Approved Minutes

TC95 Committee
Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz

0800 – 1100 US EDT
Friday, 19 June 2020

WebEx meeting

1. Call to Order Chou

The meeting started promptly at 8am US EDT.

2. Introduction of those Present All

Roll call online. It was determined that a snapshot of the attendees online would be taken by the minute taker in order to avoid undercounting the attendance. See attendance list in Attachment 1.

3. Approval of Agenda Chou

Bushberg moved to approve the draft agenda. Ziskin seconded. Approved unanimously. See approved meeting agenda in Attachment 2.

4. Approval of January 23, 2020 TC95 minutes Chou

Bushberg moved to approve (except for typos possibly found later). Haes seconded. Approved unanimously.¹

5. Call for Patents Chou

Chou illustrated the IEEE Patent policy.² No patent was brought up or noted.

6. ICES Chairman’s Report Keshvari

See report slides in Attachment 3.

¹ The approved minutes are posted in the public site of ICES and therefore not attached herein to avoid recursive document growth.

² No patent was brought up or noted.
7. **Topic presentations**
   a) Setting Human Exposure Limits in the Optical Spectrum of the THz region  
      **Sliney**

      See presentation slides in Attachment 4.

     The ensuing discussion focused on whether non thermal effects are documented in the THz range, reaching a consensus that there are no established, potentially harmful non thermal effect.

8. **TC95 Chairman’s Report**  
    **Chou**

    See report slides in Attachment 5.

9. **Secretary’s Report**  
    **Faraone**

    See report slides in Attachment 6.

    The ensuing discussion focused on the possible renewal of GET program for the TC95 standards, which is set to expire in the near future. There was widespread agreement on the urgency of finding a suitable funding source in order to continue providing free access to all interested parties.

10. **Treasurer’s Report**  
    **Chou**

    See report slides in Attachment 7.

11. **Membership Chairman’s Report**  
    **Escobar**

    See report slides in Attachment 8.

12. **IEEE Staff Report**  
    **Roder**

    See report slides in Attachment 9.

    The ensuing discussion focused on several aspects of the report.
    - The newly instituted 10 year expiration cycle for IEEE standards requires starting the standards revision process at least 4 years ahead of expiration.
    - Several TC95 members expressed concern about the recently instituted IEEE policy on Copyrights, which may significantly limit the effectiveness of standards development teams. The IEEE Intellectual Property Rights team clarified some aspects of the policy in the updated FAQ online page. The team also provides access to live webinars, with several of them scheduled in 2020.

13. **IEEE C95.1-2345 revision**  
    **Escobar**

    See report slides in Attachment 10.

14. **Subcommittee Reports**
    a) SC1 (Measurements and computations)  
       **Zollman/Butcher**

       See report slides in Attachment 11.

       The ensuing discussion focused on the risk of carrying on multiple complex projects concurrently, in terms of timeliness and accuracy.

       *Action item*: Chou to send out call for TC95 balloting for C95.3 before the end of
the voting.

- It can be done in parallel, not necessarily in serial fashion, if the expectation is that the document will be approved. This is also true for IEEE-SA level voting.

b) SC2 (Safety programs)  

Tell

See report slides in Attachment 12.

The ensuing discussion focused on the draft standard revision and it was determined that the Editorial WG will review and amend it before wider circulation to the committee members. It was also remarked that the online meeting was very well attended, featuring 46 participant overall.

c) SC3 (Safety levels – 0 Hz to 3 kHz)  

Kavet/Legros

d) SC4 (Safety levels – 3 kHz to 300 GHz)  

Ziskin/Thansandote

See report slides in Attachment 13.

It was also remarked that the online meeting was very well attended, featuring 55 participant overall.

e) SC5 (Effects of EM fields on blasting operations)  

Harmon/Hay

See report slides in Attachment 14.

f) SC6 (EMF dosimetry modeling)  

Hirata

See report slides in Attachment 15.

15. ICES Website Update  

Chou/Glembo

See report slides in Attachments 16 and 17.

The ensuing discussion highlighted that all uploaded minutes and reports are up to date, and addressed some difficulties in accessing the ICES website. A consensus emerged to gather information on the IEEE web hosting capabilities and support, in order to determine whether it represents a better option.

*Action item:* Glembo and Escobar will meet with IEEE IT staff to discuss possibility of moving ICES website from NEMA to IEEE.

16. New Business  

Chou

None.

17. Future Meetings  

Chou

Several aspects related to place and formats of the ICES meetings were discussed:

- The potential impact of a protracted pandemic across the globe suggested that it will be quite unlikely that the planned January 2021 face-to-face meeting in Chandler, AZ, USA may take place.
- There is general satisfaction with the online format experimented during the May/June 2020 subcommittee meetings, further underlining that the online format brought larger audiences that the typical audience size (including online attendees) in face-to-face meetings.
- When travel restriction is lifted, if a face-to-face meeting is held, ICES will consider establishing
an online connection fee in order to maintain sufficient budget for ongoing and foreseen expenditures.
  o AdCom will discuss details.
  • There was a consensus to continue using Webex as the platform for upcoming online meetings.

18. **Adjourn**

Having determined that no more items were up for discussion, Ziskin moved to adjourn. Bushberg seconded. The meeting was unanimously adjourned at 12 PM US EDT.

---

° Participants have a duty to inform the IEEE of holders of essential patent claims if they or their affiliations hold such claims. Check the web link on the agenda for more details. If anyone in this meeting is personally aware of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please speak to the committee chair today.

The IEEE SA patent policy is explained at the following links:

https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.ppt
<table>
<thead>
<tr>
<th>Last name</th>
<th>First name</th>
<th>Affiliation</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bailey</td>
<td>Bill</td>
<td>Exponent</td>
<td>Y</td>
</tr>
<tr>
<td>Balzano</td>
<td>Quirino</td>
<td>University of Maryland</td>
<td>Y</td>
</tr>
<tr>
<td>Bushberg</td>
<td>Jerrold</td>
<td>UC Davis</td>
<td>Y</td>
</tr>
<tr>
<td>Butcher</td>
<td>Matt</td>
<td>Sublight Engineering PLLC</td>
<td>Y</td>
</tr>
<tr>
<td>Chen</td>
<td>JC</td>
<td>Apple, Inc.</td>
<td>Y</td>
</tr>
<tr>
<td>Chou</td>
<td>C-K</td>
<td>C-K. Chou Consulting</td>
<td>Y</td>
</tr>
<tr>
<td>Cleveland</td>
<td>Robert</td>
<td>EMF Consulting</td>
<td>Y</td>
</tr>
<tr>
<td>Colville</td>
<td>Frank</td>
<td>US Army PHC</td>
<td>Y</td>
</tr>
<tr>
<td>Comlekci</td>
<td>Selcuk</td>
<td>SD University</td>
<td>Y</td>
</tr>
<tr>
<td>Cotts</td>
<td>Benjamin</td>
<td>Exponent</td>
<td>Y</td>
</tr>
<tr>
<td>Curtis</td>
<td>Bob</td>
<td>RF Safety Compliance</td>
<td>Y</td>
</tr>
<tr>
<td>Cvetkovic</td>
<td>Mario</td>
<td>University of Split, Croatia</td>
<td>Y</td>
</tr>
<tr>
<td>De Santis</td>
<td>Valerio</td>
<td>University of L’Aquila</td>
<td>Y</td>
</tr>
<tr>
<td>DeFrank</td>
<td>John</td>
<td>US Army</td>
<td>Y</td>
</tr>
<tr>
<td>Diao</td>
<td>Yinliang</td>
<td>Nagoya Institute of Technology</td>
<td>Y</td>
</tr>
<tr>
<td>Dopart</td>
<td>Pamela</td>
<td>Exponent</td>
<td>Y</td>
</tr>
<tr>
<td>Douglas</td>
<td>Mark</td>
<td>ITIS</td>
<td></td>
</tr>
<tr>
<td>Duvdevany</td>
<td>Amnon</td>
<td>Israel Institute for Occupational Safety and Hygiene</td>
<td>Y</td>
</tr>
<tr>
<td>Elder</td>
<td>Joe</td>
<td>Retired</td>
<td></td>
</tr>
<tr>
<td>Escobar</td>
<td>Roel</td>
<td>Air Force</td>
<td>Y</td>
</tr>
<tr>
<td>Faraone</td>
<td>Antonio</td>
<td>Motorola Solutions</td>
<td>Y</td>
</tr>
<tr>
<td>Fisher</td>
<td>Kevin</td>
<td>Smith and Fisher, LLC</td>
<td>Y</td>
</tr>
<tr>
<td>Fisher</td>
<td>Kyle</td>
<td>Smith and Fisher, LLC</td>
<td>Y</td>
</tr>
<tr>
<td>Futch</td>
<td>James</td>
<td>Fla. Dept. Health, Radiation Control</td>
<td></td>
</tr>
<tr>
<td>Gallamoza</td>
<td>Romeo</td>
<td>US Army</td>
<td>Y</td>
</tr>
<tr>
<td>Giles</td>
<td>Olin</td>
<td>Retired</td>
<td></td>
</tr>
<tr>
<td>Glenbo</td>
<td>Tyler</td>
<td>Intel</td>
<td>Y</td>
</tr>
<tr>
<td>Graf</td>
<td>Kevin</td>
<td>FCC</td>
<td>Y</td>
</tr>
<tr>
<td>Haes</td>
<td>Donald</td>
<td>BAE Systems</td>
<td>Y</td>
</tr>
<tr>
<td>Harmon</td>
<td>Ray</td>
<td>DoD/Navy</td>
<td>Y</td>
</tr>
<tr>
<td>Hirata</td>
<td>Aki</td>
<td>Nagoya Institute of Technology</td>
<td>Y</td>
</tr>
<tr>
<td>Israel</td>
<td>Michel</td>
<td>NCPHA-Sofia, Medical University-Pleven</td>
<td>Y</td>
</tr>
<tr>
<td>Johnson</td>
<td>Robert</td>
<td>None</td>
<td>Y</td>
</tr>
<tr>
<td>Joyner</td>
<td>Kenneth</td>
<td>Consultant</td>
<td></td>
</tr>
<tr>
<td>Karabetsos</td>
<td>Efthymios</td>
<td>Greek Atomic Energy Commission</td>
<td>Y</td>
</tr>
<tr>
<td>Kavet</td>
<td>Rob</td>
<td>Kavet Consulting LLC</td>
<td>Y</td>
</tr>
<tr>
<td>Kihlstrom</td>
<td>Cory</td>
<td>Verizon Wireless</td>
<td></td>
</tr>
<tr>
<td>Kim</td>
<td>Nam</td>
<td>Chungbuk University</td>
<td></td>
</tr>
<tr>
<td>Krebs</td>
<td>Paul</td>
<td>Verizon</td>
<td></td>
</tr>
<tr>
<td>Legros</td>
<td>Alexandre</td>
<td>LHRI</td>
<td>Y</td>
</tr>
<tr>
<td>Liu</td>
<td>Daniel</td>
<td>ARPANSA, Australia</td>
<td>Y</td>
</tr>
<tr>
<td>Name</td>
<td>Title/Company</td>
<td>Institution/Notes</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>Mathur</td>
<td>Raj</td>
<td>Hammett &amp; Edison, Inc.</td>
<td></td>
</tr>
<tr>
<td>Maxson</td>
<td>David</td>
<td>Isotrope</td>
<td></td>
</tr>
<tr>
<td>Miaullis</td>
<td>Aaron</td>
<td>USAF</td>
<td></td>
</tr>
<tr>
<td>Miyagi</td>
<td>Hiroaki</td>
<td>HM Research &amp; Consulting Co., Ltd.</td>
<td></td>
</tr>
<tr>
<td>Moule</td>
<td>Brett</td>
<td>Kordia Solutions</td>
<td></td>
</tr>
<tr>
<td>Osepchuk</td>
<td>John</td>
<td>Full Spectrum</td>
<td></td>
</tr>
<tr>
<td>Poljak</td>
<td>Dragan</td>
<td>University of Split</td>
<td></td>
</tr>
<tr>
<td>Pugliese</td>
<td>Giordano</td>
<td>US Army</td>
<td></td>
</tr>
<tr>
<td>Ravazzani</td>
<td>Paolo</td>
<td>Consiglio Nazionale delle Ricerche CNR</td>
<td></td>
</tr>
<tr>
<td>Reilly</td>
<td>Patrick</td>
<td>Metatec Associates</td>
<td></td>
</tr>
<tr>
<td>Roder</td>
<td>Patricia</td>
<td>IEEE SA</td>
<td></td>
</tr>
<tr>
<td>Šarolić</td>
<td>Antonio</td>
<td>FESB, University of Split (Croatia)</td>
<td></td>
</tr>
<tr>
<td>Sheppard</td>
<td>Asher</td>
<td>Asher Sheppard Consulting</td>
<td></td>
</tr>
<tr>
<td>Sliney</td>
<td>David</td>
<td>Johns Hopkins Univ</td>
<td></td>
</tr>
<tr>
<td>Tell</td>
<td>Ric</td>
<td>Richard Tell Associates, Inc.</td>
<td></td>
</tr>
<tr>
<td>Testagrossa</td>
<td>Paul</td>
<td>Consultant</td>
<td></td>
</tr>
<tr>
<td>Thansandote</td>
<td>Artnarong</td>
<td>Health Canada (Retired)</td>
<td></td>
</tr>
<tr>
<td>Tong</td>
<td>Zijun</td>
<td>NEMA</td>
<td></td>
</tr>
<tr>
<td>Valberg</td>
<td>Peter</td>
<td>Gradient</td>
<td></td>
</tr>
<tr>
<td>Visser</td>
<td>Auke</td>
<td>Royal Netherlands Navy</td>
<td></td>
</tr>
<tr>
<td>Weller</td>
<td>Bob</td>
<td>IEEE-BTS</td>
<td></td>
</tr>
<tr>
<td>Wessel</td>
<td>Marvin</td>
<td>Global RF Solutions</td>
<td></td>
</tr>
<tr>
<td>Wu</td>
<td>Tony</td>
<td>China Academy of Information and Communications Technology</td>
<td></td>
</tr>
<tr>
<td>Yamazaki</td>
<td>Kenichi</td>
<td>Central Research Institute of Electric Power Industry</td>
<td></td>
</tr>
<tr>
<td>Zhao</td>
<td>Xun</td>
<td>DND/QETE</td>
<td></td>
</tr>
<tr>
<td>Ziskin</td>
<td>Marvin</td>
<td>Temple University</td>
<td></td>
</tr>
<tr>
<td>Zollman</td>
<td>Peter</td>
<td>PZC (Consultant)</td>
<td></td>
</tr>
<tr>
<td>AMMAN</td>
<td>MAX</td>
<td>PZC (Consultant)</td>
<td></td>
</tr>
<tr>
<td>KLAUENBERG</td>
<td>BJON</td>
<td>US Air Force (Retired)</td>
<td></td>
</tr>
</tbody>
</table>
International Committee on Electromagnetic Safety

