

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

ET Docket No. 93-62

In the Matter of

Guidelines for Evaluating the
Environmental Effects of
Radiofrequency Radiation

NOTICE OF PROPOSED RULE MAKING

Adopted: March 11, 1993; Released: April 8, 1993

Comment Date: August 13, 1993

Reply Date: September 13, 1993

By the Commission: Commissioner Marshall not participating; Commissioner Duggan issuing a statement.

INTRODUCTION

1. By this action, we are proposing to amend and update the guidelines and methods used for evaluating the environmental effects of radiofrequency (RF) radiation from FCC regulated facilities. Specifically, we are proposing to use the new standard for RF exposure recently adopted by the American National Standards Institute (ANSI) in association with the Institute of Electrical and Electronic Engineers, Inc. (IEEE), ANSI/IEEE C95.1-1992.¹ This standard was adopted by ANSI on November 18, 1992, and is generally more restrictive than the 1982 ANSI standard, ANSI C95.1-1982, that is specified currently in our rules for evaluating the environmental effects of RF radiation.² This proposal could affect a wide variety of radio services, e.g., AM, FM, and TV broadcast services; common-carrier land-mobile services; and private-radio land-mobile services.³

¹ See ANSI/IEEE C95.1-1992 (previously issued by IEEE as IEEE C95.1-1991), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," approved September 26, 1991 by IEEE, published April 27, 1992 by IEEE. To purchase copies from the IEEE, telephone: (800) 678-IEEE. Adopted by ANSI November 18, 1992. To purchase copies from ANSI telephone (212) 642-4900. See paragraph 34, *infra*, for information on reviewing this document at the Commission.

² See ANSI C95.1-1982, "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz." American National Standards Institute, New York, NY. ANSI is a non-profit, privately funded, membership organization that coordinates the development of voluntary national standards in the United States. ANSI has a membership composed of over 1200 companies, 250 professional, technical, trade, labor, and consumer organizations, and approximately 30 government agencies.

³ See Appendix B for a discussion of possible impact of the

BACKGROUND

2. The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to evaluate the effects of their actions on the quality of the human environment.⁴ To meet its requirements under NEPA, the Commission has adopted rules for evaluating the environmental impact of its actions.⁵ One of the environmental factors considered under these rules is human exposure to RF radiation from FCC-regulated transmitters and facilities.

3. In 1985, the Commission adopted the 1982 ANSI guidelines for use in evaluating the effects of RF radiation exposure on the environment.⁶ The Commission found that these guidelines were widely accepted technically and would meet its needs for evaluating environmental RF radiation. The 1982 ANSI RF exposure guidelines were developed by a panel of experts based on the best scientific information available at the time concerning safe levels of exposure to RF radiation for workers and the general public.

4. The Commission's rules now require applicants for certain facilities to prepare an Environmental Assessment (EA) if the transmitter or facility in question would expose the general public or workers to RF levels in excess of those recommended by the 1982 ANSI guidelines.⁷ Examples of facilities which have the potential to cause exposures in excess of these guidelines include: radio and television broadcast stations; satellite uplinks; FM booster and translator stations transmitting in excess of 100 watts; and MDS and ITFS stations transmitting in excess of 200 watts.⁸ The rules also address other related matters such as the evaluation of multiple transmitter sites.⁹

5. Many low-power, intermittent, or normally inaccessible RF transmitters and facilities have been categorically excluded from our rules regarding RF radiation evaluation based on calculations and measurement data indicating that they would not cause exposures that would violate the ANSI guidelines under normal and routine conditions of use.¹⁰ The Commission has "categorically excluded" such classes of transmitters from routine environmental evaluation with respect to RF radiation.¹¹ Examples of currently excluded transmitters and facilities include: private land-mobile, cellular radio, and amateur radio stations. These

Commission's adoption of the new ANSI/IEEE guidelines.

⁴ National Environmental Policy Act of 1969, 42 U.S.C. Section 4321, *et seq.*

⁵ See 47 CFR Section 1.1301, *et seq.*

⁶ See *Report and Order*, in Gen. Docket No. 79-144, 100 FCC 2d 543 (1985) and *Memorandum Opinion and Order*, 50 Fed. Reg. 38653, 58 RR 2d 1128 (1985).

⁷ 47 CFR Section 1.1307(b).

⁸ *Id.*, Note 1.

⁹ *Id.*, Note 2.

¹⁰ See *Second Report and Order*, in Gen. Docket No. 79-144, 2 FCC Rcd 2064 (1987); and *Erratum*, 2 FCC Rcd 2526 (1987).

¹¹ The Council on Environmental Quality, which has oversight responsibilities with regard to NEPA, permits federal agencies to categorically exclude certain action 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 the National Environmental Policy Act*, 43 Fed. Reg. 55,978 (1978). In response to this provision,

exclusions were based primarily on considerations regarding the excluded transmitters' relative low operating power, intermittent operation or inaccessibility.¹²

6. On November 18, 1992, ANSI adopted a new standard for RF exposure, designated ANSI/IEEE C95.1-1992. This new standard contains a number of significant differences from the guidelines and recommendations issued by ANSI in 1982.¹³ In many respects the 1992 guidelines are more restrictive in the amount of environmental RF exposure permitted, and they also extend the frequency range under consideration to cover frequencies from 3 kHz to 300 GHz. The new 1992 guidelines specify two sets of exposure recommendations, one for "controlled environments" (usually involving workers) and another for "uncontrolled environments" (usually involving the general public). The 1982 guidelines specified only one set of exposure limits, regardless of whether the individual exposed was a worker or a member of the general public.

