

Before the
Federal Communications Commission
Washington DC 20554

In the Matter of)	
)	
Promoting Spectrum Access for Wireless Microphone Operations)	Docket No. 14-166
)	
Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and)	Docket No. 14-165
)	
Amendment of Part 74 of the Commission’s Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap)	
)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions)	Docket No. 12-268
)	

**OPPOSITION AND RESPONSE OF
SENNHEISER ELECTRONIC CORPORATION**

Sennheiser Electronic Corporation (“Sennheiser”) hereby responds to various Petitions for Reconsideration filed in the above captioned proceedings.¹

SUMMARY

Sennheiser participated extensively in all of the above-captioned proceedings, and seeks reconsideration of several actions related to spectrum access by wireless microphones: 1) the limitation on LPAS access to 1.4 GHz spectrum (no more than 30 MHz of spectrum at a given

¹ Petitions were filed challenging the following Commission decisions: *Promoting Spectrum Access for Wireless Microphone Operations*, Report and Order, 30 FCC Rcd 8739 (2015) (“Mic Opportunity R&O”) and *Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 60 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission’s Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 60 MHz Duplex Gap*, Report and Order, 30 FCC Rcd 9551 (2015) (“Part 15 R&O”).

time); 2) requiring spurious emissions limits inconsistent with the ETSI standard; and 3) the particular frequencies selected for use in the 169-172 MHz band. Sennheiser also seeks clarification and/or reconsideration regarding the applicability of antenna connector rules to unlicensed wireless microphones. Other major microphone manufacturers also request reconsideration of these Commission decisions – specifically, the limited access to 1.4 GHz, the spurious emission requirements beyond the ETSI mask, and the application of antenna rules to unlicensed microphones.²

Sennheiser supports the following issues raised for reconsideration by other wireless microphone manufacturers:

- Increasing the transmitter output power from 20 mW to 50 mW for wireless microphones operating in the guard bands and duplex gap;³
- Allowing either conducted power or radiated (“EIRP”) power measurements;⁴
- Grandfathering wireless microphones that tune to permitted frequencies;⁵ and
- Preserving a pathway for unlicensed operators to register for interference protection in the database system.⁶

Google and the National Association of Broadcasters (“NAB”) seek reconsideration of the “push” approach to white space device (“WSD”) database control.⁷ Regardless of whether a “push” or “pull” method is used, the database system must be fast responding and reliable so that wireless microphones have adequate protection.

² Petition for Reconsideration of Shure Incorporated, ET Docket No. 14-165 at 3-7 (filed Dec. 23, 2015) (“Shure Part 15 Petition”); Shure, Inc., Petition for Reconsideration, ET Docket No. 14-166 at 2-9 (filed Dec. 17, 2015) (“Shure Mic Petition”); Petition for Reconsideration of Audio-Technica U.S., Inc., ET Docket Nos. 14-165 and 14-166 at 2-6 and 8-10 (filed Dec. 17, 2015) (“Audio-Technica Petition”); and Petition for Reconsideration of Lectrosonics, Inc., ET Docket No. 14-166 (filed Dec. 17, 2015) (“Lectrosonics Petition”).

³ Shure Part 15 Petition at 7; Audio-Technica Petition at 7-8.

⁴ Shure Part 15 Petition at 11; Audio-Technica Petition at 6; Lectrosonics Petition at 3.

⁵ Shure Part 15 Petition at 12.

⁶ Shure Part 15 Petition at 13.

⁷ Google Inc. Petition for Reconsideration, ET Docket No. 14-165 at 1-8 (filed Dec. 23, 2015); Petition for Reconsideration of the National Association of Broadcasters, ET Docket No. 14-165, at 4 (filed Dec. 23, 2015).

Finally, Sennheiser opposes any increase in the permissible antenna heights for unlicensed devices.⁸

DISCUSSION

A. Parties Agree that the 30 MHz Limit on Spectrum Access for 1.4 GHz Was Not Adequately Considered, Is Unnecessary, and Should Be Eliminated.

