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IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz

IEEE Standards Coordinating Committee 39

Sponsored by the
IEEE International Committee on Electromagnetic Safety

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USA

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(Revision of
IEEE Std C95.7-2005)

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Abstract: Elements of a radio frequency (RF) exposure safety program that provide reasonable and adequate guidance for preventing exposures in excess of recognized limits to electromagnetic fields from RF sources that operate in the frequency range of 3 kHz to 300 GHz are described in IEEE Std C95.7™-2014. The means for accomplishing this are classifying exposure locations into one of four categories based on the potential hazard, as defined by exposure limits, and specifying appropriate controls for each category. Such controls include engineering and administrative controls as well as the use of personal protective equipment, placement of appropriate RF safety signage, designation of restricted access areas, the use of personal RF monitors, and RF safety awareness training. These recommendations are not intended to apply to the purposeful exposure of patients by or under the direction of medical practitioners, but can be used in the development of safety programs for medical staff and other persons working with or incidentally exposed to RF fields, and for those wearing implanted or external medical electronic devices. Although designed to complement IEEE Std C95.1™, this recommended practice may also be used for the development of programs to ensure conformance with other guidelines, standards, or regulations for controlling human exposure to electromagnetic energy as well as IEEE Std C95.6™ in which case, appropriate modifications will be necessary to address the low frequency region addressed by IEEE Std C95.6™.

Keywords: access restriction, electromagnetic exposure, electromagnetic fields (EMF), exposure assessment, exposure categorization, IEEE C95.7™, non-ionizing radiation (NIR), personal monitors, personal protective equipment (PPE), radio frequency (RF), radio frequency safety program (RFSP), RF awareness training, RF exposure, RF protection, RF safety committee, RF safety officer, signage

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Introduction

This introduction is not part of IEEE Std C95.7™-2014, IEEE Recommended Practice for Radio Frequency Safety Programs, 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. Prior to 1988, C95 standards were developed by an 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 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 SCC28 to better reflect the scope of the committee and its international membership. In accordance with policies of IEEE, C95 standards are issued and developed as IEEE standards, as well as submitted to ANSI for recognition.

The present scope of IEEE ICES is the:

"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 2 of ICES is responsible for this recommended practice. There are five subcommittees concerned with:

1. Techniques, procedures, and instrumentation
2. Terminology, units of measurement, and hazard communication
3. Safety levels with respect to human exposure, 0 kHz-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, two recommended practices, and one guide have been issued. Current versions are:

IEEE Std 1460™-1996 (Reaff 2002), 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.

IEEE Std C95.2™-1999 (Reaff 2005), IEEE Standard for Radio-Frequency Energy and Current Flow Symbols.

IEEE Std C95.3™-2002 (Reaff 2008), 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 (Reaff 2008), 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 (Reaff 2007), IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0–3 kHz.

This Recommended Practice for Radio Frequency Safety Programs (RFSPs), IEEE Std C95.7™, represents a unique product for ICES. Heretofore, no single document has been available that provided guidance for the development of RFSPs. While RF exposure limits are prescribed in IEEE Std C95.1™-2005, RF measurement techniques in IEEE Std C95.3™-2002, and RF safety signs and labels in IEEE Std C95.2™-2005, none of those documents provide specific insight on how to integrate the subjects of those standards with exposure assessment to arrive at practical measures for controlling exposure of persons subject to RF fields so that applicable RF limits are not exceeded. This recommended practice provides a practical means for accomplishing this by first characterizing areas into one of four exposure categories according to the potential risk for exposure above defined RF exposure limits and then specifying the appropriate controls. A table is provided that specifies which of the several potential elements described in the document should be included in the RFSP based on the assigned category.

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1. Overview

1.1 Scope

This recommended practice presents guidelines and procedures that could form the basis of a radio frequency exposure safety program[1] (RFSP) that provides reasonable and adequate guidance for preventing exposures above applicable radio frequency (RF) limits associated with RF sources that operate in the frequency range of 3 kHz to 300 GHz under many circumstances. This is a general-purpose document intended for application in most RF exposure scenarios with the goal of avoiding potentially hazardous exposures to electromagnetic fields, currents, and/or contact voltages. In some complex cases, however, the required elements of an adequate RFSP may exceed those described in this document. In such cases, additional guidance may be necessary to affect a satisfactory RF safety solution. There are many ways of accomplishing the goal of a satisfactory RF safety program. While this recommended practice outlines certain schemes for providing a safe environment for persons who may be exposed to excessive levels of electromagnetic energy, other schemes may be equally effective.

[1] For the purposes of this document, the term "RF safety" is a shorthand notation used to mean "RF exposure safety." See definitions.