

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, D.C. 20554

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

**To: The Commission**

**COMMENTS OF ARRL,  
THE NATIONAL ASSOCIATION FOR AMATEUR RADIO**

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.415 of the Commission’s Rules (47 C.F.R. §1.415), hereby respectfully submits its comments in response to the *First Report and Order, Further Notice of Proposed Rule Making and Notice of Inquiry*, FCC 13-39, 78 Fed. Reg. 33634, 28 FCC Rcd. 3498, released March 29, 2013 (the Notice).<sup>1</sup> The Notice, among other things, proposes to reexamine the Commission’s rules and procedures for conducting environmental reviews under the National Environmental Policy Act (NEPA)<sup>2</sup> as they relate to the guidelines for human exposure to RF electromagnetic fields. For its comments, ARRL states as follows:

**I. Introduction.**

1. In this proceeding, the Commission follows up on a proceeding commenced in 2003 to revise aspects of its rules governing radiofrequency (RF) safety issues by

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<sup>1</sup> The Notice was published in the Federal Register on June 4, 2013. The Notice specified a ninety-day comment period following such publication. Therefore, these reply comments are timely filed.

<sup>2</sup> *National Environmental Policy Act of 1969, as amended*, 42 U.S.C. §§4321-4335.

regulation of emissions from radio transmitters. It also proposes in the *Further Notice of Proposed Rule Making* to further update procedures governing RF exposure and to “treat all services equally” with respect to RF exposure evaluations. While the Commission intends to “ensure that [its] measures are compliant with [its] environmental responsibilities and requirements and that the public is appropriately protected from any potential adverse effects from RF exposure as provided by [its] rules,” it also seeks to avoid “any unnecessary burden in complying with these rules.” Finally, in the *Notice of Inquiry*, the Commission asks for input to help it determine whether the RF exposure limits and policies should be reassessed, in light of current scientific developments; i.e. whether current rules and policies should be unchanged, relaxed or tightened.<sup>3</sup>

2. ARRL’s principal concern in this proceeding is with respect to the *Further Notice of Proposed Rule Making* portion of the Notice. Specifically, ARRL is of the view that the proposal at paragraph 138 thereof to eliminate the “special exemption” (as the Notice puts it) from routine RF exposure evaluation for the Amateur Service now set forth in Section 97.13(c) of the Commission’s rules<sup>4</sup> would *substantially* complicate the process of RF exposure evaluation requirements for Amateur Radio licensees. As a practical matter, the regulatory change proposed herein would disserve Amateur Radio operators in their effort to establish and maintain effective Amateur Radio stations in the

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<sup>3</sup> In the *Notice of Inquiry*, the Commission states that its current “exposure limits . . . are fundamentally similar to more recent standards activity.” The Commission is appropriately deferential “to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe” (Notice, at ¶6). Because “the Commission is not a health and safety agency,” (*Id.*), and because the current RF exposure limits are similar to recent standards activity, it is not apparent that any change to the existing standards is warranted now.

<sup>4</sup> Section 97.13(c) now states that an Amateur Radio licensee must perform a routine RF environmental evaluation prescribed by Section 1.1307(b) of the Commission’s Rules if the peak envelope power (PEP) input to the antenna of the licensee’s station exceeds the levels (per frequency band specified in terms of the wavelength of the band) in the table. This formula is not applied to repeater stations, which are uniquely evaluated in terms of effective radiated power (ERP).

residences of licensees. The Commission proposes to subject Amateur Radio licensees to evaluation of the RF emissions from their licensed stations when those facilities exceed the general exemption limits specified in the Notice, which would be applicable to all licensees and all authorized RF emitters.<sup>5</sup> The Commission further proposes to retain the existing classification of RF exposure from Amateur Radio stations as “occupational” (rather than “non-occupational” exposure: that level of RF which would be encountered in “uncontrolled” environments) because the occupational classification presupposes a greater awareness<sup>6</sup> of exposure than that which might be expected of the general population. The Commission expects that the greater level of awareness would exist within an Amateur Radio licensee’s household.<sup>7</sup> According to the Notice, the application

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<sup>5</sup> The Notice proposes to adopt general exemption criteria applying to single RF sources, and as well general criteria for multiple RF sources in Section 1.1307(b) of the Commission’s environmental rules. These criteria are based on power, distance, and frequency, and would be uniformly applicable to all services using fixed, mobile, and portable transmitters. The Notice proposes that these criteria apply to all authorized RF sources, so as to treat all RF sources similarly. The Notice claims at paragraph 119 that RF exposure evaluation criteria based on physical properties are more appropriate than the existing distinctions between service classifications because they are simpler; they are technologically neutral; and they do not have to be modified to accommodate new or converging services. There are minimal exemption thresholds proposed, based on the general population exposure limits. The theory is that any exposure above the general population limit would need to be evaluated to insure awareness of such exposures, which include occupational awareness, control, and training requirements which are part of the newly adopted rules pursuant to the *First Report and Order* in this proceeding.

<sup>6</sup> The revised Section 1.1310(e)(1) states that “[o]ccupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational /controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure.

<sup>7</sup> When individuals are “fully aware” of and can “exercise control” over their exposure is not defined such that the terms can be practically applied. The *First Report and Order* in this proceeding adopts rules that require appropriate information and training, which the Commission holds is “necessary to achieve full awareness and control of exposure.” At paragraph 77 of the Notice, the Commission announced its decision in the *First Report and Order* to codify a policy announced earlier, in a 1996 Report and Order in ET Docket 93-62 [See, the *Report and Order, Guidelines for Evaluating the Environmental Effects of Radio frequency Radiation*, 11 FCC Rcd 15123 (1996), at para. 161] to use occupational/controlled RF exposure limits at Amateur Radio stations. This policy was established in 1996, but was not codified at that time, or until now. The new rule, codified at Section 1.1310 and referenced in the revised Section 97.13(c)(1), allows Amateur stations to be

of the general exemptions proposed in the Notice to Amateur Radio installations would preclude the possibility of overexposure that (as the Notice infers) exists now, based on the longstanding exemptions in the present Section 97.13(c) of the Rules. The current exemptions (save for repeater stations) are based only on transmitter power and do not take into account antenna gain or distance separation of persons from the transmitting antenna.

