IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

C95.1™

Sponsored by the
IEEE International Committee on Electromagnetic Safety (SCC39)

IEEE
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Abstract: Recommendations to protect against harmful effects in human beings exposed to electromagnetic fields in the frequency range from 3 kHz to 300 GHz are provided in this standard. These recommendations are intended to apply in controlled environments and for general population exposure. These recommendations are not intended to apply to the exposure of patients by or under the direction of physicians and medical professionals.

Keywords: basic restriction (BR), maximum permissible exposure (MPE), radio frequency (RF), RF exposure, RF safety, specific absorption rate (SAR)

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Introduction

This introduction is not part of IEEE Std C95.1-2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

In 1960, the American Standards Association approved the initiation of the Radiation Hazards Standards project under the co-sponsorship of the Department of the Navy and the Institute of Electrical and Electronics Engineers, Inc. Prior to 1988, C95 standards were developed by Accredited Standards Committee C95, and submitted to the American National Standards Institute (ANSI) for approval and issuance as ANSI C95 standards. Between 1988 and 1990, the committee was converted to Standards Coordinating Committee 28 (SCC 28) under the sponsorship of the IEEE Standards Board. In 2001, the IEEE Standards Association Standards Board approved the name "International Committee on Electromagnetic Safety (ICES)" for SCC 28 to better reflect the scope of the committee and its international membership. In accordance with policies of the IEEE, C95 standards are issued and developed as IEEE standards, as well as submitted to ANSI for recognition.

In 2005, SCC 28 and SCC 34 became Technical Committees 95 and 34, respectively, under a new committee, SCC 39, which is now called ICES.

The present scope of IEEE ICES is as follows:

"Development of standards for the safe use of electromagnetic energy in the range of 0 Hz to 300 GHz relative to the potential hazards of exposure of man, volatile materials, and explosive devices to such energy. It is not intended to include infrared, visible, ultraviolet, or ionizing radiation. The committee will coordinate with other committees whose scopes are contiguous with ICES."

Subcommittee 4 of ICES Technical Committee 95 (TC95) is responsible for this standard. There are five TC95 subcommittees, each of whose area of responsibility is described below in correspondence with its designated subcommittee number:

1) Techniques, Procedures, and Instrumentation;
2) Terminology, Units of Measurements and Hazard Communication;
3) Safety Levels with Respect to Human Exposure, 0-3 kHz;
4) Safety Levels with Respect to Human Exposure, 3 kHz-300 GHz;
5) Safety Levels with Respect to Electro-Explosive Devices.

Three standards, three recommended practices and one guide have been issued. Current versions are:

IEEE Std 1460™-1996 (R2002), IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields.

IEEE Std C95.1™-2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

NOTE—The recommendations in this standard protect against scientifically established adverse health effects in human beings resulting from exposure to radio frequency electromagnetic fields in the frequency range of 3 kHz to 300 GHz. Other effects that have been reported in the literature but have not been confirmed or could not be related to human health have been considered and are discussed in Annex B and Annex C of this standard.

IEEE Std C95.2™-1999 (R2005), IEEE Standard for Radio-Frequency Energy and Current Flow Symbols.

IEEE Std C95.3™-2002, Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to Such Fields, 100 kHz-300 GHz.

IEEE Std C95.4™-2002, IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations.

IEEE Std C95.6™-2002, IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz.

IEEE Std C95.7™-2005, IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz.

Notice to users

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: http://standards.ieee.org/reading/ieee/updates/errata/index.html. Users are encouraged to check this URL for errata periodically.

Interpretations

Current interpretations can be accessed at the following URL: http://standards.ieee.org/reading/ieee/interp/index.html.

Participants

This standard was prepared by Subcommittee 4 (Safety Levels with Respect to Human Exposure, 3 kHz-300 GHz) of IEEE ICES SCC 28 (now ICES TC-95). The following persons contributed to the development of this standard:

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IEEE Standards Project Editor

Contents

IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

1. Overview

1.1 Scope

Recommendations are made to protect against established adverse health effects in human beings associated with exposure to electric, magnetic and electromagnetic fields in the frequency range of 3 kHz to 300 GHz. The recommendations are expressed in terms of basic restrictions (BRs) and maximum permissible exposure (MPE) values. The BRs are limits on internal fields, specific absorption rate (SAR), and current density; the MPEs, which are derived from the BRs, are limits on external fields and induced and contact current. The recommendations, which protect against effects associated with electrostimulation and tissue and whole-body heating, are intended to apply to all human exposures except for exposure of patients by, or under the direction of, physicians and medical professionals. These recommendations are not intended for the purpose of preventing interference with medical and other devices that may exhibit susceptibility to radio frequency (RF) fields. The recommendations at 300 GHz are compatible with existing recommendations for safe exposure in the infrared frequency range, which begins at 300 GHz, cf., ANSI Z136.1-2000 [B7][1], ICNIRP guidelines [B63], and IEC 60825-1 [B65]. IEEE Std C95.6-2002[2] is the applicable standard for use at frequencies below 3 kHz.

1.2 Purpose

The purpose of this standard is to provide exposure limits to protect against established adverse effects to human health induced by exposure to RF electric, magnetic and electromagnetic fields over the frequency range of 3 kHz to 300 GHz.

[1]The numbers in brackets correspond to those of the bibliography in Annex G.
[2]Information on references can be found in Clause 2.