7. The 1992 guidelines also, for the first time, include specific restrictions on currents induced in the human body by RF fields. In addition, the guidelines contain significant changes in allowable exclusions and power levels permitted for certain low-power devices, such as hand-held radiotelephones and cellular radios. For example, the 1982 guidelines permit exclusion if the input power of the radiating device at frequencies between 300 kHz and 1 GHz is seven watts or less. The 1992 guidelines would reduce this power exclusion significantly for devices that operate in uncontrolled environments and for devices that operate on frequencies above 450 MHz in controlled environments. The 1992 guidelines also contain a further restriction that would not permit the application of the power exclusion to hand-held devices where the radiating structure is maintained at 2.5 cm or less from the body.

DISCUSSION

8. The Commission's environmental rules are intended to ensure that, consistent with NEPA, any FCC-regulated transmitters and facilities that expose the public or workers to levels of RF radiation that are considered by expert organizations to be potentially harmful undergo environmental processing. The Commission, however, is not the expert agency for evaluating the effects of RF radiation on human health and safety.¹⁴ Therefore, it uses standards and guidelines developed by those with appropriate expertise. As noted above, since 1985, the Commission has relied on the 1982 ANSI RF exposure guidelines in connection with its responsibilities under NEPA regarding the evaluation of potential RF environmental hazards.

9. As part of its procedures for periodically reevaluating its standards ANSI has recently approved a new RF exposure standard, in association with the IEEE, that is based

on additional research and study in the area of RF effects. In view of ANSI's adoption of this revision of the 1982 RF exposure guidelines, we believe that it is now incumbent upon us to consider updating the RF exposure standards specified in our rules. We are, therefore, proposing to replace the 1982 ANSI guidelines with the new 1992 ANSI/IEEE guidelines (ANSI/IEEE C95.1-1992) for purposes of evaluating environmental significance.¹⁵ These new guidelines are more up to date with respect to scientifically-based criteria for use in evaluating human exposure to RF radiation. They will ensure that FCC-regulated facilities comply with the latest safety standards for RF exposure.

10. As noted above, the 1992 ANSI/IEEE guidelines contain significant differences from the guidelines currently used by the Commission. We recognize that evaluating the biological effects of RF and microwave energy is a complex and controversial subject and that the adoption of new guidelines will raise a number of issues and implementation concerns. These include among other things: the definitions of "controlled" and "uncontrolled" environments; new requirements regarding induced and contact RF currents; discontinuities in exposure restrictions in the FM broadcast band; differences between the new guidelines and other RF exposure guidelines; treatment of hand-held devices; and the impact on existing facilities and devices. These matters are discussed below, and we invite comments regarding them.

11. We also intend to solicit comments from expert health and safety agencies within the Federal Government, including the U.S. Environmental Protection Agency, the Food and Drug Administration, the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health. In addition, we plan to confer with the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce, in the interest of developing a consistent approach to the treatment of RF exposure environments for the private sector and Federal Government. NTIA has responsibility for authorizing and managing the Federal Government's use of the RF spectrum.

Definition of "Controlled" and "Uncontrolled" Environment

12. The 1992 ANSI/IEEE guidelines specify two sets of exposure recommendations, those for "controlled environments" (usually involving workers) and those for "uncontrolled environments" (usually involving the general public). The ANSI/IEEE standard states that "[c]ontrolled environments are 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

the Commission categorically excluded a number of types of facilities. See *Second Report and Order*, in Gen. Docket No. 79-144, 2 FCC Rcd 2064 (1987); and *Erratum*, 2 FCC Rcd 2526 (1987).

¹² Even with respect to facilities that are otherwise categorically excluded from RF environmental processing, such facilities may, if the circumstances so warrant in a particular case, be subject to the Commission's environmental rules. See 47 CFR §1.1307(c) and (d).

¹³ For comparison purposes, a summary of major sections of the 1982 and 1992 RF exposure guidelines and exclusions is contained in Appendix A.

¹⁴ See, e.g., *Report and Order*, in Gen. Docket No. 79-144, 100 FCC 2d at 560.

¹⁵ By this proposal, we are not intending to supersede any other federal requirements that RF devices may also be required to comply with. For example, this action does not affect any compliance requirements for microwave ovens with respect to emission standards established by the Center for Devices and Radiological Health of the U.S. Food and Drug Administration.

passage through areas where analysis shows the exposure levels may be above [the exposure and induced current levels permitted for the general public but not those permitted for persons aware of the potential for exposure]." "Uncontrolled environments" are, "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 the general public]."

13. Within the general guidance of the definitions of a controlled and an uncontrolled environment, there will be situations where specific determinations must be made as to which definition will apply. We request comment on the criteria to be applied in determining which exposure limits would apply to the various radio operations authorized by the Commission. In general, we believe that because matters of possible health and safety are involved, a conservative approach is appropriate with regard to the evaluation of the effects of RF exposure. Accordingly, where there is any question of possible exposure of the general public (which might include non-technical employees) to RF radiation, we propose to apply the more conservative guidelines for uncontrolled environments. Therefore, the guidelines for uncontrolled environments would apply to any transmitters and facilities that are located in residential areas or locations where proximity to the RF source may be unrestricted.¹⁶ Similarly, we would apply the controlled guidelines to those situations where exposure is incidental and transitory, or the exposure is incurred in areas where personnel are aware of the exposure potential.

Low Power Devices/Exclusions

14. Both the 1982 ANSI and 1992 ANSI/IEEE guidelines provide exclusions for cases where the protection guidelines, or field strengths, may be exceeded with respect to low power devices. These exclusions are intended to apply to devices such as, "hand-held, mobile, and marine radio transceivers."¹⁷ The 1982 ANSI guidelines specify an exclusion if it can be shown by laboratory procedures that the exposure conditions do not exceed a certain specific absorption rate (SAR) or, alternatively, if "the radio frequency input power of the radiating device is seven watts or less."¹⁸ The new 1992 ANSI/IEEE guidelines also contain exclusions for low-power devices. However, the new exclusions are generally more restrictive and contain standards for both controlled and uncontrolled environments.

They also define the power exclusion in terms of "radiated power" rather than "input power" as in the 1982 ANSI guidelines.

