

**VIA ECFS**

January 22, 2015

Marlene H. Dortch, Secretary  
Office of the Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street, S.W.  
TW-A325  
Washington D.C. 20554

**Re: REQUEST FOR UPDATED INFORMATION AND COMMENT ON WIRELESS HEARING AID COMPATIBILITY REGULATIONS [WT Docket Nos. 07-250 and 10-254]**

Dear Ms. Dortch:

Enclosed for filing in the above referenced Public Notice are the comments of the Georgia Institute of Technology (Georgia Tech), Center for Advanced Communications Policy (CACP) and the Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC).

Should you have any questions concerning this filing, please do not hesitate to contact me via email at [helena.mitchell@cacp.gatech.edu](mailto:helena.mitchell@cacp.gatech.edu).

Respectfully submitted,



Helena Mitchell  
Principal Investigator, Wireless RERC  
Center for Advanced Communications Policy  
Georgia Institute of Technology

Enclosure

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**REQUEST FOR UPDATED INFORMATION AND COMMENT  
ON WIRELESS HEARING AID COMPATIBILITY REGULATIONS**

**WT Docket Nos. 07-250 and 10-254**

**COMMENTS OF  
GEORGIA INSTITUTE OF TECHNOLOGY (GEORGIA TECH), CENTER FOR ADVANCED  
COMMUNICATIONS POLICY (CACP)  
AND THE REHABILITATION ENGINEERING RESEARCH CENTER FOR  
WIRELESS TECHNOLOGIES (WIRELESS RERC)**

Georgia Tech's Center for Advanced Communications Policy<sup>1</sup> (CACP) in collaboration with the Rehabilitation Engineering Research Center for Wireless Technologies<sup>2</sup> (Wireless RERC) hereby submits comments in the above-referenced Public Notice released on November 21, 2014. CACP is recognized at the state and national level as a neutral authority that monitors and assesses technical developments, identifies future options, and provides insights into related legislative and regulatory issues. CACP evaluates technological trends that can impact issues as diverse as wearable technologies, communications and technology access by people with disabilities and emergency communications. CACP is the home of the Wireless RERC. The Wireless RERC mission is to research, evaluate and develop innovative wireless technologies and products that meet the needs, enhance independence, and improve the quality of life and community participation of people with disabilities. We believe it is essential that information and communications technologies (ICT) and services increase their levels of accessibility for people with disabilities; as access to technology can enhance inclusive, independent living. Since 2001 both CACP and the Wireless RERC have been actively involved with research and regulatory issues concerning accessible ICT. The comments respectfully

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<sup>1</sup> Georgia Tech's Center for Advanced Communications Policy (CACP) is supported, in part, by the Department of Homeland Security's Science and Technology (S&T) Directorate under contract #HSHQDC-14-C-0004. The opinions contained herein are those of the grantee and do not necessarily reflect those of the U.S. Department of Homeland Security S&T Directorate.

<sup>2</sup> The Rehabilitation Engineering Research Center for Wireless Technologies (Wireless RERC) is sponsored by the National Institute on Disability and Rehabilitation Research (NIDRR) of the U.S. Department of Education under grant number H133E110002. The opinions contained in this filing are those of the authors and do not necessarily reflect those of the U.S. Department of Education or NIDRR.

submitted below are based on subject matter expertise developed over the past 14 years. Findings from our consumer surveys and focus groups, policy research, and development efforts inform the recommendations made herein.

Specifically, the comments below are, in large part, informed by analyses of data collected via the Wireless RERC's hearing aid compatibility (HAC) survey research. The surveys focused on 1) ease of finding a HAC wireless handset by hearing aid users; 2) their ease finding a wireless handset that works well with their hearing technology, 3) their satisfaction with the sound quality of their wireless handsets and with electromagnetic interference levels between their handsets and hearing aids; and 4) knowledge of resistance ratings to electromagnetic interference of respondent wireless handsets and hearing aids. Answers to these questions have provided insight into the effectiveness of hearing aid compatibility requirements in the United States.