3. The Notice states that the Commission appreciates “that Amateur Radio operators are knowledgeable about the appropriate use of their equipment such that separation distances are likely to be maintained to ensure compliance with [the] exposure limits.” However, since those limits are specified only in terms of transmitter power and do not take into account separation distance or antenna gain, the Commission fears that transmitting antennae that are unusually close to people and/or are of significantly high gain could potentially lead to non-compliant exposure levels. Therefore, it intends to eliminate the table specifying maximum power levels per band for Amateur Service stations, below which those licensees would be exempt from routine environmental processing, and substitute therefor the general exemption table at Section 1 of Section 1.1307(b)(1)(i) for single amateur RF sources:

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evaluated with respect to occupational/controlled exposure limits as long as appropriate training and information has been provided to the amateur licensee and members of his or her immediate household. The level of training and the nature of it are not specified. The revised rule specifies that “other nearby persons who are not members of the amateur licensee’s household must be evaluated with respect to the general population/uncontrolled exposure limits.”

**Table 1—Single RF Sources Subject to Routine Environmental Evaluation**

<b>Transmitter Frequency (MHz)</b>	<b>Threshold ERP (watts)</b>
Regardless of ERP, evaluation is required if the separation distance R is less than $\lambda/2\pi$ from the radiating structure, where $\lambda$ is the free-space operating wavelength, unless the available maximum time-averaged power is less than one milliwatt. In addition, evaluation is required if the ERP in watts is greater than the value given by the formula below for the appropriate frequency, f, in MHz at the separation distance, R, in meters.	
<b>0.3 – 1.34</b>	$ERP \geq 1,920 R^2$
<b>1.34 – 30</b>	$ERP \geq 3,450 R^2/f^2$
<b>30 – 300</b>	$ERP \geq 3.83 R^2$
<b>300 – 1,500</b>	$ERP \geq 0.0128 R^2f$
<b>1,500 – 100,000</b>	$ERP \geq 19.2R^2$

4. The concern with the application of this table relates in part to the very significant increase in the number of Amateur stations that would be subject to routine environmental processing due to the wide variety (and size) of Amateur Radio residential station installations; Amateur high-frequency mobile stations; and the effect of these new rules on the ability of radio Amateurs to obtain and maintain land use authorizations for their stations. It is ARRL's position that the Commission's goal of uniformity in RF exposure evaluation thresholds creates uneven regulatory burdens which disproportionately prejudice Amateur Radio licensees due to the unique considerations applicable to residential and mobile antenna installations utilized by radio Amateurs. Most urgently, regardless of the exemption criteria ultimately adopted which would act as a threshold for routine environmental evaluation of a given Amateur Radio station

installation, the Commission *must state unequivocally* that those criteria are the *preemptive* standard, and that States, municipalities, and private land use regulatory authorities such as homeowners' associations cannot adopt their own, more stringent standards which might preclude or unreasonably restrict the installation of Amateur Radio stations, allegedly due to RF exposure considerations.

## **II. Background.**

5. The Commission does not now “categorically exempt” Amateur Radio station configurations from routine environmental processing, as it once did. The Council on Environmental Quality, which has oversight responsibilities with regard to the National Environmental Policy Act (NEPA) does permit Federal agencies to categorically exclude certain actions from routine environmental processing when the potential for individual or cumulative environmental impact is judged to be negligible. 40 C.F.R. §1508.4; *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*, 43 Fed. Reg. 55978 (1978), as amended.<sup>8</sup> Based on this, the Commission *initially* categorically excluded Amateur radio facilities from routine environmental processing.<sup>9</sup> Though categorically excluded between 1987 and 1996, individual Amateur Radio facilities always were subject to environmental evaluation, based on the standard for evaluating significant environmental impact, where circumstances of a particular

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<sup>8</sup> 40 C.F.R. §1508.4 defines a Categorical exclusion. *Categorical exclusion* means a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations ( §1507.3) and for which, therefore, neither an environmental assessment nor an environmental impact statement is required. An agency may decide, in its procedures or otherwise to prepare environmental assessments for the reasons stated in 40 C.F.R. §1508.9 even though it is not required to do so. Any procedures under §1508.4 shall provide for extraordinary circumstances in which a normally excluded action may have a significant environmental effect.

<sup>9</sup> See, the *Second Report and Order*, Docket 79-144, 2 FCC Rcd. 2064 (1987); *modified by erratum*, 2 FCC Rcd. 2526 (1987).

installation so warrant.<sup>10</sup> The finding with respect to station types that were categorically excluded initially was that the facilities were generally found to have *no significant potential for adverse environmental impact* from routine activities. Amateur Radio stations were in this category.

6. In a *Report and Order* in ET Docket 93-62, released August 1, 1996 [FCC 96-326, 11 FCC Rcd. 15123(1996)] the Commission deleted the prior regulatory plan for all licensees and applicants in the Amateur Service such that none would any longer be categorically exempt from performing routine environmental evaluations for compliance with RF safety guidelines. In that *Report and Order*, the Commission concluded that there was a *potential* for Amateur stations to cause RF exposure that would exceed its then-new limits. It was initially decided to require amateur station licensees to: 1) conduct a routine environmental evaluation if they transmit using more than 50 watts; 2) take action to prevent human exposure to excessive RF electromagnetic fields if the routine environmental evaluation indicates that the Commission's limits could be exceeded; 3) demonstrate their knowledge of RF safety guidelines through examinations;<sup>11</sup> and 4) indicate in their applications for new licenses and license renewals that they had read and understand the Commission's rules for limiting RF exposure. ARRL and others filed petitions for reconsideration of the *Report and Order* in ET Docket 93-62. ARRL argued on reconsideration that the 50-watt threshold adopted in the *Report and Order* was arbitrary and inappropriate; that the 50-watt threshold did not consider important factors, such as frequency, antenna height, antenna gain, emission

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<sup>10</sup> 47 C.F.R. §1.1307(c) and (d).

