ICES

International Committee on Electromagnetic Safety

ICES (SCC-39) Annual Report: 2017 – 2018

Includes

Technical Committee 34 (Product Safety Relative to the Safe Use of Electromagnetic Energy)

and

Technical Committee 95 (Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields)

Submitted by

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Chairman, SCC-39

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ICES (SCC-39) Annual Report: 2017 – 2018

1. Scope

"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 humans, volatile materials, and explosive devices to such energy. Such standards will be based on established effects and include exposure limits for human exposure to electric, magnetic and electromagnetic fields, including induced currents from such fields, methods for the assessment of human exposure to such fields, standards for products that emit electromagnetic energy by design or as a by-product of their operation, and environmental factors."

The structure of ICES/SCC-39 is shown below in Figure 1.

2. Administrative Committee (AdCom)

2.1 AdCom Membership

The membership of the AdCom is shown below in Table 1. New members include Dr. Jafar Keshvari and Dr. Teruo Onishi.

2.2 AdCom Activities

AdCom members continue to explore paths toward international harmonization of standards for the safe use of electromagnetic energy. The increased international ICES membership, the DoD-funded IEEE Get Program, the increasing number of IEC/IEEE standards development projects, and the agreement with the NATO Standardization Agency (now the NATO Standardization Office, NSO) to provide/maintain a new civil standard that replaces NATO standards adopted under Standards Agreement 2345 are providing greater influence within the international community. Going forward, ICES collaboration with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) will promote that IEEE C95 standards and the ICNIRP guidelines are in harmony.

ICES representatives regularly participate and give presentations on the role of ICES in international standard setting at important international meetings, including meetings sponsored by ITU (International Telecommunication Union), IEC (International Electrotechnical Commission), BioEM (the Bioelectromagnetics Society and the European Bioelectromagnetics Association), GLORE (Global Coordination of Research and Health Policy on RF Electromagnetic Fields), WHO EMF Project workshops, and workshops sponsored by the EU Presidency and the Commission on Worker Safety. ICES Chairman Jafar Keshvari represents ICES at the WHO International Advisory Committee meetings, IEC TC106 meetings and TC95 member Klauenberg represents ICES at and NATO Standardization Office meetings, respectively. New ICES Chairman Keshvari took part in the WHO EMF Program's International Advisory Committee Meeting in June 2018 to report on ICES TC34 and TC95 activities.

2.3 Highlights (2017 – 2018)

- During the past year, the Administrative Committee (AdCom) met in Rosslyn VA, Chandler, AZ, Eureka Springs, AR, and several times by teleconference. In addition to other duties, the ICES AdCom plans and arranges meetings of TC34 and TC95 and their subcommittees, and approves (or rejects) applications for membership on the

ICES technical committees. ICES Ex-Chairman Dr. Ralf Bodemann (Siemens AG, Germany), Chairman Dr. Jafar Keshvari (Intel, Belgium), TC95 Membership Chairman Dr. B Jon Klauenberg (US Air Force Research Laboratory), Ex-TC34 Chairman Dr. Jafar Keshvari (Intel, Finland), TC95 Chairman Dr. C-K Chou (Consultant–retired), and others have become ICES roving ambassadors to the EU member states and other countries. Each has given numerous presentations in support of ICES and the IEEE open consensus process at meetings throughout the world.

- In the past, international recognition of the C95 standards was hindered somewhat by their cost, especially when compared with the competing International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, which are used throughout Europe and other parts of the world and are available at no cost. In accordance with a joint IEEE/DoD agreement, IEEE Standards C-95.1-2005, C95.1a-2010, C95.1-2345-2014, C95.3-2002, C95.3.1-2010, C95.6-2002 (R2008) C95.7-2005 and C95.7-2014 have been made publicly available for the past five years at no cost through the IEEE SA Get Program (funded by the Department of Defense). Mainly through the efforts of Dr. Klauenberg, funding for the next 5 years was obtained through Mr. Greg Saunders, Director of the Defense Standardization Program Office and chairman of a number of NATO working groups. A process for future funding is being explored, e.g., rotation between the services. A decision is expected well before the end of the new agreement period. It is important to note that the no cost access is a critical component of the NATO STANAG 2345 and has enhanced international recognition of C95 standards, ICES, and IEEE in general. Since the program began in 2012 over 16,000 C95 standards have been downloaded. IEEE Std C95.1™-2005 is the standard most often downloaded; the Interest Category of those most often downloading the C95 standards were Academics/Researchers, Research Scientists, Safety/Risk Managers and "Others." During the months of January through October, 2017, 1583 copies of the standards have been downloaded, the majority by users in the following interest categories: Commercial, "Government (Non-Military), "Safety Risk Managers, and Others.

- TC34 submitted a PAR (on the December 2016 NesCom agenda) to establish a working group to develop a new standard, "Recommended Practice for Determining the Power Density of the Electromagnetic Field Associated with Human Exposure to Mobile Devices and Network Equipment Operating Between 6 GHz and 100 GHz." Note that this project also falls within the scope of IEC TC106. The intent is to move the project forward as an IEEE project and later submit it to IEC for consideration as a dual logo project. This is the process that was successfully followed for four SCC39/TC34 dual logo projects (P62704-1, -2, -3, and -4).

- TC34 SC2 WG1 submitted a PAR (P1528.6) in December 2017 to develop IoT technologies EMF compliance assessment guide.
- TC34 SC1 submitted a PAR in March 2018 to develop a dual logo (P62209-1528) SAR measurement standard with IEC TC106.
- TC34 has submitted two PAR's in 2017 to establish EMF compliance assessment for 5G technologies in mmWave range.
- TC34 SC2 WG1 submitted a PAR in Sep 2018 to revise the following standard>

IEC/IEEE P62704-1 (general requirements for FDTD simulations of SAR) – (Approved and published in 2017)

- Over the years there has been pushback by ICNIRP in establishing a collaboration effort with ICES, presumably because ICES is associated with experts (stakeholders) from industry (which ICNIRP considered a commercial vested interest). In May 2016, there was a change of leadership and some members of ICNIRP. The new ICNIRP Chairman and one of the new members of the 14 member committee are also ICES members and ICNIRP is now willing to discuss harmonization of the exposure limits found the ICNIRP Guidelines with those in IEEE Stds C95.1™-2005 and C95.6™-2002. At a June 2016 Mobile Manufacturers Forum Workshop in Ghent, Belgium, the new ICNIRP Chairman, Dr. van Rongen, presented "ICNIRP's proposed HF guidelines" and extended an invitation to ICES to comment on the proposed guidelines. TC95 formed a 19 member task group to draft a document to comment on the ICNIRP proposed guidelines; the document was circulated to the TC95 membership for comment and a final document submitted to ICNIRP in time for discussion at the ICNIRP September meeting. At the August 2017 TC95 SC3/4 meeting, an invited ICNIRP representative reported on progress of the ICNIRP revision and interacted with the TC95 members. ICES will maintain its collaborative relationship with ICNIRP with the goal of setting internationally harmonized safety limits for exposure to electromagnetic fields at frequencies below 300 GHz. A GLORE (Global Coordination of Research and Policy on RF Electromagnetic Fields) meeting will be held at the FCC November 20 – December 1, 2017; presentations from both ICES and ICNIRP will provide a forum for more interaction. (This program, which began June 2016 in Ghent Belgium and is continuing into 2018, is considered a major step forward.) ICNIRP is working on the Radiofrequency guidelines, which is a revision of the ICNIRP 1998 guidelines for frequencies above 100 kHz. ICES TC95 submitted 48 comments on October 4, 2018.

2.4 Policies and Procedures

The ICES Policies and Procedures were accepted by AudCom and the SASB at the June 2017 meetings. The Working Group P&Ps, based on the September 2015 Working Group Baseline, are on the December 2017 AudCom agenda.

2.5 Budget

2.51 TC34

TC 34 has no specific budget or operating expenses.

2.52 TC95

The operating expenses and budget for TC95 are found in 4.2.

2.6 Standards

Table 1 lists the SCC-39 published standards and their status:

Table 1(a)

SCC-39 Standards

Standard	Title
	TC34 Standards

1528a-2005	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques - Amendment 1: CAD File for Human Head Model (SAM Phantom)
1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
62704-1-2017	IEC/IEEE International Standard for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz. Part 1: General Requirements for using the Finite Difference Time Domain (FDTD) Method for SAR Calculations
62704-2-2017	IEC/IEEE International Standard for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz. -- Part 2: Specific Requirements for Finite Difference Time Domain (FDTD) Modelling of Exposure from Vehicle Mounted Antennas
62704-3-2017	IEEE/IEC International Standard for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz Part 3: Specific Requirements for Using the Finite Difference Time Domain (FDTD) Method for SAR Calculations of Mobile Phones.

TC95 Standards

1460-1996	IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields
C95.1-2005	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
C95.1a-2010	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields-Amend 1: Specifies Ceiling Limits for Induced & Contact Current
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
C95.2-1999	IEEE Standard for Radio-Frequency Energy and Current-Flow Symbols
C95.3-2002	IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields
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

C95.4-2002	IEEE Recommended Practice for Determining Safe Distances From Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations
C95.6-2002	IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0—3 kHz
C95.7-2014	IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz

Table 1 (b)

SCC-39/TC34 Standards—Status

Standard	Year	Expiration Date	SASB Approval Date	ANSI Approval Date
IEEE 1528	2013	12/31/2023	06/14/2013	12/06/2013*
IEEE 1528a	2005	12/31/2018	09/22/2005	12/29/2005
IEC/IEEE 62704-1	2017	12/31/2027	09/28/2017	
IEC/IEEE 62704-2	2017	12/31/2027	05/18/2017	
IEC/IEEE 62704-3	2017	12/31/2027	09/28/2017	

Table 1 (c)

SCC-39/TC95 Standards—Status

Standard	Year	Expiration Date	SASB Approval Date	ANSI Approval Date
1460	1996	12/31/2018	12/10/1996	06/05/1997
C95.1	2005	12/31/2018	10/03/2005	11/02/2006
C95.1a	2010	02/02/2020	02/02/2010	
C95.1-2345	2014	12/31/2024	05/16/2014	10/10/2014*
C95.2	1999	12/31/2018	09/16/1999	10/05/2005
C95.3	2002	12/31/2018	12/11/2002	04/18/2003
C95.3.1	2010	03/25/2020	03/25/2010	08/05/2010
C95.4	2002	12/31/2018	11/11/2002	02/05/2003
C95.6	2002	12/31/2018	09/12/2002	05/19/2008
C95.7	2014	12/31/2024	06/12/2014	10/10/2014*

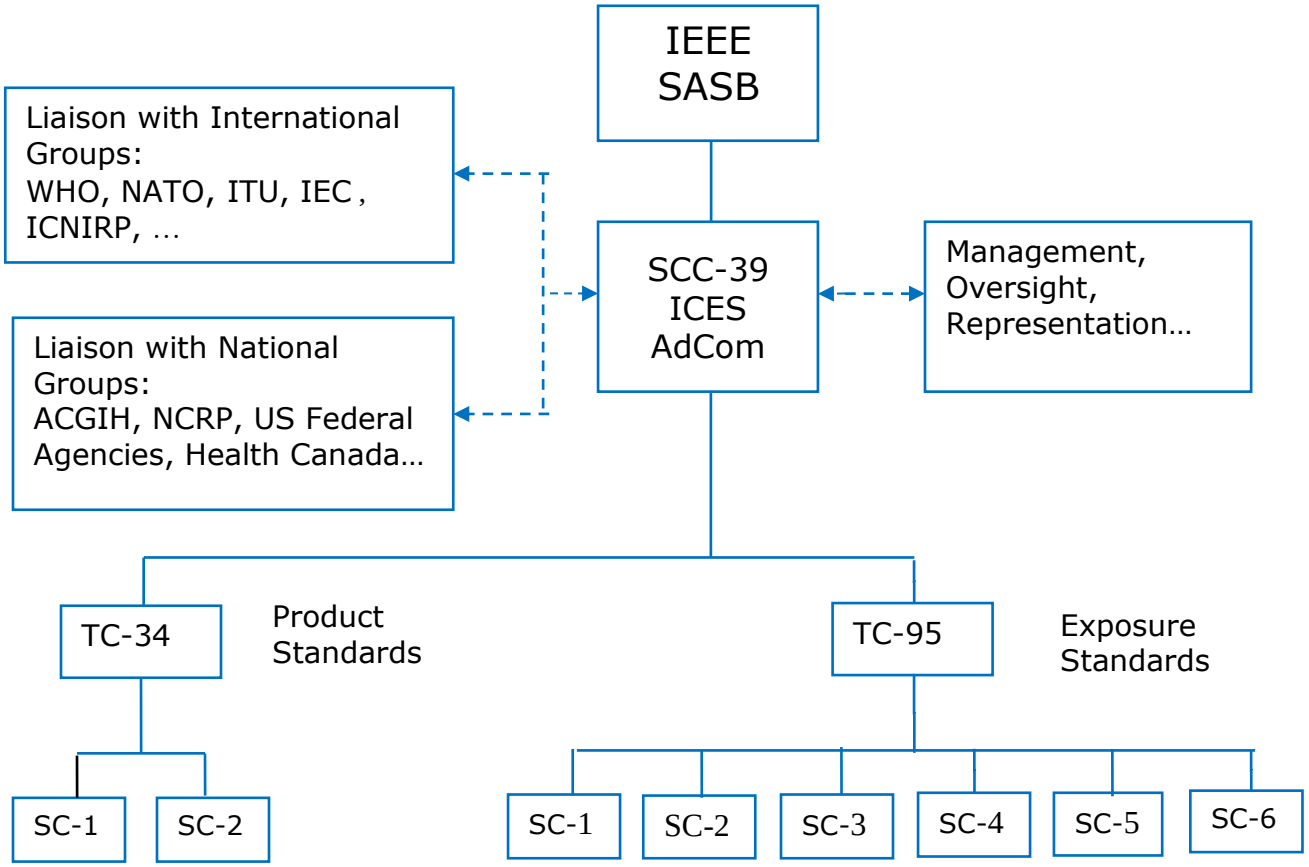
*ANSI BSR8/Public review start date.

