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

In the Matter of	)	
Section 68.4 of the Commission's Rules Hearing Aid-Compatible Telephones	)	RM No. 8658

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REPLY COMMENTS OF GSM MOU ASSOCIATION

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REPLY COMMENTS OF GSM MOU ASSOCIATION

GSM MoU Association ("GSM MoU") hereby replies to the comments submitted in response to the petition for rulemaking filed by Helping Equalize Access Rights in Telecommunications Now ("HEAR-IT NOW") to amend the exemption contained in section 68.4(a) of the Commission's Rules to require broadband PCS devices, and particularly devices using the PCS operating system called the Global System for Mobile Communications ("GSM"), to be hearing aid compatible. The comments provide no grounds for mandating that broadband PCS devices be redesigned to meet hearing aid compatibility requirements. For the reasons set forth below, the Commission should recognize the extent of inter-industry cooperation to address this issue already in progress and decline to initiate the rulemaking that HEAR-IT NOW has requested.

INTRODUCTION AND SUMMARY

In its opposition, GSM MoU demonstrated that there is no basis for granting HEAR-IT NOW's petition. As an international association of GSM licensees and government regulators, GSM MoU showed in particular that HEAR-IT NOW has misstated the experiences of hearing aid wearers in Europe and the Pacific Rim with respect to

interference from the GSM systems in operation there. In fact, as GSM MoU demonstrated, the European and Pacific Rim GSM telephones, which operate at higher power levels and lower frequencies than the phones that are planned for U.S. use, generally have caused interference only to those hearing aid wearers who wear older, inadequately shielded devices.

None of the comments filed in response to the petition offers any valid evidence to the contrary. Moreover, since the comments contain no convincing evidence that GSM systems will cause interference to hearing aids in the United States, the comments confirm that petitioner has not satisfied the applicable legal standard for revoking the exemption for PCS devices from hearing aid compatibility requirements. To the extent that a potential problem with electromagnetic incompatibility may exist, however, the comments reflect a clear consensus that the Commission should give the affected industries and consumer groups an opportunity to continue the work already started to reach a mutually acceptable solution appropriate to the U.S. marketplace, instead of imposing unnecessary regulatory burdens that will impede the long-awaited deployment of a global technology in the United States.

As discussed below, the Commission should deny HEAR-IT NOW's petition.

I. THE COMMENTS REFUTE PETITIONER'S CONTENTION THAT GSM SYSTEMS CAUSE SERIOUS ELECTROMAGNETIC INTERFERENCE PROBLEMS FOR HEARING AID WEARERS.

The comments filed in this proceeding refute HEAR-IT NOW's claim that GSM systems will cause serious electromagnetic interference problems for U.S. hearing aid wearers. Indeed, the comments make clear that the evidence of the European and Pacific Rim experiences -- the sole evidence on which petitioner relies -- does not remotely support

its claims. Even the few commenters that share petitioner's view offer no convincing evidence supporting its position.

In its opposition, GSM MoU presented unrebutted evidence from international experts that the GSM devices in operation in Europe and the Pacific Rim have not caused the serious electromagnetic incompatibility problems that petitioner claims. In particular, GSM MoU showed that: (i) hearing aid wearers are using GSM telephones successfully throughout the world; (ii) all electronic devices, including hearing aids, potentially are subject to electromagnetic interference from all digital equipment; (iii) European and Pacific Rim GSM telephones cause less interference to hearing aids than many other digital devices, and in fact generally have interfered only with older, inadequately shielded hearing aids; (iv) cost-effective hearing aid shielding, such as the use of conductive paint or shunt capacitors, substantially alleviates, if not eliminates, the interference problem; and (v) any interference problem that hearing aid wearers will experience in the United States is likely to be even more minimal than that experienced in Europe and the Pacific Rim, since the U.S. systems will operate at lower power and higher frequencies. The vast majority of the other commenters agree with GSM MoU.[1/]

Nothing in the comments provides any sound evidence suggesting that the planned U.S. GSM systems will create electromagnetic incompatibility problems for hearing aid users or any threat to the public health. In fact, only one commenter even submitted any

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[1/] See, e.g., BellSouth Comments at 8 n.16; Cellular Telecommunications Industry Association ("CTIA") Comments at 2, 4, 18-24; Ericsson Corporation ("Ericsson") Comments at 4-7; Northern Telecom Inc. ("Nortel") Comments at 4; Pacific Bell Mobile Services ("Pacific Bell") Comments at 2; Southwestern Bell Mobile Systems, Inc. ("SBMS") Comments at 2-4, 6-7.

