Before the
FEDERAL COMMUNICATIONS COMMISSION FCC 96-326
Washington, D.C. 20554

In the Matter of	)	
	)	
Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation	)	ET Docket No. 93-62
	)	

REPORT AND ORDER

Adopted: August 1, 1996
; Released: August 1, 1996

By the Commission: Commissioners Quello and Chong issuing a joint statement.

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I. INTRODUCTION

1. By this action, we are amending our rules to adopt new guidelines and methods for evaluating the environmental effects of radiofrequency (RF) radiation from FCC-regulated transmitters. We are adopting Maximum Permissible Exposure (MPE) limits for electric and magnetic field strength and power density for transmitters operating at frequencies from 300 kHz to 100 GHz.[1] We are also adopting limits for localized ("partial body") absorption that will apply to certain portable transmitting devices.[2] We believe that the guidelines we are adopting will protect the public and workers from exposure to potentially harmful RF fields.

2. In reaching our decision on the adoption of new RF exposure guidelines we have carefully considered the large number of comments submitted in this proceeding, and particularly those submitted by the U.S. Environmental Protection Agency (EPA), the Food and Drug Administration (FDA) and other federal health and safety agencies. The new guidelines we are adopting are based substantially on the recommendations of those agencies, and we believe that

[1] Specifically, we are adopting limits for field strength and power density that are generally based on Sections 17.4.1 and 17.4.2, and the time-averaging provisions recommended in Sections 17.4.1.1 and 17.4.3, of "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86 (1986), National Council on Radiation Protection and Measurements (NCRP). With the exception of the limits on exposure to power density above 1500 MHz and the limits for exposure to lower frequency magnetic fields, these MPE limits are also generally based on the guidelines contained in the RF safety standard developed by the Institute of Electrical and Electronic Engineers, Inc. (IEEE) and adopted by the American National Standards Institute (ANSI). See Section 4.1 of ANSI/IEEE C95.1-1992, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".

[2] These guidelines are based on those recommended by ANSI/IEEE and NCRP. See Sections 4.2.1 and 4.2.2 of ANSI/IEEE C95.1-1992 and Section 17.4.5 of NCRP Report No. 86.

these guidelines represent a consensus view of the federal agencies responsible for matters relating to the public safety and health.[3]

3. The MPE limits adopted herein are based on exposure criteria quantified in terms of specific absorption rate (SAR), a measure of the rate of RF energy absorption. The basis for these limits, as well as the basis for the 1982 ANSI limits that the Commission previously specified in our rules, is an SAR limit of 4 watts per kilogram. The new MPE limits are derived by incorporating safety factors that lead, in some cases, to limits that are more conservative than the limits specified by ANSI in 1982. The more conservative limits do not arise from a fundamental change in the RF safety criteria for SAR, but from a precautionary desire for more rigor in the derivation of factors which allow limits for MPE to be derived from SAR limits.

4. This action satisfies the requirements of the Telecommunications Act of 1996 for a timely resolution of this proceeding.[4] We note that research and analysis relating to RF safety and health is ongoing, and we expect changes in recommended exposure limits will occur in the future as knowledge increases in this field. In that regard, we intend to continue our cooperative work with industry and with the various agencies and organizations with responsibilities in this area in order to ensure that our guidelines continue to be appropriate and scientifically valid.

II. BACKGROUND

5. The National Environmental Policy Act of 1969 (NEPA) requires agencies of the Federal Government to evaluate the effects of their actions on the quality of the human environment.[5] To meet its responsibilities under NEPA, the Commission has adopted requirements for evaluating the environmental impact of its actions.[6] One of several environmental factors addressed by these requirements is human exposure to RF energy emitted

[3] For example, see letter from Carol M. Browner, Administrator, U.S. Environmental Protection Agency, to Reed. E. Hundt, Chairman, FCC, dated July 25, 1996; and letter from Elizabeth D. Jacobson, Ph.D., Deputy Director for Science, Center for Devices and Radiological Health, Food and Drug Administration, to Richard M. Smith, Chief, Office of Engineering and Technology, FCC, dated July 17, 1996. Both letters have been placed into the docket record as ex parte filings in this proceeding.

[4] The Telecommunications Act of 1996, which was enacted on February 8, 1996, requires that: "Within 180 days after the enactment of this Act, the Commission shall complete action in ET Docket 93-62 to prescribe and make effective rules regarding the environmental effects of radio frequency emissions." See Section 704(b) of the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996).

[5] National Environmental Policy Act of 1969, 42 U.S.C. Section 4321, et seq.

[6] See 47 CFR § 1.1301, et seq.

by FCC-regulated transmitters and facilities.

6. In 1985, the Commission adopted a 1982 ANSI standard for use in evaluating the effects of RF radiation on the environment, noting that the ANSI standard was widely accepted and was technically and scientifically supportable.[7] Since then the Commission has used this standard as its processing guideline for determining the potential environmental impact of RF emissions. The rules now require applicants for certain facilities to prepare an Environmental Assessment (EA) if the transmitter or facility under consideration could expose the general public or workers to levels of RF radiation that are in excess of the 1982 ANSI guidelines.[8] Examples of facilities that could potentially cause exposures in excess of these guidelines because of their relatively high operating power include radio and television broadcast stations and satellite uplink facilities. The rules also address other related matters, such as the evaluation of sites with multiple transmitters.

7. The Commission has "categorically excluded" many low-power, intermittent, or normally inaccessible RF transmitters and facilities from routine evaluation for RF radiation exposure based on calculations and measurement data indicating that they would not cause exposures in excess of the guidelines under normal and routine conditions of use.[9] Examples of currently excluded transmitters include land mobile, cellular and amateur radio stations.

8. In 1992, ANSI adopted a new standard for RF exposure, designated ANSI/IEEE C95.1-1992 to replace its 1982 standard.[10] This new standard contains a number of significant differences from the 1982 ANSI standard. In some respects, the 1992 ANSI/IEEE standard is more restrictive in the amount of environmental RF exposure permitted, although for some situations recommended MPE levels are similar to the 1982 limits. The 1992 ANSI/IEEE standard also extends the frequency range under consideration to cover frequencies from 3 kHz

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[7] See Report and Order, GEN Docket No. 79-144, 100 FCC 2d 543 (1985); Memorandum Opinion and Order, 58 RR 2d 1128 (1985); see also ANSI C95.1-1982, "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz," ANSI, New York, NY.

[8] 47 CFR Section 1.1307(b).

[9] See Second Report and Order, GEN Docket No. 79-144, 2 FCC Rcd 2064 (1987); Erratum, 2 FCC Rcd 2526 (1987). Facilities that are otherwise categorically excluded from RF environmental evaluation may still be required, on a case-by-case basis, to undergo evaluation pursuant to the provisions of 47CFR § 1.1307(c) and (d). The Council on Environmental Quality, which has oversight responsibility with regard to NEPA, permits 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. See 40 CFR §§ 1507, 1508.4; see also Regulations for Implementing the Procedural Provisions of NEPA, 43 Fed. Reg. 55,978 (1978).

[10] ANSI/IEEE C95.1-1992, "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz."

to 300 GHz.[11] The 1992 ANSI/IEEE standard specifies two tiers of exposure criteria, one tier for "controlled environments" (usually involving workers) and another, more stringent tier, for "uncontrolled environments" (usually involving the general public). The 1982 ANSI standard specified only one set of exposure limits, regardless of whether the individual exposed was a worker or a member of the general public. The 1992 ANSI/IEEE standard also, for the first time, includes specific restrictions on currents induced in the human body by RF fields. These restrictions apply to both "induced" currents and "contact" currents related to shock and burn hazards.

9. The 1992 ANSI standard is generally more stringent in the evaluation of low-power devices, such as hand-held radios and cellular telephones, than the 1982 standard. That is, the 1982 ANSI standard permitted exclusion from compliance with the MPE limits if the localized specific absorption rate (SAR) of a low-power device could be shown to be 8 watts/kilogram (8 W/kg) or less, or if the input power of the radiating device at frequencies between 300 kHz and 1 GHz was 7 watts or less.[12] The 1992 guidelines reduce the allowable localized SAR level for devices operating in "uncontrolled" environments by a factor of five to 1.6 W/kg, while maintaining the 8 W/kg limit for "controlled" environments. Further, the exclusion thresholds based on operating power are significantly reduced for devices that operate in uncontrolled environments and for devices that operate above 450 MHz in controlled environments. The 1992 ANSI/IEEE standard also prohibits the application of the power exclusion to hand-held devices where the radiating structure is maintained less than 2.5 centimeters (cm) from the body of the user.

10. On April 8, 1993, we issued the Notice in this proceeding to consider amending and updating the guidelines and methods used by the Commission for evaluating the environmental effects of RF radiation.[13] In the Notice, we proposed to base our RF safety regulations on the ANSI/IEEE C95.1-1992 standard instead of the 1982 ANSI standard. The major issues addressed in the Notice were: 1) the selection of the appropriate RF exposure standard; 2) use of the 1992 ANSI/IEEE definitions for "controlled" and "uncontrolled" environments to determine application of exposure criteria; 3) implementation of new limits on induced and contact currents; 4) evaluation of low-power devices such as cellular telephones; 5) categorical exclusions from

[11] The 1982 ANSI guidelines cover the frequency range 300 kHz to 100 GHz.

[12] Specific absorption rate is a measure of the rate of energy absorption by the body. SAR levels are specified for both whole-body exposure and for partial-body or localized exposure (generally specified in terms of spatial peak values), such as might occur to the head of the user of a hand-held radiotelephone.

[13] See Notice of Proposed Rule Making, ET Docket No. 93-62, 8 FCC Rcd 2849 (1993); see also 8 FCC Rcd 5528 (1993), 9 FCC Rcd 985 (1993), 9 FCC Rcd 317 (1994), 9 FCC Rcd 989 (1994) extending the comment deadlines.

environmental evaluation for certain transmitters; 6) compliance and measurement issues; and 7) administrative procedures and effective dates for implementation.

11. More than 100 parties, including telecommunications organizations, other Federal Government agencies, local and state authorities, and individuals, submitted comments in response to the Notice. Many of these parties filed extensive comments addressing the various issues discussed above. In addition, a significant number of parties addressed the issue of Federal preemption of state and local regulations for RF exposure. A list of commenting parties is provided in Appendix D.

III. DISCUSSION

A. New RF Exposure Guidelines

12. In the Notice, we noted that the 1992 ANSI/IEEE standard reflects recent scientific studies of the biological effects of RF radiation and that use of this standard would thus ensure that FCC-regulated facilities comply with the latest safety guidelines for RF exposure.[14] We also noted that other RF exposure criteria are available, such as those of the National Council on Radiation Protection and Measurements (NCRP) and those of the International Radiation Protection Association (IRPA).[15] We requested comment on whether the differences between these other guidelines and the 1992 ANSI/IEEE guidelines are significant, and whether it would be appropriate to adopt limits for RF exposure that differ from those in the 1992 ANSI/IEEE guidelines.

13. The comments filed in this proceeding have focused primarily on the 1992 ANSI/IEEE and NCRP exposure criteria. In many ways, these two sets of exposure guidelines are similar. Both organizations identify the same threshold level at which harmful biological effects may occur, and the MPE limits recommended for electric and magnetic field strength and

[14] The ANSI/IEEE standard was developed by the IEEE Standards Coordinating Committee 28 on Non-Ionizing Radiation Hazards (IEEE SCC28) and subsequently adopted by the IEEE Standards Board and the American National Standards Institute.

[15] Notice at para. 23. The NCRP is a non-profit corporation chartered by Congress to develop information and recommendations concerning radiation protection. NCRP consists of the members and participants who serve on its various scientific committees. Several government agencies and non-government organizations have established relationships with NCRP as "Collaborating Organizations." The FCC is one of these Collaborating Organizations.

power density in both documents are based on this threshold level.[16] Both the 1992 ANSI/IEEE and NCRP guidelines also are frequency dependent, based on knowledge of how whole-body-averaged human exposure is a function of the frequency of the RF signal. Further, both ANSI/IEEE and NCRP recommend two exposure tiers, one for "controlled environments" (ANSI/IEEE) or "occupational exposure" (NCRP) and another, more stringent, tier for "uncontrolled environments" (ANSI/IEEE) or "general population" exposure (NCRP). Tables 1, 2 and 3 in Appendix B show the MPE limits for the 1982 ANSI, 1992 ANSI/IEEE and NCRP exposure criteria, respectively.

14. The two sets of guidelines, however, do differ in some respects. The NCRP MPE limits are generally more stringent than the ANSI/IEEE limits for magnetic field strength at frequencies below 3 MHz and for power density at frequencies above 1500 MHz.[17] The NCRP guidelines also include a unique provision (that we are not adopting here) that reduces the exposure limit for workers with respect to certain forms of modulated RF carrier frequencies.[18] The NCRP guidelines specify that the general population MPE limits at higher frequencies are to be averaged over longer periods of time than those recommended by the ANSI/IEEE guidelines.[19] The NCRP, unlike ANSI/IEEE, only specifies MPE limits for frequencies up to 100 GHz. With respect to evaluating low-power devices, although both ANSI/IEEE and NCRP generally recommend the same localized SAR limits, ANSI/IEEE also includes an exclusion clause based on radiated power that is not a part of the NCRP guidelines. Although the ANSI/IEEE and NCRP guidelines differ at higher and lower frequencies, at frequencies used by the majority of FCC licensees the MPE limits are essentially the same regardless of whether ANSI/IEEE or NCRP guidelines are used. Therefore, the overall impact on most of our licensees

[16] Both the ANSI/IEEE and NCRP exposure criteria are based on a determination that potentially harmful biological effects can occur at an SAR level of 4 W/kg as averaged over the whole-body. Appropriate safety factors were then added to arrive at limits for both whole-body exposure (0.4 W/kg for "controlled" or "occupational" exposure and 0.08 W/kg for "uncontrolled" or "general population" exposure, respectively) and for partial-body (localized SAR), such as might occur in the head of the user of a hand-held cellular telephone.

[17] For example, in uncontrolled environments the 1992 ANSI/IEEE guidelines recommend a safe power density level of 1 mW/cm^2 at 1500 MHz increasing to a maximum of 10 mW/cm^2 at 15 GHz to 300 GHz, a significant change from the 1982 ANSI standard. The NCRP guidelines specify a fixed level of 1 mW/cm^2 for exposure of the general public at frequencies above 1500 MHz. NCRP limits for magnetic field exposure are also generally more stringent for frequencies below 100 MHz.

[18] This provision recommends that the stricter public exposure limits apply where workers are exposed to electromagnetic fields with carrier frequencies that are modulated at a depth of 50 percent or greater at frequencies between 3 and 100 hertz. See NCRP, supra, Section 17.4.7.

[19] For measuring MPE levels, the NCRP guidelines use an averaging time of 6 minutes for occupational exposure and 30 minutes for public exposure. For frequencies above 15 GHz, the ANSI/IEEE guidelines reduce this averaging time in a manner that is inversely proportional to the frequency raised to the 1.2 power.

from our adoption of new guidelines should not be significantly different regardless of which limits we choose.

15. Several federal agencies filed comments in this proceeding expressing varying viewpoints on whether we should adopt the ANSI/IEEE guidelines or some alternative. Within the Federal Government, the EPA is generally responsible for investigating and making recommendations with regard to environmental issues. In its comments, the EPA states that the new ANSI/IEEE guidelines are a significant revision of the 1982 ANSI guidelines and notes that certain aspects of the new guidelines are improvements with regard to protection.[20] However, the EPA submits that some of the provisions of the new ANSI/IEEE guidelines are not acceptable. For example, EPA does not support the relaxation in MPE limits for power density at higher microwave frequencies, and it opposes the application of the same exposure limits to both controlled and uncontrolled environments for frequencies from 15 GHz to 300 GHz. The EPA states that the ANSI/IEEE exposure limits for these frequencies are not sufficiently protective for public exposure. The EPA also argues that the terms controlled and uncontrolled environments used in the ANSI/IEEE guidelines are not well defined and are not directly applicable to any specific population group.

16. The EPA recommends that we adopt the NCRP's recommended MPE limits along with sections of the 1992 ANSI/IEEE guidelines dealing with localized exposure and induced and contact body currents. In terms of MPEs for power density and field strength, the EPA argues that the NCRP guidelines would better protect the public from potential long term effects of RF exposure at higher microwave frequencies where the two sets of guidelines differ. The EPA maintains that, "[t]here are no substantive differences in the literature base supporting 1986 NCRP and 1992 ANSI/IEEE except for the literature on RF shocks and burns." In addition, the EPA notes that NCRP is chartered by the U.S. Congress to develop radiation protection recommendations.

17. The EPA generally supports the use of the ANSI/IEEE limits for dealing with induced and contact currents to protect against shock and burn hazards. EPA states that those guidelines are not included in the NCRP exposure criteria, and they are a result of research and knowledge acquired since development of the NCRP recommendations. The EPA also supports the FCC proposal to use ANSI/IEEE SAR limits that apply to low-power devices such as cellular telephones (see discussion below). These values are similar to those recommended by the NCRP.

18. The FDA has general jurisdiction for protecting the public from potentially harmful radiation from consumer and industrial devices and in that capacity is expert in RF exposures that

[20] EPA Comments at 1.

would result from consumer or industrial use of hand-held devices such as cellular telephones.[21] The FDA generally supports our proposed use of the 1992 ANSI/IEEE guidelines, although it does express some reservations. It states that these guidelines will provide a greater level of protection to the general public, and it particularly supports use of the values for SAR that would apply to consumer and industrial devices. As discussed below, however, the FDA expresses significant concern about the radiated power exclusion clause included in the ANSI/IEEE standard that would apply to some hand-held devices.[22]

19. The National Institute for Occupational Safety and Health (NIOSH), an agency of the U. S. Department of Health and Human Services, is responsible for performing research and analysis with respect to worker safety and health. In its comments, NIOSH expresses general support for our efforts to update our RF exposure regulations and notes that the MPE limits defined in the 1992 ANSI/IEEE guidelines are similar to those contained in recommendations of the NCRP and the International Radiation Protection Association.[23] NIOSH states that we should take a more conservative approach when uncertainty exists with respect to applying certain features of the exposure guidelines. In particular, NIOSH agrees with the EPA that it would be more appropriate to use the MPE limits recommended by NCRP guidelines at higher frequencies. NIOSH also supports the use of the ANSI/IEEE limits on induced RF currents.

20. The Occupational Safety and Health Administration (OSHA) has jurisdiction over Federal regulations dealing with worker safety and health. In its comments, OSHA generally endorses our proposal to update our RF exposure guidelines by adopting the new ANSI/IEEE guidelines.[24] OSHA also urges us to require applicants to implement a written RF exposure protection program which appropriately addresses traditional safety and health program elements including training, medical monitoring, protective procedures and engineering controls, signs, hazard assessments, employee involvement, and designated responsibilities for program implementation. It notes that the exposure limits in the ANSI/IEEE guidelines may be useful in determining when specific elements of an RF safety program should be implemented. However, OSHA objects to the two categories of exposure environments contained in the new ANSI/IEEE standard, finding it unacceptable that employees may be subjected to a higher level of risk than the general public simply because they "are aware of the potential for exposure as a concomitant of employment." Rather, OSHA proposes that we adopt the uncontrolled environment criteria as an "action limit" which determines when an RF protection program will be required. That is,

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[21] See 21 CFR § 1000 et seq.

[22] FDA Comments at 1.

[23] NIOSH Comments at 1.

[24] OSHA Reply Comments at 1.

under OSHA's proposal, persons who are exposed in excess of the limits specified for uncontrolled environments would be protected by a program designed to mitigate any potential increase in risk.

21. The majority of industry comments favor adoption of the 1992 ANSI/IEEE guidelines. For example, American Personal Communications (APC), American Telephone and Telegraph Company (AT&T), Electromagnetic Energy Policy Alliance (EEPA), Ericsson Corporation (Ericsson), McCaw Cellular Communications, Inc. (McCaw), National Association of Broadcasters (NAB), Telecommunications Industry Association (TIA), and others urge that we adopt the new ANSI/IEEE guidelines, arguing that they represent the most up-to-date standard available. Telocator (now the Personal Communications Industry Association, PCIA) agrees that the ANSI/IEEE standard is the most recent and comprehensive RF exposure guideline, noting that an international committee of over 120 scientists and engineers was involved in its drafting. However, Telocator submits that the actual impact of the ANSI/IEEE, NCRP or IRPA standards would be about the same on Personal Communications Service (PCS) operations, since all three standards are based on the same specific absorption rates, and the power densities each provides for the PCS band are essentially the same.[25]

22. AT&T submits that the new ANSI/IEEE standard agrees with the latest proposals for controlled environments issued by the American Conference of Governmental Industrial Hygienists.[26] AT&T also states that the members of the IEEE committee that developed the new guidelines represent a larger and more complete group of experts than those who developed other guidelines, such as the NCRP and the IRPA guidelines. TIA notes that the IEEE committee represents the most competent and expert scientists and specialists in the world in the area of RF biological effects.[27] McCaw also states that the ANSI/IEEE standard incorporates substantial safety factors and addresses all of the environmentally significant aspects of RF exposure.[28]

23. NAB recommends that we adopt the new ANSI/IEEE guidelines and provide procedures and guidance for its application. NAB submits that there is substantial agreement among the available standards with respect to exposure limits in the 30 to 300 MHz range.[29] It also states that where the standards differ at extreme frequencies, the ANSI/IEEE standard should

[25] Telocator Comments at 3.

[26] AT&T Comments at 6.

[27] TIA Comments at 27.

[28] McCaw Comments at 3.

[29] NAB compared the ANSI/IEEE standard to standards of NCRP, IRPA, and the American Conference of Governmental Industrial Hygienists (ACGIH). NAB Comments at 32-33.

be followed, since it is based on more recent scientific information. For example, NAB notes that while there are differences between the ANSI/IEEE standard and the NCRP guidelines at lower frequencies, these differences lie in the MPE limits for the magnetic field. It states that in developing the NCRP guidelines, the magnetic field strength limit was merely made equal to the electric field strength limit and that the electric field strength was capped at a value of 614 volts per meter because of shock and burn considerations. NAB contends that such a value should not apply to the magnetic field strength, since high magnetic fields are not associated with shock or burn. Consequently, NAB argues that the limits contained in the ANSI/IEEE standard, which are based on limiting the SAR of the magnetic field, are more scientifically correct.

24. Jules Cohen & Associates (JC&A) argues that although the ANSI/IEEE exposure limits are at some points less restrictive than the NCRP limits, the averaging times must also be taken into consideration.[30] JC&A states that skin burning is the applicable consideration at higher microwave frequencies. JC&A, therefore, submits that the new ANSI/IEEE limits represent a better standard because at frequencies above 3 GHz the lower averaging times recommended allow much less energy absorption than the NCRP guidelines. EEPA argues that the ANSI/IEEE limits for higher frequencies above 15 GHz are appropriate and consistent with "well-established biologically based" national and international limits for infrared lasers.[31] EEPA and NAB note that at 300 GHz the MPE limits contained in the 1992 ANSI/IEEE standard are the same as the MPE limits in ANSI Z136.1-1993 and the International Electrotechnical Commission (IEC) laser standard, and that all three standards use the same 10-second averaging time.[32] EEPA also states that the six-minute averaging time recommended by the NCRP guidelines is not sufficiently short to protect against skin burning for exposure to short pulses at higher frequencies where most of the energy is deposited in surface layers of tissue.

25. JC&A, EEPA, Ericsson, Motorola, Raytheon Company (Raytheon), and TIA argue that there is no scientific evidence to support the modulation provisions contained in the NCRP guidelines.[33] JC&A contends that this requirement has no practical application because broadcast transmitters are not modulated at these frequencies at a depth of 50 percent or greater except for very short intervals. Therefore, JC&A concludes that circumstances would not arise that would

[30] JC&A Comments at 8.

[31] EEPA Comments at 8. See also, NAB Comments at 34.

[32] (1) American National Standard for the Safe Use of Lasers, ANSI Z136.1-1993, American National Standards Institute, New York, N.Y. (1993). (2) Radiation Safety of Laser Products, Equipment Classification, Requirements and User's Guide, Publication 825, International Electrotechnical Commission, Geneva, Switzerland (1993).

[33] As noted above, the NCRP guidelines require use of the general population exposure limits, even for the workplace, if the exposure is to carrier waves modulated at a depth of 50 percent or greaterat frequencies between 3 and 100 Hz.

call for application of this stricter standard in a controlled environment.[34] EEPA notes that no other standard-setting organization in the United States or in other countries regards modulation considerations as a meaningful issue. Ericsson claims that the IEEE committee looked at the issue of modulation effects at frequencies between 3 and 100 Hz and concluded that there is no scientific data to support the modulation provisions in NCRP's guidelines.[35] Similarly, Motorola states that there is insufficient scientific data upon which to base regulations for amplitude-modulated radio signals. Motorola recommends that we monitor any relevant biological research on this type of modulation and take appropriate regulatory action as warranted in the future.[36] Raytheon and TIA point out that studies over the last several years observed that within the recommended safe exposure levels, no reliable scientific data exists which indicates that modulation of the electromagnetic fields is a factor meaningfully related to human health.[37]

26. The IEEE's Standards Coordinating Committee 28 (IEEE/SCC28), which developed the ANSI/IEEE guidelines, took issue with several of the points made by the EPA. IEEE/SCC28 states that the new guidelines and the NCRP recommendations are actually quite similar, with the exception of the MPEs at higher microwave frequencies. In addition, it points out that both the ANSI/IEEE and the NCRP guidelines are based on the use of SAR as the fundamental dosimetric parameter, the same criterion for biological effect (behavioral disruption), and the same safety factors to define the two tiers of exposure.[38]

27. In comments filed late in this proceeding, Dr. Arthur W. Guy, former Chairman of both ANSI/IEEE and NCRP committees on RF exposure expresses his view that, "it would be a mistake for the FCC to adopt the older 1986 NCRP standard at this time considering the fact that newer and more advanced standards have been developed since the publication of the NCRP standard."[39] Similar views are expressed in letters submitted to the Commission by Dr. Eleanor Adair and Dr. C.K. Chou, both of whom have been involved in ANSI/IEEE and NCRP RF

[34] JC&A Comments at 9.

[35] Ericsson Comments at 12.

[36] Motorola Comments at 21-22.

[37] Raytheon Comments at 2.

[38] IEEE/SCC28 Reply Comments at 1-7.