<sup>11</sup> The *Report and Order* included a rule amendment to require that Amateur Radio operator license examination question pools include questions concerning RF safety at Amateur stations, requiring an additional five questions on RF safety within each of three written examination elements.

mode, or duty cycle. ARRL requested that the 50-watt threshold be modified to incorporate threshold power levels contained in its Petition for Reconsideration, which varied by frequency. The Commission agreed, and thus in 1997, established the present table at Section 97.13(c), finding that a specific power threshold for each individual Amateur band, above which a licensee must conduct a routine environmental analysis, would “eliminate burdensome and unnecessary requirements for most radio amateurs” and at the same time “help protect the public from excessive exposure to RF electromagnetic fields produced by ARS stations by requiring that their licensees perform routine environmental evaluations and take appropriate actions if they operate their station in a manner that could cause human exposure to RF electromagnetic fields above that permitted under our guidelines.” The Commission held:<sup>12</sup>

In the *Report and Order*, we noted that Amateur stations can transmit with up to 1,500 watts peak envelope power on a wide range of frequency bands from 1,800 kHz to over 300 GHz. We also noted that amateur stations are not subject generally to restrictions on antenna gain, antenna placement, duty cycles, and other relevant exposure variables and, as a result, the possibility of human exposure to RF electromagnetic fields in excess of the guidelines could not be completely disregarded. Therefore, we came to the conclusion that a categorical exclusion for all amateur stations is not justified. We continue to believe that is the case. However, we now conclude that a uniform 50-watt categorical exclusion threshold, as adopted in the *Report and Order*, would cause many amateur station licensees to perform unnecessary routine environmental evaluations. The ARRL is correct that our MPE limits are frequency dependent. Because amateur stations are permitted to transmit in frequency bands covering a wide range of frequencies, the MPE limits that might apply to any particular amateur station operation can vary dramatically. The ARRL argues, quite correctly, that by applying a single power threshold above which a routine environmental evaluation must be performed, the variations that occur in the RF exposure limit as the station transmitter frequency changes are disregarded. The ARRL proposes, in its petition, that we scale the power threshold to match the RF exposure limit. We believe that this proposal makes sense for frequency bands above 10 MHz. However, on frequency bands below 10 MHz, persons are more likely to be located

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<sup>12</sup> *Memorandum Opinion and Order*, 12 FCC Rcd 13494, at 13517 (released August 25, 1997).



in the "near-field" of the amateur station antenna, where the field strength can vary dramatically in a very short distance. In addition, a simple scaling of the power threshold to match the RF exposure limit below 10 MHz would result in extremely high-powered operations being permitted without any routine environmental evaluation. We believe that a flat 500-watt power threshold below 10 MHz is necessary to ensure that these high-powered amateur stations do not cause human exposure to excessive RF electromagnetic fields. Accordingly, we are adopting the ARRL's proposal by specifying a transmitter power threshold for each individual [Amateur Radio Service] frequency band. As indicated in the table shown in 47 CFR § 97.13(c) of the revised rules, the power threshold for transmissions in the frequency bands below 10 MHz is 500 watts. We have also established this threshold for amateur repeater stations, which are normally located high above ground level and often at commercial sites, and we will base exclusions for these antennas on factors similar to those for paging and cellular antennas, as shown in the revised table, since their operation is similar. For frequency bands above 10 MHz, the power threshold varies from 50 watts to 450 watts. We believe the revised power thresholds for the ARS will eliminate burdensome and unnecessary requirements for most radio amateurs, and thus address the overall concerns raised by the ARRL... These new thresholds, as well as some clarifying language we have added to 47 CFR § 97.13(c), also help protect the public from excessive exposure to RF electromagnetic fields produced by ARS stations by requiring that their licensees perform routine environmental evaluations and take appropriate actions if they operate their station in a manner that could cause human exposure to RF electromagnetic fields above that permitted under our guidelines.

Therefore, there is at present neither a "categorical" nor "special" exemption for Amateur Radio facilities from the rules for routine environmental review. Rather, the review must now be conducted for Amateur Radio stations which exceed specified power levels in the bands at issue. Those power levels were established with an intention to limit the routine environmental analysis obligation to those stations that might in some configurations potentially exceed the RF exposure limits, and to exempt those stations which would predictably not exceed the limit.

7. Earlier (in 1987), in the *Second Report and Order* in Docket 79-144,<sup>13</sup> by way of justification of the former categorical exemption for Amateur stations, the Commission held as follows:

Regarding amateur radio facilities, no specific evidence has been submitted that these facilities present a significant risk to the public that would warrant routine environmental evaluation. While hypothetically, RF radiation limits could be exceeded in a few instances, such situations apparently seldom occur in actual operation. Furthermore, because amateur stations are not individually licensed by frequency, modulation, power output or location, it would not be administratively feasible to evaluate amateur applications for this environmental factor. Consequently, we find that amateur radio operators, at the time of licensing, should not be required to routinely submit any environmental information concerning exposure to RF radiation. Nevertheless, as an added precaution, we agree with (ARRL) that operator education would help to assure compliance with ANSI guidelines. In that connection, RF radiation safety questions are being incorporated into amateur examination study guides.

