

# IEEE Standard for Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

IEEE Technical Committee 95

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IEEE International Committee on Electromagnetic Safety (SCC39)

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# IEEE Standard for Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

Sponsor

**Technical Committee 95**

of the

**IEEE International Committee on Electromagnetic Safety (SCC39)**

Approved 16 May 2014

**IEEE-SA Standards Board**

**Abstract:** Recommendations to protect personnel in military environments against established adverse health effects associated with exposure to electric, magnetic, and electromagnetic fields, induced and contact current, and contact and arcing voltages over the frequency range of 0 Hz to 300 GHz are provided in this standard. IEEE Std C95.1-2345™ was developed to replace North Atlantic Treaty Organization (NATO) Standardization Agreement (STANAG) 2345 (Edition 3), Evaluation and Control of Personnel Exposure to Radio Frequency Fields—3 kHz to 300 GHz, (13 February 2003).

**Keywords:** Dosimetric reference limit (DRL), electric fields, electrical excitation, electromagnetic energy, electromagnetic fields, electrostimulation, exposure limits, exposure reference level (ERL), IEEE C95.1-2345™, induced and contact currents, lowest-observed-adverse-effects-level (LOAEL), lowest-observed-effects-level (LOEL), magnetic fields, personnel protection program initiation level, radio frequency (RF), restricted environment, restricted expert only (REO) zone, RF exposure, RF risk management, specific absorption rate (SAR), unrestricted environment.

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## Introduction

This introduction is not part of IEEE Std C95.1-2345™-2014, IEEE Standard for Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz 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, Incorporated (IEEE). 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 IEEE, C95 standards are issued and reviewed as IEEE standards and submitted to ANSI for recognition.

In June 1995, the IEEE Standards Board approved the establishment of Standards Coordinating Committee 34 (SCC34), Product Performance Standards Relative to the Safe Use of Electromagnetic Energy. Standards developed by SCC34 do not specify limits for human exposure to electromagnetic fields, but refer to established limits found in science-based standards such as 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 2005, SCC 28 and SCC 34 became Technical Committee 95 and Technical Committee 34, respectively, under a new IEEE Standards Coordinating Committee, SCC 28, which is now called ICES.<sup>1</sup>

The present scope of IEEE ICES Technical Committee 95 (TC95) 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.”

There are five TC95 subcommittees, each of whose area of responsibility is described as follows in correspondence with its designated subcommittee number:

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

This standard was prepared by Subcommittee 3 and Subcommittee 4 of TC95 under a Specific Agreement between the National Standardization Agency (NSA) and IEEE in accordance with a Technical Cooperation Agreement (TCA) between NSA and IEEE. TC95 has issued four standards, four recommended practices, and one guide. Present versions are as follows:

- 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.
- IEEE Std C95.1-2345™-2014, IEEE Standard for Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz.

<sup>1</sup> Standards Coordinating Committees are established by the IEEE-SA Standards Board and provide a mechanism to oversee the development of standards that are beyond the scopes of individual technical committees within IEEE’s societies.

- IEEE Std C95.2™-1999 (R2005), IEEE Standard for Radio-Frequency Energy and Current-Flow Symbols.
- IEEE Std C95.3™-2002 (R2008), Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz-300 GHz.
- IEEE Std C95.3.1™-2010, IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields with Respect to Human Exposure to Such Fields, 0 Hz to 100 kHz.
- IEEE Std C95.4™-2002 (R2008), 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 (R2007), 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.
- IEEE Std 1460™-1996, (R2008), IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields.

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## 1. Overview

### 1.1 Scope

This standard provides recommendations to protect personnel in military environments against established adverse health effects associated with exposure to electric, magnetic, and electromagnetic fields, induced and contact current, and contact and arcing voltages over the frequency range of 0 Hz to 300 GHz. The recommendations, expressed as dosimetric reference limits (DRLs) and exposure reference levels (ERLs), incorporate safety factors that address uncertainties such as uncertainties in the experimental data, measurement uncertainties, and differences in threshold variability between individuals, so as to establish an appropriate margin of safety. The DRLs are expressed in terms of *in situ* electric field strength, specific absorption rate (SAR), and incident power density. The ERLs are expressed in terms of environmental exposure fields and power densities. In the case of contact current, however, only ERLs are provided. The DRLs and ERLs are intended to protect against established adverse human health effects associated with electrostimulation of tissue and partial and whole-body heating, but may not protect against electromagnetic interference (EMI) with implanted medical devices. This standard does not apply to