2.7 ICES Websites

AdCom members continually provide material for the ICES website (http://www.ices-emfsafety.org/), which includes separate sections for TC34 and TC95 with both public and private pages for the main committees and the subcommittees (ICES owns the domain). The website is maintained by NEMA. File Transfer Protocol (FTP) services for subcommittee activities are included. In addition, TC34 maintains the following websites:

http://grouper.ieee.org/groups/scc34/sc2/ (public),
http://grouper.ieee.org/groups/scc34/sc2/private/moindex.html (private).

The ICES website has been recently updated to present a more contemporary appearance.



TC-34

SC-1: Measurement Techniques
WG-1: SAR-Handheld Devices
SC-2: Computational Techniques
WG-1: General FDTD Requirements
WG-2: Vehicle-Mounted Antenna Configurations
WG-3: Mobile Phones and Personal Wireless Devices
WG-4: General FEM Requirements

TC-95

SC-1: Measurements and Calculations
SC-2: Warning Signs, Hazard Communications
SC-3: Low-frequency Exposure Limits
SC-4: High-frequency Exposure Limits
SC-5: Electro-explosive Devices
SC-6: EMF Modeling and Dosimetry

Figure 1—ICES Structure

Table 2—ICES AdCom

OFFICE	NAME	AFFILIATION	COUNTRY
Chair	Dr. Jafar Keshvari	Intel Corporation	FI
Vice Chair	Kenneth Gettman	NEMA	US
Executive Secretary	Dr. Antonio Faraone	Motorola Solutions	US
Treasurer	Dr. C-K. Chou	C-K. Chou Consulting	US
Chair, TC95 Membership	Dr. B Jon Klauenberg	US Air Force Research Laboratory	US
Chair, TC34 and TC34/SC2	Dr. Teruo Onishi	NTT DoCoMo	JP
Chair, TC34/SC1	Dr. Mark Douglas	IT'IS Foundation	CH
Chair, TC95	Dr. C-K. Chou	C-K Chou Consulting	US
Co-chair, TC95/SC1	Francis Colville	US Army PHC	US
Co-chair, TC95/SC1	Dr. Mark Douglas	IT'IS Foundation	CH
Chair, TC95/SC2	Richard Tell	Richard A Tell Associates, Inc	US
Co-chair, TC95/SC3	Dr. Kevin Graf	Exponent	US
Co-chair, TC95/SC3	Dr. Rob Kavet	Kavet Consulting LLC	US
Co-chair, TC95/SC4	Dr. Art Thansandote	Health Canada (Retired)	CA
Co-chair, TC95/SC4	Dr. Marvin Ziskin	Temple University Medical School	US
Co-chair, TC95/SC5	Raymond Harmon	AECOM	US
Co-chair, TC95/SC5	Tamera Hay	Naval Surface Warfare Ctr.	US
Chair, TC95/SC6	Dr. Akimasa Hirata	Nagoya Institute of Technology	JP
Past Chair , ICES	Dr. John Osepchuk	Full Spectrum Consulting	US
Past Chair, TC34	Dr. Wolfgang Kainz	US FDA/CDRH	US
At Large Members			
	Dr. Sheila Johnston	Independent Consulting Neuroscientist	IE
	Dr. Antonio Faraone	Motorola Solutions, Inc.	US
	Dr. Michael Murphy	USAF Research Laboratory (Retired)	US
	J. Patrick Reilly	Independent Consultant	US
	Arthur Varanelli	Raytheon (Retired)	US
IEEE Staff Liaison			
IEEE Staff Liaison	Soo Kim	IEEE Standards Association	US

3. Technical Committee-34

3.1 Scope

The scope of Technical Committee 34 (TC34) is "The development of compliance assessment standards relative to the safe use of electromagnetic energy for specific products that emit electromagnetic energy at frequencies between 0 and 300 GHz, i.e., the frequency range covered by the basic restrictions and maximum permissible exposure (MPE) values developed by organizations such as the IEEE International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP)." Included in the scope are standards, guides and recommended practices that describe measurement and computational protocols for determining compliance with the basic restrictions and the derived exposure values, e.g., maximum permissible exposure values (MPEs), exposure reference levels (ERLs) found in IEEE Stds C95.1 and C95.6 and in other relevant national and international standards and guidelines.

3.2 Structure of TC34

There are two subcommittees in TC34—SC1 (evaluation of electromagnetic fields and SAR—measurement techniques) and SC2 (evaluation of electromagnetic fields and SAR—numerical techniques) associated with products. SC2 includes the following four working groups:

SC1 includes the following four working groups:

- JWG12 (5G PD measurement techniques);
- JWG13 (SAR measurement techniques);
- 1528.7 (IoT Technologies EMF Compliance Assessment).

SC2 includes the following four working groups:

- WG-1 (General requirements for using the FDTD method for SAR calculations);
- WG-2 (Specific requirements for FDTD Modeling of vehicle mounted antenna configurations);
- WG-3 (Specific requirements for FDTD modeling of mobile phones/personal wireless devices);
- WG-4 (Requirements for using the finite-element method for SAR Calculations, specifically vehicle-mounted antennas and personal wireless devices).
- JWG11 (5G PD computational techniques).

The two subcommittees and their working groups are very active and hold face-to-face meetings and teleconferences several times per year. The face-to-face meetings are usually held in conjunction with IEC TC106 meetings, each of which has a similar scope and with whom TC34 has a Category D Liaison.

3.3 Membership Roster

See Table TC34-2 (NOTE—All members listed are members of TC34, TC34/SC1 and TC34/SC2, i.e., the members of SC1 are also members of SC2 and also members of TC34, and vice versa.)

3.4 Meetings (2017-2018)

3.4.1 Past meetings (2017-2018)

- Plantation, FL, 21-24 February 2017
- London, UK, 22-26 May 2017
- Melbourne, Australia, 16-20 October 2017
- Plantation, FL, 12-16 February 2018
- Paris France, 4-8 June 2018
- Stockholm Sweden, 24-28 September 2018

3.4.2 Future meetings

- Plantation, FL, 12-16 February 2018
- Paris France, 4-8 June 2018
- Stockholm Sweden, 24-28 September 2018
- New Jersey, US, 25-29 March 2019
- Helsinki Finland, 10-14 June 2019
- Tokyo Japan, 11-15 November 2019

3.5 Subcommittee activities

3.5.1 Subcommittee 1 (Electromagnetic field and SAR evaluation – measurement techniques)

- Joint meetings were held (and continue to be held) with IEC TC-106 MT1 to work on maintenance of IEC 62209 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz) and Part 2: Procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)." (IEC 62209-1 and 62209-2 were published in 2005 and 2010, respectively.) The SC1 activities are coordinated with IEC TC106 MT1 with the intent of publishing a single dual-logo international standard to replace IEEE 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques." In response to a formal ballot, the members of TC34 voted unanimously to move forward with the development of a dual logo standard (IEC 62209-1) to replace IEEE Std 1528-2013. A joint IEC TC106/IEEE SCC39/TC34 joint working group JWG13 is being formed.
- **P1528:** The revision of IEEE 1528 (which extends the frequency range of SAR measurement standards up to 6 GHz) was approved at the June 2013 SA Standards Board meeting and published in September 2013. SC1 is collaborating with IEC MT-1 toward the development of standards for devices held within 20 cm of the body

(including body-worn, hand-held and desktop devices), and addressing harmonization with IEC P62209-2 with the goal of developing a jointly developed international dual-logo standard. When published, this standard will replace IEEE Std 1528™-2013.

- A joint IEC TC106 and IEEE-ICES/TC34 Joint Working Group, JWG12, which deals with the measurement Methods to assess the power density in close proximity to the head and body has been formed to develop a dual logo IEC/IEEE standard for the assessment of power density of wireless communication devices in close proximity to the head and body by measurement from 6 GHz – 300 GHz

- P1528.7: This project is dedicated for IoT technologies EMF experimental assessment.

3.5.2 Subcommittee 2 (SAR evaluation – numerical techniques)

Following approval of four IEEE projects as IEC/IEEE jointly developed standards projects, PARs P1528.1, P1528.2, P1528.3 and P1528.4 were withdrawn and new PARs with the assigned IEC project numbers were submitted and approved.

3.5.2.1 IEC P62704-1 (formerly P1528.1):

- Approved and published 2017. Reference and model files will be available for download on the IEC server.

3.5.2.2 IEC P62704-2 (formerly P1528.2):

- Approved and published 2017

3.5.2.3 P62704-3 (formerly P1528.3):

- Approved and published 2017

3.5.2.4 P62704-4 (formerly P1528.4):

- This project had been progressing more slowly than the other three in the series. A new Chair, Dr. Andreas Christ, has been nominated, which stimulated interest in this activity from a number of software developers. The CDV is in preparation.

3.5.2.5 JWG11:

- A joint IEC TC106/IEEE SCC39/TC34 working group which is computational methods to assess the power density in close proximity to the head and body has been formed to develop a dual logo IEC/IEEE standard for a procedure to determine the assessment of power density from wireless communication devices in close proximity to the head and body from 6 GHz - 300 GHz by computational methods.

3.6.1 SC1 PARs

PAR for combining IEC62209-1, 62209-2 and IEEE 1528 into an IEC/IEEE dual logo standard now in preparation.

3.6.2 SC2 PARs

3.6.2.1 P62704-4 (Approved December 2011)

Title: Standard for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz: General Requirements for Using the Finite Element Method (FEM) for SAR

Calculations and Specific Requirements for Modeling Vehicle-Mounted Antennas and Personal Wireless Devices.
Status: New Standard Project. (A two-year PAR extension request was approved at the December 2015 meeting.)

Scope: This standard describes the concepts, techniques, models, validation procedures, uncertainties and limitations of the Finite-Element Method when used for determining the spatial-peak specific absorption rate (SAR) in standardized anatomical models exposed to wireless communication devices, including vehicle-mounted antennas and personal wireless devices, such as hand-held mobile phones. Guidance on modeling such devices and benchmark data for simulation is provided; model contents, meshing and test positions of the anatomical models are defined. This document does not recommend specific SAR values since these are found in other documents, e.g., IEEE C95.1™-2005 (IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.)

Purpose: This document will not contain a purpose clause.

3.6.2.2 P1528.5[1]

Title: Recommended Practice for Determining the Power Density of the Electromagnetic Field Associated with Human Exposure to Mobile Devices and Network Equipment Operating Between 6 GHz and 100 GHz.

Status: (Approved December 2016.) This project became an IEC/IEEE jointly developed standard project by JWG12.

Scope: Recommendations are made that specify measurement procedures for the free space power density relevant to human exposure compliance assessment for mobile devices or network equipment operating between 6 and 100 GHz. The recommendations provide a conservative estimate of the free space power density of the exposure of the head or body of a significant majority of persons during normal use of these devices.

Purpose: This document will not include a purpose clause.

3.6.2.6 P1528.6

Title: Recommended Practice for Computational Techniques to Determine the Power Density of the Electromagnetic Field Associated with Human Exposure to Wireless Devices and Network Equipment, 6 GHz to 100 GHz.

Status: (Approved June 2017.) This project became an IEC/IEEE jointly developed standard project by JWG11.

Scope: Specifies computational procedures using Finite-Difference Time-Domain (FDTD) and Finite Element Methods (FEM) to assess the peak and spatial-averaged power density relevant to the exposure of the human head or body for devices operating between 6 GHz and 100 GHz. It applies to devices with radiating structures at distances up to and including 200 mm. This includes but is not limited to mobile phones, tablets, and wearables. The recommendations provide a conservative estimate of the power

[1] With the rapid development of new wireless technologies in the frequency range or 6 GHz to 100 GHz (e.g., 5G) there is a need to ensure that compliance assessment procedures are developed for human exposure to the fields from devices used in close proximity to the head and body, and for base stations and network equipment. Current compliance assessment standards only cover frequencies up to 6GHz. This project will fill this need.

density of the exposure of the head or body for a significant majority of persons during normal use of these devices.

Purpose: This document will not include a purpose clause.

3.7 Drafts

3.7.1 SC1 (None)

IEC/IEEE JWG13: IEC/IEEE 62209-1528 CDV is in NC vote/comments and at the same time at IEEE balloting process ending by the end of November 2018.

3.7.2 SC2 (Computational Techniques)

IEC/IEEE P62704-4 was approved as dual-logo standards project—draft approved for CDV.

3.8 Objectives and goals for the past year and the TC's performance relative to meeting these goals and objectives.

3.8.1 SC1 (Measurement techniques)

3.8.1.1 Objectives (2017)

- Continue to work with IEC TC106 to ensure harmonization of IEEE 1528-2013 and IEC P62209-1 and -2
- Continue following up on harmonization process with product standards development at IEC TC106; seek jointly-developed dual-logo standards status with IEC.

