Approved Minutes
for Hybrid Meeting
IEEE/ICES TC95 Subcommittee 2
Terminology, Units of Measurements, and Hazard Communications
1300 – 1500 h BST (British Summer Time)/ 1200 – 1400 UTC/ 0800 – 1000 EDT Friday, 16 June 2023

I. Call to Order

- The meeting was called to order at 8:15 EDT by R. Tell. D. Haes recorded the minutes.

2. Welcome and Introduction

- See Appendix A for presentation by the Chairs. Attendees were asked to “sign-in” using the chat feature of the meeting platform. See Appendix B for list of registered attendees who were either in-person in Oxford, UK, or logged onto the online TEAMS platform provided.
- There was a high of 21 VIRTUAL, and 14 in-person attendees; The total attendance was 35 at the meeting.
- SC2 has 22 members and 11 observers who have attended at least 2 meetings out of the last 4 scheduled SC2 meetings as of June 16, 2023.

3. IEEE Patent and Copyright requirements

- IEEE SA’s copyright policy is described in Clause 7 of the IEEE SA Standards Board Bylaws and Clause 6.1 of the IEEE SA Standards Board Operations Manual; Any material submitted during standards development, whether verbal, recorded, or in written form, is a Contribution and shall comply with the IEEE SA Copyright Policy.
- The foregoing [copyright policy] information was provided and the copyright slides were shown (or provided beforehand).

4. Approval of Agenda: The DRAFT AGENDA circulated via e-mail by R. Tell to the members prior to the meeting was reviewed and approved (D. Maxson/M. Butcher) (See slide pack, Appendix A).

5. Approval of the Minutes from the January 17, 2023, hybrid meeting (online and in-person in Chandler, AZ).
The Minutes from the January 17, 2023, hybrid meeting (online and in-person in Chandler, AZ), previously made available via e-mail, were reviewed, and approved without changes. (R. Gallamoza/M. Butcher). (APPROVED MINUTES are posted on the ICES / SC2 website).

NOTE: At the privilege of the chairs, the “New Business” topic “Who is Responsible for Implementing RF Safety Plans at a Multi-Employer Site?” offered through a presentation by R. Curtis was taken out-of-order to accommodate local safety schedules. See Appendix C for slides.

- After the presentation a brief discussion developed with D. Maxson, R. Curtis, and R. Tell regarding slide #16, Appendix C; reproduced as shown below:
  - (20 April 2021) (4) Mitigation. (i) … specific mitigation actions are required for fixed RF sources to the extent necessary to ensure compliance with our exposure limits, including the implementation of an RF safety plan, restriction of access to those RF sources, and disclosure of spatial regions where exposure limits are exceeded.
  - (4 Dec 2019) FCC 19-126, par. 102 : “…while we also agree that a site safety plan may be an effective part of an acceptable routine evaluation, we do not adopt such a measure as a required component. Because each site is different, our rules are flexible about how to prevent access to spatial regions where the RF exposure limits are exceeded and what mitigation measures are adequate for each specific circumstance.

- While superficially it appears there is a contradiction within FCC guidance regarding the requirement (per se) of an RF Safety Plan, D. Maxson explained that latter FCC quoted section of a paragraph begins with To avoid oversignage (sic) and confusing signage, and the section has more to do with Mitigation Measures to Ensure Compliance with Exposure Limits.

6. Meeting topics:

- Publication of IEEE C95.7-2022 (what is new). R. Tell mentioned the latest publication of the C95.7 Standard and encouraged all members to obtain their free copy through the IEEE GET™ Program.

- Development of guidance for EME alerting signs (0 Hz to 300 GHz) with focus on frequencies below 100 kHz.
  - D. Haes presented slides #9 through #16 (see Appendix A) encouraging the SC to start planning an update to C95.2-2018 to include static magnetic and LF signs for personnel and concomitant EME hazards.
  - D. Maxson suggested the “touch” symbol be improved to better visualize the actual resulting injury (e.g., shocks).
  - ACTION ITEM: Develop working group (D. Maxson chair) to acquire/develop additional symbols to properly identify hazards.

- W. Bailey suggested perhaps the absence of signs is a greater hazard than an excess of signs.

