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

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WT 06-203

In the Matter of	)	
	)	
Section 68.4(a) of the Commission's Rules	)	
Governing Hearing Aid-Compatible Telephones	)	WT Docket No. ~~01-309~~
	)	RM-8658
	)	
	)	

REPORT AND ORDER

Adopted: July 10, 2003 **Released: August 14, 2003**

By the Commission: Chairman Powell, Commissioner Abernathy, Commissioner Copps, Commissioner Martin, and Commissioner Adelstein issuing separate statements.

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I. INTRODUCTION

1. In this Report and Order, we modify the exemption for wireless phones under the Hearing Aid Compatibility Act of 1988 (HAC Act)[1] to require that digital wireless phones be capable of being effectively used with hearing aids. We find that modifying the exemption in the manner described below will extend the benefits of wireless telecommunications to individuals with hearing disabilities – including emergency, business, and social communications – thereby increasing the value of the wireless network for all Americans.

2. In order to make digital wireless phones accessible to individuals who use hearing aids or have cochlear implants, we find that digital wireless phone manufacturers and service providers should be required to take steps to reduce the amount of interference emitted from digital wireless phones and to provide the internal capability for telecoil coupling. In taking this action, we hope to enable every American to have access to digital wireless telecommunications. Because we find that the statutory requirements for modifying the exemption have been met, and because doing so will serve the important public interest in preserving access to wireless telecommunications for individuals with hearing disabilities, we conclude that the exemption should be modified to the extent described below.

II. EXECUTIVE SUMMARY

3. In this Order, we take the following actions:

(1) adopt certain performance levels set forth in a technical standard established by the American National Standards Institute (ANSI) as the applicable technical standard for compatibility of digital wireless phones with hearing aids;

(2) require certain digital wireless phone models to provide reduced radio frequency (RF) interference (*i.e.,* meet a "U3" rating under the ANSI standard), and require certain digital wireless phone models to provide telecoil coupling capability (*i.e.* meet a "U3T" rating under the ANSI standard);

(3) require, within two years, each digital wireless phone manufacturer to make available to carriers and require each carrier providing digital wireless services to make available to

[1] Section 710 of the Communications Act of 1934, as amended, 47 U.S.C. § 710(b)(1)(B).

consumers at least two handset models for each air interface it offers which provide reduced RF emissions ("U3" rating);

(4) require each Tier I wireless carrier providing digital wireless services to make available to consumers within two years at least two handset models for each air interface it offers which provide reduced RF emissions ("U3" rating) or 25 percent of the total number of phone models it offers, whichever is greater;

(5) require, within three years, each digital wireless phone manufacturer to make available to carriers and require each carrier providing digital wireless services to make available to consumers at least two handset models for each air interface it offers which provide telecoil coupling ("U3T" rating);

(6) adopt a *de minimis* exception for certain digital wireless phone manufacturers and carriers;

(7) encourage digital wireless phone manufacturers and service providers to offer at least one compliant handset that is a lower-priced model and one that has higher-end features;

(8) require 50 percent of all digital wireless phone models offered by a manufacturer or carrier to be compliant with the reduced RF emissions requirements by February 18, 2008;

(9) require wireless carriers and digital wireless handset manufacturers to report semiannually (every six months) on efforts toward compliance during the first three years, then annually thereafter through the fifth year of implementation;

(10) require manufacturers to label packages containing compliant handsets and to make information available in the package or product manual, and require service providers to make available to consumers the performance ratings of compliant phones;

(11) commit the Commission staff to deliver a report to the Commission shortly after three years from the effective date of this Order to examine the impact of these requirements, and which will form the basis for the Commission to initiate a proceeding soon after the report is issued to evaluate whether to increase or decrease the 2008 requirement to make 50 percent of phone models with reduced RF emissions, whether to adopt implementation benchmarks beyond 2008, and whether to otherwise modify the implementation requirements;

(12) encourage hearing aid manufacturers to label their pre-customization products according to the ANSI standard; and

(13) deny the petition of Myers Johnson, Inc., for revision of section 24.232 as it relates to directional wireless phone antennas.

4. We take these actions to facilitate the Congressional goal of ensuring access to telecommunications services for individuals with hearing disabilities. In light of the rising number of calls to emergency services placed by wireless phone users, preserving access to wireless telecommunications for individuals with hearing disabilities is critical. In addition to the public safety benefits, these actions will also extend to individuals with hearing disabilities the social, professional, and convenience benefits offered by wireless telecommunications as well. In light of our society's increased reliance on wireless phones and the growing trend among wireless carriers to move away from analog services in favor of more efficient, feature-rich digital services, these steps will ensure that individuals with hearing disabilities continue to enjoy access to wireless telecommunications devices and services.

III. BACKGROUND

A. Hearing Aids and Wireless Phones

5. Approximately one in ten Americans – 28 million – has some level of hearing loss, and this proportion increases to one in three among the population of people over 65 years of age.[2] As the median age of the population continues to rise, the proportion of Americans with hearing loss will likely increase. Approximately six million Americans use hearing aids to improve their hearing.[3] Hearing aids operate in one of two modes – acoustic coupling or telecoil coupling. Hearing aids operating in acoustic coupling mode receive and amplify all sounds surrounding the user, both desired sounds, such as a telephone's audio signal, as well as unwanted ambient noise. Hearing aids operating in telecoil coupling mode avoid unwanted ambient noise by turning off the microphone and receiving only magnetic fields generated by telecoil-compatible telephones.[4] In the United States, about 25-30 percent of hearing aids contain telecoils, which generally are used by individuals with profound hearing loss.[5] External accessories designed to generate a magnetic field to enable telecoil coupling help some hearing aid users, but can be cumbersome and are not usable by all hearing aid users.[6]

6. Although analog wireless phones do not generally cause interference problems for hearing aid users,[7] digital wireless phones can cause interference to hearing aids and cochlear implants because of electromagnetic energy emitted by the phone's antenna, backlight, or other components. This interference can be significant enough to prevent individuals with hearing aids or cochlear implants from using digital wireless phones and services. In addition, most wireless phones do not internally provide the capability to inductively couple with hearing aids containing telecoils, as wireline phones do.[8]

7. Over the course of the last several years, wireless phones and services have increasingly become mass market consumer devices and services. As the Commission reported in its *Eighth Annual CMRS Competition Report (Eighth Competition Report)*, penetration rates for wireless subscribers (as of December 2002) were approximately 49 percent of the United States population, and more than 55 percent of Americans between the ages of 15 and 59 have wireless phones.[9] In addition, while still

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[2] *See* SHHH Comments at 2; SHHH *Ex Parte* Fact Sheet (May 19, 2003).

[3] *See* American Speech-Language-Hearing Association "Incidence and Prevalence of Hearing Loss and Hearing Aid Use in the United States - 2002 Edition" (visited June 24, 2003) <http://professional.asha.org/resources/factsheets/hearing.cfm>.

[4] *See* Self Help for Hard of Hearing People, "Hearing Loss, Sept.-Oct., 1996" (visited April 17, 2003) <http://www.shhh.org/Advocacy/Position/tcoil.cfm>. *See* also HearingLoop.org "Frequent Questions" (visited June 26, 2003) <http://www.hearingloop.org/fq_preferred.htm>. Audio signal-based magnetic fields, such as those produced by the voice coil of the speaker in hearing aid-compatible wireline telephones, are picked up by the hearing aid telecoil, amplified as needed, and converted back into sound by the hearing aid speaker.

[5] *See* SHHH May 19, 2003, *Ex Parte* Fact Sheet; HIA Jan. 7, 2003, *Ex Parte* Presentation. Some commenters have claimed that at least some hearing aid users who have telecoils do not use them. *See* Cingular Dec. 18, 2002, *Ex Parte* at 5; AAES Comments at 6.

[6] *See* Vickery Comments at 3; AG Bell Comments at 4, 6.

[7] *See* ANSI ASC C63 SC8 Comments at 10.

[8] *See* Vickery Comments at 19, 22. *See also* L. Kozma-Spytek, M.A., Research Audiologist, Gallaudet University Technology Access Program, Washington, D.C., "Digital Wireless Telephones and Hearing Aids" (visited June 17, 2003) <www.audiologyonline.com> and B.J. Wilson, "Why Don't Cell Phones Work With Hearing Aids?" (visited Feb. 2, 2003) <http://www.geocities.com/Heartland/Prairie/4727/bbhcellemi.htm>.

[9] *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services Report, *Eighth Report*, at sections II.C.1.b.(i) and II.C.1.d. (2003) (*Eighth Competition Report*).

relatively small in number, more and more consumers are beginning to view their wireless phone as their primary phone. As reported in the Commission's *Seventh Competition Report*, three to five percent of wireless customers use their wireless phone as their only phone, and according to a USA Today/CNN/Gallup poll, almost one in five wireless telephony users view their wireless phone as their primary phone.[10] And the number of customers subscribing to digital wireless service now makes up approximately 88 percent of all wireless subscribers, with 125 million subscribing to digital services and only 17 million subscribing to analog service.[11] In contrast to analog, digital technology provides better sound quality and increases spectral efficiency which, in turn, has permitted companies to offer calling plans with large buckets of relatively inexpensive minutes, free enhanced services such as voicemail and caller ID, and wireless data and mobile Internet offerings.[12] In addition, 30 to 50 percent of calls to 911 for emergency services now come from wireless phones.[13] Thus, as wireless service has evolved to become increasingly more important to Americans' safety and quality of life, the need for individuals with hearing disabilities to have access to wireless services has become critical. As Congress and the Commission have recognized, individuals with disabilities need access to telecommunications service to ensure they can more fully participate in a society that increasingly relies on these services.

B. The HAC Act and Existing Commission Rules

8. HAC Act. Understanding that telecommunications services are an essential component of our daily lives, Congress enacted the HAC Act in 1988 to provide access to telecommunications services for individuals with hearing disabilities. In adopting the HAC Act, the House of Representatives Report stated that "the inability to use all telephones imposes social and economic costs on not only the hearing impaired, but the whole nation."[14] It further stated that "the hearing impaired should have access to every telephone like the non-hearing impaired."[15] Therefore, the HAC Act was intended to enable individuals with hearing disabilities to use virtually every telephone.[16] Through the HAC Act, Congress charged the Commission with "establishing regulations as are necessary to ensure reasonable access to telephone service by persons with impaired hearing."[17] Specifically, the HAC Act required the Commission to establish regulations to ensure that the enumerated "essential phones" would provide "internal means" for effective use of hearing aids designed to be compatible with telephones that meet established technical standards for hearing aid compatibility.[18] In addition, the statute required nearly all telephones

[10] *See* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services Report, *Seventh Report*, 17 FCC Rcd 12985, 13017 (2003) (*citing* a poll that indicates one in five wireless telephony users considers their wireless phone to be their primary phone) (*Seventh Competition Report*).