Data were collected from 2006 to 2014. The questionnaire has evolved over time to provide more robust data. The goal of the data collection has been to learn if the implementation of HAC requirements by the FCC beginning in 2005 has had a positive impact on reported satisfaction levels and ease of finding a HAC wireless handset by hearing aid users. The survey was conducted from 2006 to 2010. In 2008, at the request of CTIA-The Wireless Association and several major manufacturers and service providers, a new question was added to determine whether the respondent had acquired a new wireless handset within the year prior to taking the survey. In 2013, at the request of the FCC, several more questions were added to the questionnaire related to respondent knowledge of M and T ratings of their hearing aids and devices, and their satisfaction with the purchase experience of their wireless handsets. In 2014, the Wireless RERC conducted a follow-up survey with the 2013 respondents to understand in more detail why respondents may or may not be satisfied with their cellphones, and to measure the degree and frequency with which users experience interference between their wireless handsets and their hearing aids.

## Section A: Applying the Rules in a Technologically Neutral Manner

### **¶7: Requiring compatibility in a technologically neutral manner.**

Network technology is rapidly coalescing around the use of long-term evolution (LTE) for new wireless telephones, although different carriers are using different frequencies which may have an impact on compatibility. Perhaps more importantly, consumers are frequently confused by jargon such as LTE, 4G LTE, and LTE advanced; they just want products that work for them and their needs. The Wireless RERC believes that the previous allowance for different milestones based on network technology made sense and best served the market in the past, the market has reached the point where there is no need for this anymore, and a technically neutral manner should be adopted.

**¶8: ...we seek comment on whether consumers are aware that the hearing aid compatibility rules currently apply only to digital CMRS services with certain functionalities and, relatedly, whether Section 20.19 should apply to all wireless handsets, regardless of the service, frequency, or technology with which they are used. In other words, if a wireless handset includes a built-in speaker and is typically held to the ear in a manner functionally equivalent to a telephone, then should the hearing aid compatibility requirements apply?<sup>3</sup> ... We seek comment on whether this approach would be more consistent with consumer expectations, especially the expectations of persons with hearing loss, and if so, why.**

As evidenced in the limited filings by consumers in FCC rulemakings, one can imply that consumers are not fully apprised of regulations concerning HAC. In some cases, they may not have the technical and/or regulatory understanding as to why some devices are covered by Section 20.19 and others are not. The consumer may become frustrated and dissatisfied during the process of finding a wireless handset that is compatible with their hearing aid or cochlear implant. By example the majority of survey respondents were dissatisfied with HAC information, and only 25% who use hearing technology indicated they were satisfied or very satisfied with HAC information received from service provider and manufacturer websites and

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<sup>3</sup> 2010 *Hearing Aid Compatibility Further NPRM*, 25 FCC Rcd at 11195 ¶ 81.

packaging; similarly, the satisfaction rate for information obtained from retail staff was 29%.<sup>4</sup> Further, only 22% of people who use behind the ear aids, and 24% of people who use in the ears aids found it easy or very easy to find a wireless handset that worked with their hearing technology.<sup>5</sup>

These statistics indicate a need to ease the knowledge burden for consumers. If it looks like a phone and functions like a phone, it should be covered under the rules. Ease of finding a compatible phone would be greatly improved if HAC requirements applied to all wireless handsets and would simplify phone selection for people with varying capabilities. For people with hearing loss, when purchasing a handset there are other mainstream *and* accessibility features to consider in conjunction with HAC compliance. One should not have to sacrifice phone features to ensure they are purchasing a HAC compliant phone. In this regard, the Wireless RERC/CACP reiterates the comments filed<sup>6</sup> in the FCC's Public Notice, *Tentative Findings about the Accessibility of Communications Technologies for the 2014 Biennial Report under the Twenty-first Century Communications and Video Accessibility Act*:

"Currently, people with disabilities are limited to a subset of devices that suit their needs, whereas the general population can choose from the full array of options. The subset of devices may or may not be within their desired price range. In a recent Delphi survey conducted by the Wireless RERC, one respondent noted that youth with hearing impairments often paid more for devices to achieve better access."<sup>7</sup>

In a 2014 accessibility review of wireless emergency alert (WEA) capable handsets, using the providers' web pages as reference, researchers identified 215 WEA-capable phones for evaluation. The list of evaluated phones represents a sample of phones noted for WEA

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<sup>4</sup> Morris, J., Mueller, J., Jones, J., Lippincott, B. (2014). *Hearing Aid Compatibility of Cellphones: Results from a National Survey*, Presented at the 29<sup>th</sup> Annual International Technology and Persons with Disabilities Conference, March 18-22, 2014. Available at <http://www.wirelessrerc.gatech.edu/sites/default/files/content/newroom/Hearing%20Aid%20Compatibility%20Results%20from%20a%20National%20Survey.pdf>

<sup>5</sup> Ibid.

<sup>6</sup> Mitchell, H., LaForce, S., Price, E., Morris, J. Lucia, F. (2014). Comments in response to *Tentative Findings about the Accessibility of Communications Technologies for the 2014 Biennial Report Under the Twenty-first Century Communications and Video Accessibility Act* [10-213]. Federal Communications Commission: Washington, DC, September 11, 2014.

<sup>7</sup> Preliminary findings from Delphi survey on *The Futures of Disabilities: Migratory Trends in Technology*, from Wireless RERC research in progress (2014).

capability in April 2012 through July 2014. Researchers assessed up to 27 points of data for each device in the sample. In addition to noting the model, operating system (OS), providers, dimensions and display size, 15 features that impact accessibility and/or were designed to provide access to people with vision, hearing, cognitive and mobility disabilities were tabulated, such as HAC rating, ability to adjust font, contrast adjustment, vibration adjustment, and two-way video. While researchers found HAC ratings for 98% of the sample, only 40% of the sample included the two-way video feature and vibration adjustment. This could be further complicated if the consumer also required a simplified interface (40% of sample) or contrast adjustment (35% of sample).<sup>8</sup> This further supports extending the HAC requirement to all wireless handsets as it would benefit people with just hearing loss, and those that have hearing loss in conjunction with another disability, such as low vision.

**¶9: Amending rules to cover, among other things, handsets that operate over Wi-Fi systems and private internal networks regardless of whether they are interconnected with the public switched telephone network (PSTN).**

Phones are rapidly changing forms and technologies; the Commission should attempt to create a large tent to encompass as many technologies that might be used in devices with phone features. Most Wi-Fi phones and private internal phone networks interconnect with the PSTN through a gateway so they can be used to make traditional phone calls. As is stated above in response to paragraph seven, a technologically neutral manner should be adopted. Such an approach would correspond with the FCC's recent analysis of the mobile wireless marketplace:

"Because consumers increasingly view various mobile voice, messaging and data services as interchangeable with one another, no matter their regulatory classification, service providers are competing for customers using CMRS services as well as non-CMRS services. As a result, the Commission has indicated that it is important to consider potential substitutes when analyzing the competitive landscape for these services, and to evaluate the mobile industry as a whole, rather than just focus on CMRS services."<sup>9</sup>

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<sup>8</sup> Preliminary findings from Georgia Tech/CACP's *Accessibility Review of WEA Capable Devices*; DHS S&T research in progress (2014).

<sup>9</sup> FCC (2014). *In the matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services* [WT

The Wireless RERC/CACP contends that this same assertion holds true for consumers with disabilities with regard to mobile device accessibility; and specifically, HAC compliance.