15. The 1992 ANSI/IEEE guidelines provide an exclusion based on certain SARs or on the radiated power of the low power device.¹⁹ In controlled environments, the standard permits exclusion at frequencies between 100 kHz and 450 MHz if the radiated power of the device is seven watts or less. At frequencies between 450 and 1500 MHz, the radiated power must be limited to $7(450/f)$ watts where f is the frequency in MHz for exclusion. In uncontrolled environments, the standard permits exclusion at frequencies between 100 kHz and 450 MHz if the radiated power of the device is 1.4 watts or less. At frequencies between 450 and 1500 MHz, the radiated power must be limited to $1.4(450/f)$ watts where f is the frequency in MHz.²⁰ However, the new 1992 ANSI/IEEE guidelines state that the exclusions based on radiated power do not apply to devices with the radiating structure maintained within 2.5 cm of the body.

16. We are proposing to adopt the exclusions for low-power devices provided in the new 1992 ANSI/IEEE guidelines.²¹ As indicated above, we will consider that hand-held portable devices, such as cellular telephones, must comply with the requirements specified for uncontrolled environments.²² Categorical exclusions can be based on either radiated power or specific absorption rate (SAR). Therefore, even if a low-power device does not comply with ANSI/IEEE guidelines with respect to radiated power, it may alternatively comply with the ANSI/IEEE guidelines for SAR. Compliance with the latter guidelines can be demonstrated through appropriate laboratory measurements.

17. As stated above, we note that under the ANSI/IEEE guidelines exclusions based on radiated power would not apply when the "radiating structure" is within 2.5 cm of the body. We also note that the radiating structure may include parts of the device other than the antenna itself. In these cases manufacturers may instead demonstrate by appropriate measurements that a particular device complies with the exclusion guidelines that are based on SAR. We ask for comment on whether proof of such measurements and compliance should be submitted as part of the equipment authorization process, and, if so, what form such showings should take.

¹⁶ In this regard, we are proposing that as a general policy exposure of *non-users* due to hand-held devices and amateur radio facilities will be considered as occurring in uncontrolled environments. Exposure of *users* due to hand-held devices and amateur facilities will also be considered as occurring in uncontrolled environments unless the user is, "aware of the potential for exposure as a concomitant of employment" (e.g., through training or education) or who is otherwise aware of the potential for exposure (as defined by ANSI/IEEE for persons exposed in controlled environments). We ask for comment on whether there are any non-employees who would fall within this latter category, and, if so, who they would be. The term "non-user" refers to other persons in the immediate vicinity of the user who do not fit the criteria specified by ANSI/IEEE for controlled environments.

¹⁷ See ANSI/IEEE C95.1-1992 (IEEE C95.1-1991), Section 5 ("Explanation").

¹⁸ These exclusions apply at frequencies between 300 kHz and 100 GHz or between 300 kHz and 1 GHz, respectively. See Section 4.2, ANSI C95.1-1982, *supra*. Also, see Appendix A.

¹⁹ See Section 4.2, ANSI/IEEE C95.1-1992 (IEEE C95.1-1991). Also, see Appendix A.

²⁰ As an illustration, at 800 MHz the new ANSI/IEEE guidelines specify that in "uncontrolled environments" (e.g., general public exposure) in order to be excluded a low-power device could not exceed a radiated power level of $1.4 \times (450/800)$ or about 0.79 watts. At 1500 MHz, the exclusion level would be 0.42 watts.

²¹ With respect to this issue we note that the Commission has received a Petition for Rule Making, filed February 5, 1993, by Ken Holladay, seeking to prohibit the sale of all hand-held telephones and radios that operate between 400 and 1300 MHz pending evaluation of any health risk. We will treat this petition as a comment in the current proceeding.

²² See footnote 16, *supra*.

18. For purposes of the exclusions that are based on radiated power, we propose to exclude only those low-power devices that meet the uncontrolled guidelines. However, the exclusions based on SAR could apply according to the actual situation or "environment" in which a device is used.

Existing Categorical Exclusions

19. As discussed above, the Commission has exempted a number of transmitting facilities and operations from the NEPA requirement for routine evaluation.²³ These "categorical exclusions" were based on calculations and measurement data indicating that such facilities and transmitters would not cause RF exposures that would violate the 1982 ANSI guidelines under normal and routine conditions of use. Some of the current categorical exclusions may not be consistent with the provisions of the new 1992 ANSI/IEEE guidelines. This may be true with regard to certain currently excluded facilities and operations such as some amateur radio stations and some land-mobile services, both common carrier and private. We, therefore, will review our current categorical exclusions in light of the new guidelines.

20. We request comment, information and analysis relating to the existing categorical exclusions from our RF exposure rules. We intend to address in this proceeding whether it is appropriate to maintain the individual exclusions, particularly those indicated above, and whether we should re-define those exclusions. We request comment and proposals for any changes to our rules that may be necessary to ensure compliance with the RF exposure guidelines, e.g., general power reductions in a service or other restrictive measures. Interested parties are asked to indicate the impact of eliminating an exclusion from the RF exposure rules for specific services, facilities and operations. Such parties are also requested to provide information on how affected facilities and operations could demonstrate compliance with the new guidelines. We also seek proposals and suggestions for alternative plans that would minimize the impact of eliminating exclusions for specific types of transmitting facilities and operations.

21. With respect to occupational exposure, there may be situations where transmitters that have been categorically excluded previously would not cause excessive exposure to members of the *general public*, but might present the possibility of exposure of *workers* to fields in excess of the guidelines. An example might be a relatively high-powered land-mobile or cellular site where workers are in the immediate vicinity (*i.e.*, within a few feet) of a transmitting antenna. How should such situations be dealt with? Should categorical exclusions only be limited to situations where there is no possibility of excessive worker exposure (for example, when work procedures have clearly been established that preclude working near high-powered, transmit-

ting antennas)? Should certification of such procedures be required for previously excluded transmitters before granting a license or other FCC authorization?