[11] *Eighth Competition Report* at section II.C.1.b.(i).

[12] *Seventh Competition Report*, 17 FCC Rcd 12985, 13009.

[13] The National Emergency Number Association (NENA) estimates that, of the 150 million calls that were made to 911 in 2000, 45 million of them (30 percent) were made by wireless telephone users. NENA anticipates that, by 2005, the majority of 911 calls will be from wireless callers. *See* "Wireless 9-1-1 Overview" (visited June 26, 2003) <http://www.nena9-1-1.org/Wireless911/Overview.htm> (NENA Wireless 9-1-1 Overview).

[14] *See* H.R. Rep. No. 100-674, at 7 (1988) (*House Report*).

[15] *Id.*

[16] *Id.* at 3.

[18] *See* 47 U.S.C. § 610(b)(1)(B). Congress defined the "essential phones" required to comply as "only coin-operated phones, telephones provided for emergency use, and other telephones frequently needed for use by persons using [compatible] hearing aids." *See* 47 U.S.C. § 610(b)(4)(A). The Act also forbade the Commission from requiring retrofitting of equipment to achieve the purposes of the Act, except for coin-operated telephones and telephones provided for emergency use. *See* 47 U.S.C. § 610(f).

manufactured in the United States (other than for export) or imported for use in the United States after August 16, 1988, to be hearing aid compatible as defined in the statute.[19]

9. Congress specifically exempted certain telephones, including telephones used with public mobile service (wireless phones), from the "essential phones" designation. Congress considered the exempted phones to be "secondary," meaning that such phones were viewed at the time to be complements, as opposed to substitutes, for the "essential phones" it identified.[20] At the time of the HAC Act's adoption, wireless phones were primarily business tools. However, members of Congress realized that wireless phones may play an increasingly vital role in our society. To make certain that the HAC Act kept pace with the evolution of telecommunications, it granted the Commission a means by which to revoke or limit the exemption for wireless phones. Thus, the statute directs the Commission to periodically assess the appropriateness of continuing the exemptions.[21] Specifically, the statute requires us to "revoke or otherwise limit" the exemptions if we determine that

i. such revocation or limitation is in the public interest;

ii. continuation of the exemption without such revocation or limitation would have an adverse effect on hearing-impaired individuals;

iii. compliance with the requirements of [the rule] is technologically feasible for the telephones to which the exemption applies; and

iv. compliance with the requirements of [the rule] would not increase costs to such an extent that the telephones to which the exemption applies could not be successfully marketed.[22]

10. FCC Rules. The Commission initially adopted rules implementing the HAC Act in 1989.[23] In 1992, the Commission expanded the HAC requirements to apply to telephones in particular establishments, such as hospitals, hotels and motels, prisons, and workplaces.[24] In 1996, the Commission adopted regulations designed to ensure that individuals with hearing disabilities would be able to use "virtually all wireline phones in workplaces, confined settings, and hotels and motels."[25] The Commission adopted rules relating to volume control to ensure that telephones were more accessible for

[19] *See* 47 U.S.C. § 610(b)(1).

[20] *See House Report* at 9. *See also* 47 U.S.C. § 610(b)(2)(A). Public mobile services are air-to-ground radiotelephone services, cellular radio telecommunications services, offshore radio services, rural radio services, public land mobile telephone services, and other common carrier radio communications services covered by Part 22 of our rules. *See* 47 U.S.C. § 610(f); 47 C.F.R. § 68.3. The term public mobile services was subsequently reclassified as commercial mobile radio service (CMRS). *See* Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory Treatment of Mobile Services, Second Report and Order, 9 FCC Rcd 1411 (1994) (implementing Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993).

[21] 47 U.S.C. § 610(b)(2)(C).

[22] 47 U.S.C. § 610(b)(2)(C); 47 C.F.R. § 68.4(a)(4). Although the Commission announced that it would review the exemptions every five years, it has not done so since their initial promulgation in 1989. Access to Telecommunications Equipment and Services by the Hearing Impaired and Other Disabled Persons, 4 FCC Rcd 4596, 4600 (1989).

[23] *See* Access to Telecommunications Equipment and Services by the Hearing Impaired and Other Disabled Persons, CC Docket No. 87-124, *First Report and Order*, 4 FCC Rcd 4596 (1989).

[24] *See* Access to Telecommunications Equipment and Services by Persons With Disabilities, CC Docket No. 87-124, *Notice of Proposed Rulemaking*, 11 FCC Rcd 4338 (1995). The rules required that, with minor exceptions, all wireline telephones in hospitals and other health care facilities, in hotels and motels, in prisons, and in all workplaces be made telecoil compatible by May 1, 1993. The Commission subsequently stayed its rules and impaneled a Rulemaking Committee, which proposed rules that the Commission sought comment on in 1995.

those that use hearing aids and others with hearing impairments.[26] In addition, the Commission required telecoil compatibility of all telephones that are required to be hearing aid compatible.[27] Specifically, the Commission required that, except for telephones used with public mobile services, telephones used with private radio services, and secure telephones, every telephone manufactured in the United States (other than for export) or imported for use in the United States must be hearing aid compatible as defined in section 68.316 of the Commission's rules.[28] Finally, the Commission required all telephones with telecoil compatibility to be labeled with the letters "HAC," to more readily identify hearing aid-compatible phones to consumers.[29]

11. In addition to its rules on technical standards and requirements for compliance, the Commission clarified the status of the HAC Act in light of the adoption by Congress in the intervening years of the Americans with Disabilities Act of 1990[30] and section 255 of the Telecommunications Act of 1996.[31] In the *Wireline HAC Order*, the Commission determined that the protections afforded individuals with hearing disabilities under the HAC Act provided greater protection than those afforded under the "reasonable accommodation" standard provided by the ADA, and thus as stated in the ADA, the HAC Act was not intended to be invalidated.[32] With regard to section 255 of the 1996 Act, the Commission found that while this section shares a similar goal with the HAC Act, namely access to the telecommunications network by individuals with disabilities, the HAC Act remains binding law by operation of section 601 of the 1996 Act. Section 601 states that the 1996 Act "and amendments made by this Act shall not be construed to modify, impair, or supersede Federal, State, or local laws unless expressly so provided in such Act or amendments."[33] The Commission concluded that the HAC Act remained unaltered.[34]

C. Efforts to Facilitate Wireless Accessibility

12. In 1995, the HEAR-IT NOW Coalition (HEAR-IT NOW) filed a petition in which it argued that a limited revocation of the exemption for digital wireless phones was warranted under the four criteria.[35] HEAR-IT NOW appended to its petition studies demonstrating interference experienced by hearing aid users when attempting to use, or even simply standing near, a Global System for Mobile Communications, or GSM, wireless telephone.[36] HEAR-IT NOW argued that such interference prevents individuals who are hard of hearing from using Personal Communications Service (PCS) devices, thus excluding them from the next phase of the telecommunications revolution.[37]

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[26] *See Wireline HAC Order*, 11 FCC Rcd 8249, 8279. *See also* 47 C.F.R. §§ 68.6, 68.317.

[27] *See Wireline HAC Order*, 11 FCC Rcd 8249, 8251.

[28] *See* 47 C.F.R. § 68.4. *See also* 47 C.F.R. § 68.316.

[29] *See Wireline HAC Order*, 11 FCC Rcd 8249, 8291. *See also* 47 C.F.R. § 68.300.

[30] Americans with Disabilities Act of 1990, Pub. L. 101-336, 104 Stat. 328 (1990), *codified at* 42 U.S.C. §§ 12101-12213 (ADA).

[31] Telecommunications Act of 1996, Pub. L. 104-104, 110 Stat. 56 (1996) (1996 Act).

[32] *See Wireline HAC Order*, 11 FCC Rcd 8249, 8258-59. *See also* 42 U.S.C. § 12201(b).

[33] *Codified at* 47 U.S.C. § 152 nt. Section 601(c) of the 1996 Act, Pub. L. 104-104, Title VII, § 601, Feb. 8, 1996, 110 Stat. 143, is reproduced in the notes under 47 U.S.C. § 152.

[34] *See Wireline HAC Order*, 11 FCC Rcd 8249, 8259-60.

[35] *See* HEAR-IT NOW Petition at 5-8.

[36] HEAR-IT NOW Petition at Appendices 1-4.

[37] *See* HEAR-IT NOW Petition at 5-6.

13. In response to the HEAR-IT NOW petition, the Commission established a steering committee and working groups to develop and report to the Commission on possible solutions to problems faced by individuals with hearing disabilities in using digital wireless telephones. That committee, at the direction of the Commission, organized the Hearing Aid Compatibility and Accessibility to Digital Wireless Telecommunications Summit, which convened in January 1996.[38] Summit participants, who included representatives of digital wireless phone manufacturers and other interested parties, later submitted a report to the Commission on the agreements of the parties.[39]

14. As detailed in the report, the participants agreed that interface and accessibility problems could only be solved through a combination of both modifications to digital wireless phone designs and improvements in hearing aid immunity to RF emissions.[40] Additionally, the participants recognized that educating individuals with hearing disabilities on the compatibility issues could help foster understanding and encourage access to wireless telecommunications.[41] The participants also recognized that to promote consumer choice, they would need to pursue a range of options, given the range of levels of hearing loss and the range of means to address that loss.[42] Moreover, the participants agreed that further research would be needed to identify objective levels of interference that hearing aid users could tolerate.[43] They also agreed that the results of that further research would then be used to establish a preliminary matrix with recommended performance targets for electromagnetic emission and immunity levels that would serve as an interim benchmark.[44]

15. Concurrent with the work of the steering committee, the University of Oklahoma began research into the interaction between hearing aids and digital wireless phones. The study, which tested hearing aids manufactured for eighteen participants with hearing disabilities, sought to determine the levels of interference from digital wireless phones to hearing aids and to relate subjective ratings of speech intelligibility, usability, and annoyance to those interference levels. Results of the study support the use of acoustic measurements of immunity as a basis for a standard. The results also demonstrate the existence of a number of digital wireless phones that can be used successfully with hearing aids. Six of the eighteen hearing aids experienced no interference or only very slight interference at the highest power level when used with both 800 MHz and 1900 MHz digital wireless phones.[45] These results served as the basis for the development and adoption of a voluntary standard by ANSI in April 2001, namely, the "American National Standard for Methods of Measurement between Wireless Communication Devices and Hearing Aids ANSI C63.19-2001" (ANSI C63.19).