Draft Agenda
TC95 Committee
Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz
0800 – 1100 EDT
Friday, 19 June 2020
WebEx meeting

1. Call to Order           Chou
2. Introduction of those Present        All
3. Approval of Agenda       Chou
4. Approval of August 8, 2019 TC95 minutes     Chou
5. Call for Patents*        Chou
6. ICES Chairman’s Report  Keshvari
7. Topic presentations
   a) Setting Human Exposure Limits in the Optical
      Spectrum of the THz region      Sliney
8. TC95 Chairman’s Report   Chou
9. Secretary’s Report       Faraone
10. Treasurer’s Report      Chou
11. Membership Chairman’s Report  Escobar
12. IEEE Staff Report
   IEEE-SA issues            Roder
13. IEEE C95.1-2345 revision   Escobar
14. Subcommittee Reports
   a) SC1 (Measurements and computations)   Zollman/Butcher
   b) SC2 (Safety programs)                 Tell
   c) SC3 (Safety levels – 0 Hz to 3 kHz)   Kavev/Legros
   d) SC4 (Safety levels – 3 kHz to 300 GHz) Ziskin/Thansandote
   e) SC5 (Effects of EM fields on blasting operations)  Harmon/Hay
   f) SC6 (EMF dosimetry modeling)          Hirata
15. ICES Website Update     Chou/Glembo
16. New Business            Chou
17. Future Meetings         Chou
18. Adjourn

* Participants have a duty to inform the IEEE of holders of essential patent claims if they or their affiliations hold such claims. Check the web link on the agenda for more details. If anyone in this meeting is personally aware of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please speak to the committee chair today.

The IEEE SA patent policy is explained at the following links:
https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.ppt
IEEE/ICES
Chairman’s Report
to TC 95
Jafar Keshvari
19th June 2020
Items

• Letter and comments sent by ICES
• ICES liaison and collaborations
• WHO statements and IAC activities
• EMF statements and Reports
  • ARPANSA
  • Sweden
  • IARC
Letters and Comments by ICES

1. Response to U.S. Government Accountability Office (GAO) questions
   • IEEE office received the U.S. Government Accountability Office (GAO) questions related to technology assessment report of 5G.
   • ICES established a response letter which went through IEEE legal and sent to the GAO in Feb 2020.

IEC and IEEE/ICES Collaboration

• Regular monthly meeting are established: besides IEC and IEEE office representatives, project teams and WG chairs participate.
  ● The objective is to get the PT’s and WG’s well connected during COVID-19 pandemic times.
  ● Has shown to be a good practice which can be continued
WHO International Advisory Committee (IAC) Meeting

• The WHO International Advisory Committee meeting, originally scheduled for 29 June to 1 July 2020, was cancelled due to the COVID-19 pandemic.

• WHO IAC is decided to have its 2020 meeting as virtual meeting.

• A set of shorter online sessions on the days previously scheduled for the face-to-face meeting will be organized as follows.

• Three sessions will be organized:
  • Monday 29 June: Topics of general NIR interest
  • Tuesday 30 June: Topics related to electromagnetic fields
  • Wednesday 1 July: Topics related to optical radiation
  • To account for the time difference between countries, the sessions will start at 13:00 (CET) and last for about 1.5 hour.
WHO Q&A on 5G

• Please note that the World Health Organization has posted a Q&A (Questions and Answers) on 5G on its corporate website.

• https://www.who.int/news-room/q-a-detail/5g-mobile-networks-and-health).
WHO Statement ‘5G mobile networks DO NOT spread COVID-19’

• The World Health Organization (WHO) has included the false 5G claims to its main Myth busters page for COVID-19.
  • “Viruses cannot travel on radio waves/mobile networks. COVID-19 is spreading in many countries that do not have 5G mobile networks.
  • COVID-19 is spread through respiratory droplets when an infected person coughs, sneezes or speaks.

Upcoming NIR meetings for 2020 cancelled

ARPANSA advice on EME and the immune system

• The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has published the following community announcement that 5G and other telecommunications do not affect the immune system. In light of COVID-19, some members of the Australian public are concerned about the human immune system and whether it can be compromised by wireless telecommunications sources such as 5G.

• The 20th newsletter of the Swiss expert group on electromagnetic fields and non-ionising radiation (BERENIS) is now online, and ready for download from the website of the Swiss Federal Office for the Environment: Download BERENIS-Newsletter No. 20: English
Swedish SSM 14th report on EMF and Health

- The Swedish Radiation Safety Authority’s (SSM) Scientific Council has published the 14th report (03/04) on electromagnetic fields and health covering from April 2018 up to March 2020.


Advisory Group Report on Priorities for the IARC Monographs

• The Advisory Group Report on Priorities for the IARC Monographs during 2020-2024 is now available on the IARC Monographs website:


• On the topic of non-ionizing radiation, the recommendations were as follows (p. 148-149):

• Recommendation for non-ionizing radiation (radiofrequency): High priority (and ready for evaluation within 5 years)

• Recommendation for extremely low-frequency magnetic fields: No evaluation
On 3 June 2020, a new Frequently Asked Questions (FAQ) on 5G was published on the European Commission website under the “Digital Single Market” heading. The FAQ includes 14 frequently asked questions about 5G. They address the technology (5), benefits (4) and electromagnetic fields (5). [https://ec.europa.eu/digital-single-market/en/faq/5g-faq](https://ec.europa.eu/digital-single-market/en/faq/5g-faq)
EU EMF directive and 1999 council recommendation revisions

• 1st European EMF Forum Conference, 23-24.11.2020 “7 years of experience with the EMF directive”. Monday 23rd to Tuesday 24th November 2020 at BAuA in Dortmund, Germany, with a pre-conference gathering for early arrivals on Sunday evening (22.11.2020).

• The European EMF Forum is a cooperation of national occupational safety and health institutions aiming to enhance the implementation of the EMF directive 2013/35/EU (electromagnetic fields) in the European member states.

• What is this conference about?
  • The aim is for governmental experts from ministries, labour inspectorates and research institutes to exchange information on the practical application of the Directive in member states and discuss challenges in in-depth workshops or in front of your poster.
EU 5G CONFERENCE 2020

1. European commission is worried about fragmentation of exposure limits in EU countries and its negative impact on 5G deployment.

2. Poland harmonized its very restrictive exposure limits with ICNIRP guidelines from 1st Jan 2020. Belgian ministry of environment introduces solutions to harmonize the Belgian RF safety limits.

3. ICNIRP gave a talk “Ensuring informed EMF policy for the benefit and protection of all”. How best protect all people:
   - Uniform exposure limits throughout the world
   - Concern about lower limits in other countries may also be cause of health Effects
   - Legal rulings based on misinformation very unfortunate
   - Proper science-based information in lay terms needed, giving the same message in all countries (role of WHO?)
CONTRASTING THE RF AND OPTICAL RADIATION GUIDELINES
(a step in the “The THz Region”)

David Sliney, Ph.D.

Associate Faculty – Dept. of Environmental Health Sciences, Johns Hopkins University School of Public Health, Baltimore, MD, USA

Formerly – US Army Center for Health Promotion and Preventive Medicine (now Army Public Health Center)

Member ACGIH Physical Agents TLV Committee, IEC & ISO TCs on lasers, ICES, etc.