"evidence" purporting to demonstrate the existence of an interference problem. QUALCOMM Incorporated ("Qualcomm"), the company that developed the rival Code Division Multiple Access ("CDMA") technology and that will be manufacturing CDMA phones, purports to show that most hearing aid users cannot use GSM phones at any feasible power level, while they will be able to use Qualcomm's own CDMA phones.

As the report of Henry Galle Stech of Telecom Danmark A/S shows,[2] Qualcomm's study is inconsistent with prior extensive research conducted in Denmark and contains major technical flaws that invalidate the study's conclusions. First, the study erroneously concludes that hearing aid wearers cannot use a GSM telephone, since the Danish report on which the study relies in fact determined that 62% of the modern in-the-ear hearing aids used in Denmark could be worn while using a 2 watt GSM phone.[3] Second, the Qualcomm study incorrectly concludes that a hearing aid user will receive interference from others using GSM phones several meters away; the Danish test results showed, however, that 91% of the in-the-ear hearing aids tested could not be disturbed 30 cm away from an active 2 watt GSM phone, and that 77% of the behind-the-ear hearing aids could not be disturbed from 1 meter away. Third, the Qualcomm study uses an erroneous GSM peak transmitter power. Fourth, since the study uses an insufficient hearing aid sample size -- only six hearing aids compared with the over 100 hearing aids tested in Denmark -- the

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[2] Henry Galle Stech's report is located at Attachment 1 hereto.

[3] See Conclusive Report by the Working Group on GSM and DECT Telephones and Hearing Aids, National Telecom Agency of Denmark, "Interference With Hearing Aids Caused by GSM Digital Cellular Telephones and DECT Digital Cordless Telephones" (June 28, 1994) (Exhibit 1 to HEAR-IT NOW petition).

study's results are not scientifically credible; indeed, the only hearing aid identified in the study apparently is over 15 years old. Fifth, properly interpreted, the data used in Qualcomm's study actually show that there is no difference in terms of interference to hearing aid wearers between GSM and CDMA systems.

But even aside from these defects in the Qualcomm study, the study does not satisfy the generally accepted guidelines for such studies in the scientific community, because it does not provide sufficient information to replicate the test results.[4/] Testers must consider a large number of variables in examining the potential of digital devices to create electromagnetic interference to hearing aids, including, among others, the models of the hearing aids and digital equipment used, the number of cell sites in existence, the number of people using the system at a particular time, antenna configuration, power levels, and frequencies. Although the Qualcomm study provides some of this information, it does not provide sufficient details to enable replication of its test results. For example, the Qualcomm study only names one of the six hearing aids that it tested. As a result, the study amounts to little more than an advertisement for Qualcomm's own product.

Two other parties also filed comments in support of petitioner, but their comments contain nothing more than generalized assertions unsupported by any evidence.[5/]

[4/] See N.M. Ryanwenger, "Guidelines for Critique of a Research Report," Heart & Lung, Vol. 21, No. 4, at 394 (July-Aug. 1992) (explaining that the tenets of the scientific method, measurement theory, statistical principles, and research ethics require scientific research to satisfy the criteria of credibility, integrity, and potential for replication).

[5/] After the deadline for filing opening comments in this proceeding, over 200 persons submitted letters to the Commission, and others submitted signed petitions, supporting petitioner's position. A number of these letters apparently were precipitated by a recent

(continued...)

Liss Communications Research ("Liss") asserts simply that, unless the Commission grants HEAR-IT NOW's petition, hearing aid wearers will not be able to experience the benefits of PCS devices. The Hearing Industries Association ("HIA") baldly asserts that "[s]ome of the PCS systems . . . appear to be incompatible with hearing aids," and goes on to allege that unnamed European studies support this conclusion.[6] HIA further claims that the small size of U.S. hearing aids will make shielding or other protective measures unworkable, although it offers no evidence to support its statement.[7]

GSM MoU has demonstrated that the evidence contradicts these unsupported claims. For example, in a March 1995 letter clarifying the conclusions of a previous study, Dr. Lauridsen reported that, with the exception of older, inferior quality hearing aids, hearing aid users could use 2 watt GSM telephones without interference, and he further stated that the Danish Telecom Inspector had received no complaints of interference with