[39] See "Reply Comments of Arthur W. Guy, Ph.D.," March 9, 1996, and letter of A. W. Guy to Reed E. Hundt, Chairman, FCC, dated March 14, 1996. Both placed in the record of this proceeding as ex parte filings.

committees.[40] All of these individuals urge that we adopt the ANSI/IEEE standard instead of the NCRP exposure criteria.

28. Decision. Although most commenting parties generally support our proposal to adopt the 1992 ANSI/IEEE guidelines, some of the Federal agencies filing comments in this proceeding, principally those with responsibility for oversight regarding health and safety issues, object to the use of certain aspects of these guidelines. In the past, the Commission has stressed repeatedly that it is not a health and safety agency and would defer to the judgment of these expert agencies with respect to determining appropriate levels of safe exposure to RF energy.[41] We continue to believe that we must place special emphasis on the recommendations and comments of Federal health and safety agencies because of their expertise and their responsibilities with regard to health and safety matters. Accordingly, as recommended by the EPA, we are adopting exposure limits for field strength and power density based on those recommended by the NCRP for frequencies from 300 kHz to 100 GHz (see Appendix C). As noted previously, over a wide frequency range these limits are also based on those recommended in the ANSI/IEEE 1992 standard.[42] We believe that the exposure criteria we are adopting will protect workers and the general public from potentially harmful RF emissions due to FCC-regulated transmitters.

29. We recognize that the NCRP guidelines do not address exposure at frequencies below 300 kHz or above 100 GHz, as do the ANSI/IEEE guidelines. However, the FCC-regulated transmitters of concern operate at frequencies between 300 kHz and 100 GHz. Therefore, we see no need at this time to adopt guidelines for frequencies outside of the range of the NCRP recommendations.

30. We appreciate the concerns raised by NAB with respect to NCRP guidelines for low-frequency magnetic-field exposure, and we recognize that the NCRP guidelines may be conservative for frequencies below 100 MHz. However, compliance with these limits would appear to be an issue only in occupational situations, e.g., in the immediate vicinity of an AM broadcast transmitter; and, there is nothing in the record to indicate that significant problems exist with respect to compliance with these magnetic field limits in the workplace.

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[40] See, letter from Eleanor R. Adair, Ph.D., to Reed E. Hundt, Chairman, FCC, dated March 14, 1996, and letter from C.K. Chou, Ph.D., to Thomas P. Stanley, Chief Engineer, FCC, dated March 20, 1996.

[41] See, e.g., Report and Order, GEN Docket 79-144, at para. 26 note 6 supra. See also, letter from Mark S. Fowler, Chairman, FCC, to Anne M. Burford, Administrator, EPA, February 22, 1983; letter from Dennis R. Patrick, Chairman, FCC, to Lee M. Thomas, Administrator, EPA, November 29, 1988; and letter from Thomas P. Stanley, Chief Engineer, FCC, to Ken Sexton, Director, Office of Health Research, Office of Research and Development, EPA, October 24, 1990.

[42] See note 1, supra.

31. We also recognize the merit of arguments as to whether, at the higher microwave frequencies, incorporating different time-averaging values, such as those specified by the ANSI/IEEE guidelines may be desirable. As discussed by JC&A, IEEE/SCC28 and others, the level of energy density allowed by the 1992 ANSI/IEEE guidelines can actually be more restrictive at higher frequencies than the NCRP guidelines when time-averaging is considered. For frequencies above 3 GHz (uncontrolled) and 15 GHz (controlled) the ANSI/IEEE time-averaging values are less than those of NCRP, and they continue to decrease at higher frequencies. Because of the lengthier NCRP averaging times at these frequencies, very short exposures at very high power densities might comply with NCRP limits as long as they are followed by insignificant exposures for the duration of the time-averaging interval. In that sense, ANSI/IEEE could be viewed as affording a greater degree of protection from skin burning at the higher microwave frequencies. However, we are not aware of any practical situations involving FCC-regulated transmitting facilities where such exposures are likely to occur. Of far greater significance, we believe, is the case of a consumer-product without any identifiable usage pattern, where continuous exposure would have to be assumed and time-averaging would not be relevant.

32. We agree with those commenters who maintain that there is insufficient evidence to give special consideration to modulation effects at this time. Since we have no specific indication of exposure hazards related to modulation caused by FCC-regulated transmitters, we believe it would be premature at this time to adopt the NCRP modulation criteria.

33. We believe that OSHA's suggestion that we use the uncontrolled exposure tier of the ANSI/IEEE standard as the basis for an "action limit" for establishment of an RF safety program is beyond the scope of our jurisdiction. Our NEPA responsibilities do not appear to encompass the issuance of specific rules on workplace practices and procedures. If such a policy were to be instituted by the Federal Government it would seem more appropriate for OSHA itself to promulgate this type of rule.

34. Both the IEEE and the NCRP have committees that are working on revisions of their respective exposure guidelines. We encourage these organizations and other similar groups developing exposure criteria to work together, along with the relevant federal agencies, to develop consistent, harmonized guidelines that will address the concerns and issues raised in this proceeding. We will consider amending our rules at any appropriate time if these groups conclude that such action is desirable.

B. Definitions of Controlled and Uncontrolled Environments

35. The 1992 ANSI/IEEE guidelines specify two sets of exposure limits based on the "environment" in which the exposure takes place.[43] These environments are classified as either "controlled" or "uncontrolled." Controlled environments are defined as locations where "there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above [the exposure and induced current levels permitted for uncontrolled environment but not those permitted for controlled environments]." Uncontrolled environments are defined as "locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed [the exposure and induced current levels permitted for uncontrolled environments]." The NCRP designates exposure limits in terms of "occupational" and "general population" exposure. However, the NCRP report does not provide specific definitions of these terms.

36. In the Notice, we requested comment on the criteria to be used in determining which set of exposure limits would apply to the various situations that would be subject to environmental analysis and whether the definitions of controlled and uncontrolled environments used in the ANSI/IEEE guidelines were practical and supportable for the Commission's purposes. We stated that because matters of possible health and safety are involved, a conservative approach would be appropriate. Accordingly, we proposed to provide that where there is any question of possible exposure of the general public, the more stringent guidelines for uncontrolled environments would apply. We also specifically stated that the guidelines for uncontrolled environments would apply to any transmitter or facility located in a residential area where proximity to the transmitter is unrestricted. On the other hand, we indicated that controlled environment limits would apply to situations where exposure is incidental and transitory or where exposure is incurred when individuals are aware of the exposure potential.

37. Most parties support the use of a two-tier RF exposure standard and the ANSI/IEEE definitions for "controlled environment" and "uncontrolled environment." In general, these parties support applying the ANSI/IEEE definition for uncontrolled environment to those transmitters and facilities in residential areas or locations with unrestricted access. They suggest that the controlled environment should apply to incidental and transitory exposure and in areas where people are aware of potential exposure through warning signs and instructions. The Land Mobile Communication Council (LMCC), NAB, and others propose that the distinction between the two environments be based on the context of the equipment's use and types of communication operations being performed. They argue that the controlled standards should be applied when the equipment is used in a commercial or business setting where the operator is "knowledgeable" in

[43] The 1982 ANSI guidelines contain a single level of MPE limits and do not differentiate based on environment.

the use of his/her equipment. They state that the uncontrolled standard should apply to the general public where the user or party exposed is not considered "knowledgeable" about the transmitting device and the use of those devices is incidental or personal in nature.[44]

38. JC&A and EEPA state that the ANSI/IEEE uncontrolled/controlled environment designations are less ambiguous than the terms occupational and general population used by NCRP.[45] IEEE/SCC28 states that during consideration of its standard, it explicitly rejected NCRP's occupational and general population categories on the grounds that there is no reliable scientific data indicating that certain subgroups of the population are more at risk than others.[46] On the contrary, IEEE/SCC28 maintains, the important distinction is not population type, but the nature of the exposure environment.[47]

39. A number of parties, such as Broadcast Signal Lab (BSL), Du Treil, Lundin & Rackley, Inc. (DLR), Ericsson and Sprint Cellular Company (Sprint), urge that we define these terms more completely and clearly to minimize any ambiguity in the application of these definitions. These parties argue that without clear definitions of controlled and uncontrolled environments and related terms, such as incidental or transient exposure, many locations could unnecessarily end up subject to the more stringent uncontrolled environment category. AMSC Subsidiary Corporation (AMSC), the Department of Defense (DoD), the Utilities Telecommunications Council (UTC), and others are similarly concerned that applying the more conservative uncontrolled guidelines where there is "any question of possible exposure" of the general public would frustrate the purpose of a two-tiered standard.[48] DLR argues that better definitions are needed to avoid confusion and inconsistent application of the standard and suggests defining a controlled environment as "an area which is restricted from access by all except authorized personnel . . . ."[49] Alternatively, DLR submits that we should adopt a single exposure limit based on the uncontrolled environment. E.F. Johnson Company (E.F. Johnson) states that the controlled/uncontrolled dichotomy may lead some to conclude that exposure levels

[44] LMCC Comments at 4. NAB Comments at 2.

[45] JC&A Reply Comments at 2-3, EEPA Reply Comments at 2-3.

[46] IEEE/SCC28 Comments at 2.

[47] See also Raytheon Comments at 1, IEEE Committee on Man and Radiation (COMAR) Comments at 1.

[48] UTC Comments at 3-4.

[49] DLR Comments at 2.

appropriate in the controlled environment are dangerous and that we should specify measures to ensure that those that are expected to be aware of their environment are, in fact, aware.[50]

40. The EPA opposes use of the terms controlled and uncontrolled environments and recommends that we define exposure environments using the traditional terms of "occupational" and "general population or public" contained in the NCRP guidelines. EPA contends that its own 1984 report on the biological effects of RF radiation and the NCRP have concluded that the general population has groups of individuals particularly susceptible to heat, including the elderly, infants, pregnant women and others.[51] EPA argues that the ANSI/IEEE terms are not directly applicable to any population group and are not well defined.[52] OSHA and NIOSH do not oppose the use of the ANSI/IEEE definitions but raise questions about their application. OSHA, for example, states that employees should not be subjected to a higher level of risk as a condition of their employment just because they are made aware of the potential for exposure.[53] NIOSH states that where there is any question about exposure category, the more conservative uncontrolled criteria should be applied.[54]

41. The American Radio Relay League, Inc. (ARRL) also opposes use of the ANSI/IEEE definitions, arguing that under these definitions amateur operations would unjustly be categorized as operating in an uncontrolled environment. It suggests that there is no reason to require amateurs to meet the high safety factor below the threshold for adverse health effects that is the basis for the uncontrolled MPE limits. The ARRL indicates that the controlled environment MPE limits "should be safe for all."[55]

42. Decision. We find it appropriate to use the terms "occupational" and "general population" contained in the NCRP report. We note, however, that the NCRP report does not provide explicit definitions of these terms, and we agree with the commenting parties that we need to define these terms more completely and clearly to minimize any ambiguity in the application of the exposure limits. We believe that the ANSI/IEEE definitions for controlled and uncontrolled environments can be used as a basis for applying our use of the two exposure tiers

[50] E..F. Johnson Comments at 4-5.

[51] EPA Comments at 3.

[52] EPA Comments at 3-4.

[53] OSHA Reply Comments at 1-2.

[54] NIOSH Comments at 2.

[55] ARRL Comments at 11-12.

we are adopting, while at the same time accomplishing the intent of the NCRP criteria to protect workers and the public.

43. Accordingly, "occupational/controlled" exposure, as used by the Commission, will apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over the their exposure. Occupational/controlled exposure will also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. We will apply the occupational/controlled exposure limits to amateur radio operators and members of their immediate household, as discussed later (see para. 162, infra).

44. "General population/uncontrolled" exposure, as used by the Commission, will apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or can not exercise control over their exposure. Therefore, members of the general public always fall under this category when exposure is not employment-related, as in the case of residents in an area near a broadcast tower. We believe that these definitions will clarify the ambiguities pointed out by many of the commenting parties and will thus ensure that the appropriate level of protection is applied in each situation. We do not agree with those parties that support applying the general population or uncontrolled limits to all situations. This approach would impose significant and unnecessary economic and technical burdens for which adequate justification has not been presented.

45. For purposes of these definitions, awareness of the potential for RF exposure can be provided through specific training as part of an RF safety program. Warning signs and labels can also be used to establish such awareness as long as they provide information, in a prominent manner, on risk of potential exposure and instructions on methods to minimize such exposure risk.[56] However, warning labels placed on low-power consumer devices such as cellular telephones will not be considered sufficient to achieve the awareness necessary to qualify these devices as operating in a controlled environment. We plan to provide further instructions on the application of these definitions in an upcoming revision of OST Bulletin No. 65 concerning compliance with RF exposure guidelines.[57]

[56] For example, a sign warning of RF exposure risk and indicating that individuals should not remain in the area for more than a certain period of time could be acceptable.

[57] "Evaluating Compliance with FCC-Specified guidelines for Human Exposure to Radiofrequency Radiation," OST Bulletin No. 65, October 1985. OST Bulletin No. 65 will be renamed OET Bulletin No. 65 when it is released.

C. Evaluation of Low-Power Devices

46. The 1992 ANSI/IEEE guidelines permit low-power devices designed to be used in the immediate vicinity of the body, such as portable and hand-held radios and telephones, to be excluded from compliance with the prescribed limits for field strength and power density provided that such devices comply with specific SAR limits or that the radiated power of the device is below a certain level.[58] "Low-power" devices include mobile transmitters such as automobile and marine radio transceivers, and hand-held portable devices such as cellular telephones and "walkie-talkie" type radios. These low-power exclusions would eliminate the need for making MPE field strength measurements in areas extremely near to the transmitting device where they may not be an appropriate measure of actual energy absorption. For low-power devices in controlled environments, SAR levels must be less than 0.4 W/kg as averaged over the whole-body, and the spatial peak SAR must be less than 8 W/kg as averaged over any 1 gram of tissue at frequencies between 100 kHz and 6 GHz. The corresponding limits for devices operated in uncontrolled environments are 0.08 W/kg for whole-body average exposure and 1.6 W/kg for spatial peak SAR. These SAR limits are also essentially the same as those recommended by the NCRP for occupational and general population exposure, respectively.[59]

47. With regard to exclusions based on radiated power, the ANSI/IEEE guidelines permit an exclusion in controlled environments if the radiated power of a device is 7 watts or less at frequencies between 100 kHz and 450 MHz. At frequencies between 450 and 1500 MHz, the radiated power is limited to 7(450/f) watts, where f is the frequency in MHz. In uncontrolled environments, the guidelines permit exclusion if the radiated power is 1.4 watts or less for frequencies between 100 kHz and 450 MHz and 1.4(450/f) watts for frequencies between 450 and 1500 MHz. The ANSI/IEEE guidelines also state that exclusions based on radiated power do not apply when the "radiating structure" of the device is within 2.5 cm of the body. The NCRP guidelines do not provide exclusions based on radiated power.

48. In the Notice, we proposed to adopt the ANSI/IEEE SAR exclusion for low-power devices for both controlled and uncontrolled environments, depending on the actual environment

[58] See Notice at para. 14 ("Low-Power Devices/Exclusions). The ANSI/IEEE low-power exclusions are based on consideration of either SAR or a device's radiated power ("radiated power exclusion"). See also ANSI/IEEE C95.1-1992, clauses 4.2.1.1 and 4.2.2.1.

[59] See NCRP Report No. 86, Section 17.4.5. The NCRP guidelines specify that the criterion for general-population, localized exposure "should allow no more than one-fifth the levels of SAR allowed for occupational exposures [8 W/kg]," i.e., 1.6 W/kg as also recommended by ANSI/IEEE. However, the NCRP also notes that exposure of individuals in the general population who use "radio emitters" such as hand-held transceivers is permitted, "as a personal decision by the individual, provided that the devices are designed and used as designed so that the exposure of the individual does not exceed the occupational guidelines [8 W/kg] and provided that . . . . the individual does not expose other persons above the population guidelines."

in which the device would be used. We also proposed to adopt the radiated power exclusion, but only for those low-power devices that meet the more conservative guidelines for uncontrolled environments. We also requested comment on whether proof of compliance should be required to be submitted as part of the equipment authorization process, and, if so, the form such a showing should take.

49. The various Federal health and safety agencies commenting in this proceeding, including the EPA, FDA, NIOSH and OSHA, generally support the SAR limits contained in the ANSI/IEEE guidelines. EPA states that these limits are similar to those recommended by the NCRP. FDA supports use of the SAR limits as they would apply to consumer and industrial devices. FDA, however, opposes the ANSI/IEEE radiated power exclusions. It argues that recently published scientific studies indicate that some hand-held radiotelephones that meet the exclusion criteria for radiated power can be used in a manner that induces SARs exceeding the 1.6 W/kg limit for uncontrolled environments.[60] Therefore, the FDA does not believe that the ANSI/IEEE guidelines for radiated power are sufficient to guarantee compliance with SAR limits. The FDA argues that all low-power devices should be certified by their manufacturers as not exceeding the local SAR limits, as determined under "realistic worst-case conditions."

50. Most other commenting parties support both the SAR and radiated power exclusions for low-power devices contained in the ANSI/IEEE guidelines. Several parties disagree with our proposal that the exclusion should apply to only those low-power devices that meet the more stringent uncontrolled radiated power guidelines. These parties generally argue that devices intended to be used in a commercial, business or public safety context should be permitted to comply with the exclusion levels for controlled environments. EEPA, LMCC, Motorola, TIA and others state that hand-held devices such as those typically used in a number of the private land mobile services should be included under the controlled environment category because such users are aware of the potential for RF exposure. Motorola and TIA argue that the controlled limits should apply to Part 90 services except Specialized Mobile Radio (SMR) and also to certain services under Parts 21, 74, 80, 94, and 95 of our rules.[61] E.F. Johnson similarly states that if workers who use communications equipment as part of their employment are provided

[60] Letter from Elizabeth D. Jacobson, Ph.D., Deputy Director for Science, Center for Devices and Radiological Health, FDA, to Richard M. Smith, Chief, Office of Engineering and Technology, FCC, December 12, 1994. According to FDA staff, primary studies of concern are: (1) N. Kuster, T. Schmid and K. Meier, "Studies of Absorption in the Extreme Near Field of Transmitters," Proceedings of VDE Meeting, Bad Nauheim, Germany, November 9-10, 1993, and (2) M. Jensen and Y. Rahmat-Samii, "EM Interaction of Handset Antennas and a Human in Personal Communications," Proceedings of the IEEE, 83, pp. 7-17, January 1995.

[61] See also comments from the National Association of Business and Educational Radio, Inc. (NABER) at 3-4. NABER also urges that we consider case-by-case classifications, since not all devices can be easily classified as being applicable to either controlled or uncontrolled environments.

appropriate notification of their exposure, then standards for controlled environments should be used.

51. TRW, Inc. (TRW) states that application of the uncontrolled criteria to all hand-held devices would be unnecessarily restrictive. TRW maintains that the handsets to be used with its mobile satellite service (MSS) system should be regulated under the controlled criteria, since only the MSS user will be exposed to any significant level of RF energy and there will be no danger of exposure to non-users or unaware individuals. It argues that any potential exposure could be mitigated through a combined program of consumer education and strategic design of the equipment.[62] UTC expresses the view that the ANSI/IEEE guidelines already include a wide margin of safety and that additional protective measures are not needed.

52. The Arizona Department of Public Safety (ADPS) argues that the controlled classification is essential to state governmental agencies so that they can continue to operate their existing 7 watt portable radios at frequencies below 450 MHz. ADPS states that undue hazards of RF exposure from the operation of mobile and portable radio devices can be avoided by appropriate training of personnel.

53. GTE Service Corporation (GTE) maintains that Part 15 and Part 22 mobile transmitters operate at power levels that should not raise concerns under the new ANSI/IEEE standards. It points out that cellular telephones' use of "adaptive power control" provides an additional margin of safety, i.e., the telephones normally operate at a power level less than the 0.6 watt maximum in a typical urban market. According to GTE, as carriers further increase cell density to accommodate growing consumer demand, average transmit power will continue to decline.

54. The Electronic Industries Association/Consumer Electronics Group (EIA) notes that the Notice did not specify whether products that are subject to the Part 15 regulations would be subject to evaluation for compliance with the ANSI/IEEE guidelines. EIA believes that the proposed rules should not apply to intentional and unintentional radiators authorized under Part 15, including wireless video and audio distribution equipment, remote-controlled toys, and similar RF devices used by consumers. According to EIA and others, such devices are already subject to emission limits for purposes of reducing electromagnetic interference and that compliance with

[62] TIA recommends that we dismiss the petition from Ken Holladay, referenced in the Notice, note 21, which requests the prohibition of all hand-held telephones and radios pending evaluation of any health risk, since the petition has met none of the Commission's clearly-enunciated requirements for petitions. To that end we are following TIA's recommendation and dismissing the Holladay petition for this reason and, also, because the Commission's adoption of rules for evaluation of health risk negates the premise for the petition.

these limits essentially precludes human exposure to harmful levels of RF energy.[63] Apple Computer, Inc. (Apple) also asks that if the radiated power exclusion limit for Part 15 devices operating in the Industrial, Scientific and Medical ("ISM") frequency bands is lower than the presently allowable 1 watt, a substantial period of time should be provided for industry to comply. Apple also proposes that the duty cycle of devices be taken into account when setting power exclusion limits due to the extreme variability in the operating characteristics of unlicensed PCS and other Part 15 devices.

55. A number of parties request clarification of various aspects of the low-power exclusion. In particular, several parties request that we specify the method to be used for measuring radiated power for purposes of the exclusion. For example, Alcatel SEL (Alcatel) suggests defining "radiated power" as the root mean square (RMS) value of the radiated power averaged over a six-minute time interval, while Ericsson and TIA recommend the IEEE definition of radiated power.[64] Other parties request that we clarify the applicability of time-averaging criteria to the low-power exclusions and define the term "radiating structure." For example, GTE and TRW note that the exposure potential of a device can be considerably less when actual use characteristics are taken into account.[65] Matsushita submits that parts of a device that radiate RF energy at levels that are ten times below the ANSI recommended limits for uncontrolled environments should not be considered as radiating structures.[66]

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[63] See also Linear Corporation (Linear) Comments at 3-4, Matsushita Communications Industrial Corporation of America (Matsushita) Comments at 12.

[64] Ericsson and TIA note that the IEEE Standard Dictionary of Electrical and Electronics Terms (5th Ed.) defines radiated power output (transmitter performance) as "The average power output available at the antenna terminals, less the losses of the antenna, for any combination of signals transmitted when averaged over the longest repetitive modulation cycle." In 1993, Ericsson requested an interpretation of the term "radiated power" used in defining the low-power exclusions from the IEEE. The IEEE response, which Ericsson forwarded to us on September 12, 1994, was prepared by the Interpretations Working Group of IEEE/SCC28. The response indicates that the term "radiated power" as applied to low-power devices means "the total power radiated into free space in absence of objects that may cause scattering, e.g., 'radiated power' excludes effects caused by the presence of the user's hand or head."

[65] For example, TRW notes that during a three-minute telephone call a user would be both transmitting (talking) and not transmitting (listening). Assuming a conservative "voice activity factor" of 50%, TRW continues, a handset would emit RF radiation for only 1.5 minutes of the call and those emissions would likely be random, short bursts, and not a continuous transmission. GTE notes that 71% of all cellular calls last less than 90 seconds. See TRW Comments at 1, GTE Comments at 10-11.

[66] Matsushita Comments at 6.

56. Several parties also recommend extending the range of applicability of the radiated power exclusion clause from its current upper limit of 1500 MHz to 2 GHz or above.[67] Alcatel, for example, maintains that the 1500 MHz limit of the ANSI/IEEE standard is arbitrary and should be extended to 2000 MHz. Alcatel believes that such an extension would make the U.S. standards more consistent with those of Europe. According to BellSouth, extension of the radiated power exclusion criteria to include 2 GHz PCS frequencies would reduce the burden on manufacturers of complying with the new RF exposure standards. Motorola urges that we request ANSI to develop the necessary experimental data to justify extension of the radiated power exclusions up to 5 GHz to accommodate the PCS and other future technologies. TIA recommends extending the applicable range to 6 GHz.

57. A number of parties also address the ANSI/IEEE provision that the radiated power exclusion clause does not apply to devices where the radiating structure is within 2.5 cm of the body. For example, Alcatel maintains that the 2.5 cm separation requirement is arbitrary and renders compliance with the low-power exclusion clause unnecessarily complicated. Alcatel does not believe that the 2.5 cm requirement is supported by the theory of the behavior of electromagnetic fields. Ericsson submits that the IEEE did not intend that the radiated power exclusions not apply to low-power devices where the radiating structure may be within 2.5 cm of the head some of the time.[68] E.F. Johnson, LMCC, Motorola, Northern Telecom, TIA and others recommend that we develop a radiated power exclusion for devices with radiating elements within 2.5 cm of the body.

58. Most commenting parties agree that a demonstration of compliance with the RF exposure standards for low-power devices should be part of the equipment authorization process. The Cellular Telecommunications Industry Association (CTIA), EEPA, Motorola, Northern Telecom, Telocator, TIA, and others generally recommend that applications for type acceptance include statements indicating that SAR measurements were performed by approved methods and that the unit meets the appropriate SAR criteria. NABER (now merged with PCIA) states that all equipment authorized under the low-power standards should carry a label certifying that the

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[67] See Comments of Bell South Corporation, etc., (BellSouth) at 4, E.F. Johnson Comments at 6-7, LMCC at 8, Northern Telecom Comments at 3-4, PCIA Comments at 5-6, Sprint Comments at 8, TIA Comments at 10-11 and others.

