

SLOVENSKI STANDARD

SIST EN 62369-1:2009

01-september-2009

Nadomešča:
SIST EN 50357:2002

Vrednotenje izpostavljenosti ljudi elektromagnetnim sevanjem kratkega dosega (SRD) na različnih področjih uporabe v frekvenčnem območju od 0 GHz do 300 GHz - 1. del: Sevanja naprav, ki se uporabljajo za elektronski nadzor blaga, radiofrekvenčno razpoznavanje in podobne sisteme (IEC 62369-1:2008)

Evaluation of human exposure to electromagnetic fields from short range devices (SRDs) in various applications over the frequency range 0 GHz to 300 GHz -- Part 1: Fields produced by devices used for electronic article surveillance, radio frequency identification and similar systems
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Ermittlung der Exposition von Personen gegenüber elektromagnetischen Feldern im Frequenzbereich 0 Hz bis 300 GHz durch Geräte mit kurzer Reichweite für verschiedene Anwendungen -- Teil 1: Felder, die durch Geräte erzeugt werden, die zur elektronischen Artikelüberwachung, Hochfrequenz-Identifizierung und für ähnliche Anwendungen verwendet werden

Evaluation de l'exposition humaine aux champs électromagnétiques produits par les dispositifs radio à courte portée dans la plage de fréquence 0 GHz à 300 GHz -- Partie 1: Champs produits par les dispositifs utilisés pour la surveillance électronique des objets, l'identification par radiofréquence et les systèmes similaires

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**Evaluation of human exposure to electromagnetic fields
from short range devices (SRDs) in various applications
over the frequency range 0 GHz to 300 GHz -
Part 1: Fields produced by devices used for electronic article surveillance,
radio frequency identification and similar systems
(IEC 62369-1:2008)**

Evaluation de l'exposition humaine
aux champs électromagnétiques
produits par les dispositifs radio
à courte portée dans la plage
de fréquence 0 GHz à 300 GHz -
Partie 1: Champs produits
par les dispositifs utilisés pour
la surveillance électronique des objets,
l'identification par radiofréquence
et les systèmes similaires
(CEI 62369-1:2008)

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CENELEC

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

Central Secretariat: avenue Marnix 17, B - 1000 Brussels

Foreword

The text of the International Standard IEC 62369-1:2008, prepared by IEC TC 106, Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure, was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 62369-1 on 2009-03-01 without any modification.

This European Standard supersedes EN 50357:2001.

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- latest date by which the national standards conflicting
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Endorsement notice

The text of the International Standard IEC 62369-1:2008 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

| | | |
|---------------|------|-----------------------------------------------------|
| IEC 61566 | NOTE | Harmonized as EN 61566:1997 (not modified). |
| IEC 62209-1 | NOTE | Harmonized as EN 62209-1:2006 (not modified). |
| IEC 62311 | NOTE | Harmonized as EN 62311:2008 (modified). |
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NORME INTERNATIONALE

Evaluation of human exposure to electromagnetic fields from short range devices (SRDs) in various applications over the frequency range 0 GHz to 300 GHz –

Part 1: Fields produced by devices used for electronic article surveillance, radio frequency identification and similar systems

Evaluation de l'exposition humaine aux champs électromagnétiques produits par les dispositifs radio à courte portée dans la plage de fréquence 0 GHz à 300 GHz –

Partie 1: Champs produits par les dispositifs utilisés pour la surveillance électronique des objets, l'identification par radiofréquence et les systèmes similaires