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[5](...continued)
article asserting that the European experience has demonstrated that GSM phones interfere with hearing aids. See Bill Machrone, "Portable Telephones for Everyone," PC Magazine, July 1995, at 83. As GSM MoU has demonstrated, that article misstates the facts. Moreover, none of the letters or petitions supporting petitioner offers any evidence that an interference problem will exist in the United States. GSM MoU nevertheless takes seriously the concerns expressed in these filings. Indeed, precisely because of such concerns, GSM MoU believes that it is imperative for the digital wireless industry to continue to investigate the interference question and to work cooperatively with all interested parties to reach solutions to potential interference problems that are appropriate to the U.S. marketplace and fair to all concerned.

[6] See HIA Comments at 2-3.

[7] Id. at 3.

hearing aids.[8] Similarly, in May 1995, the National Acoustic Laboratories of Australian Hearing Services, a Commonwealth Government Authority, concluded that interference can be resolved in most cases through the use of properly shielded hearing aids.[9]

HIA also errs in its claim that shielding will not work for small, deep-in-the-ear hearing aids. Small hearing aids can be shielded, such as by coating them with conductive paint, just as easily as larger hearing aids. Indeed, the very small, deep-in-the-ear hearing aids that are popular in the United States market presently are in use in Europe and satisfy the European Union's EMC directive, 89/336/EEC, which requires electronic equipment, such as hearing aids, to be immune from RF electromagnetic fields of 3 V/m by January 1, 1996. Moreover, as Nortel's comments note, such hearing aids are much less prone to electromagnetic interference in any event.[10]

Henry Galle Stech's report confirms Nortel's conclusion.[11] As the Stech report explains, since small in-the-ear hearing aids collect much less RF-energy from the radiated field than larger, behind-the-ear hearing aids, in-the-ear hearing aids are more immune to radio transmissions from GSM phones than behind-the-ear hearing aids. In fact,

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[8] See Letter to Honorable Reed E. Hundt, Chairman, FCC, from Ole Mørk Lauridsen, Corporate Director R&D, Telecom Denmark, at 1 (March 26, 1995) (Attachment 1 to GSM MoU Opposition).

[9] See National Acoustic Laboratories, "Interference to Hearing Aids by the New Digital Mobile Telephone System, Global System for Mobile Communications (GSM)," NAL Report No. 131, at Abstract iv (May 1995) (Attachment 4 to GSM MoU Opposition).

[10] Nortel Comments at 4.

[11] See Report of Henry Galle Stech (Attachment 1).

the Danish tests showed that, for more than 62% of the in-the-ear hearing aids tested, the hearing aid user was able to use a 2 watt GSM phone without any interference.

The statement of Dr. Arne Foxman, head of the Land Mobile Systems Section of the Technical Division of Tele Danmark Mobil A/S, one of the two Danish operators licensed to provide GSM services in Denmark in the 900 MHz band, further rebuts the claims of Qualcomm, Liss, and HIA.[12/] Dr. Foxman, who himself is hearing impaired and wears in-the-ear hearing aids, works with and around, and uses, 2 watt GSM phones on a daily basis. In his statement, Dr. Foxman states that he currently has two types of hearing aids. With one set, which he uses on a daily basis both in the office and in his private life, he has no problem whatsoever in using a handheld GSM phone; similarly, he hears no interference from any GSM phone in the vicinity. With the other set, which is useful for international meetings with marginal listening conditions (such as those resulting from loudspeaker systems and speaker microphones), he can use GSM phones with a walkman-type plug-in unit, which several mobile phone manufacturers offer; although interference from a nearby GSM phone creates a low, tolerable buzzing sound, he can alleviate that interference simply by slightly shifting his position. Dr. Foxman further notes that the interference issue is not a current problem in Denmark, and that his company receives virtually no complaints from subscribers about interference. Dr. Foxman's statement plainly shows that petitioner and those supporting its position are wrong in asserting that the deployment of GSM technology in the United States will harm all hearing aid wearers.

[12/] See Statement of Dr. Arne Foxman (Attachment 2).

In sum, the comments filed in response to HEAR-IT NOW's petition do not even suggest, much less prove, the existence of any public health problem, and those comments clearly demonstrate that the European and Pacific Rim evidence on which petitioner relies does not support its position. The Commission therefore should deny the petition.