[68] Ericsson states that it asked the IEEE to clarify the meaning of the requirement for a distance of 2.5 cm to be maintained between the radiating structure of a device and the body of the user. In response, the Interpretations Working Group of IEEE/SCC28 stated that:

> Subcommittee 4 did not intend to exempt from the exclusion clause hand-held devices where the radiating structure may be within 2.5 cm of the head some of the time. The paragraphs in 4.2.1.1 and 4.2.2.1 that start with "This exclusion does not apply" .... was directed to the use of devices worn on the body with radiating structures maintained within 2.5 cm of the torso."

device complies with the Commission's RF exposure standards.[69] NABER also recommends that equipment manufacturers be required to provide manuals and pamphlets with each device that explain how the equipment should be installed and maintained to ensure safe operation.[70]

59. Telocator recommends that we amend Part 2 of our rules to require manufacturers of portable radio units that do not fall under the low-power exclusion to submit technical showings that the radios are in compliance with the guidelines. Telocator submits that manufacturers are better able to effect compliance because they control the design of the device; that it would be less burdensome overall to monitor compliance through the equipment authorization process than the licensing procedures of the various radio services; and that the public would be best served by preventing the sale of devices that do not comply with the guidelines.[71]

60. A number of parties support the development of standards for measurement of SAR. Ericsson recommends that we designate an appropriate ANSI-accredited standards generating body to develop standardized measurement and calibration procedures for facilities, phantom (human) models, and antenna models to enable manufacturers and the Commission to measure with certainty that RF devices meet appropriate standards.[72] Ford Motor Company (Ford) submits that the Commission, in cooperation with industry and with the guidance of ANSI and the IEEE, should develop recommended modeling techniques for SAR measurement. Ford notes that procedures for measuring RF exposure potential were developed for the broadcast industry, as illustrated in OST Bulletin No. 65, and submits that a similar approach would be appropriate here.[73] Motorola supports the development of standards for measurement procedures and test site construction. TIA states that measurement standards for low-power devices could be developed through an ANSI-accredited standards-setting process and that it is willing to serve as a focal point for such efforts.[74]

61. Many respondents seek clarification regarding the use of analytic methods for SAR evaluation. AT&T notes that the ANSI/IEEE standard does not require laboratory measurements for showing SAR compliance, but rather permits establishing compliance "by appropriate techniques." AT&T, Ericsson and others urge us to clarify that it is permissible to use numerical

[69] See also Comments of Northern Telecom at 5.

[70] NABER Comments at 5.

[71] Telocator Comments at 11.

[72] Ericsson Comments at 6. See also BellSouth Comments at 7, Comsat Reply Comments at 4.

[73] Ford Comments at 11.

[74] Motorola Comments at 23. TIA Reply Comments at 14.

methods such as high-resolution Finite Difference Time Domain (FDTD) techniques in evaluating SAR compliance.[75] Matsushita recommends that we approve certain analytic techniques, such as those discussed in existing scientific and technical publications by Kuster, Balzano and others, as alternatives to testing by laboratories for demonstrating compliance.[76]

62. Decision. Most commenting parties, including Federal health and safety agencies, support the use of the ANSI/IEEE SAR limits for localized (partial body) exposure for evaluating low-power devices designed to be used in the immediate vicinity of the body. As mentioned above, the SAR limits specified by the ANSI/IEEE guidelines for devices used in controlled and uncontrolled environments are essentially the same as those recommended by NCRP for occupational and general population exposure, respectively. Therefore, in view of the consensus and the scientific support in the record, we are adopting SAR limits for the determination of safe exposure from low-power devices designed to be used in the immediate vicinity of the body based upon the 1992 ANSI/IEEE guidelines. We will apply the MPE limits we are adopting to certain mobile and unlicensed devices that, although not normally used within the immediate vicinity of the body, can use higher power and may be relatively close to the body of the user and to nearby persons. Examples of the latter are cellular "bag phones."

63. The SAR limits we are adopting will generally apply to portable devices submitted for Commission authorization that are designed to be used with any part of the radiating structure of the device in direct contact with the body of the user or within 20 cm of the body of the user under normal conditions of use. For example, this definition would apply to hand-held cellular telephones. We believe that a threshold of 20 cm is appropriate, since the ANSI/IEEE standard specifies 20 cm as the minimum separation distance where reliable MPE measurements can be made.[77] At these closer distances, we believe an SAR determination is a more appropriate measure of exposure.

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[75] McCaw submits results of studies performed by Dr. Om Gandhi, of the University of Utah, thatillustrate the use of the computer-based FDTD model technique to determine compliance with the ANSI/IEEE guidelines for cellular telephones. Dr. Gandhi applied this model to ten cellular handsets from four different manufacturers and found that the peak SAR averaged over one gram of tissue ranged from 0.09 to 0.29 W/kg, considerably less than the 1.6 W/kg recommended by the standard. For the whole-body average SAR, Dr. Gandhi's results ranged from 0.5 to 1.1 mW/kg, depending on the telephone and antenna used. These values are 70 to 160 times smaller than the 80 mW/kg ANSI/IEEE recommended level. Sprint cites studies reported by the CTIA indicating that the SAR from a portable cellular telephone is approximately 0.45 W/kg (a value three and one-half times lower than the 1.6 W/kg limit recommended by ANSI/IEEE).

[76] See also Comments of EEPA at 4, Matsushita Comments at 10-11.

[77] Although ANSI/IEEE does not explicitly state a rule for determining when SAR measurements are preferable to MPE measurements, we believe that the 20 cm distance is appropriate based on Sec. 4.3 (3) of ANSI/IEEE C95.1-1992.

64. In addition to SAR limits for portable devices, exposure criteria in terms of the MPE limits will apply to certain mobile and unlicensed devices that would normally be used with radiating structures maintained 20 cm or more from the body of the user. Examples include transportable cellular telephones ("bag" phones), cellular telephones and other radio devices that use vehicle-mounted antennas and certain other transportable transmitting devices. For these types of transmitters, evaluation of compliance with MPE limits rather than SAR limits is more appropriate because of the greater separation distance between radiator and user.

65. We will require routine SAR evaluation, either by laboratory measurement techniques or by computational modeling, prior to equipment authorization or use for the following categories of portable devices: (1) portable telephones or portable telephone devices to be used in the Cellular Radiotelephone Service under Part 22 Subpart H or to be used in the Private Land Mobile Radio Services for certain "covered" SMR systems under Part 90 of our rules;[78] (2) portable devices to be used for PCS under Part 24 of our rules; (3) mobile devices to be used for earth-satellite communication under Part 25 and Part 80 of our rules; and (4) portable unlicensed PCS and portable unlicensed millimeter wave devices authorized under Part 15 of our rules. In all cases the term "portable" means that the telephone or device is intended for use within 20 cm of the body of the user as defined previously. The applicable SAR limit will normally be the 1.6 W/kg as recommended by ANSI/IEEE for uncontrolled environments, such as those typical for consumer use. However, devices intended solely for use in the workplace may be considered under the less restrictive occupational/controlled environment category.

66. We also will require routine evaluation prior to equipment authorization or use for the following mobile transmitters if the effective radiated power (ERP) of the station, in its normal configuration, will be 1.5 watts or greater[79]: (1) mobile radio telephones to be used in the Cellular Radiotelephone Service authorized under Part 22 Subpart H or in the Private Land Mobile Radio Services for covered SMR systems under Part 90 or our rules; (2) mobile devices to be used for PCS under Part 24 of our rules; and (3) mobile devices to be used for earth-satellite communication as authorized under Part 25 and Part 80 of our rules. For purposes of this rule, "mobile devices" means devices for which radiating structures would normally be maintained at

[78] "Covered SMR" systems include two classes of SMR licensees: geographic area SMR licensees in the 800 MHz and 900 MHz SMR bands that offer real-time, two-way switched voice service that is interconnected with the public switched network; and Incumbent Wide Area SMR licensees, defined in Section 20.3 as "licensees who have obtained extended implementation authorizations in the 800 MHz or 900 MHz service, either by waiver or under Section 90.629 of these rules, and who offer real-time, two-way voice service that is interconnected with the public switched network."

[79] The effective radiated power (ERP) limit of 1.5 watts was determined by calculating the ERP that could result in the most restrictive power density limit for general public/uncontrolled exposure at the relevant frequencies of the devices to be evaluated at a distance of 20 cm from the radiating structure. For 800-900 MHz transmitting devices this limit is in the range of 0.5-0.6 mW/cm^2.

least 20 cm from the body of the user or of nearby persons. We will also continue to require routine evaluation of unlicensed PCS and unlicensed millimeter wave devices authorized under Sections 15.253, 15.255, and Part 15 Subpart D of our rules unless these devices are portable devices, as defined above.[80] The general population/uncontrolled MPE limits will apply to such mobile and unlicensed devices. Mobile transmitters intended solely for use in the workplace may be considered under the less restrictive occupational/controlled environment category. We recognize that it may not be possible for the manufacturer of the mobile or unlicensed transmitter to ensure that persons will not be located in areas in which the MPE limits could be exceeded. Accordingly, manufacturers may address such concerns by the use of warning labels and instructional material provided to users and installers that advises as to minimum separation distances required between users and radiating antennas to meet the appropriate limits.

67. Although our exposure criteria will apply to portable and mobile devices in general, at this time routine evaluation for compliance will not be required of devices such as "push-to-talk" portable radios and "push to talk" mobile radios used in taxicabs, business, police and fire vehicles and used by amateur radio operators. These transmitting devices will be excluded from routine evaluation because their duty factors (percentage of time during use when the device is transmitting) are generally low and, for mobile radios, because the antennas are normally mounted on the body of a vehicle which provide some shielding and separation from the user. This significantly reduces the likelihood of human exposure in excess of the RF safety guidelines due to emissions from these transmitters. Duty factors associated with transmitting devices that are not "push-to-talk," such as transportable cellular telephones ("bag" phones) or cellular telephones that use vehicle-mounted antennas, would be generally higher, and we will require that these devices be subject to routine evaluation for compliance with general population/uncontrolled MPE limits. Although we are not requiring routine evaluation of all portable and mobile devices, under Sections 1.1307(c) and 1.1307(d) of the FCC's Rules, 47 CFR 1.1307(c) and (d), the Commission reserves the right to require evaluation for environmental significance of any device (in this case with respect to SAR or compliance with MPE limits).

68. We are providing the following guidelines on the application of the exposure criteria to portable and mobile devices in general. First of all, devices other than those specified above may generally be evaluated based on whether they are designed to be used under occupational/controlled or general population/uncontrolled conditions, as defined previously. Devices that are designed specifically to be used in the workplace, such as many hand-held, two-way portable radios, would be considered as operating in an occupational/controlled environment and the applicable limits for controlled environments would apply. On the other hand, devices designed to be purchased and used primarily by consumers, such as cellular telephones and most

[80] These devices are already subject to such requirements, as specified in Sections 15.253(f), 15.255(g), and 15.319(i) of our existing rules.

personal communications devices, would be considered to operate under the general population/uncontrolled category as specified above, and limits for uncontrolled environments would apply. Devices that can be used in either environment would normally be required to meet uncontrolled exposure criteria.

69. For purposes of evaluating compliance with localized SAR guidelines, portable devices shall be tested or evaluated based on "standard" operating positions or conditions. In situations where higher exposure levels may result from unusual or inappropriate use of the device, instructional material should be provided to the user to caution against such usage. With regard to devices that are not hand-held, labels may be useful as when a minimum separation distance is desired to be maintained. For example, in the case of a cellular "bag" phone a prominent warning label as well as instructional information on minimum required distances for compliance would be an acceptable means of ensuring that the device is used safely.

70. We note that several publications are available that describe appropriate methods and techniques for determining SAR for compliance purposes.[81] In addition, many papers have been published in the scientific literature on this topic.[82] We agree with the commenting parties that the use of appropriate numerical and computational techniques, such as FDTD analysis, is acceptable for demonstrating compliance with SAR values. Studies by O.P. Gandhi and others indicate that such techniques offer valid means to determine energy absorption characteristics in exposed subjects. We also understand that the Electromagnetic Energy Association (formerly EEPA) has initiated a project to develop product performance standards for SAR evaluation.[83] This effort should be very helpful in facilitating the provision of compliance information and services to manufacturers and others. Also, the Wireless Technology Research (WTR) organization plans to establish a certification program for wireless telephones that should be helpful in ensuring accurate and reliable SAR determination.[84]

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[81] For example, see ANSI/IEEE C95.3-1992 and NCRP Report No. 119, discussed below in section on measurements and compliance. Also, other organizations are providing information on SAR evaluation procedures, and SAR evaluation services and systems are commercially available.

[82] For example, see Balzano et al., "Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones," in IEEE Transactions on Vehicular Technology, Vol. 44, No. 3, page 390, August 1995.

[83] Letter from D. McElfresh, Executive Director, Electromagnetic Energy Association, to American National Standards Institute, August 15, 1994, submitting application for proposed committee on product performance relative to safe use of electromagnetic energy.

[84] Risk Management Research Certification Program, presentation to the FCC by Wireless Technology Research, L.L.C., on October 24, 1995.

71. Based on the concerns expressed by the FDA, we are not adopting at this time low-power device exclusions based on radiated power, as contained in the 1992 ANSI/IEEE guidelines. As discussed above, the FDA cites recent studies indicating that cellular telephones and other hand-held transmitters that meet ANSI/IEEE radiated power exclusion limits can exceed the corresponding exclusion limits for SAR. In one of those studies, the highest SAR values were measured when the antennas and cases of various hand-held cellular telephones were placed in direct contact with a head model, i.e. less than 2.5 cm from the head.[85] Of six telephone models tested in this study under these "worst case" conditions, the highest SAR obtained was approximately 8.8 mW/gram (8.8 W/kg) for 1 watt of output power. This SAR exceeds the recommended limit of 1.6 W/kg for an uncontrolled environment, suggesting that an appropriate radiated power exclusion level for ensuring that the 1.6 W/kg SAR limit could not be exceeded under "worst case" conditions would be on the order of 180 mW at 900 MHz.[86] The ANSI/IEEE low-power device exclusion clause allows for exclusions at a power level of 700 mW at 900 MHz provided a separation of 2.5 cm is maintained between the radiating structure of the device and the body of the user, although, as discussed earlier, comments submitted in this proceeding maintain that the 2.5 cm distance was not meant to apply to the head.

72. This study also reported SAR values measured when the telephones were positioned normally against the head model (i.e., less than 2.5 cm from the head), but with the antenna at various angles and distances from the head. This was referred to as "standard" handling of the telephone. For this "standard" operating situation, the highest SAR measured from the six models tested was approximately 2.8 W/kg for 1 watt of power. This implies that, for the "standard" exposure condition, an appropriate "worst case" radiated power level to meet the 1.6 W/kg SAR limit at 900 MHz should be on the order of about 570 mW, not 700 mW as recommended by the 1992 ANSI/IEEE standard. Similarly, recent data submitted to our laboratory analyzing SAR values for hand-held PCS devices operating near 2 GHz shows that at 125 mW of average power maximum, SAR values (averaged over 1 gram) can, in some cases, be up to 80-90% of the 1.6 W/kg limit. The 1992 ANSI/IEEE radiated power exclusion clause applies only to frequencies up to 1500 MHz. However, if this exclusion were extrapolated to PCS frequencies (1850-1990 MHz), the radiated power exclusion limit would be in the range of 300-350 mW, more than twice the 125 mW used by the devices tested.[87] Therefore, it would appear that some devices that would qualify for the radiated power exclusion in the 1992 ANSI/IEEE standard might exceed the SAR limit of 1.6 W/kg.

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[85] See note 60, supra., study by Kuster et al.

[86] This value is derived by dividing 8.8 by 1.6 and dividing that number into 1.0 watt.

[87] An interpretation from the IEEE states that an extension of the current formula for the radiated power exclusion clause to 2200 MHz would be conservative. See Letter to Thomas P. Stanley, FCC Chief Engineer, from Eleanor R. Adair, Co-Chairman, SC-4, IEEE Standards Coordinating Committee 28, October 11, 1993.

73. As noted by the FDA, these studies raise questions about the accuracy of the low-power device exclusions based on radiated power as contained in the 1992 ANSI/IEEE guidelines. We acknowledge, however, that all of the transmitters in the devices in these studies were placed directly against the head and did not maintain the 2.5 cm separation distance required by ANSI. However, as discussed above, it is unclear whether that separation distance was meant to apply to the head. In light of these outstanding issues and questions, we do not feel that, at this time, it is appropriate for us to adopt the low power exclusion. On the other hand, we also recognize that to require SAR evaluation of every low-power transmitting device subject to Commission authorization would prove to be a costly and unnecessary burden for many manufacturers. Therefore, at this time we will require only routine SAR evaluation for the devices noted above that constitute the classes for which there appears to be the greatest potential for exposure because of their relatively higher duty factors. Based on additional scientific evidence that may be forthcoming, we may consider modifying or expanding this requirement, and we may also consider whether a modified exclusion clause based on radiated power can be adopted.

74. For evaluation of devices that are designed to be used only in occupational/controlled environments, consideration of duty factors would be allowed in evaluating localized SAR and radiated power. The ANSI/IEEE and NCRP guidelines are based on time-averaged exposures. Therefore, if sufficient data are available on typical and maximum duty factors for operation of controlled devices, such as two-way radios used in the workplace, it is reasonable that these be applied in determining compliance with the guidelines. However, this would not be allowed for evaluation of devices that are used in general population/uncontrolled environments, since there is no control over usage of consumer devices such as cellular telephones.

D. Categorical Exclusions

75. Our existing environmental rules regarding RF radiation exposure delineate particular categories of existing and proposed transmitting facilities for which licensees and applicants are required to conduct an initial environmental evaluation and prepare Environmental Assessments if their environmental evaluation indicates that their facilities exceed or will exceed the specified RF exposure guidelines. See 47 CFR § 1.1307(b)(Note 1). As for transmitting facilities not specifically delineated under Section 1.1307(b)(Note 1), the Commission had determined, based on calculations, measurement data and other information, that such transmitters offered little potential for causing exposures in excess of the guidelines,[88] and thus "categorically excluded" those transmitters from the initial environmental evaluation requirement. Categorical exclusions from routine environmental evaluation are allowed under NEPA when actions are judged individually and cumulatively to have no significant potential for effect on the human

[88] Second Report and Order, GEN Docket No. 79-144, id.; Erratum, 2 FCC Rcd 2526 (1987).

environment. See 47 CFR § 1.1306(a); see also, Notice at para. 5, ET Docket No. 93-62, 8 FCC Rcd 2849 (1993). However, the Commission, under § 1.1307(c) and (d), retains the authority to request that a licensee or an applicant conduct an environmental evaluation and, if appropriate, file environmental information pertaining to an otherwise categorically excluded application if it is determined that in that particular case there is a possibility for significant environmental impact. All transmitting facilities and devices regulated by this Commission are expected to be in compliance with the RF radiation exposure guidelines, and, if not, to file an Environmental Assessment for review under our NEPA procedures.

76. Examples of currently excluded transmitters are those used for land mobile, cellular radio and fixed microwave communications. In the Notice, we noted that some existing categorical exclusions may not be consistent with the more stringent provisions of the 1992 ANSI/IEEE guidelines or may not warrant automatic categorical exclusions because of new data or other information on exposure potential. We, therefore, requested comment, information and analysis relating to the existing categorical exclusions.

77. Comments submitted by the land mobile communications industry argue that the categorical exclusions should be continued for transmitters operated under Parts 21, 22, and 99.[89] For example, AT&T comments that common carrier microwave facilities, cellular base stations, and mobile cellular transmitters should remain excluded because RF exposures from this equipment will be below the MPE limits contained in the proposed ANSI/IEEE guidelines.[90] GTE states that the use of controlled and uncontrolled environment criteria should not result in the elimination of Part 21 and 22 categorical exclusions for base stations because the reasons for the earlier Commission decisions are still valid.[91] Ericsson, Motorola, the Land Mobile Communications Council (LMCC), and the American Mobile Telecommunications Association, Inc. (AMTA) similarly state that the justification for categorically excluding most or all transmitters under Parts 21, 22, 90 and 94 is valid and should be continued under the ANSI/IEEE guidelines.[92] Motorola submits a technical analysis indicating that the distances required to meet the ANSI/IEEE guidelines for the land mobile industry in the high frequency bands are much shorter than those reported in the Notice because the main beam of the antenna does not radiate directly downward where individuals are most likely to be located.

[89] Part 99 has been re-numbered as Part 24.

[90] AT&T Comments at 2, 10, 11.

[91] GTE Comments at 16.

[92] Ericsson Comments at 17, LMCC Comments at 9, AMTA Reply Comments at 5, Motorola Comments at 15-20.

78. McCaw submits similar comments stating that the record and studies and operational evidence confirm that existing land-mobile transmitting facilities are unlikely to exceed the new guidelines.[93] PacTel Corporation (PacTel) asserts that continuation of the Commission's existing categorical exclusion for these facilities is appropriate given the minimal opportunity they pose for overexposure and because of land mobile's "minute contribution to the ambient electromagnetic field emissions in the environment."[94] TIA comments that "by the best information available, not a single case of human harm due to this radiofrequency energy has been substantiated."[95] The EEPA submits that both point-to-point microwave radio stations and cellular base stations will typically result in public exposure levels below 1 $\mu W/cm^2$, and that exposure from vehicular cellular radios, when time-averaging is considered, will fall well below the uncontrolled environment limits of the ANSI/IEEE guidelines.[96]

79. NABER encourages us to categorically exclude land mobile transmitters, expressing concern that if categorical exclusions for land mobile services are eliminated manufacturers would have to institute unnecessary and costly testing.[97] Northern Telecom believes that the proper solution is the adoption of appropriate power limits for PCS, cellular radio, and Part 15 devices to ensure that higher power devices that may create unreasonable risk are restricted in those services.[98]

80. Glenayre Electronics, Inc. (Glenayre) and Paging Network, Inc. (PageNet) respond that paging system transmitting facilities are well within the ANSI/IEEE guidelines under normal use and should continue to qualify for a categorical exemption.[99] Glenayre states that worst-case calculations demonstrate that the controlled environment limits will not be exceeded outside a distance of 3-4 meters from a transmitting antenna.[100] Further, Glenayre maintains that, "exposure threats" to personnel due to high-powered paging equipment can best be handled by "training and personnel awareness." Similarly, PageNet states that such risks to workers in controlled areas can be addressed by use of warning signs and appropriate work procedures.

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[93] McCaw Reply Comments at 8.

[94] PacTel Comments at 7. See also Personal Communications Industry Association Reply Comments at 5.

[95] TIA Comments at 19.

[96] EEPA Comments at 5-8.

[97] NABER Comments at 5-6.

[98] Northern Telecom Reply Comments at 6.

[99] Glenayre Comments at 2, PageNet Comments at 4-6.

[100] Glenayre Comments at 2.

81. Other comments address services regulated under Parts 25 and 74. AMSC argues that MSS mobile earth terminals should be categorically excluded because that equipment operates with low transmitter and radiated power levels.[101] Similarly, COMSAT requests exclusion of portable or vehicular RF satellite devices, such as Inmarsat terminals, when such terminals operate at a sufficiently low-power and have a radiating structure that is separate from the handset.[102]

82. The Association of Federal Communications Consulting Engineers (AFCCE), JC&A, and others, submit technical analyses of power levels and distances at which certain services regulated under Part 74 and other rule parts would comply with the ANSI/IEEE guidelines.[103] These entities argue that such analyses support the continuation of the categorical exclusion of certain services such as those covered by Part 74. AFCCE recommends that categorical exclusion be allowed for those transmitters which pose little or no potential for exposure in excess of the guidelines.[104]

83. Several parties address continuation of the categorical exclusion for the amateur radio service. The ARRL and the ARRL-Bioeffects Committee support prudent avoidance[105] and state that most of the amateur radio users do not possess the requisite equipment, technical skills, and/or financial resources to conduct an environmental analysis.[106] Both the ARRL and the ARRL Bio-Effects Committee submit that we could raise an amateur radio applicant's awareness concerning RF energy by placing relevant questions on the amateur license examination.[107] On

[101] AMSC Comments at 10-11.

[102] COMSAT Reply Comments at 4.

[103] For example, according to JC&A and AFCCE, assuming a 100-watt base-station transmitter, a broad vertical beam, unity-gain, and a vertically-polarized dipole antenna, the proposed exposure guidelines will not be exceeded for either controlled or uncontrolled environment if the antenna is located at least 3 meters above a surface upon which an individual may stand. For the case of aural STLs, AFCCE notes that, with transmitters using output powers of 10 watts, ERPs may be from 100 to 1000 watts with typical antennas, resulting in safe exposure distances from 7 to 24 meters in the main beam. When the main beam is elevated well above ground level and access is only possible to the sidelobe patterns, this distance drops to approximately 0.5 to 2.5 meters. AFCCE Comments at 5-6. See also NAB Comments at 20-26, JC&A Comments at 5-7, Assoc. of Maximum Service Television & National Broadcasting Company (MSTV/NBC) Comments at 5-7.

[104] AFCCE Comments at 6.

[105] ARRL Comments at 17, ARRL Bio-Effects Committee Comments at 4.

[106] ARRL Comments at 14.

[107] ARRL Comments at 16, ARRL Bio-Effects Committee Comments at 5.

the other hand, Dr. Wayne Overbeck and the Amateur Radio Health Group comment that it would be inappropriate for this Commission to exempt the amateur service automatically from all requirements for compliance with radiation safety guidelines.[108] Overbeck and the Amateur Radio Health Group state that education is not enough and suggest that we create a version of OST Bulletin No. 65 for radio amateur operations. They state this bulletin could supplement Part 97 rules and be used by amateurs to certify compliance with the RF exposure safety guidelines.[109]

84. Several entities express concerns regarding the continuation of categorical exclusions. Cohen, Dippell & Everist (CDE) and NIOSH comment that categorical exclusions should be limited to situations where there is no possibility of excessive worker exposure.[110] Louis Williams, Jr. indicates that certain transmitters that are currently excluded can be located in accessible areas where they may constitute a potential risk. Williams states that categorical exclusions should be limited to situations where the applicant can certify that there is minimal risk.[111]

85. Doty-Moore Tower Services (Doty-Moore) submits measurement data for two multiple-emitter roof-top environments involving a combination of paging, cellular, and other land mobile antennae. Based on these measurements, Doty-Moore states that almost all locations within the vicinity of the land-mobile transmitters exhibit RF levels in excess of the ANSI/IEEE MPE limits. Doty-More argues that in such situations the landlord/manager should be responsible for limiting access to the rooftop and to coordinate participation among owners to reduce or shut off power.[112]

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[108] Overbeck Comments at 2, Overbeck and Amateur Radio Health Group Reply Comments at 11.

[109] Overbeck and Amateur Radio Health Group Reply Comments at 13.

[110] NIOSH Comments at 2 and CDE Comments at 6.

[111] Williams Comments at 1.