16. ANSI C63.19, which was developed by a Task Group that included representatives of several wireless phone manufacturers, wireless carriers, representatives of the FCC and FDA, and other interested parties, provides guidance on measuring digital wireless phones' RF emission levels and hearing aids' immunity levels to the RF emissions, and specifies rating categories for different levels of RF emissions

[38] *See* Wireless Telecommunications Bureau Fiscal Year 1995-1996 Progress Report, 1996 WL 668142 (Nov. 19, 1996). Invitees to the summit included representatives from the digital wireless phone industry, organizations representing individuals with hearing loss, and hearing aid manufacturers.

[39] *See* Letter from Pamela J. Ransom, Summit Facilitator, to Chairman Reed Hundt, FCC (May 16, 1996) (Summit Agreement).

[40] *Id.*

[41] *Id.*

[43] *Id.*

[44] *Id.*

[45] "Investigation of the Interaction Between Wireless Phones and Hearing Aids, Phase III-B: Subjective Validation Study" at 31, University of Oklahoma Center for the Study of Wireless Electromagnetic Compatibility, performed for ANSI C63.19 (October 1999).

and immunity. The RF rating categories are intended to assist hearing aid users with the selection of a digital wireless phone that will be usable with a particular hearing aid. In addition, ANSI C63.19 provides guidance on measuring digital wireless phones' desired and undesired magnetic field emission levels and hearing aids' immunity to undesired magnetic fields, and specifies rating categories for different levels of magnetic field emissions and immunity. The magnetic field rating categories are intended to assist hearing aid users in choosing a digital wireless phone that can be successfully operated with a particular telecoil- or acoustic coupling-capable hearing aid.[46]

17. In October 2000, while the ANSI C63.19 standard was still awaiting final approval, the Wireless Access Coalition (WAC) formally requested that the Commission reopen the petition for rulemaking filed in 1995 by HEAR-IT NOW, seeking to revoke the exemption for PCS devices from the Commission's rule requiring telephones to be hearing aid compatible.[47] In its petition, WAC noted the qualified success of the steering committee and the working groups to bring about consensus on certain issues and the development of ANSI C63.19.[48] WAC, however, also expressed its disappointment in progress on the "central problem" of digital wireless phones' interference with hearing aids.[49] WAC reiterated its belief in the need for the Commission to address this central problem quickly, noting that PCS providers continue to offer more feature-rich services at lower prices, as compared to their analog offerings, over their digital PCS networks.[50] If not addressed, WAC is concerned that hearing aid users will find themselves marginalized from mainstream communications, resulting in a regression to more dependent, less productive lives.[51]

18. In 2001, responding to both WAC's formal request and the HAC Act's requirement that the Commission periodically review the appropriateness of the exemption, the Commission released a Notice of Proposed Rulemaking (*Notice*) to reexamine the wireless phone exemption provided by the HAC Act.[52] In the *Notice*, the Commission sought comment on issues related to requirements of the statute for repeal or limiting of the HAC Act exemption. The Commission sought comment on operation of the requirements of the HAC Act as they relate to establishment of technical standards and the meaning of the phrase "internal means."[53] Additionally, the Commission sought comment on the limitations on compatibility imposed by the statute in requiring that telephones only be compatible with "hearing aids that are designed to be compatible with telephones that meet established technical standards for hearing aid compatibility."[54]

19. The Commission also sought comment on whether the four criteria in the statute, which must be met before the Commission can revoke or limit the wireless phone exemption, have been met. Based on the decline in analog service offerings coupled with the rise in more efficient, lower-cost, and feature-rich digital offerings, the Commission tentatively concluded that limiting the exemption would serve the

[46] *See* ANSI C63.19 at 1-2.

[47] *See* Petition for Rulemaking of Helping Equalize Access Rights in Telecommunications Now (HEAR-IT NOW), In the Matter of Section 68.4(a) of the Commission's Rules, Hearing Aid-Compatible Phones, RM-8658 (filed June 5, 1995) (HEAR-IT NOW Petition); Request of WAC to Reopen the Petition for Rulemaking, RM-8658 (filed October 10, 2000) (WAC Request).

[48] *See* WAC Request at 2.

[49] *Id.* at 3.

[50] *Id.*

[51] *Id.* at 4.

[53] *Notice*, 16 FCC Rcd 20558, 20564-65.

[54] *Id.*, 16 FCC Rcd 20558, 20565.

public interest.[55] The Commission also tentatively concluded that continuation of the exemption without limitation would have an adverse effect on individuals with hearing disabilities. The Commission based its tentative conclusion on the growing prevalence of digital wireless phones and the declining availability of analog phones and service.[56] It further noted that access to applications that are possible through use of a digital wireless phone, such as short messaging service, e-mail, and Internet access would allow the benefits of these features to be experienced by individuals with hearing disabilities.[57]

20. Regarding the technological feasibility criterion in the HAC Act, the Commission sought comment on ways in which hearing aid manufacturers, digital wireless phone manufacturers, and service providers could work together to develop long-term solutions to compatibility problems.[58] The Commission also sought comment on whether a "pairing" approach, recommended by CTIA, would satisfy the requirements of the statute.[59] The Commission further sought comment on whether the costs of compliance with the HAC Act would increase costs to such an extent that the digital wireless phones could not be successfully marketed.[60] Finally, the Commission sought comment on the costs and benefits to all telephone users of requiring compliance,[61] as well as whether full revocation of the exemption or a limited exemption was warranted.[62]

21. Recognizing the efficiencies that wireless carriers can gain from using digital technology, the Commission's *Analog Sunset Order* established a process by which carriers may discontinue providing analog service.[63] In that Order, the Commission found that it was appropriate to eliminate the analog requirement contained in our rules because of the competitive nature of wireless telephony. In addition, the Commission believed that the spectral efficiency that would be gained supported elimination of the analog service requirement.[64] The Commission, however, also recognized that analog service has offered individuals with hearing disabilities access to wireless telephony, and therefore immediate removal of the analog requirement could create access barriers to wireless telephony for individuals with hearing disabilities.[65] It therefore decided to adopt a sunset period of five years to allow carriers to resolve problems associated with access to digital wireless service by individuals with hearing disabilities. To monitor the adequacy of access to wireless telephony, the Commission required certain nationwide wireless carriers to report on the availability and usability of hearing aid-compatible digital devices.[66]

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[55] *Id.*, 16 FCC Rcd 20558, 20567.

[56] *Id.*, 16 FCC Rcd 20558, 20568.

[57] *Id.*, 16 FCC Rcd 20558, 20568.

[59] *Id.*, 16 FCC Rcd 20558, 20569. The pairing approach would test and categorize digital wireless phones and hearing aids based on the phone's RF emission levels and magnetic field quality, and the hearing aid's immunity to interference, as specified in the ANSI C63.19 standard. The information could then be used to pair a hearing aid and wireless phone based on their respective ratings. *See* ANSI C63.19 at 1-5.

[60] *Id.*, 16 FCC Rcd 20558, 20569.

[61] *Id.*, 16 FCC Rcd 20558, 20569-70.

[62] *Id.*,16 FCC Rcd 20558, 20570-71.

[63] See Year 2000 Biennial Review – Amendment of Part 22 of the Commission's Rules to Modify or Eliminate Outdated Rules Affecting the Cellular Radiotelephone Service and Other Commercial Mobile Radio Services, WT Docket No. 01-108, Report and Order, 17 FCC Rcd 18401, 18414-20 (2002) (*Analog Sunset Order*).

[64] *Id.*, 17 FCC Rcd 18401, 18406.

[65] *Id.*

[66] *Id.*

D. Technical Description of Hearing Aids and Digital Wireless Phones

22. A hearing aid is an electronic device that amplifies weak sounds and transmits them through a small speaker. Hearing aids come in several models, behind-the-ear (BTE), in-the-ear (ITE), in-the-canal (ITC), and completely-in-the-canal (CIC). A hearing aid's components include a microphone, amplifier, and speaker. Additionally, some models have a coil of wire known as a telecoil or "t-coil." Hearing aids operate in one of two coupling modes, acoustic or inductive (known as "telecoil mode"), with the latter typically being employed by those with profound hearing loss. As we have noted, approximately 25-30 percent of hearing aids sold in the United States include telecoils.[67] In acoustic coupling mode, the microphone picks up surrounding sounds, desired and undesired, and converts them into electrical signals. The electrical signals are amplified as needed and then converted back into sound by the hearing aid speaker. In telecoil mode, with the microphone turned off, the telecoil picks up the audio signal-based magnetic field generated by the voice coil of a dynamic speaker in hearing aid-compatible telephones, audio loop systems, or powered neck loops. The hearing aid converts the magnetic field into electrical signals, amplifies them as needed, and converts them back into sound via the speaker. Using a telecoil avoids the feedback that often results from putting a hearing aid up against a telephone earpiece, can help prevent exposure to over amplification, and eliminates background noise, providing improved access to the telephone.[68]

23. Cochlear implants bypass the external and middle ears by using electrical stimulation of electrodes implanted in the cochlea to reintroduce the signals carried by auditory nerve fibers to the brain. With a cochlear implant, a microphone in a headpiece worn at the ear is connected via a thin cable to a processor that is worn on the belt, carried in a pocket or, in some models, worn at ear level. The processor translates the signal from the microphone into digital signals that are sent to a transmitter (in some models, the transmitter and microphone are in the same piece). The transmitter, which is held by a magnet on the side of the head behind the ear, sends the coded signals via radio waves through the skin to the cochlear implant. The signals are directed to auditory nerve fibers using an array of electrodes implanted in the deaf patient's cochlea where they elicit patterns of nerve activity that the brain interprets as sound.[69] Some cochlear implants are now being manufactured with built-in telecoils, which could enable a user to hear more clearly when using a hearing aid-compatible telephone, neck loop, or in the vicinity of an audio loop.[70]

24. Individuals with hearing disabilities that use hearing aids or cochlear implants, whether only capable of acoustic coupling or also capable of telecoil coupling, may encounter several problems when using digital wireless telephones. The pulsing nature of RF signals from digital wireless phones can interfere with a hearing aid operated in acoustic or telecoil coupling mode, preventing acceptable use by

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[67] *See* "Hearing aids" (visited June 26, 2003) <http://www.hearingaidhelp.com/hearingaids.html>. *See also* "Telecoils in Hearing Aids in the USA" (visited June 26, 2003) <http://hohadvocates.org/telecoils.htm>. Some commenters indicate that there may be some hearing aid users who do not utilize the telecoil functionality, even though it is included in their hearing aids. *See* AAES Comments at 3-6; CTIA Comments at 9.