All major wireless microphone manufacturers (Audio-Technica, Lectrosonics, Sennheiser, and Shure) agree that that the Commission's action limiting LPAS access to the 1.4 GHz band to no more than 30 MHz of spectrum undermines the purpose of making the band available to wireless microphone use and should be reconsidered. In addition to the procedural error of failing to raise this limitation during the course of the proceeding, it is unnecessary because each application will be scrutinized and approved by the frequency coordinator, the Aerospace and Flight Test Radio Coordinating Council ("AFTRCC"). This pre-operational approval process, together with the required electronic key, provides for tight control over wireless microphone use of the frequency band, though it also makes planning and operating wireless microphones in this range more difficult. This complexity should not be exacerbated by this artificial limit on access to spectrum. The Commission's suggestion that operators apply for special temporary authority to exceed this 30 MHz limit adds unnecessary complexity and cost to spectrum access, and is unnecessary given the other effective technical safeguards.

B. Wireless Microphone Manufacturers Agree that the ESTI Standard Should Be Adopted in its Entirety.

Sennheiser and other manufacturers supported adoption of the ETSI out-of-band emissions ("OOBE") standard, which provides for spectral efficiency within and outside of a

⁸ Petition for Partial Reconsideration of the Wireless Internet Service Providers Association, ET Docket No. 14-165 at 6-7 (filed Dec. 23, 2015).

frequency band. The ETSI standards are considerably more stringent than the traditional FCC requirements, but the wireless microphone community had already adopted use of the standard to meet performance criteria.⁹

Though the Commission adopted the ETSI mask, it also required an additional out-of-band emission requirement that does not follow the applicable ETSI measurement method. This requirement is unnecessary to protect 600 MHz licensees, is not imposed on other users (*e.g.*, WSDs), and will impede progress in the industry. As Lectrosonics explains:

[E]xtending this limit across the full frequency measurement range in compliance testing is unnecessary and greatly complicates the design of wireless microphone transmitters. The difficulty in meeting the -90 dBc requirement lies not in the vicinity of the ETSI emission mask but in the more distant frequency range where harmonics of the carrier frequency fall. These are very difficult to attenuate by greater than 90 dB relative to the carrier given the size, power and cost constraints according to which we must design wireless microphone transmitters. If this limit stands it will certainly delay the introduction of new transmitter models for professional users operating under Part 74 rules.¹⁰

Shure agrees, noting that “[i]f this requirement is not amended to reflect the entire ETSI OOB limit as stated in the standard, it will not be feasible for industry to manufacture wireless microphones in the future.”¹¹ It is inconceivable that this was the intent of the Commission, but these unintended consequences can be avoided by simply adopting the proven ETSI OOB standard without additional requirements.

C. The Selection of Frequencies in 169-172 MHz Should Be Altered.

Sennheiser reiterates its request that frequency assignments in the 169-172 MHz band

⁹ Spectral efficiency has been, and will continue to be, a primary design criteria for wireless microphones because applications can require dozens, and sometimes hundreds, of microphones in the same venue, densely packed into small bits of spectrum.

¹⁰ Petition of Lectrosonics at 2.

¹¹ Shure Mic Petition at 2.

should be modified to allow more wireless microphone frequencies to operate simultaneously.¹² Sennheiser provided a specific suggestion. Other scenarios are possible and we are ready and willing to work with the Commission further on this issue.

D. Antenna Standards for Unlicensed Wireless Microphones Should Remain as They Were Under the Waiver.

The microphone manufacturers also seek reconsideration so unlicensed wireless microphones operating under Part 15 rules may continue to use external antennas without proprietary connectors.¹³ There is a large equipment base with external antennas using standard connectors already in the field. There is no basis for discontinuing this practice, as it does not pose an increased risk of harmful interference.

