

**REPORT OF THE RF SAFETY COMMITTEE
TO THE
ARRL BOARD OF DIRECTORS**

January 2022

The RF Safety Committee participated in the following areas over the past six months:

1. RF Safety Committee Activities.
2. Monitoring current events and scientific studies regarding RF Safety.
3. Participation in the scientific RF Safety community.
4. Administrative issues.

1 RF Safety Committee Activities

- 1.1 A subset of the Committee, that includes Dr. Lapin, Dr. Siwiak, Mr. Tell and Mr. Butcher, has been meeting regularly with a group from the RSGB to discuss methods of conforming with RF exposure regulations. The RSGB approached the ARRL RFSC because their regulatory agency, Ofcom, is in the process of making updates to their RF exposure regulations that will require radio amateurs to comply for the first time. We have shared our experiences in negotiating with our regulator, communicating the topic with our membership and have been jointly developing tools for performing exposure analyses.
- 1.2 A new structured plan for ARRL RF Safety publications is being put into effect. The ARRL Handbook will have a general discussion of why RF safety is important, the history of RF exposure research and safety standards, an explanation of the FCC exposure regulations and an introduction into the simplest forms of exposure analysis and simple forms of mitigation for stations that are analyzed to have the potential for overexposure. The ARRL Antenna Book will concentrate on more complex methods of analyzing exposure, including the use of near-field antenna modeling, spatial averaging, the use of the correct ground parameters to accurately assess exposure, an introduction to pre-assessed configurations, a discussion of limb currents, which are not regulated by the FCC but are included in an FCC Notice of Proposed Rulemaking and may turn into new additions to the exposure rules in the future, and other more complex exposure topics. A potential rewrite of the ARRL book, *RF Exposure and You*, will contain all of these topics plus additional pre-assessed configurations, discussions of ways to modify a station to lessen human exposure, proximity detectors to automatically modify a station's operation if a person is detected to be in a high exposure region and ways to analyze multiple transmitter situations, such as Field Day.
- 1.3 The Committee has been rewriting the FCC publication OET Bulletin 65 Supplement B, **Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, *Additional Information for Amateur Radio Stations***. Most sections of the new document have been completed and it currently has 72 pages of single-spaced text. Some sections have yet to be written and decisions will soon be made whether they are necessary. The document is serving as an adjunct to the main OET Bulletin 65, which has yet to be released.
- 1.4 One topic that has caused a lot of discussion among the Committee and with the FCC is the regulations related to Positive Access Control. The FCC has very specific language about the mitigation steps that must be taken if regions of potential excessive exposure are identified. This

includes actions such as erecting fences and displaying alerting signs. While this may make sense for a facility such as a broadcast transmitter, which is unattended and always transmitting, we have been attempting to get FCC agreement that different conditions may apply better to radio amateurs. For instance, we have proposed that the ability to stop operating or decrease power when a person is seen to be in a high-exposure area makes fencing and signage unnecessary. Automatic proximity detection has precedent in the FCC equipment authorization procedures and we are proposing that a manual version of this is also appropriate for radio amateurs. We have also opined that placing alerting signs around an amateur station will merely serve to terrify some neighbors and is likely to lead to unnecessary, unfounded complaints. The FCC personnel have been somewhat receptive to our arguments and the wording of mitigation processes for amateurs is still being worked on. Of course, we continue to make the point that designing an amateur radio station to avoid accessible over-exposure areas is the best way to proceed.