[68] *See supra* note 4. *See also* D. Mulvany, MSW, LCSW, "Choices in Hearing Aids" (visited March 14, 2002) <http://members.tripod.com/~Dana_Mulvany/HearingAids.htm>.

[69] *See* Dr. D.K. Eddington and M.L. Pierschalla, "Cochlear Implants Restoring Hearing to the Deaf," *The Harvard Mahoney Neuroscience Institute Letter On The Brain*, Fall 1994 Volume 3, Number 4 (visited Feb. 28, 2003) <http://www.med.harvard.edu/publications/On_The_Brain/Volume3/Number4/Cochlear.html>. *See also* "How a Cochlear Implant Works" (visited June 26, 2003) <http://www.earsugery.org/howto.html> and P.C. Loizou, "Introduction to cochlear implants" (visited Feb. 28, 2003) <http://www.utdallas.edu/~loizou/cimplants/tutorial/tutorial.htm>.

[70] *See* Center On Disabilities Technology And Persons With Disabilities , "Conference 2003 Conference Proceedings" (visited June 26, 2003) <http://www.csun.edu/cod/conf/2003/proceedings/133.htm>.

the hearing aid user. This form of electromagnetic interference (EMI), which is produced as a result of pickup and demodulation of the RF field by the hearing aid circuitry, will generate noise in hearing aids if detected during telecoil operation, and may even introduce interference to hearing aids operated in acoustic coupling mode. In addition, whether the hearing aid is being operated in acoustic or telecoil coupling mode, interference from electromagnetic energy emitted as a result of a wireless phone's display and keyboard backlight operation can cause interference that results in the hearing aid user experiencing distracting and sometimes painful buzzing noises.[71] Even if a wireless phone produces high audio volume or a strong magnetic field for acoustic or telecoil coupling, respectively, the interference described above could be overpowering and prevent the hearing aid user from using the digital wireless phone.[72]

25. Changes to hearing aids have been made to increase these devices' ability to block electromagnetic energy, which is referred to as immunity. Hearing aid manufacturers have focused on hardening the components in the hearing aid, which has resulted in improved immunity to both RF and non-RF sources of interference.[73] In addition, the advances that are being made in digital hearing aids, which often do not experience interference issues, offer an opportunity to help control the interference that users of analog hearing aids may experience.[74]

IV. ANALYSIS OF STATUTORY CRITERIA

26. We next set out our analysis of the four criteria Congress provided the Commission to determine whether revocation or limiting of the HAC Act exemption for wireless phones is warranted. In the HAC Act, Congress specifically exempted phones used with public mobile services and phones used with private wireless services from having to be hearing aid compatible.[75] We note, at the outset, that our rules provide that public mobile services are air-to-ground radiotelephone services, cellular radio telecommunications services, offshore radio services, rural radio services, public land mobile telephone services, and other common carrier radio communications services covered by Part 22 of our rules.[76] In 1994, Congress amended section 332 of the Communications Act of 1934, replacing private and public

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[71] *See* Vickery Comments at 9, 11. *See* also University of Oklahoma Wireless EMC Center "Investigation of the Interaction Between CDMA Wireless Phones and Hearing Aids" (visited Jan. 8, 2003) <http://www.ou.edu/engineering/emc/projects/CDG.html>; H. S. Berger, TEM Consulting, "ANSI C63.19 Hearing Aid/Cellular Telephone Compatibility" (visited Feb. 27, 2003) <http://www.ieee.org/organizations/pubs/newsletters/emcs/sprng01/stan_act.htm>. RF emissions from the antenna of a handset operating with a digital air interface are more likely to produce interference that renders a hearing aid inoperable than those from a handset operating with an analog air interface. The Code Division Multiple Access (CDMA) digital interface provides the lowest levels of interference, with Time Division Multiple Access (TDMA), and TDMA variations such as GSM and Integrated Digital Enhanced Network (iDEN), producing the most interference. *See* "Preliminary Results SHHH Mobile Phone Survey September 2002" (visited June 17, 2003) <http://www.shhh.org/Advocacy/mppreliminarysurvey.cfm>.

[72] *See* D. Mulvany and R. Vickery, "An Analysis of Inductive Coupling and Interference Issues in Digital Wireless Phones: Technically Feasible Solutions" (visited June 17, 2003) <http://hearingloss.org/html/accdigwire752a.html>.

[73] *See* HIA Comments at 4; HIA Feb. 15, 2002, *Ex Parte* Presentation at 1.

[74] *See* "Power Support" (visited July 2, 2003) http://www.oticon.com/eprise/main/Oticon/com/SEC_Professional/PowerSupprt/AssistiveListeningDevise/CNT03_CellularPhones; "SELF HELP FOR HARD OF HEARING PEOPLE: FAQ Assisted Listening Device" (visited July 2, 2003) <http://www.shhh.org/faq/3.cfm?pf=1>. Digital hearing aids, however, can be significantly more expensive than analog hearing aids. *See* "Buy Hearing Aids" (visited June 26, 2003) <http://deafness.about.com/cs/buyaids/>.

[75] 47 U.S.C. § 610(c).

[76] 47 C.F.R. § 68.3. Private mobile radio services are private land mobile radio services and other communications services characterized in our rules as private radio services. *Id.*

mobile service categories with two new categories of mobile services, commercial mobile radio service (CMRS) and private mobile radio service (PMRS), and treating CMRS providers, which includes PCS and cellular service providers, as common carriers.[77] As we have done in the context of other proceedings, we conclude that the rules we adopt in this Order apply to telephones used with all wireless systems to the extent that they offer real-time, two-way switched voice service that is interconnected with the public switched network, and utilize an in-network switching facility which enables the provider to reuse frequencies and accomplish seamless handoffs of subscriber calls.[78] Therefore, in addition to telephones used with broadband PCS,[79] we apply these rules to telephones used with other public mobile services, including Cellular Radio Telephone Service,[80] as well as Geographic Area Specialized Mobile Radio (SMR) Services and Incumbent Wide Area SMR Licensees in the 800 MHz and 900 MHz bands.[81]

27. The legislative history of the HAC Act indicates that Congress provided the exemption to wireless phones because it viewed them as complements, not substitutes, for wireline telephones.[82] Congress authorized the Commission to revoke or limit that exemption upon a finding that: 1) continuation of the exemption would have an adverse effect on hearing impaired individuals; 2) revocation or limiting of the exemption would be in the public interest; 3) compliance with the HAC Act requirements is "technologically feasible;" and 4) compliance would not increase costs of wireless phones to such an extent that they could not be successfully marketed.

28. We conclude that the HAC Act applies to both reduction of RF interference to hearing aids as well as providing inductive coupling capability for the hearing aid's telecoil. In the legislative history of the HAC Act, Congress stated that the Act does not tie manufacturers to a particular technology and inhibit future development; instead, it sought only to require that telephones be compatible.[83] Congress specifically noted that, in an effort to avoid mandating any particular type of technology, "induction coupling and electromagnetic fields are not even mentioned" in the Act.[84] This legislative history, coupled with the statutory language instructing the Commission to establish such regulations as are necessary to ensure reasonable access to telephone service by individuals with hearing disabilities,[85] compels our conclusion in this Order that both the reduction of RF interference and the provision of inductive coupling for the hearing aid's telecoil are necessary to ensure wireless phone compatibility with hearing aids.

29. For the reasons set forth below, we find that continuation of the exemption would have an adverse effect on individuals with hearing disabilities. Furthermore, we find that modifying the wireless phone exemption is in the public interest. In addition, we find that it is both technologically feasible to

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[77] *See* Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory Treatment of Mobile Services, Second Report and Order, 9 FCC Rcd 1411 (1994). We note that "commercial mobile radio service" is defined as a mobile service that is: "(a)(1) provided for profit . . . (2) An interconnected service; and (3) Available to the public, or to such classes of eligible users as to be effectively available to a substantial portion of the public; or [the functional equivalent thereof]." *See* 47 C.F.R. § 20.3.

[78] *See* 47 C.F.R. § 20.18(a) (identifying carriers subject to E911 rules); 47 C.F.R. § 52.21(c) (identifying carriers subject to local number portability rules).

[79] Broadband PCS is described in Part 24, Subpart E of our rules, 47 C.F.R. §§ 24.200-24.253.

[80] Cellular Radio Telephone Service is described in Part 22, Subpart H of our rules, 47 C.F.R. §§ 22.900-22.967.

[81] These services are described in Part 90, Subpart S of our rules, 47 C.F.R. §§ 90.601-90.699.

[82] *See House Report* at 8.

[83] *Id.* at 8.

[84] *Id.* at 8.

[85] 47 U.S.C. § 610(a).

require compliance in the manner detailed in this Order, and that requiring such compliance will ensure that the digital wireless phones subject to this Order are marketable.[86] And, finally, to the extent the modification of the exemption from the HAC Act for wireless phones facilitates usage by hearing aid users, we expect that individuals with cochlear implants will likewise benefit.

A. *Adverse Effect on Hearing Impaired Individuals*

30. Based on the record in this proceeding, we conclude that continuing the exemption afforded to wireless phones under the HAC Act would have an adverse effect on individuals with hearing disabilities. Consumers who use hearing aids or cochlear implants indicate they have had difficulty finding wireless phones they can use without suffering from annoying and sometimes painful interference, without resorting to expensive and cumbersome external attachments.[87] Consumers state that it is becoming very difficult to find analog wireless phones and services, and they are unable to use most digital wireless phones because of the resulting interference.[88] By not being able to take advantage of most newer, digital wireless phones and services, hearing aid users assert they cannot take advantage of the attractive pricing and service plans available to other consumers, many of which include free or reduced-price phones, because the phones offered do not work with their hearing aids.[89] Some consumers point out that their lack of ability to use a digital wireless phone causes them problems in their employment, particularly since many employers now rely on digital phones and services to stay in contact with employees in the field.[90] A few consumers reported difficulty in finding a phone that works with their hearing aids because they were unable to test the phone before purchasing it.[91] Some consumers expressed a desire to use a wireless phone for emergency use while away from home, but are unable to find one they can use, which they believe puts them at greater risk than non-hearing aid users since they are unable to call 911 or for automotive assistance using a digital wireless phone.[92]

31. Consumer advocacy groups assert that the market has not responded to the needs of individuals with hearing disabilities because of the relatively small size of the population of consumers that would benefit from hearing aid compatibility features in digital wireless phones (as compared to the size of the total population of digital wireless phone users).[93] However, these groups also note that the number of Americans with hearing disabilities is growing, and that the market for wireless phones and

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[86] The HAC Act requires the Commission to determine whether "compliance with the requirements . . . would not increase costs to such an extent that the telephones to which the exemption applies could not be successfully marketed." 47 U.S.C. § 610(b)(2)(C)(iv).