II. THE COMMENTS CONFIRM THAT PETITIONER HAS NOT SATISFIED THE LEGAL STANDARD FOR REVOKING THE EXEMPTION FOR PCS DEVICES FROM HEARING AID COMPATIBILITY REQUIREMENTS.

The vast majority of the commenters agree that petitioner has failed to satisfy the four legal requirements for revoking the exemption for PCS devices from the hearing aid compatibility requirements of the Hearing Aid Compatibility Act of 1988[13/] and the Commission's implementing regulations.[14/] Indeed, no commenter provides any basis for concluding that HEAR-IT NOW has satisfied even one of the four statutory criteria for removing the exemption.

First, nothing in the comments assists petitioner in showing that eliminating the exemption for PCS devices will serve the public interest. To the contrary, the vast majority of the commenters agree that, particularly in light of the absence of any evidence of a serious interference problem in the United States, requiring hearing aid compatibility in fact would disserve the public interest.[15/] The delay in the rapid deployment of PCS systems would reduce the availability of digital wireless telecommunications to all

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13/ 47 U.S.C. § 610.

14/ 47 C.F.R. §§ 68.4, 68.5.

15/ See, e.g., BellSouth Comments at 3, 5; CTIA Comments at i, 2, 26-29; Nortel Comments at 3; Personal Communications Industry Association ("PCIA") Comments at 3-6.

Americans, and exclude the United States from participating in a global digital system. GSM MoU agrees with other commenters that requiring hearing aid compatibility also would disserve the public interest by undermining the competitive market forces to which the Commission has deferred for the selection of PCS operating standards.[16]

Second, the comments do not show that maintaining the exemption would have an adverse effect on hearing-impaired individuals. As discussed above, many of the commenters agree that, although users of poorly shielded hearing aids may have experienced some discomfort as a result of the higher-powered systems of other countries, the extent of such a problem as PCS becomes widespread in the United States over the next few years is purely speculative, and any remaining problem will be alleviated substantially as existing unshielded hearing aids are replaced in the ordinary course during the same time period. In fact, the statement of Dr. Foxman plainly shows that many hearing aid wearers can use high-power GSM phones today without any problem at all.

Third, the comments confirm that compliance with the hearing aid compatibility requirements is not feasible at this time.[17] In fact, none of the comments in support of the petition even suggests that compliance currently is feasible. As GSM MoU noted in its opposition, apart from the obvious delay in the deployment of PCS systems that imposing a compatibility requirement would cause, it is unreasonable to require manufacturers that already have spent several years and billions of dollars developing a new technology to unilaterally shoulder the burden of redesigning their systems to correct a

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[16] See, e.g., BellSouth Comments at 2, 5-6; CTIA Comments at 27.

[17] See, e.g., BellSouth Comments at 2, 6-7, 9.

speculative problem. Nevertheless, the wireless industry is eager to do its part to ensure that its products are available to the hearing-impaired community, and it therefore is participating actively in cooperative inter-industry efforts to find mutually acceptable solutions that will be appropriate for the American marketplace. In light of the technical infeasibility of redesigning GSM systems to make them hearing aid compatible and the industry's participation in these cooperative efforts, a government-imposed requirement plainly would be inappropriate.

Fourth, the comments show that petitioner has failed to make its case that the costs of compliance with the hearing aid compatibility requirements would not result in GSM devices being unmarketable. Like petitioner, Liss urges that PCS equipment has not yet been designed, marketed, or installed, and that the expense of making that equipment hearing aid compatible therefore will be far less than the expense of eventual retrofitting.[18/] But the fact that PCS has not yet been deployed in the United States is irrelevant to the question of who should bear the cost, particularly when the evidence shows that simple, cost-effective hearing aid shielding can resolve the vast majority of interference problems that may arise. The industry has made a substantial investment in the development of the technology and the infrastructure to deploy GSM phones in the United States, and changes at this late date -- particularly changes that require the addition of components that most consumers may find unnecessary and burdensome -- ultimately will result in higher consumer prices for phones that have features that many consumers find undesirable. Such changes could well make GSM phones unmarketable.

[18/] Liss Comments at 2-3.

Thus, neither petitioner nor the commenters that support it can satisfy the legal standard for removing the exemption for PCS systems from hearing aid compatibility requirements. To the contrary, the comments clearly show that maintaining the exemption is appropriate, and that HEAR-IT NOW's petition is meritless.