Long before that categorical exemption was determined, ARRL thoroughly investigated RF exposure issues from a scientific perspective and took a very aggressive approach toward education of licensees in the Amateur Service, suggesting and providing specific guidelines for the minimization of exposure of licensees, their family members and their neighbors and the general public to sources of RF energy. The relatively low power levels, low duty cycles, and intermittent operation of Amateur stations, however, are such as to avoid exposure of neighbors to RF energy in excess of the current Maximum Permitted Exposure (MPE) levels in essentially any of a vast number of possible station configurations. ARRL includes in a variety of its publications<sup>14</sup> and on its web site<sup>15</sup> extensive sections on RF safety, including the potential hazards of RF fields. Each includes a comprehensive reading list of articles in reputable medical and scientific

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<sup>13</sup> *Second Report and Order*, Docket 79-144, 2 FCC Rcd. 2064 (1987), *supra*.

<sup>14</sup> Most notably among its publications, ARRL publishes a comprehensive guide on RF exposure and how to conduct an RF safety evaluation, if required. (E.F. Hare, *RF Exposure and You*, 1998).

<sup>15</sup> See, <http://www.arrl.org/rf-exposure> and links cited therein.

publications; links to Commission documents on the subject; recommended procedures for RF protection; and as well, formulae for calculating RF power densities given various station configurations. The educational material made available to licensed radio Amateurs by ARRL and others<sup>16</sup> is indeed ample, and sufficient to provide licensees with the tools to evaluate their station's compliance with Commission standards for RF exposure, to protect themselves, their families, neighbors and the general public.<sup>17</sup> ARRL also sponsors and acts on the recommendations of a committee of nationally respected authorities on RF safety.<sup>18</sup> This Committee keeps track of scientific determinations on RF exposure and its findings are disseminated to radio Amateurs through ARRL publications and via its web site<sup>19</sup> periodically. As ARRL counts among its members the majority of active licensees in the Amateur Radio Service, it is believed that the educational efforts conducted by ARRL have been effective and will continue to be sufficient to apprise licensees of the need to minimize RF exposure; to consider the issue when configuring new and modified Amateur stations; and to limit exposure of all concerned to those levels considered safe. This unique educational effort, and the very nature of the Amateur Radio Service, distinguishes the Service from all other radio services which are not focused specifically on technical self-training and education in the radio art and creates opportunities to regulate RF safety by education and information rather than arbitrary rule

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<sup>16</sup> Indeed, ARRL contributed substantially to OET Bulletin 65, Supplement B (Edition 97-01) entitled *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields*. This is a comprehensive document which is now and has been available on the Commission's web site: [http://transition.fcc.gov/Bureaus/Engineering\\_Technology/Documents/bulletins/oet65/oet65b.pdf](http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65b.pdf) . It is sincerely hoped that the Commission will continue to publish this useful document and that it will consider referencing it in the Part 97 rules governing RF safety.

<sup>17</sup> Educational efforts are extensive, and include RF safety segments in Amateur Radio examination training classes. The Commission retains regulatory control over examination syllabi for Amateur Radio licenses and the question pools for each class of Amateur Radio license examination include questions on RF safety.

<sup>18</sup> See, <http://www.arrl.org/arrl-rf-safety-committee> .

<sup>19</sup> See, <http://www.arrl.org/arrl-rf-safety-committee-board-reports> .

limitations. Uniquely, radio Amateurs can be relied upon by the Commission for competent, diligent self-regulation and self-training with respect to RF safety.

8. There has not been, to date, any study of which ARRL is aware that would draw into question the conclusion of the Commission in Docket 79-144 that “no specific evidence has been submitted that [Amateur Radio] facilities present a significant risk to the public that would warrant routine environmental evaluation” and that, while “hypothetically, RF radiation limits could be exceeded *in a few instances*, such situations apparently seldom occur in actual operation,” RF levels that exceed the specified limits were not found in the overwhelming majority of cases.<sup>20</sup> In 1996, the Commission and the Environmental Protection Agency jointly released a report<sup>21</sup> on studies conducted in 1990 of the potential environmental impact of transmissions from Amateur Radio stations. Personnel from the Office of Engineering and Technology and the National Air and Radiation Environmental Laboratory of the Environmental Protection Agency (EPA) measured electromagnetic fields at several Amateur Radio stations in southern California in July, 1990.<sup>22</sup> Measurements of electric and magnetic field strength were made in areas near antennas and transmitting equipment in order to determine potential levels of exposure to RF radiation for Amateur licensees and other individuals who may be present in the immediate vicinity of amateur stations. The Executive Summary of that study indicates that there is *not* typically a concern with RF fields from a wide variety of typical Amateur Radio station installations:

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<sup>20</sup> In those rare cases, the licensee is required by the current rules to conduct a routine environmental evaluation anyway.

<sup>21</sup> See, Cleveland and Mantiply, *Measurements Of Environmental Electromagnetic Fields At Amateur Radio Stations, FCC/OET ASD-9601(1996)*, available at

<sup>22</sup> It is notable that in southern California, residential housing density is quite high, and single family residences are in close proximity to each other.

In order to obtain data on environmental radiofrequency (RF) fields in the vicinity of amateur radio stations, the Federal Communications Commission (FCC) and the U.S. Environmental Protection Agency (EPA) conducted a joint measurement study of nine amateur stations in southern California. This information will be useful to the FCC in determining how to implement newly revised guidelines for human exposure to RF energy. Amateur stations were chosen that represented a variety of antenna and equipment types, many of which are commonly used by amateur radio operators licensed by the FCC.

Measurements of electric and magnetic field strength were made in areas near amateur antennas and equipment in order to determine typical and "worst case" exposure levels of amateur radio operators, their families and other individuals who live or work in the vicinity of these stations. Measurements were made using instrumentation appropriate for the particular transmitting frequency being used at a given location. Both broadband and narrowband instruments were used.

For most of the stations surveyed, current RF protection guidelines for field strength and power density were not exceeded in accessible areas. The highest readings in accessible areas were generally associated with vehicle-mounted antennas. However, when "duty factors" are taken into account routine exposures from such antennas would be expected to comply with safety guidelines.