[87] *See* AG Bell Comments at 6; SHHH Comments at 6; TDI Comments at 2-4; Anderson Comments; Angelo Comments; DeVilbiss Comments at 1; Diedrichsen Comments; Harper Comments; Klein Comments; MacKenzie Comments; Taylor Comments at 3; Vickery Comments at 3. *See also* Letter from Nancy A. Dietrich to Office of the Secretary, FCC, WT Docket No. 01-309 (May 8, 2002); Letter from Lisa Devlin to Office of the Secretary, FCC, WT Docket No. 01-309 (March 11, 2002).

[88] *See* SHHH Comments at 6-7; Consumer Action Network Comments at 2; TDI Comments at 2-5; Yagi Comments.

[89] *See* AG Bell Comments at 10; Klein Comments; NAD Comments at 1-2; TDI Comments at 5.

[90] AG Bell Comments at 3; Consumer Action Network Comments at 2; NAD Comments at 2; TDI Comments at 5; MacKenzie Comments; McCarley Comments; Waldron Reply Comments at 1; Simmons Comments.

[91] AG Bell Comments at 14; Anderson Comments at 1-2; MacKenzie Comments.

[92] *See* Murphy Comments; Bahl Comments at 2; Mohney Comments; Schultz Comments; Vickery Comments at 5. There are also adverse effects upon the hearing population which flow from the wireless exemption. *See* Arizona Commission for the Deaf and Hard of Hearing Comments at 3 (describing effects such as businesses' loss of resources, impacts on families and friends of individuals with hearing disabilities, as well as the need for support services when individuals are communicatively isolated).

[93] RERC Comments at 4.

services would be increased if wireless phone manufacturers would improve access for hearing aid and cochlear implant users.[94]

32. Some wireless industry commenters contend that removal of the exemption for wireless phones would not solve the hearing aid compatibility problem because it would not address issues associated with interference.[95] A few commenters argue that the number of people who would benefit from removal of the exemption is relatively small, since such a small percentage of people have telecoils in their hearing aids, and many of them do not even use the telecoil functionality.[96] Because telecoil coupling is typically used by individuals with more severe hearing loss, these are the people who rely upon them the most for telecommunications. Our rules should address the needs of these users since they are the most adversely affected by the exemption, despite the fact that they make up a minority of hearing aid users. In addition, we do not simply remove the exemption for wireless phones and subject these phones to the wireline HAC requirements which, essentially, mandate only telecoil coupling. Our modification of the exemption will benefit people who use their hearing aids for both inductive coupling and acoustic coupling, because our rules will require both reduction of RF interference to hearing aids as well as providing inductive coupling capability for the hearing aid's telecoil. As a result, our rules could benefit the entire population of hearing aid users, which is estimated to be approximately six million people.

33. We are not persuaded by the other arguments against modifying the exemption. Some commenters claim that the compatibility problem should be solved by only requiring hearing aid manufacturers to increase the immunity of hearing aids.[97] However, this would not address the need for telecoil coupling capability and, while hearing aid immunity has been significantly improved in recent years, it does not appear to be possible to completely shield against all RF interference from digital wireless phones.[98] In addition, contrary to the assertions of some industry commenters, we do not find the security concerns presented by providing telecoil coupling to be significant.[99] Eavesdroppers would need to be within the magnetic field generated by the phone, which is typically about 12 to 18 inches from the handset speaker.[100]

34. While we recognize that the wireless industry has made some efforts to address the needs of individuals with hearing disabilities,[101] we believe that maintaining the exemption for wireless phones

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[94] *See* AG Bell Comments at 5-6; SHHH Comments at 7; TDI Comments at 4.

[95] CTIA Comments at 3-8; TIA Comments at 5.

[96] *See* AAES Comments at 3-6; CTIA Comments at 9; Sprint PCS February 4, 2003, *Ex Parte* at 5.

[97] *See* Sprint PCS Comments at 11-14; TIA Comments at 13-22; Nextel Reply Comments at 4, 7-8.

[98] *See* HIA Feb. 20, 2003, *Ex Parte* Presentation at 2-3; Cochlear Americas Comments at 3.

[99] *See* AAES Comments at 8; Cingular/Siemens October 23, 2002, *Ex Parte* Letter at 11.

[100] *See* ANSI C63.19 at 10. *See also* "Induction Loop Systems" (visited July 7, 2003) <http://www.dt4u.com/dtsystems/loopmed.htm> and S.C. Ewens, "LIMITS OF INDUCTIVE COUPLING IN HEARING AIDS," *TELEPHONES AND HEARING AIDS PROCEEDINGS OF COST 219 SEMINAR, The Hague, 17th of March 1993*, Commission of the European Communities Information Technologies and Sciences, "telecommunications and disability," Edited by Patrick R.W. Rowe (visited June 26, 2003) <http://www.stakes.fi/cost219/HAGUE93.DOC>.

[101] Representatives of the wireless industry participated in the ANSI C63.19 Task Group which developed the standard. *See* ANSI C63.19 at iii-iv (participants included Ericsson, Motorola, Nokia, Pacific Bell Mobile Services, Qualcomm, and Siemens). In addition, several wireless handset manufacturers state that they have begun testing under ANSI C63.19, and some have made efforts to produce lighter, less cumbersome accessories. For example, Nokia reports that it has updated its neck loop for inductive coupling to eliminate the need for separate batteries. CTIA has established an Internet web site, which is available at <www.accesswireless.org>, to provide information on wireless phones that provide hearing aid compatibility characteristics. *See* CTIA June 13, 2003, *Ex Parte* at 1-2.

from the HAC Act would adversely affect hearing aid users. In light of the migration of consumers to more efficient, feature-rich, and lower-cost digital wireless phones and services, we believe that maintaining the exemption for wireless phones would prevent hearing aid users from taking advantage of these devices and services. In addition, the market transition from analog to digital services, recognized by the Commission's decision to sunset the analog service requirements imposed on wireless carriers, could restrict the choices for telecommunications services that are available to individuals with hearing disabilities, unless the HAC Act's exemption for wireless phones is modified or eliminated.[102] These constitute adverse effects that would be caused by continuing the wireless phone exemption from the HAC Act.

B. Public Interest

35. Based on the record in this proceeding, and in light of the adverse effects of continuing the exemption described above, we conclude that the public interest is served by modifying the exemption afforded wireless phones under the HAC Act. As commenters to this proceeding have affirmed, greater access to digital wireless service for individuals with hearing disabilities will enable them to benefit from this technology, which has influenced Americans' work and social lives, and that benefit will inure to all consumers of telecommunications.[103] In other orders, the Commission has recognized such benefits. For example, in its Order implementing section 255 of the Telecommunications Act, the Commission stated that ensuring greater access to a particular group of telecommunications consumers creates benefits that flow to all consumers of telecommunications services.[104] Moreover, it is important to preserve access to wireless telecommunications for individuals with hearing disabilities, particularly in view of the public safety benefits offered by these services. Over the last 10 years, there has been more than a 10-fold increase in the number of wireless 911 calls, and this trend is likely to continue.[105] As the general public increasingly relies on wireless phones to obtain emergency services, individuals with hearing disabilities should also be able to take advantage of the safety benefits of wireless services by having access to digital wireless phones that work effectively with hearing aids.

36. The rise in use of digital wireless service is well documented. As the Commission noted in the *Eighth Competition Report*, digital technology is now dominant in the wireless telephone sector, with approximately 125 million subscribers, far surpassing the 17 million analog subscribers.[106] Digital wireless technologies enable wireless service providers to more efficiently use their spectrum, which in turn allows them to offer their customers relatively inexpensive bundles of minutes, more enhanced services, such as text messaging, and wireless data and mobile Internet offerings.[107] These offerings have allowed wireless telecommunications to evolve from what was once considered a complementary business service to a mass market consumer offering that delivers an essential service, telecommunications, through a platform that offers users the benefits of mobility and greater independence. Wireless services also offer users greater access to emergency services. As evidenced by the continued growth in the number of wireless subscribers, consumers are realizing these benefits, often

[102] *See Analog Sunset Order*, 17 FCC Rcd 18401, 18417.

[103] AT&T Wireless Comments at 3; AG Bell Comments at 4; Consumer Action Network Comments at 2.

[104] Implementation of Sections 255 and 251(a)(2) of the Communications Act of 1934, As Enacted by the Telecommunications Act of 1996: Access to Telecommunications Service, Telecommunications Equipment and Customer Premise Equipment by Persons With Disabilities, WT Docket No. 96-198, Report and Order and Further Notice of Inquiry, 16 FCC Rcd 6417, 6420 (1999) (*Section 255 Order*).

[105] NENA Wireless 9-1-1 Overview, *see supra* note 13.

[106] *See supra* note 11, *Eighth Competition Report* at section II.C.1.b.(i).

[107] *See supra* note 12, *Seventh Competition Report*, 17 FCC Rcd 12985, 13009.

considering their wireless phone to be their primary phone.[108] For these reasons, access to digital wireless service for the country's approximately six million hearing aid users is necessary to facilitate their full participation in our society, and we therefore conclude that it is in the public interest that the exemption afforded to wireless phones under the HAC Act be modified. As the Commission has recognized in other proceedings, increasing the number of people connected to the telecommunications network makes the network more valuable to all of its users.[109]

37. In addition to the benefits to hearing aid wearers that will accrue from modifying the exemption for wireless phones, we believe increased accessibility to digital wireless telecommunications will result in benefits for all consumers. Even people who do not wear hearing aids would benefit from the spectrum usage efficiencies realized by the increased use of digital wireless phones rather than the continued use of analog wireless phones.[110] Also, measures to redirect RF energy could extend phone battery life for all users.[111] In addition, the wireless industry would benefit from the business opportunity in serving the expanding market segment comprised of individuals with hearing disabilities, and employers of individuals with disabilities would benefit from improved communication with employees in the field. We also anticipate that, based on similarities between the experiences of cochlear implant users and hearing aid users when using digital wireless phones,[112] any handset changes that are made as a result of modifying the exemption will likewise benefit cochlear implant users.[113] In sum, the public interest would be served by modifying the HAC Act's wireless phone exemption.