[112] Doty-Moore's measurement data are at least partially supported by the results of measurements made in late 1994 by FCC and EPA staff. A study was undertaken in Atlanta, Georgia, to evaluate RF fields from a variety of sources, including multiple-emitter paging and cellular operations at rooftop locations. The results showed that in areas that are accessible to workers or maintenance personnel, high-power paging transmitters could create RF fields that exceed the NCRP or ANSI/IEEE guidelines when multiple emitters were present in close proximity. This study also showed, in general, that RF fields measured from the roof-mounted cellular base-station antennas did not create high fields in accessible areas. However, a recent study performed for the Commission by Richard Tell Associates, Inc., did indicate that under some circumstances relatively high RF fields could be created on rooftops by cellular base stations. See "Measurement of Radiofrequency Fields and Potential Exposure from Land-mobile Paging and Cellular Radio Base Station Antennas," R.F. Cleveland, et al. Presented at the Seventeenth Annual Meeting, Bioelectromagnetics Society, Boston, MA, June 1995 (final FCC report in preparation); see also "Engineering Services for Measurement and Analysis of Radiofrequency (RF) Fields," Richard Tell Associates, Inc., FCC Report No. OET/RTA 95-01, June 1995. Copies available from National Technical Information Service (NTIS), (800) 553-

86. Decision. We continue to believe that it is desirable and appropriate to categorically exclude from routine evaluation those transmitting facilities that offer little or no potential for exposure in excess of the specified guidelines. Requiring routine environmental evaluation of such facilities would place an unnecessary burden on licensees. However, we believe that some alteration of our previous categorical exclusion policy is necessary. Several commenters have submitted technical documentation indicating the power levels and distances at which transmitting sources in various services will comply with the exposure guidelines.[113] Our staff has evaluated this material and has performed analyses of its own. Based on these studies, we now believe that in certain cases we should no longer exempt entire services from demonstrating compliance. Examples include high-power paging and cellular telephone sites on relatively short towers or rooftops where access may not be restricted. There is also evidence that certain amateur radio facilities have the potential for exceeding our new limits.

87. Our current rules require that environmental evaluation for RF exposure be performed for facilities and operations authorized under Parts 5 (Experimental Radio Services); 15 (millimeter wave and unlicensed PCS devices); 21, Subpart K, (Multipoint Distribution Service); 24 (Personal Communications Service); 25 (Satellite Communications); 73 (Radio Broadcast Services); 74, Subparts A, G, I, and L (Experimental, Auxiliary, and Special Broadcast and other Program Distributional Services) and 80 (ship earth stations in the Maritime Services).[114] We believe it is appropriate to continue to subject these facilities and operations to routine environmental evaluation with certain modifications. With respect to transmitting facilities not in these categories, there are certain cases where we no longer believe that an automatic categorical exclusion is justified, and we will require evaluation of some transmitting facilities that were previously excluded. This expansion of the list of transmitting facilities subject to routine evaluation would be necessary regardless of whether our MPE guidelines are based on 1992 ANSI/IEEE or NCRP recommendations.

88. It is important to emphasize, however, that even if a transmitting source or facility is not automatically excluded from routine evaluation, no further environmental processing is required once it has been determined that exposures are within the guidelines, as specified in Part 1 of our rules. There are various ways to accomplish compliance, including restrictions on access, implementation of appropriate work procedures for personnel, incorporation of RF shielding, mounting of appropriate warning signs, control of time of exposure and reduction of

6847. NTIS Order No. PB 95-253829.

[113] See comments of JC&A, AFCCE, Motorola, MSTV/NBC, and NAB.

[114] See 47 CFR Parts 5, 15 (§15.253, §15.255, and Subpart D), 21 (Subpart K), 24, 25, 73, 74 (Subparts A, G, I, and L) and 80 (ship earth stations).

power during periods when personnel or the public are present. The revised edition of the FCC's OST Bulletin 65 will include a detailed discussion of this topic.

89. Our new policy on categorical exclusion is designed to bring consistency in the way that we decide what transmitters or facilities warrant an automatic exemption from evaluation. This policy is based on our own calculations and analyses, along with information and data acquired in the record of this proceeding and from other sources. We believe that some transmitting facilities, regardless of service, may offer the potential for causing exposures in excess of MPE limits because of such factors as their relatively high operating power, location or relative accessibility. We believe that it is more reasonable to base our exclusions on such variables since they apply generally to all transmitting facilities. In that regard, our new exclusion policy will also eliminate the requirement for routine evaluation of some relatively low-powered transmitters in some of the services for which routine evaluation was previously required such as certain broadcast services.

90. Routine environmental evaluation for RF exposure will only be required for transmitters, facilities or operations that are included in the categories listed in Table 1 of the new rule Section 1.1307(b)(1) that we are adopting, as shown in Appendix C. This includes some, but not necessarily all, transmitters, facilities or operations that are authorized under the following Parts of our rules: 5, 15, 21 Subpart K, 22 Subpart E, 22 Subpart H, 24, 25, 73, 74 (Subparts A, G, I, and L), 80, 90, and 97. Within a specific service category, conditions are listed to determine which transmitters will be subject to evaluation. These conditions are generally based on one or more of the following variables: (1) operating power, (2) location, or (3) height above ground. In the case of Part 15 devices, only devices that transmit on millimeter wave frequencies and unlicensed PCS devices are covered, as noted in Table 1. Transmitters and facilities not included in these categories will continue to be categorically excluded from routine evaluation.[115] Such transmitting facilities generally pose little or no risk for causing exposures in excess of the guidelines. Our new policy will provide a clear, "bright line" standard for categorical exclusions that is administratively easy to apply and affords adequate protection from harmful RF exposure.

91. Relatively high operating power implies that a transmitter should be evaluated if certain conditions apply. For example, if a transmitter operates using relatively high power and if there is a possibility that workers or the public could have access to the transmitter site, such as at a rooftop site, then routine evaluation is justified. In Table 1, an attempt has been made to identify situations in the various services where such conditions could prevail. In general, at rooftop transmitting sites evaluation will be required if power levels are above the values indicated in Table 1. These power levels were chosen based on generally "worst-case"

[115] However, as noted previously, Sections 1.1307(c) and (d) of our rules allow that, even though a transmitter may be categorically excluded, the Commission may still require environmental evaluation on a case-by-case basis.

assumptions where the most stringent uncontrolled/general population MPE limit might be exceeded within several meters of transmitting antennas at these power levels. In the case of paging antennas, the likelihood that duty factors, although high, would not normally be expected to be 100% was also considered. Of course, if procedures are in place at a site to limit accessibility or otherwise control exposure so that the safety guidelines are met, then the site is in compliance and no further environmental processing is necessary under our rules.

92. Tower-mounted ("non-rooftop") antennas that are used for cellular telephone, PCS, and covered SMR operations warrant a somewhat different approach for evaluation. While there is no evidence that typical installations in these services cause ground-level exposures in excess of our limits, construction of these towers has been a topic of ongoing public controversy on environmental grounds, and we believe it necessary to ensure that there is no possibility of excessive exposures from these antennas. Although we believe there is no need to require routine evaluation of towers where antennas are mounted high above the ground, out of an abundance of caution we are requiring that tower-mounted installations be evaluated if antennas are mounted lower than 10 meters above ground and the total power of all channels being used is over 1000 watts ERP. This height and power combination was chosen as a threshold recognizing that a theoretically "worst case" site could use many channels and several thousand watts of power. At such power levels a height of 10 meters above ground is not an unreasonable distance for which an evaluation generally would be advisable. For antennas mounted higher than 10 meters, measurement data for cellular facilities have indicated that ground-level power densities are typically hundreds to thousands of times below the new MPE limits.[116] In view of the expected proliferation of these towers in the future and possible use of multiple channels and power levels at these installations, and to ensure that tower installations are properly evaluated when appropriate, we will institute these new requirements for this limited category of tower-mounted antennas in these services. For consistency we are also instituting similar requirements for several other services that could use relatively high power levels with antennas mounted on towers lower than 10 meters above ground.

93. Paging systems operated under Part 22 (Subpart E) and Part 90 of our rules have previously been categorically exempted from routine RF evaluation requirements. However, the potential exists that our new, more restrictive limits may be exceeded in accessible areas by relatively high-powered paging transmitters with rooftop antennas. These transmitters may operate with high duty factors in densely populated urban environments. The record and our own recently-acquired data indicate the need for ensuring appropriate evaluation of such facilities, especially at multiple transmitter sites. Accordingly, out of an abundance of caution, we have

[116] See, for example, R. Petersen and P. Testagrossa, "Radio-Frequency Electromagnetic Fields Associated with Cellular-Radio Cell-Site Antennas." Bioelectromagnetics, 13:527 (1992). Data collected independently by the Commission also confirms this (see study by R. Cleveland, et al., note 112, supra, and study by Richard Tell, note 165, infra).

decided to subject paging stations authorized under Part 22 Subpart G and Part 90 to routine environmental evaluation for RF exposure if a transmitter is located on a rooftop and if its ERP exceeds 1000 watts. The applicable exposure limits specified in Appendix C will apply according to the specific situation, and, if multiple transmitters are present, Section 1.1307(b)(3) will apply to the site as appropriate.

E. Compliance Evaluation, Measurement Procedures and Transition Provisions

94. In the Notice, we requested comment on issues related to the procedures to be used for demonstrating compliance with exposure guidelines and also on issues concerning quantitative measurement of RF fields and exposure. We recognized that compliance with new guidelines could impose new and significant burdens on some licensees and equipment manufacturers and stated that we would seek to minimize this impact wherever possible. With respect to measurements, we proposed that the procedures established by ANSI/IEEE C95.3-1992 would be appropriate for determining compliance with the new RF exposure guidelines.[117] We further proposed to continue the requirement that facilities and operations subject to environmental evaluation provide environmental information at the time of application for a construction permit, license renewal, or other Commission authorization.[118] We requested comment on whether we should require more complete documentation or evidence from applicants who claim compliance with environmental RF guidelines and what form that documentation should take. Finally, we requested comments, opinions, data and other information concerning devices that are commercially available for measuring electromagnetic fields and currents.

95. There is considerable comment in the record concerning the means by which compliance should be evaluated. AFCCE comments that a revision of OST Bulletin No. 65 should be available in advance of the effective date for implementing new RF exposure guidelines. AFCCE states that the revised bulletin, with appropriate charts, graphs, and formulas, would allow a station's technical staff to perform evaluations with minimal outside assistance.[119] The Society of Broadcast Engineers agrees that the proposed RF safety guidelines should not be effective until OST Bulletin No. 65 is updated.[120] It also urges that the revised bulletin contain the necessary information to determine compliance with contact and induced current limits.

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[117] "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." ANSI/IEEE C95.3-1992. See Notice at para. 28.

[118] As addressed above, we also requested comment on whether proof of compliance for low-power devices should be submitted as part of the equipment authorization process.

[119] AFCCE Comments at 6; see also National Public Radio (NPR) Comments at 4, EEPA Comments at 11, GTE Reply Comments at 8, MSTV/NBC Comments at 8, BJC Comments at 36

[120] SBE Reply Comments at 4, BJC Reply Comments at 36.

EEPA requests that we adopt definitive compliance methods as well as cooperate with industry to develop measurement techniques useful to broadcasters and others in evaluating their facilities.[121]

96. NAB, in its comments, suggests the following "three-pronged" approach for evaluating compliance: 1) the charts and graphs in the revised OET bulletin would be used to determine compliance in the majority of cases; 2) in cases where compliance cannot be confirmed using the bulletin, the use of mathematical formulas and computations would be used; and 3) actual measurements would be required when compliance cannot be determined by using the above-mentioned techniques.[122] UTC concurs with NAB and recommends that licensees be permitted to use any one of a variety of methods to demonstrate compliance, including actual measurements, calculations based on acceptable engineering standards and practices, operating practices that would limit the exposure to the device, and recognized exclusions.[123]

97. JC&A states that the ANSI/IEEE C95.3 guidelines for RF measurement are appropriate for determining compliance with the 1992 ANSI/IEEE exposure guidelines.[124] It also comments that although manufacturers are offering induced current meters, there is not much information available relative to their effectiveness and accuracy. CDE also supports the adoption of the C95.3 document for making RF field measurements but suggests that measuring devices should be certified for repeatability and calibration.[125] On the other hand, NPR argues that the C95.3 measurement guidelines provide limited guidance and are not directly applicable to the broadcast service. Accordingly, it states that third-party assistance will typically be required to measure the RF environment around a broadcast facility.[126] NAB comments that while it is true that ANSI/IEEE C95.3 does provide general guidance on measurement procedures, the Commission should go a step further and specify exact procedures and type of instrumentation to be used to demonstrate compliance.[127]

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[121] EEPA Comments at 12.

[122] NAB Reply Comments at 3.

[123] UTC Comments at 9.

[124] JC&A Comments at 10.

[125] CDE Comments at 4.

[126] NPR Comments at 5.

[127] NAB Reply Comments at 4.

98. Rolm Corporation states that the C95.3 document does not specify a standard method for SAR measurement and that one should be chosen before enacting the proposed regulation.[128] TRW agrees and states that SAR measurements that are based on unambiguous field strength readings at specific frequencies and distances from the subject device should be required.[129] NABER responds that the area of measurement procedures requires further review and analysis and that an industry group should be responsible for developing these procedures.[130] Similarly, Ford requests that we clarify how measurements are to be made within 20 centimeters from a radiating object.[131]

99. UTC comments that we should require applicants only to file a certification that they: 1) are aware of the standards; 2) do not have any information that would indicate that their radio equipment would be operated in a manner that would cause exposure in excess of the guidelines; and, 3) will engage in periodic training and adopt appropriate operating practices to minimize the possibility of exposure in excess of the guidelines.[132] The Broadcast Joint Commenters suggest that additional paperwork should not be required to establish compliance with the new policies because it would be needlessly burdensome to the broadcasters and to the Mass Media Bureau.[133]

100. PacTel believes that answering "No" on a license application form, to the question regarding whether authorization of a particular facility would have a significant environmental impact, is sufficient acknowledgement of compliance. TIA and the LMCC express the view that a formal certification of compliance is unnecessary and would pose an administrative burden which would not be commensurate with the attendant benefit.[134] NABER believes that an applicant should only be required to affirm the safety and compliance of the subject equipment.[135] Motorola sees no need for us to routinely require the submission of information in conjunction with each license application relative to radio site "safety."[136]

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[128] Rolm Comments at 3.

[129] TRW Comments at 12.

[130] NABER Comments at 8.

[131] Ford Comments at 3-6.

[132] UTC Comments at 8.

[133] Broadcast Joint Commenters Reply Comments at 39-40.

[134] TIA Comments at 22, LMCC Comments at 9.

[135] NABER Comments at 6.

[136] Motorola Comments at 18.

101. PageNet believes that with regard to multiple-transmitter sites, it would be most reasonable for the Commission to place the burden for verifying compliance with RF guidelines on the site owner.[137] According to PageNet, site owners would be responsible for acquiring data on multiple-user sites, as opposed to requiring each individual licensee to acquire and update such data. Furthermore, under this scheme, the costs associated with calculating aggregate RF compliance could be factored into a lease agreement and shared equitably among all of the licensees operating at a single site. PageNet maintains that the Commission has general authority, pursuant to Section 503(b)(5) of the Communications Act to subject non-licensees to forfeitures for violation of its rules.

102. Some comments address the certification of work procedures to demonstrate compliance with exposure guidelines. Narda Microwave Corporation (Narda) supports the position of OSHA with reference to its RF safety program,[138] commenting that an RF Safety Program must be in place in order for a station to operate at levels above the uncontrolled MPE limits. UTC asserts that an applicant should be allowed to certify that operating practices exist to minimize exposure.[139] Telocator responds that it is its understanding that individual carriers have procedures and practices to ensure that worker exposure is below applicable limits.[140] Sprint suggests that we should allow licensees to certify that procedures exist to preclude worker exposure above controlled limits in order to avoid environmental processing.[141] Similarly, NIOSH agrees that certification of procedures to preclude working near antennas would be a protective approach.[142]

103. The Arizona Department of Public Safety and NAB recommend an effective date one year after the issuance of the revised OST Bulletin No. 65.[143] AMSC recommends at least a two-year period before implementing the new guidelines to permit the establishment of measurement facilities for SAR determination.[144] Similarly, Joint Broadcasters state that after

[137] PageNet Comments at 8.

[138] Narda Reply Comments at 3-1.

[139] UTC Comments at 8.

[140] Telocator Comments at 8.

[141] Sprint Comments at 5.

[142] NIOSH Comments at 3.

[143] Ariz. comments at 8. NAB Comments at 36.

[144] AMSC Comments at 12.

problems are resolved and a revised version of OST Bulletin No. 65 is released, a transition period of two years should be permitted before we begin requiring use of the new guidelines.

104. AT&T comments that since there are no verified reports of injury or adverse health effects to people caused by exposure from equipment meeting prior ANSI standards, the new standard should apply to all applications filed, but not those still pending, after the effective date of the new guideline. AFCCE recommends that entities be allowed several months to complete applications for new or modified facility permits or licenses. AFCCE comments that a delay of 60 days would be appropriate for the reworking of applications presently on file. JC&A recommends that demonstration of compliance be required for all applications for new facilities, changed facilities and license renewals filed after 60 days from the effective date of the change in order to avoid the need to rework applications in process.

105. Regarding existing services or equipment, several comments argue that since there is no evidence of adverse health effects caused by transmitting facilities meeting previous standards, existing stations and equipment should not be subject to a requirement for a showing of compliance with the new standard.[145] CDE, MSTV/NBC, NAB, and AFCCE recommend that existing facilities be allowed to continue operating and should be required to demonstrate compliance with the new standards only upon filing of a license renewal or an application for a modification of the existing equipment. AFCCE adds that existing installations with a high probability of non-compliance must be brought to the attention of the Commission in case immediate compliance is needed to protect the public. JC&A urges us to allow the sale of presently available stock and new devices that are manufactured within a year after adoption of the new RF exposure guidelines. UTC recommends that licensees with existing systems be given a reasonable period of time to "amortize" the equipment before replacement is required and in the meantime, licensees should be required to adopt appropriate operating procedures to limit unnecessary exposures.

106. A number of commenting parties argue that some or all existing operations should be "grandfathered" (subjecting previously approved facilities and equipment to the new guidelines) for the life of the equipment. TIA asserts that land mobile operations are environmentally safe because they operate at low RF levels and the land mobile industry provides information on safe use of its equipment. E.F. Johnson and TIA recommend that the majority of equipment in use today, particularly mobile and portable units used in land mobile operations, be indefinitely grandfathered.[146] Ericsson recommends grandfathering devices type-accepted or manufactured prior to some specific date, arguing that it would be virtually impossible to recall portable devices that do not comply with the new standard. TRW submits that grandfathering is

[145] AMSC Comments at 10, AT&T Comments at 7, and JC&A Comments at 7.

[146] TIA Comments at 28.

acceptable where older, higher-power transmitters do not negatively affect new lower-emission devices. PCIA recommends that all existing equipment authorizations should be grandfathered.

107. Telocator, Ericsson, E.F. Johnson, LMCC and others advocate "grandfathering" all existing equipment authorizations of low-power devices with respect to SAR compliance. Telocator states that most equipment already authorized would fall within the low-power exclusion exception. GTE agrees, maintaining that existing mobile transmission equipment appear to comply with the new guidelines by a wide margin. Furthermore, according to GTE, recertification of these devices would cause significant and wasteful expenditures and there is no public interest basis for such expenses. TIA recommends that existing land mobile radio units be indefinitely grandfathered because of their established record for safety thus demonstrating that such equipment operates well below the threshold for harm to humans.

108. Wizard Broadcast Company and GTE believe existing licensees should be grandfathered from complying with the ANSI/IEEE guidelines.[147] Further, Wizard submits that a specific question is needed on broadcast applications that asks if the applicant complies with the guidelines and references of OST Bulletin No. 65.

109. With regard to SAR determination for low-power devices, E.F. Johnson Company, TIA, and Ericsson Corporation (Ericsson) comment that the effective date for compliance with the rules for portable radio units should be two years after approval of an appropriate SAR measurement standard or available SAR measurement laboratories are established. TIA submits that it is willing to act as the focal point in development of requisite test procedures, using its normal ANSI accredited standards setting process.[148] Motorola concurs with TIA's comments that the effective date should be delayed until standards are developed for measurement procedures and test site facilities, and in some cases to construct test facilities before commencing measurements of SAR.[149] Ericsson argues that subsequent to the effective date, applicants for equipment authorization should be required to affirm that 1) either the product is excluded from the ANSI/IEEE standard due to its power, frequency and/or operational characteristics, or 2) the product has been appropriately tested or analyzed for SAR and is within the standard limits.

110. JC&A recommends that within one year of the date we adopt new RF exposure guidelines low-power device manufacturers should be required to submit new requests for authorization based on the 1992 standards, and, after one year, applications for authorization of devices should include a certification of compliance with the low-power exclusion clause based

[147] Wizard Comment at 4, GTE Reply Comments at 7.

[148] TIA Comments at 29.

[149] Motorola Comments at 23.

on either radiated power or SAR. Ericsson suggests that new low-power devices be required to meet the ANSI/IEEE criteria two years after we adopt: (1) a definitive SAR measurement standard, or (2) an equivalent standardized numerical analysis technique, whichever occurs first. Ericsson also supported the proposal that the TIA be designated to develop such standards. E.F. Johnson also recommends that the effective date for compliance with rules for portable radio units should be two years after adoption of new standards. According to E.F. Johnson, this additional time is necessary in order for industry "to develop SAR measurement standards." UTC believes that demonstration of compliance for the many different models or types of a given piece of equipment would not be practical and should not be required.

111. NAB comments that manufacturers should be allowed reasonable time, perhaps one year after adoption of revised rules, to submit to the Commission a request for recertification of their equipment that includes proof of compliance with the new guidelines. NAB submits that at some period, perhaps eighteen months after adoption of new guidelines, only re-certified equipment should be allowed to be sold.[150] TIA estimates that a two-year period of time will be required for appropriate test facilities to be available for SAR testing, and it recommends that the effective date for compliance for low-power devices be set at two years after SAR measurement laboratories are established.

112. Decision. We believe that the rules we are adopting should provide a reasonable transition period for applicants and stations to come into compliance with the new requirements. After considering the comments and the impact of these new requirements, we conclude that the new RF guidelines will apply to station applications filed after January 1, 1997, as described in Appendix C, Section 1.1307(b)(4). During the period between the effective date of the rules we are adopting and January 1, 1997, our existing RF guidelines will continue to apply to station applications. We recognize that this relatively short transition period may cause some difficulties for certain applicants. Accordingly, for a period of one year from the date this Order is adopted, we will allow our Bureaus to address under delegated authority the specific needs of individual parties that make a good cause showing that they require additional time to meet the new RF guidelines. Such relief could come through waivers of our rules or through other similar actions.

113. The new guidelines for SAR and MPE will apply immediately to non-excluded applications for equipment authorization for portable, mobile, and unlicensed devices as described in Appendix C, Section 1.1307(b)(2). We see no need to delay implementation of the new guidelines for these devices. As previously discussed, information on techniques and procedures for SAR evaluation is already available from several references including ANSI/IEEE C95.3-1992. There are several acceptable techniques for SAR evaluation, including numerical analytic techniques such as the FDTD procedure discussed earlier, and we do not believe it is practical or

[150] NAB Comments at 37.

necessary at this time for us to institute a certification program for laboratories that perform such services. In fact, as noted previously, we already require SAR evaluation from manufacturers of PCS and portable unlicensed devices, and we have already granted authorizations based on SAR data submitted to us. In addition, certification programs for hand-held devices such as cellular telephones are being developed by other organizations.[151] Similarly, for mobile devices, typical exposure levels can be determined by the use of simple calculational methods and equations such as those described in the current edition of the FCC's OST Bulletin 65.

114. We appreciate the desires of many commenting parties that we delay the effective date for implementation of the new RF exposure guidelines. We recognize that applicants may need to undertake significant analysis and study in order to comply with the new guidelines. Detailed information on evaluating compliance, in the form of a revised version of OST Bulletin No. 65, would provide significant assistance to those attempting to comply with these new guidelines. Therefore, it is our intent to issue in the near future a draft revised OST Bulletin 65. We plan to solicit comments on the draft from individuals and organizations who are active and knowledgeable in this area. This was the same approach that the Commission took in developing the original version of OST Bulletin No. 65.

115. We agree with the Broadcast Joint Commenters and others that additional compliance documentation beyond that already required is unnecessary. We believe that our existing rules, which place the burden for compliance on existing licensees and parties filing applications for new stations and modifications, have worked adequately in the past and should be continued. We have made some minor changes in the organization and content of our rules in order to make them more clear.

116. We find that the record generally supports our proposal to endorse the measurement procedures and techniques contained in the ANSI/IEEE C95.3-1992 document for use in evaluating RF exposure potential. In addition, we note that the NCRP has recently published NCRP Report No. 119, which contains practical guidelines and information for performing field measurements in broadcast and other environments, and we also endorse its use.[152] If, in the future, questions arise as to measurement procedures or instrumentation issues, we intend to rely on the above documents. We may also consult expert bodies such as the appropriate NCRP or IEEE committees and other groups, organizations and agencies, as appropriate. Any decisions regarding such issues will be addressed in official Commission notices, proceedings or bulletins, or in response to individual inquiries.

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[151] See para. 70, supra.

[152] "A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields," Report No. 119. Copyright 1993, NCRP. Copies may be purchased from NCRP Publications, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814. Telephone: (800) 229-2652.

117. With respect to compliance, Hewlett-Packard Company ("HP") requests clarification as to how the guidelines adopted by the FCC would apply to FCC-authorized equipment operating in the unlicensed millimeter-wave frequency bands.[153] HP notes that if the limit to be adopted for these bands were 1 mW/cm^2, a separation distance of 28 cm from the RF source would be required for continuous exposure in order to be consistent with the Commission's formerly prescribed limitations on equivalent isotropically radiated power (EIRP).[154] HP is correct that the emission limits prescribed previously indicate a maximum EIRP level such that, as can be shown by calculation, a level of 1 mW/cm^2 would be reached at a distance of approximately 28 cm from the RF source. Therefore, in the case of a device operating at the maximum EIRP level of about 10 W, some means must be taken by the manufacturer to ensure that persons will not be closer than 28 cm to the RF source if exposure is to be continuous. Closer distances are possible if the power is to be less than the maximum allowed or if exposure times are shorter than the applicable time-averaging period.