If maximum permissible power levels and different facility configurations are used, higher exposure levels than those measured here cannot be ruled out. Such exposures could affect the amateur operator or other individuals in the immediate vicinity of a station. However, it is concluded that appropriate precautionary measures and facility siting should be sufficient to prevent exposures that are in excess of safety guidelines.

It is apparent from the foregoing that current educational measures, coupled with the current threshold criteria for routine environmental processing found in Section 97.13(c) of the Commission's Rules are appropriate and sufficient as a means of avoiding excess RF exposures from Amateur Radio stations. Given these conclusions, a factual basis does not exist for subjecting typical Amateur Radio station configurations to routine environmental analyses, or for changing the current exemption criteria for Amateur Radio

licensees. Indeed, adoption of the general exemption criteria as proposed for Amateur Stations would be regulatory overkill.

### **III. Application of the General Exemption Criteria to Amateur Radio Stations Prejudices Amateur Radio Operators, Given the Extensive Variation in Residential Fixed, and Mobile and Portable Transmitting Facilities and the Experimental Character of the Service.**

9. There are vast differences in Amateur Radio station configurations in residential areas. These differences include, but are not limited to the sizes and configurations of residential lots, and the requirement for indoor antenna installations in some instances due to the extensive proliferation of private land use regulations (a problem which the Commission has *consistently* ignored and failed to acknowledge). The same private land use regulations often preclude the use of appropriately elevated outdoor antennas.<sup>23</sup> The Amateur Radio Service is unique in its avocational status, which dictates that the majority of Amateur Radio operation is conducted in residential areas, and includes hundreds of thousands of portable and mobile facilities. Tens of thousands of radio Amateurs engage in public service and emergency communications, setting up temporary stations near scenes of natural disasters such as hurricanes, floods, fires, storms and earthquakes, and group events such as marathons, parades and the like. These emergency and public service Amateur activities would be severely limited or precluded

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<sup>23</sup> The combination of the Commission's failure to protect its Amateur Service licensees from the preclusive effect of private land use regulations which necessitate the use of indoor antennas or arbitrarily limit antenna height above ground, *and* the imposition of a regulatory requirement that is based on specific distance separations - regardless of ERP - where the separation distance is less than the free-space operating wavelength ( $\lambda$ ) divided by  $2\pi$  from the radiating structure ( unless the available maximum time-averaged power is less than one milliwatt) exposes the Amateur Radio licensee to completely arbitrary denials of land use authorizations and the inability to operate a station. Such denials are routine now. They are often based on unquantified and baseless fears of RF exposure, and are adjudicated by unqualified individuals. The unavailability of functional antennas for a licensed Amateur station is the equivalent of a license revocation.

if a formal environmental review were required before a mobile, portable or other temporary station could be activated.

10. The Amateur Radio Service is in essence an experimental radio service, where transmitting equipment, antennas and even transmission lines are subject to infinite variability and change often, as do the locations of the facilities. Much Amateur transmitting equipment, especially the transmitting antenna, is constructed and designed by the licensee. To subject Amateur licensees to routine environmental analysis each time an incremental change is made in the station configuration is overregulation. The variation in available frequency bands,<sup>24</sup> modes of emission, equipment types, power output of transmitters,<sup>25</sup> ERP, antenna gain and transmission line losses, together with the wide variation in antenna placement in residential areas necessitate a broader view of the environmental regulatory obligation with respect to these facilities than is the case with more standardized types of fixed and mobile communications facilities which are typically located in industrial or commercial areas. The Notice, at paragraph 4, indicates that the Commission in this proceeding seeks to move away from service-specific “categorical exclusions” and toward the alleged “simplicity” of the general exemptions applicable to all services. It is suggested that the general exemption model is not suitable for the Amateur Service, given the variables described above and the essentially experimental characteristic of the Service, notwithstanding the simplicity of applying the general exemption table across the board.

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<sup>24</sup> Amateur Radio operators frequently change operating frequency, and from one allocated band to another, in order to conduct operation along the desired path as propagation changes. Many combinations of antennas and station parameters are typically utilized in the space of perhaps one or two hours.

<sup>25</sup> It is noteworthy in this context that Section 97.313 of the Amateur Service Rules (47 C.F.R. §97.313) requires that stations must use the minimum transmitter power necessary to carry out the desired communications. In most cases, especially at VHF, UHF and SHF, this power is on the order of only a few watts. Mobile transceivers typically have low and higher power settings, and HF transceivers typically have variable RF output power controls.

11. Instead, ARRL is of the view that the existing exemptions from evaluation for the Amateur Radio Service now set forth in Section 97.13(c) of the Commission's rules are technically sound, and serve a useful purpose notwithstanding that they are: (1) based only on PEP output power; and (2) do not take into account the numerous other variables in Amateur station operation discussed above. As the Commission noted in OET Bulletin 65, the power levels in that rule section "were chosen to roughly parallel the frequency of the MPE limits of Table 1 in Appendix A." (OET Bulletin 65, Ed. 97-01, at 15 n.16). Given the fact that available studies indicate that Amateur stations are generally compliant with the applicable RF protection guidelines, the present Section 97.13(c) is a reasonable, standardized approach to evaluating the highly variable and often-modified station configurations in the Amateur Service. A factual record does not exist that would justify subjecting Amateur stations to the arbitrarily low thresholds for routine environmental analysis specified in the proposed General Exemption Table.