III. THE COMMENTS SHOW THAT INTER-INDUSTRY COOPERATION TO ACHIEVE ELECTROMAGNETIC COMPATIBILITY IS OCCURRING AND IS THE FAIREST WAY TO RESOLVE INTERFERENCE MANAGEMENT PROBLEMS THAT MAY ARISE.

Despite the absence of any evidence that a serious electromagnetic interference problem will exist in the United States, the comments reflect the wireless industry's recognition that it bears an ongoing social responsibility to develop fair and appropriate solutions to potential interference problems. The comments further demonstrate a clear commitment by the wireless industry to investigate potential interference management problems, and to work with hearing aid manufacturers, representatives of the hearing-impaired community, technical experts, and others in cooperative efforts to address such problems in a manner that meets the needs of the U.S. marketplace. Indeed, the industry already is participating actively in such efforts.

As a number of the commenters correctly state, the rulemaking that petitioner seeks is unnecessary. The wireless industry already is investigating concerns that, despite the lack of evidence, GSM phones may interfere with some inadequately shielded hearing aids. In fact, the comments demonstrate that many in the digital wireless industry currently are participating in joint efforts to collect the necessary data and find workable solutions.[19]

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[19] See, e.g., CTIA Comments at 17; Ericsson Comments at 7; Nokia Mobile Phones, (continued...)

For example, as the comments explain, the wireless industry on its own has undertaken substantial research, such as through the Center for the Study of Wireless Electromagnetic Compatibility at the University of Oklahoma.[20] The Center is researching and developing solutions to electromagnetic incompatibility problems, including concerns that wireless telecommunications cause interference to hearing aids. The Center has announced that it will complete its hearing aid interference research within the next six months.[21]

As an international association, GSM MoU has been, and plans to remain, at the forefront of cooperative efforts around the world to address the interference issue in a manner that fits each country's particular needs. In its opposition, GSM MoU detailed its participation in those activities, discussing its members' history of funding studies under the Association's auspices, as well as its own work with the European Hearing Instruments Manufacturers Association and the European Telecommunications Standards Institute to explore solutions to potential interference problems. As a further illustration of the importance that GSM MoU places on these and other cooperative efforts, GSM MoU has contacted the Hearing Industries Association ("HIA") to ascertain whether it, as an association representing hearing aid manufacturers and a party that urges in this proceeding that an interference problem exists, would collaborate with GSM MoU to reach mutually acceptable solutions. HIA has agreed tentatively to enter into a joint cooperation program

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[19](...continued)
Inc. Comments at 2-3; Nortel Comments at 3-4; Pacific Bell Comments at 2; PCIA Comments; Siemens Stromberg-Carlson Comments at 2; SBMS Comments at 4-6; Telecommunications Industry Association Comments at 2-4.

[20] See CTIA Comments at 2, 5, 12-15; PCIA Comments at 3.

[21] See Communications Daily, July 10, 1995.

with GSM MoU in an effort to meet the needs of the hearing-impaired community, and GSM MoU looks forward to a productive relationship.

In light of (i) the lack of evidence to support petitioner's assertions, and (ii) the wireless industry's leadership in inter-industry cooperative efforts to resolve any potential interference problems that may arise, there is no reason for governmental intervention at this time. Nor should governmental intervention be necessary in the future, since GSM MoU fully expects that the commitment to cooperative efforts expressed in the comments filed by members of the wireless industry will result in fair solutions to potential interference problems. In short, the solution to petitioner's claims is not to ban GSM systems, but to have the wireless services industry, hearing aid manufacturers, the hearing-impaired community, and responsible experts cooperatively ascertain the scope of any problem and develop voluntary solutions that are fair to all concerned. GSM MoU remains committed to being a part of those cooperative efforts in the United States and around the world.[22/]

[22/] The United States Telephone Association ("USTA") urges the Commission to issue a Notice of Inquiry, rather than a Notice of Proposed Rulemaking, so that the Commission can evaluate whether evidence exists that would necessitate an amendment of the Commission's Rules. (USTA Comments at 2-3.) For the reasons discussed above, GSM MoU agrees with USTA that a rulemaking proceeding is inappropriate. But in light of the lack of evidence of an interference problem in the United States, GSM MoU urges the Commission to let the affected industries continue to respond cooperatively to the potential interference problems that may be perceived to exist or that may be found to exist once PCS is brought to market, rather than conducting further regulatory proceedings that could impede those important efforts.

