

Before the  
Federal Communications Commission  
Washington, D.C. 20554

In the Matter of	)	
Proposed Changes in the Commission's Rules	)	ET Docket No. 03-137
Regarding Human Exposure to Radiofrequency	)	(Terminated)
Electromagnetic Fields	)	
	)	
Reassessment of Federal Communications	)	
Commission Radiofrequency Exposure Limits	)	ET Docket No. 13-84
and Policies	)	(Terminated)
	)	

To: The Commission

**Petition for Clarification of the  
ARRL, the National Association for Amateur Radio**

The ARRL, the National Association for Amateur Radio (ARRL), hereby submits this Petition for Clarification concerning application of the Commission's rules governing radio frequency (RF) exposure limits and policies to Part 97 Amateur Radio licensees.<sup>1</sup> This Petition addresses RF evaluations for fixed amateur stations in the 2200 meter (135.7-137.8 kHz) band and, more generally, for mobile and portable transmitters.

**Background**

The ARRL supports the safe use of radio by Amateur Radio licensees in all respects. We expend considerable effort and expense to provide information and resources to Amateur Radio operators to teach the information and demonstrate the skills necessary to understanding RF safety. The ARRL maintains a Board-level RF Safety Committee on RF safety issues to assist it

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<sup>1</sup> See 47 C.F.R. § 97.13(c)(1); see also §§ 1.1307(b), 1.1310, 2.1091, 2.1093, all to be amended effective June 1, 2020, Report and Order in *Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields*, ET Docket No. 03-137; and *Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies*, ET Docket No. 13-84, 34 FCC Rcd 11687 (2019), 85 Fed. Reg. 18131 (Apr. 1, 2020).

in providing knowledgeable information on this subject in the most effective manner possible.<sup>2</sup> The ARRL's efforts include publication of articles and books on RF safety specifically directed to the Radio Amateur community. After the Commission's adoption of new rules in 1996, for example, ARRL published *RF Exposure and You* to address and explain the Commission's rules.<sup>3</sup> We are in the process of reviewing and updating this book, along with other related ARRL materials, to reflect the recent changes to these rules.

ARRL staff and members of its advisory committee also serve government and industry in active leadership roles on committees that develop EMC and RF-safety standards. These efforts notably include participation by ARRL staff and volunteers in the development of the IEEE C95 standard that forms the historical basis of the existing and new rules that we address herein. A senior member of the ARRL's technical staff also holds elected leadership positions on the ANSI-ASC C63® committee and on the Board of Directors of the IEEE EMC Society.<sup>4</sup>

The Amateur Radio Service has an excellent track record of compliance with the existing RF safety rules. Under the new rules some Amateur Radio operators will need to perform new evaluations of their stations, but we believe that performing the evaluations are within the technical capabilities of amateurs.

### **RF Safety Considerations in the Amateur Radio Service**

In general, it is possible for amateur operators to either rely on the evaluations of transmitter manufacturers or, when technical evaluation of a specific installation is needed, to

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<sup>2</sup> A list of information and resources is maintained on the ARRL website at this link: <http://www.arrl.org/rf-exposure>.

<sup>3</sup> This book is available at no cost online at: <https://tinyurl.com/ycqvunmg>.

<sup>4</sup> A former Chair of the C95 committee that drafted the standard on which the present rules are based serves as a member of the ARRL RF Safety Committee, an ARRL Board-level committee that advises ARRL on RF-safety issues. The ARRL Laboratory Manager serves as ARRL's primary representative on the ANSI ASC C63 committee, and is the current Chair of its Subcommittee 5 (EMC Immunity). He also is serving as the IEEE EMC Society Vice President for Standards, working with a wide range of IEEE working groups to develop international EMC standards.

rely on evaluation methods. The evaluation methods employed may consist of calculations based on the Maximum Permissible Exposure (MPE) limits that are in the regulations, measurements of field strength, or increasingly on modeling or simulation methods to determine MPE.

Amateurs have experience doing such evaluations, and will continue to perform MPE-based evaluations under the new rules. Software packages and the computers necessary to run them are much more available now than when the FCC adopted its rules in 1996. For example, available antenna-modeling programs can be used to predict the near-field levels of antennas. These programs are affordable and generally within the competence of Radio Amateurs to use.

As discussed with the FCC staff last year, the ARRL believes that software can greatly assist Radio Amateurs in performing such evaluations. The ARRL has urged the Commission to make available on-line or otherwise approve or accept as a safe harbor the use of one or more programs. Doing so would ensure that such reliance would meet the objectives of the Commission's rules and expectations.<sup>5</sup>

Although broad service-based exemptions from the need to evaluate transmitter installations will no longer be permitted, the Amateur Radio Service is unique in that Amateurs use and modify a wide range of equipment. The ability to adapt and experiment with equipment is at the fundamental core of the Service and is an essential part of the purposes of the Amateur Radio Service as defined by the Commission's Part 97 regulations to contribute to the advancement of the radio art and to expand the existing reservoir of trained operators, technicians, and electronics experts.<sup>6</sup> To carry out these purposes in the Amateur Radio Service,

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<sup>5</sup> See ARRL *Ex Parte* letter filed in Docket 13-84 at p.2, linked here: <https://tinyurl.com/wmn7sjj>.