To support 5G compliance assessment standards developments.3.8.1.2 Objectives (2018)

- Continue to work with IEC TC106 to ensure harmonization of IEEE 1528-2013 and IEC P62209-1 and -2
- Continue following up on harmonization process with product standards development at IEC TC106; seek jointly-developed dual-logo standards status with IEC.
- To support 5G and IoT compliance assessment standards developments.
- To monitor if there is any need for new PAR for emerging technologies, for example autonomous driving.

3.8.2 SC2 (Numerical techniques)

3.8.2.1 Current levels of activity and milestones (2017)

- P62704-1 – prepare CDV for IEC and IEEE ballot: (Met)
- P62704-2 – prepare CDV for IEC and IEEE ballot: (Met)
- P62704-3 – prepare CDV for IEC and IEEE ballot: (Met)
- P62704-4 – prepare 1 CD for circulation: (Not met)

3.8.2.2 Objectives (2018)

- P62704-4 – prepare FDIS for IEC and IEEE ballot

- P62704-4 – prepare 1CD for circulation

3.9 Website

A website and reflector was set up several years ago for SC2 (now SC1 and SC2) and operates successfully. Meeting minutes, action items, motions, and drafts are posted on the web – SC balloting is carried out electronically. Public areas contain links to other sites important for subcommittee activities, e.g., the USAF Dosimetry Handbook, Tables of Dielectric Properties of Tissues (Gabriel), schedules for meetings. A private area contains draft sections of the practice, the results of measurements on canonical models, etc.

The website URL is: http://grouper.ieee.org/groups/scc34/sc2/

A reflector was also set up (stds-ices-tc34@ieee.org) and reactivation of the TC34 website is being planned.

3.10 IEEE Staff support requirements

Originally, secretarial services for SC2 originally provided by the Cellular Telecommunications and Internet Association (CTIA) are now provided by volunteer committee members. Soo Kim, who replaced Tricia Gerdon, is the IEEE Staff Engineer for both TC34 and TC95—both of their engineering backgrounds and broad knowledge of IEEE procedures is invaluable to this committee.

3.11 Liaison with other committees

Liaison with other committees occurs via the circulation of drafts, common meetings and common membership on committees such as the European Committee for Electrotechnical Standardization (CENELEC), IEC, ITU (TC34. TC34 Chairman Keshvari was nominated as liaison between ITU-T SG5 and IEEE/ICES), the Association of Radio Industries and Businesses (ARIB) and other standards developing organizations, and through a "Category D" liaison with IEC TC106/MT-1. Coordination has also been established with IEEE societies, e.g., EMC-S via representation on the Standards and Advisory Coordination Committee (SACCom).

3.12 Issues: Joint IEC/IEEE development project: IEC 62209 and IEEE 1528

Because of the close cooperation and overlap of membership and the desire for a single international standard, TC34 continues to move forward to obtain IEC approval of IEEE 1528-2013 and IEC P62209-1 as a jointly developed IEC/IEEE standards project.

Rationale: IEC TC106/MT-1 (maintenance of IEC 62209) and IEEE TC34/SC1 have worked hand in hand to develop IEC 62209-1-2005 "Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices – Human Models, Instrumentation, and Procedures - Part 1: Procedure to Determine the Specific Absorption Rate (SAR) for Hand-held Devices used in Close Proximity to the Ear (Frequency Range of 300 MHz to 3 GHz)," IEC 62209-2-2010 "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz" and IEEE 1528-2013 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques." During the development of these

standards a number of TC34 members also participated on the IEC PTs, sharing drafts to ensure harmonization. Thus the three existing standards were developed jointly by many of the same people but issued separately as three distinct IEC standards. During the past three years, TC34/SC1and MT-1 have held a number of face-to-face meetings and a number of joint teleconferences. While these exchanges are dedicated to P62209 business or TC34 business (to limit the time), the discussion topics are common to both WGs and members of both WGs participate.

These are important standards for the wireless communications industry where harmonization is critical. Having a single dual logo standard is important for a variety of reasons and both 62209 Project Team Leader and the leadership of TC34/SC1 believe that IEC 62209 and IEEE 1528 are ideal candidates for such a project.

3.13 Membership

See Table TC34-2 for detailed membership information.

Table TC34-1
TC34 Officers

OFFICE	NAME	AFFILIATION	COUNTRY
Chair	Dr. Teruo Onishi	NTT DoCoMo	JP
Vice-chair	Dr. Mark Douglas	IT'IS Foundation	CH
Chair SC1 (SAR evaluation—measurement techniques)	Dr. Mark Douglas	IT'IS Foundation	CH
Chair SC2 (SAR evaluation—numerical techniques)	Dr. Jafar Keshvari	Aalto University-School of Science	FI
Chair P1528.6 (IEC/IEEE JWG12)	Mr. Kai Niskala Dr. Teruo Onishi	Samsung NTT DOCOMO INC.	FI JP
Chair P62209-1528 (IEC/IEEE JWG13)	Dr. Sami Gabriel Dr. Jafar Keshvari	Vodafone Aalto University-School of Science	GB FI
Chair P1528.7	Dr. Andrea Schivoni Dr. Sami Gabriel	Telecom Italia Vodafone	IT GB
Chair WG-1 (IEC/IEEE P62704-1)	Dr. Andreas Christ	IT'IS Foundation	CH
Chair WG-2 (IEC/IEEE P62704-2)	Dr. Giorgi Bit-Babik	Motorola Solutions, Inc.	US
Chair WG-3 (IEC/IEEE P62704-3)	Vikass Monebhurrun	Supelec	FR
Chair WG-4 (IEC/IEEE P62704-4)	Dr. Andreas Christ	IT'IS Foundation	CH
Chair P1528.5 (IEC/IEEE JWG11)	Dr. Andreas Christ Dr. John Roman	IT'IS Intel	CH US

Table TC34-2

TC34 Membership (November 2017)

[Some updates from this table is missing]

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	
1.	Ablehamid	Hadjem	Orange – FT Group	U	FR	
2.	Almeida	Antonio	CPQD	S	BR	
3.	Alon	Leeor	NYU Med Center	A	US	
4.	Attayi	Daoud	RIM	P	CA	
5.	Balzano	Quirino	University of Maryland	A	US	
6.	Beard	Brian	US Food and Drug Administration	G	US	
7.	Bit-Babik	Giorgi	Motorola Solutions, Inc.	P	US	
8.	Bodemann	Ralf	Siemens	PI	DE	
9.	Case	David	Cisco	P	US	
10.	Chan	Kwok	US Federal Communications Commission	G	US	
11.	Chang	Isaac	US Food and Drug Administration	G	US	
12.	Chao	Justin	PC TEST	U	US	
13.	Chen	Ji	University of Houston	A	US	
14.	Choi	Dong-guen	KCC	G	KR	
15.	Choi	Hyung-Do	ETRI	P	KR	
16.	Chou	C-K.	C-K Chou Consulting	GI	US	
17.	Christ	Andreas	IT IS Foundation	A	CH	
18.	Davis	Chris	University of Maryland	A	US	
19.	Derat	Benoit	Field Imaging	P	FR	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	
20.	Dianyuan	Qi	CATR-MIIT	G	CN	
21.	Douglas	Mark	IT IS Foundation	A	CH	
22.	Faraone	Antonio	Motorola Solutions, Inc.	P	US	
23.	Forrester	John	Qualcomm	P	US	
24.	Foster	Ken	University of Pennsylvania	A	US	
25.	Francavilla	Mauro	Telecom Italia	P	IT	
26.	Gabriel	Sami	Vodafone	P	UK	
27.	Gouqing	Li	CATR	G	CN	
28.	Hamada	Lira	NICT	G	JP	
29.	Harrington	Tim	US Federal Communications Commission	G	US	
30.	Hauswirth	Steve	Motorola Mobility, Inc.	P	US	
31.	Heirman	Don	Consultant	P	US	
32.	Jeong	Chan-Ho	LG	U	KR	
33.	Joyner	Ken	Samsung	P	AU	
34.	Jun	Haeyoung	Samsung	P	KR	
35.	Kainz	Wolfgang	US Food and Drug Administration	G	US	
36.	Katsumi	Abe	Fujitsu	P	JP	
37.	Keshvari	Jafar	Aalto University-School of Science	P	FI	
38.	Kopp	Markus	ANSYS	G	US	
39.	Kozlov	Mikhail	MPG	P	DE	
40.	Kuster	Niels	IT IS Foundation	A	CH	

41.	Lee	Ae-kyoung	ETRI	U	KR	
	LAST NAME	**FIRST NAME**	**AFFILIATION**	**INTEREST CATEGORY**	**COUNTRY**	
42.	Liu	Steve	PC TEST	U	US	
43.	Loader	Benjamin	National Physical Laboratories	G	UK	
44.	Lu	Lin	Qualcomm	P	US	
45.	Luc	Jerome	Satimo	P	FR	
46.	Magana	Luis	PC TEST	U	US	
47.	Manteuffel	Dirk	Uni-Kiel	A	DE	
48.	McIntosh	Robert	Telstra	U	AU	
49.	Meier	Matthias	Consultant	P	DE	
50.	Moller	Paul	Motorola	P	US	
51.	Monebhurrun	Vikass	Supelec	A	FR	
52.	Nappert	Hughes	Industry Canada	G	CA	
53.	Nesterova	Maryna	APREL	GI	CA	
54.	Nicol	Stuart	APREL	U	CA	
55.	Niskala	Kai	Nokia	P	FI	
56.	Onishi	Teruo	NTT DoCoMo	P	JP	
57.	Park	DS	Samsung	P	KR	
58.	Parmentier	Jack	Lenovo	P	US	
59.	Penney	Chris	Remcom	P	US	
60.	Picard	Stéphane	Industry Canada	G	CA	
61.						

62.	Plicanic	Ramadan	Sony Ericsson Mobile Communications	U	SE	
63.	Poirier	Marcel	Industry Canada	G	CA	
	LAST NAME	**FIRST NAME**	**AFFILIATION**	**INTEREST CATEGORY**	**COUNTRY**	
64.	Pokovic	Katja	SPEAG	P	CH	
65.	Prokop	Alexander	CST	PM	DE	
66.	Proulx	Stephane	Industry Canada	G	CA	
67.	Roman	John	Intel	P	US	
68.	Schiavoni	Andrea	Telecom Italia	U	IT	
69.	Sen	Indranil	Apple	P	KR	
70.	Shah	Yogi	Medtronic	P	US	
71.	Simon	Winfried	IMST	P	DE	
72.	Thors	Björn	Ericsson	P	SE	
73.	Tanabe	Shinji	Mitsubishi	P	JP	
74.	Tornevik	Christer	Ericsson	P	SE	
75.	Trinchero	Daniele	Polito	A	IT	
76.	Vannatta	Louis	Motorola	P	US	
77.	Wang	Ying	Sierra Wireless	GI	CA	
78.	Watanabe	Soichi	NICT	G	JP	
79.	Wiart	Joe	Telecom Paristech	U	FR	
80.	Wittig	Tilmann	CST	P	DE	
81.	Ye	Qiubo	Communications Research Center	G	CA	
82.	Zilberti	Luca	RicMet	G	IT	

83.	El Hajj	Walid	Intel	P	FR	
84.	Chan	JC	Apple	P	US	
85.	Mezei	G	Exponent	P		
86.	Desantis	V				
87.	Muller	William	Boeing	P		
88.						
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103.						

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P = Producer
N = IEEE/IEEE SA membership unknown
U = User

4. Technical Committee 95

4.1 Scope

The scope of ICES TC95 is:

"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 TC95." (The scope remains the same as the scope of SCC-28 before reorganization in March 2005.)

4.2 Budget

TC95 manages its funds through the IEEE Concentration Banking System and NetSuite. Funding, which is obtained through meeting registration fees, is used to cover meeting and other expenses, e.g., website maintenance. Opening balance 1 January 2018: $19,569.73; current balance (as of 29 November 2018): $18,241.83. Major expenses for the year include: $1900 (website maintenance), $647.72 (maintenance of IEEE literature database website), $3673.51 (January 2018 meeting – luncheons, refreshments, etc.), $3375.64 (August 2018 meeting – luncheons, refreshments, badges, etc.), and $330 ($30/month ICES PayPal account). Income: $4654.05 (registration fees January 2018 meeting minus PayPal fee), $3776.31 (registration fees August 2018 meeting, minus PayPal process fee), $153.13 (interest).

4.3 TC95 Membership Roster

(See Tables TC95-2 through Table TC95-7.)

With the leadership of Dr. B Jon Klauenberg, TC95 Membership Chairman, the non-US membership of ICES continues to grow (now greater than 44% of the members are from outside the US). In terms of stakeholders, the membership continues to be well balanced. About 40% of the members of TC95 and its subcommittees are IEEE members, which is to be expected and defended in view of the interdisciplinary nature of our membership. TC95 is grateful for their voluntary contributions of talent and time under conditions where it would be an unreasonable imposition to require IEEE membership. (There may be more IEEE and IEEE SA members than indicated on Tables TC95-2 thru TC95-7.) TC95 recognizes the financial burden for travel and loss of income generating business opportunity already born by many volunteers during TC95 activities. However, IEEE SA membership is required of all TC95 leadership (e.g., Committee and Subcommittee Chairs, Co-Chairs) and is encouraged for all members.