CONCLUSION

For these reasons, as well as the reasons set forth in GSM MoU's opposition to the petition for rulemaking, the Commission should deny the petition for rulemaking.

Respectfully submitted,

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ATTACHMENT 1

TELECOM DANMARK

Report of Henry Galle Stech
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I am the manager of the Electromagnetic Compatibility department of Telelaboratoriet, which is part of the corporate R&D of the Tele Denmark Group, the telecommunications company of Denmark. The EMC department advises Tele Danmark on EMC issues and has one of the top laboratories in the world for testing electromagnetic compatibility. As department manager, I am responsible for overseeing the operations of the department. In that capacity, I also played a major role in the preparation of an extensive report on GSM interference with hearing aids issued by the National Telecom Agency of Denmark on June 28, 1994, entitled "Interference With Hearing Aids Caused by GSM Digital Cellular Telephones and DECT Cordless Telephones".

I have been directly involved for several years in evaluating and resolving EMC problems. Prior to joining Tele Danmark two years ago, I spent 13 years in the development department of Motorola's Danish subsidiary, where I was product manager for several radio communication products being developed in Denmark. In particular, I was responsible for developing cellular products and addressing related EMC issues.

I have reviewed the comments of QUALCOMM Incorporated concerning the petition for rulemaking filed by Helping Equalize Access rights in Telecommunications Now, and the July 6, 1995 study attached to those comments by Eber F. Lambert, entitled "Measurement of RF Interference by CDMA and GSM Digital Cellular Portable Telephones on Hearing Aids". I also have reviewed the comments submitted by the Hearing Industries Association. Both submissions are seriously flawed. My conclusions with respect to those documents follow.

A. QUALCOMM Study

QUALCOMM's study is inconsistent with prior extensive research conducted in Denmark and contains major technical flaws that invalidate the study's conclusion that CDMA signals are less likely to cause objectionable interference to hearing aids that GSM signals. The QUALCOMM study is invalid for at least the following reasons:

TELECOM DANMARK

1. **Hearing Aid Wearers' Use of GSM Phones**. In the introduction, the QUALCOMM study states that "it is very unlikely that any hearing aid user could make a telephone call using a GSM portable with a hearing aid assisted ear", and the study further states that this conclusion is consistent with the test results contained in other reports, including a report from Denmark. The Danish report to which the study apparently refers is the Conclusive Report by the Working Group on GSM and DECT Telephones and Hearing Aids, entitled "Interference With Hearing Aids Caused by GSM Digital Cellular Telephones and DECT Digital Cordless Telephones", which was issued by the National Telecom Agency of Denmark on June 28, 1994. The QUALCOMM study misstates the Danish test results. In fact, the Danish tests concluded that more than 62% of modern in-the-ear ("ITE") hearing aids used in Denmark could be worn while making a telephone call using a 2 Watt GSM portable handset.

2. **Disturbance From Others Using GSM Telephones.** The QUALCOMM study incorrectly concludes that a hearing aid user will be disturbed by other people's use of GSM portables several meters away. The Danish findings clearly showed, however, that a modern ITE-type hearing aid will not be disturbed at a distance of 1 meter from and active 2 Watt GSM handportable. Furthermore, the Danish test results showed that 91% of all ITE hearing aids tested could not even be disturbed at a distance of 30 cm from an active 2 Watt GSM portable. In addition, the Danish test results showed that 77% of all modern behind-the-ear ("BTE") hearing aids could not be disturbed at a distance of 1 meter from an active 2 Watt GSM handportable. In short, in contrast to the results reported in QUALCOMM's study, extensive Danish research has concluded that the absolute majority of modern hearing aids will not be disturbed by GSM handportables.

3. **Incorrect GSM Transmitter Power.** The QUALCOMM study uses an incorrect transmitter power for GSM. In comparing the transmitter peak power of GSM and CDMA handportables, the study incorrectly states in the Introduction that a GSM handportable always will transmit a peak power level "at least 10 to 17 dB (or 10 to 50 times) greater that CDMA phones". In fact, although a 2 Watt GSM handportable belongs to the GSM "Power Class 4", the transmitter peak power can be reduced through power control to 13 dBm or 20 mW, which is the same minimum peak power level that the study quotes for QUALCOMM's CDMA handportables. Thus, the minimum peak power level for GSM and CDMA handportable is identical. In estimating the interference level to a given hearing aid from a GSM and a QUALCOMM CDMA handportable, the study therefore should have used the same transmitter peak power level. Moreover, the study's conclusions are misleading since, with the DCS1900 GSM system at 1900 MHz, the minimum peak power level will be only 1 mW.