- R. Tell bemused the term “structures” in the SCOPE of C95.7-2022, and wondered aloud what appropriate signage, and location for placement, would be for a hypothetical crane dangling a metal rope-cable near an AM Broadcast tower? Not only could stray voltages/currents exist in
the cable, but also any nearby unenergized conductors (e.g., 60 ± Hz “AC power”) which are insufficiently or remotely grounded.

7. New business

- **Who is Responsible for Implementing RF Safety Plans at a Multi-Employer Site?**
- **PAR Study Group for EME alerting signs guidance.**
  - The members present were quizzed by the Chair concerning the priority of the suggested update of signage compared to the recent suggestions to prepare guidance documents to C95.7-2022. While most members expressed no opinion, M. Butcher suggested an incremental approach.
  - M. Butcher presented slides regarding signage titled “Signs, signs everywhere …” (see **Appendix D**).
  - R. Tell asked the members present if this type of issue with signage occurs outside the US? There was a span of silence indicating not.
  - W. Bailey mentioned guidance with signs for a wide variety of potential exposure conditions and sources are published in tables by the medical device manufacturers.
  - P. Zollman suggested a simple sign with a “QR code” updated with current safety information.
- **Proposed technical presentations on EME safety programs.**
  - D. Haes mentioned the Chairs reached out to the MIT Radiation Protection Program and other members of the HPS NIR Section in attempt to organize an online webinar concerning use of the C95.7 documents in their in-use NIR safety programs; preferably, the Static Magnetic Field Safety policy presented to the HPS and IRPA in 2022 with no response.
  - Other items/interests:
    - R. Tell mentioned that developing new Guidance Documents, including recommended sample EME SPs, is top priority; followed by LF signs.
    - P. Zollman mentioned the need for RF Safety Programs for Amateur Radio Operators.
      - **ACTION ITEM:** R. Tell and P. Zollman to take the “first step” in gauging the intent of the SC through online resources.

8. **Time and place of next meeting**

- C-K. Chou mentioned the ADCOM is considering holding the next ICES meeting at The University of Texas at San Antonio, January 2024. This would be a “hybrid” event.

9. Adjourn

- The meeting was adjourned at 9:53 BST (unanimous).

**ATTACHED APPENDICES**

- APPENDIX A: SC2 Presentation.
- APPENDIX B: Attendees.
- APPENDIX C: R. Curtis slides.
- APPENDIX D: M. Butcher slides.
Welcome to the IEEE TC95-SC2 Meeting
16 June 2023

Subcommittee on Terminology, Units of Measurements, and Hazard Communications
A subcommittee within the International Committee on Electromagnetic Safety
Under the auspices of the IEEE Standards Association

What is ICES SC2?

SC2 has the name
Subcommittee 2 on Terminology, Units of Measurement, and Hazard Communications
Consists of around 100 "signed up" members with 46 individuals having attended at least two of the last four meetings (since 6/30/2021).

Chair, Ric Tell (rtell@radhaz.com)
Vice Chair/Secretary, Don Haes (donald_haes_chp@comcast.net)

3. IEEE Patent and Copyright requirements

4. Approval of draft Agenda
5. Approval of Minutes from Jan 17, 2023

6. Meeting Topics

- Publication of IEEE C95.7-2022 (what is new).
- Development of guidance for EME alerting signs (0 Hz to 300 GHz).
  - With focus on frequencies below 100 kHz.

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5. Approval of Minutes from Jan 17, 2023

6. Meeting Topics

- Updating IEEE Std C95.7-2022
- Development of guidance for EME alerting signs (0 Hz to 300 GHz).
  - With focus on frequencies below 100 kHz.

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6. Meeting Topics

- Updating IEEE Std C95.2™-2018
- Donald L. Haes, Jr., Vice Chair

Presented to ICES/TC95 Subcommittee 2 on Terminology, Units of Measurement, and Hazard Communications

June 16, 2023
Oxford, UK and WebEx; 1300-1500 British Summer Time or 0800-1000 EDT

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6. Meeting Topics

- Updating IEEE Std C95.2™-2018

1.1 Scope

This standard specifies the design of symbols denoting the incidence of radio-frequency (RF) electromagnetic energy in the frequency range from 3 kHz to 300 GHz. The standard also specifies the use of these symbols in signs and labels intended to warn workers and the public of the presence of potentially hazardous levels of RF energy and other hazards that may arise from RF energy, such as RF induced currents, shocks, or burns. Guidance on the application and placement of these signs in operational settings is not within the scope of this document.