The technical rules that apply to licensed and unlicensed wireless microphones must be the same (except for output power) so that manufacturers are not put in a position of designing multiple products for essentially the same use. This will assure better economies of scale and cost savings for consumers, while not increasing the risk of harmful interference.¹⁴

E. Microphones Should Be Allowed to Operate at 50 mW in the Guard Bands and Duplex Gap.

Sennheiser endorses the petitions seeking the use of 50 mW power in the guard bands and duplex gap. Sennheiser supported this proposal throughout the proceeding.¹⁵ Microphones have operated for decades at power levels up to 250 mW when immediately adjacent to other services, without incident. There is no reason to believe that microphones will cause harmful interference to new licensees when operating at 50 mW, especially given the 1 MHz buffer. 20

¹² Consolidated Petition for Reconsideration of Sennheiser Electronic Corporation, Docket Nos. 12-268, 14-165, and 14-166 at 8 (filed Dec. 17, 2015); *see also* Comments of Sennheiser, Docket 14-166, at 20 (filed Feb. 4, 2014).

¹³ Sennheiser Petition at 8; Audio-Technica Petition at 8; Shure Part 15 Petition at 3.

¹⁴ Comments of Sennheiser, Docket 14-165, at 13 (filed Feb. 4, 2014).

¹⁵ *Id* at 15.

mW is insufficient power for microphones to obtain an adequate carrier-to-noise ratio operating in the duplex gap and guard bands, due to noise caused by out-of-band emissions from the adjacent services.¹⁶

F. Wireless Microphone Manufacturers Should Have the Option to Meet Either Conducted Power or Radiated (EIRP) Power Measurements.

Sennheiser agrees with the other wireless microphone manufacturers that the Commission should provide the flexibility of meeting either conducted power or radiated (EIRP) power measurements.¹⁷ Wireless microphones come in many forms and address a wide variety of applications. The flexibility to design equipment that could be certified by either measurement method would allow manufacturers to best serve market needs, and does not pose increase risk of harmful interference.

G. The Commission Should Not Apply Cut-off Dates to Microphones that Can Tune to Permitted Frequencies.

The 600 MHz reallocation, on the heels of the 700 MHz allocation, will result in a double-dose of financial hardship for many wireless microphone owners. Much of the equipment that currently operates in the 600 MHz band will need to be scrapped. Sennheiser is prepared to assist users to ensure that there is smooth transition, but requests that the Commission minimize adversity to wireless microphone users by allowing existing equipment that can tune to permissible frequencies to be “grandfathered.”

Because wireless microphones cannot tolerate any interference, users proactively seek clear frequencies. Wireless microphone users have successfully avoided operations on occupied channels for many years, ably preventing interference to TV and land mobile services. There is

¹⁶ *Id.* at n.39. Sennheiser conducted a study in Europe that demonstrates the detrimental effects on wireless microphone operations by the high noise floor in the duplex gap. The study was placed in the record as an attachment to Sennheiser’s comments.

¹⁷ Shure Part 15 Petition at 11; Audio-Technica Petition at 6; Lectrosonics Petition at 3.

no reason that wireless microphones cannot operate on the frequencies that will be allowed and successfully avoid the incoming 600 MHz licensees. In addition, for equipment that cannot tune to permissible frequencies but can be cost-effectively modified to be compliant, manufacturers should be allowed to offer such an option so the equipment can remain in use.

H. A Path for Professional Unlicensed Microphone Operators to Register for Interference Protection Should be Provided.

Sennheiser supports the request that the Commission reinstate a reservation system for unlicensed users.¹⁸ There is a broad universe of wireless microphone operators; categorizing them in a simple bifurcated manner of “licensed” or “unlicensed” is not useful, as unlicensed does not equate to unprofessional. The expansion of license-eligibility to include sound companies and venues that routinely use 50 or more microphones was certainly welcomed. However, the rules still exclude hundreds of performing arts companies, many of which stage highly sophisticated productions that provide significant cultural enrichment to our society.

The Commission claims this matter cannot be raised because no petitions for reconsideration were filed when it expanded license eligibility. This is misleading, because that decision was made well before the FCC proposed to eliminate registration protection for users of unlicensed wireless microphones. Parties were thus unaware that this avenue to protection would be cut off, and lacked the opportunity to raise these considerations by filing Petitions for Reconsideration when the Commission modified license eligibility.