118. With respect to grandfathering previously-authorized portable, mobile and unlicensed devices, we recognize that it would be impractical to require re-authorization of these devices. Furthermore, we believe that most existing devices already comply with the limits that we are adopting. Therefore, we will generally not require re-authorization or testing of previously approved devices solely to demonstrate compliance with our new RF guidelines. If we have reason to believe that a previously authorized device may cause exposures in excess of the guidelines, we may request environmental information and require that the device be re-authorized based on compliance with the guidelines.[155]

119. With respect to previously-licensed stations, we note that we expect our licensees to comply with our RF radiation environmental rules as applicable to them. See, e.g., 47 CFR §§ 1.1307, 1.1311, and 1.1312. The environmental processing requirements contained in these rules ensure that, at the time of licensing and authorization, transmitting facilities are operating within the applicable RF radiation limits. Once a license is granted, we expect our licensees to continue to operate their facilities in compliance with these limits.

F. RF Protective Clothing and Personal Monitors

[153] See letter from Cynthia Johnson, Hewlett-Packard Company, to Chairman Reed E. Hundt, March 4, 1996, placed in the record of this proceeding as an ex parte filing.

[154] The Commission's First Report and Order in ET Docket No. 94-124 (released December 15, 1995), established a 10 W EIRP limit for systems operating in the 59-64 GHz band but specifiesthis in an equivalent unit of measure, i.e., 9 $\mu W/cm^2$ at a distance of 3 meters. It should be noted that this is a limit on emissions not on exposure.

[155] 47 CFR § 1.1307(c) and (d).

120. In the Notice we requested comment on the effectiveness and appropriateness of using RF protective clothing in ensuring compliance with RF exposure guidelines. We also requested comment on the use of personal RF monitors that alert individuals to the presence of an RF field approaching or exceeding applicable RF guidelines. We stated that such devices can be useful in complex sites involving multiple antennas. At least two companies in the United States currently market these devices.

121. OST Bulletin No. 65 cautions that although protective clothing fabricated from conductive material might prove useful in preventing excessive exposures, there have been problems with such clothing in the past due to excessive heating of the fabric in the presence of high RF fields. While this has been the Commission's position on the use of such clothing in the past, a new product, Naptex®, is now available which does not appear to exhibit any of the problems shown by previously manufactured clothing.

122. Since the Commission is not an agency with primary jurisdiction in matters relating to occupational safety and health, we would not normally be in a position to determine independently whether Naptex® is acceptable for reducing occupational exposures and complying with RF safety guidelines. We therefore consulted other Federal agencies on the use of Naptex® in RF environments. In response, OSHA indicated that if certain criteria are met, then clothing such as Naptex® could be a valuable addition to existing safety measures used in RF environments. OSHA points out that the manufacturer's restrictions on use of Naptex products are field intensities of 20 mW/cm^2 for frequencies up to 60 MHz and 125 mW/cm^2 for frequencies from 65 MHz to 10 GHz, and that test data demonstrate compliance with RF protection guidelines if the Naptex® product is used within these limits.[156]

123. JC&A comments that RF clothing and some work gloves appear to offer considerable help in complying with protection guidelines when working near energized antennas.[157] Hammett & Edison projects that if we find that RF clothing may be used in the near field and is effective for induced and contact currents, it could save the broadcast industry 10 million dollars.[158]

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[156] We are also aware of recent data obtained by R. Olsen and B. Van Matre of the Naval Aerospace Medical Research Laboratory (NAMRL) in which measurements were made of the ability of Naptex to reduce SAR in a human-equivalent model. The NAMRL results indicated that at frequencies of about 30 MHz and 80 MHz the fully-suited model (suit, hood and overshoes) experienced a significant reduction in SAR in near-field or quasi near-field conditions. Further, Maxwell Safety Products, Ltd., a vendor for Naptex clothing states that the test data show that mean ankle SARs of greater than 23 W/kg were measured for some unprotected conditions, but with full suit protection, no mean ankle SAR exceeded 1.1 W/kg.

[157] JC&A Comments at 10.

[158] Hammett & Edison Comments at 15-16.

124. The AFCCE comments that active controls, such as reduced power or suspended operation during work, are preferable to passive barriers such as an RF protective suit and that the use of passive barrier controls must be carefully considered to assure that accidental overexposure does not occur.[159] Similarly, NPR notes that, as with dosimeters, the use of protective clothing can lead to a false sense of security and that in a sufficiently high field strength environment, individuals inside the protective clothing can experience RF exposures in excess of ANSI/IEEE guidelines.[160] Furthermore, NPR suggests that exposure in excess of the ANSI/IEEE guidelines can result if a user does not correctly wear the protective clothing, or if that clothing is damaged while the user is in a high RF environment. NPR cites OSHA's caution that the variable working conditions at job sites and possible alterations or misapplication of an otherwise safe product could easily create a hazardous condition beyond the control of the manufacturer.

125. Narda believes that RF protective suits must be viewed with extreme caution, since there is no qualified independent organization that can competently test such a product; there is no guarantee that protective clothing will be used correctly; and the suits introduce/increase new hazards, such as decreased visibility and degraded traction/footing. Further, Narda states that research demonstrates that SAR levels are higher if the user is not wearing footwear with the suit, than if the suit was not worn at all.[161]

126. CD&E and AFCCE strongly urge that we limit the use of personal monitors until they are proven reliable, accurate, and able to work under all conditions.[162] The AFCCE alleges that one of the commercially-available personal monitors is accompanied by misleading and inaccurate advertising claims and labeling. NPR suggests that we authorize or certify personal monitors to assure that these devices accurately reflect exposure in relation to the guidelines, since failure of a device to accurately measure RF energy may occur unnoticed and could potentially give deceptively low readings.[163] NPR recommends that manufacturers of personal monitors have self-testing circuits that would sound an alarm when the device was operating improperly.[164]

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[159] AFCCE Comments at 7.

[160] NPR Comments at 7.

[161] Narda Reply Comments at 6-1.

[162] CDE Comments at 4.

[163] NPR Comments at 7.

[164] NPR Comments at 6.

127. Hatfield & Dawson comments that it has performed limited testing on one model of personal monitor and found that this particular model sounded an alarm at 50% of the ANSI/IEEE C95.1-1992 limits for the magnetic field when the energy was propagating toward the front of the monitor. In addition, the monitor sounded an alarm at 100% of the limit for the magnetic field when the energy was propagating toward the side of the monitor. These tests were performed at ground level near FM broadcast antennas and on rooftops near 800 MHz antennas. Hatfield & Dawson concludes that this model of personal monitor provides a worst-case indication of localized fields when the measured field were at or above the levels shown in Table 1 of the ANSI/IEEE guidelines.

128. Decision. In 1994 the Commission's Office of Engineering and Technology (OET) awarded a contract to Richard Tell Associates, Inc., of Las Vegas, Nevada, to evaluate the use of certain RF instrumentation and devices, including Naptex® protective clothing and personal monitors.[165] The Tell Report concludes that an analysis of test data on a commercial RF protective suit shows that such a suit can provide substantial reductions in whole body SARs in the wearer, assuming that the suit material adequately covers the body. This report found that the suit must be adequately coupled to ground to be effective, so that body currents are shunted to ground via the fabric rather than the legs, ankles and feet. Based on these findings, OSHA's comments in this proceeding and the data from NAMRL we find that use of such clothing, if properly utilized, is an acceptable means for reducing exposure to high RF fields. We will discuss this matter further in our new edition of OST Bulletin No. 65.

129. In addition, the Tell Report provided test results on one commonly-used RF personal monitor, indicating that the monitor appeared to act as a reliable detector of RF magnetic fields, but expressed reservations about some deficiencies related to the general use of this device. In particular, the Tell Report concluded that the monitor may not be completely adequate for registering high fields existing in very close proximity to certain dipole antennas. Nonetheless, for frequencies above 50 MHz, the Report states that the monitor could be useful in alerting workers to the presence of high RF fields that may exceed safety limits. Our staff and staff from the EPA conducted a joint field measurement study in 1994 on a similar device, which appeared to function properly and as advertised.[166] In general, the problems identified in the Tell Report do not seem to be serious enough to preclude use of the type of personal monitor tested, and we conclude that its use in the situations specified is acceptable for helping ensure compliance with

[165] "Engineering Services for Measurement and Analysis of Radiofrequency (RF) Fields," FCC Report No. OET/RTA 95-01, prepared for OET by Richard Tell Associates, Inc., Las Vegas, NV 89129. Copies available for purchase from the National Technical Information Service (NTIS), Department of Commerce, (800) 553-6847. Purchase order number: PB95-253829. Released by the Commission in September, 1995.

[166] See note 112, supra.

RF guidelines. Further discussion of this topic will also be included in the revision of OST Bulletin No. 65.

IV. ADDITIONAL ISSUES

A. Induced and Contact Current Compliance

130. As discussed in the Notice, the new ANSI/IEEE guidelines contain recommendations regarding maximum permissible limits for induced and contact currents that result from RF exposure. The previous 1982 ANSI guidelines did not address this issue. The ANSI/IEEE recommendations require exposure evaluation over the frequency range from 3 kHz to 100 MHz for RF currents induced in the human body as well as for RF contact currents that can result in shock and burn hazards. We recognize that this new provision has raised many issues relative to interpretation and implementation, and we requested comment on whether we should adopt these requirements.

131. In particular, we asked for comment on how to evaluate FM radio broadcast stations with respect to induced and contact currents since the upper frequency limit in the ANSI/IEEE standard is 100 MHz, which is in the middle of the FM band.[167] We proposed to require that evaluation for exposure from induced and contact currents be carried out by: 1) all FM broadcast stations with carrier frequencies below 100 MHz, and 2) all FM broadcast stations regardless of carrier frequency at multiple-use sites when at least one of the stations transmits at or below 100 MHz.

132. AFCCE, the Broadcast Joint Commenters, EEPA, NAB, and others observe that industry has little experience in making measurements of induced and contact currents and that making such measurements is expensive and requires equipment that is not readily available. They propose that licensees use tables and figures (developed previously by NAB and JC&A) to determine whether facilities comply with the induced current limits based on electric field strength levels that can be associated with induced current levels. If the facilities failed to comply with the limits based on the tables or figures, then strict and careful measurements, performed by professionals using the proper equipment and techniques could be employed to further evaluate the facilities. NAB and JC&A suggest that induced and contact currents limits could also be applied to workers who climb energized AM towers. They state that power limits to protect against excessive exposure could be proscribed based on theoretical and experimental data obtained by Cleveland and Tell.[168]

[167] See Notice at footnote 24. The FM radio broadcast band ranges from 88-108 MHz.

[168] NAB Comments at 30.

133. Narda comments that if calculations or analysis based on Bulletin No. 65 indicate, with confidence, that electric and magnetic field levels are below the uncontrolled ANSI/IEEE MPEs then actual field measurements of induced current levels should not be necessary.[169] Narda states that when the electric field is well below the MPE limit, then compliance with the induced current MPE can be assured without direct measurement. Narda cautions, however, that contact currents are totally unpredictable, bear no relationship to electric field levels, and cannot be calculated.

134. Most commenting parties oppose our proposal to require only FM broadcast stations with carrier frequencies below 100 MHz to be evaluated for exposure from induced and contact currents. These parties argue that the "breakpoint" at 100 MHz is unfair and could be scientifically incorrect. The ARRL contends that it is difficult to determine the basis for any limits on induced and contact current above 30 MHz, but to extend the limit arbitrarily to 100 MHz, the middle of the FM band, creates distinctions without differences among like licensees in the FM Broadcast Service.[170] BSL states the 100 MHz cutoff was arbitrary, and was chosen without regard to practical considerations of implementation.[171] It suggests that between 30 MHz and 100 MHz a standard for presumptive compliance should be established. Hammett & Edison contends that extending induced and contact currents above 30 MHz is arbitrary and capricious and that ANSI has provided no justification for doing so.

135. The IEEE/SCC28, the committee that developed the new ANSI/IEEE guidelines, comments that the issue relating to the discontinuity of treatment within the FM band (the 100 MHz breakpoint) has already been addressed during the process of reaching a consensus. According to the IEEE/SCC28, it was made clear at that time that the discontinuity of treatment within the FM band was based upon biological considerations rather than those involved in spectrum allocation.[172]

136. Many commenters assert that there is no reliable equipment to measure induced and contact current above 30 MHz.[173] "Based on the preliminary induced current measurements conducted by CBS, the Broadcast Joint Commenters (BJC) believe the scientific understanding of these phenomena -- and of the techniques and devices that will be needed to measure them --

[169] Narda Reply Comments at 4-1.

[170] ARRL Comments at 11.

[171] BSL Comments at 4-5.

[172] IEEE/SCC28 Comments at 1-2.

[173] Hammett & Edison, NAB, Louis A. Williams, Hatfield & Dawson, AFCCE, Broadcast Joint Commenters and CDE.

have not yet developed to the point that would allow their measurement with sufficient reliability."[174] The BJC's position on measurement was reinforced recently by a study performed for the Commission by Richard Tell Associates.[175] Based on an assessment of commercially available instrumentation for induced current measurement, Tell concluded that, "it is not clear that measurements of induced body current are sufficiently reliable to accurately assess compliance with standards specifying limits for body currents under all possible conditions." [emphasis in original].

137. NAB states that given the present state of measurement technology and research data (particularly with respect to contact currents) "it is difficult, at best," and costly to certify a broadcast facility for compliance with the new ANSI/IEEE induced and contact current limits based on measurements.[176] NAB states that it is aware of commercially-available instrumentation for direct measurement of induced currents (and direct contact currents at certain frequencies). However, NAB cautions that requiring all broadcasters to perform costly field measurement to demonstrate compliance with the body current limitations would surely have a severe, negative impact on broadcasters.

138. Hammett & Edison and the Broadcast Joint Commenters indicate that a reliable, repeatable, commercially available VHF induced body current meter does not yet exist. Hammett & Edison state that tests made using a prototype Narda Model 8850 induced current meter showed variability between persons standing on the meter, non-symmetrical currents between left-foot only and right foot only conditions, . . . meter zeroing problems, and sensitivity to relatively low power emissions above 100 MHz."[177] The AFCCE agrees that there are no commercially available instruments to reliably measure contact currents.[178]

139. Hatfield & Dawson and the AFCCE note that Richard Tell & Associates has specialized equipment for measuring contact current but that this equipment has limited utility in a multiple frequency environment such as an antenna farm.[179] NIOSH states that with a

[174] BJC Comments at 18.

[175] See, note 165, supra.

[176] NAB Comments at 28.

[177] Hammett & Edison Comments at 14-15, BJC Comments at 20-21.

[178] AFCCE Comments at 8.

[179] Hatfield & Dawson Comments at 4, AFCCE Comments at 8.

properly calibrated, frequency-tunable, field intensity meter, induced current measurements could be measured for stations operating up to 108 MHz.[180]

140. NAB points out that while research data are available for induced currents, it does not appear to exist for contact currents.[181] NAB contends that contact currents vary with the size and shape of the object contacted and if the contacted object is relatively small, the presence of a body in the near vicinity modifies the field. Therefore, based on the limited information available, NAB suggests that we assume, for purposes of the guidelines, that electric fields low enough to guarantee compliance with induced current criteria will, in general, also assure compliance with contact current criteria.

141. BJC also agrees that the contact current standard poses measurement problems that are even more difficult, and are complicated in the AM band by the potential to energize objects such as construction cranes or metallic rope located as much as half a mile from an AM tower.[182] BJC contends it would be extremely impractical to require broadcasters to measure all metal objects near AM towers. These measurements would also be only temporary, BJC argues, because the configuration of such non-broadcast structures change frequently. JC&A argues that because of the many variables such as grounding of the person, size, shape and orientation of the object being contacted, judgements will have to be made on a case-by-case basis relative to the need for contact currents.[183]

142. Narda notes that the only way to quantify contact currents is to measure them and suggests that we require that contact current measurements be made on metallic objects, such as fences, that the public may come in contact with or that may be contacted by station personnel. It submits that these measurements should be made once to obtain certification and need be repeated only when antenna patterns are changed or whenever new metallic objects are added in the vicinity of the antenna(s).[184]

143. CDE urges that measurements with validated instruments by competent professionals "supersede any calculated evaluation" of facilities, and measurements or prediction methods

[180] NIOSH Comments at 3.

[181] NAB Comments at 31.

[182] BJC Comments at 32-33.

[183] JC&A Comments at 8-9.

[184] Narda Reply Comments at 4-2.

should take precedence over personal monitors until their effectiveness and accuracy have been verified.[185]

144. Hammett & Edison states that the ANSI/IEEE limits on induced and contact body currents are likely to be very burdensome to broadcasters if we do not declare some reasonable limits regarding demonstrating compliance with the new standard.[186] For example, it notes that ANSI/IEEE does not define the impedance of a "standard person" at VHF frequencies, which would allow consistent modeling of induced and contact currents. Hammett & Edison also suggests that the we standardize measurement procedures for body currents.[187] It states that these factors should be measured with one foot raised to simulate a walking person and should also be required to be made at uniform heights. Hammett & Edison also asserts that ankle straps should be used in conjunction with an "RF boot" to ensure consistent and conservative readings.

145. The EPA recommends that we "consider including limits for induced and contact RF currents for the frequency range of 300 kHz to 100 MHz to protect against shock and burn . . . ."[188] This recommendation was in addition to EPA's support for our selection of the NCRP guidelines for field strength and power density that are somewhat different than those of ANSI/IEEE (see earlier discussion). EPA states that it agrees that the ANSI/IEEE induced current limits are useful and should also be implemented.

146. Dr. Om P. Gandhi of the University of Utah advises that since currents in excess of the RF safety guidelines could result for both controlled and uncontrolled environments, it appears to be important to measure not only the electric and magnetic fields but also the induced currents up to the maximum frequency of 100 MHz recommended in the ANSI/IEEE C95.1-1992 Safety Standard.[189] Dr. Gandhi further submits that induced currents are also substantial up to at least 108 MHz, and he, therefore, suggests that it may be desirable to limit induced and contact RF currents for the entire FM band up to 108 MHz. NIOSH also suggests that the induced current measurements should be required for up to 108 MHz, even though these frequencies were not included in the ANSI/IEEE 1992 guidelines.[190]

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[185] CDE Comments at 4.

[186] Hammett & Edison Comments at 11.

[187] Hammett & Edison Comments at 14.

[188] EPA Comments at 2.

[189] Om P. Ghandi Comments at 1. Dr. Gandhi has done much of the research on induced currents and serves on the IEEE/SCC28 committee that developed the ANSI/IEEE guidelines.

[190] NIOSH Comments at 3.

147. Decision. Most comments, including those of federal health and safety agencies, generally support the use of ANSI/IEEE limits for induced and contact currents as a means of controlling potentially harmful exposure to RF fields. However, in view of the continuing questions and difficulties relating to evaluation of induced and contact currents, especially with regard to measurements, we are not adopting the exposure guidelines for induced and contact currents at this time. Until these questions are satisfactorily resolved, we see no practical way to require compliance with these limits. We see merit in the suggestion of NAB and others that it may be possible to determine compliance with the induced current limits using the magnitude of the electric field strength. However, at this time we do not believe there is sufficient documentation in the record to support the accuracy and reliability of this method. Although we are not adopting limits for induced and contact currents in this proceeding, we recognize the desirability for limits to be adopted in the future, particularly if more accurate measuring instruments become available. Accordingly, we will continue to monitor the issues raised in this proceeding with respect to induced and contact currents, and we may revisit this issue and issue a specific proposal for controlling such exposures.

148. With respect to the availability and reliability of instrumentation for measuring induced and contact currents, we note that there presently are at least two commercially-available "stand-on" type devices for measuring induced current.[191] Unfortunately, as noted above, the results of the study performed for the Commission recently by Richard Tell Associates shows that measurements using such instrumentation may be unreliable. Tell recommends that, "more extensive evaluation" of body current meters and their applications is needed in order to decide how best to perform assessments of compliance with the guidelines.[192]

149. With respect to compliance with limits for contact currents, the Tell study evaluated the only commercially available instrument for measuring these currents. The study concludes that under most exposure conditions this meter could be used to adequately assess compliance with the ANSI/IEEE limits. However, it also concludes that "under typical working conditions" application of the meter can be inconvenient or inappropriate. Because of the many possible types and configurations of metallic objects that may be near a transmitter it appears that demonstrating compliance would require a large number of measurements. Furthermore, as reported in the Tell study, the commercially-available equipment for measuring contact currents only measures currents for frequencies up to 30 MHz. The ANSI/IEEE contact current limits apply up to 100 MHz.

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[191] At least one manufacturer has also recently made available a "clamp-on" type induced current meter that may show improved measurement results. However, we have not yet evaluated this type of device with regard to accuracy and reliability.

[192] See, note 165, supra, Tell study at page 1.

150. In general, we agree with the comments of many respondents that at the present time compliance with contact current limits would be difficult to ascertain, and, in many cases, impractical. It was suggested in the comments that if induced current compliance is demonstrated then compliance with contact current restrictions should be considered to be proven by association. However, we have no specific data that would support this conclusion, and, the lack of confidence in demonstrating compliance with induced current limits makes this assertion irrelevant.

151. It should be noted that a source of significant exposure in occupational situations is the climbing of AM broadcast towers by persons who must perform maintenance and other tasks while the station is still transmitting. In these instances the primary source of energy absorption by the climber is due to the induced RF current flowing through the body. This has been a significant issue for many AM stations. Data and information does exist for the specific case of induced currents flowing through the body of a person climbing an AM broadcast tower. In this case control of the climber's exposure can be based on reducing operating power of the station while the person is on the tower. Data on such exposures has been acquired through joint studies conducted by our staff and the EPA and through a contract study performed for the Commission.[193] These studies have provided models for identifying the power levels associated with specific levels of induced current in the body of a tower climber. The specific procedures for determining these values are discussed in the referenced studies.

B. Amateur Radio

152. Amateur stations present an unusual case with respect to compliance with RF exposure guidelines. First, over 700,000 amateur stations in the United States are authorized by our rules to transmit from any place where the Commission regulates the service, as well as on the high seas. The Commission does not pre-approve individual amateur station transmitting facilities and no additional application is made for permission to relocate an amateur station or to add additional stations at the same or other locations. Second, the granting of a license is solely conditional upon the applicant passing an examination demonstrating that the examinee possesses the operational and technical qualifications required to perform properly the duties of an amateur operator under our rules. Third, amateur stations vary greatly. Amateur stations are located in dwellings, in air, surface and space craft, and carried on the person. Many of these stations transmit from residential or other areas where individuals may be in close proximity to an RF radiator. In addition, amateur station transmissions are made intermittently and may

[193] See: (1) R.F.Cleveland, Jr., E.D. Mantiply and R.A. Tell; "A Model for Predicting Induced Body Current in Workers Climbing AM Towers." Presented at the Twelfth Annual Meeting, Bioelectromagnetics Society, San Antonio, Texas, 1990 (Abstracts, p. 77). (2) R.A. Tell; "Induced body Currents and Hot AM Tower Climbing: Assessing Human Exposure in Relation to the ANSI Radiofrequency Protection Guide." Prepared for Office of Engineering and Technology, Federal Communications Commission, 1991.

involve as many as 1,300 different emission types -- each with a distinctive on-off duty cycle. Finally, most amateur stations engage only in two-way communications. Thus, even when in operation, the station is usually transmitting but half of the time. There are many variables, therefore, to be considered in determining whether an amateur station complies with guidelines for environmental RF radiation.

153. Measurements made during a Commission/EPA study of several typical amateur stations in 1990 indicated that there may be some situations where excessive exposures could occur.[194] Further, among amateur operators themselves there appears to be varying degrees of knowledge concerning the potential hazards of RF radiation. At least one prominent amateur radio publication has a comprehensive section dealing with potential RF hazards at amateur stations.[195]

154. Comments on continuing to exempt amateur stations from demonstrating compliance are divided. The ARRL opposes inclusion, and claims that most amateur operators adopt the philosophy of prudent avoidance, that is, they avoid unnecessary exposure to electromagnetic radiation as a common-sense response to potential -- but not yet proven -- health hazards. The ARRL also states that its publications, which include sections on RF safety, urge amateur operators to practice prudent avoidance wherever possible and are sufficient to keep the amateur community informed of the hazards of RF radiation. The ARRL and the ARRL Bio-Effects Committee support "prudent avoidance" and state that most amateur operators do not possess the requisite equipment, technical skills, and/or financial resources to conduct an environmental analysis if the categorical exclusion for Part 97 were eliminated.

155. The ARRL argues that amateur stations, because of their intermittent operation, low duty cycles, and relatively low power levels, rarely exceed the 1992 ANSI/IEEE standard. Further, the ARRL suggests that the risk of exceeding those levels would only be relevant for a licensee and his or her family. The ARRL maintains that in this experimental service it is better to rely on education and testing of licensees than on submission of a complex environmental assessment which would not be valid for long in most cases since much amateur station transmitting equipment, especially antennas, is constructed and designed by the licensee and often changes. Therefore, the ARRL argues that amateur service licensees should not be subjected to routine environmental processing.

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[194] "Measurements of Environmental Electromagnetic Fields at Amateur Radio Stations," Report No. FCC/OET ASD-9601 (February 1996). Copies can be ordered through the National Technical Information Service (NTIS) at (800) 553-6847. NTIS Order No. PB 96-145016.

[195] See *The ARRL Radio Amateur Handbook For Radio Amateurs.* Copyright ARRL, Newington, CT.

156. The ARRL states that if the Commission applied these rules to the amateur radio service, it then must facilitate the installation of amateur station antennas in configurations that will permit compliance with the RF exposure guidelines by issuing a more comprehensive preemption statement with respect to amateur station antennas than now exists, and must completely preempt the judicial enforcement of restrictive covenants which result in amateurs installing station antennas indoors or at locations on a horizontal plane with human occupants of residences. Indeed, the ARRL continues, such an order is overdue anyway; but the combination of adoption of a strict RF exposure standard and continuation of a hands-off attitude with respect to antenna covenants is tantamount to a license revocation, as it would preclude the operation of any amateur station subject to both restrictions.

157. The ARRL Bio-Effects Committee claims that amateur operators normally would be exempted from environmental review requirements, since most engage in operations that would not cause the ANSI/IEEE guidelines to be exceeded. However, it notes, a 100 watt VHF "vehicular installation" may produce higher fields inside the vehicle than the ANSI/IEEE standard would allow. Furthermore, hand-held transceivers, facilities employing indoor antennas, and facilities engaging in specialized activities such as "moonbounce" communication, may produce significant localized fields near the antenna.