Induced and Contact RF Currents

22. The 1992 ANSI/IEEE guidelines also contain new recommendations regarding the maximum permissible exposure from induced and contact RF currents. The former ANSI guidelines did not address these phenomena. The new induced and contact RF current recommendations require exposure evaluation over the frequency range between 3 kHz and 100 MHz. This new requirement has raised some issues as to how these exposure guidelines would be used in evaluating certain broadcast transmitters.²⁴ For example, because evaluation is limited to frequencies up to 100 MHz, the new requirement raises a question on how to treat FM broadcast stations, especially with regard to multiple stations at a single site.²⁵ To address this issue, we propose that evaluation for exposure from induced and contact RF 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 that are located at a single site where one of the stations operates below 100 MHz. We believe that this will ensure that all stations covered by the recommendation are evaluated and that all RF contributions to the exposure at multiple stations sites are considered. We request comment on this approach and on other matters concerning this aspect of the new 1992 ANSI/IEEE guidelines.

Alternative RF Exposure Guidelines

23. The 1992 ANSI/IEEE guidelines are the most recent recommendations on RF exposure from the scientific and technical community. According to the ANSI and the IEEE, the maximum permissible exposure levels recommended in the guidelines are levels "to which a person may be exposed without harmful effect and with an acceptable safety factor."²⁶ As stated above, we believe that these new standards will provide the Commission with better scientifically-based criteria for use in evaluating human exposure to RF radiation, and ensure that FCC-regulated facilities comply with the latest safety standards for RF exposure.

24. At the same time, we recognize that the 1992 ANSI/IEEE guidelines, while in some ways more restrictive than the 1982 ANSI standards, permit higher exposure levels above 3 GHz than other published exposure recommendations. For example, in "uncontrolled environments," ANSI/IEEE recommends a safe level of 2 milliwatts per square centimeter (mW/cm²) at 3 GHz increasing up to a maximum of 10 mW/cm² at 15 GHz to 300 GHz. On the other hand, the guidelines issued by the National Council on Radiation Protection and Measure-

²³ As set forth in Section 1.1306 of the FCC's rules [47 CFR §1.1306(a)], such transmitting facilities and operations are exempted from requirements for "environmental processing" with respect to RF radiation. This means that applicants for such transmitters are not required to perform an environmental evaluation with respect to RF radiation prior to filing an application with the Commission since there is a presumption that these transmitters would normally comply with the limits set forth in the guidelines.

²⁴ For example, in letters to the IEEE and ANSI, the firm of Hammett and Edison, Inc., has objected to certain features of

the ANSI/IEEE guidelines, especially the discontinuity for induced current limits that occurs at 100 MHz in the middle of the FM broadcast band. See, letter from Dane E. Ericksen, Hammett and Edison, Inc., to Board of Standards Review, American National Standards Institute, dated February 20, 1992. See paragraph 34, *infra*, for information on reviewing this document at the Commission.

²⁵ The FM broadcast frequency band is between 88 and 108 MHz.

²⁶ See ANSI/IEEE C95.1-1992 (IEEE C95.1-1991) *supra*, definition of "maximum permissible exposure (MPE)."

ments (NCRP) specify a fixed level of 1 mW/cm² for exposure of the general public in the frequency range of 1.5 to 300 GHz.²⁷ In addition, the International Radiation Protection Association's (IRPA) guidelines for public exposure recommend 1 mW/cm² between 2 GHz and 300 GHz.²⁸ There are additional differences between the ANSI/IEEE recommendations and these other guidelines. We request comment on whether these differences are significant and whether there is a need to adopt exposure requirements different than those contained in the ANSI/IEEE guidelines.

25. We also note that the NCRP guidelines include a special provision with respect to modulated RF carrier frequencies.²⁹ The NCRP suggested a need for caution with respect to exposure to electromagnetic fields with carrier frequencies that are modulated at a depth of 50 percent or greater at frequencies between 3 and 100 hertz, and recommended that stricter exposure limits apply for workers exposed to such fields. This recommendation is apparently due to experimental results showing neurophysiological effects of modulated RF fields.³⁰ We invite comment on the importance of this aspect of the NCRP guidelines for protecting workers from adverse RF exposures. Is this modulation restriction important enough to be considered by the Commission in connection with the ANSI/IEEE guidelines? What would be the practical implications of implementation of this provision if it were adopted by the Commission?

Effective Date and Other Issues

26. We recognize that compliance with the new ANSI/IEEE guidelines could impose new and significant burdens on some licensees and equipment manufacturers. We seek to minimize this impact wherever possible, consistent with the need to implement the important safety protections signified by the RF exposure rules as rapidly as possible. For those facilities and operations that are or will become subject to environmental processing with respect to RF radiation, we propose to continue the requirement that such evaluations be made, and, if necessary, Environmental Assessments filed, at the time of application for a construc-

tion permit, license renewal, or other Commission authorization. All such applications submitted after the effective date of the new standard would be evaluated in accordance with the new 1992 ANSI/IEEE guidelines.³¹ We request comment on this approach. We also request comment on how best to treat equipment and facilities that are in use but do not comply with the new guidelines. Should we, for example, require re-submission of certain equipment authorization applications?

27. With respect to showing compliance with current RF guidelines, many of the Commission's application forms contain a question on environmental impact. An example of this question is as follows: "Would a Commission grant of this application be an action which may have a significant environmental effect as defined by Section 1.1307 of the Commission's Rules? If 'YES,' submit the statement as required by Sections 1.1308 and 1.1311." On some, but not all, forms, there is an additional statement: "If 'NO,' explain briefly why not." It has been our experience that a simple "NO" answer to this question may not be sufficient for the Commission to adequately judge whether there will be a significant environmental impact, particularly with respect to RF radiation exposure. We request comment on whether the Commission routinely should require more complete documentation or evidence from applicants who claim compliance with environmental RF guidelines. What should this documentation consist of?