### **Section B: Fractional Deployment Benchmarks**

#### **¶13: In light of the increasing trend among consumers to reside in wireless only households and other factors, does the current fractional deployment approach effectively meet the communication needs of people with hearing loss?**

The FCC's hearing aid compatibility requirements were phased in gradually over several years beginning in 2005. The requirements for manufacturers and service providers in the early years were unlikely to have significantly changed the experiences of hearing aid users with regard to difficulty of finding and satisfaction with a compatible wireless handset. In more recent years, when requirements have increased substantially, Wireless RERC HAC survey findings suggest a limited impact of these requirements, and present a mixed picture of hearing aid user experiences with wireless handsets. Hearing aid users report little improvement in ease of finding a hearing aid compatible wireless handset over the course of implementation of the HAC Act requirements. Substantial proportions of hearing aid users still report their search as being difficult or very difficult. Levels of satisfaction with sound quality also have improved only modestly since implementation of the HAC Act requirements. There is, however, evidence from the 2013 Wireless RERC HAC survey to suggest that those who purchased their cellphones more recently experienced slightly higher levels of satisfaction with sound quality. HAC survey respondents were asked to rate the ease or difficulty of finding a cellphone that worked with their hearing technology (hearing aid or cochlear implant) on a 5-point scale from very difficult to very easy. Ratings of "ease of finding a compatible cellphone" were summarized into a single "Ease Index" for each survey year (Table 1). This was accomplished by assigning values of 1 to 5 respectively to the responses "very difficult" to "very easy." These values were then multiplied by the number of respondents who reported each level of ease/difficulty. The product of this operation was then divided by the highest possible value

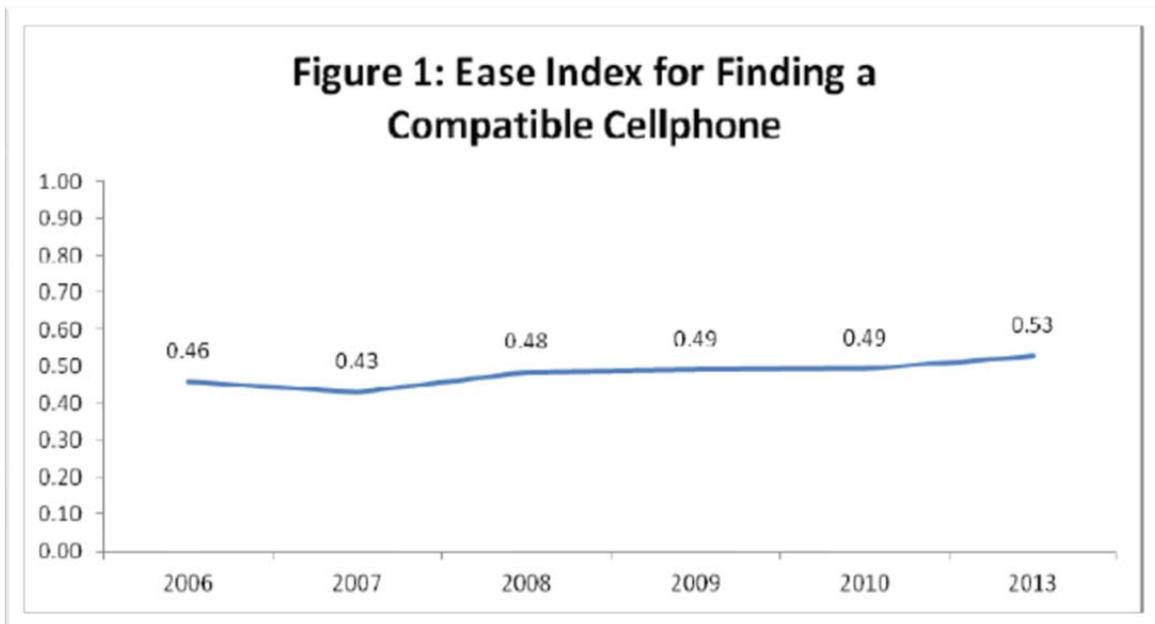
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Docket No. 13-135]. Washington, DC: 18 December. Available at <http://www.fcc.gov/document/17th-annual-competition-report>.