C. Technological Feasibility

38. Based on the record in this proceeding, we also find that it is technologically feasible for digital wireless phones to comply with the requirement that they be hearing aid compatible. Below, we describe some of the technological aspects involved in achieving compatibility between digital wireless phones and hearing aids, and we detail the various parts of the technological feasibility criterion to establish such a requirement.

39. ANSI C63.19 Technical Standard. Fundamental to deciding to modify the exemption on grounds of technological feasibility is the requirement that there be an established technical standard.[114] As discussed above, since 1996, the Commission, in conjunction with various industry participants and consumers, has been working to establish a technical standard that would allow digital wireless phones to work properly with hearing aids. One product of the HAC Summit of 1996 was the establishment of a technical working group, which led to the formation by ANSI C63 of Task Group C63.19.[115] ANSI C63 charged the Task Group with developing a standard for methods of measurement and defining the limits

[108] *See supra* note 10, *Seventh Competition Report*, 17 FCC Rcd 12985, 13017 (*citing* a poll that indicates one in five wireless telephony users considers their wireless phone to be their primary phone).

[109] *See* Federal-State Joint Board on Universal Service, Report and Order, 12 FCC Rcd 8776, 8783 (1997) ("Increasing subscriber ship also benefits society in ways unrelated to the value of the network per se. For example, all of us benefit from the widespread availability of basic public safety services, such as 911.").

[110] *See Analog Sunset Order*, 17 FCC Rcd 18401, 18406.

[111] *See* F.M. Caimi, Ph.D., Senior Scientist, "MLA Antennas - Physically Small, Electrically Large" (visited March 5, 2003) <http://www.skycross.com/MLA_antenna.asp>.

[112] *See* Cochlear Americas May 16, 2003, *Ex Parte* at 2.

[113] Cochlear implant manufacturers indicate that they are beginning to incorporate telecoils into newer cochlear implant models. *See* Cochlear Americas May 16, 2003, *Ex Parte* at 2. As a result, cochlear implant users will benefit from telecoil coupling capability as well as reduced RF emissions from digital wireless handsets.

[114] *See* 47 U.S.C. § 610(b)(1)(B).

[115] ANSI C63 is the Accredited Standards Committee on Electromagnetic Compatibility.

for hearing aid compatibility and accessibility to wireless telecommunications.[116] Task Group C63.19, which included wireless carriers, digital wireless handset manufacturers, and hearing aid manufacturers, as well as representatives from the FCC and Food and Drug Administration (FDA), prepared and adopted by an almost unanimous vote[117] a standard that is predictive of the successful use of digital wireless phones with hearing aids.[118]

40. To use a digital wireless phone with a hearing aid or cochlear implant in acoustic coupling mode, RF interference and other EMI from the wireless phone must be controlled. Based on recommended audio signal-to-interference ratios and other assumptions about wireless phones' performance, ANSI C63.19 specifies ratings for digital wireless phones, U1 through U4, based on their RF emission levels, with U1 being the highest emissions and U4 the lowest emissions. The standard also provides a methodology for rating hearing aids from U1 to U4 based on their immunity to interference, with U1 being the least immune and U4 the most immune. To determine whether a particular digital wireless phone will not interfere with a particular hearing aid, the immunity rating of the hearing aid is added to the emissions rating of the wireless phone. A sum of 4 would indicate that the wireless phone is usable; a sum of 5 would indicate that the wireless phone would provide normal use; and a sum of 6 or greater would indicate that the wireless phone would provide excellent performance with that hearing aid.[119]

41. Reduced RF emissions are also needed to improve inductive coupling with hearing aid or cochlear implant telecoils. In addition, to use a wireless phone with a hearing aid or cochlear implant in telecoil coupling mode, without employing an accessory device (*e.g.*, a neck loop), the voice coil of the wireless phone's speaker or a separately installed coil must generate an audio signal-based magnetic field of sufficient intensity and frequency response for reception by the telecoil and conversion into sound by the hearing aid speaker or into digital signals by the cochlear implant processor. If the magnetic field's intensity is too low, a hearing aid user may attempt to compensate by increasing the sensitivity of the telecoil. But this could introduce interference from undesired electromagnetic fields not previously detected, such as from operation of the wireless phone's display and keyboard backlight.[120]

42. The ANSI standard specifies the axial field and radial field intensity of the audio signal's magnetic field required for satisfactory operation of digital wireless phones with hearing aids in telecoil mode. The standard also specifies ratings for the magnetic field quality of digital wireless phones as well as the immunity of hearing aids to undesired magnetic fields, U1T through U4T.[121] To determine whether a particular digital wireless phone will function with a particular hearing aid in telecoil mode, the immunity rating of the hearing aid is added to the magnetic field rating of the wireless phone. A sum of 4 would indicate that the wireless phone is usable; a sum of 5 would indicate that the wireless phone would provide normal use; and a sum of 6 or greater would indicate that the wireless phone would provide excellent performance with that hearing aid in telecoil mode.[122]

43. ANSI C63.19 is a detailed standard that is highly predictive of the usability of compatible wireless phones with sufficiently immune hearing aids, a point which the Telecommunications Access

[116] *See* ANSI C63.19 at iii.

[117] HIA *Ex Parte*, filed Mar. 26, 2003 (indicating that HIA voted against ANSI C63.19, but expressing support for its application in today's manufacturing environment).

[118] *See* ANSI C63.19 at 1-2.

[119] *See* ANSI C63.19 at 38-39.

[120] *See supra* note 72.

[121] *See* ANSI C63.19 at 40.

[122] *See* ANSI C63.19 at 39.

Advisory Committee to the United States Architectural and Transportation Barriers Compliance Board makes in declaring ANSI C63.19 to be a success.[123] Even though the Commission expressed the view in the *Notice* that ANSI C63.19 did not appear to constitute an established technical standard within the meaning of the HAC Act,[124] through comments submitted on the record by ANSI ASC C63 SC8 and other information gathered during the course of this proceeding, we now believe the standard does constitute a workable technical standard to produce digital wireless phones that can be used effectively with hearing aids.[125] ANSI C63.19 was made publicly available shortly before the adoption of the Notice, and Commission staff had a limited time within which to evaluate its applicability and usefulness for purposes of determining whether it was a standard that would be technologically feasible for digital wireless phones to meet. We have since had a more thorough opportunity to evaluate the standard and to obtain additional information from persons involved with the standard's development and initial testing, and it appears to be a workable technical standard for purposes of lifting the exemption for digital wireless phones.[126] We, therefore, find that the ANSI C63.19 standard for digital wireless phone compatibility with hearing aids is an established technical standard, as required by the HAC Act.

44. Feasibility of Meeting the ANSI Standard. In addition to requiring an established standard, the technological feasibility criterion of the HAC Act requires that wireless phones be capable of meeting that standard. In the record, manufacturers, including Motorola and Nokia, confirm that certain of their digital wireless phones across four air interfaces currently meet the U3 or higher rating required under the ANSI C63.19 standard for good performance with compliant hearing aids.[127] Because shielding can reduce the RF energy directed toward a user, such techniques have the potential to permit wireless phones to achieve the U3 or higher rating, and thus reduce the interference to hearing aids.[128] Contrary to Sprint PCS's assertion that reducing EMI from wireless phones will significantly reduce industrial design options,[129] there are a number of steps manufacturers might take to reduce EMI without significantly affecting handset designs. For example, printed circuit board shielding and shunt traces can effectively reduce EMI-causing emissions from printed circuit boards.[130] Also, cell phone enclosure shielding has evolved from plated metal, to plated plastic, to today's robotically-painted and EMI-gasketed parts, which can significantly reduce EMI.[131] As Sprint PCS states, some metals used for shielding, such as copper,

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[123] *See* ANSI ASC C63 SC8 Comments at 16 (stating that tests indicate the standard is 96 percent predictive of usability).

[124] *Notice*, 16 FCC Rcd 20558, 20560.

[125] *See generally* ANSI ASC C63 SC8 Comments; AAES Comments at 9-10.

[126] *See* ANSI ASC C63 SC8 March 21, 2003, *Ex Parte* Letter at 2-3; Motorola May 5, 2003, *Ex Parte* Letter at 1; Nokia July 1, 2003, *Ex Parte* Presentation at 8.

[127] These air interfaces include CDMA, GSM, iDEN, and TDMA. *See* Motorola January 31, 2003, *Ex Parte* at 16, and Nokia July 3, 2003, *Ex Parte* Letter.

[128] *See* Vickery Comments at 7-10; L. Kozma-Spytek, M.A. Research Audiologist, Gallaudet University Technology Access Program, Washington, D.C., "Digital Wireless Telephones and Hearing Aids" (visited June 17, 2003) <www.audiology.com>.

[129] *See* Sprint Feb. 4, 2003, *Ex Parte* Presentation at 4.

[130] The use of shunt traces, which are alternative paths for interfering currents, is reportedly one of the most effective means for reducing emissions from printed circuit boards. *See* S. A. Bokhari, "Analysis of the effect of Shunt Traces on the Radiation from Printed Circuit Boards," *Proceedings of the 1998 IEEE International Symposium on Electromagnetic Compatibility*, Vol. 1, July 1998, at 621.

[131] *See* N. Quesnel, "Optimizing EMI Shielding for Wireless Systems" (visited Feb. 25, 2003) <http://www.chomerics.com/tech/EMI_shld_%20Artcls/Wireless%20EMI%20Shielding.pdf>. Ericsson has developed a shield for its model T10s wireless phone that reduces the specific absorbed radiation by approximately 87 percent, while actually increasing the relative radio frequency power transmitted by approximately 45 percent. *See* M.I. Manning and M. Densley, "SARTest Report 0113 June 2001 On the Effectiveness of Various Types of

(continued....)

readily oxidize upon exposure to the environment.[132] However, techniques have been developed to prevent such metals from oxidizing.[133] Sprint PCS also notes that a capacitor intended to filter audio signal EMI would also reduce the gain of the audio signal.[134] We agree, because if the frequency of the undesired signal is at or near that of the desired signal, a filter designed to attenuate the undesired signal will also attenuate the desired signal.[135] Techniques other than filtering could be used to eliminate audio signal EMI.[136]

45. Although direct current (DC) wireless phone batteries do not typically produce EMI,[137] alternating current (AC) elsewhere in the phone, such as for the RF amplifier, the keypad light, and the display screen light can generate EMI to hearing aids. Techniques to mitigate such interference include passive inductive cancellation,[138] as well as the shielding techniques previously discussed. Also, several mobile phone manufacturers, including Kyocera, LG, Samsung, and Sanyo, are currently producing wireless phones with a programmable backlight setting that allow a user to select how long the display screen and keypad remain backlit after any key press is made.[139] As more manufacturers follow suit, then this source of interference to hearing aids users will be eliminated because consumers will be able to turn off or otherwise control the backlight.

