SLOVENSKI STANDARD
oSIST prEN IEC 63184:2023

01-oktober-2023

Ocenjevanje izpostavljenosti ljudi sistemu brezžičnega prenosa energije z električnim in magnetnim poljem - Modeli, instrumenti, meritve ter računalniške metode in postopki (frekvenčno območje od 3 kHz do 30 MHz)

Assessment Methods of the Human Exposure to Electric and Magnetic Fields from Wireless Power Transfer Systems - Models, Instrumentation, Measurement and Computational Methods and Procedures (Frequency Range of 3 kHz to 30 MHz)

Ta slovenski standard je istoveten z: **prEN IEC 63184:2023**

ICS:

17.220.20	Merjenje električnih in magnetnih veličin	Measurement of electrical and magnetic quantities
17.240	Merjenje sevanja	Radiation measurements

oSIST prEN IEC 63184:2023 **en**

106/612/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC/IEEE 63184 ED1**	
DATE OF CIRCULATION: **2023-08-25**	CLOSING DATE FOR VOTING: **2023-11-17**
SUPERSEDES DOCUMENTS: **106/586/CD, 106/597A/CC**	

IEC TC 106 : METHODS FOR THE ASSESSMENT OF ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS ASSOCIATED WITH HUMAN EXPOSURE

SECRETARIAT: Germany	SECRETARY: Mr Alexander Prokop
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 9,TC 26,TC 27,TC 34,SC 62A,SC 62B,TC 69,TC 77,TC 78,TC 96,TC 100,TC 124,TC 125,CISPR	PROPOSED HORIZONTAL STANDARD: ☒ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

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The CENELEC members are invited to vote through the CENELEC online voting system.

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TITLE:

Assessment Methods of the Human Exposure to Electric and Magnetic Fields from Wireless Power Transfer Systems – Models, Instrumentation, Measurement and Computational Methods and Procedures (Frequency Range of 3 kHz to 30 MHz)

PROPOSED STABILITY DATE: 2030

NOTE FROM TC/SC OFFICERS:

Title corrected.

IEC/IEEE 63184 ED1 replaces IEC PAS 63184 ED1

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ASSESSMENT METHODS OF THE HUMAN EXPOSURE TO ELECTRIC AND MAGNETIC FIELDS FROM WIRELESS POWER TRANSFER SYSTEMS – MODELS, INSTRUMENTATION, MEASUREMENT AND COMPUTATIONAL METHODS AND PROCEDURES (FREQUENCY RANGE OF 3 kHz TO 30 MHz)

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IEC/IEEE 63184 was prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure, in cooperation with the International Committee on Electromagnetic Safety of the IEEE Standards Association, under the IEC/IEEE Dual Logo Agreement between IEC and IEEE. It is an International Standard.

This first edition replaces IEC PAS 63184 ED1, published in 2021

This document is published as an IEC/IEEE Dual Logo standard.

The text of this International Standard is based on the following IEC documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with the rules given in the ISO/IEC Directives, Part 2, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications/.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

The wireless power transmission systems described in the scope of this document require particularly developed procedures and protocols for the assessment of human exposure. Such systems are increasingly being implemented in a wide range of applications at different frequency ranges from consumer electronics (e.g. mobile phones, tablet PCs) to automotive (electric vehicles). Human exposure to electric and magnetic fields is limited to avoid established adverse health effects, including electrostimulation of nervous tissues (3 kHz < 10 MHz) and thermal effects (> 100 kHz). A published ITU-R report (ITU-R SM.2303-3 [1][1]) on WPT systems describes RF exposure assessment methodologies, yet no definitive assessment method was introduced. An exposure assessment method of WPT for EV charging systems was described in IEC 61980-3:2022 [2]; however, there are currently no other detailed product standards related to WPT systems. Because WPT systems will continue to become ubiquitous in a multitude of applications in the future, IEC and IEEE established a joint working group to address WPT system assessment methods related to human exposures to electric, magnetic, and electromagnetic fields.

