

# IEEE ICES Safety Standards for Electromagnetic Energy

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**What is IEEE ICES?** The International Committee on Electromagnetic Safety (ICES) develops standards for the safe use of electromagnetic energy in the range of 0 Hz to 300 GHz. ICES is sponsored by the Institute of Electrical and Electronics Engineers (IEEE) and operates under its rules and oversight. ICES follows an open consensus process, with a balanced representation from the medical, scientific, engineering, industrial, government, and military communities. Present membership of ICES is 119, including 43 members from outside the US, representing 23 different countries. ICES strives to achieve consensus among all the stakeholders in the safe use of electromagnetic energy, thereby producing practical standards that are readily accepted and applied.

**ICES Background:** Founded in 1884, the IEEE is today the world's largest technical professional society, with 360,000 members, approximately one third of whom are from outside the US, representing 175 countries. In 1960, IEEE and U.S. Navy co-sponsored the development of the first US national RF standard (C95.1-1966). Later, C95.1-1982 was the first standard to base field limits on the frequency-dependant dosimetric quantity, specific absorption rate (SAR). Dosimetry and a threshold SAR of 4 W/kg are now the bases for most of the world's RF safety standards and guidelines, including those of the ICNIRP, NATO, and the US DoD. IEEE Standards are "Living" documents that are continuously refined through the worldwide volunteer efforts of stakeholders in the safe use of electromagnetic energy.

**ICES Organization:** ICES is led by a Parent Committee, chaired by Ronald C. Petersen, and is further organized into 5 Subcommittees: SC1 Techniques, Procedures, and Instrumentation; SC2 Terminology, Units of Measurements, and Hazard Communication; SC3 Safety Levels with Respect to Human Exposure, 0 - 3 kHz; SC4 Safety Levels with Respect to Human Exposure, 3 kHz - 300 GHz; and SC5 Safety Levels with Respect to Electro-Explosive Devices.

**ICES Exposure Standard for Extremely Low Frequency EMF (C95.6):** In 2002 ICES published C95.6-2002 "IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 to 3 kHz." The maximum permissible exposures (MPEs) and basic restrictions recommended by C95.6-2002 were scientifically derived to avoid: (1) aversive or painful stimulation of sensory neurons; (2) muscle excitation that might lead to injuries while performing potentially hazardous activities; (3) excitation of neurons or direct alteration of synaptic activity within the brain; (4) cardiac excitation (heart contraction that might lead to fibrillation); and (5) magneto-hydrodynamic effects.

**ICES Exposure Standard for the Radio Frequency Range (C95.1):** C95.1, the ICES "Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," is undergoing a major revision. In 2002, participants of an Air Force Workshop presented reviews of more than 1300 scientific papers pertaining to the revision of C95.1. The manuscripts from this workshop were peer reviewed and published in the journal Bioelectromagnetics (Supplement 6, S1-S213, 2003). The draft revised standard is currently undergoing balloting by ICES.

## **Other Recently Published Standards from IEEE ICES:**

- C95.1(b)-2004, "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. Amendment 2: Specific Absorption Rate (SAR) Limits for the Pinna"
- C95.4-2002, "IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas when Using Electric Blasting Caps"
- C95.3-2002, "IEEE Recommended Practice for Measurements & Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to such fields, 100 kHz to 300 GHz"
- C95.2-1999, "IEEE Standard for Radio Frequency Energy and Current-Flow Symbols" (undergoing reaffirmation)

**How to Participate in ICES:** All are welcome to participate in the meetings of ICES and to join and vote in the Subcommittees. To apply for voting membership on the ICES parent committee, send a letter and resume to: Dr. Tom McManus, [mcmanustom@eircom.net](mailto:mcmanustom@eircom.net). Visit our website at <http://grouper.ieee.org/groups/scc28/> for more information.