4.4 Meetings (2017-2018)

4.4.1 Main Committee

4.4.1.1 Past Meetings

- January 12, 2017 – Plantation, FL
- August 16 2017 – Arlington, VA
- January 24, 2018 – Chandler, AZ
- August 15, 2018 – Eureka Springs, AR

4.4.1.2 Future Meetings

- January 25, 2019 – Plantation, FL

- August 2019 – Sonoma, CA

4.4.2 Subcommittee 1 (Measurements and Computation)

4.4.2.1 Past Meetings

- January 10, 2017 –Plantation, FL
- August 14, 2017 – Arlington. VA
- January 22, 2018 – Chandler, AZ
- August 13, 2018 – Eureka Springs, AR
-

4.4.2.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.4.3 Subcommittee 2 (Warning Signs, Symbols and Hazard Communication)

4.4.3.1 Past Meetings

- January 10, 2017 –Plantation, FL
- August 14, 2017 – Arlington. VA
- January 22, 2018 – Chandler, AZ
- August 13, 2018 – Eureka Springs, AR

4.4.3.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.4.4 Subcommittee 3 (Safety Levels – 0-3 kHz)

4.4.4.1 Past Meetings

- January 11, 2017 –Plantation, FL
- August 15, 2017 – Arlington. VA
- January 23, 2018 – Chandler, AZ
- August 14, 2018 – Eureka Springs, AR

4.4.4.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.4.5 Subcommittee 4 (Safety Levels – 3 kHz to 300 GHz)

4.4.5.1 Past Meetings

- January 11, 2017 –Plantation, FL
- August 14, 2017 – Arlington. VA
- January 23, 2018 – Chandler, AZ
- August 14, 2018 – Eureka Springs, AR
-

4.4.5.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.4.6 Subcommittee 5 (Safe Distances from Antennas during Blasting Operations)

SC5 is responsible for IEEE Std C95.4, "IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations." This standard is stable and the sub-

committee has not found it necessary to meet regularly face-to-face. The January 2016 meeting was the first time the subcommittee met since the June 2008 San Diego meeting. However, a PAR for the revision of the standard was approved September 2016 and the subcommittee expects to meet regularly going forward.

4.4.6.1 Past Meetings

- January 23, 2018 – Chandler, AZ

4.4.6.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.4.7 Subcommittee 6 (EMF Modeling and Dosimetry)

4.4.7.1 Past Meetings

- January 23, 2018 – Chandler, AZ

4.4.7.2 Future Meetings

- January 25, 2019 – Plantation, FL
- August 2019 – Sonoma, CA

4.5 Main Committee and Subcommittee Status

4.5.1 Main Committee

A major effort during the past several years has been to increase the membership of ICES, particularly non-U.S. members. TC95 now has members from Australia (4), Austria (1), Belgium (1), Bulgaria (1), Canada (7), China (1), Croatia (2), Czechoslovakia (1), Finland (1), France (4), Germany (1), Greece (4), Hungary (1), India (1), Ireland (3), Israel (3), Italy (3), Japan (6), Korea (4), Malaysia (3), the Netherlands (2), New Zealand (1), Poland (1), Slovenia (1), Switzerland (4), Thailand (1), Turkey (1), the United Kingdom (4) and the United States (83)—more than 44% of the main committee membership is from outside the US. The TC95 mailing list now approaches 350, including subcommittee members and observers.

All meeting minutes are posted on the ICES website (http://www.ices-emfsafety.org/), which contains both open and private pages for TC95 and its subcommittees and links to TC34 and its subcommittees. All agendas, approved meeting minutes, white papers, RF research databases, draft standard documents, and many special reports are publicly available; certain proprietary or working documents are available only to members of the subcommittees on private sections of the site. The TC95/SC3/SC4 literature database, containing more than 6900 titles, is supported by ICES and appears on the ICES website at http://www.ieee-emf.com/. All publicly available papers (titles and abstracts only) are accessible to all; the complete papers are offered only to members of the TC95/SC3/SC4 literature evaluation working groups.

4.5.2 Subcommittee 1 (Measurement and Computation)

Subcommittee 1 (Techniques, Procedures and Instrumentation) has the responsibility for IEEE Std C95.3™-2002 "IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz" and 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"

and IEEE Std 1460™-1996 (R2002), "IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields."[2]

Work is continuing on the revision and merging of IEEE Stds C95.3 and C95.3.1 into a single standard covering the frequency range of 0 Hz to 300 GHz. A PAR extension request for the revision of C95.3-2002 was approved at the September 2016 NesCom meeting. The project is now active until 31 December 2018. An initial draft that combines existing IEEE Stds C95.3™-2002 (R2007) and C95.3.1™-2010 has been prepared and an SC1 balloting draft is now being prepared and approximately 50% complete—Sponsor balloting is expected to begin in early 2018. (Note that before Sponsor ballot, TC95 subcommittees go through a rigorous ballot process with essentially the same requirements as Sponsor ballot, e.g., ballot groups are formed, 75% response rate and 75% approval rate after ballot resolution is required before a draft standard is moved to IEEE Sponsor Ballot. This process speeds up Sponsor ballot in that many of the issues that would be identified during the Sponsor ballot more than likely would have already been addressed during the TC95 balloting process.)

4.5.3 Subcommittee 2 (RF Warning Symbols, Safety Programs and Hazard Communication)

Subcommittee 2 has responsibility for the following standards: IEEE C95.2, "IEEE Standard for Radio-Frequency Energy and Current-Flow Symbols" and IEEE C95.7, "IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz." A PAR for the revision of C95.2-2002 was approved at the December 2016 Standards Board Meeting; a revision of C95.2 was developed, processed through the TC95 ballot process and submitted for IEEE Sponsor Ballot in October, 2017. A number of comments received during the balloting process resulted in two recirculations during the Sponsor Balloting and was ultimately approved by the IEEE-SA Standards Board on 27 September 2018. The revised document is designated IEEE Std C95.2™-2018 (Revision of IEEE Std C95.2-1999).

Past discussions on developing a guide that could outline the minimal RF awareness deemed sufficient of permitting individuals to enter restricted RF environments did not reached a conclusion. Development of an "RF Safety Information Sheet" also stalled due to differences of opinion on appropriate language to include in the document for making persons sufficiently aware of potential RF exposure. These discussions will continue during 2019.

In view of the revision of C95.1 occurring during 2018, the subcommittee is considering relevant revisions to IEEE Std C95.7-2014 to make it consistent with the underlying philosophy espoused in C95.1 relative to exposure to RF fields exceeding the lower tier exposure limits of the standard. The primary issue driving this potential revision is the apparently lack of any biological hazard associated with exposure to RF fields below the upper tier exposure limits. Work on this issue will be a main focus of the subcommittee during 2019.

Previous discussions and planning for a workshop that would be sponsored by Subcommittee 2 and would address practical guidance on implementing an RF safety program at locations where there exists potential exposure to RF fields that exceed the

[2] IEEE 1460 has been incorporated into C95.3.1 and will not be revised or reaffirmed.

recommendations contained in IEEE Std C95.1 were put on hold after it was deemed that it would take longer than originally anticipated to organize and present the workshop. This idea may be resurrected at some point in the future.

4.5.4 Subcommittee 3 (Safety Levels – 0 to 3 kHz)

There are no active PARs for new or existing projects. However, SC3 has worked jointly with SC4 for the past four years on the revision of C95.1-2005 (PC95.1), which will incorporate C95.6-2002, thereby extending the frequency range of C95.1 from 0 Hz to 300 GHz. Portions of C95.6 were incorporated into C95.1-2345™-2014, a civil standard considered as a replacement of STANAG 2345, the current NATO RF safety standard. In addition, members of SC3 are making progress in encouraging further research on improvement of induction models and synaptic effects thresholds, including magnetophosphenes in human volunteers, detailed anatomical modeling, and on issues related to compatibility of medical implants. In order to address issues and inconsistencies in the models and dosimetry used to determine the induced fields in the body (and exposure limits), subcommittee 6 (SC6) was established in 2014 (see 4.5.7). Many members of SC3 are also members of SC6.

4.5.5 Subcommittee 4 (Safety Levels – 3 kHz-300 GHz)

Until 2015, Subcommittee 4 had responsibility for the C95.1 standard "IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 3 kHz – 300 GHz." This standard was first published as a USASI standard in 1966 and revisions were published as ANSI standards in 1974 and 1982. In 1991 a revision was published as an IEEE standard. It was reaffirmed in 1997, a corrigendum published in 1998, a combined edition published in 1999, and an amendment in 2004. The latest revision, C95.1™-2005 was approved October 3, 2005 and published April 19, 2006. The revision is the result of a major effort by SC4 to fully review and evaluate the relevant scientific literature. An amendment (C95.1a) that specifies ceiling values for induced and contact current, distinguishes between peak power density and localized exposure, and corrects other technical issues was published in March 2010.

The major effort by SC4 (and SC3) for the past four years was revising and combining C95.6™-2002, the low frequency (0 Hz – 3 kHz) safety standard, with C95.1™-2005, the RF safety standard (3 kHz to 300 GHz) into a single standard (C95.1-201X – 0 Hz – 300 GHz). Note that the first combined C95 standard covering frequencies from 0 Hz to 300 GHz is IEEE C95.1™-2345, "IEEE Standard for Military Workplaces – Force Health Protection Regarding Personnel Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz," which was approved by the Standards Board on April 18, 2014, and published May 30, 2014. Having been promulgated by NATO on November 26, 2015, this standard will be used in NATO and military installations replacing NATO STANAG 2345 (Edition 3)

Two major hurdles that were overcome: developing limits for contact currents; addressing differences in the approaches for defining adverse effect thresholds, i.e., effects associated with electrostimulation (low frequencies) and effects associated with tissue heating (high frequencies). Specifically, the question of whether the adverse effects level at high frequencies (a threshold model) should be determined using a probabilistic model (as for low frequencies). After much discussion, it was decided to keep the two different approaches.

The development and revision of the C95.1 standard is carried out by an editorial working group that meets about three times per year face-to-face and more frequently by teleconference. The working group, with members from both SC3 and SC4, prepares the drafts and addresses comments received by the subcommittees following circulation of each draft.

The exposure values and basic restrictions continue to be based on a critical review of the relevant scientific literature. RF literature surveillance is ongoing. Literature review has started with the selection of topic WG Chairs and members. The research selection of topics and proposed authors to initiate the creation of white papers summarizing the findings pertaining to health concerns is ongoing. Guidelines have been prepared on the procedure for developing a transparent systematic review of the literature in order to minimize "cherry picking" of the literature that could lead to biased conclusions. These guidelines will be used in the literature review and preparation of the white papers.

SC4 continues to pursue the investigation of relationships between localized tissue temperature increase and peak spatial-average SAR (100 kHz to 3 GHz) and power density (3 GHz to 300 GHz) as a basis for a decision on the need to revise the limits for localized exposure at frequencies from 100 kHz to 300 GHz. Although numerous studies that report effects at levels below those where thermal mechanisms would prevail, all reliable evidence indicates that established adverse effects are thermal in nature and, therefore, changes in temperature under localized exposure conditions is important with respect to devices that produce such exposures, e.g., mobile telephones. The results are being used to provide a scientifically sound basis for the current SAR limits for localized exposure or the basis for a change.

SC4 responded to a request from the Federal Communications Commission (FCC) for comment on their intended changes in electromagnetic exposure limits. SC4 also responded to a request from the World Health Organization (WHO) to review their proposed document on "Radio Frequency Fields: Environmental Health Criteria." A 38 page document of detailed comments was provided to the WHO.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) presented its revised RF Guidelines at the BioEm2016 meeting in Ghent, Belgium. SC4 prepared a multipage commentary on the proposal and submitted it to ICNIRP on September 15, 2016. An ICNIRP response to SC4's comments was planned to be ready by the end of the year, but additional time was necessary for considering the detailed comments. **The** ICNIRP Project Group (PG) on "HF guidelines (up to 300 GHz), which includes at least one member of ICES, including the PG Chairman, is now willing to work with ICES to develop science based safety standards. This will enhance the possibility of harmonized international RF safety standards.

As indicated above, SC4 has been able to procure funding to extend the no cost availability (through the Get Program) of C95 standards for an additional five years. This important accomplishment will greatly enhance our ability to spread the utilization of the IEEE safety standards throughout the world.

An ad hoc committee has been established to address bio-effects at THz frequencies. This is the continuation of a joint effort between members of SC4 and ANSI ASC Z136 (laser safety) that began informally in 2000. While there was little data in 2000, there is a growing body of data that can be used to provide additional science-based support for

reaffirming or revising the maximum permissible exposure values at 300 GHz (the upper frequency of IEEE C95.1 and the lower frequency of ANSI Z136.1). There is close coordination between ICES and ANSI ASC Z136 (ICES Secretary, Ron Petersen, chaired the Z136 committee from 2000 until 2009 and was a member of the Z136.1 AdCom).