4. **Insufficient Sample Size.** The test described in the QUALCOMM study used an insufficient sample size. Page 2 of the study states that the sample was limited to only "six different hearing aids from three different manufacturers". In contrast, the Danish test on hearing aid immunity to interference from GSM phones was carried out on more that 100 types of hearing aids, representing the best-selling hearing aid types in Denmark and Norway during the period 1991-1993.

No one possibly could derive any final conclusion with respect to GSM interference based on the performance of only six hearing aids. Most of the over 100 hearing aid types evaluated in the Danish hearing aid test possessed excellent immunity properties toward GSM signals and could not be disturbed. A very limited number of hearing aids (4-5 different types) did possess rather poor immunity properties, however, and could be disturbed easily. If a sample size is too small, there is always a risk that the sample size contains too may "deviants" and that the conclusions of the study will be based on the deviant group. That appears to have been the case here. The QUALCOMM study thus must extend the sample size of the tested hearing aids substantially in order to make the results of the study scientifically credible.

The size of the QUALCOMM sample is particularly important to the scientific credibility of the study since an impartial authority did not select the hearing aids being tested. In order to guarantee the quality of the Danish hearing aid test, Danish Telecom Agency (the national governmental authority on telecommunications matters), in close cooperation with the Danish Association for Equal Rights of the Handicapped, selected the hearing aids to be evaluated, in order to ensure an unbiased and credible evaluation. The QUALCOMM study contains no such guarantee, and thus there is no assurance that a fair range of hearing aids was studied.

For example, the only hearing aid mentioned by name in the study is the Phonak PE845 hearing aid. Phonak is a Swiss hearing aid manufacturer that makes high end, very reliable products. The Danish hearing aid study tested Phonak products. In fact, Phonak manufactured and supplied some of the hearing aids that the Danish test found had the highest GSM immunity; those hearing aids could sustain RF-fields in excess of 100 V/m without interference. But the specific type of Phonak hearing aid that QUALCOMM's study tests - PE845 - is unknown to us, our audiological experts, and the Danish Phonak subsidiary. The Danish Phonak subsidiary found some reference material in its files indicating that this hearing aid type presumably was manufactured in the late 1970s or early 1980s. It clearly would be inappropriate if QUALCOMM's study evaluated hearing aids that are more than 15 years old and that were manufactured at a time when hearing aids were not designed to handle interference from digital equipment.

5. <u>Questionable GSM and CDMA Interference Data.</u> In contrast to the conclusion of the QUALCOMM study, QUALCOMM's data show that the interference situation with GSM in fact is similar to the situation with CDMA (as it is with many other digital technologies). The table at the top of page 5 of the study states the necessary transmitter power level for a CDMA signal to generate audible interference to hearing aids at a distance of 2 cm. These power levels vary from 8.0 dBm to −3.3 dBm. The data can be represented with an average peak power level value of 1.2 dBm = 1.3 mW (and a deviation of around 3 dB).

These measurements were taken at 1900 MHz with the hearing aid 2 cm away from the transmitter antenna. Using a "simple antenna", such as a dipole, the antenna nearfield limit is given by the requirements of **kr**>1, where **k** is the wavenumber and **r** is the distance to the antenna. In the specific situation, **kr** equals 0.8, meaning that the hearing aids being tested were somewhat within the radiating nearfield of the antenna.

Ignoring the nearfield correction factor, and assuming an ideal lossless dipole antenna on the CDMA handportable, then the average peak power value of 1.3 mW corresponded to a field strength of 12.6 V/m at the hearing aid for interference to be detected. This number differs form the results of the Danish hearing aid test at 1900 MHz, in which more than 60% of the ITE-type hearing aids could be operated without interference at a fieldstrength of 25 V/m or higher.

Comparing the QUALCOMM CDMA results with the Danish results at 1900 MHz, one might be tempted to state that CDMA-based handportables generate interference at 1900 MHz at 6 dB lower peak transmitter power. But the QUALCOMM and the Danish tests used different hearing aids, and no nearfield correction factor was used in calculating fieldstrength from QUALCOMM's transmitter power data. Thus, based on the available data, the interference situation with both GSM and CDMA is similar.