12. The real problem with the application of the general exemption criteria to the Amateur Service is that the Table would require a *large* number of routine environmental analyses that are not required now, without justification. Though the Notice, at paragraph 138, states that the general exemptions would "require further evaluation only when necessary," the general exemption table at Section 1 of Section 1.1307(b)(1)(i) for single Amateur RF sources would require, *regardless of ERP*, a routine evaluation "if the separation distance  $R$  is less than  $\lambda/2\pi$  from the radiating structure, where  $\lambda$  is the free-space operating wavelength, unless the available maximum time-averaged power is less than one milliwatt." This would subject virtually all mobile and portable Amateur Radio operations to routine environmental analyses, without a factual predicate for the



additional regulatory burden,<sup>26</sup> and without taking into account a number of factors, including the shielding effect of car bodies, etc. Furthermore, the separation distances in Table 1, using the radian sphere  $\lambda/2\pi$ , would require a great many radio Amateurs who live on smaller real estate lots, and those who must reside in multiple unit dwellings to do an environmental analysis in order to operate in the 160, 80 and 40-meter Amateur bands regardless of the power level used. As to the formula for calculating ERP at the radian sphere  $\lambda/2\pi$  distance for those three bands in particular, the ERP is higher than that which is achievable with a standard half-wave dipole at full legal power for the Amateur Service. Many, probably most, radio Amateurs utilize simple antennas for those frequency bands (i.e. some sort of dipole or random wire antenna).<sup>27</sup> It is arguable therefore that for operation on Amateur frequencies below 14 MHz, the  $\lambda/2\pi$  separation distance threshold, if adopted as proposed, should be waived for radio Amateurs. It is impossible to be close to all parts of an efficient radiator at those frequencies simultaneously. The point is that the general exemption table ill-suits the Amateur Service for the reasons specified, and there is no evidence that the increased regulatory

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<sup>26</sup> According to OET Bulletin 65, Supplement A as it now reads: Although not required by the FCC's rules, it is advisable that mobile stations also be considered for potential exposure before an amateur automatically applies the categorical exemption. As an example, a 500-watt, 10-meter mobile installation with a vehicle mounted antenna would certainly merit a closer look. On VHF, the use of a high-power amplifier could also present problems in some cases. In general, it is recommended that in these higher powered installations, the antenna be located such that the vehicle occupants will be shielded from the antenna during normal use. One good location is in the center of an all-metal roof. Locations to be avoided for high-power operation would be a trunk-mounted antenna, or installation on a vehicle with a fiberglass roof. ***In general, mobile installations, even higher-powered ones, should not exceed the MPEs if sound installation guidelines are followed.*** (emphasis added). The ARRL *Handbook* and ARRL antenna books, available from the ARRL, have additional material on mobile installations and antennas... Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, Edition 97-01 (November, 1977).

<sup>27</sup> It is of course possible to build or utilize gain antennas for these bands, and for those who have the space on their residential lots to do so, this is not a problem under the proposed general exemption criteria. Those with smaller, suburban residences however, and those who use shortened, inefficient antennas due to land use regulations or the practicalities of lot size, would use lower gain antennas.

burden is justified by the nature of Amateur Radio operation, since the available studies have indicated that few Amateur station configurations, when duty cycle of operation is taken into account, exceed MPE levels of RF exposure.

#### **IV. The Commission Should Not Subject Radio Amateurs to the Inapplicable General Exemption Criteria.**

13. The proposed general exemption criteria specified at Table 1 above (*supra*, paragraph 3) outlines threshold criteria necessitating routine evaluations of transmitting stations by the licensee. That Table, however, stipulates that for all exposure that may occur within a distance of  $\lambda/2\pi$  of a transmitting antenna, an evaluation must be performed. This single provision essentially requires that *all* Amateur stations be evaluated (unless the available maximum time-averaged power is less than one milliwatt, which is exceptionally low); even those exempt according to the *rest* of the table are swept in by this provision, and it would require routine environmental evaluation even when a station's ERP is *lower than the power levels listed in the remainder of the table*, because very few Amateur station licensees could fairly conclude that there would *never* be people present within a distance of  $\lambda/2\pi$  during at least very brief periods of time.

14. The requirement to evaluate station operation for any level of exposure above a time-averaged power of one milliwatt within the distance of  $\lambda/2\pi$  is extremely onerous, especially at frequencies below 30 MHz. In this frequency range, any efficient antenna is relatively large, and all but very small antennas produce fields that decay at a lower rate than the 40 dB/decade that the Commission has (erroneously) assumed to be the rate at which fields decay with distance within  $\lambda/2\pi$ . Below 30 MHz, the exposure limits are much *higher* than they are at higher frequencies, in a way that is inversely proportional to frequency. The  $\lambda/2\pi$  region, however, becomes *larger* as frequency is decreased.

Requiring routine evaluation within the  $\lambda/2\pi$  boundary places the burden of routine evaluation over greater and greater distances as the frequency decreases, while at the same time, anomalously, the exposure limits are decreasing, allowing *safe* operation at closer and closer distances. Thus, Table 1 above, in this context, is illogical and arbitrary. As but one example, at 3.5 MHz, the  $\lambda/2\pi$  region ends at a distance of 13.6 meters from the radiating element. However, at a *continuous* exposure to a transmitter operating at 1500 watts into a dipole antenna, assuming that such exposure is in the main beam of that antenna (and adding a ground-reflection gain that is not likely to exist at very close distances to the antenna because the far-field pattern of that antenna has not formed at those distances), uncontrolled exposure would be below the limit at distances greater than 1.5 meters.<sup>28</sup>

15. The existing table in Section 97.13(c) of the Amateur Service rules exempting many Amateur stations based on PEP power levels correctly takes into account the changes in exposure limits as frequency is decreased. It correctly exempts Amateur stations from the requirement to perform routine evaluations under circumstances under which an evaluation will almost certainly result in a determination that all human exposure is below the limit. Amateur licensees have the technical skills and educational material available to them, allowing them to easily recognize the very few instances in which an evaluation may be required under unusual circumstances, and that recognition triggers the obligation under the existing rules to perform a routine evaluation. Radio amateurs have a good track record of compliance with all rules that govern the Amateur Radio Service, and RF safety compliance is no exception.

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<sup>28</sup> For a large antenna such as a 3.5 MHz halfwave dipole, It is not possible to be 1.5 meters distant from all parts of that antenna. The entire antenna radiates, so at very close distances, one is exposed to only a small amount of the energy coming from that antenna.