4.5.5.1 Issues

4.5.5.1.1: Justification of the lower tier of exposure limits

Over the past few years there has been considerable discussion within SC3 and SC4 regarding the rationale and need for the lower tier of exposure limits for the general public. In order to stimulate discussion on the inherent conservatism built into the C95.1 standard, SC4 members John Bergeron and Ric Tell drafted a paper "IEEE Standard C95.1 on Radiofrequency Electromagnetic Safety: Considerations of Conservatism." The paper was circulated to the subcommittees for review and comment and posted on the ICES website. The authors believe that justification of a lower tier of exposure limits demands clarification in order to distinguish their basis from that used to justify the upper tier. Specifically, it is argued that the language of the standard must recognize the non-scientific basis for the lower tier limits, and whether a lower tier is necessary in future standards. The paper stimulated discussion at the 2014 ICES Pismo Beach, CA, meeting, which continued online and at the June 2015 meeting. Discussions on the desirability of the lower tier continue.

4.5.5.5.1.2: Literature review

In March 2016 the TC95 Literature Review task Group developed "Guidelines for the Systematic Review of Scientific Literature on Health and Electromagnetic Fields (0-300 GHz)," for use by the Literature Review WG during the revision of IEEE C95.1™-2005 Annex B (Identification of levels of RF exposure responsible for adverse effects: summary of the literature). The original intent was to wait for publication of the WHO literature review (WHO Environmental Health Criteria Monograph EHC), refer to the EHC document in Annex B, review any relevant papers not included in the EHC review and papers published after the original EHC cutoff-date but before the revision of C95.1-2005 is complete. The publication date of the EHC Monograph has now been moved back to 2018, which means that the gap in the relevant literature published after publication of the EHC document but before the revision of C95.1-2005 is complete (2019) will no longer exist. Options were explored to address this issue including commissioning the Literature Review WG to update Annex B by summarizing expert reviews by independent international expert groups and health authorities, which were included in the revised C95.1-2019. An extensive research database is maintained by Joe Elder and accessible online at http://ieee-emf.com. A comprehensive list of safety statements from international and national organizations and expert panels has been placed in the ICES web site: https://www.ices-emfsafety.org/expert-reviews/.

4.5.5.5.1.3.: C95.1-2019

The revision of C95.1-2005 has gone through a major revision, The first ballot, C95.1-D.3.2, was approved with 671 comments. Every comment was addressed and resolved. A Recirculation Ballot, C95.1-D.3.3, was approved by 93% of votes with three negative votes with comments. A revised recirculation ballot, C95.1-D.3.5.4, was approved with just 2 negative votes. The final revision, C95.1-D.3.3.5, has been submitted to the IEEE RevCom for evaluation at the beginning of 2019.

4.5.6 Subcommittee 5 (Safe Distances from Antennas during Blasting Operations)

Subcommittee 5 is responsible for IEEE C95.4™-2002, "IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas When Using Electric Blasting Caps during Explosive Operations." The standard was reaffirmed at the March 2008 SASB meeting. While the standard is considered stable, a PAR for a revision of the standard, possibly with a broadened scope, was approved in April 2016. The C95.4 draft revision was prepared sent for TC95 balloting in September 2017 with a 91% return received in November 2017. The draft document was approved with a 95% approval rating. A number of reviewers provided comments which are in the adjudication process. The final document is expected to be complete by February 2019. The Chairman, Ray Harmon, will resume SC5 activities to ensure harmonization with other international standards.

The Chairman Ray Harmon attended the US Department of Defense Joint Ordnance Commanders Group Electromagnetic Environmental Effects Ordnance Safety Group meeting in June 2017 Dahlgren, VA to discuss Hazards of Electromagnetic Radiation to Ordnance standards, guidelines, and publications that may impact C95.4 document. In addition, Mr. Harmon attended the North Atlantic Treaty Organization (NATO) Working Group 6 on Environmental Engineering and Testing (EE&T), E3 Action Team in Toulouse, France in May 2017 and in Cardiff, United Kingdom in October 2017. Mr. Harmon attend the NATO E3 Radiation Hazards (RADHAZ) meeting in Koblenz, Germany in May 2017 and Brussels, Belgium in September 2017 to discuss national and international standards related RADHAZ with respect to EEDs.

4.5.7 Subcommittee 6 (EMF Modeling and Dosimetry)

The aims of this new subcommittee (established September 2014) are: resolution of uncertainties in the dosimetric data used for the development of dosimetric reference limits and exposure reference levels (the bases of standards and guidelines for human exposure to electric, magnetic and electromagnetic fields); recommend analytical tools and data applicable to human exposure standards, follow and assess the recent literature on EMF dosimetry modeling, both for nerve stimulation effects caused by exposure to electric, magnetic and electromagnetic fields at frequencies below ~100 kHz, and for heating effects caused by RF energy absorption at frequencies above ~100 kHz. SC6 coordinates closely with the other subcommittees, especially with Subcommittee 3 and Subcommittee 4, both of which are currently working on the update and merger of IEEE Std C95.1™-2005 and IEEE-Std C95.6™-2002 (Reaffirmed 2007) into a single standard that covers the frequency range of 0 Hz to 300 GHz.

As a key activity, SC6 held an open workshop "The Current Status of Low Frequency Modeling" in Monterrey, California on June 14, 2015. Nine speakers covered three main topics: (1) Induction modeling; (2) Electrostimulation modeling; (3) Combined induction and electro-stimulation, including experimental verification. A panel discussion on future research topics was included at the end of the formal presentations. Eighty five attendees – many of whom were not IEEE/ICES members but were attending the BioEM2015 meetings – participated.

The results and conclusions of the workshop have been made freely available to interested parties via publication in a special section of *Physics in Medicine and Biology* (June 2016). The special section includes the research agenda for human safety from low-frequency fields, in which topics helpful for merging C95.1 and C95.6 are listed.

In addition to the original working group "Merging Computational and Experimental Approaches to Resolve Uncertainties Related to the Electrostimulation Threshold"

(established in 2015), two new working groups were established; "Numerical Artifacts" and "Inter-comparison" (established in 2016) and "Exploring the Brain Stimulation Threshold" (established in 2017). Also, with TC95 Editorial Working Group Task Force 2, a task force of intercomparison for low-frequency uniform exposure has been formed. The results of working group 2 "Numerical Artifacts" were summarized in two reports, both of which have been published in IEEE Transactions on Electromagnetic Compatibility. The results of task force 2 have been published in IEEE Access.

4.6 PARs

The following TC95 PARS are currently active:

4.6.1 SC1 PARs

4.6.1.1 PC95.3 (Approved February 2012 – Extension Request Approved September 2016)

Title: Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0 Hz-300 GHz.

Status: Revision Project

Project Scope: This recommended practice describes methods for measuring and computing external electric, magnetic and electromagnetic fields to which persons may be exposed over the frequency range of 0 Hz to 300 GHz. Instrument characteristics and the methods of calibrating such instruments and methods for computation and the measurement of the resulting fields and currents that are induced in bodies of humans exposed to these fields are included.

4.6.2 SC2 PARs

4.6.2.1 PC95.2 (Approved December 2016)

Title: Standard for Radio-Frequency Energy and Current-Flow Symbols

Status: Revision Project

Project Scope: This standard provides a description of warning symbols for radio frequency radiation and radio frequency induced and contact currents in the frequency range of 3 kHz to 300 GHz.

Project Purpose: The purpose of this standard is to provide recommendations on the standardized design of warning symbols that may be used on alerting signs for informing individuals of the potential for exposure to electric, magnetic and electromagnetic fields and associated induced and contact currents and contact voltages.

4.6.3 SC3/4 PARs

4.6.3.1 PC95.1 (Approved June 2010 – Extension Request approved September 2016)

Title: Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz

Status: Revision Project

Project scope: Recommendations are made to protect against established adverse health effects in humans resulting from exposure to electric, magnetic and electromagnetic

fields in the frequency range of 0 Hz to 300 GHz. The recommendations are expressed in terms of exposure reference levels (ERLs) and dosimetric reference levels (DRLs). The DRLs are limits on in situ electric field strength, specific absorption rate (SAR), and incident power density; the ERLs, which are derived from the DRLs, are limits on external fields and induced and contact current. This standard is intended to apply to all human exposures except for exposure of patients under medical supervision. The 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 consistent with existing recommendations for safe exposure in the infrared frequency range, which begins at 300 GHz, cf., ANSI Z136.1, and IEC 60825-1.

Project purpose: The purpose of this standard is to provide rational, science- based exposure values to protect against established adverse effects to human health induced by exposure to electric, magnetic, and electromagnetic fields over the frequency range of 0 Hz to 300 GHz.

4.6.4 SC5 PARs

4.6.4.1 PC95.4 (Approved September 2016)

Title: Recommended Practice for Determining Safe Distances From Radio Frequency Transmitting Antennas When Using Electric Blasting Caps During Explosive Operations

Status: Revision Project

Project scope: This project provides recommended practices for the prediction and practical determination of safe distances from radio and radar transmitting antennas when using electric initiators to remotely detonate an explosive charge. Specifically, this document includes mathematical formulas, tables, and charts that allow the user to determine safe distances from RF transmitters with spectrum bands from 0.5 MHz to 300 GHz, including VHF, UHF television antennas, FM, AM radio transmitting antennas, radar navigation beacons, and portable communication devices. This document excludes criteria for the use of electro-explosive devices (EEDs) within electrically conductive enclosures or weapons and does not include discussion of hazards deriving from electromagnetic fields generated by other sources of energy such as electrical storms, electromechanical equipment, electrical power plants or power transmission lines.

Project purpose: The purpose of this project is to provide recommendations for the prevention of the inadvertent detonation of electric initiators by radio-frequency electric and magnetic fields generated from transmitting antennas with spectrum bands from 0.5 MHz to 300 GHz. The intended users of this document may include, but are not limited to, the domestic international commercial demolition industries and the armed forces.

4.7 Objectives and Goals for 2018 with milestones indicated

- Initiate subcommittee balloting on PC95.3. (SC1 – 3rd Q 2017): Not met
- Initiate Subcommittee balloting on PC95.1. (SC3/SC4 – 4th Q 2017): Met
- Begin the revision of C95.2. (SC2 – 1st Q 2017): Met (3rd Q): Met
- Begin the revision of C95.4. (SC5 – 1st Q 2017): Met (3rd Q): Met
- Initiate ICNIRP/ICES collaboration meeting to discuss harmonization of exposure limits. (SC3/4 – 3rd Q 2017): Met

4.8 Objectives and Goals for 2019 with milestones indicated

- PC95.1: Initiate revision of IEEE Std C95.1™-2019(SC3/4 – 1st Q 2019)

- PC95.3: Complete the revision of IEEE Std C95.3™-2002 and TC95 balloting and begin IEEE Sponsor Ballot (SC1 – 2nd Q 2019)
- PC95.4: Complete the revision of IEEE Std C95.4™-2002 and TC95 balloting and begin IEEE Sponsor Ballot (SC5 – 1st Q 2019)
- Continue ICNIRP/ICES collaboration to discuss harmonization of exposure limits. (SC3/4 – 2nd Q 2019)
- Improve communication of TC95 standards with the users of the standards including governmental agencies.

4.9 IEEE Staff

Support in setting up meetings at IEEE Piscataway has been required in the past and may be in the future; availability of the IEEE Staff Engineer at meetings held at IEEE is desirable. The engineering background and broad knowledge of IEEE procedures of Soo Kim, Staff Liaison for both TC34 and TC95, is invaluable to this committee.

4.10 Other Activities:

Members of ICES TC95 are continually involved in a wide spectrum of activities that relate to standard-setting including research, education, and drafting of regulations. Members participate in the governmental activities in many nations, as well. These include the FCC and FDA in the US and the EU/EC in Europe. TC95 members participate in the broad activities of the WHO and its EMF Project as well as the European EBEA, and in various other meetings around the world.

4.12 Issues

4.12.1 Interaction with ICNIRP

During the past few years there has been some softening in ICNIRP's position stemming from an issue in the EU whereby a European Commission (EC) Worker Safety Directive to implement ICNIRP-based guidance in the workplace was initially delayed because of impacts to several stakeholder groups, including MRI operators performing certain interventional procedures, would be exposed to low frequency magnetic fields in excess of the ICNIRP limits. The relevant ICNIRP limits are far more restrictive than those of IEEE C95.6 and the incorporation of extremely large safety factors in the ICNIRP limits has never been explained. TC95/SC6 was established to reconcile issues related to dosimetry and induction models in order to reconcile the differences. Additional stakeholder impacts included industry (welders and heat-sealer operators) and military (induced and contact current impacts on operations). The NATO Stakeholder to the EC Advisory Group that revised the proposed Directive 2004/40/EC on EMF exposure limits in the workplace obtained several derogations in the final Directive 2013/35/EU for militaries operating in the EU. The derogations allowed the EU NATO Nations to lawfully ratify and implement STANAG 2345-2015 which adopts IEEE C95.1-2345™-2014.

In May 2016, there was a change of leadership and members of ICNIRP. The new ICNIRP Chairman and one of the new members of the 13 member committee are also ICES members and ICNIRP is now willing to discuss harmonization of the exposure limits found in IEEE Stds C95.1™-2005 and C95.6™-2002 and the ICNIRP Guidelines. At a June 2016 Mobile Manufacturers Forum Workshop in Ghent, Belgium, the new ICNIRP Chairman, Dr. van Rongen, presented "ICNIRP's proposed HF guidelines" and extended an invitation to ICES to comment on their proposed limits. TC95 formed a 19 member task group to draft a document to comment on the ICNIRP proposed limits. The document

was circulated to the TC95 membership for comments. A final document was submitted to ICNIRP in time to be discussed at the ICNIRP September meeting. ICES will maintain its collaborative relationship with ICNIRP with the goal of in setting internationally harmonized safety limits for exposure to electromagnetic fields at frequencies below 300 GHz. This interaction with ICNIRP is considered a major step forward.