<sup>6</sup> The purposes of the Amateur Radio Service are codified at 47 C.F.R § 97.1.

however, it is vital that the flexibility in the current rules continues to rely on the individual and collective technical abilities of operators to perform RF safety evaluations.

### **Using MPE for Evaluations in the Amateur Radio Service**

The Commission's rules are based on Specific Absorption Rate (SAR) limits. The Maximum Permissible Exposure (MPE) requirements published in Section 1.1307(b)(3)(i)(C), Table 1,<sup>7</sup> correspond to conservative estimates of SAR.<sup>8</sup> Most Amateur installations may use this Table in conducting evaluations, but there are two cases under the recent amendments that appear to be possible exceptions: stations that operate at 2200 meters, and stations that employ handheld and portable devices. This request is to clarify that calculation of the MPE, which corresponds to a conservative estimate of SAR, complies with the regulatory requirements when SAR measurements are indicated in the following two situations.

### **Evaluations of 2200 Meter Stations**

Amateur Radio operators are authorized to use a small piece of spectrum below 300 kHz, at 135.7-137.8 kHz (the 2200-meter band). Table 1, supra, is derived from the ICNIRP guidelines which at the time only specified levels beginning at 300 kHz. However, the latest ICNIRP guidelines (dated March, 2020) specify levels down to 100 kHz, thereby including the 2200-meter band.<sup>9</sup> The equivalent ANSI/IEEE standard at the time, C.95.1-1992, also specified requirements down to 100 kHz and thereby appropriately including the 2200-meter band.<sup>10</sup>

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<sup>7</sup> See 47 C.F.R. § 1.1307(b)(3)(i)(C).

<sup>8</sup> See, for example, Kwok Chan, FCC Technical Research Branch, Laboratory Division, Office of Engineering and Technology: *Overview of RF Exposure Concepts and Requirements*, presentation to TCB Workshop, October, 2005 at p.8: "Field Strength and power density limits (MPE) are derived from SAR.... MPE limits have included additional margins to ensure compliance with respect to SAR requirements while using simpler free-space field evaluation procedures." Presentation is available at this link: <https://tinyurl.com/yc9hfplt>.

<sup>9</sup> See ICNIRP Guidelines For Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz) (2020) at this link: <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf>.

<sup>10</sup> The latest standard, IEEE C95.1-2019, continues to specify the same standard from 100 kHz upward past the amateur allocation. (The terminology "MPE" has been changed to "Exposure Reference Level, or "ERL".) See Letter from Jafar Keshvari, Ph.D., Chairman IEEE-ICES, ET Docket 13-84 (dated Oct. 17, 2019) informing the

Importantly for considering the Amateur 135.7-137.8 kHz band, the equivalent ANSI/IEEE C95.1-1992 standard (and subsequent versions thereof), as well as the current ICNIRP guidelines, both specify the same level for safety from 100 kHz through 300 kHz and higher. Accordingly, it is clear that there is no scientific basis for measuring compliance for the Amateur 2200-meter band differently than for frequencies at 300 kHz (and up to 1 MHz). Applying the Commission's MPE limit to stations using the 2200-meter band in the same manner as to 300 kHz would ensure their safe operation in all respects and accord with the current scientific knowledge.

Therefore, we request clarification that the rules do not intend to preclude the use of MPE as a surrogate for SAR to evaluate amateur operations in the 2200-meter band. The C95.1 standard and the latest ICNIRP guidelines both clearly demonstrate that exposure levels at 135.7-137.8 kHz can be (and should be) treated the same as those at 300 kHz. There is no evidence from a safety perspective that they should be treated in any different way. Furthermore, as the Commission has recognized, measurements of MPE are related to those for SAR. The reasons for relying upon SAR for transmitters used close to bodies cannot reasonably be applied to equipment used by fixed Radio Amateur stations at 2200 meters.

Using MPE for RF Safety requirements is important to ensuring Radio Amateur compliance because, as the Commission appreciates, SAR evaluations are very complex to directly measure and we believe generally exceed the capability of most individual amateur operators. SAR tests require prohibitively expensive laboratory equipment and facilities or very specialized and expensive simulation and modeling software. Lab testing or modeling also

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Commission of the updated standard and stating that the new standard “represents a substantial advancement over previous editions, as it incorporates updated limits that reflect current scientific knowledge....” Link: <https://tinyurl.com/y7rqjldf>.

require personnel trained and experienced in techniques well beyond the scope that any individual amateur operator could be expected to possess. In short, Radio Amateurs do not have the necessary resources to perform individual determinations based on SAR testing or simulation. But MPE can be determined, and is a valid measure for RF safety determinations at this frequency.