5. Design and use of advisory signs

IEEE C95.7™-2022 Standard for Electromagnetic Energy Safety Programs, 0 Hz to 300 GHz

1.1 Scope
This standard presents the required elements for the development, implementation, and administration of electromagnetic energy (EME) safety programs (SPs), in the frequency range of 0 Hz to 300 GHz. SPs can help mitigate established health and safety risks that might arise from unintended interaction of electromagnetic fields (EMFs), currents, and/or contact voltages with a) people (human exposure), and/or b) electronics, materials, substances, or structures (concomitant EME hazards).

The conundrum with the current C95.2 version:

- The frequency band of interest does not match IEEE C95 series of documents; i.e., > 0 Hz.
- No guidance for safety signage to "help mitigate safety risks that might arise from unintended interaction of electromagnetic fields (EMFs), currents, and/or contact voltages with electronics, materials, substances, or structures (concomitant EME hazards)."
  - E.g., IMDs may be adversely affected by the presence of electromagnetic fields at levels below the allowable general public exposure limits.
  - Strong static magnetic fields can attract ferromagnetic surgical implants, and other objects such as gas cylinders, tools, etc.
- Without proper guidance and communication, signs often chosen out of ignorance.

Observed Safety "DO-ALL" Sign in Use
Observed Static Magnetic Field Signs in Industry

Image of static magnetic field warning signs.

Observed “Other NIR” Signs in Industry

Image of NIR warning signs.

Observed “Other Radiation” Signs in Use

Image of radiation warning signs.

Document Needs

- Revision down to 0 Hz.
- Symbols for static and LF.
- Sample signs for concomitant EME hazards.
- Other?
7. New Business:
- Who is Responsible for Implementing RF Safety Plans at a Multi-Employer Site?
- Technical presentation on EME safety programs by Bob Curtis.

7. New Business:
- PAR Study Group for EME alerting signs guidance.

7. New Business:
- Proposed technical presentations on EME safety programs.
- Other items/interests?

8. Time and Place of Next Meeting:
9. Adjourn - Thank you

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Who is responsible for implementing an RF Safety Plan at Multi-Employer Sites?

FCC and OSHA Enforcement to Motivate Adoption of C95.7 Elements

Bob Curtis, RFSafetyCompliance.com  
June 16, 2023

IEEE C95.7 is an Industry Standard for EME Safety Plans

Some Regulators can enforce industry standards (e.g., National Electrical Code).

MAIN ELEMENTS
- Policy
- Locations of RF Restricted Areas
- Procedures for Access
- Signs & Barricades
- Training
- Program Audits

Example RF Plan in C95.7 shows they can be simple – Only 3 to 5 Pages
Plans become more complicated when they involve multiple Employers

IEEE C95.7 is an Industry Standard for EME Safety Plans

- Each Employer should have its Own Plan.
- A site with multiple Employers needs a Site Plan!

Who is responsible for the RF Safety plan for Multi-Employer sites?

Example: Building roof tops and towers with cellular and TV/radio antennas.

Multiple Employers

Property Owner
  Employees responsible to manage, maintain and inspect property.

Site Manager
  Contracted by Property Owner to manage the site.

Site Maintenance Contractors
  Subcontracted by Site Manager to perform maintenance on the roof/tower.

Licensees
  Employees responsible to operate transmitters, install/maintain antennas and inspect sites.

Licensee Contractors
  Contracted by Licensees for on-site work.

Site RF Safety Plans require agreement by all Employers

- Problem – Waiting for the “responsible” Employer to take the lead.
  - Licensees assume the Site Manager should implement the site Plan since only the Site Manager can control all Employers at the site.
  - Property Owner/Site Manager are not Licensees and are not responsible for FCC compliance.
    (FCC does expect them “to allow” Licensees to take steps to comply.)

- Solution – Consider ways to motivate cooperation from all Employers
  - Convince Property Owner/Site Manager to require agreement to a site RF Safety Plan as a condition for occupying the property.
  - Convince government safety agencies to enforce some EME plan elements.
    A few example enforcement cases can alert Employers and Insurance Carriers.
    (FCC covers Licensees in the US; OSHA covers most all other Employers.)
**Suggestion from FCC to Licensees:**
Get agreement or mount antennas somewhere else.

