

# **Evaluation of human exposure to electromagnetic fields from devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications**

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## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN 50357:2002 sisaldab Euroopa standardi EN 50357:2001 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 10.09.2002 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN 50357:2002 consists of the English text of the European standard EN 50357:2001.</p> <p>This document is endorsed on 10.09.2002 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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<p><b>Käsitlusala:</b></p> <p>This European Standard applies to devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications. The objective of the Standard is to specify, for such equipment, the methods for demonstration of compliance with basic restrictions or reference levels related to human exposure to electromagnetic fields.</p>	<p><b>Scope:</b></p> <p>This European Standard applies to devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications. The objective of the Standard is to specify, for such equipment, the methods for demonstration of compliance with basic restrictions or reference levels related to human exposure to electromagnetic fields.</p>
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**ICS** 13.280, 33.100.01

**Võtmesõnad:**

**Evaluation of human exposure to electromagnetic fields  
from devices used in Electronic Article Surveillance (EAS),  
Radio Frequency Identification (RFID) and similar applications**

Evaluation de l'exposition humaine aux champs électromagnétiques (EMFs) émis par les dispositifs utilisés pour la surveillance électronique des objets (EAS), l'identification par radiofréquence (RFID) et les applications similaires

Ermittlung der Exposition von Personen gegenüber elektromagnetischen Feldern von Geräten, die in der elektronischen Artikelüberwachung (en: EAS), Hochfrequenz-Identifizierung (en: RFID) und ähnlichen Anwendungen verwendet werden

This European Standard was approved by CENELEC on 2001-07-03. 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.

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## 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**

## Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 106X (former TC 211), Electromagnetic fields in the human environment.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50357 on 2001-07-03.

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) | 2002-07-01 |
| - latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2004-07-01 |

Annexes designated "informative" are given for information only.  
In this standard, annexes A and B are informative.

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## Introduction

This document presents procedures for the evaluation of human exposure to electromagnetic fields (EMF's) from Devices used in electronic article surveillance (EAS), radio frequency identification (RFID) and similar applications. The work has been carried out in response to:

- The ICNIRP <sup>1)</sup> Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) [1];
- European Council Recommendation 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields 0-300 GHz (the EC Recommendation) [2];
- European Council Directive 73/23/EEC on the harmonisation of the laws of member states relating to electrical equipment designed for use within certain voltage limits (the LV Directive) [3];
- European Council Directive 1999/5/EC on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (the R&TTE Directive) [4].

The techniques presented in this document may also be used to demonstrate compliance to other National or International requirements.

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 such as magnetic flux density, induced current density and specific absorption rate. These quantities are not directly measurable so they must be determined either, by calculation for each case, or by measuring a reference quantity which has a pre-derived relationship to them.

The examples used in this document are taken from the EC Recommendation and from the ICNIRP Guidelines. They each contain a series of Basic Restrictions for magnetic flux density, induced current density, power density and specific absorption rate as well as a series of derived Reference Levels

In any particular exposure situation, measured or calculated values can be compared to the appropriate reference level. The reference levels are generally obtained from the basic restriction by mathematical modelling and laboratory experimentation at specific frequencies. They reflect maximum coupling of the fields to the exposed human being, thereby providing maximum protection. Respect of the reference level will ensure respect of the relevant basic restriction. If the measured value exceeds the reference level, 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 adopts a staged approach to compliance assessment. The first stage is a simple measurement against the appropriate derived Reference Levels. If the device meets these, there is no requirement for further assessment. Stage 2 is a more complex series of measurements, coupled with analysis techniques. Again, if the device meets the appropriate levels, there is no requirement for further assessment. Stage 3 requires detailed modelling and analysis to show compliance with the Basic Restrictions. Device compliance can be shown using any one of the stages; it is not necessary to use more than one, unless an assessment using Stages 1 or 2 fails to demonstrate compliance.

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.

Measurements and methods are derived with reference to:

1. Work carried out within CENELEC
2. Notes and explanatory text from the EC Recommendation and the ICNIRP Guidelines
3. Similar techniques proposed or adopted by IEC <sup>2)</sup>, especially in the case of desktop equipment [5].
4. Other, specifically referenced techniques.

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<sup>1)</sup> International Commission on Non-Ionising Radiation Protection

<sup>2)</sup> International Electrotechnical Committee

## 1 Scope

This European Standard applies to devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications. The objective of the Standard is to specify, for such equipment, the methods for demonstration of compliance with basic restrictions or reference levels related to human exposure to electromagnetic fields.

The Council Directive 1999/5/EC [4], Article 3.1(a), defines essential requirements for equipment that is either radio equipment or telecommunications equipment or both; with regard to the protection of the health and safety of the user and any other person. This document may be used for demonstration of compliance to the Council Directive with reference to human exposure to electromagnetic fields (EMF's). There are additional requirements covered by Article 3.1(a), which are not included in this document.

The Council Directive 73/23/EEC [3], Article 2, stipulates that the Member States take all appropriate measures to ensure that electrical equipment may be placed on the market only if, having been constructed in accordance with good engineering practice in safety matters in force in the Community, it does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was made. The principal elements of those safety objectives are listed in annex I clause 2b. This document may be used for demonstration of compliance to the Council Directive only with reference to human exposure to electromagnetic fields (EMF's). There are additional requirements covered by Article 2 and annex I clause 2b, which are not included in this document.

The Council Recommendation 1999/519/EC [2] provides Basic Restrictions and derived Reference Levels for exposure of the general public in the areas where they spend significant time. This document may be used for demonstration of equipment compliance to the Council Recommendation on this basis, but there may be additional specific National or International requirements which are not included.

The ICNIRP Guidelines [1] provide Basic Restrictions and derived Reference Levels for both occupational and general public exposure. This document may be used for demonstration of equipment compliance to ICNIRP Guidelines on this basis, but there may be additional specific National or International requirements which are not included.

Other Standards can apply to products covered by this document. In particular this document is not designed to assess the electromagnetic compatibility with other equipment, medical or otherwise. It does not reflect any product safety requirements other than those specifically related to human exposure to electromagnetic fields.

It is also possible to use this document as a basis to demonstrate compliance to other National and International Guidelines or Requirements with regard to human exposure from EMF's. In these cases, other Restrictions and Levels may be used.

## 2 Physical quantities, units and constants

### 2.1 Quantities

The internationally accepted SI units are used throughout this document

<u>Quantity</u>	<u>Symbol</u>	<u>Unit</u>	<u>Dimension</u>
Current density	J	ampere per square metre	$\text{Am}^{-2}$
Electric field strength	E	volt per metre	$\text{Vm}^{-1}$
Electric flux density	D	coulomb per square metre	$\text{Cm}^{-2}$
Electric conductivity	$\sigma$	siemens per metre	$\text{Sm}^{-1}$
Frequency	f	hertz	Hz