Measurement Procedures and Related Issues

28. There are also issues related to the measurement of RF fields and procedures for quantitative determination of exposure. In addition to its revised exposure guidelines, ANSI and IEEE have issued guidelines on measurement procedures for RF electromagnetic fields with respect to hazard assessment.³² Therefore, we are proposing to specify these measurement guidelines for purposes of showing compliance with ANSI/IEEE C95.1-1992. We request comment on these measurement guidelines and any other measurement procedures that may be relevant.

²⁷ "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, 1986. National Council on Radiation Protection and Measurements. Copies available from: NCRP Publications, 7910 Woodmont Ave., Suite 800, Bethesda, MD 20814; (301) 657-2652. The NCRP is a non-profit corporation chartered by the United States Congress to, among other things, develop information and recommendations concerning radiation protection. The NCRP is made up of the members and participants who serve on its various scientific committees. Several government agencies and non-government organizations have established relationships with the NCRP either as "Collaborating Organizations" or through a "special liaison" program for governmental organizations. The FCC maintains an association with the NCRP as a Collaborating Organization.

²⁸ "Guidelines on Limits of Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 100 kHz to 300 GHz." International Non-ionizing Radiation Committee of the International Radiation Protection Association, *Health Physics*, 54(1): 115-123 (1988). The IRPA is a non-governmental, international organization representing most of the national radiation protection societies in the world. These recommendations form part of the WHO Environmental Health Criteria Programme, which is funded by the United Nations Environment Pro-

gramme (UNEP). Support for IRPA's activities also comes from the International Labour Office and the Commission of the European Communities.

²⁹ See NCRP, *supra*, Section 17.4.7 of NCRP exposure guidelines.

³⁰ See NCRP, *supra*, Section 11.1.2.2 of NCRP exposure guidelines.

³¹ It is relevant to note that the next renewal cycle for AM and FM radio broadcast stations begins on October 1, 1995 and ends on August 1, 1998. The next complete renewal cycle for television broadcast stations begins on October 1, 1996 and ends on August 1, 1999. The exact date depends on a given station's geographic location.

³² "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave." (IEEE C95.3-1991; also designated ANSI/IEEE C95.3-1992 by the American National Standards Institute). Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc. Copies can be ordered from the IEEE, Attn: Publications Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, (800) 678-IEEE; or from ANSI, (212) 642-4900. See paragraph 34, *infra*, for information on reviewing this document at the Commission.

29. We are also interesting in obtaining data and information on devices that are commercially available for measuring electric and magnetic fields, induced body currents, and contact currents as defined in the recent ANSI/IEEE guidelines? Are there advantages/disadvantages of certain types of equipment and instrumentation over others? We also request comment on the effectiveness of personal monitors/dosimeters and such things as RF protective clothing in controlling exposure to workers at locations where high RF fields are present.

EX-PARTE PRESENTATIONS

30. This is a non-restricted notice and comment rule-making proceeding. *Ex parte* presentations are permitted, except during the Sunshine Agenda period, provided they are disclosed as provided in the Commission's rules. *See generally*, 47 CFR Sections 1.1202, 1.1203 and 1.1206(a).

INITIAL REGULATORY FLEXIBILITY ANALYSIS

31. Pursuant to the provisions of the Regulatory Flexibility Act of 1980, 5 U.S.C. Section 603, the Commission's Initial Regulatory Flexibility Analysis is as follows.

A. Reason for action: Because of the Commission's responsibilities under provisions of the National Environmental Policy Act (NEPA) the Commission must evaluate the significance of its actions on the environment. Since the emission of radiofrequency (RF) radiation from FCC-regulated transmitters is a major environmental effect that must be considered, it is necessary to establish guidelines and thresholds to use in determining whether there is environmental significance. The RF protection guides of the American National Standards Institute (ANSI) that the Commission had adopted in 1985 have now been revised, and it is necessary for us to update our guidelines.

B. Objective: We are proposing to adopt the newly revised guidelines adopted by ANSI and the Institute of Electrical and Electronics Engineers, Inc. (IEEE) that are designated ANSI/IEEE C95.1-1992 (previously published as IEEE C95.1-1991). These guidelines will be used for evaluating the significance to public health of RF radiation emitted into the environment by transmitters regulated by the Commission.

C. Legal basis: This action is a result of the Commission's legal obligations under the NEPA, 42 U.S.C. Section 4321 *et seq.* (1976), to provide the means by which to evaluate Commission actions with respect to environmental significance, and it is in furtherance of Sections 4(i), 4(j), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 154(j) and 303(r) (1978).

D. Description, potential impact, and number of small entities affected: There may be significant economic impact on small, regulated entities as a result of this action if the new guidelines are officially adopted by the Commission. This is because the new ANSI/IEEE guidelines are more restrictive than previous guidelines and may require additional effort and resources to show compliance or undertake corrective action to bring a transmitter into compliance. This extent of this potential impact will depend on decisions made with respect to categorical exclusion of transmitters from environmental consideration with respect to RF exposure.

E. Recording, recordkeeping, and other compliance requirements: Although no specific compliance requirements are being described at this time, if the Commission adopts the new guidelines applicants may be required to submit additional documentation as part of a showing with respect to environmental compliance.

F. Federal rules which overlap, duplicate, or conflict with these rules: There are none of which we are aware.

G. Any significant alternative minimizing impact on small entities and consistent with the stated objective: We might have considered adopting other exposure criteria that might result in less impact on small entities. However, since we are required to use the best available methodology in evaluating environmental significance, the new ANSI/IEEE guidelines appear to offer the most up-to-date and technically-supportable guidance for evaluating RF exposure.