ICES will continue to discuss the IEEE standards and process at major international fora to help recruit key scientists and engineers who have no other way of participating in setting safety standards. Indications are that there may be a closer relationship with ICNIRP in the future.

4.13 Membership

See Tables TC95-1 through Table TC95-7 for committee and subcommittee membership information.

Table TC95-1

TC95 Officers

OFFICE	NAME	AFFILIATION	COUNTRY
Chairman	C-K Chou	C-K. Chou Consulting	US
Vice Chairman (Vac)			
Secretary	Antonio Faraone	Motorola Solutions, Inc.	US
Treasurer	C-K. Chou	C-K. Chou Consulting	US
Co-chairman, SC1	Francis Colville	US Army PHC	US
Co-chairman, SC1	Mark Douglas	IT'IS Foundation	CH
Chairman, SC2	Richard Tell	Richard A Tell Associates, Inc.	US
Co-chairman, SC3	Kevin Graf	Exponent	US
Co-chairman, SC3	Rob Kavet	Kavet Consulting LLC	US
Co-chairman, SC4	Art Thansandote	Health Canada (Retired)	CA
Co-chairman, SC4	Marvin Ziskin	Temple University Medical School	US
Co-chairman, SC5	Tamera Hay	Naval Surface Warfare Ctr.	US
Co-chairman, SC5	Ray Harmon	URS Corp.	US
Chairman, SC6	Akimasa Hirata	Nagoya Institute of Technology	JP

Table TC95-2

TC95 Membership: Main Committee (November 2016)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Adhikari	Sam	Syssoft Corp.	GI	US	
2.	Alon	Leeor	NYU Medical Center	GI	US	
3.	Ammann	Max	Dublin Institute of Technology	A	IE	
4.	Anderson	Vitas	Swinburne University	A	AU	Y
5.	Attayi	Daoud	Research In Motion, Ltd	P	CA	
6.	Bailey	William	Exponent, Inc.	GI	US	Y
7.	Baron	David	AIHA Representative	GI	US	Y
8.	Bavin	John	Consumers Energy	U	US	
9.	Bellier	Pascale	Health Canada	G	CA	
10.	Bergeron	John	Independent Consultant	GI	US	
11.	Bodemann	Ralf	Siemens AG	P	DE	Y
12.	Bowman	Joseph	CDC NIOSH	G	US	
13.	Brooker	Ian	Tyco Fire and Security	P	IE	
14.	Bushberg	Jerrold	U. of California, Davis	A	US	
15.	Butcher	Matt	Sitesafe	U	US	Y
16.	Cassara	Antonio	IT'IS Foundation	GI	CH	
17.	Chen	Jyun-cheng	Apple	GI	US	
18.	Chen	Xi Lin (Vick)	St Jude Medical Center	GI	US	
19.	Chiang	Huai	Zhejiang Medical University	A	CN	
20.	Chou	C.K.	C-K. Chou Consulting	GI	US	Y
21.	Cifra	Michal	Czech Technical University	A	CZ	
22.	Cleveland	Robert	EMF Consulting	U	US	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
23.	Colville	Frank	US Army PHC	G	US	
24.	Comlekci	Selcuk	Suleyman Demirel University	A	TR	
25.	Cotton	David	Sitesafe Inc	U	US	
26.	Cotts	Benjamin	Exponent	GI	US	
27.	Curtis	Robert	RF CHECK Incorporated	U	US	Y
28.	Cvetković	Mario	FESB University of Split	A	HR	
29.	D'Andrea	John	Naval Medical Research Unit (Ret)	G	US	Y
30.	Davis	Clay	Los Alamos National Laboratory	GI	US	
31.	De Santis	Valerio	University of L'Aquila	A	IT	
32.	de Seze	Rene	INERIS	GI	FR	
33.	DeFrank	John	US Army PHC	G	US	Y
34.	Delgato	Michael	Verizon Wireless	U	US	Y
35.	Dockzat	Martin	FCC-OET	G	US	
36.	Douglas	Mark	IT'IS Foundation	GI	CH	Y
37.	Dovan	Thanh	SP AusNet (Retired)	P	AU	Y
38.	Duvdevany	Amnon	IDF Medical Corps	G	IL	
39.	El Hajj	Walid	INTEL Mobile Communications	GI	FR	
40.	Elder	Joe	Independent Consultant	U	US	
41.	Erdreich	Linda	Exponent	GI	US	Y
42.	Escobar	Roel	US Air Force Research Laboratory	G	US	
43.	Faraone	Antonio	Motorola Solutions	GI	US	Y
44.	Farrer	Donald	Independent Consultant	U	US	
45.	Filippopoulos	George	Greek Atomic Energy Comm.	G	GR	
46.	Findlay	Richard	EMF Comp	GI	UK	
47.	Fink	Nir	Israel Defence Forces	G	IL	
48.	Fisher	Kevin	Smith and Fisher LLC	GI	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
49.	Foster	Kenneth	Univ. of Pennsylvania	A	US	Y
50.	Futch	James	Florida Dept of Health	G	US	
51.	Gajsek	Peter	Institute of Public Health	U	SI	
52.	Geber	Kurt	Dynamac Corporation	P	US	
53.	George	David	Unisys Corp.	P	US	Y
54.	Gettman	Ken	NEMA	GI	US	Y
55.	Giaccone	Luca	Politecnico di Torino	A	IT	
56.	Gledhill	Martin	Monitoring and Adv. Serv. NZ, Ltd	U	NZ	
57.	Gomez-Tames	Jose	Nagoya Institute of Technology	GI	JP	
58.	Graf	Kevin	Exponent Failure Analysis Assc.	GI	US	Y
59.	Haes, Jr.	Donald	BAE Systems	P	US	Y
60.	Halkiotis	Konstantinos	Medical School of Athens	A	GR	
61.	Hare	Ed	American Radio Relay Leaque	GI	US	Y
62.	Harmon	Raymond	AECOM	U	US	Y
63.	Hatfield	James	Hatfield & Dawson	GI	US	Y
64.	Hay	Tamera	Naval Surface Warfare Center	U	US	Y
65.	Heirman	Donald	Don HEIRMAN Consultants	GI	US	Y
66.	Hill	Jonathin	ASSESSAFRICA, LLC	GI	US	
67.	Hirata	Akimasa	Nagoya Institute of Technology	A	JP	Y
68.	Ibey	Bennett	US Air Force Research Laboratory	U	US	
69.	Ikehata	Masateru	Railway Technical Research Inst	A	JP	
70.	Israel	Michel	National Centre of Hygiene	G	BL	
71.	Ivans	Veronica	Medtronic Inc. (Retired)	G	US	Y
72.	Jiang	Hai	Underwriters Lab	G	US	
73.	Jirjis	Michael	US Air Force Research Labs	G	US	
74.	Johnston	Sheila	Independent Consultant	GI	IE	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
75.	Jones	Christine	Naval Surface Warfare Ctr.	G	US	
76.	Joyner	Ken	Samsung	P	AU	Y
77.	Kandel	Shaiela	Hebrew University of Jerusalem	A	IL	
78.	Karabetsos	Efthymios	Greek Atomic Energy Commission	G	GR	
79.	Karpowicz	Jolanta	Central Institute for Labor Protection	A	PL	
80.	Kavet	Robert	Kavet Consulting LLC	GI	US	Y
81.	Keshvari	Jafar	Aalto University-School of Science	P	FI	Y
82.	Kihlstrom	Cory	Verizon Wireless	U	US	
83.	Kilian	David	Verizon Wireless	U	US	
84.	Kim	Byung Chan	ETRI, Korea	GI	KR	Y
85.	Kim	Nam	Chungbuk National University	A	KR	Y
86.	Klauenberg	B. Jon	US Air Force Research Laboratory	G	US	Y
87.	Koepfinger	Joseph	Consultant	G	US	Y
88.	Kuster	Niels	IT'IS Foundation	A	CH	Y
89.	Laakso	Ilkka	Nagoya Inst of Tech	A	JP	Y
90.	Lee	Ae-Kyoung	ETRI	GI	KR	
91.	Legros	Alexandre	Lawson Health Research Institute	A	CA	
92.	Lodwick	Jeffrey	US Department of Labor	G	US	
93.	Manatrakul	Nisakorn	Ministry of Public Health	G	TH	
94.	Mathur	Rajat	Hammett & Edison, Inc.	U	US	
95.	Mattsson	Mats-Olof	Austrian Institute of Technology	A	AT	
96.	Maxson	David	Isotrope, LLC	GI	US	
97.	McNamee	James	Health Canada	G	CA	
98.	Mezei	Gabor	Exponent Health Services	GI	US	
99.	Miyagi	Hiroaki	Japan NUS Co., Ltd	P	JP	
100.	Mueller	William	Boeing	U	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
101.	Mundy	Wesley	Altalink	U	US	Y
102.	Murphy	Michael	USAF Research Laboratory (Retired)	G	US	Y
103.	Muthuvelu	Pirunthavany	Ministry of Health	G	MY	
104.	Nappert	Hughes	CEM Industry Canada	G	CA	
105.	Ng	Kwan-Hoong	Dept of Radiation	G	MY	
106.	Osepchuk	John	Full Spectrum Consulting	U	US	Y
107.	Packer	Malcolm	Harris RF Communications	P	US	Y
108.	Pakhomov	Andrei	McKesson Bio Services	GI	US	
109.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
110.	Poljak	Dragan	University of Split, Croatia	A	HR	
111.	Ramachandran	TV	Vodafone	U	IN	Y
112.	Ravazzani	Paolo	Italian Nat Res Council	G	IT	
113.	Reilly	J. Patrick	Metatec Associates	GI	US	Y
114.	Repacholi	Michael	World Health Organization (Retired)	GI	CH	
115.	Roman	John	Intel Corp	GI	US	
116.	Ryu	Chungsang	KR Com Radio Res Agency	G	KR	
117.	Samaras	Theodoros	Aristotle University of Thessaloniki	A	GR	Y
118.	Sayers	Andrew	Elbit Systems of Australia, Pty. Ltd	GI	AU	
119.	Scanlon	William	Queens University, Belfast	A	UK	Y
120.	Sen	Indranil	Apple	P	US	
121.	Shelton, Jr	Wesley	AT&T Mobility	G	US	
122.	Sheppard	Asher	Asher Sheppard Consulting	U	US	
123.	Sheppard	Christopher	Verizon Wireless	U	US	Y
124.	Shkolnikov	Yakov	Advanced Data Analytics	GI	US	
125.	Shrivastava	Devashish	University of Minnesota	A	US	
126.	Sindia	Suraj	Intel Corp	P	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
127.	Sliney	David	Health Physics Society (Liaison)	GI	US	
128.	Swicord	Mays	Mays Swicord Consulting	U	US	Y
129.	Tanghe	Emmeric	Ghent University	A	BE	
130.	Tattersall	John	DSTL	G	UK	
131.	Tell	Richard	Richard Tell Assoc. Inc.	U	US	Y
132.	Testagrossa	Paul	Independent Consultant	GI	US	Y
133.	Thansandote	Art	Health Canada (Retired)	G	CA	Y
134.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	G	HU	
135.	Umbdenstock	Donald	Tyco/Sensormatic	P	US	Y
136.	Valberg	Peter	Gradient Corporation	GI	US	
137.	van Rongen	Eric	Health Council of the Netherlands	G	NL	
138.	Varanelli	Arthur	Independent Consultant	U	US	Y
139.	Vijayalaxmi	“Vijay”	University of Texas	GI	US	
140.	Visser	Auke	Royal Netherlands Navy	G	NL	
141.	Wan Nor Liza	Mahadi	Mahadi. Institute: University Malaya	A	MY	
142.	Wessel	Marvin	Global RF Solutions	U	US	Y
143.	Wiart	Joe	France Telecom Orange Labs R&D	U	FR	Y
144.	Williams, Jr.	Louis	Louis A. Williams Jr. & Associates	U	US	Y
145.	Yamazaki	Kenichi	Central Res Inst Elec Power Ind	G	JP	
146.	Young	Roger	Engineering Energy, LLC	GI	US	
147.	Zhadobov	Maxim	IETR	GI	FR	
148.	Zipse	Donald	Electrical Forensics, LLC	GI	US	Y
149.	Ziskin, MD	Marvin	Temple Univ. Medical School	A	US	Y
150.	Zollman	Peter	Peter Zollman Consultancy	GI	UK	

A = General Interest: Academic G = General Interest: Government GI = General Interest P = Producer U = User