that would result if all respondents in each year rated their search for a compatible wireless handset as “very easy.” As shown in Table 1 (and Figure 1), the overall Ease Index for finding a wireless handset that worked with respondent hearing technology increased modestly from 0.46 to 0.53 (with 1.00 representing a “very easy” rating from all respondents). In other words, ease of finding a compatible wireless handset has steadily, but only modestly, improved from 2006 to 2013 (the latest year this question was asked).

**Table 1 – Ease of finding a compatible cellphone by survey year 2006-2013**

	2006	2007	2008	2009	2010	2013
<b>Very Easy</b>	1	3	9	17	12	39
<b>Easy</b>	15	5	50	42	41	70
<b>About Average</b>	30	17	103	91	75	126
<b>Difficult</b>	39	27	102	95	95	108
<b>Very Difficult</b>	30	25	85	78	61	99
<b>Total Respondents</b>	115	77	349	323	284	442
<b>Total “Ease” Score</b>	263	165	843	794	700	1168
<b>Highest Possible Score (Total n x 5)</b>	575	385	1745	1615	1420	2210
<b>Ease Index</b>	<b>0.46</b>	<b>0.43</b>	<b>0.48</b>	<b>0.49</b>	<b>0.49</b>	<b>0.53</b>



Furthermore, fractional deployment causes problems for consumers in today's market as more and more consumers are opting to have wireless devices only. Statistics cited in the Commission's *Seventeenth Annual Report of Competitive Market Conditions with Respect to Mobile Wireless*, confirm that wireless only households (39%) are on the rise; households that have both landline and wireless phones (52%) are on the decline; and landline only households, steadily decreasing since 2008, are already below 10%.<sup>10</sup> According to a 2013 Wireless RERC survey, this trend holds for people with disabilities, with 32% reporting wireless only households. Also, as consumer's age they might need hearing aids they did not need when they purchased the equipment. These factors indicate it might be time to phase out the fractional deployment rules.

**¶14. We renew our request for comment on how consumers with hearing loss would benefit if all newly manufactured handsets were hearing aid compatible – i.e., have ratings of M3 and T3 or better. For example, to what extent would this improve the ability of consumers to select phones that meet their communication needs and reduce consumer confusion when shopping at retail establishments? To the extent that consumers currently have difficulty finding handsets that work effectively with their hearing aids or implants, would this change meaningfully address the difficulty?**

The information provided to consumers at the point of sale is critical especially for persons with hearing loss. Sometimes it can be confusing in selecting a phone that can accommodate one's hearing loss versus price, ease of use and reliability. The comments expressed on pages 4-6 are equally applicable to answering the questions posed above in paragraph 14. To add to the discussion, detailed HAC survey data on satisfaction is presented.