27. We also recognize that many licensees do not control all of the sites at which their antennas are located. However, licensees cannot walk away from their obligations on this basis. Such leasing arrangements are contractual, and licensees can provide for owner attention to this obligation, including responsibility for any losses due to their failure to maintain compliance, as specific provisions of the lease. (FCC A.27 Licensee Obligations and Landlord Contractual Responsibilities)

**Convince Employers to Establish a New “Norm”**

If you cannot get agreement to a Site RF Safety Plan:

- **Licensees:** Mount antennas somewhere else.
- **Contractors:** Don’t work at the site.
- **Property Owners:** Don’t lease the space or accept the contractor.

May need Government to help motivate Employers to adopt the new “norm”.

**Government enforcement of RF safety elements.**

**MAIN SAFETY ELEMENTS**

- **Policy**
- **Locations of RF Restricted Areas**
- **Procedures for Access**
- **Signs & Barricades**
- **Training**
- **Program Audits**

Some can enforce C95.7 as an industry standard. (e.g., National Electrical Code).

**FCC and OSHA can enforce some elements under existing regulations.**

**FCC can enforce RF mitigation elements similar to C95.7 elements.**

**“Positive Access Controls”**
Identify RF restricted areas and implement controls, such as locked gates to prevent persons from entering RF areas where they can be over-exposed. 47 CFR 1.1307(b)(4)(iii)

**Power-reduction Procedures or Lockout/Tagout**
As necessary to prevent excessive exposures while in restricted areas. 47 CFR 1.1307(b)(4)(v) and (vi)

**RF Signs**
FCC specifications, such as describing “Behavior necessary to comply” to limits. 47 CFR 1.1307(b)(4)(vi)

**RF Training**
"Instant training" via signs is not sufficient training. (Note C3.106)
Training must be provided to all persons who access RF restricted areas including for temporary maintenance activities. 47 CFR 1.1310(a)(2)(ii)

Note: An “RF Safety Plan” ensures required mitigation actions are implemented, maintained and effective.
OSHA can enforce standards requiring elements of a C95.7 RF Plan

Construction “Accident prevention responsibilities” 1926.20(b)(1)
Maintain programs “necessary to comply” (i.e., to provide safe work to employees). Applies to construction and maintenance of property (repairing roof, painting tower).
- Inspections (audits) - 1926.20(b)(2)
  Programs include required inspections of the job site made by competent persons.
- Training 1926.20(b)(2)
  Train employees to recognize and avoid unsafe conditions and the regulations applicable to their work environment to control or eliminate hazards. (Some plans require documented training).

General Industry Standards include:
- Lockout/Tagout of Hazardous Energy 1910.147
  Lockout/tagout of power during maintenance to prevent exposure to hazardous energy.
- Signs and Tags 1910.145, 1926.200
  Identify hazards and post signs to warn of hazards.
- Personal Protective Equipment 1910.132
  Requires PPE for personal protection when exposed to hazards.
- Access to Employee Exposure and Medical Records 1910.1020
  Allow employees to see EME exposure monitoring results.
- Training Specific training requirements are included in specific standards, e.g. electrical. Many require documentation of training and written safety programs.

OSHA Multi-Employer Citation Policy CPL 2-0.124 can help.

Simple OSHA inspection question to:
Site Manager: Have you reviewed the Lockout/Power-Down Safety Program of your tower maintenance contractor?
Are you cooperating in the Lockout/Power-Down Safety Program of the antenna maintenance contractor?

If “No”, OSHA can consider citing the Site Manager and both Maintenance Contractors per CPL 2-0.124.

- The Site Managers are considered “Controlling Employers” since they control the contract and have “the power to control safety and health violations or require others to correct them”.
- Controlling Employers “must exercise reasonable care to prevent and detect (OSHA) violations on the site”.

Enforcement should motivate Site Managers to have a Site RF Safety Plan since they are partially responsible for the safety of their maintenance contractors’ employees.

Companies are still responsible when contracting out hazardous activities.

Limited enforcement until guidance is given to Compliance Officers
Guidance helps officers; also helps Employers to know how to comply.

Guidance being considered for US:
- FCC OET Bulletin 65 updates
- FCC enforcement guidance
- OSHA Technical Manual for compliance officers
- OSHA Standards Interpretation Letters

Should SC2 assist in developing guidance?