46. In addition, we note that some wireless carriers are considering the use of directional antennas to improve network performance,[140] and that these antennas may also reduce the RF interference

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Mobile Phone Radiation Shields" prepared for the United Kingdom Department of Trade and Industry (visited Feb. 25, 2003) <http://www/dti.gov.uk/cii/docs/R500016att.pdf> at 7.

[132] *See* Sprint February 4, 2003, *Ex Parte* at 5.

[133] Typically, a nickel coating is applied over the copper, or other susceptible metal, to protect it from environmental exposure. *See* B. C. Jackson and G. Shawhan, "Current Review of the Performance Characteristics of Conductive Coatings for EMI Control," *Proceedings of the 1998 IEEE International Symposium on Electromagnetic Compatibility*, Vol. 1, July 1998, at 568.

[134] *See* Sprint February 4, 2003, *Ex Parte* at 5. Capacitor filters have gain that is dependent on signal frequency.

[135] *See* K. Lacanette, "A Basic Introduction to Filters – Active, Passive, and Switched-Capacitor," *National Semiconductor Corporation Application Note 779*, April 1991 (visited March 11, 2003) <http://www.swarthmore.edu/NatSci/echeeve1/Ref/DataSheet/IntroToFilters.pdf>.

[136] *See* T. Raper and S. Knauber, "Designing for Electromagnetic Interference (EMI) Compliance," March 1999 (visited June 26, 2003) <http://www.amd.com/epd/processors/2.16bitcont/16bitmc/22507/22507.pdf>.

[137] *See* Sprint PCS February 4, 2003, *Ex Parte* at 5.

[138] Inductive field cancellation is accomplished by configuring conductors in such a way so the positive field generated by one conductor is nearly cancelled by the negative field produced by the other conductor. *See Ex Parte* Letter from George DeVilbiss to Edmond Thomas, WT Docket No. 01-309 (filed February 26, 2003). *See also* P. Giddings, PE, "Getting a Perspective on Noise in Audio Systems" (visited June 26, 2003) <http://www.engineeringharmonics.com/papers/gpnas.htm>.

[139] *See* Sprint February 4, 2003, *Ex Parte* Letter at 5. *See also* Samsung March 3, 2003, *Ex Parte* Letter at 1.

[140] Some carriers are considering deploying directional phone and base stations antennas in so-called "diversity schemes" in order to improve wireless system performance and reduce the number of base stations needed. *See* D. McDonough, Jr., "Building a Better Wireless Antenna," *Wireless News Factor,* June 5, 2002 (visited March 5, 2003) <http://www.skycross.com/WNF_06052002.asp>. *See also* C. Beckman, "Development Trends in Antennas for Mobile Phones," Portable 2001 Conference, February 13-15, 2001, San Jose, CA (visited Feb. 19. 2003) <http://www.s3.kth.se/signal/edu/seminar/01/Portable2000.pdf>; J. H. Winters, "Smart Antennas for Wireless Systems," *IEEE Personal Communications,* February 1998 at 23-27; F. Viquez, "Smart Antenna Deployment in Next-Generation Wireless Systems" (visited Feb. 19, 2003) <http://www.base-earth.com/march-april2002/allied.html>.

experienced by some hearing aid users. A few vendors are currently working to develop accessory directional antennas that connect to the hands-free antenna port on the back of some handset models, and which are designed to reduce the level of RF emissions directed toward the hearing aid.[141] Some commenters claim that directional antennas could significantly impact wireless networks' performance by affecting initial call connection attempts and later handoffs, potentially requiring considerable changes to networks' configurations and operation.[142] Contrary to these assertions, however, directional antennas have the potential to help mitigate the effects of multipath, improve frequency bandwidth performance, achieve higher gain, and provide better directional control over emissions.[143] Although handsets that employ directional antennas may need to be slightly reoriented when used in certain locations, techniques such as antenna diversity are being considered to combat large-scale fading effects caused by shadowing from large obstacles (*e.g.*, buildings or other terrain features).[144] Because such antennas have the potential to significantly reduce the RF interference to hearing aids, as well as provide efficiency benefits both to the wireless network and to battery life, there are several benefits that could be gained from their increased use in handsets.

47. We note that some commenters claim that the Commission's rules appear to prohibit the use of directional wireless phone antennas.[145] Section 24.232(b) limits the power for broadband PCS mobile stations to 2 watts peak Effective Isotropic Radiated Power (EIRP), and the equipment must employ means to limit the power to a minimum necessary for successful communications.[146] A directional antenna manufacturer, Myers Johnson, Inc. (MJI), has filed a petition for revision of this rule. MJI believes that the rule, as it is written, prohibits the use of directional antennas.[147] We disagree. The EIRP requirement does not in any way prohibit employing wireless phone directional antennas. We do not interpret the rule to require antennas to radiate only in an isotropic pattern. Instead, section 24.232 only establishes the maximum power that can be transmitted from wireless phones. As a result, we deny Myers Johnson's petition to modify section 24.232.

48. In addition to employing techniques to reduce interference caused by digital wireless phones to hearing aids, we also believe it is technologically feasible for digital wireless phones to be made capable of inductive coupling with the hearing aid's telecoil (*i.e,* to meet a U3T rating). Nokia indicates that initial testing demonstrates that some of its phones meet the U2T to U4T magnetic field quality rating.[148] Although some wireless industry parties contend that a new standard for inductive coupling

[141] *See* Myers Johnson Petition at 3; Damax Oct. 21, 2002, *Ex Parte* at 1-2.

[142] *See* CTIA Comments at 23; Sprint Feb. 4, 2003, *Ex Parte* Presentation at 5.

[143] *See* note 140, *supra.*

[144] *See* A.J. Paulraj, D. Gesbert, C. Papadias, "Smart Antennas for Mobile Communications," *Paulraj, Gesbert, Papadias Encyclopedia for Electrical Engineering*, John Wiley Publishing Co., 2000 (visited March 5, 2003) <http://heim.ifi.uio.no/~gesbert/papers/encyclopedia_chapter.pdf>.

[145] See Cingular/Siemens January 22, 2003, *Ex Parte* at 5. In addition, stating its belief that the section 24.232 of our rules restricts the use of directional antennas in wireless phones, Myers Johnson, Inc., has petitioned the Commission to amend section 24.232 of our rules to limit the power supplied to the antenna to 32 dBm (1.584 Watts), and to require the equipment to employ the means to limit the power to the minimum necessary for successful communications. *See* Myers Johnson Petition at 1-4 (filed Jan. 27, 2003).

[146] *See* 47 C.F.R. § 24.232(b).

[147] *See* Myers Johnson Petition at 1-4.

[148] Nokia July 1, 2003, *Ex Parte* at 8. *See also* Nokia July 3, 2003, *Ex Parte* Letter (confirming that some of its phones meet the U3 and U3T criteria).

needs to be developed,[149] the ANSI C63.19 standard recommends specific magnetic intensity levels and signal plus noise-to-noise ratios (*i.e.*, quality levels) for successful inductive coupling with hearing aids.[150] The magnetic field specified in ANSI C63.19 can be provided by internal means via the voice coil of a wireless phone's dynamic speaker.[151] Alternatively, to increase durability and battery life and to decrease component weight, a wireless phone manufacturer may elect to incorporate an induction coil in addition to a non-inductive speaker assembly, such as a piezoelectric speaker, to provide the required magnetic field. ANSI C63.19 recommends that the location of the additional coil should be near but not necessarily centered on the speaker opening.[152] We note that some Samsung digital wireless phone models have designs which approximate the section 68.316 requirements for wireline hearing aid compatibility, and this appears to promote telecoil coupling capability.[153] In addition, consumers have reported finding some digital wireless phones that provide adequate telecoil coupling capability.[154] We also note that Audex Inc. has developed an external device which, when used with a digital wireless phone, generates a magnetic field that is sufficient to provide telecoil coupling capability.[155] This device is currently employed as an external attachment to certain handsets, fitting between the phone's body and the battery.[156] Alternatively, its functionality could be incorporated into a wireless handset itself.[157]

49. Because we believe that the U3 and U3T performance levels for normal use specified in ANSI C63.19 constitute an established standard which digital wireless phones currently available on the market meet, we conclude that it is technologically feasible for certain digital wireless phones to be made hearing aid compatible. The record evidence indicating that digital wireless phones can meet the U3 and U3T performance levels in the ANSI C63.19 standard is sufficient evidence to establish the requirement that such phones be capable of meeting the established technical standard. We recognize that, as the industry engages in testing and design work geared to comply with the U3 and U3T performance levels, the standard may need to be revisited. In addition, alternative approaches to the problem of providing greater wireless accessibility for hearing aid users should be explored. We encourage these steps as part of an evolutionary process that will ultimately lead to increased wireless communications accessibility for individuals with hearing disabilities.

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[149] *See* Letter from Diane Cornell, CTIA, to Marlene Dortch, FCC, WT Docket No. 01-309 at 2-3 (June 13, 2003) (CTIA June 13, 2003, *Ex Parte* Letter); Cingular May 16, 2003, *Ex Parte* Letter at 2; Motorola May 5, 2003, *Ex Parte* Letter at 1; Sprint July 3, 2003, *Ex Parte* Letter at 1.

[150] *See* ANSI C63.19 at 40-42.

[151] *See* CTIA Comments at 5; Motorola Comments at 4; Sprint PCS Comments at 28. *See also* "Motorola Products and Services Features" (visited May 6, 2003) <http://commerce.motorola.com/consumer/QWhtml/accessibility/features.html>.

[152] *See* ANSI C63.19 at 35.

[153] *See Ex Parte* Letter from Muzibul H. Khan, Samsung, in WT Docket No. 01-309 (March 3, 2003).

[154] *See* SHHH September 12, 2002, *Ex Parte* Presentation, Preliminary Results of SHHH Mobile Phone Survey at 2 and Comments on Accessories from Survey Respondents at 1; Dana Mulvany Reply Comments at 1; Letter from Susan Matt to Washington State SHHH Members (visited June 17, 2003) <http://www.wasa-shhh.org/telecommunications.htm>.

[155] *See* Audex Aug. 2, 2002, *Ex Parte* Letter at 1.

[156] The Audex CHAAMP accessory is currently designed to work with Nokia handsets. *See* Audex Aug. 2, 2002, *Ex Parte* at 1.

[157] *See* Audex Aug. 2, 2002, *Ex Parte* at 1.