Past Member – ICNIRP and IRPA/INIRC

IR-C AND THZ SPECTRAL DESIGNATIONS

○ Traditional Dividing Line between far-infrared (IR-C Band) and microwave (sub-mm) regions has been at 300 GHz, i.e., @ λ = 1 mm in standards and publications related to occupational and environmental health, e.g., EN, WHO, ICNIRP, ICOH, ILO, AIHA, ACGIH, ANSI, IEEE, etc.

○ CIE/ISO/ACGIH/ICNIRP Definition –
  - IR-C extends from 3 µm (100 THz) to 1 mm (300 GHz)
IS THERE A GAP IN GUIDELINES FOR HUMAN EXPOSURE BETWEEN RF & FAR-INFRARED?

- RF (mm-wave) guidelines exist to 300 GHz (λ ≤ 1 mm)
- **Optical radiation exposure guidelines** are explicitly clear only for wavelengths less than 3 μm (3,000 nm).
- **Laser guideline limits** have always included IR-C (3 μm to 1,000 μm = 1 mm) – but vary with exposed area

Why do we have an apparent gap for incoherent IR-C?

- Heat stress and heat strain becomes the health hazard from surface heating of the skin in the IR-C band (but also with mm-wave exposures)
- Radiant heating is only one element of heat stress!
- Isolated infrared limits without humidity, air-flow and air temperature are considered meaningless – or at least unwise!

DIFFERENT RATIONALES FOR EXPOSURE LIMITS: – IN THE OPTICAL SPECTRUM – IN THE RF SPECTRUM

- Surface area vs. “partial body” a key difference
- If we applied to the optical spectrum the same basic restrictions, even just limiting Temperature elevations to 1°C, and follow the rationale with large reduction factors used in the RF community, then we could not permit:
  - Infant radiant warmers
  - Radiant heat of any type
  - Saunas
  - Walking outdoors in the summer time
  - Many electric lamps
  - Many electronic products

- **Why not apply the same rationale** used for infrared exposure limits to the mm-wave region?
**Why is there an apparent contradiction in guidelines at 1-mm wavelength (300 GHz)?**

- Health-Protection Guidelines developed from quite different underlying assumptions about biological effects, dosimetry, applications, public perceptions and philosophy of protection.

- Radiofrequency radiation Dosimetry of volumic, mass absorption; SAR or EM Field quantities.
  - Concerns of unknown (“toxic”) effects, thresholds
  - Public concerns; may be politically controversial

- Optical Radiation and LASERs applied to IR-C
  - Surface, thin-layer absorption, lack of public concern
  - Philosophy: Optimization of Benefits-vs.-Risks
  - Recognition of environmental thermal conditions

---

**Hidden Agendas? – Neighborhood Aesthetics**

*In the 1970s, RF limits became hostage to tower politics in the USA*

---

*Which is beautiful?*

- RF – Hidden Agendas – Aesthetics
- Lighting is Beautiful! Let there be light!
DIFFERENT HISTORIES
- DIFFERENT EVOLUTION OF LIMITS

○ In USA – 1956-1962 – Research program on RF biological effects research and ANSI Committee C95 develops the first consensus occupational limits 1965/6 – Main contributors Telecommunications industry + Bell Laboratories + the defense community + research labs.
  • Political controversies; unknowns, more conservative limits from USSR and then Scandinavia and other groups
  • IRPA/INIRC- 1977 – 1985 – Conservative compromise

○ LASER – 1968-1972 – ANSI Z136 Committee developed first consensus standard by bioeffects research community govt. agencies, defense, universities and industry
  • Lasers had “good press” and the public wants laser Tx
  • Worldwide consensus in limits – ANSI, IEC, CIE, ACGIH
  • No controversies on optical/laser tissue-interaction mechanisms

TEMPERATURE AND THERMAL EFFECTS

○ “Please remember – Temperature is a physiological factor and not a toxic agent.”

    — Prof. Jan A. J. Stolwijk
    Yale University School of Public Health
    Pioneer in heat-stress physiol., epidem.
    Past member, ICNIRP, ACGIH PAC etc.

    Core body temperature:
    \[ T = 37^\circ \text{C} \text{ with } \approx 0.5^\circ \text{C diurnal fluctuations} \]

    Thermoregulatory mechanisms of humans – excellent!

## Concepts of Radiation Protection

### RF Approach | Optical Approach

<table>
<thead>
<tr>
<th>Radiofrequency Radiation</th>
<th>Optical Radiation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Greatest concerns</strong> –</td>
<td><strong>Greatest Concern</strong> – Ultraviolet: low</td>
</tr>
<tr>
<td>30-300 MHz Whole-body resonance</td>
<td>Photochemical Effects (UV/Vis) TWA</td>
</tr>
<tr>
<td>Electrically excited tissues</td>
<td>Thermal effects – Lasers and pulsed sources - acute effects</td>
</tr>
<tr>
<td>Chronic Exposure (but not TWA &gt; 6min)</td>
<td></td>
</tr>
<tr>
<td><strong>Coherent Radiation</strong> – Resonant circuits</td>
<td><strong>Coherent Radiation</strong> – LASERs</td>
</tr>
<tr>
<td><strong>Incoherent Radiation</strong> – Background very, very low</td>
<td><strong>Incoherent Radiation</strong></td>
</tr>
<tr>
<td>- 21-cm line of H₂, static</td>
<td>Incoherent – UV &amp; Sunlight; lamps</td>
</tr>
<tr>
<td><strong>Public Perceptions</strong> – Concerns &amp; dislikes for “ugly towers” nearby;</td>
<td><strong>Public Perceptions</strong> – “Sunlight is good,” radiant heating nice – “What’s the risk?” Desired technol. good press</td>
</tr>
<tr>
<td>media sensationalism</td>
<td></td>
</tr>
<tr>
<td><strong>Human experience</strong> – no real sensation of radiation; mysterious;</td>
<td><strong>Human Experience</strong> – Evolved under sunlight and the warmth of fire (IR); “Sauna is good;” almost all lamps are safe</td>
</tr>
<tr>
<td>“Any sufficiently advanced technology is indistinguishable from magic” Arthur C. Clark</td>
<td></td>
</tr>
</tbody>
</table>

### Background – Infrared (IR) Radiation – the CIE Bands

- Infrared (IR) radiation is defined as optical radiation in the wavelength range from approximately 780 nm to 1,000 μm = 1 mm.
- IR radiation is divided into IR-A (λ ~ 780 nm to 1400 nm), IR-B (1400 nm - 3000 nm) and IR-C (3000 nm – 1 mm).
- Most **high-intensity** light sources emit negligible levels of IR-C compared to shorter wavelengths and produce **aversion response**.
- Thermal discomfort typically reduces potentially hazardous exposures to the eyes and skin. Hazardous sources are typically contained, filtered or baffled.
CURRENT ACGIH/ICNIRP EXPOSURE GUIDANCE
NON-LASER INFRARED RADIANT ENERGY

- Laser exposure limits extend to 1 mm – i.e., 0.3 THz in terms of frequency

- The whole-body Laser Exposure Limit is 100 W/m² (10 mW/cm²) for continuous exposure.
  - higher values for short periods up to 1,000 s (eye and skin)
  - Limit 10x higher for small areas < 100 cm².

- At present, ICNIRP and ACGIH, exposure guidelines for non-laser infrared are provided only explicitly for IR-A and IR-B spectral bands (i.e, for 780 nm - 3,000 nm: 0.78-3 µm)
  - IR-C should not have exposure/irradiance limits!

EXAMINING THE “CLIFF” AT 300 GHZ

- Laser exposure limit at λ = 1 mm (f = 300 GHz)
- For the eye: The CW limit (t > 10 s) is 100 mW/cm²
- For the eye: 0.1 µs < t < 10 s the limit is 0.56 t^{1/4} J/cm²
- For the skin (irradiated surface area is important):
  - 100 mW/cm² for spatial areas less than 100 cm²
  - Spatial averaging over an aperture of 11 mm (~ 1 cm²)
  - Small beams are often below thermal sensation thresholds (depends on ambient temperature)
  - 10 mW/cm² for areas greater than 1000 cm²
  - Limit is (10,000/As) mW/cm² for irradiated skin areas between 100 cm² and 1000 cm².
WHAT?

Exposure limits are simply not given for non-coherent (IR-C) optical radiation!

Limits only for IR-C lasers!

WHY?

BLACKBODY SOURCES AND IR-C

ICNIRP & ACGIH have been frequently asked why there are no explicit guidelines for IR-C (non-laser)

There are several reasons, but key are:

• Because IR-C is always a background and does not pose a significant fraction of the radiant energy risk for most hazardous thermal sources
• Because, when IR-C is the significant stressor, heat stress guidelines should be used and not a permissible irradiance
• Example 100 mW/cm² (1 kW/m²) is warming, pleasant and comfortable at 5⁰ C ambient, but painful at 35⁰ C ambient – The ambient thermal environment is the dominant factor!
**RATIO OF RADIANCE IN IR-A,B/C**

**Fraction of total Radiance**

- Radiant warmers – no visible energy; IR-C exposure limits not feasible – Use WBGT
- Deeply penetrating and metavisible IR-A&B Exposure limits provided

Human exposure from IR-C is from warm objects and typically $E > 100 \text{ W/m}^2$

---

**BIOEFFECTS - THERMOREGULATION**

- The human body maintains $37 \degree \text{C}$ “core body temperature” in its deep interior
- This changes slightly during the circadian rhythm, and more strongly with exercise, possible disease states, and with thermal loading from ambient conditions.
- Heat exchange due to body heat, physical activity, convective heat exchange, evaporative cooling, sweating, etc. with the environment must be balanced in order to maintain a relatively constant body temperature.
- Heat stress, effective temperature and thermal comfort indices have been developed for use in the workplace: The WBGT Index.
**THE IMPORTANCE OF AMBIENT CONDITIONS – HEAT STRESS & STRAIN**

- Unlike IR-B and IR-A hazardous sources, the ambient determines whether IR-C sources are a whole-body irradiation problem – unless one is speaking of lasers, which can heat a spot
  - An irradiance of 100 W/m² is just detectable at room temperature. Sensation & Comfort dependent on T.
  - An irradiance of 1 kW/m² (whole-body) gives life-saving warmth under frigid conditions, but could provoke a heat stroke at 35°C.

