed in tesla (T)

$$B = \mu H$$

where μ is the permeability of the medium and H is the magnetic field strength

Note 1 to entry: In free space and in biological materials, magnetic flux density and magnetic field strength (H) can be interchanged using the magnetic field strength of $H = 1$ A/m equivalence to magnetic flux density of $B = 4\pi \cdot 10^{-7}$ T (approximately 1,25 microtesla).

3.13**power density**

power per area unit normal to the direction of electromagnetic wave propagation

$$S=EH = E^2/Z=H^2Z$$

Note 1 to entry: For plane waves the power density (S), electric field strength (E) and magnetic field strength (H) are related by $Z = Z_0 = 120\pi \Omega = 377 \Omega$

Note 2 to entry: E and H are expressed in units of V/m and A/m, respectively, and S in the unit of W/m².

3.14**transmitter**

device to generate the radio frequency broadcast signal which is fed into the antenna system

3.15**worker**

any person employed by an employer, including trainees and apprentices but excluding domestic servants

[SOURCE: Directive 89/391/EEC [7]]

3.16**work place**

location where workers have access as part of their duties

Note 1 to entry: Particular place of work within the broadcast site as for example the area near a transmitter with an open enclosure, the area inside a transmitting antenna, on a ladder inside a broadcast mast / tower and platforms under and above the antennas, the area around feed lines, etc.

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4 Assessment methods

4.1 Worker exposure assessment

The assessment should be done using the steps outlined below:

- collection of technical data (Clause 5);
- determination of exposure levels by calculation or measurement (Clause 6). This includes checking of operating procedures in the different exposure work places (Clause 8).

The results of the assessment process are:

- zoning of exposure work places (Clause 7);
- information and training (Clause 9);
- assessment report (Clause 10).

In the case of simultaneous exposure to multiple sources, the combined exposure shall be considered, referring to Annex A.

4.2 Use of public exposure assessment

If an evaluation has already been undertaken in accordance with the provisions of Council Recommendation 1999/519/EC, and the restrictions as specified therein are respected, then the exposure limit values for workers of Directive 2013/35/EU are also met.

EN 50496:2018 (E)**4.3 Assessment after technical modification**

After a technical modification to the installation or the environment, it is necessary to consider repeating or revising the assessment. This is particularly necessary if an additional transmitter or antenna is added to a site.

5 Collection of technical data

In order to plan the assessment of a site correctly, it is necessary to make a preliminary evaluation of the expected electromagnetic fields.

Therefore, it is very important to collect information about the site itself and the electromagnetic sources in and around it. It is useful to understand, in relation to each source if the point under evaluation is in the near or far field, which are the propagation characteristics, if there are elements that can cause absorption, reflection, reinforcements, resonance, etc.

Information on the following items may be needed:

- 1) with regard to the surrounding area:
 - Map of the surrounding areas possibly including facilities (such as buildings, territory, metallic structures, etc.);
 - information on areas where public assessment has been carried out in compliance with Council Recommendation 1999/519/EC or national regulation;
 - information on the nature of the field from any external sources should be obtained from the operators of those sources. Examples of useful information are the frequency, the radiated power, the type of service, and whether the transmissions are intermittent. However, it should be noted that much of the detailed information can be commercially sensitive;
- 2) with regard to the site:
 - the area controlled e.g. information on property, fencing, where the controlled area is bounded;
 - the site map showing all facilities, e.g. buildings, towers, anchor cables, earth mat;
 - the several areas:
 - where a public assessment has been carried out in compliance with Council Recommendation 1999/519/EC or national regulation;
 - where workers have access without specific care;
 - where workers only have access under specific circumstances;
- 3) with regard to power supply ELF emissions, information to collect is given in EN 50647;
- 4) with regard to the radio-frequency emissions, for each relevant source:
 - the mechanical configuration of the antennas (e.g. geometric dimensions, construction drawings, position in the mast);
 - radiation pattern, polarization and gain of antennas;
 - maximum and nominal transmitter power;
 - frequency, type of modulation (e.g. AM, FM, COFDM), channel bandwidth;

- feeder type and length, attenuation/meter, additional losses (combiners, patch panels, antenna cables and power dividers);
- 5) with regard to scheduling:
- transmitting time table (especially for short wave, SW);
 - permitted operating configuration.

Such information is collected in order to estimate the expected electromagnetic fields using different calculation methods/tools. An accurate analysis of the data/results will allow appropriate planning of the measurement campaign, in particular in relation to issues such as physical quantities to measure, which instruments to use, location of critical points with high values of electromagnetic fields, reinforcements or resonance are expected etc., if it is necessary to further protect workers who make the assessment (see § 7.2).

6 Determination of exposure levels by calculation or measurement

6.1 General

This standard does not directly address product performance standards, which are intended to limit electromagnetic field (EMF) emissions under specified test conditions.

6.2 Methodologies

6.2.1 General

In the near field, the electromagnetic field structure may be highly inhomogeneous, and there may be substantial variations from the plane-wave impedance of 377 ohms; that is, there may be preponderant electric fields in some regions and preponderant magnetic fields in others.

6.2.2 Exposure from power supplies

EN 50647 gives guidance for assessing 50 Hz power supplies and in particular criteria for power sources which are deemed to comply without any further assessment.

At 50 Hz, the electric or the magnetic field are to be measured separately.

6.2.3 Exposure from transmitters from 9 kHz to 100 kHz

Methodologies of measurement and calculation are defined in EN 62226-2-1.

6.2.4 Exposure from transmitters from 100 kHz to 30 MHz

Methodologies of measurement and calculation are defined in:

- 100 kHz to 3 MHz: EN 50413.
- 3 MHz to 30 MHz: EN 50475;

Information can also be found in ITU-R BS.1698 [5].

6.2.5 Exposure from transmitters from 30 MHz to 40 GHz

Methodologies of measurement and calculation are defined in EN 50420.

Information can also be found in ITU-R BS.1698 [5].

7.2 gives the process for use of a broadband field meter in a mast. Assessment of both the electric field strength and magnetic field strength may need to be performed.