158. Further, the ARRL Bio-Effects Committee notes that a comprehensive environmental review would be too burdensome both for the amateur operators and the Commission staff. It therefore recommends that a tabular chart showing the calculated field intensities at various distances from antennas having directive patterns, driven by transmitters of various power output levels common in the amateur service be added to Part 97. The ARRL Bio-Effects Committee also recommends inserting questions about electromagnetic radiation safety in each amateur operator license examination and requiring certification on the license application that the applicant has read the Commission guidelines, understands them, and agrees to comply. Under this scheme, the ARRL Bio-Effects Committee argues, amateur operators would follow the policy of "prudent avoidance" that the ARRL publications now advocate.

159. Professor Wayne Overbeck, filing comments as an individual, believes that few amateur operators are aware of the electromagnetic radiation levels present near their own amateur stations and that rather than being excluded from our requirements, the amateur service should be subject to the standard for "uncontrolled environments" through language added to Part 97. Professor Overbeck points out that vast numbers of amateurs are neither members of the ARRL nor subscribers to any amateur service magazines and consequently these educational sources are not sufficient to ensure adherence to our guidelines. Because actual measurements would be financially prohibitive for most amateur operators, Professor Overbeck recommends that we promulgate a rule requiring amateur operators to adopt operating and antenna-placement practices calculated to meet the exposure limits and that they be required to certify on their application forms that they have read and will adhere to the guidelines for antenna placement.

Finally, Professor Overbeck suggests that we promulgate an amateur service version of OST Bulletin No. 65 that would include charts and tables showing required separation distances between antennas and inhabited areas for various power levels. He also suggests that amateurs be tested on this topic as part of operator license examinations.

160. Decision. The Commission expects all its licensees to comply with the RF guidelines specified in our rules, or, if not, to file an Environmental Assessment for review under our NEPA procedures. After a thorough review of the comments and the results of an FCC/EPA measurement study,[196] we conclude that, although it appears to be relatively small, there is a potential for amateur stations to cause exposures to RF radiation in excess of these guidelines. Amateur stations can transmit with up to 1500 watts peak envelope power on frequencies in specified bands from 1,800 kHz to over 300 GHz. Certain of the emission types permitted have high duty cycles, for example frequency or phase shifted digital signals. Amateur stations are not subject generally to restrictions on antenna gain, antenna placement and other relevant exposure variables. Even though situations where exposures are excessive may be relatively uncommon and even though most amateur stations transmit for short periods of time at power levels considerably lower than the maximum allowed, the possibility of human exposure to RF radiation in excess of the guidelines cannot be disregarded. Therefore, a blanket exemption for all amateur stations does not appear to be justified, and we will apply our new guidelines to amateur stations. We will rely upon amateur licensees to demonstrate their knowledge of our guidelines through examinations. We will also rely on amateur licensees to evaluate their own stations if they transmit using more than 50 watts of output power. Applicants for new licenses and renewals also will be required to demonstrate that they have read and that they understand our applicable rules regarding RF exposure.

161. We find it to be the duty of the licensee of an amateur station to prevent the station from transmitting from any place where the operation of the station could cause human exposure to levels of RF radiation that are in excess of the limits we are adopting. We concur with the ARRL that amateur operators should follow a policy of prudent avoidance of excessive RF exposure. We will continue to rely upon amateur operators, in constructing and operating their stations, to take steps to ensure that their stations comply with the MPE limits for both occupational/controlled and general public/uncontrolled environments. In this regard, we recognize and agree with the ARRL's position that the occupational/controlled limits generally can be considered adequate for situations involving amateur stations considering the most commonly used power levels, intermittent operation and frequencies involved. We recognize that operation in the amateur radio service presents certain unique conditions. Nonetheless, we are concerned that amateur radio operations are likely to be located in residential neighborhoods and may expose persons to RF fields in excess of the MPE guidelines. We will consider amateur

[196] See, note 194, supra.

radio operators and members of their immediate household to be in a "controlled environment" and will apply the occupational/controlled MPE limits to those situations. Neighbors who are not members of an amateur operator's household, are considered to be members of the general public, however, since they cannot reasonably be expected to excercise control over their exposure. In those cases general population/uncontrolled exposure MPE limits will apply.

162. We believe that the burden for action to assure compliance with RF exposure limits should fall on the relatively few licensees who operate stations that can potentially cause individuals, knowingly or unknowingly, to be exposed to RF energy in excess of these guidelines. We want the licensees of such stations to provide adequately for RF safety. We do not believe, however, that a detailed EA or other routine environmental filing is practical or necessary. To make the complex determination of possible excessive exposure as simple as possible, we are specifying a threshold limit for transmitter power that will apply regardless of frequency used. Below 50 watts transmitter power, the licensee will not be required to take any action, unless requested by Commission staff pursuant to Section 1.1307(c) or 1.1307(d) of our rules. Above this power threshold, the licensee must perform a routine evaluation to predict if the RF radiation could be in excess of that allowed by the criteria listed in § 1.1310. If so, the licensee must take action to prevent such an occurrence. The action could be in the form of altering operating patterns, relocating the antenna, revising the station's technical parameters such as frequency, power or emission type or combinations of these and other remedies. To assist with routine evaluation of exposure levels in accordance with the guidelines, we encourage the amateur community to develop and disseminate information in the form of tables, charts and computer analytical tools that relate such variables as operating patterns, emission types, frequencies, power and distance from antennas. We also intend to provide straightforward methods for amateur operators to determine potential exposure levels. This information could be included in our updated version of OST Bulletin No. 65, or we may follow the suggestion to develop a separate bulletin tailored for the amateur service community. As a result of the adoption of a transition period, which was discussed earlier, the new guidelines will apply to amateur stations beginning January 1, 1997. This should provide sufficient time for the amateur community and the Commission staff to prepare the necessary information to help amateur operators comply with these requirements.

163. As suggested by the ARRL, the ARRL Bio-Effects Committee and Professor Overbeck, we are amending our rules to require the operator license examination question pools to include questions concerning RF safety at amateur stations. We are requiring an additional five questions on RF safety within each of three written examination elements. We also are adopting ARRL's proposal that amateur operators should be required to certify, as part of their license application process, that they have read and understand our bulletins and the relevant FCC

rules.[197] We will rely on our Wireless Telecommunications Bureau to develop suitable methods for obtaining this certification.

C. Federal Preemption

164. In the past, parties have requested that the Commission preempt state and local authority over RF exposure matters.[198] To date the Commission has declined to preempt on health and safety matters. However, the Commission has noted that should non-Federal RF radiation standards be adopted that adversely affect a licensee's ability to engage in Commission-authorized activities, the Commission would consider reconsidering whether Federal action is necessary.[199]

165. In the Notice, we did not discuss Federal preemption of state and local regulations regarding RF radiation exposure. However, many commenters request that we address this matter by establishing Federal preemption of state and local regulations concerning RF radiation exposure.[200] Two Petitions for Rule Making have been filed in this docket requesting a Further Notice of Proposed Rule Making to address the preemption of non-Federal government regulations concerning RF radiation hazards.[201] The Village of Wilmette, Illinois, and Ergotec Assocation, Inc, in late-filed reply comments, oppose federal preemption of local RF exposure regulations.

166. Decision. In the past the Commission has hesitated to intrude on the ability of states and localities to make regulations affecting health and safety. Many of the comments indicate that a patchwork of divergent local and State regulations could pose a burden on interstate communications. However, since these comments were filed, Congress has passed the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996). Section 704 of the Telecommunications Act amends the Communications Act by providing for federal preemption of state and local regulation of personal wireless service facilities on the basis of RF

[197] ARRL Comments at 17. ARRL Bio-Effects Committee Comments at 5.

[198] See, 5 FCC Rcd 486 (1990).

[199] See, GEN Dkt 79-144, Report and Order, 100 FCC 2d at 558.

[200] See, for example, comments of MSTV/NBC, McCaw, PacTel, Hammet & Edison, Joint Broadcasters, Celpage, Ericsson, AMSC, the New Jersey Broadcasters Association, and ARRL.

[201] See Electromagnetic Energy Association (formerly EEPA), Petition for Further Notice of Proposed Rulemaking and Hammett & Edison Comments requesting that it serve as a Petition for Rule Making concerning the preemption of state and local RF regulations.

environmental effects.[202] The Telecommunications Act also provides for resolution of conflicts related to the regulation of RF emissions by the courts or by petition to the Commission.[203] Accordingly, we are amending § 1.1307 of our rules to incorporate the provisions of Section 704 of the Telecommunications Act.

167. The Telecommunications Act does not preempt state or local regulations relating to RF emissions of broadcast facilities or other facilities that do not fall within the definition of "personal wireless services."[204] It would appear from the comments that a few such regulations have been imposed, generally as a result of health and safety concerns. At this point, it does not appear that the number of instances of state and local regulation of RF emissions in non-personal wireless services situations is large enough to justify considering whether or not they should be preempted. We have traditionally been reluctant to preempt state or local regulations enacted to promote bona fide health and safety objectives. We have no reason to believe that the instances cited in the comments were motivated by anything but bona fide concerns.

168. We believe that the regulations that we are adopting herein represent the best scientific thought and are sufficient to protect the public health. Once states and localities have had an opportunity to review and analyze the guidelines we are adopting, we expect they will agree that no further state or local regulation is warranted. Should our expectations prove to be misplaced and should FCC licensees encounter a pattern of state or local activities which constitute an obstacle to the scheme of federal control of radio facilities set forth in the Communications Act, they should present us with such evidence as well as their view of the legal basis which could justify FCC preemption of state and local ordinances. At this time, however, we deny the petitions from the EEA and from Hammett and Edison, as well as the comments from several parties, requesting a broad-based preemption policy to cover all transmitting sources.

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[202] Telecommunications Act of 1996, Section 704. Facilities Siting: Radio Frequency Emission Standards. Sec. 704 (a) (7) (B) (iv). This section states that: "No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's regulations concerning such emissions."

[203] Telecommunications Act of 1996, Section 704 (a) (7) (B) (v). This section states that, "Any person adversely affected by any final action or failure to act by a State or local government or any instrumentality thereof that is inconsistent with this subparagraph may, within 30 days after such action or failure to act, commence an action in any court of competent jurisdiction. The court shall hear and decide such action on an expedited basis. Any person adversely affected by an act or failure to act by a State or local government or any instrumentality thereof that is inconsistent with clause (iv) may petition the Commission for relief."

[204] Section 704 (a) (C) (i) of the Act defines "personal wireless services" to mean "commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services."

V. CONCLUSION

169. To protect public health with respect to RF radiation from FCC-regulated transmitters, and to fulfill our responsibilities under NEPA, we are updating our guidelines for evaluating the environmental impact of RF emissions. We believe that the guidelines we are adopting will be of benefit both to the public and to the telecommunications industry. They will provide assurance that recent scientific knowledge is taken into account regarding future decisions on approval of FCC-authorized facilities and equipment.

VI. ORDERING CLAUSES

170. Section 704(b) of the Telecommunications Act of 1996 requires that we prescribe and make effective these new rules by August 6, 1996. Accordingly, we find that good cause exists, pursuant to 5 U.S.C. Sec. 553(d)(3), to make these rules effective upon publication in the Federal Register rather than to follow the normal practice of making them effective 30 days after publication in the Federal Register.[205] Completion of this rulemaking has required an extensive amount of work to resolve extremely complex issues. In addition, coordination with the various affected federal agencies through to the Interdepartment Radio Advisory Committee has consumed more time than anticipated. The time required to review the comments, decide on the best possible guidelines and coordinate that decision with other federal agencies has made it impossible to delay the effective date for 30 days and still meet the Congressionally imposed deadline. Thus, we have no alternative but to make these rules effective immediately. We note that the Notice in this proceeding was first issued in 1993. In addition, we note that the Telecommunications Act of 1996, containing a deadline for implementation, was enacted in early February of this year. Therefore, most parties to this proceeding have had considerable notice of the likely actions we would be taking, and they should have had sufficient opportunity to prepare for the implementation of new guidelines pursuant to the implementation schedule set forth above.

171. Accordingly, pursuant to the authority contained in Sections 4(i), 7(a), 303(c), 303(f), 303(g), 303(r) and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), 303(r) and 332(c)(7), IT IS ORDERED, that effective August 6, 1996, Parts 1, 2, 15, 24, and 97 of the Commission's Rules and Regulations, 47 CFR Parts 1, 2, 15, 24, and 97, ARE AMENDED as specified in Appendix C.

[205] See note 4, supra. Unlike other sections of that Act, see, e.g., Secs. 251(d)(d)(1), which directs us to "complete" action, and Sec. 254(a)(2), which directs us to "promulgate" rules, Sec. 704 requires that the RF exposure guidelines be made effective within the prescribed 180 day time period.

172. IT IS FURTHER ORDERED, that the respective petitions of the Electromagnetic Energy Association, Hammett and Edison, Inc., and Ken Hollady ARE DENIED.

VII. PROCEDURAL MATTERS

173. For further information concerning this rule making, contact the Commission's radiofrequency safety program at (202) 418-2464. Address: Office of Engineering and Technology, Federal Communications Commission, Washington, D.C. 20554. Internet e-mail address: rfsafety@fcc.gov.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

APPENDIX A

Final Regulatory Flexibility Analysis

As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603 (RFA), an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Notice.[206] The Commission sought written public comments on the proposals in the Notice, including on the IRFA. The Commission's Final Regulatory Flexibility Analysis (FRFA) in this Report and Order conforms to the RFA, as amended by the Contract With America Advancement Act of 1996 (CWAAA), Pub. L. No. 104-121, 110 Stat. 847 (1996).[207]

I. Need for and Purpose of this Action:

The National Environmental Policy Act (NEPA) of 1969 requires agencies of the Federal Government to evaluate the effects of their actions on the quality of the human environment. To meet its responsibilities under NEPA, the Commission has adopted revised RF exposure guidelines for purposes of evaluating potential environmental effects of RF radiation from FCC-regulated facilities. The new guidelines reflect more recent scientific studies of the biological effects of RF radiation. Use of these new guidelines will ensure that the public and workers receive adequate protection from exposure to potentially harmful RF field.

II. Summary of Issues Raised by the Public Comments in Response to the Initial Regulatory Flexibility Analysis:

No comments were filed in direct response to the IRFA. In general comments on the Notice, however, some commenters raised issues that might affect small entities. In particular, some commenters argued that the cost of complying with the radio frequency (RF) limits could be overly burdensome, and this could negatively impact small businesses. They express concern that the cost of testing, with respect to devices operating in close proximity to the body, is extremely expensive and obtaining testing equipment could be difficult for small businesses. For example, the National Association of Business and Educational Radio, Inc. (NABER) encourages us to categorically exclude land mobile transmitters, expressing concern that if categorical exclusions for land mobile services are eliminated, manufacturers would have to institute unnecessary and costly testing.[208] They also request that we limit the

[206] See Notice of Proposed Rule Making, ET Docket No. 93-62, 8 FCC Rcd 2849 (1993).

[207] Subtitle II of the CWAAA is "The Small Business Regulatory Enforcement Fairness Act of 1996" (SBREFA), codified at 5 U.S.C. § 601 et seq.

amount of paperwork that is necessary for demonstrating compliance with the limits. In particular, the Broadcast Joint Commenters suggest that additional paperwork should not be required to establish compliance with the new policies because it would be needlessly burdensome to the broadcasters and to the Mass Media Bureau.[209] As discussed in Section V of this FRFA, we have attempted to address these concerns.

III. Description and estimate of the Small Entities Subject to the Rules:

The rules in this Report and Order will apply to the following twelve industry categories and services. The RFA generally defines the term "small business" as having the same meaning as the term "small business concern" under the Small Business Act, 15 U.S.C. § 632. Based on that statutory provision, we will consider a small business concern one which (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA). The RFA SBREFA provisions also apply to nonprofit organizations and to governmental organizations. Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information regarding the number of small business within each of these services or the number of small business that would be affected by this action. We have, however, made estimates based on our knowledge about applications that have been submitted in the past.
To the extent that a government entity may be a licensee or an applicant, the impact on those entities is included in the estimates for small businesses below.

As discussed below, under the rules we are adopting many radio services are categorically excluded from having to determine compliance with the new RF radiation limits that are being adopted. This exclusion is based on a determination that there is little potential for these services causing exposures in excess of the limits. Within the services below, many transmitting facilities are also categorically excluded based on antenna location and power. These categorical exclusions significantly reduce the burden associated with these rules, and may reduce the impact of these rules on small businesses.

A. Radiofrequency Devices

The radiofrequency devices affected by this rulemaking are low power, unlicensed transmitters that will be used to provide, on millimeter wave frequencies, a variety of services, including vehicle collision avoidance and high data rate/short range wireless data communications. Unlicensed personal communications service (PCS) transmitters are also

[208] NABER Comments at 5-6.

[209] Broadcast Joint Commenters Reply Comments at 39-40.

radiofrequency devices. Radiofrequency devices are subject to compliance with the new RF radiation requirements at the time of equipment authorization. Therefore, it will be the equipment manufacturers and importers who will be affected by this action.

We expect most of the firms that would be interested in producing millimeter wave and unlicensed PCS devices will be large businesses. We note that Ford Motor and Hewlett Packard have expressed interest in millimeter wave devices and filed comments in this proceeding. In addition, Motorola and Ericsson Corporate, both large equipment manufacturers, have expressed interest in manufacturing unlicensed PCS devices. Nevertheless, it is conceivable that small businesses will also want to manufacture these devices.

The Commission has not developed a definition of small entities applicable to radiofrequency devices. Therefore, the applicable definition of small entity is the definition under the SBA applicable to the "Communications Services, Not Elsewhere" category. A small millimeter wave device or unlicensed PCS entity under this definition is one with less than $11.0 million in annual receipts.[210]

The Commission has not yet authorized any millimeter wave devices, and has authorized fewer than ten unlicensed PCS devices. Both these services are new, so we really don't know how many applications for equipment authorization we may receive, nor how many small manufacturers may be interested in producing these products. Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information regarding the number of small businesses in this category. The Census Bureau estimates indicate that of the 848 firms in the "Communications Services, Not Elsewhere" category, 775 are small businesses. Based on this information, as well as our past experience in granting equipment authorization for other types of radiofrequency devices, we estimate that 50 percent of the applications for millimeter wave and unlicensed PCS devices will be from small businesses.

The Commission anticipates that approximately 30 applications will be filed annually for devices that operate in the millimeter band and unlicensed PCS spectrum. All of these applications will require an initial determination of compliance with our new RF guidelines. Of these devices, ten will require specific absorption rate (SAR) modeling or measurement, which adds cost to the authorization process.

B. Cellular Radio Telephone Service

[210] 13 CFR § 121.201, Standard Industrial Classification (SIC) Code 4899.

The Commission has not developed a definition of small entities applicable to cellular licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.[211] Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information regarding the number of small cellular businesses and is unable at this time to make a precise estimate of the number of cellular firms which are small businesses.

The size data provided by the SBA does not enable us to make a meaningful estimate of the number of cellular providers which are small entities because it combines all radiotelephone companies with 500 or more employees.[212] We therefore used the 1992 Census of Transportation, Communications, and Utilities, conducted by the Bureau of the Census, which is the most recent information available. That census shows that only 12 radiotelephone firms out of a total of 1,178 such firms which operated during 1992 had 1,000 or more employees.[213] Therefore, even if all 12 of these large firms were cellular telephone companies, all of the remainder were small businesses under the SBA's definition**.** We assume that, for purposes of our evaluations and conclusions in the Final Regulatory Flexibility Analysis, all of the current cellular licensees are small entities, as that term is defined by the SBA. Although there are 1,758 cellular licenses, we do not know the number of cellular licensees, since a cellular licensee may own several licenses.

We assume that all of the current rural cellular licensees are small businesses. Comments filed by small business associations, the Organization for the Protection and Advancement of Small Telephone Companies (OPASTCO), state that 2/3 of its 440 members provide cellular service,[214] and comments filed by the Rural Cellular Association (RCA) state that its members serve 80 cellular service areas.[215] We recognize that these numbers represent

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[211] 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) Code 4812.

[212] U. S. Small Business Administration 1992 Economic Census Employment Report, Bureau of the Census, U.S. Department of Commerce, SIC Code 4812 (radiotelephone communications industry data adopted by the SBA Office of Advocacy).

[213] U.S. Bureau of the Census, U.S. Department of Commerce, 1992 Census of Transportation, Communications, and Utilities, UC92-S-1, Subject Series, Establishment and Firm Size, Table 5, Employment Size of Firms: 1992, SIC Code 4812 (issued May 1995).

[214] OPASTCO Comments at 1-2 (filed January 9, 1995).

[215] RCA Comments at 2 (filed January 9, 1995).

only part of the current rural cellular licensees because there might be other rural companies not represented by either association.

The rules we are adopting generally require cellular stations to make a determination, through calculation or measurement, as to whether a transmitter facility will comply with the RF radiation exposure limits. If the facility does not comply with the limits, then the applicant (for a new license, a modification, or a renewal of an existing license) must file an Environmental Assessment (EA) pursuant to the National Environment Policy Act. The vast majority of applicants will find their facilities in compliance with the limits, or take steps such as controlling access around the transmitting facility, and will only need to indicate on their application that they comply with the limits. Many cellular transmission facilities are categorically exempted from making a compliance determination based on power and/or antenna height. The Commission processes roughly 700 applications for cellular transmitters facilities, involving 7,000 site locations, per year. Approximately 2,800 transmitting facilities will exceed categorical exclusion criteria and will require a determination of compliance with our new guidelines, based on calculations or measurements.

Manufacturers of mobile and portable cellular transmitters will have to make measurements, or in some cases calculations, as a condition for equipment authorization. Many of these manufacturers are likely to be the same as those that will manufacture unlicensed PCS transmitters, as discussed in the radiofrequency device category above. Based on the information presented for radiofrequency devices, as well as our past experience in granting equipment authorization for other types of radiofrequency devices, we estimate that 50 percent of the applications for cellular telephones will be from small businesses. It is estimated that 200 mobile and portable cellular transmitters will require authorization per year.

C. Personal Communications Service

The broadband PCS spectrum is divided into six frequency blocks designated A through F. Pursuant to 47 C.F.R. § 24.720(b), the Commission has defined "small entity" for Blocks C and F licensees as firms that had average gross revenues of less than $40 million in the three previous calendar years. This regulation defining `"small entity" in the context of broadband PCS auctions has been approved by the SBA.[216]

The Commission has auctioned broadband PCS licenses in Blocks A, B, and C. We do not have sufficient data to determine how many small businesses under the Commission's

[216] *See* Implementation of Section 309(j) of the Communications Act -- Competitive Bidding, PP Docket No. 93-253, Fifth Report and Order, 9 FCC Rcd 5532, 5581-84 (1994)

definition bid successfully for licenses in Blocks A and B. As of now, there are 90 non-defaulting winning bidders that qualify as small entities in the Block C auction. Based on this information, we conclude that the number of broadband PCS licensees affected by the rule adopted in this *Report and Order* includes the 90 non-defaulting winning bidders that qualify as small entities in the Block C broadband PCS auction.

At present, no licenses have been awarded for Blocks D, E, and F for spectrum. Therefore, there are no small businesses currently providing these services. However, a total of 1,479 licenses will be awarded in the D, E, and F Block broadband PCS auctions, which are scheduled to begin on August 26, 1996. Eligibility for the 493 F Block licensees is limited to "entrepreneurs" with the average gross revenues of less than $125 million. However, we cannot estimate how many small businesses under the Commission's definition will win F Block licenses, or D and E Block licenses. Given the facts that nearly all radiotelephone companies have fewer than 1,000 employees and that no reliable estimate of the number of prospective D, E, and F Block licensees can be made, we assume, for purposes of our evaluations and conclusions in this FRFA, that all of the licenses will be awarded to small entities, as that term is defined by the SBA.

After all PCS licenses have been issued, the Commission expects to receive approximately 1,000 applications per year involving 10,000 sites. We anticipate that 3000 sites will not meet the categorical exclusion criteria and will involve a determination of compliance with the RF exposure guidelines.

As in the case of cellular telephones, mobile and portable PCS transmitters will have to undergo measurement or modeling to determine compliance with the RF radiation limits as a condition of equipment authorization. Again, we estimate that 50% of the manufacturers will be small businesses. Although we have authorized fewer than ten PCS transmitters, it is estimated that eventually 50 of such devices will be authorized each year.

D. Private Land Mobile Radio Services, Specialized Mobile Radio

Pursuant to 47 C.F.R. § 90.814(b)(1), the Commission has defined "small entity" for geographic area 800 MHz and 900 MHz SMR licenses as firms that had average gross revenues of less than $15 million in the three previous calendar years. This regulation defining "small entity" in the context of 800 MHz and 900 MHz SMR has been approved by the SBA.[217]

[217] *See* Amendment of Parts 2 and 90 of the Commission's Rules to Provide for the Use of 200 Channels Outside the Designated Filing Areas in the 896-901 MHz and the 935-940 MHz Bands Allotted to the Specialized Mobile Radio Pool, PR Docket No. 89-553,*Second Order on*

The rule adopted in this *Report and Order* applies to SMR providers in the 800 MHz and 900 MHz bands that either hold geographic area licenses or have obtained extended implementation authorizations. We do not know how many firms provide 800 MHz or 900 MHz geographic area SMR service pursuant to extended implementation authorizations, nor how many of these providers have annual revenues of less than $15 million. Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information regarding the number of small businesses in this category. We do know that one of these firms has over $15 million in revenues. We assume, for purposes of our evaluations and conclusions in this FRFA, that the remaining existing extended implementation authorizations may be held by small entities, as that term is defined by the SBA.

The Commission recently held auctions for geographic area licenses in the 900 MHz SMR band. There were 60 winning bidders who qualified as small entities under the Commission's definition in the 900 MHz auction. Based on this information, we conclude that the number of geographic area SMR licensees affected by the rule adopted in this *Report and Order* includes these 60 small entities.

No auctions have been held for 800 MHz geographic area SMR licenses. Therefore, no small entities currently hold these licenses. A total of 525 licenses will be awarded for the upper 200 channels in the 800 MHz geographic area SMR auction. However, the Commission has not yet determined how many licenses will be awarded for the lower 230 channels in the 800 MHz geographic area SMR auction. There is no basis to estimate, moreover, how many small entities within the SBA's definition will win these licenses. Given the facts that nearly all radiotelephone companies have fewer than 1,000 employees and that no reliable estimate of the number of prospective 800 MHz licensees can be made, we assume, for purposes of our evaluations and conclusions in this FRFA, that all of the licenses will be awarded to small entities, as that term is defined by the SBA. . . . . .