- IR-C is readily filtered from a radiometer reading by a glass window; ambient fluctuations then do not complicate readings

---

**WET-BULB-GLOBE TEMPERATURE (WBGT INDEX) FOR MONITORING HEAT STRESS**

- From the American Conference of Governmental Industrial Hygienists (ACGIH) circa. 1974.
- With direct exposure to sunlight:
  - \( \text{WBGT}_{\text{out}} = 0.7 \ T_{\text{nwb}} + 0.2 \ T_{\text{g}} + 0.1 \ T_{\text{db}} \)
- Without direct exposure to the sun:
  - \( \text{WBGT}_{\text{in}} = 0.7 \ T_{\text{nwb}} + 0.3 \ T_{\text{g}} \)
- where:
  - \( T_{\text{nwb}} \) = natural wet-bulb temperature (NWB)
  - \( T_{\text{g}} \) = globe temperature (GT)
  - \( T_{\text{db}} \) = dry-bulb (air) temperature (DB)
- Note that indoors the black-globe temp (largely IR-C) accounts for only 30% of the contribution.
MEASURING THE WET-BULB-GLOBE TEMPERATURE (WBGT INDEX) FOR MONITORING HEAT STRESS BY HYGIENISTS

Static Setup    Hand Portable

ICNIRP STATEMENT ON FAR-INFRARED – 2006*

- ICNIRP provides guidelines to limit exposure to intense infrared radiation up to $\lambda = 3 \, \mu m$ (IR-A, IR-B).
- Guidelines for exposure to energy at longer far-infrared wavelengths (referred to as IR-C) from lamps and other industrial sources were not provided because these wavelengths contribute a small fraction of the total radiant heat energy.
- Guidance is being provided for special conditions of lengthy far-infrared exposure that can occur despite the conditions of hyperthermia and skin discomfort. This can occur with elective exposure for perceived health benefit, in infrared warming cabins or “infrared saunas.”
- IR-C is frequently the main spectral emission encountered in infrared warming cabins.

TC95 Chairman’s Report

June 19, 2020 Meeting

C-K. Chou

ATTACHMENT 5
Public Presentation

January 11, 2020: “What you need to know about RF safety” in a “Beyond 5G and RF Safety” meeting, organized by the North America Taiwanese Engineering & Science Association in San Jose, CA. The other speaker was Nicole Chan, former Chair of National Communications Commission of Republic of China (Taiwan).
Questions for IEEE International Committee on Electromagnetic Safety:

1. To what extent were the National Toxicology Program rat and mouse studies evaluated for IEEE C95.1-2019? (Footnote 8 refers to awareness of the draft reports and peer review outcomes.)

2. Was the Ramazzini Institute study evaluated in IEEE C95.1-2019? If not, why was it not evaluated?

3. How do the results from these studies bear on the IEEE radiofrequency radiation exposure standards?

4. What plans and timelines does ICES have to release an addendum to update Annex C, Summary of the Literature, or a subsequent revision to the standard?
   - Will this include peer-reviewed papers and technical reports of original research at frequencies below 6 GHz?
   - Specifically, will this include the results of the NTP and Ramazzini Institute studies at cellular frequencies?
   - How is ICES coordinating with WHO on the EHC reviews?

5. What should be done to dispel or allay public concern about the biological effects of radiofrequency radiation and 5G deployment?
   - What is the role for private entities?
   - What additional federal role(s) or activities may further address public concern?

Task Group: Marv Ziskin; Richard Tell; Jerrold Bushberg; Bill Bailey; Kenneth Foster; Antonio Faraone; Joe Elder; Robert Cleveland; Keshvari, Jafar; C-K. Chou

On February 21, ICES replied within the two weeks of deadline.

- **Item 1: VLF/LF Limits.** The FCC has proposed to adopt limits similar to the ICNIRP 2010 guidelines at frequencies between 3 kHz and 10 MHz. ICES believes that such a proposal lacks clear and compelling scientific justification, and recommends that the Commission adopts an alternative such as IEEE Std C95.1™-2019. Unlike the ICNIRP guidelines, the IEEE standard provides correspondence between external exposure limits and internal dose limits, such that compliance can be conducted accurately with a straightforward environmental measurement. The Commission’s proposed approach, lacking this correspondence, may likely impose restrictions that could unnecessarily burden operators in this spectrum.

- **Item 2: Localized Exposures above 6 GHz.** ICES recommends that the FCC adopt a more conservative curve for localized exposure limits above 6 GHz.

- **Item 3: Averaging Time.** The choice of averaging times in Table 3 of the FCC Notice of Proposed Rulemaking is based on a goal of limiting the peak temperature rise in tissue from an “impulse.” This proposal may be overly conservative, inefficient, and inconsistent. A simple remedy is to limit the fluence for brief, high-fluence pulses, and to apply a 6- or 30-minute averaging time to waveforms lacking high-fluence pulses. In addition, questions may be raised by the potentially inconsistent whole-body averaging times set forth in Table 1 of 47 CFR §1.1310(e).

- **Item 4: Averaging Area above 6 GHz.** The power density averaging area of 1 cm2 is based on an earlier version of the IEEE C95.1™ standard, IEEE C95.1™-1991, which was superseded by IEEE C95.1™- 2005, and again by IEEE C95.1™-2019. Adopting the updated averaging area of 4 cm2 and the SAR limits of the IEEE C95.1™-2019 standard (as well as the 2020 ICNIRP Guidelines) would not only reflect the underlying science based on substantial improvements in RF dosimetry over the last two decades, but would also avoid a discontinuity at 6 GHz caused by the transition from spatial-peak SAR to localized power density limits.

- **Task Group:** C-K. Chou, Bob Cleveland, Antonio Faraone, Ken Foster, Rob Kavet, David Maxson, Ric Tell, Bob Weller, Marv Ziskin (lead)
C95.1-2019 Corrigenda 2

• Correct Figures 1 and 2 in C95.1-2019
• SC3&4 voting: 46 votes, 45 approve and 1 abstain.
• TC95 voting: 57 votes, 56 approve and 1 abstain.
• Results presented to AdCom.
• AdCom Chair will submit it to IEEE-SA for sponsor balloting
COMAR concludes that while we acknowledge gaps in the scientific literature, particularly for exposures at millimeter wave frequencies, the likelihood of yet unknown health hazards at exposure levels within current limits is considered to be very low, if they exist at all.
SC major events:

- SC1: New co-chairs, Peter Zollman and Matt Butcher, revised C95.3, SC1 voting in progress
- SC2 starts on revision of C95.7
- SC3&4, Alex Legros is the new co-chair of SC3 and chair of Editorial Working Group for C95.1 revision emphasizing on low frequency range
- SC5 will withdraw C95.4-2002, TC95 voting in progress.
- SC6 are busy on many research topics.
Secretary’s Report

19 June 2020 Meeting

Webex @ World

Antonio Faraone
TC95 is comprised of six subcommittees:

1. Techniques, Procedures, Instrumentation and Computation (IEEE Stds C95.3, C95.3.1)
2. Terminology, Units of Measurements and Hazard Communication (IEEE Stds C95.2, C95.7)
3. Safety Levels with Respect to Human Exposure, 0 Hz–3 kHz (IEEE Std C95.6)
4. Safety Levels with Respect to Human Exposure, 3 kHz–300 GHz (IEEE Stds C95.1, C95.1-2345)
5. Safety Levels with Respect to Electro-Explosive Devices (IEEE Std C95.4)
6. EMF Modeling
ICES TC95 Standards: Status

C95.1-2019: (Safety levels, 0 Hz – 300 GHz)
- Published in October 2019!
- Revision incorporates C95.6 (Safety levels, 0 Hz to 3 kHz)
  - Stressing harmonization with ICNIRP guidelines
  - Addresses mm-wave exposures with new metrics & limits

C95.1-2345-2014: (Safety levels, 0 Hz – 300 GHz)
- Approved 16 May 2014; published 30 May 2014
- NATO STANAG 2345 Ed.4, November 2015
- Expires in 2024 – 5 years for revision & NATO endorsement
- To be revised based on IEEE C95.1-2019
ICES TC95 Standards: Status

**C95.2-2018:** (RF energy and current flow symbols)
- No current activity.

**C95.3-2002:** (RF exposure assessments, measurements and computations: 100 kHz to 300 GHz)
- Reaffirmed 2008
- PAR for Revision – approved 6 February 2012;
  - PAR extended to 30 November 2019 and extended 2 more years (SASB approved)
- Revision incorporates C95.3.1 (0 Hz to 100 kHz)
  - **Revision ongoing, new editorial team formed**
- Peter & Matt became co-chairs at May meeting
ICES TC95 Standards: Status

C95.4-2002: (Safe distances during blasting operations)
- Reaffirmed 2008
- PAR for Revision – approved 22 September 2016;
  - PAR expires 31 December 2020
  - Based on IME feedback, withdrawn is proposed
  - TC95 ballot application (closed on 2 June 2020)
  - Withdraw ballot ongoing (closing on 8 July 2020)

C95.6-2002: (Safety levels – 0 to 3 kHz)
- Reaffirmed 2007
- Incorporated into C95.1-2019 revision
- C95.6-2002 has become obsolete
ICES TC95 Standards: Status

C95.7-2014: (RF safety programs)
- Revision of C95.7-2005
- Approved 12 June 2014; published 8 August 2014
- Working Group formed to improve guidance consistency with the rationale of the newly revised C95.1-2019 standard
- Portable occupational devices to be addressed
Get C95™ Standards

Access to the following standards at no cost has been sponsored by the US Navy, US Air Force, and US Army:*

- IEEE Std C95.1™-2019!
- IEEE Std C95.1a™-2010
- IEEE Std C95.1-2345™-2014
- IEEE Std C95.2™-2018
- IEEE Std C95.3™-2002
- IEEE Std C95.3.1™-2010
- IEEE Std C95.6™-2002
- IEEE Std C95.7™-2014

https://ieeexplore.ieee.org/browse/standards/get-program/page/series?id=82

*Sponsorship of the Get IEEE C95 no-cost-to-public web access of the IEEE C95 standards does not imply that the Department of Defense nor its Component Services endorse or are obligated in any manner to adopt the covered standards current or future versions.