- 1.5 Mr. Hare placed a far-field RF exposure calculator on the ARRL website, at www.arrl.org/rf-exposure-calculator. The calculator has been modified twice after Committee review. The Committee discussed variations of several online exposure calculators that we have seen and knowing that an online calculator is giving us the right results is difficult. With our own online calculator our job is easier, permitting us to recommend a tool that we have tested and can trust.
- 1.6 Mr. Hare authored an article in the September issue of QST that clearly explained the changes to the FCC RF exposure rules and gave some pointers to performing a simple exposure evaluation.
- 1.7 Mr. Tell authored an article in the July/August issue of QEX entitled "Amateur Portable Radios (Handheld Transceivers): Exposure Considerations Based on SAR" that described a preliminary review of information from the FCC's Equipment Authorization Database on specific absorption rate (SAR) test results for commercially used handheld transceivers. The results suggested that handhelds commonly used in the amateur radio service would not exceed exposure regulations. This is relevant since SAR will become the exposure metric for amateur radio handheld transceivers under the updated FCC rules that went into effect on May 3.
- 1.8 Dr. Lapin is in the process of writing an entirely new RF Safety chapter for the 2022 edition of the ARRL Handbook. The Committee has reviewed the text.
- 1.9 The Committee was informed that as of January 1, 2022, Roy Lewallen, W7EL, would be retiring and providing his popular antenna analysis program, EZNEC, free of charge. Those on the Committee who were not already performing antenna analysis were encouraged to install this program and learn how to perform exposure analyses using this tool.
- 1.10 Dr. Lapin performed an exposure analysis of the redesigned antenna site of the University of Arizona Amateur Radio Club in Tucson, Arizona. He used the process to teach the students and other club members how such an exposure analysis should be performed.
- 1.11 Dr. Kaune presented an RF safety talk on the new FCC rules to his club in Washington state.
- 1.12 Mr. Tell made presentations on RF safety for the amateur radio operator to several ham clubs in 2021, including the Huntsville Amateur Radio Club, the Long Island CW Club and the South Orange Radio Association.
- 1.13 The Committee discussed modeling of a mobile roof mount antenna. One simplified model showed that some high electromagnetic fields existed inside the car's cabin. Comments were made that some high fields had been measured. Further study is warranted.
- 1.14 The Committee responded to a ham who had a question about exposure from his EME antenna array. He was prompted to use his spectrum analyzer and a half-wave dipole antenna, performing a rudimentary calibration, to get a rough feeling for the exposure fields from his station, just to see in

- what locations there may be issues. Mr. Tell contacted this ham and performed an NEC model to determine the exposure around that antenna array, providing him with a fairly detailed assessment of where his signals might cause people to be exposed above the FCC MPE limits.
- 1.15 The Committee reviewed the RF Exposure FAQ page on the ARRL website, written by Mr. Hare. Some suggestions were made to clarify language, but generally it was well received.
 - 1.16 The Committee reviewed the RF Safety questions proposed for the upcoming Technician Question Pool. Our recommendations were to remove one of the questions as being both inaccurate and irrelevant to the goal of ensuring that radio amateurs know how to operate their stations safely. A replacement question was recommended by the Committee.
 - 1.17 The Committee was contacted by Den Forrest, M0ACM, who was preparing a presentation for his ham club about the new exposure regulations being enacted in the UK. Den was informed that the RFSC is collaborating with its colleagues in the RSGB and we gave him the names of people there that he could contact.
 - 1.18 The Committee was contacted by Brian Austin, G0GSF (ex ZS6BKW) with questions about the FCC exposure regulations as described in the September 2021 QST article. He pointed out some discrepancies between the MPE values in the article and those in IEEE C95.1-2019. We informed him that the FCC uses MPEs from a combination of IEEE C95.1-1991 and NCRP Report #86.
 - 1.19 The Committee received a communication from a ham questioning the accuracy of the RF Exposure Calculator when used with antennas that have open wire feedlines, such as doublets, and other antennas that need tuners. Discussion of those types of antennas is being crafted for OET Bulletin 65 Supplement B. In our analysis to this point, it appears that the online RF exposure calculators that use far-field analysis in the near-field provide conservative estimates of the required compliance distances for these types of antennas, but our analysis is ongoing.
- 2 Monitoring Current Events and Scientific Studies
 - 2.1 The Committee discussed Havana Syndrome. We have doubts that microwave energy could be used to cause the symptoms that have been reported. However, the publicly available facts are very sparse and it is likely that the government has much more information that is classified.
 - 2.2 The Committee discussed a court case in which a federal judge criticized FCC's new exposure regulations for not sufficiently justifying their decision to not change the MPE limits from what had originally been used when the regulations were written in 1996. The judge did not express an opinion about whether or not the current MPE levels are correct but agreed with the plaintiffs that the FCC had not sufficiently justified leaving them the same. The feeling in the Committee was that amateur radio should stay on the sidelines and allow the FCC to respond to this.
 - 2.3 The Committee was made aware of a dispute between neighbors in an HOA-governed neighborhood in Florida, where a woman wanted an amateur two doors down to stop operating because she claimed that his transmissions had interfered with her insulin pump. Even though the issue had occurred two year prior, it was recently aired on a local TV station. This was not an exposure issue, but rather was EMC-related, so we recommended that the ARRL EMC Committee consider it. However, in our discussions it was described to us that the amateur had erected what was meant to be a stealth antenna, that was an end-fed wire running up the side of his house, along his gutter and out to a tree. The radiation patterns from such an antenna are difficult to predict and it could have been the source of excessive human exposure in the neighbor's own yard. It is also unclear that exposure distances from such an antenna could be accurately assessed with an online far-field calculator. This topic needs further study and is being added to the various RF exposure documents that we are working on.