FCC Requirements for Exposure Mitigation [47 CFR 1.1307(b)(4)]

(20 April 2021)
(4) Mitigation, (i) ... specific mitigation actions are required for fixed RF sources to the extent necessary to ensure compliance with our exposure limits, including the implementation of an RF safety plan, restriction of access to those RF sources, and disclosure of spatial regions where exposure limits are exceeded.

(6 Dec 2019)
FCC 19-126, par. 102 : ... "while we also agree that a site safety plan may be an effective part of an acceptable routine evaluation, we do not adopt such a measure as a required component. Because each site is different, our rules are flexible about how to prevent access to spatial regions where the RF exposure limits are exceeded and what mitigation measures are adequate for each specific circumstance."
If any RF mitigation action is required, such as:
- "Positive Access Controls"
- Power-reduction Procedures or Lockout/Tagout
- RF Signs
- RF Training

Then an “RF Safety Plan” is necessary to implement the required actions, even if the plan is not as comprehensive or compliant with C95.7.

For example, You must at least describe:
- What are the access controls, procedures, training, signs.
- Who is responsible for implementing, maintaining and reviewing the effectiveness of the actions
- Typically, the Plan must be written, especially if multiple Employers are involved.

My Conclusion – Yes!

Per Lockout/Tagout, the Climber must lockout all broadcast antennas for the duration of climb to change the lightbulb at top.

Is it an acceptable alternative to have formal written procedures signed by all involved Employers (maintenance contractors, transmitter operators, Licensees)?

We give an example in C95.7

Is the procedures alternative to Lockout acceptable to FCC, OSHA, SC2?

Must the power-down procedures be written? What if they involve multiple Employers?

Is this acceptable to FCC, OSHA, SC2? -- NO SIGNS ON THE TOWER

Signs only at access Points; Safety Sheet shows RF Boundaries

47 CFR 1.1307(b)(iv) ... If signs are not used at the occupational exposure limit boundary, controls or indicators (e.g., chains, railings, contrasting paint, diagrams, etc.) must designate the boundary where the occupational exposure limit is exceeded.
Confusing Safety Alert Signs Violate OSHA Standards

Which are more helpful to workers?

OSHA can cite Employers when required signs are not effective.

Stay-back distance is much greater for public and workers not trained in RF.

FCC adopted two sets of RF exposure limits

Controlled/Occupational limits for workers
“aware of and in control” of their RF exposures,
vs. Uncontrolled/General Public limits

Is this acceptable to FCC, OSHA, SC2? - REQUIRED TRAINING

Is the RF Safety Sheet sufficient curriculum for tower workers?

Does it allow workers to be “aware of, and in control” of their exposures?

Can it be used by Employers to certify workers for occupational limits?

What is acceptable to FCC, OSHA, SC2?

This site uses Caution labels high on the pole just below the antennas.

Alternatively, the signs could be at the base of the pole but state the location of the RF hazard area.

Or do we require both places?
What is acceptable for assessing exposures

- Direct Measurement
- Risk Tilt Modelling
- IXUS Modelling

What will regulators accept for “time averaging” versus “worst case” models for beamed 5G?

Who is responsible for implementing the Site RF Safety Plan?

EME safety plans protect all Employers against:
- Injuries
- Liability claims
- FCC/OSHA citations
- Higher insurance costs and
- Bad press and image.

All Employers involved in the Plan

But we need decisions from regulators to help.

Proposed SC Projects?

- Enforcement checklists and guidance for regulatory agencies for different countries.

- Assistance in interpretations of standards e.g., Signage, Multi-employer sites, Lockout, Measuring/modelling 5G exposures.

RFSafetyCompliance.com - Developing RF Safety Plans since 1998

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1. Selected as OSHA’s National RF Expert for 27 years
2. Represented OSHA in developing new standards for FCC, IEEE/ANSI, ICNIRP
3. Initial (1998), and still active in developing C95.7 standard on RF Safety Plans

Richard Curtis – RF and enterprise software engineering
1. 15 years RF safety experience, including RF Safety plans, EME and Intermodulation studies (RF Safety Compliance, SiteSafe, Velocitel)
2. 9 years’ experience in implementing enterprise software solutions for Fortune 500 companies
Signs, Signs, Everywhere Signs

But not very helpful...

...and missing where needed

Thank You
For your attention.