FUNDING TO EXPIRE SOON – UNSURE ABOUT POTENTIAL RENEWAL (50k/5Y)

19 June 2020

Slide 7
Annual Report:
2017-2018 ICES Report accepted at the Dec 2018 SASB
- New TC34 P&P submitted in mid-September

Policies and Procedures (P&Ps):
- **Sponsor P&Ps:** Accepted at the June 2017 SASB*
- **WG P&Ps:** New TC34 P&P still under review
  - Discussed at AdCom. AI to circulate for AdCom review by August

* [https://development.standards.ieee.org/pub/view-sponsor-pnps](https://development.standards.ieee.org/pub/view-sponsor-pnps)
Secretary’s report

Questions?
Interim Treasurer’s Report

June 19, 2020 Meeting

C-K. Chou
<table>
<thead>
<tr>
<th>Date</th>
<th>SubGroup</th>
<th>Amount</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-DEC-19</td>
<td>2019 Balance</td>
<td></td>
<td>22,091.40</td>
</tr>
<tr>
<td>01-JAN-20</td>
<td>Interest Paid</td>
<td>23.78</td>
<td>22,115.18</td>
</tr>
<tr>
<td>21-JAN-20</td>
<td>Membership fees</td>
<td>3,783.45</td>
<td>25,898.63</td>
</tr>
<tr>
<td>22-JAN-20</td>
<td>Membership fees</td>
<td>1,017.15</td>
<td>26,915.78</td>
</tr>
<tr>
<td>27-JAN-20</td>
<td>Motorola Solutions food service</td>
<td>(15.00)</td>
<td>26,900.78</td>
</tr>
<tr>
<td>27-JAN-20</td>
<td>Motorola Solutions food service</td>
<td>(1,798.22)</td>
<td>25,102.56</td>
</tr>
<tr>
<td>27-JAN-20</td>
<td>Membership fees</td>
<td>600.00</td>
<td>25,702.56</td>
</tr>
<tr>
<td>01-FEB-20</td>
<td>Interest Paid</td>
<td>24.45</td>
<td>25,727.01</td>
</tr>
<tr>
<td>18-FEB-20</td>
<td>Meeting fee refund</td>
<td>(50.00)</td>
<td>25,677.01</td>
</tr>
<tr>
<td>01-MAR-20</td>
<td>Interest Paid</td>
<td>24.71</td>
<td>25,701.72</td>
</tr>
<tr>
<td>01-APR-20</td>
<td>Interest Paid</td>
<td>18.77</td>
<td>25,720.49</td>
</tr>
<tr>
<td>01-MAY-20</td>
<td>Interest Paid</td>
<td>15.64</td>
<td>25,736.13</td>
</tr>
<tr>
<td>01-JUN-20</td>
<td>Data base website</td>
<td>(419.70)</td>
<td>25,316.43</td>
</tr>
</tbody>
</table>
Membership Update

Roel Escobar
19 June 2020
Location: Binary Space
AGENDA

• Reports

• Membership Model

• Recruitment & Sustainment

• Action Items / Website
Reports

• 168 Members

• 3 members removed:
  – Masateru Ikehata, JP, Railway Technical Research Institute
  – William Scanlon, UK, Queens University
  – Pascale Bellier, CA, Health Canada

• 3 members moved to observer
  – Malcom Packer, US, L3 Harris RF Comms
  – Bjon Klauenberg, US, USAF Retired
  – Eric Van Rongen, NL, Health Council of NL
Country Demographics - June 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>91</td>
</tr>
<tr>
<td>CA</td>
<td>7</td>
</tr>
<tr>
<td>AU</td>
<td>6</td>
</tr>
<tr>
<td>JP</td>
<td>6</td>
</tr>
<tr>
<td>UK</td>
<td>6</td>
</tr>
<tr>
<td>CH</td>
<td>4</td>
</tr>
<tr>
<td>FR</td>
<td>4</td>
</tr>
<tr>
<td>GR</td>
<td>4</td>
</tr>
<tr>
<td>HR</td>
<td>2</td>
</tr>
<tr>
<td>IN</td>
<td>2</td>
</tr>
<tr>
<td>NL</td>
<td>2</td>
</tr>
<tr>
<td>AT</td>
<td>1</td>
</tr>
<tr>
<td>BG</td>
<td>1</td>
</tr>
<tr>
<td>CN</td>
<td>1</td>
</tr>
<tr>
<td>CZ</td>
<td>1</td>
</tr>
<tr>
<td>FI</td>
<td>1</td>
</tr>
<tr>
<td>HU</td>
<td>1</td>
</tr>
<tr>
<td>NZ</td>
<td>1</td>
</tr>
<tr>
<td>PL</td>
<td>1</td>
</tr>
<tr>
<td>SE</td>
<td>1</td>
</tr>
<tr>
<td>SI</td>
<td>1</td>
</tr>
<tr>
<td>TH</td>
<td>1</td>
</tr>
<tr>
<td>TR</td>
<td>1</td>
</tr>
</tbody>
</table>
Jan – March Members

**Timothy Mikulski (Radiation Safety Officer, US Army, USA)**
*Synopsis*: Currently the Army Radiation Safety Officer. Overseeing the Army radiation safety program of 10,000 occupational radiation workers on more than 100 installations world-wide, as well as deployed soldiers employing radioactive commodities, depleted uranium munitions, depleted uranium armor, laser devices, and radiofrequency and electromagnetic radiation devices.

**Pamela Dopart (Occ Health Scientist, Exponent Engineering & Scientific Consulting, USA)**
*Synopsis*: Environmental and occupational health scientist who specializes in exposure assessment methods to inform health risk assessments. Her work has involved developing exposure estimates for epidemiology studies and health risk assessments using various exposure assessment approaches, including exposure reconstruction from historical data, job-exposure matrices, determinants of exposure modeling, and simulation studies.

**Mattias Gunther (MD: Anesthesiology and Intensive Care, Researcher, Karolinska Institutet, Sweden)**
*Synopsis*: MD and researcher in field of EMF exposures. Currently working with NATO and European Defense Agency on High Power pulsed RF Exposures.

**Yi Pan (Certification and Engineering Bureau, Science and Economic Development, Senior Engineer, Canada)**
*Synopsis*: Provide RF exposure engineering support to certification group for the certification and market surveillance activities of the Bureau established pursuant to the Radiocommunication Act. Makes recommendations and conduct certification and notification reviews/audits, with focus on portable devices with SAR and power density evaluations.

**Kyle Fisher (Senior Engineer/EMF Consultant, Smith and Fisher, USA)**
*Synopsis*: He has performed a number of power density measurements at various transmitter sites and rooftops. Kyle is a member of the Society of Broadcast Engineers and an associate member of the Institute of Electrical and Electronics Engineers. He attended January ICES meeting in Plantation. He is an active member of community (No CV)
Don Nilantha Wijayasinghe (EM Technical Specialist, Radiation Protection & Nuclear Safety Agency, Australia)

Synopsis: Technical specialist – Electromagnetic Radiation Group (EMR), Radiation Protection Services Section. Electromagnetic Radiation Group within Radiation Health Services Branch conduct research, measurements and provide advice to the public and Government about the potential harmful effects of EMR in collaboration with universities, community groups and the broader health protection community.

George Chan (Senior Product Safety Engineer, ASM Pacific Technology Ltd, GBR)

Synopsis: Senior product engineer evaluating product compliance in term of safety and EMC. Updates product statutory requirements and local regulations to R&D teams and international customers.

John Sessa (Adaptive Multi-Discipline Electronic Engineer, Imanna Laboratory Rockledge, USA)

Synopsis: B.S.E.T. with more than 30 years engineering experience as Technician, Engineer, Project Manager, Program Manager, and Entrepreneur. Consulting Compliance Engineer performing pre-compliance on commercial marine equipment. Applicable standards are CISPR; EN 60945; EN 61000-X-X; Analyze noise profile on marine LED navigation lighting.

Aymen Ben Saada (Embedded Test Engineer, ACTIA Engineering Services, Tunisia)

Synopsis: electrical engineer and Ph.D. student who works on the estimation of the Specific-Absorption-Rate (SAR) and the modeling of the Human tissues to predict SAR values. I am also an EMC Graduate student member.
Giuseppe Vecchi (Director Antenna and EMC lab, Politecnico di Torino, Italy)

Synopsis: Prof. Vecchi is a Fellow of the IEEE, and member of the Board of the European School of Antennas (ESOA). He has been an Associate Editor of the IEEE Transactions on Antennas and Propagation, Chairman of the IEEE AP/MTT/ED Italian joint Chapter, and member of the IEEE-APS Educational Committee. His current research activities concern analytical and numerical techniques for analysis, design and diagnostics of antennas and devices, medical applications, and imaging.

Marco Aurelio Azpúrua Auyanet (Engineer Grup de Compatibilitat Electromagnètica, Universitat de Catalunya, Spain)

Synopsis: Researcher at GCEM-UPC. Expert in EMI measurements, time-domain and RF/uW instrumentation. IEEE Senior Member

Daniel Liu (Radiation Safety Technical Officer, Australian Radiation Protection and Nuclear Safety Agency, Australia)

Synopsis: will be working in SC1, performs work w/ RF meters and probes, assisting with developing test and measurement methods. Member of national council of EMC Society of Australia (EMCSA), a sister society of IEEE EMCS. Assistant editor of EMCSA newsletter.
Membership Model

• We must promote diversity and recruit active members
• Provide value proposition to new, prospective members while doing the same for current active members
• Reinvigorate the current member base to promote more participation
• Changes to membership models were discussed – no change. Against PnP to charge dues.
Recruiting Goals

• Recruit additional members
• Recruit additional members with medical and biology expertise
• Promote recruitment and advancement of more diverse membership
• Consider additional or alternative organization of members to more readily identify applicable personnel, including trees of teams based on scientific expertise
Website Redesign

• Improved Profiles
  – Better Organized
  – Relevant Information
• Document Organization
• Email Lists
• Membership Request (website based, ADCOM process)
• Subcommittee Areas
ATTACHMENT 9

ICES/TC95
JUNE 2020 VIRTUAL MEETING

IEEE SA STAFF UPDATE

PAT RODER
SENIOR PROGRAM MANAGER
OPERATIONAL PROGRAM MANAGEMENT
P.RODER@IEEE.ORG
(732) 465-6475
AGENDA

- Status of TC95 PARs
- Status of TC95 Standards
- IEEE SA Updates
## STATUS OF TC95 PARS

<table>
<thead>
<tr>
<th>PAR Number</th>
<th>Committee</th>
<th>Title</th>
<th>Approval Date</th>
<th>PAR Expiration</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC95.1-Cor 2</td>
<td>SCC39/C95.1 WG</td>
<td>Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300Gz – Corrigendum 2</td>
<td>6/03/2020</td>
<td>12/31/2024</td>
<td>SC and TC95 approval stage</td>
</tr>
<tr>
<td>PC95.7</td>
<td>SCC39/TC95_SC2</td>
<td>Recommended Practice for Radio Frequency Safety Programs, 0 Hz to 300 Gz</td>
<td>6/03/2020</td>
<td>12/31/2024</td>
<td>Draft Development</td>
</tr>
<tr>
<td>PAR Number</td>
<td>Committee</td>
<td>Title</td>
<td>Approval Date</td>
<td>PAR Expiration</td>
<td>Status</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>---------------</td>
<td>----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>PC95.1-2345</td>
<td>SCC39/TC95 NATO WG</td>
<td>Standard for Military Workplaces -- Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz</td>
<td>5/21/2019</td>
<td>12/31/2023</td>
<td>Draft Development</td>
</tr>
<tr>
<td>PC95.3</td>
<td>SCC39/TC95_SC1</td>
<td>Recommended Practice for Measurements and Computations of Electric, Magnetic and Electromagnetic Fields With Respect to Human Exposure to Such Fields, 0 Hz-300 GHz</td>
<td>2/6/2012</td>
<td>12/31/2021</td>
<td>Draft Development</td>
</tr>
</tbody>
</table>
## STATUS OF TC95 STANDARDS