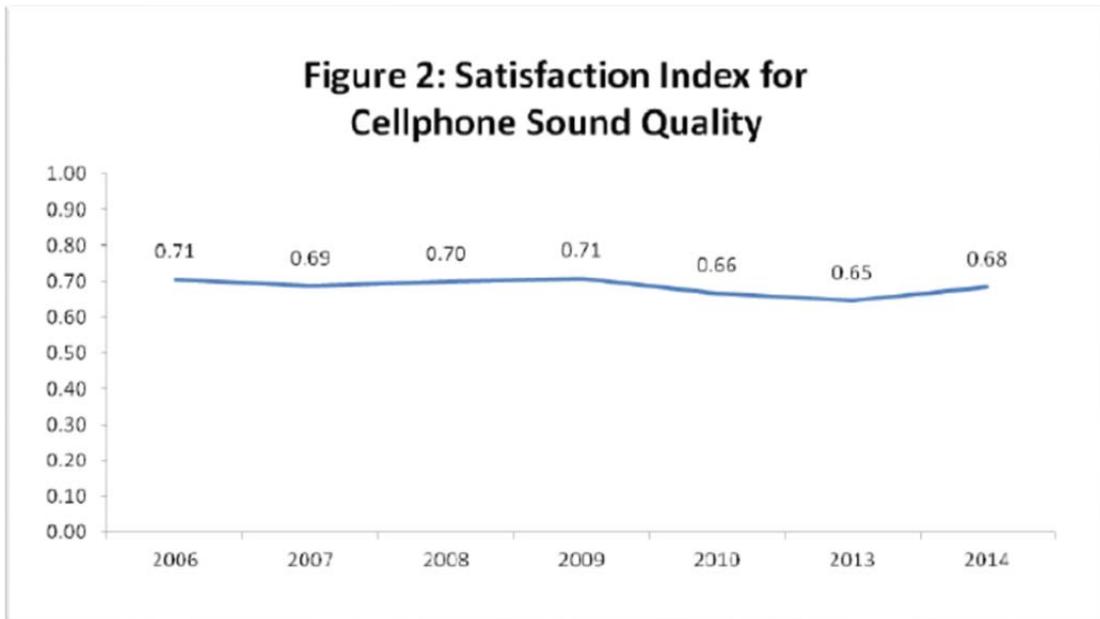
With regard to the satisfaction of hearing aid users with the sound quality of their handsets, there has been little change from 2006 through 2013. Respondents were asked to rate their satisfaction on a 5-point scale, from very dissatisfied to very satisfied. The overall satisfaction ratings for each survey year were converted into a single Satisfaction Index using the same methodology used for calculating the Ease Index (see Table 2 and Figure 2).

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<sup>10</sup> FCC (2014). *In the matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services* [WT Docket No. 13-135]. Washington, DC: 18 December. Available at <http://www.fcc.gov/document/17th-annual-competition-report>.

**Table 2: Satisfaction Index: Cellphone sound quality, by survey year**

	2006	2007	2008	2009	2010	2013
Very Satisfied	30	18	79	75	55	79
Satisfied	30	23	100	96	96	139
About Average	32	18	105	92	94	115
Dissatisfied	22	11	46	43	41	109
Very Dissatisfied	3	7	20	15	31	38
<b>Total respondents</b>	<b>117</b>	<b>77</b>	<b>350</b>	<b>321</b>	<b>317</b>	<b>480</b>
<b>Total Satisfaction Score</b>	<b>413</b>	<b>265</b>	<b>1222</b>	<b>1136</b>	<b>1054</b>	<b>1552</b>
<b>Highest Possible Satisfaction Score</b>	<b>585</b>	<b>385</b>	<b>1750</b>	<b>1605</b>	<b>1585</b>	<b>2400</b>
<b>Satisfaction Index</b>	<b>0.71</b>	<b>0.69</b>	<b>0.70</b>	<b>0.71</b>	<b>0.66</b>	<b>0.65</b>