Table TC95-3

TC95 Membership: SC1 (Techniques, Procedures, Instrumentation and Computation)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Alon	Leeor	NYU Medical Center	A	US	Y
2.	Baron	David	AIHA Representative	GI	US	
3.	Bodemann	Ralf	Siemens AG	P	DE	Y
4.	Bowman	Joe	NIOSH	G	US	
5.	Brooker	Ian	Tyco Fire and Security	P	IE	
6.	Butcher	Matthew	Sitesafe	U	US	Y
7.	Choi	Dong-guen	Radio Research Agency	P	KR	
8.	Chou	C.K.	C-K. Chou Consulting	P	US	Y
9.	Cleveland	Robert	EMF Consulting	U	US	Y
10.	Colville	Frank	US Army PHC	G	US	
11.	Cotton	David	Sitesafe Inc	U	US	
12.	DeFrank	John	US Army PHC	G	US	Y
13.	Dockzat	Martin	FCC OET	G	US	
14.	Douglas	Mark	IT'IS Foundation	GI	CH	Y
15.	Faraone	Antonio	Motorola Solutions, Inc	P	US	Y
16.	Friedrich	Gerd	Deutche Telekom	U	DE	
17.	Gettman	Ken	NEMA	GI	US	Y
18.	Harrington	Tim	FCC	G	US	Y
19.	Kainz	Wolfgang	UCFDA/CDRH	G	US	Y
20.	Klauenberg	B. Jon	USAF Research Laboratory	G	US	Y
21.	Kong	Sungsik	Radio Research Agency	G	KR	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
22.	Mantiply	Ed	FCC/OET	G	US	
23.	McKenzie	Ray	Telstra, Australia	P	AU	Y
24.	Menard	Francois	Industry Canada	G	CA	
25.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
26.	Reilly	J Patrick	Metatec Associates	GI	US	Y
27.	Tell	Richard	Richard Tell Assoc. Inc.	GI	US	Y
28.	Testagrossa	Paul	Independent Consultant	GI	US	Y
29.	Thansandote	Art	Health Canada (Retired)	G	CA	Y
30.	Umbdenstock	Donald	Tyco/Sensormatic	P	US	Y
31.	Wessel	Marvin	Global Solutions	U	US	Y
32.	Ziskin	Marvin	Temple Univ Med School	A	US	Y

A = General Interest: Academic
G = General Interest: Government
GI = General Interest
P= Producer
U = User

Table TC95-4

TC95 Membership: SC2: (Terminology, Units of Measurements and Hazard Communication)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Alon	Leeor	NYU Medical Center	A	US	
2.	Anderson	Vitas	Swinburne University	A	AU	Y
3.	Bailey	William	Exponent	GI	US	Y
4.	Baron	David	AIHA Representative	GI	US	Y
5.	Bellier	Pascale	Health Canada	G	CA	
6.	Biby	Richard	Crown Castle International	U	US	Y
7.	Bodemann	Ralf	Siemens AG	P	DE	Y
8.	Bowman	Joe	CDC NIOSH	GI	US	
9.	Boyer	Jim	Lawrence Livermore National Labs	G	US	
10.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US	Y
11.	Bushberg	Jerrold	U. of California, Davis	A	US	
12.	Chou	C.K.	C-K. Chou Consulting	P	US	Y
13.	Cleveland	Robert	EMF Consulting	GI	US	Y
14.	Curtis	Robert	Curtis Engineering and Management	U	US	Y
15.	D'Andrea	John	Naval Medical Research Unit	G	US	Y
16.	DeFrank	John	US Army PHC	G	US	Y
17.	Erdreich	Linda	Exponent	GI	US	Y
18.	Everist	Donald	Cohen, Dipell and Everist	GI	US	Y
19.	Gajda	Greg	Health Canada	GI	CA	
20.	Gettman	Ken	NEMA	GI	US	Y
21.	Haes, Jr.	Donald	BAE Systems	P	US	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
22.	Hatfield	James	Hatfield & Dawson	U	US	Y
23.	Hubbard	Roy	Technology Services International	U	ZA	Y
24.	Johnson	Robert	L-3 Microwave NARDA	U	US	
25.	Joyner	Ken	Samsung	P	AU	Y
26.	Kantner	Kimberly	AT&T	U	US	Y
27.	Khalil	Kathy	SPAWARSYSCEN Charleston	U	US	
28.	Kierl	Bill	Motorola, Inc	P	US	
29.	Klauenberg	B. Jon	USAF Research Laboratory	G	US	Y
30.	Kumbier	Werner	Narda Safety Test Solutions	P	DE	
31.	Kuster	Niels	IT'IS Foundation	GI	CH	Y
32.	Mantiply	Ed	FCC/OET	G	US	
33.	Mercer	Christopher	Vodacom Group, Pty Ltd	U	ZA	
34.	Nappert	Hughes	CEM Industry Canada	G	CA	
35.	Norman	Larry	Pike Electric	P	US	
36.	Osepchuk	John	Full Spectrum Consulting	U	US	Y
37.	Persson	Bertil	Lund University	A	SE	
38.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
39.	Rogers	Walt	Veridian Eng/RFR Branch	GI	US	Y
40.	Rowley	Jack	Telstra Research Labs	GI	AU	
41.	Scanlon	William	Queens University, Belfast	A	UK	Y
42.	Seabury	David	Chase Systems Inc.	U	US	Y
43.	Smith	Matthew	Dade Moeller & Associates	GI	US	
44.	Strickland	Richard	RF Safety Solutions	U	US	Y
45.	Tell	Richard	Richard Tell Assoc. Inc.	GI	US	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
46.	Testagrossa	Paul	Independent Consultant	GI	US	Y
47.	Thansandote	Art	Health Canada (Retired)	G	CA	Y
48.	Ulcek	Jerry	FCC	G	US	
49.	Varanelli	Arthur	Independent Consultant	GI	US	Y
50.	Ziskin, MD	Marvin	Temple Univ. Medical School	GI	US	Y

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Table TC95-5
TC95 Membership: SC3 (Safety Levels with Respect to Human Exposure, 0-3 kHz)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Alon	Leeor	NYU Medical Center	A	US	
2.	Ammann	Max	Dublin Institute of Technology	A	IE	
3.	Anderson	Vitas	Swinburne University	A	AU	Y
4.	Attayi	Daoud	Research In Motion, Ltd	P	CA	
5.	Bailey	William	Exponent Inc.	GI	US	Y
6.	Barker	J. Richard	General Cable	P	US	Y
7.	Baron	David	AIHA Representative	GI	US	Y
8.	Bavin	John	Consumers Energy	P	US	
9.	Bellier	Pascale	Health Canada	G	CA	
10.	Bergeron	John	Independent Consultant	GI	US	
11.	Bodemann	Ralf	Siemens AG	P	DE	Y
12.	Boeggeman	Charles	PECO Energy Co.	P	US	Y
13.	Bowman	Joseph	CDC NIOSH	G	US	
14.	Brecher	Aviva	DOT/RSPA Volpe Ctr.	G	US	Y
15.	Brewer	John	HCJB Global	U	US	
16.	Brooker	Ian	Tyco Fire and Security	P	IE	
17.	Butcher	Matthew	Sitesafe	U	US	Y
18.	Carberry	Robert	Northeast Utilities	P	US	Y
19.	Cassata	Jim	Navy Medical NIR Branch	G	US	
20.	Comlekci	Selcuk	Suleyman Demirel University	A	TR	
21.	Cotton	David	Sitesafe Inc	U	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
22.	Cotts	Benjamin	Exponent	GI	US	
23.	Croft	Rodney	Department of Psychology	A	AU	
24.	Dale	Steiner	ABB Power T&D Company	U	US	Y
25.	Doczkat	Martin	Federal Communications Commission	G	US	
26.	Dovan	Thanh	SP AusNet (Retired)	P	AU	Y
27.	Duvdevany	Amnon	IDF Medical Corps	G	IL	
28.	Erdreich	Linda	Exponent	GI	US	Y
29.	Farrer	Donald	Independent Consultant	GI	US	
30.	Filippopoulos	George	Greek Atomic Energy Comm.	G	GR	
31.	Geber	Kurt	Dynamac Corporation	P	US	
32.	George	David	Unisys Corp.	P	US	Y
33.	Gettman	Ken	NEMA	GI	US	Y
34.	Goulet	Daniel	Hydro-Quebec	U	CA	
35.	Graf	Kevin	Exponent	GI	Y	
36.	Haes, Jr.	Donald	BAE Systems	P	US	Y
37.	Harmon	Raymond	URS Corp.	GI	US	Y
38.	Hernandez	Martin	Florida Power & Light Co.	P	US	Y
39.	Herz	Michael	Pacific Gas & Electric Co.	P	US	Y
40.	Hicks	Danny	South Carolina Electric & Gas Co.	P	US	Y
41.	Hirata	Akimasa	Nagoya Institute of Technology	A	JP	
42.	Holley	Jeff	Florida Power and Light	U	US	
43.	Hongbin	Jin	China Mobile	U	CN	
44.	Hubbard	Roy	Technology Services International	GI	ZA	Y
45.	Ibey	Bennett	US Air Force Research Laboratory	G		

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
46.	Ikehata	Masateru	Railway Technical Research Institute	A	JP	
47.	Jaffa	Kent	Retired	GI	US	Y
48.	Jiang	Hai	UL Labs	GI	US	Y
49.	Karabetsos	Efthymios	Greek Atomic Energy Commission	G	GR	
50.	Kautz	Richard	Ford	P	US	
51.	Kavet	Robert	Kavet Consulting LLC	GI	US	Y
52.	Klauenberg	B. Jon	US Air Force Research Laboratory	G	US	Y
53.	Kim	Byung Chan	ETRI, Korea	GI	KR	Y
54.	Kim	Nam	Chungbuk National University	A	KR	Y
55.	Koepfinger	Joseph	Consultant	GI	US	Y
56.	Kuster	Niels	IT'IS Foundation	GI	CH	Y
57.	Kaalso	Ilkka	Nagoya Institute of Technology	A	JP	Y
58.	Lee	Ae-Kyoung	ETRI	GI	KR	
59.	Link	Richard	Radiation Safety Institute of Canada	A	CA	
60.	Lodwick	Jeffrey	US Department of Labor	G	US	
61.	Mair	Peter	Fronius International GMBH	P	DE	
62.	Manatrakul	Nisakorn	Ministry of Public Health	G	TH	
63.	Mathur	Rajat	Hammett & Edison, Inc.	U	US	
64.	McNamee	James	Health Canada	G	CA	
65.	Miyagi	Hiroaki	Japan NUS Co., Ltd	U	JP	
66.	Muthuvelu	Pirunthavany	Ministry of Health	G	MY	
67.	Nappert	Hughes	CEM Industry Canada	G	CA	
68.	Nelson	David	Michigan Technical University	A	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
69.	Ng	Kwan-Hoong	Dept of Radiation	G	MY	
70.	O'Connor	Roger	Dept of Comm, Marine and Nat Res	G	IE	
71.	Osepchuk	John	Full Spectrum Consulting	GI	US	Y
72.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
73.	Pittman	Steve	Potlach Pulp and Paperboard	P	US	Y
74.	Podhrasky	Robert	Garrett Metal Detectors	P	US	
75.	Ravazzani	Paolo	Italian Nat Res Council	G	IT	
76.	Reilly	J. Patrick	Metatec Associates	GI	US	Y
77.	Ryu	Chungsang	KR Com Radio Res Agency	G	KR	
78.	Sahl	Jack	J. Sahl Associates	GI	US	
79.	Samaras	Theodoros	Aristotle University of Thessaloniki	A	GR	Y
80.	Sawdon	Dave	IBM Global Services	P	UK	
81.	Sheppard	Asher	Asher Sheppard Consulting	GI	US	
82.	Shkolnikov	Yakov	Exponent	GI	US	
83.	Shrivastava	Devashish	University of Minnesota	A	US	
84.	Swicord	Mays	Mays Swicord Consulting	GI	US	Y
85.	Tell	Richard	Richard Tell Assoc. Inc.	U	US	Y
86.	Thansandote	Art	Health Canada (Retired)	G	CA	Y
87.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	A	HU	
88.	Umbdenstock	Donald	Tyco/Sensormatic	P	US	Y
89.	van Rongen	Eric	Health Council of the Netherlands	G	NL	
90.	Varanelli	Arthur	Independent Consultant	GI	US	Y
91.	Vijayalaxmi		Univ. Texas Health Science Ctr.	A	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
92.	Wan Nor Liza	Mahadi	Mahadi. Institute: University Malaya	A	MY	
93.	Wiart	Joe	France Telecom Orange Labs R&D	GI	FR	Y
94.	Woods	Richard	Sensormatic Electronics	P	US	Y
95.	Yamazaki	Kenichi	Central Res Inst Elec Power Ind	P	JP	
96.	Yandek	Edward	GE Lighting	P	US	Y
97.	Zhadobov	Maxim	IETR	GI	FR	
98.	Zipse	Donald	Electrical Forensics, LLC	GI	US	Y
99.	Ziskin, MD	Marvin	Temple Univ. Medical School	GI	US	Y