<table>
<thead>
<tr>
<th>Standard Number</th>
<th>Year</th>
<th>Committee</th>
<th>Title</th>
<th>SASB Expiration</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1460</td>
<td>1996</td>
<td>SASB/SCC39/TC95_SC1</td>
<td>IEEE Guide for the Measurement of Quasi-Static Magnetic and Electric Fields</td>
<td></td>
<td>Inactive (incorporated into C95.3.1)</td>
</tr>
<tr>
<td>C95.1-2019/Cor 1</td>
<td>2019</td>
<td>SASB/SCC39/TC95/C95.1 Rev. WG</td>
<td>IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields, 0 Hz to 300 GHz - Corrigendum 1</td>
<td>12/31/2029</td>
<td>Active</td>
</tr>
<tr>
<td>C95.1-2345</td>
<td>2014</td>
<td>SASB/SCC39/TC95 NATO WG</td>
<td>IEEE Standard for Military Workplaces-Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz</td>
<td>12/31/2024</td>
<td>Revision PAR opened in 2019</td>
</tr>
<tr>
<td>Standard Number</td>
<td>Year</td>
<td>Committee</td>
<td>Title</td>
<td>SASB Expiration</td>
<td>Status</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>C95.3</td>
<td>2002</td>
<td>SCC39/TC95_SC1</td>
<td>IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz-300 GHz</td>
<td>12/31/2021</td>
<td>Revision PAR open; expires 2021</td>
</tr>
<tr>
<td>C95.3.1</td>
<td>2010</td>
<td>SCC39/TC95_SC1</td>
<td>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</td>
<td>12/31/2020</td>
<td>Being combined with C95.3</td>
</tr>
<tr>
<td>C95.6</td>
<td>2002</td>
<td>SCC39/TC95_SC</td>
<td>IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz</td>
<td></td>
<td>Superseded by C95.1</td>
</tr>
<tr>
<td>C95.7</td>
<td>2014</td>
<td>SCC39/TC95_SC2</td>
<td>IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz</td>
<td>12/31/2024</td>
<td>Revision PAR open; expires 2024</td>
</tr>
</tbody>
</table>
IEEE SA UPDATE

- Standards Expiration Update
- Copyright Policy Update
- Myproject Update
- WG Training Modules Available
The consent agenda for the IEEE SA Standards Board (SASB) March 2020 meeting included for transfer to Inactive-Reserved status all standards with an expiration date of 31 December 2019 for which there was not an active revision project (i.e., an SASB approved PAR for revision)

Beginning in 2021, the consent agenda for the first IEEE SA Standards Board (SASB) meeting of the year will include for transfer to Inactive-Reserved status all standards with an expiration date on or before 31 December of the previous year. Consideration for inactivation of expired standards will occur regardless of the status of any active revision projects.
COPYRIGHT POLICY

- IEEE SA has developed Copyright Slides to be presented to participants in IEEE standards development meetings
- Purpose is to familiarize participants with the IEEE SA Copyright Policy that was revised in 2019
  - Clarifies Contributions
  - When to obtain permissions
  - Clarifies when you need authorization and consent
    - [https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/Copyright_Policy_for_Participants.pdf](https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/Copyright_Policy_for_Participants.pdf)
- Training on the copyright policy is planned throughout the year
- The Copyright FAQs have been updated and are located at [https://standards.ieee.org/ipr/copyright-materials.html](https://standards.ieee.org/ipr/copyright-materials.html)
- The Copyright FAQs are divided up into three separate sections:
  - Copyright FAQs for Participants
  - Copyright FAQs for Working Group and Activity Chairs
  - FAQs on Requesting Permission for Use of Material from Approved IEEE Standards
IEEE SA launched a newly improved myProject in January 2020
- designed to bring you a new user-friendly look and feel but similar functions,
- some enhancements in areas such as the way ballot results are displayed
- adds features/edits to be in line with governance changes that have occurred since the last myProject release.

myProject Training material has been developed
- Updated User Guide
- Some Key function videos are now available (see https://development.standards.ieee.org/myproject-web/public/view.html#landing)
- Program Managers are available for further training
IEEE SA launched a new course, *Working Group Chair Fundamentals*, to empower working group participants, foster individual effectiveness, and increase the efficacy of the standards development process.

- Course is comprised of 12 modules on critical aspects of standards development, procedures, and the roles and responsibilities of the Working Group Chair.

Course became available on 8 June 2020 and is free of charge.

To access the course, go to [https://iln.ieee.org/Public/ContentDetails.aspx?id=AE404C2328DA4A39AAD7AB5117681F05](https://iln.ieee.org/Public/ContentDetails.aspx?id=AE404C2328DA4A39AAD7AB5117681F05)
Questions?
C95.1-2345 Update

Roel Escobar
19 June 2020
Location: Binary Space
Project End date is 31 Dec 2023
• Project Plan
  – Send Call for Participants
  – Coordinate with other Working Groups (NATO / DoD)
  – Coordinate w/ Operational Groups
  – Formalize EWG
  – Begin Drafts
Stakeholder Support

- DoD Transmitted EMF Radiation Protection WG (TERP WG)
  - Coordinated Comparison between C95.1-2019 and C95.1-2345
- NATO WG feedback regarding current standard and its relation to NATO operations
- USAFSAM Occupational Health
  - Comparison of Standards By Year
  - Comparison of C95.1-2345
### Terp Comparison

**Comparison of Tables in C95.1-2345-2014* and C95.1-2019 Draft**

*(Note: IEEE Std C95.1-2345™ 2014 combines the exposure limits found in IEEE Std C55.6-2002 and IEEE Std C95.1-2005)*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Table 1</strong> — Parameters $E$ and $A$ in Equation 1 (expressed as in situ electric field) for computing the dosimetric reference limits (DRLs) applying to various regions of the body; $f = 0$ Hz to 5 MHz</td>
<td><strong>Table 1</strong> — Dosimetric Reference Limits (DRLs) for electrostimulation mechanisms ($0$ Hz to 5 MHz)</td>
<td>Same</td>
</tr>
<tr>
<td><strong>Table 2</strong> — Magnetic field ERLs for exposure of the head and torso; $f = 0$ Hz to 5 MHz</td>
<td><strong>Table 2</strong> — Magnetic field ERLs for exposure of head and torso ($0$ Hz to 5 MHz) (see Figure 1 and Figure 2 (4.2.4) for graphical representation)</td>
<td>Same</td>
</tr>
<tr>
<td><strong>Table 3</strong> — Magnetic field ERLs for the limbs; $f = 0$ Hz to 5 MHz</td>
<td><strong>Table 3</strong> — Magnetic Field ERLs for the limbs ($0$ Hz to 5 MHz) (see Figure 1 and Figure 2 (4.2.4) for graphical representation)</td>
<td>Same</td>
</tr>
<tr>
<td><strong>Table 4</strong> — Electric field ERLs — whole-body exposure: $f = 0$ Hz to 100 kHz</td>
<td><strong>Table 4</strong> — Electric field ERL ($0$ Hz to 100 kHz) — Whole body exposure (see Figure 1 and Figure 2 (4.2.4) for graphical representation)</td>
<td>Same</td>
</tr>
<tr>
<td><strong>Table 5</strong> — Induced and contact current limits for continuous sinusoidal waveforms (a) $f = 0$ Hz to 3 kHz</td>
<td><strong>Table 5</strong> — RMS induced and contact current ERLs for continuous sinusoidal waveforms based on ES effects — frequencies between 0 Hz and 3 kHz</td>
<td>Same</td>
</tr>
<tr>
<td><strong>Table 5</strong> — Induced and contact current limits for continuous sinusoidal waveforms (b) $f = 3$ kHz to 100 kHz</td>
<td><strong>Table 5</strong> — RMS induced and contact current ERLs for continuous sinusoidal waveforms based on ES effects — frequencies between 3 kHz and 5 MHz</td>
<td>Same</td>
</tr>
</tbody>
</table>

### 1.3 Introduction

Based on the results of the latest ICES LRNG literature review, relevant mechanisms of interaction were found to be stimulation of excitable nervous tissues by electric fields induced within the body due to electric and/or magnetic fields and produced by contact current (frequencies between 0 Hz and...
Terp Comparison

<table>
<thead>
<tr>
<th>Table 6 — DRLs for frequencies between 100 kHz and 3 GHz</th>
<th>Table 5 — DRLs (100 kHz to 6 GHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same except frequency range extended from 3 GHz to 6 GHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 7 — ERLs for induced and contact current (mA) for continuous sinusoidal waveforms — frequencies between 100 kHz and 110 MHz</th>
<th>Table 14 — RMS induced and contact current ERLs for continuous sinusoidal waveforms (100 kHz to 110 MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same except C93.1-2014 includes Zone 2 (restricted experts only—REO) ERLs for induced and contact current (mA) for continuous sinusoidal waveforms — frequencies between 100 kHz and 110 MHz</td>
<td></td>
</tr>
</tbody>
</table>

1.3.3.3 Frequencies between 100 kHz and 6 GHz

Above 100 kHz the effect associated with exposure to CW fields transmits from electrostimulation to tissue heating, and exposures are assessed with reference to an averaging time that varies in accordance with whole body or local exposure. The frequency 100 kHz nominally represents a “thermal crossover” below which electrostimulation effects dominate, and above which thermal effects dominate for CW exposure. However, for pulsed waveforms, especially those of a low duty factor, the upper frequency at which electrostimulation has been demonstrated reaches 5 kHz. This standard contains criteria to protect against adverse electrostimulation effects for pulsed waveforms with fundamental frequencies above 100 kHz.
### Terp Comparison

<table>
<thead>
<tr>
<th>Table 5 — Zone 0 ERLs for frequencies between 100 kHz and 300 GHz (See Figure 1 for graphical representation)</th>
<th>Table 7 — ERLs for whole-body exposure of persons in unrestricted environments (100 kHz to 300 GHz) (see Figure 3 for graphical representation)</th>
<th>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 9 — Zone 1 ERLs for frequencies between 100 kHz and 300 GHz (See Figure 2 for graphical representation)</td>
<td>Table 8 — ERLs for whole-body exposure of persons permitted in restricted environments (100 kHz to 300 GHz) (see Figure 4 for graphical representation)</td>
<td>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</td>
</tr>
<tr>
<td>No table for local exposure DRLs. DRL explained in 1.3.8.3 Frequencies above 3 GHz.</td>
<td>Table 6 — Local exposure DRLs (6 GHz to 300 GHz)</td>
<td>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</td>
</tr>
<tr>
<td>No table. ERLs for localized exposure in unrestricted environments (Zone 0) explained in 4.8 Spatial peak power density ERLs for localized exposure.</td>
<td>Table 10 — Local exposure ERLs (100 kHz to 6 GHz) — persons in unrestricted environments +</td>
<td>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</td>
</tr>
<tr>
<td>No table. ERLs for localized exposure in restricted environments (Zone 1) explained in 4.8 Spatial peak power density ERLs for localized exposure.</td>
<td>Table 16 — Local exposure ERLs (100 kHz to 6 GHz) — persons permitted in restricted environments +</td>
<td>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</td>
</tr>
<tr>
<td>No table. ERLs for localized exposure in restricted environments (Zone 1) explained in 4.8 Spatial peak power density ERLs for localized exposure.</td>
<td>Table 11 — Local exposure ERLs (6 GHz to 300 GHz)</td>
<td>Different. Explanations in IEEE Std C95.1-2019™ Final Draft. B.1.2.1 Similarities and differences between this standard and IEEE Std C95.6TM-2002 and IEEE Std C95.1-2005.</td>
</tr>
</tbody>
</table>
Previous Members