16. Because RF exposure is indeed well-understood among Amateur Radio licensees and there is a plethora of information available to them, the present Section 97.13(c), coupled with OET Bulletin 65, Supplement B and all of the other information are sufficient in the aggregate to insure that Amateur stations remain safe for the licensee as well as the licensee's family and neighbors. However, as is quite obvious from many of the comments filed in this proceeding to date, the subject remains a frightening mystery to the general public. The fear that accompanies the ignorance and negative assumptions of most non-technical people on this subject leads to baseless and preclusive restrictions imposed on Amateur Radio licensees who are seeking land use approvals from municipalities or community associations. The unquantified fear of excessive RF exposure is articulated in most land use hearings or homeowners' association meetings at which antenna approvals, use permits or variances are under discussion. The subject is often raised as a "scapegoat" argument when the underlying objection to a proposed antenna installation in a residential area is based on aesthetic concerns (as most such objections are).<sup>29</sup> The Amateur Service has benefited frequently in this context from the ability to explain the exemption from routine environmental processing with reference to the simplicity and logic of the PEP output power-based table in Section 97.13(c) of the Commission's rules. The existing rule makes it possible to explain in terms that non-technical persons can readily understand why a proposed Amateur Radio installation is safe from an environmental perspective, to the extent that it is based on the only applicable Federal standard, objectively determined.

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<sup>29</sup> In this connection, the absence of a preemptive standard for RF exposure has contributed to the hysteria that is generated by baseless and unsupported expressions of fear of harm from RF emissions from nearby antenna installations in residential areas.

17. The formulas in the proposed general exemption table are not as efficient to apply as is the Section 97.13(c) table, and they foment the fear of RF that exists among the general public. The Section 97.13(c) table, on the other hand, provides Amateur Radio licensees an efficient, easy to apply, and effective threshold when changing operating bands during an operating period or when using a temporary configuration, or after implementing a change in station configuration. Therefore, rather than adopt the proposed general exemptions for the Amateur Radio Service, ARRL recommends instead that the table in section 97.13(c) be retained. If necessary, it could be modified to include antenna gain and separation distance factors and to specify emissions in ERP rather than PEP output. This would meet the Commission's goal of an efficient, practical procedure to ensure compliance, while still providing a relatively simple means of demonstrating that compliance to non-technical persons. Antenna gain, height above ground, and distance factors are already considered in one case in the table in the current Section 97.13(c): building mounted repeater stations are exempted if their effective radiated power is less than 500 watts, and non-building mounted repeater antennas are exempt from evaluation if their effective radiated power is less than 500 watts and the distance from ground level to the lowest point of the antenna is at least 10 meters.

18. Should the Commission, notwithstanding the above discussion, nevertheless decide to apply the general exemption criteria to Amateur Station environmental evaluations as proposed, it should at the very least permit Amateur licensees to apply *time-averaged power* to Table 1, *supra*. If power is to be expressed in ERP instead of PEP, the ERP to be considered should be defined as the worst case time-averaged ERP, which will account for the duty factor of the mode being utilized and the on-off times

within the averaging period (6 minutes for controlled environments and 30 minutes for uncontrolled environments). A substantial amount of Amateur Radio operation, and a significant majority of operation in the MF and HF allocations, is conducted with non-continuous transmissions and long periods of receiving only, with duty factors considerably less than unity. Further, unless explicitly permitted by rule, one-way Amateur Radio transmissions are generally not permitted, and so a licensee's transmitter is not generating RF while one or several other participants in a communication are transmitting. Time-averaging is permitted in the current RF exposure rules, and the factors and methodology involved are well established in existing literature provided by the Commission and by ARRL which is available to Amateur Radio operators. Permitting time-averaged ERP values to be used would ameliorate somewhat the substantial burden of the largely gratuitous and unnecessary analyses required of Amateur Radio licensees by switching to an ERP based general exemption.

**V. Whatever Threshold Calculation Method is Ultimately Adopted for the Amateur Service, the Commission Should Preempt Non-Federal RF Exposure Standards Which Are More Restrictive.**

19. There have been instances over the years in which State, county or municipal governmental authorities have imposed RF exposure standards that are more restrictive, often significantly, than the guidelines adopted for routine environmental processing by the Commission.<sup>30</sup> An ancillary problem is as discussed above, in which unquantified, vaguely stated concerns over RF safety are raised as objections to particular Amateur Radio antenna installations when building permits or conditional use permits are sought

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<sup>30</sup> For example, in Multnomah County, Oregon, an ordinance was adopted some years ago, MCC.7035(F)(4)(b), which required measurements to be taken by a registered professional engineer over long periods of time, if those measurements showed RF levels greater than one-fifth of the RF power densities permitted by the ordinance.

by Amateurs for antennas in residential areas from local governmental and private land use authorities. Whatever method of calculating RF levels for demonstrating compliance with the Commission's RF exposure limits is ultimately selected going forward, non-Federal limits or threshold standards applicable to licensed telecommunications facilities that are more restrictive than the Commission's standard should be preempted.