PROCEDURAL MATTERS

32. Accordingly, there is hereby instituted a Notice of Proposed Rule Making in this proceeding to amend Part 1 of the Commission's Rules and Regulations. Authority for issuance of this Notice of Proposed Rule Making is contained in Sections 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended [47 U.S.C. Sections 154(i), 154(j) and 303(r)], and Sections 4321-4335 of the National Environmental Policy Act, 42 USC §§4321-4335. Pursuant to applicable procedures set forth in Sections 1.415, 1.419, and 1.430 of the Commission's Rules, interested parties may file comments on or before **August 13, 1993** and reply comments on or before **September 13, 1993**.

33. All relevant and timely comments will be considered by the Commission. To file formally in this proceeding, participants must file an original and four copies of all comments, reply comments and supporting comments. If participants would like each Commissioner to receive a personal copy of their comments, an original and nine copies must be filed. Comments and reply comments should be sent to the Office of the Secretary, Federal Communications Commission, Washington, D.C. 20554. Comments and reply comments will be available for public inspection during regular business hours in the FCC Reference Center (Room 239) of the Federal Communications Commission, 1919 M Street, N.W., Washington, D.C. 20554.

34. For further information concerning this proceeding contact Dr. Robert F. Cleveland, Office of Engineering and Technology, Spectrum Engineering Division, Mail Stop 1300A2, Federal Communications Commission, Washington, D.C. 20554, (202) 653-8169. Copies of the ANSI/IEEE guidelines and other pertinent documents are available for inspection at the FCC during regular business hours. Please call the above number for scheduling.

FEDERAL COMMUNICATIONS COMMISSION

Donna R. Searcy
Secretary

APPENDIX A

SUMMARY OF MAJOR SECTIONS OF ANSI/IEEE
GUIDELINES

I. ANSI C95.1-1982

Principal sections of ANSI C95.1-1982, "American National Standard Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz," are summarized below with permission. The complete text should be consulted for details. This ANSI standard has been copyrighted (1982) by the Institute of Electrical and Electronics Engineers, Inc., (IEEE), New York, N.Y. This standard has now been replaced by ANSI/IEEE C95.1-1992 (see below).

Scope and Purpose:

Recommendations are made to prevent possible harmful effects in human beings exposed to electromagnetic fields in the frequency range from 300 kHz to 100 GHz. These recommendations are intended to apply to non-occupational as well as to occupational exposures. These recommendations are not intended to apply to the purposeful exposure of patients by or under the direction of practitioners of the healing arts.

Definitions:

Radio frequency protection guides (RFPG). The radio frequency field strengths or equivalent plane wave power densities which should not be exceeded without (1) careful consideration of the reasons for doing so, (2) careful estimation of the increased energy deposition in the human body, and (3) careful consideration of the increased risk of unwanted biological effects. Specific absorption rate (SAR). The time rate at which radio-frequency electromagnetic energy is imparted to an element of mass of a biological body.

Recommendations:

Radio Frequency Protection Guides. For human exposure to electromagnetic energy at radio frequencies from 300 kHz to 100 GHz, the protection guides, in terms of the mean squared electric (E^2) and magnetic (H^2) field strengths and in terms of the equivalent plane-wave free-space power density, as a function of frequency, are given in Table 1.

For near field exposures, the only applicable protection guides are the mean squared electric and magnetic field strengths as given in Table 1, columns 2 and 3. For convenience, these guides may be expressed as the equivalent plane wave power density, given in Table 1, column 4.

For both pulsed and non-pulsed fields, the power density, the squares of the field strengths, and the values of specific absorption rates (SARs) or input power, as applicable, are averaged over any 0.1 h period.

Table 1

RADIO FREQUENCY PROTECTION GUIDES

1	2	3	4
Frequency Range (MHz)	Electric Field Strength E^2 (V^2/m^2)	Magnetic Field Strength H^2 (A^2/m^2)	Power Density (mW/cm^2)
0.3-3	400,000	2.5	100
3-30	4,000 ($900/f^2$)	0.025 ($900/f^2$)	$900/f^2$
30-300	4,000	0.025	1.0
300-1500	4,000 ($f/300$)	0.025 ($f/300$)	$f/300$
1500-100,000	20,000	0.125	5.0

Note: f = frequency in megahertz (MHz)
 E^2 = electric field squared
 H^2 = magnetic field 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

Exclusions:

(1) At frequencies between 300 kHz and 100 GHz, the protection guides may be exceeded if the exposure conditions can be shown by laboratory procedures to produce specific absorption rates (SARs) below 0.4 W/kg as averaged over the whole body, and spatial peak SAR values below 8 W/kg as averaged over any one gram of tissue.

(2) At frequencies between 300 kHz and 1 GHz, the protection guides may be exceeded if the radio frequency input power of the radiating device is seven watts or less.

II. ANSI/IEEE C95.1-1992 (IEEE C95.1-1991)

Some major sections of ANSI/IEEE C95.1-1992 (also issued by IEEE as IEEE C95.1-1991), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," are summarized below with permission. This ANSI/IEEE standard has been copyrighted (1992) by the Institute of Electrical and Electronics Engineers, Inc., (IEEE), New York, N.Y. The complete text should be consulted for details. Copies are available from ANSI [telephone: (212) 642-4900] or the IEEE [telephone: (800) 678-IEEE (4333)].

Maximum Permissible Exposure (MPE) for Controlled Environments

Electromagnetic Fields (controlled environments)

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)
0.003-0.1	614	163	(100;1,000,000)*
0.1-3.0	614	16.3/f	(100; 10,000/f ²)*
3.0-30	1842/f	16.3/f	(900/f ² ; 10,000/f ²)*
30-100	61.4	16.3/f	(1.0; 10,000/f ²)*
100-300	61.4	0.163	1.0
300-3000	--	--	f/300
3000-15,000	--	--	10
15,000-300,000	--	--	10

Notes: f = frequency in megahertz (MHz)
 E = electric field
 H = magnetic field
 V/m = volts per meter
 A/m = amperes per meter
 mW/cm² = milliwatts per centimeter squared

* These plane-wave equivalent power density values, although not appropriate for near-field conditions, are commonly used as a convenient comparison with MPEs at higher frequency and are displayed on some instruments in use.