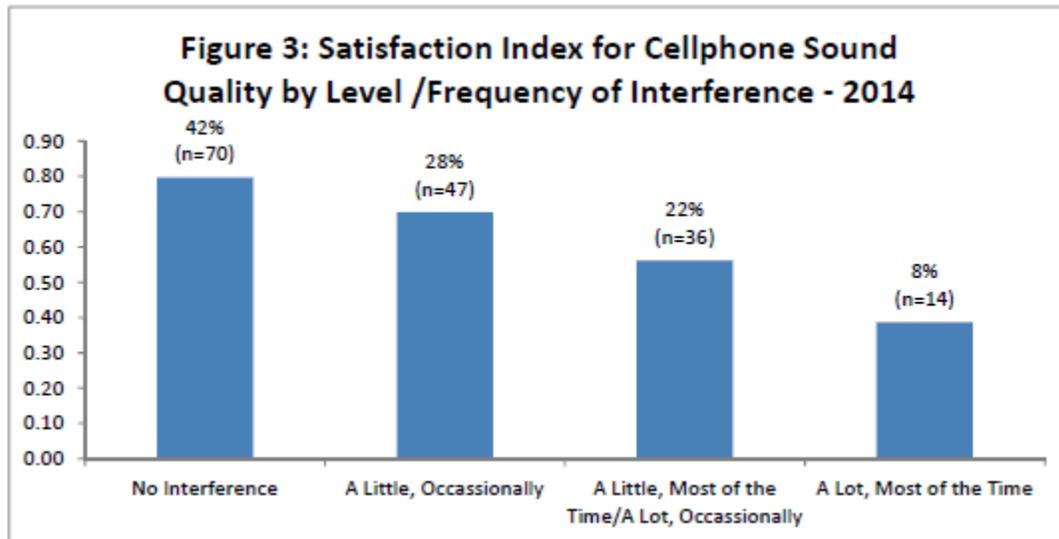


There are many reasons why a user might be satisfied or dissatisfied with the sound quality of their device, including volume output, volume control, signal quality, and electromagnetic interference. In order to check whether electromagnetic interference did indeed negatively

impact overall satisfaction with sound quality, the satisfaction index was calculated for respondents who reported each of the four levels/frequency of interference. Table 3, also Figure 3, shows a strong inverse relationship between level and frequency of electromagnetic interference and the Satisfaction Index for sound quality.

**Table 3 – Crosstabs: Cellphone interference by satisfaction with cellphone sound quality, 2014 Follow-up Survey**

	No interference	A little, occasionally	A little, most of the time; OR a lot, occasionally	A lot, most of the time
<b>Very Satisfied</b>	30	7	3	0
<b>Satisfied</b>	22	20	6	2
<b>About Average</b>	8	11	9	2
<b>Dissatisfied</b>	7	7	17	3
<b>Very Dissatisfied</b>	3	2	1	7
<b>Sum</b>	70	47	36	14
<b>Percentage of respondents</b>	42%	28%	22%	8%
<b>Satisfaction Index</b>	<b>0.80</b>	<b>0.70</b>	<b>0.56</b>	<b>0.39</b>



The above presented data indicates that consumers with hearing loss are still experiencing interference when using their wireless handsets with their hearing technology. Interference between wireless handsets and hearing aids appears to be strongly and inversely related to

satisfaction with sound quality. So, interference *does* limit the enjoyment of “the social, professional, and convenience benefits offered by wireless telecommunications”<sup>11</sup> by people with hearing disabilities. The interference experienced may be a result of not purchasing the appropriate device for their needs as evidenced by the fact that the percentage of hearing aid users in the sample who knew the M and T ratings was low: only 29% reported knowing the ratings of their hearing aids; 39% reported knowing the ratings of their cellphones. Therefore, to diminish this difficulty of choice, the Wireless RERC recommends that, in the short-term, all newly manufactured handsets be HAC compliant.

However, long-term efforts should encourage wireless handset manufacturers to partner with hearing aid manufacturers to produce devices that are designed to work together. Apple’s Made-for-iPhone (MFi) program provides a successful model of this approach. Officially launched in February 2014 with the debut of Danish earpiece maker GN Resound’s LiNX hearing aid, the MFi program relies on Bluetooth pairing of the iPhone with Apple certified hearing aids. Hearing aid settings are controlled directly on the iPhone, allowing users to switch between audiologist-prescribed preset configurations for different environments (indoors, outdoors, etc). To date the Apple website lists 11 certified hearing aid models produced by 8 different manufacturers (<https://www.apple.com/accessibility/ios/hearing-aids/>). In light of the success of the MFi program, the FCC might consider revising the HAC Act requirements to specify the desired outcome from a user-experience perspective rather than technical specifications for radio interference.

