Before the

Federal Communications Commission

Washington, D.C. 20554

In the Matter of	)	
	)	
Request for Updated Information and Comment on Wireless Hearing Aid Compatibility Regulations	)	WT Docket Nos. 07-250 and 10-254
	)	

Comments of the Rehabilitation Engineering Research Center on Technology for Individuals who are Deaf or Hard of Hearing

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A. Applying the Rules in a Technologically Neutral Manner

As noted in the Request, technological neutrality needs to address both the increasing variety of handset-like devices and their increasing variety of RF communication protocols. As to the first

of these considerations, a hearing aid user should be able to expect telephone-like performance from any device that is functionally equivalent to a telephone. A "functionally equivalent" device could be defined as, "a portable two-way speech communication device having a built-in speaker for receivinge audio that is intended for positioning against the user's head and is capable of being manually positioned for best sound reception." Such a definition would include devices that are used in a similar manner as a conventional handset, but would exclude, for example, Bluetooth hands-free adaptors that are mounted in a non-adjustable position on the user's ear.

The second consideration refers to the differing potentials for audio frequency RF interference of the various emerging RF protocols. The latest revision of ANSI 63.19[1] addresses the measurement of this parameter for individual wireless products through its "RF audio interference level" evaluation procedure. Based on a near-field scan of a wireless device, the amplitude modulation of the RF signal is detected in a manner similar to the inadvertent detection mechanisms in a hearing aid (square-law detection). The recovered signal undergoes spectral and temporal weighting approximating the sensitivity to such signals by an average hearing aid user's corrected hearing to yield the final result. In practice, an equivalent alternative method is employed wherein a separately measured "Modulation interference factor" (MIF) is combined with a more easily achievable root mean square (rms) measurement of the time-average wireless device near-field level. The MIF is determined only by the amplitude modulation characteristics of the RF waveform and is independent of the field's overall level. It is readily measurable from the conducted or radiated field using available equipment[2], and can even be determined through mathematical modeling in advance of product development once the

[1] "Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids," ANSI Standard C63.19, 2011.

[2] http://www.speag.com/products/dasy/dasy5-hac-extension/aia/

RF protocol parameters are set. Since modulation characteristics and power levels can vary over time within the parameters of a given protocol, the standard states (under section *5.4.4 WD setup and use*), "Search for the combination of power and modulation characteristic that is representative of the worst case (highest interference potential) likely to be encountered in normal voice mode operation."

While the standard's RF audio interference level method is technologically neutral with respect to present and future transmission protocols, it does require evaluation through near-field scanning of a sample of every wireless product that is to be HAC-rated. A recent study, however, draws into question the degree to which roughly similar devices operating under the same protocol and power level differ in their near-fields and the degree to which these relatively small differences correspond to significant variations in in-use hearing aid interference, especially in comparison to other influencing factors that can result in much wider variations in audio frequency interference potentially experienced by hearing aid users. This result is summarized in the following paragraph from the to-be-submitted document *RF Interference Coupling from Cellphones to Hearing Aids*, which is drawn from a full paper being readied for submission to a peer-reviewed journal:

"The overall range of measured WD [wireless device] near-field emissions levels of the eight tested phones varied over a range of about 8 dB in each frequency band, which is actually fairly modest in comparison to other variables contributing to the final level of in-use coupled interference. Specifically, the relationship of the in-use coupling to the predictions based on the emissions and immunity measurements varies over a much wider range. It may be surmised that, in comparison to this wide range, the interference-generating near-field emissions of various WDs operating within the same protocol and power levels will likely not show large variations in

their interference-producing abilities. Larger variations in WD audio interference-generating potential can be expected from protocols having differing MIFs and differing power levels. In particular, the MIF can vary from +3.3 dB for GSM modulation to perhaps -20 dB for protocols exhibiting very low levels of audio-frequency amplitude modulation. ANSI C63.19 presently includes a low-power WD testing exemption (not requiring near-field emissions scanning) that combines a WD's MIF with its maximum average antenna input power, comparing the result against a threshold. An implication of our results is that these two factors taken together could prove to be the most relevant WD parameters in predicting interference coupling to a HA and that contributions from the comparatively modest WD product-to-product variation within a given protocol are likely minor by comparison."

While this result has not yet been published or submitted to the ANSI C63.19 working group and is therefore not yet under consideration for any implied changes to the standard, such a simplified protocol-wide test regimen could serve as an enabler of eased testing according to product class. This could not only greatly reduce testing needs for individual products, but also enable certainty in the earliest stages of product development and even encourage the adoption of low-interference protocols.

It should be noted that the foregoing discussion relates to the RF characteristics of wireless devices, but not directly to their telecoil signal rating (T-rating). Magnetic speech signal strength and magnetic noise characteristics will be specific to a particular wireless device design and would still need to be tested for each design. It will be found, though, that devices with low RF interference potential will tend to produce lower audio frequency magnetic noise. The electrical currents driving the RF output stage are often the major source of magnetic noise, and these tend to follow the RF amplitude modulation envelope.

B. Fractional Deployment Benchmarks

Consumers should be able to enjoy the expectation that any handset-type device available to them should be compatible with their hearing aid. This, of course, requires good RF immunity from the hearing aid and proper adjustment of the hearing aid's telecoil. These are, by now, achievable goals. Moving away from the GSM protocol may ease the burden of making wireless devices hearing aid compatible. For example, spread spectrum and frequency-division multiplexed protocols are generally benign in comparison to time-division multiplexed protocols that pulse at audio frequency rates (unless they also incorporate a pulsing characteristic). The 217 Hz, 1/8 duty cycle characteristic of GSM produces particularly strong audio interference relative to its average power level. Hopefully, other present and future protocols will register lower MIFs and possibly make use of lower power levels.

It would seem, from this non-manufacturer perspective, that the burden of making all handset-type devices HAC should ease over time, especially if the requirements can be clear and incorporated at the earliest conceptual design stages across broad product categories and protocols less interference-prone than GSM become widespread.

Respectfully submitted,
On behalf of the DHH-RERC[3]:

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