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CONTENTS

| | |
|----------------------------------------------------------------------------------------------|----|
| FOREWORD..... | 5 |
| INTRODUCTION..... | 7 |
| 1 Scope..... | 8 |
| 2 Normative references | 9 |
| 3 Terms, definitions, and abbreviations | 9 |
| 3.1 Quantities..... | 9 |
| 3.2 Constants..... | 9 |
| 3.3 Terms and definitions..... | 10 |
| 4 Measurements and calculations for equipment evaluation | 15 |
| 4.1 Introduction | 15 |
| 4.2 Evaluation against reference values | 16 |
| 4.2.1 General | 16 |
| 4.2.2 Direct measurement for comparison against reference values | 16 |
| 4.2.3 Spatial measurements for comparison against reference values | 17 |
| 4.2.4 Modelling and analysis including field non-uniformity..... | 17 |
| 4.3 Specific absorption rate (SAR) measurements..... | 24 |
| 4.3.1 General | 24 |
| 4.3.2 Internal electric field strength measurements..... | 24 |
| 4.3.3 Internal temperature measurements | 25 |
| 4.3.4 Calorimetric measurements of heat transfer | 26 |
| 4.3.5 Phantom models and fluid | 26 |
| 4.4 Numerical evaluations for comparison against basic restrictions..... | 26 |
| 4.4.1 General..... | 26 |
| 4.4.2 Evaluations using homogeneous models | 26 |
| 4.4.3 Special case of inductive near-field exposure 100 kHz to 50 MHz..... | 28 |
| 4.4.4 Frequencies > 50 MHz..... | 29 |
| 4.4.5 Localised SAR (100 kHz to 10 GHz) | 29 |
| 4.5 Evaluations using non-homogeneous models for comparison against basic restrictions | 30 |
| 4.5.1 General | 30 |
| 4.5.2 Anatomical body models..... | 30 |
| 4.5.3 Calculation/modelling method | 31 |
| 4.5.4 Position of the body in relation to the unit under evaluation | 31 |
| 4.6 Measurement of limb and touch currents | 31 |
| 5 Measurements for field monitoring..... | 32 |
| 5.1 General..... | 32 |
| 5.2 Field measurements | 32 |
| 5.2.1 Measurement where persons spend significant periods of time..... | 32 |
| 5.2.2 Detailed measurements for non-transitory exposure | 32 |
| 5.3 Additional evaluation | 32 |
| 6 Exposure from sources with multiple frequencies or complex waveforms..... | 33 |
| 7 Exposure from multiple sources..... | 33 |
| 8 Uncertainty..... | 34 |
| 8.1 General..... | 34 |
| 8.2 Evaluating uncertainties | 34 |
| 8.2.1 Individual uncertainties..... | 34 |

| | |
|---------------------------------------------------------------------------------------|----|
| 8.2.2 Combining uncertainties | 35 |
| 8.3 Examples of typical uncertainty components | 35 |
| 8.3.1 Measurement..... | 35 |
| 8.3.2 Numerical calculation | 35 |
| 8.4 Overall uncertainties | 35 |
| 9 Evaluation report | 35 |
| Annex A (informative) Characteristics of equipment | 37 |
| Annex B (informative) Information for numerical modelling..... | 47 |
| Annex C (informative) A simplified method for summation of multiple sources | 67 |
| Annex D (informative) Uncertainty | 70 |
| Bibliography..... | 71 |
| Figure 1 – General torso grid | 19 |
| Figure 2 – General head grid | 19 |
| Figure 3 – Single floor standing antenna..... | 20 |
| Figure 4 – Dual floor standing antenna | 20 |
| Figure 5 – Single floor antenna | 21 |
| Figure 6 – Single ceiling antenna..... | 21 |
| Figure 7 – Combined floor and ceiling antennas..... | 22 |
| Figure 8 – “Walk-through” loop antenna..... | 22 |
| Figure 9 – Counter or desk mounted antenna | 23 |
| Figure 10 – Vertical, wall or frame mounted antenna..... | 23 |
| Figure 11 – Hand-held antenna..... | 24 |
| Figure 12 – Disk model | 28 |
| Figure 13 – Cubic model | 28 |
| Figure 14 – Spheroid model..... | 28 |
| Figure A.1 – Example of exit mounted equipment showing detection range..... | 40 |
| Figure A.2 – Example of aisle mounted equipment..... | 40 |
| Figure A.3 – Inductive coupling..... | 42 |
| Figure A.4 – Electromagnetic coupling | 42 |
| Figure A.5 – Capacitive coupling..... | 42 |
| Figure A.6 – Overview of an RFID system..... | 44 |
| Figure B.1 – Current induced in a loop..... | 47 |
| Figure B.2 – Disk model..... | 51 |
| Figure B.3 – Disk model used for validations | 51 |
| Figure B.4 – Cubic model..... | 52 |
| Figure B.5 – Cubic model example showing current induced in 3 dimensions..... | 53 |
| Figure B.6 – Prolate spheroid | 54 |
| Figure B.7 – Helmholtz coils and prolate spheroid..... | 55 |
| Figure B.8 – 60 cm by 30 cm prolate spheroid results (magnetic field) | 56 |
| Figure B.9 – 60 cm by 30 cm prolate spheroid results (induced current density) | 56 |
| Figure B.10 – 120 cm by 60 cm prolate spheroid results (magnetic field) | 57 |
| Figure B.11 – 120 cm by 60 cm prolate spheroid results (induced current density)..... | 57 |
| Figure B.12 – 160 cm by 80 cm prolate spheroid results (magnetic field) | 58 |