**¶15: Given the increasing number of wireless-only households, to what extent would this change improve access to emergency services for individuals with hearing loss?**

Hearing aid compatibility of wireless handsets would greatly improve the access to emergency services for individuals with hearing loss. First and foremost, all emergencies do not occur while individuals are at home. A need to connect with emergency services may occur at or on the way to work, at the

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<sup>11</sup> FCC (2003). Hearing Aid-Compatible Telephones; Final Rule. Washington, D.C.: 16 September. Available at <http://www.gpo.gov/fdsys/pkg/FR-2003-09-16/html/03-23527.htm>.

grocery store, at a friend's house, or a host of other locations. Just as this is true for the general population, it is true for individuals with hearing loss. Additionally, during an emergency, a user may not be using their own phone, so having the requirement that all phones are compliant will increase public safety.

As noted earlier, wireless-only households are becoming more prominent in the general population, and we have found that people with hearing loss are also moving away from landline phones to wireless only environments. Additionally, there is indication that the shift to wireless-only households is correlated with type of hearing loss. In a 2014 survey of people with hearing loss regarding their use of Wireless Emergency Alerts (WEAs), we asked if they owned a landline phone in their home (in addition to their wireless handset), the majority of respondents who were deaf (59%) indicated they did not own a landline phone. The response was less for those who were hard-of-hearing, where only 22% indicated they did not have a landline phone. The drastic difference between the identified hearing loss groups may be due to trouble relying on their wireless handset due to ineffective HAC. Intuitively, more individuals who self-identify as hard-of-hearing would benefit from hearing aid compliance on telephones. Therefore, our finding on use of landline phones (in addition to wireless phones) among individuals who are hard-of-hearing may be directly correlated with the lack of hearing aid compliance on wireless devices. Preliminary analysis of focus groups conducted in 2014, found that individuals identified as having (at least) residual hearing with the use of hearing aids reported using their wireless phone's Bluetooth feature to interface with their hearing aids and cochlear implants. During the same focus groups, others mentioned having trouble with specific wireless phones and their hearing aid.

Hence, while we are aware of the increasing popularity of wireless-only households, individuals with hearing loss that choose to maintain access to landline phones can benefit from HAC wireless handsets to connect with emergency services when they are not at home. Second, emergency services are increasingly deploying methods to reach (or communicate with) individuals using wireless devices. In 2012 the Federal Emergency Management Agency deployed WEAs; and the FCC has been taking steps to make Next Generation 9-1-1 more widely available. While these advanced communications technologies enable the public to receive emergency messaging or assistance beyond voice-centric features, there is no reason to assume that more robust services will not be developed using a combination of voice, text, photos and video. In fact, we should plan for the continual advancement of communications technology and include the concerns of people with hearing loss and others with

disabilities in the early stages of technology development and the formation of regulations.

In closing, the FCC's attention to ensuring HAC compliance is reflective of consumer expectation *and* the evolution of wireless technologies is commendable. With the sometimes competing priorities of industry and consumers; and given the complexity of interaction between increasingly sophisticated and powerful wireless handsets and hearing aids the difficulty of crafting regulations is not overlooked by the Wireless RERC/CACP. Nevertheless, people with hearing loss deserve and are entitled to having parity of access to telecommunications services, wireless, or otherwise.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "H. Mitchell", is positioned above the typed names of the signatories.

Helena Mitchell, PhD,  
John Morris, PhD,  
Salimah LaForce,  
DeeDee Bennett, PhD  
Ed Price, and  
Frank Lucia  
Wireless RERC / Center for Advanced Communications Policy  
Georgia Institute of Technology  
500 10th Street, 3rd Fl. NW  
Atlanta, GA 30332-0620  
Phone: (404) 385-4640

Dated this 22<sup>nd</sup> day of January 2015