This similarity is reflected in the results of the Phonak PE845 hearing aid tests reported in the QUALCOMM study. The table on page 5 of the study states the distance at which the hearing aid could just detect interference from CDMA and GSM signals at 800 MHz. The table shows that, for a 200 mW peak power CDMA transmission, a hearing aid detects such interference at a distance of 25 cm, whereas for a 2 Watt GSM transmission, a hearing aid detects interference at 100 cm.

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But it is incorrect to compare a 2 Watt GSM-induced interference with interference due to a lower peak power CDMA transmission, and correction for different transmission power there is necessary. Being at farfield at 800 MHz, and thus having a "one-over-r" field dependency, it is relatively simple to correct for the GSM higher transmitter power: going from 2 Watt to 200 mW, the corresponding GSM disturbance distance reduces from the stated 1 meter to 32 cm being practically identical to the CDMA disturbance distance of 25 cm, considering the overall measuring uncertainty of the test setup. Hence, QUALCOMM has proved that the disturbance distance for CDMA and the disturbance distance for GSM actually are identical

B. Hearing Industries Association Comments.

In paragraph 5 of its comments, the Hearing Industries Association states that "the vast majority (of hearing aids) sold in the United States are models that fit completely within the user's ears. Because of the size limits inherent in this product, there is little room available to shield the instrument or provide countermeasures for electronic interference". This assertion is incorrect.

ITE-type hearing aids are physically much smaller than BTE-type hearing aids. Since both types of hearing aids are much smaller that the wavelength of the potentially disturbing radio signal, the ITE-type hearing aid will collect much less RF-energy from the radiated field. Thus, an ITE hearing aid, all other matters being equal, in fact will be more immune to radio transmissions from handportable cellular telephones that a similar-technology BTE-type hearing aid. The Danish hearing aid tests verified this fact, showing that, for more that 62% of the ITE-type hearing aids tested, the hearing aid user was able to use a 2 Watt GSM cellular telephone himself without any interference.

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Dated: August 1, 1995

ATTACHMENT 2

TELEDANMARK
MOBIL

Statement of Arne Foxman

My name is Arne Foxman. I am Head of Land Mobile Systems Section in the Technical Division of Tele Danmark Mobil A/S, one of the two Danish operators licensed to provide GSM Services in Denmark in the 900 MHz Band.
I have been working with Land Mobile Cellular Systems, such as NMT (Nordic Mobile System), since 1 August 1982 and have participated in the International Standardisation of GSM since the question was raised in the European Post and Telegraph Committee (CEPT) early 1983. I have been responsible for the procurement and commissioning of GSM Base Station Infrastructure, which was put into service in Denmark on July 1st, 1991 on a technical trial basis.

In my capacity as Head of Land Mobile Systems Section, I am responsible for the correct functioning of the GSM radio infrastructure and am also Liaison Officer in Radio Matters relative to the industry and regulatory authorities in Denmark. As a representative of my company, I have participated in a detailed investigation of interference problems related to hearing aids on a Committee established by The National Telecom Agency of Denmark. Since I also represent Tele Danmark Mobil A/S in the European Standardisation Organisation (ETSI) and in the GSM-MoU Association I not only use GSM Phones in Denmark but also at international meetings all over the world where GSM is implemented.

I am hearing impaired as a result of Menieres disease, and I use in-the-ear hearing aids in both ears. I have been using hearing aids for 5 years. In Denmark, hearing aids are provided as a part of the Health Service, and the Health Service decides on the type and brand of hearing aids provided. The government issues new hearing aids every 5 years.

My first hearing aid was a simple type of hearing aid that received interference from 2W GSM phones at a distance of 50 cm to 1 m. The interference generated a laud, but not intolerable, 217 Hz buzz and was normally caused by a person sitting next to me or standing extremely close. I was unable to use a 2W GSM phone myself.

In early 1995, Tele Danmark Mobil A/S purchased a new set of in-the-ear WIDEX LOGO hearing aids for me. With these hearing aids, I have no problem whatsoever in using GSM phones, and I use the GSM resistant hearing aid on a daily basis both in the office and in my private life. Moreover, I hear absolutely no interference from any GSM phone in the vicinity.

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