In this document, prepared by IEC Technical Committee 106 (TC 106) and Technical Committee 34 (TC 34) Subcommittee 1 (SC 1) of IEEE International Committee on Electromagnetic Safety (ICES), the basic methods to assess the direct and indirect effects of exposure to WPT systems, case studies, and relevant research are described. These methods mainly focus on frequencies between 3 kHz and 30 MHz and consider both electrostimulation and thermal effects. This document specifies:

- general conformity assessment procedures (Clause 5);
- measurement methods (Clause 6);
- computational assessment methods (Clause 7);
- assessment combining experimental and computational methods (Clause 8).

[1] Numbers in square brackets refer to the Bibliography.

ASSESSMENT METHODS OF THE HUMAN EXPOSURE TO ELECTRIC AND MAGNETIC FIELDS FROM WIRELESS POWER TRANSFER SYSTEMS – MODELS, INSTRUMENTATION, MEASUREMENT AND COMPUTATIONAL METHODS AND PROCEDURES (FREQUENCY RANGE OF 3 kHz TO 30 MHz)

1 Scope

The objective of this document is to specify the assessment methods to evaluate exposure to stationary wireless power transfer (WPT) systems with electromagnetic human exposure guidelines (specific absorption rate (SAR), internal electric fields, or current density, including contact currents). The frequency range covered by this document is from 3 kHz to 30 MHz. This version of the document focuses on exposures from inductive WPT systems. Future versions will consider extended guidance for assessments of exposure from capacitive WPT systems.

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.

ISO/IEC Guide 98-1:2009, *Uncertainty of measurement – Part 1: Introduction to the expression of uncertainty in measurement*

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

IEC 61786-1:2013, *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 61786-2:2014, *Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to 100 kHz with regard to exposure of human beings – Part 2: Basic standard for measurements*

IEC/IEEE 62704-1:2017, *Determining the peak spatial-average specific absorption rate (SAR) in the human body from wireless communications devices, 30 MHz to 6 GHz – Part 1: General requirements for using the finite difference time-domain (FDTD) method for SAR calculations*

IEC/IEEE 62704-4:2020, *Determining the peak spatial-average specific absorption rate (SAR) in the human body from wireless communications devices, 30 MHz to 6 GHz – Part 4: General requirements for using the finite element method for SAR calculations*

3 Terms and definitions

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

ISO, IEC, and IEEE 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

- IEEE Dictionary Online: available at http://dictionary.ieee.org

3.1
exposure
<of a body> situation that occurs wherever a person is subjected to electric, magnetic, or electromagnetic fields

3.2
basic restriction
BR
maximum permissible field level induced in the body of a person exposed to electric, magnetic or electromagnetic fields below which established adverse health effects are assumed not to occur

Note 1 to entry: Examples of basic restrictions can be found in ICNIRP Guidelines [3], [4], [5] and in Annex II of the Council Recommendation 1999/519/EC [6].

Note 2 to entry: Documents issued by the IEEE ICES TC 95, such as [7] and [8], refer to the basic restrictions as dosimetric reference levels (DRL).

Note 3 to entry: Directive 2013/35/EU [9] refers to basic restrictions as "exposure limit values (ELVs)," i.e. “values 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 and electrical stimulation of tissues.”

3.3
reference level
maximum permissible level of the incident electric, magnetic or electromagnetic fields below which the basic restrictions are assumed not to be exceeded

Note 1 to entry: Examples of reference levels can be found in ICNIRP Guidelines [3], [4], [5] and in Annex II of the Council Recommendation 1999/519/EC [6].

Note 2 to entry: Documents issued by the IEEE ICES TC 95, such as [7] and [8], refer to the reference levels as exposure reference levels (ERL).

Note 3 to entry: Directive 2013/35/EU [9] refers to reference levels as "action levels (ALs)," i.e. “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."

3.4
direct effect
biological effect resulting from exposure of the body to an electric, magnetic, or electromagnetic field without interaction with a conducting object

3.5
indirect effect
biological effect resulting from interaction of the body with a conducting object with an electric potential different from the one of the body

3.6
incident field
field that would exist in the absence of a person at a point where a person could be located

Note 1 to entry: In some documents, the incident field is called an unperturbed field or environmental field.