The Commission receives about 3,000 applications for covered SMR transmitters facilities per year. Approximately 1,000 transmitters will exceed categorical exclusion criteria and will require a determination of compliance. In addition, as in the case of cellular telephones and PCS, mobile and portable covered SMR transmitters will have to undergo measurement or modeling to determine compliance with MPE and/or SAR requirements. It is estimated that 200 of such devices will require authorization per year.

Reconsideration and Seventh Report and Order, 11 FCC Rcd 2639, 2693-702 (1995); Amendment of Part 90 of the Commission's Rules to Facilitate Future Development of SMR Systems in the 800 MHz Frequency Band, PR Docket No. 93-144, *First Report and Order, Eighth Report and Order, and Second Further Notice of Proposed Rulemaking*, 11 FCC Rcd 1463 (1995).

E. Satellite Communications Services

The Commission has not developed a definition of small entities applicable to satellite communications licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.

Satellite systems authorized by the Commission can be divided into the following categories: mobile satellite service (MSS) non-geostationary satellite orbit (NGSO) (low or medium orbit satellites); mobile satellite service geostationary; mobile satellite service ship stations; and fixed satellite service.

In the MSS NGSO category the commission has divided its spectrum allocation into small and large NGSO. In the small NGSO or small low Earth-orbit (LEO) satellite service there are three existing and three pending or further licensees, all of which may be considered small business entities in the context of this analysis. These licensees are authorized in the VHF/UHF bands.

In the large LEO MSS category of MSS NGSO there are three existing licensees and three pending or future licensees in the 1.6/2.5 GHz band. The three existing are probably not small business entities and the three pending are probably small business entities. In the category of geostationary MSS the Commission has licensed one consortium, in the 1.5/1.6 GHz band, that comprises many small business entities.

The fixed satellite service (FSS) has generally been authorized in the 4/6 and 11/12 GHz band. There are three FSS licensees, that serve domestic US markets, none of which are small business entities. There are also two licensees serving international markets with FSS authorizations and these entities may be considered small business entities.

It should be noted that in most of the satellite areas discussed above the Commission issues one license to an entity but generally issues blanket license authority for thousands or even hundreds of thousands of earth stations or hand held transceivers. In this analysis we have considered satellite companies that have less than 1500 employees to be small business entities. Therefore, we are concluding that small business entities are largely affected by this proceeding in the satellite area.

The Commission receives about 600 applications for satellite facilities per year. All applicants must make a determination of compliance with the limits, based on calculations or measurements.

F. Radio Broadcast Service

The SBA has defined small radio broadcast service entities based on their "annual receipts" specifically in 13 C.F.R § 104, and its calculations include an averaging process. We do not currently require submission of financial data from licensees that we could use to apply the SBA's definition of a small business. Thus, for purposes of estimating the number of small entities to which the rules apply, we are limited to considering the revenue data that are publicly available, and the revenue data on which we rely may not correspond completely with the SBA definition of annual receipts.

Under SBA criteria for determining annual receipts, if a concern has acquired an affiliate or been acquired as an affiliate during the applicable averaging period for determining annual receipts, the annual receipts in determining size status include the receipts of both firms. 13 C.F.R. § 121.104(d)(1). The SBA defines affiliation in 13 C.F.R. § 121.103. While the Commission refers to an affiliate generally as a station affiliated with a network, the SBA's definition of affiliate is analogous to our attribution rules. Generally, under the SBA's definition, concerns are affiliates of each other when one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both. 13 C.F.R. § 121.103(a)(1). The SBA considers factors such as ownership, management, previous relationships with or ties to another concern, and contractual relationships, in determining whether affiliation exists. 13 C.F.R. § 121.103(a)(2). Instead of making an independent determination of whether radio and television stations were affiliated based on SBA's definitions, we relied on the data bases available to us to afford us that information.

We have performed a study based on the data contained in the BIA Publications, Inc. Master Access Television Analyzer Database, which lists a total of 1,141 full-power commercial television stations. Low Power Television (LPTV) Stations and translator stations are discussed in paragraph H below. It should be noted that the percentage figures derived from the data base may be underinclusive because the data base does not list revenue estimates for noncommercial educational stations, and these are therefore excluded from our calculations based on the data base. Non-commercial stations are subject to the requirements adopted in the Report and Order. The data indicate that, based on 1995 revenue estimates, 440 full-power commercial television stations had an estimated revenue of 10.5 million dollars or less. That represents 54 percent of commercial television stations with revenue estimates listed in the BIA program. The data base does not list estimated revenues for 331 stations. Using an extreme scenario, if those 331 stations for which no revenue is listed are counted as small stations, there would be a total of 771 stations with an estimated revenue of 10.5 million dollars or less, representing approximately 68 percent of the 1,141 commercial television stations listed in the BIA data base.

Alternatively, if we look at owners of commercial television stations as listed in the BIA data base, there are a total of 488 owners. The data base lists estimated revenues for 60 percent of these owners, or 295. Of these 295 owners, 156 or 53 percent had annual revenues of less than 10.5 million. Using an extreme scenario, if the 193 owners for which revenue is not listed are assumed to be small, the total of small entities would constitute 72 percent of owners.

In summary, based on the foregoing extreme analysis using census data, we estimate that our rules will apply to as many as 1,150 commercial and non-commercial television stations (78 percent of all stations) that could be classified as small entities. Using the extreme analysis based on the data in the BIA data base, we estimate that as many as approximately 771 commercial television stations (about 68 percent of all commercial televisions stations) could be classified as small entities. As we noted above, these estimates are based on a definition that we believe greatly overstates the number of television broadcasters that are small businesses. Further, it should be noted that under the SBA's definitions, revenues of affiliates that are not television stations should be aggregated with the television station revenues in determining whether a concern is small. The estimates overstate the number of small entities since the revenue figures on which they are based do not include or aggregate such revenues from non-television affiliated companies.

In addition, according to the SBA's regulations, a radio broadcasting station must have annual gross receipts of $5.0 million or less in order to qualify as a small business concern.[218] There are approximately 10,250 commercial radio broadcasting stations and 1,810 noncommercial radio broadcast stations of all sizes in the nation, with approximately 5,200 different commercial licensees. For the same reasons as above, the exact number of small radio broadcasting entities to which the elimination of the rule will apply is unknown. Based on 1996 revenue estimates, the BIA Publications, Inc. Master Access Analyzer Database indicates that 3,314 commercial radio stations had an estimated revenue of $5.0 million or less. That represents approximately 32 percent of commercial radio stations with revenue estimates listed in the BIA program. The data base does not list estimated revenue for 6,571 stations. Using the most extreme scenario, if those 6,571 stations for which no revenue estimates is listed are counted as small stations, there would be a total of 9,885 stations with an estimated revenue of $5.0 or less, representing approximately 96 percent of the 10,257 commercial radio stations listed in the BIA data base.

Alternatively, if we look at owners of commercial radio stations as listed in the BIA data base, there are a total of 5,207 owners. The data base lists estimated revenues for 29 percent of these owners, or 1,532. Of these 1,532 owners, 1,344 or 88 percent had annual

[218] 13 C.F.R. § 121.201.

revenue of less than $5.0 million. Using the most extreme scenario, if the 3,675 owners for which revenue estimates are not listed are assumed to be small businesses, then the total of small entities would constitute 96 percent of commercial radio station owners. Further, many noncommercial radio broadcasters are considered to be small entities. Thus, a large number of licensees of radio broadcast facilities of several types (commercial AM, commercial FM, and noncommercial FM stations) could benefit from the rule amendment herein adopted.

The Commission receives about 1,800 applications for broadcast facilities per year. All applicants must make a determination of compliance with the limits, either by calculation or measurement.

G. Stations in the Maritime Services

This item would require licensees and applicants for ship satellite earth terminals to make a determination of compliance with the new RF radiation requirements. The Commission has not developed a definition of small entities applicable to ship satellite earth station licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.

Ship MSS is similar to geostationary MSS, as discussed above, except that earth stations are aboard maritime vessels rather than traditional earth stations in the MSS. In the area of ship MSS the Commission has two pending licensees for operation of the satellite service, one of which can be considered small business.

The Commission receives about 272 applications for ship earth stations per year. All applicants must make a determination of compliance with the new RF radiation limits.

H. Experimental, auxiliary, and special broadcast and other program distribution services

This service involves a variety of transmitters, generally used to relay broadcast programming to the public (through translator and booster stations) or within the program distribution chain (from a remote news gathering unit back to the station). It also includes Instructional Television Fixed Service stations, which are used to relay programming to the home or office, similar to that provided by cable television systems. The Commission has not developed a definition of small entities applicable to broadcast auxiliary licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.

There are currently 2,637 FM translators and boosters, 4,910 TV translators, and 1,903 Low Power TV stations which will be affected by the new requirements.[219] There are also 2,032 ITFS licensees. The FCC does not collect financial information on any broadcast facility and the Department of Commerce does not collect financial information on these auxiliary broadcast facilities. We believe, however, that most, if not all, of these auxiliary facilities, including Low Power TV stations, could be classified as small businesses by themselves. We also recognize that most translators and boosters are owned by a parent station which, in some cases, would be covered by the revenue definition of small business entity discussed above. These stations would likely have annual revenues that exceed the SBA maximum to be designated as a small business (either $5 million for a radio station or $10.5 million for a TV station). As we indicated earlier, 96% of radio stations and 78% of TV stations are designated as small.

The approximate number of annual applications processed by the Commission for this service is 1,032. All of these applications would be required to have a determination made regarding compliance with the new RF radiation limits.

I. Multipoint Distribution Service (MDS)

This service involves a variety of transmitters, which are used to relay programming to the home or office, similar to that provided by cable television systems. The Commission has not developed a definition of small entities applicable to MDS licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons. There are 1,800 MDS stations currently licensed and 500 applications for additional channels.

The approximate number of annual applications processed by the Commission for MDS is 900. It is estimated that of the 900 processed, only 113 will not meet the categorical exclusion criteria and have to make a determination of compliance with the RF radiation limits.

J. Paging and Radiotelephone Service, and Private Land Mobile Radio Services, Paging Operations

Since the Commission has not yet approved a definition for paging services, we will utilize the SBA's definition applicable to radiotelephone companies, i.e., an entity employing less than 1,500 persons.

[219] FCC news release, *Broadcast Station Totals as of June 30, 1996*, released July 10, 1996.

The Commission anticipates that a total of 15,531 non-nationwide geographic area licenses will be granted or auctioned. The geographic area licenses will consist of 3,050 MTA licenses and 12,481 EA licenses. In addition to the 47 Rand McNally MTAs, the Commission is licensing Alaska as a separate MTA and adding three MTAs for the U.S. territories, for a total of 51 MTAs. No auctions of paging licenses has been held yet, and there is no basis to determine the number of licenses that will be awarded to small entities. Given the fact that nearly all radiotelephone companies have fewer than 1,000 employees, and that no reliable estimate of the number of prospective paging licensees can be made, we assume, for purposes of this FRFA, that all the 15,531 geographic area paging licenses will be awarded to small entities, as that term is defined by the Small Business Administration (SBA).

We estimate that the approximately 600 current paging carriers could take the opportunity to partition and or/ disaggregate a license to obtain an additional license through partitioning or disaggregation. We estimate that up to 48,393 licensees or potential licensees could take the opportunity to partition and/or disaggregate a license or obtain a license through partitioning or disaggregation. This number is based on the total estimate of paging carriers (approximately 600) and non-nationwide geographic area licenses to be awarded (15,531) and our estimate that each license will probably not be partitioned and/or disaggrageted to no more than three parties. Given the fact that nearly all radiotelephone companies have fewer than 1,000 employees, and that no reliable estimate of the number of future paging licensees can be made, we assume for purposes of this FRFA that all of the licensees will be awarded to small businesses. We believe that it is possible that a significant number of up to approximately 48,393 licensees or potential licensees who could take the opportunity to partition and/or disaggregate a license or who could obtain a license through partitioning and/or disaggregation will be a small business.

The Commission receives about 10,000 applications for paging facilities per year. Approximately 1,176 transmitters will exceed categorical exclusion criteria and will require a determination of compliance with the new guidelines, either by measurement or calculation.

K. Experimental Radio Service

The Commission has not developed a definition of small entities applicable to experimental licensees. Therefore, the applicable definition of small entity is the definition under the Small Business Administration (SBA) rules applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.[220] Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information

[220] 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) Code 4812.

regarding the number of small experimental radio businesses and is unable at this time to make a precise estimate of the number of Experimental Radio Services which are small businesses.

The majority of experimental licenses are issued to companies such as Motorola and Department of Defense contractors such as Northrop, Lockheed and Martin Marietta. Businesses such as these may have as many as 200 licenses at one time. The majority of these applications, 70 percent, are from entities such as these. Given this fact, the remaining 30 percent of applications, we assume, for purposes of our evaluations and conclusions in this FRFA, will be awarded to small entities, as that term is defined by the SBA.

The Commission processes approximately 1,000 applications a year for experimental radio operations. About half or 500 of these are renewals and the other half are for new licenses. Approximately 500 of these applications will be required to make an initial determination of compliance with our new RF guidelines.

IV. Summary of Projected Reporting, Recordkeeping and Other Compliance Requirements:

Applicants that are subject to the new RF radiation guidelines (i.e., not categorically excluded), are required to make a statement on any application filed with the Commission indicating that they comply with the RF radiation limits. Technical information supporting that statement must be retained by the applicant, and provided to the Commission upon request. In some cases, the applicant will be able to determine compliance by making calculations or reading applicable literature, including OST Bulletin No. 65. In other cases, detailed measurements of the transmitting facility may be necessary. In addition, steps to control access to the facility, such as warning signs or fences, may be required. Manufacturers of radio transmitting equipment will, as indicated above, need to make MPE and/or SAR measurements that will need to form part of the manufacturer's records for equipment authorization.

Reporting

Reporting requirements are limited to certain classes of applicants and licensees for which the potential for human exposure to RF emissions is the greatest. Most applicants and licensees are categorically excluded from routinely evaluating their facilities, operations or transmitters for compliance with the new RF exposure guidelines. The National Environmental Policy Act (NEPA), upon which our rules are based, allows "categorical exclusion" of large classes of actions that generally do not provide an opportunity for causing significant environmental impact, such as would result from human exposure to RF emissions in excess of the guidelines. In this case, the "actions" excluded are the granting of

Commission applications and authorizations. Therefore, we are categorically excluding many applications submitted to the Commission from routine evaluation for compliance with the RF guidelines. This exclusion significantly limits burden on our regulatees, including many small businesses. The category exclusions apply to all radio services except those listed in section IV above and the radio amateur service. This means, for example, that all land mobile and public safety two-way systems are categorically excluded.

Applicants in services that are not categorically excluded may also be categorically excluded from determining compliance based on antenna location or station power. Applicants who are not categorically excluded are required to make a statement on certain application forms filed with the Commission indicating whether they comply with our environmental rules. This action by a licensee or applicant is the primary reporting requirement. In addition, supporting information (such as measurement data, site drawings, and calculations) may be requested, in certain cases, to justify the statement made on a Commission form.

Recordkeeping

The Commission has no specific recordkeeping requirements related to compliance with the RF exposure guidelines. This has not changed from the rules previously in place regarding compliance with RF exposure guidelines. The Commission does reserve the right to request information supporting the answer an applicant gives on a form. Such information would normally be technical in nature and could involve a report of calculations performed or measurements made to determine compliance. Therefore, many applicants and licensees may keep information related to their compliance on file in some form for their own records. The Commission provides applicants with guidance on performing calculations or measurements through its OST Bulletin No. 65, which is being updated to reflect the new guidelines. In many cases, an applicant or licensee can easily use this bulletin to determine compliance through the use of charts, figures and tables. This largely eliminates the need for keeping a detailed analytic report in many cases. Manufacturers of equipment who are required to evaluate portable or mobile devices would likely have to perform more detailed analysis and keep on file a specific technical report for review by the Commission if requested. Also, in a few cases involving multiple transmitters at large antenna farms detailed measurement studies may be necessary. Reports of such studies would be retained by an applicant to provide evidence of compliance if required.

Other Compliance Requirements

As was true for the previous rules, there are no specific compliance requirements, as such. Under the Commission's NEPA rules, applicants and licensees are required to submit an Environmental Assessment (EA) if they do not comply with our RF exposure guidelines (47

CFR § 1.1311). An EA is a detailed accounting of the consequences created by a specific action that may have a significant environmental impact, in this case a Commission authorization of a transmitter or facility that exceeds the RF guidelines. An EA would be evaluated by the Commission to determine whether the authorization should be granted in view of the environmental impact. In reality, this leads to a de facto compliance requirement, since most applicants and licensees who are not categorically excluded (see above) undertake measures to ensure compliance before submitting an application in order to avoid the preparation of a costly and time-consuming EA. For this reason EAs are rarely filed with the Commission. This has not changed from the existing rules. As for determining compliance, as mentioned above, the Commission provides applicants with specific guidance in the form of a technical bulletin. This bulletin is designed to minimize the effort and burden required by an applicant to determine compliance with the guidelines prior to submitting an application. Many options are available for ensuring compliance, including restricting access to an area where high RF levels exist, using warning signs or fences to provide notice of potential RF exposure, use or protective shielding or warning devices, reduction of power when people are in high RF areas and, in the case of portable and mobile devices, designing devices to minimize RF absorption in the body of the user.

Skills Needed to Meet Requirements

If a station is not categorically excluded, then the licensee or applicant must make a determination of whether the station will comply with the RF radiation limits. This study can be done by calculation or measurement, depending upon the situation. The calculations can be done in many cases by a radio technician or engineer familiar with radio propagation. If measurements are necessary, then a radio technician or engineer will also be required.

The applicant must indicate on its application that it meets the NEPA requirements and, therefore, does not exceed the RF radiation limits. The is usually done by checking a box on a form, which can be done by a clerical person.

V. Steps Taken to Minimize the Economic Impact on Small Entities:

The Commission has made every effort to devise ways to minimize the impact of the new RF limits on small entities, while protecting the health and safety of the public. However, we have incorporated sufficient flexibility in the procedures to make compliance as minimally burdensome as possible. We have taken the following steps to ease the impact on small businesses.

1. The Commission has created a categorical exclusion that requires only those transmitters that appear to have the highest potential to create a significant environmental effect to perform an environmental evaluation.

2. The Commission will revise OST Bulletin No. 65 to provide guidance for determining compliance with FCC-specified RF limits. This should be of particular assistance to small businesses since it will provide straightforward information that should allow a quick understanding of the requirements and a quick assessment of the potential for compliance problems without the need for an expensive consultant or measurement.

3. The Commission allows various methods for ensuring compliance with RF limits such as fencing, warning signs, labels, and markings, locked doors in roof-top areas, and the use of personal monitors and RF protective clothing in an occupational environment.

4. The Commission has rejected its initial proposal to adopt induced and contact currents limits due to the lack of reliable equipment available.

5. The Commission has specified a variety of acceptable testing methods and procedures that may be used to determine compliance. This will allow each small business to choose a procedure that best meets its needs in the manner that is least burdensome to it.

6. The Commission has always allowed multiple transmitter sites, i.e., antenna farms, to pool their resources and have only one study done for the entire site. This is very common at sites that have multiple entities such as TV, FM, paging, cellular, etc. In most circumstances, rather than each licensee hiring a separate consultant and submitting a study showing their compliance with the guidelines, one consulting radio technician or radio engineer can be hired by the group of licensees. The consultant surveys the entire site for compliance and gives his recommendations and findings to each of the licensees at the site. The licensees can then use the findings to show their compliance with the guidelines. In this way the cost of compliance is minimized as no one licensee has to pay the entire consulting fee, rather just a portion of it.

The Commission has determined cost of performing an environmental evaluation is minimal for 87 percent of the businesses required to determine compliance. In normal situations, an environmental evaluation can be performed within 1 hour or less with the use of the revised OST Bulletin No. 65, "Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radio Frequency Radiation." In situations involving devices intended to be used in close proximity to the body, only PCS, cellular, and SMR portable and mobile devices will be required to evaluate compliance under the Commission's equipment authorization process.

Report to Congress: The Commission shall send a copy of this Final Regulatory Flexibility Analysis, along with this Report and Order, in a report to Congress pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. § 801(a)(1)(A). A copy of this FRFA will also be published in the Federal Register.

APPENDIX B: EXPOSURE LIMITS FOR ANSI 1982, ANSI/IEEE 1992 AND NCRP

For information and comparison, Tables 1-3 summarize the maximum permissible exposure (MPE) limits of the 1982 and 1992 standards of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and American National Standards Institute (ANSI), and the 1986 exposure criteria of the National Council on Radiation Protection and Measurements (NCRP).

TABLE 1. ANSI C95.1-1982 RADIOFREQUENCY PROTECTION GUIDES

Frequency Range (MHz)	Electric Field Strength E^2 (V^2/m^2)	Magnetic Field Strength H^2 (A^2/m^2)	Power Density (S) E-field; H-field (mW/cm^2)	Averaging Time (minutes) $\|E\|^2$; S; or $\|H\|^2$
0.3-3	400,000	2.5	100	6
3-30	4,000 ($900/f^2$)	0.025 ($900/f^2$)	$900/f^2$	6
30-300	4,000	0.025	1.0	6
300-1500	4,000 (f/300)	0.025(f/300)	f/300	6
1500-100,000	20,000	0.125	5.0	6

f = frequency in megahertz (MHz) E^2 = electric field strength squared
H^2 = magnetic field strength squared V^2/m^2 = volts squared per meter squared
A^2/m^2 = amperes squared per meter squared mW/cm^2 = milliwatts per centimeter squared

NOTES for ANSI C95.1-1982:

(1) The squares of the field strengths or the power density, as applicable, are to be averaged over any six-minute period, and these time-averaged values should not exceed the values given in the table.

(2) For near field exposures, the only applicable protection guides are the mean squared electric and magnetic field strengths as given in the table above, columns 2 and 3. For convenience, these guides may be expressed as the equivalent plane-wave power density, given in the last column of the table.

(3) The 1982 ANSI guidelines incorporate exposure criteria for localized SAR (e.g., from hand-held devices) of 8 watts/kg (W/kg) and exclude low-power devices with input powers of 7 watts or less (frequency range of 300 kHz to 1 GHz).

(4) As noted, these guidelines have been replaced by the ANSI/IEEE C95.1-1992 (IEEE C95.1-1991) guidelines in Table 2.

TABLE 2. ANSI/IEEE C95.1-1992 (IEEE C95.1-1991) RADIOFREQUENCY PROTECTION GUIDES

(A) MAXIMUM PERMISSIBLE EXPOSURE (MPE): CONTROLLED ENVIRONMENTS

ELECTROMAGNETIC FIELDS

Frequency Range (MHz)	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density (S) E-field; H-field (mW/cm^2)	Averaging Time (minutes) $\|E\|^2$; S; or $\|H\|^2$
0.003-0.1	614	163	(100; 1,000,000)*	6
0.1-3.0	614	16.3/f	(100; 10,000/f^2)*	6
3.0-30	1842/f	16.3/f	(900/f^2; 10,000/f^2)*	6
30-100	61.4	16.3/f	(1.0; 10,000/f^2)*	6
100-300	61.4	0.163	1.0	6
300-3000	--	--	f/300	6
3000-15,000	--	--	10	6
15,000-300,000	--	--	10	616,000/$f^{1.2}$

* Plane-wave equivalent power density; not appropriate for near-field conditions, but used for comparison.

f = frequency in megahertz (MHz) V/m = volts per meter

A/m = amperes per meter mW/cm^2 = milliwatts per centimeter squared

INDUCED AND CONTACT RADIOFREQUENCY CURRENTS

Frequency Range (MHz)	Maximum Current (milliamps) Through both feet	Through each foot	Contact Current
0.003-0.1	2000f	1000f	1000f
0.1-100	200	100	100

TABLE 2. ANSI/IEEE C95.1-1992 (IEEE C95.1-1991) RADIOFREQUENCY PROTECTION GUIDES (continued)

(B) MAXIMUM PERMISSIBLE EXPOSURE (MPE) FOR UNCONTROLLED ENVIRONMENTS

ELECTROMAGNETIC FIELDS

Frequency Range (MHz)	Electric Field Strength E (V/m)	Magnetic Field Strength H (A/m)	Power Density (S) E-field; H-field (mW/cm^2)	Averaging Time (minutes) $\|E\|^2$; S;	$\|H\|^2$
0.003-0.1	614	163	(100; 1,000,000)*	6	6
0.1-1.34	614	16.3/f	(100; $10,000/f^2$)*	6	6
1.34-3.0	823.8/f	16.3/f	($180/f^2$; $10,000/f^2$)*	$f^2/0.3$	6
3.0-30	823.8/f	16.3/f	($180/f^2$; $10,000/f^2$)*	30	6
30-100	27.5	$158.3/f^{1.668}$	($0.2; 940,000/f^{3.336}$)*	30	$0.0636f^{1.337}$
100-300	27.5	0.0729	0.2	30	30
300-3000	--	--	f/1500	30	--
3000-15,000	--	--	f/1500	90,000/f	--
15,000-300,000	--	--	10	$616,000/f^{1.2}$	--

* Plane-wave equivalent power density; not appropriate for near-field conditions, but sometimes used for comparison purposes.

f = frequency in megahertz (MHz) V/m = volts per meter

A/m = amperes per meter mW/cm^2 = milliwatts per centimeter squared

INDUCED AND CONTACT RADIOFREQUENCY CURRENTS

Frequency Range (MHz)	Maximum Current (milliamps) Through both feet	Through each foot	Contact Current
0.003-0.1	900f	450f	450f
0.1-100	90	45	45

NOTES FOR ANSI/IEEE C95.1-1992

(1) "Controlled Environments" are defined as "locations where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above those shown in [(B) above] but do not exceed those in [(A) above] . . ."

(2) "Uncontrolled Environments" are defined as "locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces where there are no expectations that the exposure levels may exceed those shown in [(B) above] . . ."

(3) Various periods of time are specified for averaging exposures.