Participants

At the time this IEEE standard was completed, the Technical Committee 95 Subcommittee 3 and Subcommittee 4 Working Group had the following membership:

T. Dovan, R. Kavet, Co-chairs SC3
A. Thansandote, M. Ziskin, Co-chairs SC4
Ronald Petersen, Secretary

William Bailey
David Baron
John Bergeron
Ralf Bodemann
Ayrton Brecher
Jerold Bushberg
Chung-Kwang Chou
Robert Cleveland
Rodney Croft
John D’Andrea
John DeFrank
Amnon Davdevany
Kenneth Getman
Martin Gledhill
Donald Haas
Akihisa Hirata
Makoto Ichihara
Michael Israel
Kent Jaffa
Hai Jang
Kenneth Joyner
Effymnos Karabetsos
Bertram Klimenberg
Rapt Mathur
Michael Murphy
Robert Needy
John Osepchuk
Robert Podlorsky
J. Patrick Reilly
Asher Shepard
Yakov Shkolnikov
Devashish Shrivastava
John Tattersall
Richard Tell
Paul Testagrossa
Donald Umhdenstock
Arthan Vannelli

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Max Ammann
David Baron
Ralf Bodemann
Chris Brooks
Chung-Kwang Chou
Keith Chow
Robert Cleveland
Brian Cramer
Robert Curtis
John D’Andrea
John DeFrank
Thad Dovan
Souvik Dutta
Kenneth Foster
Dona Golds
Kenneth Getman
Randall Groves
Donald Haas
James Hatfield
Akihisa Hirata
Werner Hielsi
Makoto Ichihara
Noriyuki Ikuchi
Sheila Johnston
Kenneth Joyner
Lazaros Kadar
Effymnos Karabetsos
Yuri Khersonsky
Nam Kim
Bertram Klimenberg
Joseph L. Koppinger
Michael Laxman
Greg Luri
Rapt Mathur
Marita Meltz
Michael Newman
John Osepchuk
Malcolm Packer
Ronald Petersen
J. Patrick Reilly
Brad Roberts
Michael Roberts
Ervin Root
Jesse Rosabugh
Bartem Sayogo
Yakov Shkolnikov
Walter Struppler
Kni Sze
John Tattersall
Richard Tell
Paul Testagrossa
Arthur Thansandote
Donald Umhdenstock
Arthan Vannelli
Robert Weiler
Edward Yankel
Donald Ziper
Marvan Ziskin
Main task - PC95.3 revision
28 EWG mtgs, 500+ emails, 150+ revisions
SC1 WebEx May 28 [32 people]
Chair passed to Butcher & Zollman
PC95.3 overview presented (prelim draft circulated prior to mtg.)
Within PAR timescale (end 2021) – aim mid 2021
Discussion on having more than 2 mtg./yr
  Next mtg. WebEx in late Aug 2020 TBC
ACTION - PC95.3 SC1 review and ballot ends 1 July
ACTION - Need to issue call for TC-95 ballot - C-K?

*Co-Chairs  Matt Butcher, Peter Zollman
Call to Order: The meeting was called to order at 09:00 EDT by R. Tell. D. Haes recorded the minutes. **There were up to 46 attendees at any one time during the 2 hour meeting.**

An Editorial Working Group (EWG) consisting of 8 SC2 members and the chair held meetings prior to the main SC2 meeting involving work on the revised C95.7 update version. More than 10 hours were spent online in three meetings.

The Minutes from the 21 January 2020 meeting in Plantation, FL previously distributed via e-mail were reviewed and conditionally approved with two minor changes addressing typographical errors.

Meeting topics:

- R. Tell delivered a presentation covering the topics of:
  - Status of submission of new PAR for revision of C95.7.
  - Revision of C95.7-2014 Recommended Practice on RF Safety Programs.
  - Discussion of revised Table 3 in C95.7-2014 Minimum recommended components for an RFSP based on category of the exposure environment.
  - Coordination with Power and Energy Society (PES).

- An excellent presentation on “Registry of RF Workers in the UK” by Karina Beeke (University of Birmingham, UK).
  - A comment was offered about the low numbers of participants and correspondingly low statistical significance. J. Bushberg offered a slide about statistical significance.

New business: Additional EWG meetings are needed and will be held dates and times TBD.

The next meeting is tentatively to be held January 20, 2021 in Chandler, AZ.

Adjourn: The meeting was adjourned at 11:04.
TC95 Meeting
Joint SC3 & SC4 Report
June 19, 2020
Teleconference
Joint virtual meeting of SC-3 and SC–4 took place on June 3 and 4, 2020 (two sessions).

Chaired by Alexandre Legros

55 people were in attendance.
SC – 3:  Safety Levels 0 Hz to 3 KHz

Co-Chairs: Rob Kavet
Alexandre Legros

SC - 4: Safety Levels 3 KHz to 300 GHz

Co-Chairs: Art Thansandote
Marv Ziskin

Secretary:
Auke Visser
Major Tasks of SC – 3/4

C95.1-2019  Safety Standard  (0 Hz – 300 GHz)
C95.1-2019  Corrigendum No. 1 to Correct all Errors
C95.1-2019  Publication – Published Version
Announcements to Major Regulatory Bodies
Synopsis of C95.1-2019
Revision of Synopsis
Synopsis Published
Letter to FCC re New Regulations
C95.1-2019 Corrigendum No. 2
Progress on Standards
Editorial Working Group (EWG)

- Bill Bailey
- Ralf Bodemann
- Bob Cleveland
- C-K Chou
- Antonio Faraone
- Ken Foster
- Aki Hirata
- Rob Kavet
- Alexandre Legros, Chair
- David Maxson
- John Opsepchuk
- Pat Reilly
- Ric Tell
- Art Thansandote
- Marv Ziskin
- Peter Zollman
ICES Data Base and Literature Review

Data Base & Literature Surveillance
Joe Elder

Literature Review
Antonio Faraone, Chair
Progress on Standards

Invaluable Help from IEEE Staff

Thanks to Patricia Roder
Progress on Standards

All C95.XX Standards are now available free of charge.
https://ieeexplore.ieee.org/browse/standards/get-program/page/series?id=82

Thanks to
    US Air Force,
    US Army
    US Navy
Synopsis of IEEE Std C95.1™-2019 “IEEE Standard for Safety Levels With Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz”

IEEE International Committee on Electromagnetic Safety Technical Committee 95™

ABSTRACT The newly released IEEE Std C95.1™-2019 defines exposure criteria and associated limits for the protection of persons against established adverse health effects from exposure to electric, magnetic, and electromagnetic fields, in the frequency range 0 Hz to 300 GHz. The exposure limits apply to persons permitted in restricted environments and to the general public in unrestricted environments. These limits are not intended to apply to the exposure of patients by or under the direction of physicians and care professionals, as well as to the exposure of informed volunteers in scientific research studies, or to the use of medical devices or implants. IEEE Std C95.1™-2019 can be obtained at no cost from the IEEE Get Program https://ieeexplore.ieee.org/document/8859679.

INDEX TERMS Non-ionizing radiation protection, radio frequency (RF), RF exposure, RF safety, dosimetric reference limit (DRL), exposure reference level (EFL), induced and contact currents, specific absorption rate (SAR), electric fields, magnetic fields, electromagnetic fields, (epiphegal) power density, electrostimulation, general public, restricted environment, uncontrolled environment.

BACKGROUND In 1940, the American Standards Association approved the initiation of the Radiation Hazards Standards Project under the co-sponsorship of the US Department of the Navy and the Institute of Electrical and Electronics Engineers, Incorporated (IEEE), (called the "Institute of Radio Engineers (IRE)" at the time). The first C95.1 standard was published in 1960. In 2001, the IEEE Standards Association Standards Board approved the name "International Committee on Electromagnetic Safety (ICES)" to better reflect its international membership as well as the scope of its Technical Committees (TC-TC34, addressing compliance assessment methods; and TC-39, addressing exposure safety. The scope of IEEE ICES TC34, which developed IEEE Std C95.1™-1991, 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 to non-ionizing 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 scope are contiguous with ICES." There are six TC34 Subcommittees, each of whose area of responsibility is described as follows in correspondence with its designated Subcommittee (SC) number:

SC 1: Techniques, Procedures, Instrumentation, and Computation
SC 2: Terminology, Units of Measurements, and Hazard Communication
SC 3: Safety Levels with Respect to Human Exposure, 0 Hz to 300 kHz
SC 4: Safety Levels with Respect to Human Exposure, 3 kHz to 300 GHz
SC 5: Safety Levels with Respect to Electro-Explosive Devices
SC 6: EMP Modeling and Dosimetry

IEEE Std C95.1™-2019 was prepared by SC 3 and SC 4. This synopsis is only a reference document and is not designed to replace the standard. For a better understanding of the C95.1 standard, please download a free copy through the IEEE Get Program™ (https://ieeexplore.ieee.org/document/8859679). Non-IEEE members will have to purchase a copy of the standard from the IEEE Online Catalog (https://ieeexplore.ieee.org).
Progress on Synopsis

Special Thanks to The Authors:

William Bailey
Ralf Bodemann
Jerrold Bushberg
C-K Chou
Robert Cleveland
Antonio Faraone
Ken Foster
Ken Gettman
Kevin Graf
Tim Harrington
Aki Hirata

Rob Kavet
Jafar Keshvari
B Jon Klauenberg
Alexandre Legros
David Maxson
John Osepchuk
Pat Reilly
Ric Tell
Art Thansdandote
Kenichi Yamazaki
Marv Ziskin
Peter Zollman
For those FCC exposure limit followers here is the long-awaited release of:

Resolution of Notice of Inquiry,
Second Report and Order,
Notice of Proposed Rule Making, and Memorandum Opinion and Order.
FCC Proposed Rule Making

Generation of Letter from ICES to FCC

Initial Draft Produced by:
- C-K Chou
- Ric Tell
- Rob Kavet
- Ken Foster
- David Maxson
- Marv Ziskin

Significant Additional Input:
- Antonio Faraone
- Bob Cleveland
- Bob Weller

Additional Step:
- IEEE Legal Approval
- Submission to FCC
International Committee on Electromagnetic Safety

May 29, 2020

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Dear Ms. Dortch,


We hope that our comments will be helpful.

Sincerely,

Jafar Keshvari, Chairman, IEEE/ICES
Jafar.keshvari@aalto.fi

Adjunct Professor of Bio-electromagnetics
Aalto University, Helsinki-Finland
Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of:

Targeted Changes to the Commission's Rules
Regarding Human Exposure to Radiofrequency Electromagnetic Fields

) ET Docket No. 19-226

Comments of the IEEE International Committee on Electromagnetic Safety
on the
NOTICE OF PROPOSED RULE MAKING

May 29, 2020

The Institute of Electrical and Electronics Engineers (IEEE) International Committee on Electromagnetic Safety (ICES) is pleased to respond to the Targeted Changes to the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields. We appreciate the Commission's responsibility to maintain safety limits that are based on the best available scientific evidence.