3.7
coupling factor
factor which correlates the measured incident field to the induced field in the human body

3.8
electric field strength
vector field quantity $\boldsymbol{E}$ which exerts on any charged particle at rest a force $\boldsymbol{F}$ equal to the product of $\boldsymbol{E}$ and the electric charge Q of the particle:

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

[SOURCE : IEC 60050-121:1998/AMD5:2021 [10], 121-11-18]

3.9
internal electric field
<in a body> electric field induced inside the body as a result of exposure to electric, magnetic, or electromagnetic fields

3.10
magnetic field strength
vector quantity obtained at a given point by subtracting the magnetization $\boldsymbol{M}$ from the magnetic flux density $\boldsymbol{B}$ divided by the magnetic constant μ_0

[SOURCE: IEC 60050-121:1998/AMD5:2021 [10], 121-11-56]

3.11
contact current
<for human body> 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).

3.12
current density
at a given point within a volume element of quasi-infinitesimal volume V, vector quantity equal to the sum, for all free charge carriers within the volume element, of the products of electric charge and velocity, divided by the volume V:

$$\boldsymbol{J} = \frac{1}{V}\sum_{i=1}^{n} Q_i \boldsymbol{v}_i$$

where

n is the number of free carriers within the volume element;

Q_i is the electric charge of the i-th carrier;

$\boldsymbol{v}_i$ is the velocity of the i-th carrier.

Note 1 to entry: The flux of the electric current density $\boldsymbol{J}$ through any directed surface $\boldsymbol{S}$ is equal to the electric current I through that surface:

$$I = \int \boldsymbol{J} \cdot \boldsymbol{e}_n \mathrm{d}\boldsymbol{A}$$

where $\boldsymbol{e}_n \mathrm{d}\boldsymbol{A}$ is the vector surface element.

[SOURCE: IEC 60050-121:1998 [10], 121-11-11]

3.13
specific absorption rate
SAR
measure of the rate at which energy is absorbed by the human body when exposed to a radio frequency electromagnetic field

Note 1 to entry: The SAR in the tissue (or tissue-equivalent medium) can be determined by the rate of temperature increase or by E-field measurements, according to the following formulas:

$$SAR = \frac{\sigma E^2}{\rho}$$

$$SAR = c_h \left.\frac{\partial T}{\partial t}\right|_{t=0}$$

where

SAR is the specific absorption rate in W/kg;

E is the RMS value of the electric field strength in the tissue medium in V/m;

σ is the electrical conductivity of the tissue medium in S/m;

ρ is the mass density of the tissue medium in kg/m^3;

c_h is the specific heat capacity of the tissue medium in J/(kg K);

$\left.\frac{\partial T}{\partial t}\right|_{t=0}$ is the initial time derivative of temperature in the tissue medium in K/s.

[SOURCE: IEC/IEEE 62209-1528:2020 [11]]

3.14
peak spatial-average SAR
psSAR
maximum average SAR within a local region based on a specific averaging volume or mass, e.g. any 1 g or 10 g of tissue in the shape of a cube

Note 1 to entry: The cubic shape of the averaging volume is specified in [8] and [3].

3.15
magnitude <of a vector>
for any vector $\boldsymbol{U}$, non-negative scalar, usually denoted by $|\boldsymbol{U}|$, equal to the non-negative square root of the scalar product or, in the case of a complex vector, of the Hermitian product of the vector by itself

[SOURCE: IEC 60050-121:1998/AMD5:2021 [10], 102-03-23]

3.16
gradient
vector ∇f associated at each point of a given space region with a scalar f, having a direction normal to the surface on which the scalar field has a constant value, in the sense of increasing value of f, and a magnitude equal to the absolute value of the derivative of f with respect to distance in this normal direction

Note 1 to entry: The scalar f may refer to a component of a vector field.

[SOURCE: IEC 60050-121:1998/AMD5:2021 [10], 102-03-23, Note added.]

3.17
phantom
physical model with an equivalent human anatomy and comprised of a tissue-equivalent medium with dielectric properties specified in this document