D. Marketability

50. In order to modify the exemption contained in the HAC Act for wireless phones, the Commission must also find that compliance "would not increase costs to such an extent that the telephones...could not be successfully marketed."[158] Based on the record in this proceeding, we further find that it is possible for digital wireless phones to comply with the hearing aid compatibility requirement and that such a requirement would not increase the costs of such phones to such an extent that they could not be successfully marketed.

51. There is evidence on the record that supports a finding that compliance with U3 and U3T performance levels of the ANSI C63.19 standard is not only technologically feasible, but that such compliance can be achieved in competitively-priced digital wireless phones. As stated above, a number of manufacturers have asserted in this proceeding that they currently offer customers digital wireless phones that meet the U3 performance level of the ANSI C63.19 standard.[159] These entities manufacture digital wireless phones over all air interfaces and these digital wireless phones incorporate a variety of features. Also, manufacturers are producing digital wireless phones that approximate the magnetic field intensity for wireline telephones specified in section 68.316 of our rules.[160] While the U3T performance level goes beyond the wireline standards contained in our rules, we do not believe that digital wireless phones that meet the U3T performance level would be too costly to market. As we discussed above, modifications to the handset could yield the necessary magnetic field for inductive coupling, and it does not appear that such modifications will cause significant research and development or production costs.[161]

52. In addition, as the number of hearing aid and cochlear implant users continues to increase over the next several years,[162] we expect that demand for hearing aid-compliant handsets also will increase. This increased demand should drive down the costs of production for hearing aid-compliant phones. Moreover, to the extent manufacturers incorporate hearing aid compatible functionality into greater numbers of digital wireless handsets, this should also drive down the cost per unit and increase the likelihood that these phones could be successfully marketed. Based on this evidence, we conclude that the "marketability" criterion for modifying the exemption is met.[163]

V. REQUIREMENTS FOR HEARING AID COMPATIBILITY OF WIRELESS PHONES

53. In this Section, we detail the requirements that we adopt in this Order and provide a timeframe for implementation of those requirements. We adopt certain performance levels set forth in ANSI C63.19 as a technical standard to govern digital wireless phone compatibility with hearing aids. Within two years, we require each digital wireless phone manufacturer to make available to carriers and require each carrier providing digital wireless services to make available to consumers at least two handset models for each air interface it offers[164] which provide reduced RF emissions ("U3" rating) to

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[158] 47 U.S.C. § 610(b)(2)(C)(iv).

[159] *See supra* note 127; Motorola Jan. 21, 2003, *Ex Parte* Presentation at 14; Nokia July 3, 2003, *Ex Parte* Letter.

[160] *See* Samsung March 3, 2003, *Ex Parte*; 47 C.F.R. § 68.316.

[161] *See supra* para. 48.

[162] *See* SHHH Comments at 2 (number of individuals with hearing loss is increasing as a result of noise exposure and aging of society); Cochlear Americas May 16, 2003, *Ex Parte* at 1 (number of individuals who are candidates for cochlear implantation is growing by approximately 20 percent each year).

[163] *See* paras. 78-79, *infra* (discussing costs and benefits of our actions as required by HAC Act, 47 U.S.C. §610(e)).

[164] Under our requirements, digital wireless service providers are required to offer consumers at least two compliant phone models for each air interface they offer, but not necessarily two for every manufacturer they carry.

enable acoustic coupling.[165] Also within two years, we require each Tier I wireless carrier providing digital wireless services to make available to consumers at least two handset models for each air interface it offers to provide reduced RF emissions ("U3" rating) or 25 percent of the total number of phone models it offers, whichever is greater. Within three years, we require each digital wireless phone manufacturer to make available to carriers and require each carrier providing digital wireless services to make available to consumers at least two handset models for each air interface it offers which provide telecoil, or inductive, coupling ("U3T" rating). We adopt a *de minimis* exception to these requirements for certain digital wireless phone manufacturers and carriers.

54. To enhance consumer choice, we encourage digital wireless phone manufacturers and service providers to offer at least one compliant handset that is a lower-priced model and one that has higher-end features. By February 18, 2008, the date on which wireless carriers may discontinue providing analog service in accordance with the *Analog Sunset Order*,[166] we require 50 percent of all digital wireless phone models offered by a manufacturer or carrier to be compliant with the reduced RF emissions requirements. Additionally, we require manufacturers to label the handsets accordingly, and we require carriers to make available the performance rating of the compliant handsets. We require wireless carriers and digital wireless handset manufacturers to report semiannually (every six months) on efforts toward compliance during the first three years, then annually thereafter through the fifth year of implementation. We commit the Commission staff to deliver a report to the Commission shortly after three years from the effective date of this Order so we can examine the impact of these requirements. This report will form the basis for the Commission to initiate a proceeding soon after the report is issued to evaluate whether to increase or decrease the 2008 requirement to provide 50 percent of phone models, whether to adopt implementation benchmarks beyond 2008, and whether to otherwise modify the implementation requirements. We encourage hearing aid manufacturers to label their pre-customization products according to the ANSI standard. And, finally, we encourage phone manufacturers and service providers to engage in outreach efforts intended to educate the public, audiologists, hearing aid dispensers, and retail personnel concerning using digital wireless phones with hearing aids. These actions are described in greater detail below.

A. Adoption of ANSI C63.19 Performance Levels as the Applicable Technical Standard

55. As discussed above in Section IV.C, the ANSI C63.19 standard is the most relevant technical standard currently available for measuring whether a particular digital wireless phone is likely to work with a hearing aid with particular characteristics. This standard was developed by representatives of a number of interested parties, including wireless carriers, digital wireless phone manufacturers, and hearing aid manufacturers, as well as by representatives from the FCC and FDA. While we recognize that some parties have asserted that ANSI C63.19 is not a perfect tool for ensuring that any given hearing aid will work with a particular digital wireless phone,[167] we believe the standard presents a workable approach to measuring levels of interference digital wireless handsets cause to hearing aids, as well as for measuring the immunity of hearing aids. In addition, ANSI C63.19 sets forth obtainable performance characteristics for wireless phones and provides a reasonable methodology for predicting the likelihood that two devices will work together.

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[165] *See supra* at para. 22 (explaining that acoustic coupling involves all sounds being received by the hearing aid's microphone, being converted to electrical signals and amplified as needed, and then being converted back into sound through the hearing aid's speaker).

[166] *Analog Sunset Order,* 17 FCC Rcd 18401, 18419. *See* para. 21, *supra* (describing process by which carriers may discontinue providing analog service).

[167] *See* Sprint PCS Comments at 14-16; Sony Ericsson March 13, 2003, *Ex Parte* Presentation at 4; Nokia April 10, 2003, *Ex Parte* Presentation at 9; Samsung Telecommunications America March 21, 2003, *Ex Parte*, Letter at 2.

56. As discussed above, a digital wireless handset which meets a U3 rating for reduced RF interference and a U3T rating for telecoil coupling would likely result in normal performance with a U2-rated hearing aid and in excellent performance for a person using a U3-rated hearing aid.[168] Hearing aid manufacturers indicate that the majority of hearing aids being produced today are capable of meeting an immunity level that would result in good performance with a digital wireless phone meeting the U3 or U3T requirements under the ANSI standard. As a result, we find that a requirement that handsets meet a *U3 and U3T rating under ANSI C63.19 will facilitate successful combinations of hearing aids and digital* wireless phones, and should be mandated. The record indicates that there are some digital wireless handsets presently on the market that meet the U3 level, and while further testing is necessary, it appears that there are some handsets which produce a sufficient electromagnetic field to permit telecoil coupling with hearing aids.[169] This may mean that these handsets either already do meet the U3T rating under ANSI C63.19, or that they could feasibly meet that rating with some minor modifications.

57. Some wireless phone manufacturers have questioned whether handset compliance with ANSI C63.19 will ensure a successful consumer experience in all cases, particularly since we are not imposing immunity requirements on hearing aid manufacturers.[170] HIA has expressed concern regarding the labeling of hearing aids, particularly since they are highly customized for each person's physiology and individual hearing loss and it is difficult to predict whether a particular hearing aid will provide the same level of immunity for every user.[171] Nonetheless, by requiring digital wireless phones to provide a reduced level of RF emissions and to provide telecoil coupling capability as described in this Order, we believe that a greater number of hearing aid and cochlear implant users will be able to find digital wireless phones that will work for them. Also, it appears that, by meeting the ANSI C63.19 performance standards, compliant digital wireless phones will have improved audio quality. As a result, we do not need to impose rules concerning volume control of wireless phones like those governing wireline phones.

58. Hearing aid manufacturers have increased the immunity of hearing aids in recent years, and they state that, if a digital wireless handset meets the U3 or U3T or better rating under ANSI C63.19, "HIA member companies can identify hearing aids that have been designed to meet higher immunity levels as compatible with digital handsets that meet [the U3 and U3T requirements.] Further, HIA members, as a policy, will continue to provide at least a 30-day trial period on hearing aids respective companies consider to be compatible and offer a full refund should the hearing aid not meet the customer's expectations."[172] HIA has committed that, in the event we adopt such performance requirements for digital wireless phones, its members would allow the user a 30-day trial period, and the manufacturer would take the hearing aid back for a full refund "if it cannot be adjusted, re-manufactured, or replaced to satisfy the needs of the user."[173]

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[168] ANSI C63.19 at Section 7.2, Table 1 (p. 39).

[169] *See* SHHH September 12, 2002, *Ex Parte* Presentation, Preliminary Results of SHHH Mobile Phone Survey at 2 and Comments on Accessories from Survey Respondents at 1; Dana Mulvany Reply Comments at 1; Letter from Susan Matt to Washington State SHHH Members (visited June 17, 2003) <http://www.wasa-shhh.org/telecommunications.htn>.

[170] *See* Cingular/Siemens April 4, 2003, *Ex Parte* Presentation at 6, 15; Motorola July 3, 2003, *Ex Parte* Letter at 2, 4; Sony Ericsson March 13, 2003, *Ex Parte* Presentation at 4, 7.

[171] *See* HIA March 26, 2003, *Ex Parte* at 2-3. Although HIA has expressed concern regarding what claims hearing aid manufacturers can make on product packaging with respect to compatibility with digital wireless phones, we note no FDA enforcement issues that would preclude such labeling. *See* Letter from Harold A. Pellerite, FDA Center for Devices and Radiological Health, to Marlene H. Dortch, WT Docket No. 01-309 (July 2, 2003).

[172] HIA February 20, 2003, *Ex Parte* at 2.

[173] HIA March 26, 2003, *Ex Parte* at 2.