TABLE 3. NCRP EXPOSURE CRITERIA FOR RF FIELDS (1986)

(A) OCCUPATIONAL EXPOSURE:

(IDENTICAL TO ANSI C95.1-1982 - SEE TABLE 1)

(B) GENERAL PUBLIC EXPOSURE:

Frequency Range (MHz)	Electric Field Strength E^2 (V^2/m^2)	Magnetic Field Strength H^2 (A^2/m^2)	Power Density (S) E-field; H-field (mW/cm^2)	Averaging Time (minutes) $\|E\|^2$; S; or $\|H\|^2$
0.3-1.342	400,000	2.5	100	30
1.342-30	4,000 ($180/f^2$)	0.025 ($180/f^2$)	$180/f^2$	30
30-300	800	0.005	0.2	30
300-1500	4000 (f/1500)	0.025(f/1500)	f/1500	30
1500-100,000	4,000	0.025	1.0	30

f = frequency in megahertz (MHz)
E^2 = electric field strength squared
H^2 = magnetic field strength squared
V^2/m^2 = volts squared per meter squared
A^2/m^2 = amperes squared per meter squared
mW/cm^2 = milliwatts per centimeter squared

NOTES FOR NCRP EXPOSURE CRITERIA:

(1) Unlike ANSI/IEEE 1992, NCRP guidelines do not include criteria for induced and contact currents.

(2) For localized exposure (e.g., from hand-held devices) NCRP recommends the same limits as ANSI C95.1-1982 for occupational exposure (8 W/kg as averaged over 1 gram of tissue). For exposure of the general public NCRP recommends generally one-fifth of that level (1.6 W/kg) as averaged over 1 gram. This latter value is the same as that recommended by ANSI/IEEE C95.1-1992 for "uncontrolled" environments. NCRP guidelines do not incorporate exclusion criteria based on radiated power alone as do both the 1982 and 1992 ANSI/IEEE guidelines.

APPENDIX C: Final Rules

Title 47 of the Code of Federal Regulations, parts 1, 2, 15, 24 and 97 are amended as follows:

Part 1 - PRACTICE AND PROCEDURE

1. The authority citation for part 1 continues to read as follows:

AUTHORITY: 47 U.S.C. 151, 154, 303 and 309(j) unless otherwise noted.

2. Section 1.1307 is amended by revising paragraph (b), by removing notes 1, 2 and 3 following paragraph (b), and by adding new paragraphs (b)(1), (b)(2), (b)(3), (b)(4), and (e) to read as follows:

§ 1.1307 Actions which may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.

* * * * *

(b) In addition to the actions listed in paragraph (a) of this section, Commission actions granting construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities, require the preparation of an Environmental Assessment (EA) if the particular facility, operation or transmitter would cause human exposure to levels of radiofrequency radiation in excess of the limits in § 1.1310 and § 2.1093 of this chapter. Applications to the Commission for construction permits, licenses to transmit or renewals thereof, equipment authorizations or modifications in existing facilities must contain a statement confirming compliance with the limits unless the facility, operation, or transmitter is categorically excluded, as discussed below. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(1) The exposure limits in § 1.1310 are generally applicable to all facilities, operations and transmitters regulated by the Commission. However, a determination of compliance with the exposure limits in § 1.1310 (routine environmental evaluation), and preparation of an EA if the limits are exceeded, is necessary only for facilities, operations and transmitters that fall into the categories listed in Table 1, or those specified in paragraph (b)(2) of this section. All other facilities, operations and transmitters are categorically excluded from making such studies or preparing an EA, except as indicated in paragraphs (c) and (d) of this section. For purposes of Table 1, "rooftop" means the roof or otherwise outside, topmost level or levels of a building structure that is occupied as a workplace or residence and where either workers or the general public may have access. The term "power" in column 2 of Table 1

refers to total operating power of the transmitting operation in question in terms of effective radiated power (ERP), equivalent isotropically radiated power (EIRP), or peak envelope power (PEP), as defined in § 2.1 of this chapter. For the case of the Cellular Radiotelephone Service, subpart H of part 22 of this chapter; the Personal Communications Service, part 24 of this chapter and covered Specialized Mobile Radio Service operations, part 90 of this chapter, the phrase "total power of all channels" in column 2 of Table 1 means the sum of the ERP or EIRP of all co-located simultaneously operating transmitters of the facility. When applying the criteria of Table 1, radiation in all directions should be considered. For the case of transmitting facilities using sectorized transmitting antennas, applicants and licensees should apply the criteria to all transmitting channels in a given sector, noting that for a highly directional antenna there is relatively little contribution to ERP or EIRP summation for other directions.

TABLE 1: TRANSMITTERS, FACILITIES AND OPERATIONS SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

SERVICE (TITLE 47 CFR RULE PART)	EVALUATION REQUIRED IF:
Experimental Radio Services (part 5)	power > 100W ERP (164W EIRP)
Radio Frequency Devices (part 15)	millimeter wave devices operating in one of the following bands 46.7-46.8 GHz, 59.0-64.0 GHz or 76.0-77.0 GHz (see §§ 15.253 and 15.255 of this chapter) unlicensed personal communications service devices operating under subpart D of this chapter
Multipoint Distribution Service (subpart K of part 21)	non-rooftop antennas: height above ground level to radiation center < 10 m and power > 1640 W EIRP rooftop antennas: power > 1640W EIRP

TABLE 1 (contd.)

SERVICE (TITLE 47 CFR RULE PART)	EVALUATION REQUIRED IF:
Paging and Radiotelephone Service (subpart E of part 22)	non-rooftop antennas: height above ground level to radiation center < 10 m and power > 1000W ERP (1640 W EIRP) rooftop antennas: power > 1000W ERP (1640W EIRP)
Cellular Radiotelephone Service (subpart H of part 22)	non-rooftop antennas: height above ground level to radiation center < 10 m and total power of all channels > 1000W ERP (1640 W EIRP) rooftop antennas: total power of all channels > 1000W ERP (1640W EIRP)
Personal Communications Services (part 24)	(1) Narrowband PCS (subpart D): non-rooftop antennas: height above ground level to radiation center <10 m and total power of all channels > 1000W ERP (1640 W EIRP) rooftop antennas: total power of all channels > 1000W (1640W EIRP) (2) Broadband PCS (subpart E): non-rooftop antennas: height above ground level to radiation center <10 m and total power of all channels > 2000W ERP (3280 W EIRP) rooftop antennas: total power of all channels > 2000W (3280W EIRP)
Satellite Communications (part 25)	all included

TABLE 1 (contd.)

SERVICE (TITLE 47 CFR RULE PART)	EVALUATION REQUIRED IF:
Radio Broadcast Services (part 73)	all included
Experimental, auxiliary, and special broadcast and other program distributional services (part 74)	subparts A, G, L: power > 100W ERP subpart I: non-rooftop antennas: height above ground level to radiation center < 10 m and power > 1640 W EIRP rooftop antennas: power > 1640W EIRP
Stations in the Maritime Services (part 80)	ship earth stations only
Private Land Mobile Radio Services Paging Operations (part 90)	non-rooftop antennas: height above ground level to radiation center < 10 m and power > 1000W ERP (1640 W EIRP) rooftop antennas: power > 1000W ERP (1640W EIRP)
Private Land Mobile Radio Services Specialized Mobile Radio ("covered" providers only - see below)* (part 90)	non-rooftop antennas: height above ground level to radiation center < 10 m and total power of all channels > 1000W ERP (1640 W EIRP) rooftop antennas: total power of all channels > 1000W ERP (1640W EIRP)
Amateur Radio Service (part 97)	transmitter output power > 50W PEP

* Note: "Covered" SMR providers includes geographic area SMR licensees in the 800 MHz and 900 MHz bands that offer real-time, two-way switched voice service that is interconnected

with the public switched network and Incumbent Wide Area SMR licensees, as defined in § 20.3 of this chapter.

(2) Mobile and portable transmitting devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services (PCS), the Satellite Communications Services, the Maritime Services (ship earth stations only) and covered Specialized Mobile Radio Service providers authorized under subpart H of part 22, part 24, part 25, part 80, and part 90 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, as specified in §§ 2.1091 and 2.1093 of this chapter. All unlicensed PCS and millimeter wave devices are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, as specified in § 15.253(f), § 15.255(g), and § 15.319(i) of this chapter. All other mobile, portable, and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure under §§ 2.1091 and 2.1093 of this chapter except as specified in paragraphs (c) and (d) of this section.

(3) In general, when the guidelines specified in § 1.1310 are exceeded in an accessible area due to the emissions from multiple fixed transmitters, actions necessary to bring the area into compliance with the guidelines are the shared responsibility of all licensees whose transmitters produce field strengths or power density levels at the area in question in excess of 1% of the exposure limits applicable to their particular transmitter.

(i) Applicants for proposed (not otherwise excluded) transmitters, facilities or modifications that would cause non-compliance with the limits specified in § 1.1310 at an accessible area previously in compliance must submit an EA if emissions from the applicant's transmitter or facility would result in a field strength or power density at the area in question that exceeds 1% of the exposure limit applicable to that transmitter or facility.

(ii) Renewal applicants whose (not otherwise excluded) transmitters or facilities contribute to the field strength or power density at an accessible area not in compliance with the limits specified in § 1.1310 must submit an EA if emissions from the applicant's transmitter or facility results in a field strength or power density at the area in question that exceeds 1% of the exposure limit applicable to that transmitter or facility.

(4) Transition Provisions. For applications filed with the Commission prior to January 1, 1997, Commission actions granting construction permits, licenses to transmit or renewals thereof, equipment authorizations, or modifications in existing facilities require the preparation of an Environmental Assessment if the particular facility, operation or transmitter would cause human exposure to levels of radiofrequency radiation that are in excess of the requirements contained in paragraphs (4) (i) - (4)(iii) of this section. These transition provisions do not apply to applications for equipment authorization of mobile, portable, and

unlicensed devices specified in paragraph (2) of this section.

(i) For facilities and operations licensed or authorized under parts 5, 21 (subpart K), 25, 73, 74 (subparts A, G, I, and L), and 80 of this chapter, the "Radio Frequency Protection Guides" recommended in "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz", (ANSI C95.1-1982), issued by the American National Standards Institute (ANSI) and copyright 1982 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York shall apply. With respect to subpart K of part 21 and subpart I of Part 74 of this chapter, these requirements apply only to multipoint distribution service and instructional television fixed service stations transmitting with an equivalent isotropically radiated power (EIRP) in excess of 200 watts. With respect to subpart L of part 74 of this chapter, these requirements apply only to FM booster and translator stations transmitting with an effective radiated power (ERP) in excess of 100 watts. With respect to part 80 of this chapter, these requirements apply only to ship earth stations.

(ii) For facilities and operations licensed or authorized under part 24 of this chapter, licensees and manufacturers are required to ensure that their facilities and equipment comply with IEEE C95.1-1991 (ANSI/IEEE C95.1-1992), "Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz." Measurement methods are specified in IEEE C95.3-1991, "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields -- RF and Microwave." Copies of these standards are available from IEEE Standards Board, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331. Telephone: 1-800-678-4333. The limits for both "controlled" and "uncontrolled" environments, as defined by IEEE C95.1-1991, will apply to all PCS base and mobile stations, as appropriate.

(iii) Applications for all other types of facilities and operations are categorically excluded from routine RF radiation evaluation except as provided in paragraphs (c) and (d) of this section.

* * * * *

(e) No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the regulations contained in this chapter concerning the environmental effects of such emissions. For purposes of this paragraph:

(1) The term "personal wireless service" means commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services;

(2) The term "personal wireless service facilities" means facilities for the provision of personal wireless services;

(3) The term "unlicensed wireless services" means the offering of telecommunications services using duly authorized devices which do not require individual licenses, but does not mean the provision of direct-to-home satellite services; and

(4) The term "direct-to-home satellite services" means the distribution or broadcasting of programming or services by satellite directly to the subscriber's premises without the use of ground receiving or distribution equipment, except at the subscriber's premises or in the uplink process to the satellite.

3. A new Section 1.1310 is added to read as follows:

§ 1.1310 Radiofrequency radiation exposure limits.

The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

NOTE TO INTRODUCTORY PARAGRAPH: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

Table 1. Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

f = frequency in MHz
* = Plane-wave equivalent power density

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled 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 an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

Part 2 - FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for part 2 continues to read as follows:

AUTHORITY: Sec. 4, 302, 303 and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154, 302, 303 and 307, unless otherwise noted.

2. A new Section 2.1091 is added to read as follows:

§2.1091 Radiofrequency radiation exposure evaluation: mobile and unlicensed devices.

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular § 1.1307(b).

(b) For purposes of this section mobile devices are defined as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between radiating antennas and the body of the user or nearby persons.

(c) Mobile devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications Services, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, part 24 of this chapter, part 25 of this chapter, part 80 of this chapter (ship earth station devices only) and part 90 of this chapter ("covered" SMR devices only, as defined in the note to Table 1 of §1.1307(b)(1) of this chapter), are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use if their effective radiated power (ERP) is 1.5 watts or more. Unlicensed personal communications service and unlicensed millimeter wave

devices authorized under § 15.253, § 15.255 and subpart D of part 15 of this chapter are also subject to routine environmental evaluation for RF exposure prior to equipment authorization or use, regardless of their power used, unless they meet the definition of a portable device as specified in § 2.1093(b). All other mobile and unlicensed transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization, except as specified in §§ 1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of mobile and unlicensed transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(d) The limits to be used for evaluation are specified in § 1.1310 of this chapter. All unlicensed personal communications service (PCS) devices shall be subject to the limits for general population/uncontrolled exposure.

(1) For purposes of analyzing mobile transmitting devices under the occupational/controlled criteria specified in § 1.1310 of this chapter, time-averaging provisions of the guidelines may be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels.

(2) Time-averaging provisions may not be used in determining typical exposure levels for devices intended for use by consumers in general population/uncontrolled environments as defined in § 1.1310 of this chapter. However, "source-based" time-averaging based on an inherent property or duty-cycle of a device is allowed. An example of this is the determination of exposure from a device that uses digital technology such as a time-division multiple-access (TDMA) scheme for transmission of a signal. In general, maximum average power levels must be used to determine compliance.

(3) Compliance with exposure guidelines for mobile and unlicensed devices can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas.

4. A new section 2.1093 is added to read as follows:

§ 2.1093 Radiofrequency radiation exposure evaluation: portable devices.

(a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of Part 1 of this chapter, in particular § 1.1307(b).

(b) For purposes of this section portable devices are defined as transmitters designed to be used within 20 centimeters of the body of the user.

(c) Portable devices that operate in the Cellular Radiotelephone Service, the Personal Communications Services, the Satellite Communications services, the Maritime Services and the Specialized Mobile Radio Service authorized under subpart H of part 22 of this chapter, part 24 of this chapter, part 25 of this chapter, part 80 of this chapter (ship earth station devices only), part 90 of this chapter ("covered" SMR devices only, as defined in the note to Table 1 of § 1.1307(b)(1) of this chapter), and portable unlicensed personal communication service and millimeter wave devices authorized under § 15.253, § 15.255 or subpart D of part 15 of this chapter are subject to routine environmental evaluation for RF exposure prior to equipment authorization or use. All other portable transmitting devices are categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization, except as specified in §§ 1.1307(c) and 1.1307(d) of this chapter. Applications for equipment authorization of portable transmitting devices subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in paragraph (d) of this section as part of their application. Technical information showing the basis for this statement must be submitted to the Commission upon request.

(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate ("SAR") in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section.

(1) Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube). Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.

(2) Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section.

(3) Compliance with SAR limits can be demonstrated by either laboratory measurement techniques or by computational modeling. Methodologies and references for SAR evaluation are described in numerous technical publications including "IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave," IEEE C95.3-1991.

(4) For purposes of analyzing portable transmitting devices under the occupational/controlled criteria, the time-averaging provisions of the MPE guidelines identified in § 1.1310 of this chapter can be used in conjunction with typical maximum duty factors to determine maximum likely exposure levels.

(5) Time-averaging provisions of the MPE guidelines identified in § 1.1310 of this chapter may not be used in determining typical exposure levels for portable devices intended for use by consumers, such as hand-held cellular telephones, that are considered to operate in general population/uncontrolled environments as defined above. However, "source-based" time-averaging based on an inherent property or duty-cycle of a device is allowed. An example of this would be the determination of exposure from a device that uses digital technology such as a time-division multiple-access (TDMA) scheme for transmission of a signal. In general, maximum average power levels must be used to determine compliance.

Part 15 - RADIO FREQUENCY DEVICES

1. The authority citation for part 15 continues to read as follows:

AUTHORITY: Secs. 4, 302, 303, 304, 307 and 624A of the Communications Act of 1934, as amended, 47 U.S.C. 154, 302, 303, 307 and 544A.

2. Section 15.253 is amended by revising paragraph (f) to read as follows:

§ 15.253 Operation within the bands 46.7-46.9 GHz and 76.0-77.0 GHz.

* * * * *

(f) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radiofrequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

3. Section 15.255 is amended by revising paragraph (g) to read as follows:

§ 15.255 Operation within the band 59.0-64.0 GHz.

* * * * *

(g) Regardless of the power density levels permitted under this section, devices operating under the provisions of this section are subject to the radiofrequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

4. Section 15.319 is amended by revising paragraph (i), to read as follows:

§ 15.319 General technical requirements.

* * * * *

(i) Unlicensed PCS devices are subject to the radiofrequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Part 24 - PERSONAL COMMUNICATIONS SERVICES

1. The authority citation for part 24 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 301, 302, 303, 309, and 332, unless otherwise noted.

2. Section 24.52 is revised to read as follows:

§ 24.52 RF hazards.

Licensees and manufacturers are subject to the radiofrequency radiation exposure requirements specified in § 1.1307(b), § 2.1091 and § 2.1093 of this chapter, as appropriate. Applications for equipment authorization of mobile or portable devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Part 97 - AMATEUR RADIO SERVICE

1. The authority citation for part 97 continues to read as follows:

AUTHORITY: 48 Stat. 1066, 1082, as amended; 47 U.S.C. §§ 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. §§ 151-155, 301-609, unless otherwise noted.

2. Section 97.13 is amended by adding paragraph (c) to read as follows:

§ 97.13 Restrictions on station location.

* * * * *

(c) Before causing or allowing an amateur station to transmit from any place where the operation of the station could cause human exposure to levels of radiofrequency (RF) radiation in excess of that allowed under § 1.1310 of this chapter, the licensee is required to take certain actions. A routine RF radiation evaluation, as discussed in § 1.1307(b) of this chapter, is required if the transmitter power exceeds 50 watts peak envelope power; otherwise the operation is categorically excluded from routine RF radiation evaluation except as specified in § 1.1307(c) and § 1.1307(d) of this chapter. Where the routine evaluation indicates that the RF radiation could be in excess of the limits contained in § 1.1310 of this chapter, the licensee must take action to prevent such an occurrence. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluation Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation."

3. Section 97.503 is amended by revising paragraphs (b)(1), (b)(2), and (b)(3), and adding paragraph (c)(10) to read as follows:

§ 97.503 Element standards.

* * * * *

(b) * * *

(1) Element 2: 35 questions concerning the privileges of a Novice Class operator license. The minimum passing score is 26 questions answered correctly.

(2) Element 3(A): 30 questions concerning the privileges of a Technician Class operator license. The minimum passing score is 22 questions answered correctly.

(3) Element 3(B): 30 questions concerning the privileges of a General Class operator license. The minimum passing score is 22 questions answered correctly.

* * * * *

(c) * * *

Topics:	Element: 2	3(A)	3(B)	4(A)	4(B)
* * * * *					
(10) Radiofrequency environmental safety practices at an amateur station	5	5	5	0	0
* * * * *					

APPENDIX D: PARTIES FILING COMMENTS

1. Alcatel SEL (Alcatel)
2. American Personal Communications (APC)
3. American Radio Relay League, Inc. (ARRL)
4. American Radio Relay League Bio-Effects Committee
5. American Telephone and Telegraph Company (AT&T)
6. AMSC Subsidiary Corporation (AMSC)
7. Apple Computer, Inc. (Apple)
8. Arizona Department of Public Safety
9. Association of Federal Communications Consulting Engineers (AFCCE)
10. Association of Maximum Service Television and National Broadcasting Company, Inc. (MSTV/NBC)
11. Bell South Corporation, Bell South Telecommunications, Inc, Bell South Enterprises, Inc., and Bell South Cellular Corp. (BellSouth)
12. Broadcast Signal Lab (BSL)
13. Joint Comments of CBS, Inc., Capital Cities/ABC Inc., Greater Media, Inc., Tribune Broadcasting Company and Westinghouse Broadcasting, Inc. (Broadcast Joint Comments)
14. Cellular Telecommunciations Industry Association (CTIA)
15. Center for Devices and Radiological Health, U.S. Food and Drug Administration (FDA)
16. Cohen, Dippell and Everist, P.C. (CDE)
17. Jules Cohen & Associates, P.C. (JC&A)
18. Doty-Moore Tower Service, Inc. (Doty-Moore)
19. Du Treil, Lundin & Rackley, Inc. (DLR)
20. E.F. Johnson Company (E.F. Johnson)
21. Electromagnetic Energy Policy Alliance (EEPA)
22. Electronic Industries Association Consumer Electronics Group (EIA)
23. Sheldon L. Epstein
24. Ericsson Corporation (Ericsson)
25. Federal Aviation Administration (FAA)
26. Ford Motor Company
27. David Smith Forsman
28. Prof. Om Gandhi
29. Glenayre Electronics, Inc. (Glenayre)
30. Global Communications Corporation (Global)
31. GTE Service Corporation (GTE)
32. Professor Mark J. Hagmann; Florida International University
33. Hammett & Edison, Inc. (Hammett & Edison)
34. Hatfield & Dawson Consulting Engineers, Inc. (Hatfield & Dawson)
35. Ken Holladay

36. IEEE Standards Coordinating Committee 28 (IEEE/SCC28)
37. IEEE Standards Department
38. IEEE Committee on Man and Radiation
39. Industrial Hygiene Institute
40. Insterstitial, Inc. (Insterstitial)
41. Alan S. Kaul
42. Land Mobile Communications Council (LMCC)
43. Linear Corporation (Linear)
44. Matsushita Communications Industrial Corporation of America (MCC/Panasonic)
45. Maxwell Safety Products Ltd. (Maxwell)
46. McCaw Cellular Communications, Inc. (McCaw)
47. Motorola
48. Narda Microwave Corporation (Narda)
49. National Association of Broadcasters (NAB)
50. National Association of Business and Educational Radio, Inc. (NABER)
51. National Institute for Occupational Safety and Health (NIOSH)
52. National Public Radio (NPR)
53. National Volunteer Examiners
54. New Jersey Broadcasters Association
55. Northern Telecom, Inc. (Northern Telecom)
56. Dr. Wayne Overbeck
57. Pacific Bell and Nevada Bell
58. PacTel Corporation (PacTel)
59. Paging Network, Inc. (PageNet)
60. Raytheon Company (Raytheon)
61. Rolm Company (Rolm)
62. Silliman and Silliman
63. Southwestern Bell Mobile Systems, Inc. (Southwestern Bell)
64. Sprint Cellular Company (Sprint)
65. Telecommunications Industry Association (TIA)
66. Telocator, The Personal Communications Industry Association (Telocator)
67. TRW, Inc. (TRW)
68. U.S. Department of Defense (DoD)
69. U.S. Environmental Protection Agency (EPA)
70. US West
71. United States Telephone Association
72. Utilities Telecommunications Council (UTC)
73. Louis A. Williams, Jr. and Associates
74. Wizard Broadcasting Company (Wizard)

REPLY COMMENTS

1. American Mobile Telecommunications Association (AMTA)
2. American Personal Communications (APC)
3. American Radio Relay League, Inc. (ARRL)
4. AMSC Subsidiary Corporation (AMSC)
5. Celpage, Inc. (Celpage)
6. Cohen, Dippell and Everist, P.C. (CDE)
7. Comsat Corp. (Comsat)
8. Jules Cohen & Associates, P.C. (JC&A)
9. Electromagnetic Energy Policy Alliance (EEPA)
10. Sheldon L. Epstein
11. Ericsson Corporation (Ericsson)
12. GTE Service Corporation (GTE)
13. Hammett & Edison, Inc. (Hammett & Edison)
14. Hatfield & Dawson Consulting Engineers, Inc. (Hatfield & Dawson)
15. IEEE Standards Coordinating Committee 28 (IEEE/SCC28)
16. Maxwell Safety Products Ltd. (Maxwell)
17. McCaw Cellular Communications, Inc. (McCaw)
18. Motorola
19. Narda Microwave Corporation (Narda)
20. National Association of Broadcasters (NAB)
21. National Association of Business and Educational Radio, Inc. (NABER)
22. Northern Telecom, Inc. (Northern Telecom)
23. Occupational Safety and Health Administration, U.S. Department of Labor (OSHA)
24. Dr. Wayne Overbeck and the Amateur Radio Health Group
25. Paging Network, Inc. (PageNet)
26. Personal Communications Industry Association (formerly Telocator), (PCIA)
27. Pixel Instruments Corp. (Pixel)
28. Society of Broadcast Engineers (SBE)
29. Southwestern Bell Mobile Systems, Inc. (Southwestern Bell)
30. Telecommunications Industry Association (TIA)
31. TRW, Inc.
32. Village of Wilmette, IL

August 1, 1996

JOINT SEPARATE STATEMENT OF

COMMISSIONERS JAMES H. QUELLO AND RACHELLE B. CHONG

Re: *In the Matter of Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, ET Docket 93-62*

We support the adoption of new guidelines and methods for evaluating the environmental effects of radiofrequency (RF) emissions from FCC-regulated transmitters. The exposure limits contained in these guidelines are generally based on the most conservative of the limits contained in the recommendations of the National Council on Radiation Protection and Measurement (NCRP), and in guidelines issued by the Institute for Electrical and Electronics Engineers, Inc. (IEEE), and subsequently adopted by the American National Standards Institute (ANSI) as an ANSI standard (ANSI/IEEE C95.1-1992).

We note that the Commission has used the 1982 ANSI standard[1] for the last twelve years. In the Notice of Proposed Rulemaking, the Commission had proposed to adopt the updated 1992 ANSI standard. A majority of the commenters supported that proposal. We write separately because we would have felt comfortable continuing that precedent by adopting the most recent 1992 ANSI standard. We find merit in the open, voluntary, industry-driven ANSI standard-setting process. We support today's decision, however, because we recognize the importance of adopting guidelines that command the broad support of federal agencies charged with the protection of the public health. We clarify that our decision today does not in any way diminish our support for the ANSI standard-making process or the latest 1992 ANSI standard.

[1] ANSI C95.1-1982, "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz," ANSI, New York, NY ("1982 ANSI").