| | |
|---------------------------------------------------------------------------------------|----|
| Figure B.13 – 160 cm by 80 cm prolate spheroid results (induced current density)..... | 58 |
| Figure B.14 – Homogeneous human shape body model..... | 60 |
| Figure B.15 – Homogeneous human shape (induced current) | 60 |
| Figure B.16 – Homogeneous hand model..... | 61 |
| Figure B.17 – Approximate conductivities for LF homogeneous body modelling | 66 |
| Table 1 – Dimensions and distances for Figures 1 to 11 | 18 |
| Table 2 – Dimensions and distances for simplified body shapes | 27 |
| Table 3 – Maximum total evaluation uncertainties | 35 |
| Table A.1 – Frequency ranges and typical system characteristics | 43 |
| Table A.2 – Example frequency bands and their applications | 43 |
| Table B.1 – Disk model dimensions for Figure B.2 | 51 |
| Table B.2 – Cubic disk model dimensions for Figure B.4 | 52 |
| Table B.3 – Prolate spheroid dimensions for Figure B.6 | 54 |
| Table B.4 – Summary of results | 59 |
| Table B.5 – Examples of anatomical models | 62 |
| Table B.6 – Conductivity of tissue types..... | 64 |
| Table B.7 – Relative permittivity of tissue types | 65 |

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<https://standards.iteh.ai/catalog/standards/sist/20b8a078-e2f8-4568-9beb-ce825baa96f2/sist-en-62369-1-2009>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EVALUATION OF HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS FROM SHORT RANGE DEVICES (SRDS) IN VARIOUS APPLICATIONS OVER THE FREQUENCY RANGE 0 GHz to 300 GHz –

Part 1: Fields produced by devices used for electronic article surveillance, radio frequency identification and similar systems

FOREWORD

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International Standard IEC 62369-1 has been prepared by IEC technical committee 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|--------------|------------------|
| 106/156/FDIS | 106/159/RVD |

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all parts of IEC 62369 series, published under the title *Evaluation of human exposure to electromagnetic fields from short range devices (SRDs) in various applications over the frequency range 0 GHz to 300 GHz*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

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INTRODUCTION

Electromagnetic fields interact with the human body and other biological systems through a number of physical mechanisms. The main mechanisms of interaction are based on nervous system effects and heating. These effects are dependent on frequency and are defined by biologically relevant quantities. Based on these scientifically established health effects, there are international, regional and sometimes national exposure requirements. These are set as basic restrictions on quantities, which are not necessarily directly measurable, and contain high safety factors to ensure a high level of protection. These quantities may be determined either by calculation for each case, or by measuring a reference value that has a pre-derived relationship to them, usually under worst-case, far-field conditions. Respect of the reference value will ensure respect of the relevant basic restriction, except in some specific near field situations which would normally be identified or highlighted within the applicable exposure guidelines. If the measured quantity exceeds the reference value, it does not necessarily follow that the basic restriction is also exceeded. Under those circumstances, more detailed evaluation techniques will be necessary which are specific to that type of equipment and exposure.

This document is part of a multi-part standard covering the evaluation of human exposure to electromagnetic fields from short range devices (SRDs) in various applications over the frequency range from 0 GHz to 300 GHz.

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EVALUATION OF HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS FROM SHORT RANGE DEVICES (SRDS) IN VARIOUS APPLICATIONS OVER THE FREQUENCY RANGE 0 GHz to 300 GHz –

Part 1: Fields produced by devices used for electronic article surveillance, radio frequency identification and similar systems

1 Scope

This part of IEC 62369 presents procedures for the evaluation of human exposure to electromagnetic fields (EMFs) from devices used in electronic article surveillance (EAS), radio frequency identification (RFID) and similar applications. It adopts a staged approach to facilitate compliance assessment. The first stage (Stage 1) is a simple measurement against the appropriate derived reference values. Stage 2 is a more complex series of measurements or calculations, coupled with analysis techniques. Stage 3 requires detailed modelling and analysis for comparison with the basic restrictions. When assessing any device, the most appropriate method for the exposure situation may be used.

At the time of writing this International Standard, electronic article surveillance, radio frequency identification and similar systems do not normally operate at frequencies below 1 Hz or above 10 GHz. EMF exposure guidelines and standards can cover a wider range of frequencies, so clarification on the required range is included as part of the evaluation procedures.

The devices covered by this document normally have non-uniform field patterns. Often these devices have a very rapid reduction of field strength with distance and operate under near-field conditions where the relationship between electric and magnetic fields is not constant. This, together with typical exposure conditions for different device types, is detailed in Annex A.

Annex B contains comprehensive information to assist with numerical modelling of the exposure situation. It includes both homogeneous and anatomical models as well as the electrical properties of tissue.

This International Standard does not include limits. Limits can be obtained from separately published human exposure guidelines. Different guidelines and limit values may apply in different regions. Linked into the guidelines are usually methods for summation across wider frequency ranges and for multiple exposure sources. These shall be used. A simplified method for summation of multiple sources is contained in Annex C. This has to be used with care as it is simplistic and will overestimate the exposure; however it is useful as a guide, when the results of different evaluations are in different units of measure which are not compatible.