Averaging Times for Maximum Permissible Exposure (controlled environments)

Frequency Range (MHz)	Averaging Time (minutes) $ E ^2$; S; or $ H ^2$
0.003-0.1	6
0.1-3.0	6
3.0-30	6
30-100	6
100-300	6
300-3000	6
3000-15,000	6
15,000-300,000	$616,000/f^{1.2}$

f = frequency in MHz

Induced and Contact Radiofrequency Currents (controlled environments).

(may not adequately protect against startle reactions caused by transient discharges when contacting an energized object; see complete text for details)

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

f = frequency in MHz

Maximum Permissible Exposure (MPE) for Uncontrolled Environments**Electromagnetic Fields (uncontrolled environments)**

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)
0.003-0.1	614	163	(100; 1,000,000)*
0.1-1.34	614	16.3/f	(100; 10,000/f ²)*
1.34-3.0	823.8/f	16.3/f	(180/f ² ; 10,000/f ²)*
3.0-30	823.8/f	16.3/f	(180/f ² ; 10,000/f ²)*
30-100	27.5	158.3/f ^{1.668}	(0.2; 940,000/f ^{3.336})*
100-300	27.5	0.0729	0.2
300-3000	--	--	f/1500
3000-15,000	--	--	f/1500
15,000-300,000	--	--	10

Notes: f = frequency in megahertz (MHz)
 E = electric field
 H = magnetic field
 V/m = volts per meter
 A/m = amperes per meter
 mW/cm² = milliwatts per centimeter squared

* These plane-wave equivalent power density values, although not appropriate for near-field conditions, are commonly used as a convenient comparison with MPEs at higher frequency and are displayed on some instruments in use.

Averaging Times for Maximum Permissible Exposure (uncontrolled environments)

Frequency Range (MHz)	Averaging Time (minutes)	
	E ² ; S	H ²
0.003-0.1	6	6
0.1-1.34	6	6
1.34-3.0	f ² /0.3	6
3.0-30	30	6
30-100	30	0.0636f ^{1.337}
100-300	30	30
300-3000	30	--
3000-15,000	90,000/f	--
15,000-300,000	616,000/f ²	--

f = frequency in MHz

Induced and Contact Radiofrequency Currents (uncontrolled environments).

(may not adequately protect against startle reactions caused by transient discharges when contacting an energized object; see complete text for details)

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

f = frequency in MHz

Exclusions

Controlled Environments. At frequencies between 100 kHz and 6 GHz, the MPE in controlled environments for electromagnetic field strengths may be exceeded if:

(a) the exposure conditions can be shown by appropriate techniques to produce SARs below 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), except for the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube), and

(b) the induced currents in the body conform with the MPE [for controlled environments].

The SARs are averaged over any 6-minute interval. Above 6 GHz, the relaxation of the MPE under partial body exposure conditions is permitted [see Section 4.4 of IEEE C95.1-1991 or ANSI/IEEE C95.1-1992].

At frequencies between 0.003 and 0.1 MHz the SAR exclusion rule, stated above, does not apply. However, the MPE in controlled environments can still be exceeded if it can be shown that the peak rms current density, as averaged over any 1 cm² area of tissue and 1 second does not exceed 35f mA/cm² where f is the frequency in MHz.

Low-Power Devices: Controlled Environment. This exclusion, consistent with [the provisions given above], pertains to devices that emit RF energy under the control of an aware user. This exclusion addresses exposure of the user. For such devices, the exposure of other persons in the immediate vicinity of the user

will meet the exclusion criterion for the uncontrolled environment. [See below]

At frequencies between 100 kHz and 450 MHz, the MPE may be exceeded if the radiated power is 7 watts or less.

At frequencies between 450 and 1500 MHz, the MPE may be exceeded if the radiated power is $7(450/f)$ watts or less where f is frequency in MHz.

This exclusion does not apply to devices with the radiating structure maintained within 2.5 cm of the body.

Uncontrolled Environments. At frequencies between 100 kHz and 6 GHz, the MPE in uncontrolled environments for electromagnetic field strengths may be exceeded if:

(a) the exposure conditions can be shown by appropriate techniques to produce SARs below 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), except for 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), and

(b) the induced currents in the body conform with the MPE [for uncontrolled environments].

The averaging time for SARs is as indicated in [the table for uncontrolled environments]. Above 6 GHz, the relaxation of the MPE under partial body exposure conditions is permitted [see Section 4.4 of IEEE C95.1-1991 or ANSI/IEEE C95.1-1992].

At frequencies between 0.003 and 0.1 MHz the SAR exclusion rule does not apply. However, the MPE in uncontrolled environments can still be exceeded if it can be shown that the peak rms current density, as averaged over any 1 cm² area of tissue and 1 second does not exceed 15.7f mA/cm² where f is the frequency in MHz.

Low-Power Devices: Uncontrolled Environment. This exclusion, consistent with [the provisions given above], pertains to devices that emit RF energy without control or knowledge of the user. At frequencies between 100 kHz and 450 MHz, the MPE may be exceeded if the radiated power is 1.4 watts or less. At frequencies between 450 and 1500 MHz, the MPE may be exceeded if the radiated power is $1.4(450/f)$ watts or less where f is frequency in MHz. This exclusion does not apply to devices with the radiating structure maintained within 2.5 cm of the body.