- 2.4 The Committee reviewed a paper by James Lin, (Health Safety Guidelines and 5G Wireless Radiation, *IEEE Microwave Magazine*, vol. 23, no. 1, Jan 2022) in which he performed a theoretical analysis of localized SAR based on a series of very high peak power pulses that would result in average power that could cause a 1°C temperature increase, which he feels could damage tissue. He used theoretical extrapolations to the known data that were used to develop the IEEE C95.1 standard, and his conclusions were that the standards are not protective under his theoretical conditions. It was felt by members of the Committee that his conclusions are a theoretical stretch and are unlikely to represent reality.

3 Participation in the Scientific RF Safety Community

- 3.1 Mr. Butcher continues to serve as the co-chair of IEEE ICES TC-95 Subcommittee SC-1: Techniques, Procedures, Instrumentation, and Computation.
- 3.2 Mr. Tell continues to serve as the chairman of the IEEE ICES TC-95 Subcommittee SC-2: Terminology, Units of Measurement, and Hazard Communication.
- 3.3 Mr. Hare continues to serve on the IEEE ICES TC-95 RF Safety Standards Committee.
- 3.4 Dr. Lapin continues to serve on the IEEE ICES TC-95 RF Safety Standards Committee.
- 3.5 Mr. Tell continues to serve as the chairman of the IEEE EMBS Committee on Man and Radiation, COMAR.
- 3.6 Mr. Butcher continues to serve as a member of the IEEE EMBS Committee on Man and Radiation, COMAR.
- 3.7 Dr. Lapin continues to serve as a member of the IEEE EMBS Committee on Man and Radiation, COMAR.
- 3.8 Mr. Butcher continues to serve as a member of the United States National Committee of the International Electrotechnical Commission (USNC/IEC) for TC106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure.

4 Administrative Issues

- 4.1 Dr. Siwiak is a contributing editor for QST and Editor of QEX. He shares submitted RF Safety-related articles with the Committee.
- 4.2 The Committee welcomes a new member, Jerrold Bushberg, KJ6HDL. Dr. Bushberg is a professor at the University of California, Davis, Medical School, with a specialty in Radiation Biology and Health Physics. He is a fellow in both the American Association of Physics in Medicine and the Health Physics Society. He has broad experience with RF exposure and safety standards and is a member of IEEE COMAR, IEEE ICES, and NCRP.
- 4.3 The Committee is reworking the RF Safety Committee pages on the ARRL website. With the invaluable help of Mr. Hare and Zak Lau, W1VT, Committee member photos and biographical sketches are being updated and the pointers to tools related to exposure analysis are being made easier to find.
- 4.4 The Committee held an online teleconference in August to bring everyone up to date on progress in writing OET Bulletin 65 Supplement B, to critique the appropriateness of the writing style, and to discuss what topics were still needed at that point.

Respectfully submitted,

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Chair, ARRL RF Safety Committee

The ARRL RF Safety Committee

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