ICES is composed of experts from many fields, including engineering, medicine, biology, and public health. Membership is open to all interested parties internationally. ICES develops standards and recommended practices relating to the safe use of electromagnetic energy, and its standards development process, in accordance with IEEE rules, is rooted in consensus, due process, openness, rights to appeal, and balance. ICES adheres to and supports the principles and requirements of the World Trade Organization's (WTO) Decision on Principles for the Development of International Standards, Guides, and Recommendations [https://standards.ieee.org/develop]. ICES maintains a scientific-literature database and conducts an ongoing evaluation of new publications on the subject of human exposure to radiofrequency (RF) electromagnetic fields.

ICES responds to the Commission's proposals. The following position statements represent the views of ICES. They do not necessarily represent the views of IEEE as a whole, its global membership, or other IEEE Organizational Units.
In summary

Item 1: **VLF/IF Limits.** The FCC has proposed to adopt limits similar to the (ICNIRP 2010) guidelines at frequencies between 3 kHz and 10 MHz. ICES believes that such a proposal lacks clear and compelling scientific justification, and recommends that the Commission adopts an alternative such as IEEE Std C95.3™-2013. Unlike the (ICNIRP) guidelines, the IEEE standard provides correspondence between external exposure limits and internal dose limits, such that compliance can be conducted accurately with a straightforward environmental measurement. The Commission’s proposed approach, lacking this correspondence, may likely impose restrictions that could unnecessarily burden operators in this spectrum.

Item 2: **Localized Exposures above 6 GHz.** ICES recommends that the FCC adopt a more conservative curve for localized exposure limits above 6 GHz.

Item 3: **Averaging Time.** The choice of averaging times in Table 3 of the FCC Notice of Proposed Rulemaking is based on a goal of limiting the peak temperature rise in tissue from an “impulse.” This proposal may be overly conservative, inefficient, and inconsistent. A simple remedy is to limit the fluence for brief, high-fluence pulses, and to apply a 6- or 30-minute averaging time to waveforms lacking high-fluence pulses. In addition, questions may be raised by the potentially inconsistent whole-body averaging times set forth in Table 3 of 47 CFR §1.1310(e).

Item 4: **Averaging Area above 6 GHz.** The power density averaging area of 1 cm² is based on an earlier version of the IEEE C95.1™ standard, IEEE C95.1™-1991, which was superseded by IEEE C95.1™-2005, and again by IEEE C95.1™-2013. Adopting the updated averaging area of 4 cm² and the SAR limits of the IEEE C95.1™-2013 standard (as well as the 2020 ICNIRP Guidelines) would not only reflect the underlying science based on substantial improvements in RF dosimetry over the last two decades, but would also avoid a discontinuity at 6 GHz caused by the transition from spatial-peak SAR to localized power density limits.

Item 1: **Frequencies between 3 kHz and 100 kHz**

Excerpts from FCC Notice Paragraphs 122-124

122. ... We noted that some inductive wireless chargers operate at frequencies below 100 kHz, and Commission staff has been approached by parties seeking guidance on how to determine compliance for wireless car chargers generally operating at similarly low frequencies. We are aware of three extant guidelines for RF exposure that extend to frequencies below 100 kHz: ICNIRP 2010, IEEE Std C95.1™-2005, and more recently, Health Canada Safety Code 6 (2015). All of these guidelines are aimed at prevention of electrostimulation due to RF electric fields induced internally within the human body in the...
C95.1-2019 Corrigendum 2

Discovery of errors:
  in Figures 1 and 2
  of C95.1-2019
Figure 1 — Graphical representations of the ERLs of Table 2, Table 3, and Table 4 for electric and magnetic fields — persons in unrestricted environments.
Figure 2 — Graphical representations of the ERLs of Table 2, Table 3, and Table 4 for electric and magnetic fields—persons in restricted environments
C95.1-2019 Corrigendum 2

Correct Graphs drawn by:
   Ric Tell
   Peter Zollman

Significant Input by:
   David Maxson
   Tim Karabetsos
C95.1-2019 Corrigendum 2

Discovery of errors in Figures 1 and 2  April 15
Correction of Figures 1 and 2  April 16
Application for Project Authorization Request (PAR)  April 22
IEEE Approval of PAR  June 3
SC 3-4 Final Vote  June 12
TC95 Vote  June 19
SCC39 AdCom Approval  June 22
Formation of IEEE-SA Ballot Group  June 23 – July 8
IEEE Mandatory Editorial Coordination  June 23 – July 8
IEEE-SA Vote  July 8 – Aug 7
Submission of Cor 2 to IEEE RevCom for Approval  Aug 10
Approval of Cor 2 by IEEE SASB  Sept 24
Publication of C95.1-2019 Corrigendum No. 2  Last Quarter of 2020
Technical Presentations

Non-invasive brain stimulation; relevance to standards  Bikson

Comparison of new ICNIRP RF guidelines with Ours  Chou/Tell/Foster

Summary of the FCC’s NPRM and associated issues (VLF/LF)  Kavet

Contact current limits alignment with E-field ERLs  Kavet/Tell
Technical Presentations

ICNIRP Guidelines
- Basic Restriction (BR)
- Reference Level (RL)
- General Public
- Occupational Workers

IEEE C95.1-2019
- Dosimetric Reference Limit (DRL)
- Exposure Reference Level (ERL)
- Persons in Unrestricted Environments
- Persons in Restricted Environments
Technical Presentations

All Presentations are included in the minutes of the SC3-4 Meeting
SC–5 EM Safety with Respect to Electric Blasting Caps
Status C95.4–2002

- Jan 2020 – discussions were held to withdrawal C95.4 doc.
- May 2020 – SC5 voted to withdrawal C95.4
- Jun 2020 – TC95 Call to ballot completed (30 of the 147 members responded they would vote)
- Jun 2020 – Call to vote email sent Jun 2020 with a respond date of 8 Jul 2002 (so far 20 members have responded)
- No SC5 meeting was held in Jun 2020
SC6 Activity

- Two WGs are active; one WG will be moved to SC3.
- Four technical presentations are given in SC6 meeting.
- WG for LF non-uniform exposure is under discussion.
ICNIRP

- ICNIRP Data Gap document has been published.
- Research agenda of ICES and ICNIRP gap documents are encouraged to read for scientific rationale.
- Revision of LF guidelines was listed in the next 4-year project (2020-2024).
NEMA Website Analysis Form

Completed by NEMA\Sr. Digital Media Manager and provided to website liaison for their review and feedback.

<table>
<thead>
<tr>
<th>Year:</th>
<th>2020</th>
<th>Jan-May</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website:</td>
<td>ICES (<a href="http://www.ices-emfsafety.org">http://www.ices-emfsafety.org</a>)</td>
<td></td>
</tr>
<tr>
<td>Liaison:</td>
<td>C-K. Chou</td>
<td></td>
</tr>
<tr>
<td>Reviewed By:</td>
<td>Bill Green</td>
<td></td>
</tr>
</tbody>
</table>

Contents

2. Website Analytics Summary & Comparison ................................... Error! Bookmark not defined.
5. Top Search Terms (Jan. 1, 2020 – May 31, 2020) ............................... 3
1. Website Analytics Charts (Jan 1 – May 31, 2020)

<table>
<thead>
<tr>
<th>Top 10 Pages</th>
<th>Pageviews¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>/home/</td>
<td>3,076</td>
</tr>
<tr>
<td>/electromagnetic-energy/</td>
<td>2,056</td>
</tr>
<tr>
<td>/expert-reviews/</td>
<td>1,181</td>
</tr>
<tr>
<td>/committees/tc95-subcommittees/</td>
<td>364</td>
</tr>
<tr>
<td>/the-ieee-std-c95-1-2019-is-published/</td>
<td>325</td>
</tr>
<tr>
<td>/publications/standards/</td>
<td>264</td>
</tr>
<tr>
<td>/about-us/</td>
<td>237</td>
</tr>
<tr>
<td>/home/meetings/</td>
<td>181</td>
</tr>
<tr>
<td>/publications/reports/</td>
<td>175</td>
</tr>
<tr>
<td>/dr-jafar-keshvari-new-chair-of-ices/</td>
<td>174</td>
</tr>
</tbody>
</table>

2. Website Analytics Summary & Comparison

<table>
<thead>
<tr>
<th></th>
<th>Pageviews</th>
<th>Sessions²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 1 – May 31, 2020</td>
<td>10,468</td>
<td>5,922</td>
</tr>
<tr>
<td>Jan 1 – May 31, 2019</td>
<td>7,148</td>
<td>4,536</td>
</tr>
<tr>
<td>% Change</td>
<td>+46.45%</td>
<td>+30.56%</td>
</tr>
</tbody>
</table>

3. Traffic Sources (Jan 1 – May 31, 2020)

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>25.5%</td>
</tr>
<tr>
<td>Referral</td>
<td>21.1%</td>
</tr>
<tr>
<td>Search</td>
<td>53.4%</td>
</tr>
</tbody>
</table>

4. Top Referral Sites (Jan 1 – May 31, 2020)

<table>
<thead>
<tr>
<th>Sites</th>
<th>Pageviews</th>
<th>Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>trafficbot4free.xyz</td>
<td>522</td>
<td>203</td>
</tr>
<tr>
<td>m.facebook.com</td>
<td>351</td>
<td>284</td>
</tr>
<tr>
<td>grouper.ieee.org</td>
<td>136</td>
<td>50</td>
</tr>
<tr>
<td>blogs.scientificamerican.com</td>
<td>124</td>
<td>56</td>
</tr>
<tr>
<td>mail.google.com</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>baidu.com</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>habr.com</td>
<td>75</td>
<td>57</td>
</tr>
<tr>
<td>m-habr-com.cdn.ampproject.org</td>
<td>58</td>
<td>46</td>
</tr>
<tr>
<td>spectrum.ieee.org</td>
<td>51</td>
<td>33</td>
</tr>
<tr>
<td>linkedin.com</td>
<td>50</td>
<td>39</td>
</tr>
</tbody>
</table>

¹ Pageviews: The total number of pages viewed. Repeated views of a single page are counted.
² Sessions: The period time (not greater than 30 minutes) a user is actively engaged with your website.
5. Top Search Terms (Jan 1 – May 31, 2020)

<table>
<thead>
<tr>
<th>Keyword</th>
<th># (Clicks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>electromagnetic energy</td>
<td>296</td>
</tr>
<tr>
<td>ieee ices</td>
<td>180</td>
</tr>
<tr>
<td>electromagnetic energy facts</td>
<td>86</td>
</tr>
<tr>
<td>what is electromagnetic energy</td>
<td>76</td>
</tr>
<tr>
<td>jafar keshvari</td>
<td>46</td>
</tr>
<tr>
<td>facts about electromagnetic energy</td>
<td>39</td>
</tr>
<tr>
<td>international committee on electromagnetic safety</td>
<td>37</td>
</tr>
<tr>
<td>the behavior of electromagnetic energy is dependent upon its</td>
<td>28</td>
</tr>
<tr>
<td>electromagnetic energy examples</td>
<td>26</td>
</tr>
<tr>
<td>ieee c95.1</td>
<td>21</td>
</tr>
</tbody>
</table>