Measuring or estimating MPE for stations operating in the 2200 meter Amateur band is sufficient also because of the low maximum power used by Amateurs. Amateur transmitting systems are limited to operating only at fixed locations using a power level of 1 watt Effective Isotropic Radiated Power (EIRP), which is 0.61 watt Effective Radiated Power (ERP).<sup>11</sup> Furthermore, antennas are very limited in size compared to wavelength, so the complex radiation patterns that might be present in the radiating field of an antenna that is large in terms of wavelength will not be present in Amateur installations for this band. Any fields presented to a human body will be uniform across the body, making it extremely unlikely that there would be the kinds of internal concentrations that may make localized SAR different than whole-body SAR.

The permitted SAR limits are the same at 100 kHz as they are on 300 kHz (as are the MPE limits in the C.95 standard and ICNIRP guidelines, *supra*) so using the MPE limits specified for 300 kHz is scientifically valid to evaluate the near-field exposure possible at 137 kHz. Near-field calculation of a uniform field resulting from a transmitter and antenna operating at 1 watt EIRP on 2200 meters would predict a very conservative estimate of SAR relative to the maximum allowable value.

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<sup>11</sup> 47 C.F.R. § 97.313(k).

Accordingly, we request clarification that operators in the Amateur Radio Service are permitted to use the MPE limits specified for 300 kHz for evaluation of their operations in the 2200 meter band. This allows Amateur operators to perform the required evaluations in the same manner as the Rules permit for other frequencies used in the Amateur Service and complies with the Rule. This also could further be clarified in the revision of OET Bulletin 65, Supplement B, that is necessary because of the rules changes generally.<sup>12</sup>

### **Mobile and Portable Transmitters**

Before the 2020 rules changes, mobile and portable transmitters used by Radio Amateurs generally were categorically exempt from the requirement to perform routine environmental evaluations, subject to the requirement that all licensees are responsible for compliance of their facilities and equipment irrespective of their exemption status. Use of mobile and portable transmitters is common in the Amateur Radio Service, and the new rules require that all such stations be evaluated.

Portable devices can be and often are used within 20 cm of the body. Table 1 in the rules, however, indicates that it cannot be used for human exposure within 20 cm *even though meeting MPE limits*. Yet as noted above, MPE values correspond to a conservative estimate of SAR, and especially at the higher levels of localized SAR compared to whole-body limits. If near-field calculations to derive MPE are applied, even within 20 cm, the use of MPE calculations would conservatively determine whether a handheld portable device meets the SAR limit for being used safely.

Equipment used in Radio Amateur Part 97 service is unique in that generally it is not subject to Part 2 Commission equipment authorization requirements. So generally measured

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<sup>12</sup> The ARRL RF Safety Committee has offered to assist with revisions to Supplement B to reflect the changed rules.

SAR data is not available for Amateur equipment as is the case for equipment used in other services. This result is based at least in part on the fact that unlike in most other services, the Amateur service is based on experimentation and equipment modifications and changes often are made for experimental purposes. Many transmitters used by amateurs also may be older equipment or equipment that has been equipped with a different antenna than that provided by the manufacturer. These have been common practices in the Amateur Radio Service since its inception and relate directly to the experimentation and technological advancement purposes of the Service.

Although in some circumstances routine environmental evaluations by Amateurs may rely upon or be derived from SAR measurements done by transmitter manufacturers, Amateurs need to be able to use MPE data as a surrogate for SAR to do an evaluation that may be unique to that particular amateur installation or use. Performing SAR testing itself is beyond the capabilities of most individual operators in any service, including the Radio Amateur Service as discussed above. However, the RF safety objective can be accomplished by correctly considering near-field regression rates allowing the use of the MPE Table to compare against the maximum field strength that may occur from a mobile or portable device. This would result in a demonstrably conservative estimate of SAR exposure. Determined in this manner, the result always will be below the level that would be found in whole-body and localized SAR testing.

Accordingly, we request clarification that this method is permitted for compliance purposes in the Radio Amateur Service. We believe that this method also should be addressed in the revision of OET Bulletin 65, Supplement B.



## **Conclusion**

Near-field calculation of a uniform field applied to a transmitter and antenna operating at 1 watt EIRP on 2200 meters would result in a very conservative estimate of SAR and is a valid measurement for determining safety of operation. The C95.1 standard and the latest ICNIRP guidelines both demonstrate that exposure levels at 135.7-137.8 kHz should be treated the same as those at 300 kHz. Therefore, ARRL requests clarification that the use of the MPE limits are permitted in the Amateur Radio Service for the required evaluations of Amateur fixed operations in the 2200-meter band, as they are used for all other frequencies in the Amateur Service.

Similarly, near-field regression rates using the MPE Table to compare against the maximum field strength that may occur from a handheld portable device results in a demonstrably conservative estimate of SAR. Accordingly, we request clarification that these methods are permitted.

Respectfully submitted,

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