APPENDIX B

PRELIMINARY ANALYSIS OF IMPACT OF NEW ANSI/IEEE GUIDELINES

Broadcast

It is difficult to measure the exact impact on the broadcast community due to the complexity of the new standard and the relative lack of information on how certain aspects of the new guidelines can be implemented with respect to

broadcast stations. One source that may be helpful is a 1985 report commissioned by the Environmental Protection Agency (EPA) to help determine costs incurred in implementing various radiofrequency "guidance" levels for exposure of the general public in the broadcast community.³³ This report included information on broadcaster compliance with field intensity levels comparable to those recommended by the ANSI/IEEE guidelines. However, the EPA report did not consider the impact of the induced current limitations contained in the new guidelines. Furthermore, the report is based on information gathered several years ago, and its database included only approximately 9000 radio stations and 1000 television stations. The report also only addresses single-facility installations and does not consider the cumulative levels of RF energy that may be present at multiple-user sites.

(1) AM Radio

The EPA report estimated that of approximately 4600 AM stations analyzed, only about 100-500 (about 2-11%) would require corrective action to comply with field intensity levels roughly comparable to the ANSI/IEEE guidelines. However, this is probably an underestimate since compliance with induced current limits for the public and for workers was not considered. Since compliance with induced current limitations would probably affect AM stations the most of all broadcasters, the actual percentage impacted could be significantly higher than the EPA figure.

(2) FM Radio

Of 4400 FM radio stations the EPA report estimated that about 750 stations (approximately 17%) would require corrective action to comply with public exposure limits essentially the same as those contained in the ANSI/IEEE 1992 guidelines. However, once again, induced current limitations were not considered, and the actual impact could be greater.

(3) Television

Only 40 (about 4%) television stations of approximately 1100 analyzed were judged to require corrective measures to comply with levels similar to the ANSI/IEEE thresholds. Since most television stations operate at frequencies for which there are no induced current limitations, this estimate may be more accurate than those for radio stations. However, induced current limitations would apply for channels 2-6, and there could be additional impact for stations operating at these frequencies.

Other Services

It appears that the greatest impact of the new guidelines will fall within the broadcast services. For non-broadcast services there is also likely to be some impact, but the extent of that impact will depend largely on which transmitters or services are categorically excluded from environmental processing. Until we have more extensive

³³ U.S. Environmental Protection Agency, Office of Radiation Programs, Washington, D.C. 20460, "An Estimate of the Potential Costs of Guidelines Limiting Public Exposure to Radiofrequency Radiation from Broadcast Sources, Vol.1: Report," EPA 520/1-85-025, July 1985.

information on the variables that determine compliance with the guidelines, it is not possible to arrive at exact figures on impact.

Due to the more restrictive field intensity levels in "uncontrolled" environments there may be transmitters, now categorically excluded, that could not be justifiably excluded in all cases with respect to the new guidelines. For example, the following table gives "worst-case" estimates of the minimum height above ground for a simple dipole antenna at various power levels that might be required to meet the "uncontrolled" field intensity limits between 100 and 300 MHz. If there are situations where these minimum height requirements are not met, or if there are multiple transmitters at an accessible site with relatively high cumulative power, the limits might be exceeded, and environmental analysis would be required.

**Estimated Minimum Height to Meet
ANSI/IEEE Limits for Field Intensity
(100-300 MHz, "uncontrolled") at ground level**

Est. Min. Height Above Ground (meters)	Operating Power (ERP) in watts
6	100
8	200
11	500
15	1000
20	2000

Similar tables can be constructed for "controlled environments," for other frequencies, and for other antenna types. However, each situation will be different, and the likelihood of exposures that exceed the guidelines will depend on many factors including accessibility and intermittency of operation, as well as frequency and power. In addition, the new restrictions on induced and contact currents may impact facilities that operate below 100 MHz and may make evaluation of some previously excluded transmitters necessary.

The majority of land-mobile transmitters will very likely comply with the ANSI/IEEE guidelines in most environments. However, there may be some situations, e.g., paging or multiple-transmitter sites, where higher powered transmitters may require evaluation. In addition, there may be questions related to compliance with the induced current limitations at HF frequencies, and compliance with respect to hand-held devices.

With respect to satellite communications, there could be compliance problems with respect to transportable earth stations where appropriate restrictions have not been placed on accessibility. However, such situations may be relatively uncommon. Since main-beam access is usually necessary for excessive exposure from satellite-dish antennas, and since this does not normally occur, the majority of these transmitters should not cause an exposure problem.

**Separate Statement
of
Commissioner Ervin S. Duggan**

**In Re: Guidelines for Evaluating the Environmental
Effects of Radiofrequency Radiation**

I support today's action to update the Commission's processing standards under the National Environmental Policy Act of 1969. I hope that the parties will provide us useful information both on the revised 1992 American National Standards Institute (ANSI) standard for radiofrequency (RF) exposure that we propose to adopt and on the procedures we should use in putting that standard into effect.

The safety of the services and facilities that we license, and the equipment we approve, are a vital concern. The National Environmental Policy Act requires us to ensure that our licensing and other regulatory actions do not create adverse health or environmental effects. While we do not have the primary government responsibility in this area (that task belongs to other agencies such as the Food and Drug Administration and the Environmental Protection Agency), the FCC undoubtedly has an obligation to work closely with the frontline health and safety agencies to ensure the safety of equipment that emits RF radiation.

It is worth emphasizing here that the FCC has a continuing responsibility to track and take account of any changes in widely-accepted standards regarding RF exposure, such as the revised ANSI/IEEE standard we propose to adopt today. In this connection, the press and public should be aware that the FCC began work on this notice of proposed rulemaking last fall, as soon as the revised ANSI standard was adopted. Our proceeding was launched in the normal course of business-- not as a response to any recent publicity about the safety of FCC-approved equipment.

This is as it should be: press scares and media hype are poor substitutes for the careful processes of science and government. The FCC and other government agencies, as well as the cellular industry, will work energetically to resolve questions about the safety of all RF devices. Meanwhile, it is important to keep such safety questions in perspective: *Any* new technology presents risks and uncertainties, which must be weighed intelligently against the obvious benefits that new technology brings. Modern life challenges us to balance those risks with courage and calm analysis, and to avoid hysteria.