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 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

[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.

[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.

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 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

[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.

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]

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

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[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

[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.

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.

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.

[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.

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 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

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

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

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

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.

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

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[91] GTE Comments at 16.

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

[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.

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.

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

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[98] Northern Telecom Reply Comments at 6.

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

[100] Glenayre Comments at 2.

[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.

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 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

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[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.

[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

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]

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

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[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) 553-6847. 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).

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 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" 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

[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.

[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).

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 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.

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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.

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. 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

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[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

[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

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]

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

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[126] NPR Comments at 5

[127] NAB Reply Comments at 4

[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

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]

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

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

[135] NABER Comments at 6

[136] Motorola Comments at 18

[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

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 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.

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[142] NIOSH Comments at 3

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

[144] AMSC Comments at 12

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

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 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

[146] TIA Comments at 28

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

[148] TIA Comments at 29

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 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

[149] Motorola Comments at 23

[150] NAB Comments at 37

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 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

[151] See para. 70, supra.

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.

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

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[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

[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 specifies this in an equivalent unit of measure, i.e., 9 μW/cm^2 at a distance of 3 meters. It should be noted that this is a limit on emissions not on exposure.

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

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]

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[155] 47 CFR § 1.1307(c) and (d).

[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-

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]

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]

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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.

[159] AFCCE Comments at 7.

[160] NPR Comments at 7.

[161] Narda Reply Comments at 6-1.

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]

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.

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[162] CDE Comments at 4

[163] NPR Comments at 7

[164] NPR Comments at 6

[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.

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 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.

[166] See note 112, supra.

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

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.

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[168] NAB Comments at 30.

[169] Narda Reply Comments at 4-1.

[170] ARRL Comments at [illegible]

[171] BSL Comments at 4-5.