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Table TC95-6
TC95 Membership: SC4 (Safety Levels with Respect to Human Exposure, 3 kHz – 300 GHz)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Abd Rahman	Nazaruddin	Universiti Tenaga Nasional	A	MY	
2.	Alon	Leeor	NYU Medical Center	A	US	
3.	Ammann	Max	Dublin Institute of Technology	A	IE	
4.	Anderson	Vitas	Swinburne University	A	AU	Y
5.	Attayi	Daoud	Research In Motion, Ltd	P	US	
6.	Bailey	William	Exponent Inc.	GI	US	Y
7.	Baron	David	AIHA Representative	GI	US	Y
8.	Bellier	Pascale	Health Canada	G	US	
9.	Bergeron	John	Independent Consultant	GI	NZ	
10.	Bodemann	Ralf	Siemens AG	P	US	Y
11.	Bowman	Joseph	CDC NIOSH	G	US	
12.	Brecher	Aviva	DOT/RSPA Volpe Ctr. (Retired)	G	US	Y
13.	Brewer	John	HCJB Global	P	IE	
14.	Brooker	Ian	Tyco Fire and Security	P	US	
15.	Bushberg	Jerrold	UC Davis	A	US	
16.	Butcher	Matthew	Sitesafe, Inc.	U	US	Y
17.	Cassata	Jim	Navy Medical NIR Branch	G	UK	
18.	Chiang	Huai	Zhejiang Medical University	A	US	
19.	Chou	C.K.	C-K. Chou Consulting	GI	US	Y
20.	Cleveland	Robert	EMF Consulting	GI	UK	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
21.	Colville	Frank	US Army PHC	G	US	
22.	Comlekci	Selcuk	Suleyman Demirel University	A	TR	
23.	Cotton	David	Sitesafe Inc	U	US	
24.	Cotts	Benjamin	Exponent	GI	US	Y
25.	Croft	Rodney	Department of Psychology	A	AU	
26.	Curtis	Robert	Curtis Engineering and Management	U	US	Y
27.	D'Andrea	John	Naval Med. Research NIR Unit (Retired)	G	US	Y
28.	DeFrank	John	US Army PHC	G	US	Y
29.	Delgato	Michael	Verizon Wireless	U	US	Y
30.	Dini	David	UL	U	US	
31.	Doczkat	Martin	Federal Communications Commission	G	IT	
32.	Dovan	Thanh	SP AusNet (Retired)	GI	AU	Y
33.	Duvdevany	Amnon	IDF Medical Corps	G	ZA	
34.	Elder	Joe	Independent Consultant	G	IL	
35.	Erdreich	Linda	Exponent	GI	US	Y
36.	Faraone	Antonio	Motorola Solutions, Inc.	P	US	Y
37.	Farrer	Donald	Independent Consultant	GI	US	
38.	Filippopoulos	George	Greek Atomic Energy Comm.	G	US	
39.	Foster	Kenneth	Univ. of Pennsylvania	A	US	Y
40.	Futch	James	Florida Department of Health	U	US	
41.	Gajsek	Peter	Institute of Public Health	G	GR	
42.	Geber	Kurt	Dynamac Corporation	P	SI	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
43.	Gettman	Ken	NEMA	A	US	Y
44.	Gledhill	Martin	Monitoring and Advis. Serv. NZ, Ltd.	U	NZ	
45.	Graf	Kevin	Exponent	GI	US	Y
46.	Haes, Jr.	Donald	BAE Systems	P	UK	Y
47.	Halkiotis	Konstantinos	Medical School of Athens	A	US	
48.	Hatfield	James	Hatfield & Dawson	U	US	Y
49.	Hay	Tamera	Naval Surface Warfare Center	G	CH	
50.	Heirman	Donald	Don HEIRMAN Consultants	U	US	Y
51.	Hirata	Akimasa	Nagoya Institute of Technology	A	GR	
52.	Hongbin	Jin	China Mobile	U	IE	
53.	Hubbard	Roy	Technology Services International	GI	US	Y
54.	Ibey	Bennett	US Air Force Research Laboratory	G	US	
55.	Ikehata	Masateru	Railway Technical Research Institute	A	CA	
56.	Israel	Michel	National Centre of Hygiene	G	US	
57.	Jiang	Hai	Underwriters Labs	U	US	
58.	Johnson	Robert	L-3 Microwave-NARDA	US	GI	Y
59.	Johnston	Sheila	Independent Consultant	GI	BL	
60.	Jones	Christine	Naval Surface Warfare Ctr.	U	US	
61.	Joyner	Ken	Samsung	P	US	Y
62.	Kandel	Shaiela	Hebrew University of Jerusalem	A	IE	
63.	Kantner	Kimberly	AT&T	U	AU	Y
64.	Karabetsos	Efthymios	Greek Atomic Energy Commission	G	IL	
65.	Kavet	Robert	Kavet Consulting LLC	GI	US	Y
66.	Keshvari	Jafar	Aalto University-School of Science	GI	FI	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
67.	Kim	Nam	Chungbuk National University	A	KR	Y
68.	Kim	Byung Chan	ETRI, Korea	GI	KR	Y
69.	Klauenberg	B. Jon	US Air Force Research Laboratory	G	US	Y
70.	Koepfinger	Joseph	Consultant	U	US	Y
71.	Kwee	Sianette	University of Aarhus	A	US	
72.	Laakso	Ilkka	Nagoya Institute of Technology	A	JP	Y
73.	Lee	Ae-Kyoung	ETRI	GI	FI	
74.	Link	Richard	Radiation Safety Institute of Canada	A	US	
75.	Lodwick	Jeffrey	US Department of Labor	G	CA	
76.	Manatrakul	Nisakorn	Ministry of Public Health	G	US	
77.	Mantiply	Ed	FCC/OET	G	TH	
78.	Mathur	Rajat	Hammett & Edison, Inc.	U	US	
79.	McKenzie	Ray	Telstra Chief Technology Office	P	US	
80.	McNamee	James	Health Canada	G	AU	
81.	Meltz	Martin	Retired	GI	CA	Y
82.	Miyagi	Hiroaki	Japan NUS Co., Ltd	P	US	
83.	Mundy	Wesley	Altalink	U	US	
84.	Muthuvelu	Pirunthavany	Ministry of Health	G	US	
85.	Nappert	Hughes	CEM Industry Canada	G	US	
86.	Nelson	David	Michigan Technical University	A	US	
87.	Ng	Kwan-Hoong	Dept of Radiation	G	MY	
88.	Osepchuk	John	Full Spectrum Consulting	GI	CA	Y
89.	Packer	Malcolm	Harris RF Communications	P	US	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
90.	Pakhomov	Andrei	McKesson Bio Services	GI	US	
91.	Persson	Bertil	Lund University	A	MY	
92.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
93.	Ramachandran	TV	Vodafone	IN	GI	Y
94.	Ravazzani	Paolo	Italian Nat Res Council	G	SE	
95.	Reilly	J. Patrick	Metatec Associates	GI	US	Y
96.	Rogers	Walt	Veridian Eng/RFR Branch	GI	US	Y
97.	Rybak	Terence	General Motors Proving Grnd.	GI	IT	Y
98.	Ryu	Chungsang	KR Com Radio Res Agency	G	US	
99.	Samaras	Theodoros	Aristotle University of Thessaloniki	A	US	Y
100.	Scanlon	William	Queens University, Belfast	A	US	Y
101.	Shelton	Wesley	AT&T Mobility	U	US	Y
102.	Sheppard	Asher	Asher Sheppard Consulting	GI	US	Y
103.	Sheppard	Christopher	Verizon Wireless	GI	US	Y
104.	Shkolnikov	Yakov	Exponent	GI	FI	
105.	Shrivastava	Devashish	University of Minnesota	A	UK	
106.	Swicord	Mays	Mays Swicord Consulting	GI	PL	Y
107.	Tattersall	John	DSTL	G	US	
108.	Tell	Richard	Richard Tell Assoc. Inc.	U	US	Y
109.	Testagrossa	Paul	Independent Consultant	U	CA	Y
110.	Thansandote	Art	Health Canada (Retired)	G	US	Y
111.	Thuroczy	Gyorgy	Nat Res Inst for Radiobiology	G	IT	
112.	Umbdenstock	Donald	Tyco/Sensormatic	P	NL	Y
113.	van Rongen	Eric	Health Council of the Netherlands	G	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
114.	Varanelli	Arthur	Independent Consultant	GI	MY	Y
115.	Wan Nor Liza	Mahadi	Mahadi. Institute: University Malaya	A	US	
116.	Weller	Robert	National Broadcasting Association	G	US	Y
117.	Wiart	Joe	France Telecom Orange Labs R&D	P	FR	Y
118.	Woods	Richard	Sensormatic Electronics	P	KR	Y
119.	Yamazaki	Kenichi	Central Res Inst Elec Power Ind	P	JP	
120.	Zhadobov	Maxim	IETR	GI	FR	
121.	Zipse	Donald	Electrical Forensics, LLC	GI	US	Y
122.	Ziskin, MD	Marvin	Temple Univ. Medical School	GI	US	Y

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Table TC95-7
TC95 Membership: SC5 (Safety Levels with Respect to Electro-Explosive Devices)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Balzano	Quirino	University of MD	A	US	Y
2.	Bean	John	Naval Surface Warfare Center	G	US	
3.	Colville	Frank	US Army PHC	G	US	
4.	Comlekci	Selcuk	Suleyman Demirel University	A	TR	
5.	DeFrank	John	US Army PHC	G	US	Y
6.	Doczkat	Martin	Federal Communications Commission	G	US	
7.	Duvdevany	Amnon	IDF Medical Corps	G	IL	
8.	Harmon	Ray	EG&G	P	US	
9.	Hatfield	James	Hatfield & Dawson	U	US	Y
10.	Hay	Tamera	Naval Surface Warfare Center	G	US	
11.	Joyner	Ken	Samsung	P	AU	Y
12.	Leidel	David	Halliburton Energy Services	U	US	
13.	Nappert	Hughes	CEM Industry Canada	G	CA	
14.	Petersen	Ronald	R C Petersen Associates	GI	US	Y
15.	Stuart	James	Franklin Applied Physics	GI	US	
16.	Thompson	Ramie	Franklin Applied Physics	GI	US	

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Table TC95-8
TC95 Membership: SC6 (EMF Dosimetry Modeling)

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
1.	Alon	Leeor	New York University	G	US	
2.	Altunyurt	Nevin	Ford Motor Company	P	US	
3.	Angelone	Leonardo	FDA/CDRH	G	US	
4.	Bikson	Marom	City College of New York	A	US	
5.	Bodemann	Ralf	Siemens	P	DE	Y
6.	Cassara	Antonio	IT'IS Foundation	G	CH	
7.	Chen	Xi Lin	St. Jude Medical Center	P	US	
8.	Costen	Fumie	University of Manchester	A	UK	Y
9.	Cvekovic	Mario	University of Split	A	HR	Y
10.	Daga	Andrew	Momentum Dynamics	P	US	
11.	De Santis	Valerio	University of L'Aquila	A	IT	Y
12.	Diao	Yin Liang	South China Agricultural University	A	CH	Y
13.	Diamant	Alan	Diamant Engineering	G	US	
14.	Dovan	Thanh	Retired	P	AU	
15.	Findlay	Richard	EMFcomp	GI	UK	
16.	Giaccone	Luca	Politecnico di Torino	A	IT	Y
17.	Gomez-Tames	Jose David	Nagoya Inst Tech	A	JP	
18.	Hikage	Takashi	Hokkaido University	A	JP	Y
19.	Hirata	Akimasa	Nagoya Institute of Technology	A	JP	Y
20.	Huang	Xin	Abbott	P	US	

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
21.	Iacono	Maria	FDA/CDRH	G	US	
22.	Israel	Michel	Medical University, Blevin	A	BG	
23.	Ito	Takahiro	Nagoya Institute of Technology	A	JP	
24.	Jeffreys	John	University of Oxford	A	UK	
25.	Kainz	Wolfgang	FDA/CDRH	G	US	Y
26.	Kamimura	Yoshitsugu	Utsunomiya University	A	JP	Y
27.	Kashiwa	Tatsuya	Kitami Inst Tech	A	JP	Y
28.	Kavet	Robert	Kavet Consulting LLC	GI	US	Y
29.	Krauthamer	Victor	FDA/CDRH	G	US	
30.	Kuster	Niels	IT'IS Foundation	G	CH	Y
31.	Laakso	Ilkka	Aalto University	A	FI	Y
32.	Lazzi	Gianlucca	University of Utah	A	US	Y
33.	Legros	Alexandre	Lawson Health Research Institute	A	CA	
34.	Lee	Ae-Kyoung	ETRI	A	KR	
35.	Leung	Sai Wing	City University of Hong Kong	A	HK	Y
36.	Matsumoto	Hideyuki	Japanese Red Cross Medical Center	GI	JP	
37.	McIntyre	Cameron	Case Western Reserve University	A	US	
38.	Neufeld	Esra	IT'IS Foundation	G	CH	Y
39.	Poljak	Dragan	University of Split	A	HR	Y
40.	Reilly	J. Patrick	Metatec Associates	GI	US	Y
41.	Samaras	Theodros	Aristotle U. of Thessaloniki	A	GR	Y
42.	Sasaki	Kensuke	NICT	GI	JP	Y

	LAST NAME	FIRST NAME	AFFILIATION	INTEREST CATEGORY	COUNTRY	IEEE MEMBER?
43.	Sarolic	Antonio	University of Split	A	HR	
44.	Schmid	Gernot	Seibersdorf Lab.	GI	AT	
45.	Sindia	Suraj	Intel Corp, Corp Quality Network	P	US	
46.	Sweeney	James D.	FL Gulf Coast U.	A	US	Y
47.	Takei	Amane	Miyazaki University	A	JP	
48.	Taguchi	Kenji	Kitami Inst Tech.	A	JP	Y
49.	Tarao	Hiroo	Kagawa National College of Tech.	A	JP	
50.	Wake	Kanako	NICT	GI	JP	Y
51.	Wiart	Joe	Orange Lab	U	FR	Y
52.	Wout	Joseph	University of Ghent	A	BE	Y
53.	Wu	Tongning	China Acad. of Telecomm. Research	GI	CN	Y
54.	Xin	Xiyao	Abbott	P	US	
55.	Yamazaki	Kenichi	CRIEPI	U	JP	Y
56.	Yilmaz	Ali E.	University of Texas at Austin	A	US	Y
57.	Ziskin	Marvin	Temple University	A	US	Y

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