20. The Commission has heretofore refused to preempt state or local regulation of RF emissions [other than those applied to Personal Wireless Service facilities, preemption of which was called for by the Telecommunications Act of 1996, Pub. L. 104-104, 110 Stat. 56 (1996)] due to a claimed lack of expertise in the subject matter. That claim is reiterated in the instant Notice at Paragraph 6 relative to the Commission's ability to determine the proper substantive limits for RF exposure.<sup>31</sup> However, the Commission is obligated, pursuant to Section 307(b) of the Communications Act of 1934 to make such distribution of licenses, frequencies, hours of operation and of power among the several States and communities as to provide a fair, efficient and equitable distribution of radio service to each of the same. It is inconsistent for the Commission to decline to examine the preclusionary effect of non-Federal RF exposure regulation on its licensees, once the Commission has determined at what levels of RF its licensees should have to conduct routine evaluations, and what levels are inherently safe, to the extent that further inquiry is not necessary. The Commission may not be a "health and safety agency", but it is uniquely charged with unified, exclusive jurisdiction over telecommunications, and it is obliged to make telecommunications widely available. It is also obligated to ensure that licensees are not discriminated against due to the size of

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<sup>31</sup> At paragraph 6 of the Notice, the Commission states its deference "to other organizations and agencies with respect to interpreting the biological research necessary to determine what levels are safe." This is so because "the Commission is not a health and safety agency," (*Id.*)

their residential real property or whether or not they have to live in apartments or in condominiums. Its duty therefore is to balance RF exposure limits against the objective of a fair, efficient and equitable distribution of radio service to each of the States and communities. Any standards and procedures adopted in this proceeding for determining what levels of RF are safe without further analysis and which should trigger environmental assessments should be the standard by which the Commission's licensees are determined to be operating safely and in the public interest, without an obligation or burden imposed by a non-Federal authority reacting to the same considerations and the same subject matter. Non-Federal requirements that are more stringent than those adopted by the Commission should be preempted absent a showing that a State, county or municipal government, or a private land use regulator has conducted specific studies of the matter which have resulted in specific findings of scientific fact which establish a compelling need for the more stringent, non-Federal regulation or restriction. Those specific factual findings would, without more, have to support the more restrictive non-Federal standard. Without such, instances of indirect control over Commission licensees will continue unabated and inherent inequities will result. Patchworks of restrictions on interstate telecommunications facilities were long ago held to be unacceptable.<sup>32</sup> Any and all procedures for calculating RF exposure levels and the levels themselves should be the preemptive standard relative to more stringent standards imposed by non-Federal authorities.

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<sup>32</sup> *Federal Radio Commission v. Nelson Brothers Bond & Mortgage Co.*, 289 U.S. 266, 279 (1933); *Fisher's Blend Station v. Tax Commission of State of Washington*, 297 U.S. 650 (1936); *United States v. Southwestern Cable Co.* 392 U.S. 157, 172 (1943).



## **VI. Conclusions.**

21. ARRL is committed to continuing its educational efforts; to RF safety; and to exposure limits that protect Amateur Radio operators, their families and neighbors, and the general public. The Commission's intent, stated at Paragraph 3 of the Notice, "to provide more efficient, practical, and consistent application of evaluation procedures to ensure compliance..." is well-taken. That said, there are no studies of which ARRL is aware which have shown that there is any significant likelihood that a typical Amateur Radio station will expose licensees, their neighbors, or their families to RF levels in excess of the maximum permitted exposure levels. Given this, ARRL is of the view that the best regulatory approach to RF safety for the Amateur Service is to continue its heretofore successful educational efforts and to rely principally thereon. A 1996 EPA/FCC analysis of typical Amateur station configurations has confirmed the Commission's finding in 1987 in Docket 79-144 that Amateur Radio facilities typically pose no threat of RF emissions over the Commission's specified limits:

[N]o specific evidence has been submitted that these facilities present a significant risk to the public that would warrant routine environmental evaluation. While hypothetically, RF radiation limits could be exceeded in a few instances, such situations apparently seldom occur in actual operation. Furthermore, because amateur stations are not individually licensed by frequency, modulation, power output or location, it would not be administratively feasible to evaluate amateur applications for this environmental factor. Consequently, we find that amateur radio operators, at the time of licensing, should not be required to routinely submit any environmental information concerning exposure to RF radiation.

The existing exemptions from evaluation for the Amateur Radio Service in section 97.13(c) are sufficient under these circumstances, and have served Amateur Radio licensees well over time by providing an objective, simple means of determining when routine environmental evaluation is required. Section 97.13(c) now states that an

Amateur Radio licensee must perform a routine RF environmental evaluation prescribed by Section 1.1307(b) of the Commission's Rules if the peak envelope power (PEP) input to the antenna of the licensee's station exceeds the levels (per frequency band specified in terms of the wavelength of the band) in the table. There is no record evidence that the Section 97.13(c) rule is inadequate in preventing excessive RF exposure. It should be preserved as-is.

22. The formulas in the proposed general exemption criteria are not as efficient to apply as is the present Section 97.13(c) table, and the  $\lambda/2\pi$  threshold distance separation requirement, without more, is inherently arbitrary. Radio amateurs utilize numerous different frequency bands and change operating frequencies and allocated bands often, in order to conduct operations along desired paths as propagation changes. Licensees utilize mobile and portable stations often, and implement temporary configurations. Because it is inherently an experimental type Service, Amateur station facilities change often as well. The table presently in section 97.13(c) provides Amateur Radio licensees an efficient, easy to apply, and effective standard when changing the operating band during an operating period or when using a temporary station configuration and it easily accommodates frequent station modifications. Licensees are, notwithstanding the Section 97.13 table, nevertheless required to do a routine environmental evaluation when their station configurations could exceed the MPE levels.

23. If the Commission is inclined nevertheless to adopt general exemptions for the Amateur Radio Service, it should permit Amateur licensees to apply time-averaged power when using Table 1. However, if general exemption criteria including antenna gain and distance considerations are adopted, Amateur Radio, its licensees, and the public

would be served well by maintenance of a table in section 97.13(c) incorporating these factors for typical Amateur Radio installations. Under any circumstances, the blanket requirement of a routine environmental analysis for stations at which persons may at some time come within  $\lambda/2\pi$  of the transmitting antenna should not be applied to Amateur Radio stations regardless of ERP, and no blanket distance separation criteria should apply to stations operating below 30 MHz.

Therefore, the foregoing considered, ARRL, the national association for Amateur Radio, respectfully requests that the Commission enact new RF exposure regulations in accordance with the recommendations contained herein, and not otherwise.

Respectfully submitted,

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