Different countries and regions have different guidelines for handling the uncertainties from the evaluation. Annex D provides information on the two most common methods.

A bibliography at the end of this standard provides general information as well as useful information for the measurement of electromagnetic fields. See [1],[2],[3],[4],[5],[6]¹⁾.

Similar national or international standards may be used as an alternative.

1) Figures between brackets refer to the bibliography.

2 Normative references

None.

3 Terms, definitions, and abbreviations

The internationally accepted SI units are used throughout this document.

3.1 Quantities

| Quantity | Symbol | Unit | Dimension |
|--------------------------|------------|---------------------------|-------------------|
| Magnetic flux density | B | tesla (Vs/m^2) | T |
| Electric flux density | D | coulomb per square metre | Cm^{-2} |
| Electric field strength | E | volt per metre | Vm^{-1} |
| Frequency | f | hertz | Hz |
| Magnetic field strength | H | ampere per metre | Am^{-1} |
| Current density | J | ampere per square metre | Am^{-2} |
| Power density | S | watt per square metre | Wm^{-2} |
| Specific absorption rate | SAR | watt per kilogram | Wkg^{-1} |
| Temperature | T | kelvin | K |
| Permittivity | ϵ | farad per metre | Fm^{-1} |
| Wavelength | λ | metre | m |
| Permeability | μ | henry per metre | Hm^{-1} |
| Mass density | ρ | kilogram per cubic metre | kgm^{-3} |
| Electric conductivity | σ | siemens per metre | Sm^{-1} |

3.2 Constants

| Physical constant | Symbol | Magnitude |
|---------------------------------|--------------|-----------------------------------------|
| Velocity of light in free space | c | $2,998 \times 10^8 \text{ ms}^{-1}$ |
| Permittivity of free space | ϵ_0 | $8,854 \times 10^{-12} \text{ Fm}^{-1}$ |
| Permeability of free space | μ_0 | $4\pi \times 10^{-7} \text{ Hm}^{-1}$ |
| Impedance of free space | Z_0 | 120π (or 377) Ω |

3.3 Terms and definitions

3.3.1

antenna

antennas are conductive elements that radiate, and/or receive energy in the radio frequency spectrum

3.3.2

average (temporal) absorbed power

P_{avg}

time – averaged rate of energy transfer defined by:

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

where t_1 and t_2 are the start and stop time of the exposure (the period $t_2 - t_1$ is the exposure duration)

3.3.3

averaging time

t_{avg}

appropriate time over which exposure is averaged for purposes of determining compliance

3.3.4

bandwidth

range or band of frequencies in the electromagnetic spectrum within which a system is capable of receiving and transmitting

3.3.5

basic restrictions (or basic limits)

values for human exposure to time-varying electric, magnetic, and electromagnetic fields that are based on levels for which there are established health effects, with a high level of safety included. These values may be defined in terms of induced current density, in-situ electric field, specific absorption rate or similar dosimetric quantity

3.3.6

carrier

frequency used to carry data by appropriate modulation of the carrier waveform

3.3.7

conductivity

σ

ratio of the conduction–current density in a medium to the electric field strength in the medium

$$J = \sigma E$$

3.3.8

current density

J

electromagnetic field-induced current per unit area inside the body

3.3.9

deactivator

device which changes transponders so that they no longer respond

3.3.10**dielectric constant** ϵ

See permittivity.

3.3.11**electric field strength** E

magnitude of a field vector at a point that represents the force (F) on an infinitely small charge (q) divided by the charge

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

3.3.12**electric flux density** D

magnitude of a field vector that is equal to the electric field strength (E) multiplied by the permittivity (ϵ)

$$D = \epsilon E$$

3.3.13**electronic article surveillance****EAS**

system which detects the presence of transponders, which is often used for anti-theft purposes

3.3.14**exposure**

exposure occurs whenever and wherever a person is subjected to electric, magnetic or electromagnetic fields or to touch currents other than those originating from physiological processes in the body and other natural phenomena

3.3.15**exposure level**

value of the quantity under analysis when a person is exposed to electromagnetic fields or touch currents

3.3.16**exposure requirements**

standard, recommendation, set of guidelines or limits or other document that defines exposure levels for guidance, assessment or compliance purposes

3.3.17**far-field**

that region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna. In this region (also called the free space region), the field has a predominantly plane-wave character, i.e. locally uniform distribution of electric field strength and magnetic field strength in planes transverse to the direction of propagation

3.3.18**harmonics**

multiples of a principal frequency, invariably exhibiting lower amplitudes