Venues staging professional productions that do not qualify for FCC licenses should have a means to register for protection. This is particularly vital for assembly areas that are mandated to have assistive listening systems to comply with requirements that satisfy the Americans with Disabilities Act (“ADA”) for the hearing and visually impaired. Wireless microphones are front

¹⁸ Shure Part 15 Petition at 13.

end components of these systems, and if the microphones are subject to harmful interference it undermines the intent of the ADA.

I. Regardless of “Push” or “Pull,” the Database System Needs to be Fast, Accurate, and Equally Applied to All Shared TV Channels.

All concerned parties seem to share the same goal of ensuring that the white space database system is accurate, reliable, and swiftly clears channels for licensed microphone use. Regardless of whether a “push” or “pull” system is adopted, Sennheiser seeks a fast responding, reliable system. The Commission made a sound choice in adopting the “push” approach. However, petitions filed by NAB and Google point to valid concerns that some unlicensed devices will not receive a pushed message and may continue to operate on a channel required by a licensed operator. For the database system to succeed, the system itself, as well as all the devices it governs, must work with absolute reliability. Google references “potentially millions of individual unlicensed devices” that may be communicating with a database.¹⁹ The Commission must ensure that all devices receive the notification message one way or the other. Requiring notification in twenty minutes or less would ensure that wireless microphones can obtain use of channels when needed for critical events.

Google reiterates its proposal for two fast polling channels, but it assumes that late-breaking events operate exclusively on the two reserved channels and does not consider the future spectrum landscape. During a major news story or other event that draws dozens or even hundreds of media and production personnel to a given location, wireless microphones quickly occupy not just the two current reserve channels but any other available channel. When the reserved microphone channels are eliminated and 600 MHz repurposed, the remaining TV band will become very congested as the remaining television stations are repacked into fewer

¹⁹ Google Petition for Reconsideration at 5.

channels. This will present greater challenges those producing spontaneous and late-breaking events to find available channels, even if the database system clears channels within 30 minutes. The Commission should ensure that all shared channels should be made available promptly to licensed wireless microphones when needed. Google claims that frequent database communications to protect licensed wireless microphones will drain battery power excessively. If battery drain is a legitimate concern, there are other channels that will be available for WSDs use that cannot be reserved by wireless microphones and will not require frequent database communications.²⁰ Manufacturers can design WSDs that require extended battery life to operate in these other channels.

J. The Permissible Antenna AGL and HAAT Heights for Fixed Unlicensed Devices in Less Congested Areas Should Not Be Changed.

The Wireless Internet Service Providers Association (“WISPA”) is seeking reconsideration of the Commission’s decision regarding the maximum antenna height above ground level (“AGL”) and the maximum height above average terrain (“HAAT”) for less congested areas. WISPA claims that the Commission provided an insufficient explanation of its decision.²¹ This is not accurate. The Commission noted its concerns for increased interference; the potential difficulty in identifying the source of interference; the reduced opportunity to share the spectrum; and a “belief that it is generally not necessary to mount an antenna at heights greater than 30 meters (100 feet) AGL to avoid shadowing by trees and other obstructions in rural areas.”²² This reasoning is sound. The Commission acted prudently in accommodating the need for greater range by allowing highly directional antennas with more than doubled the permissible EIRP (from 4 Watts to 10 Watts).

²⁰ Specifically, Channel 37, a portion of the duplex gap, and a portion of the lower guard band.

²¹ WISPA Petition at 7.

²² Part 15 R&O at ¶ 57.

Wireless microphones operate throughout the country, including in rural areas and other locations considered “less congested;” for example, national broadcasts of college sporting events that occur nearly every day. Sennheiser opposes increasing antenna height above ground for WSDs, as this would increase interference potential to wireless microphone operations.

CONCLUSION

The Commission should reconsider its decisions and: 1) not limit LPAS access to the 1.4 GHz band to no more than 30 MHz of spectrum per location; 2) not apply the -90 dBc spurious emissions limit for all frequencies above and below the ETSI mask specification; 3) designate coordinated frequencies for wireless microphones in 169-172 MHz; and 4) find that the Section 15.201 waiver remains in force. Sennheiser also supports: 1) increasing the transmitter output power from 20 mW to 50 mW for wireless microphones operating in the guard bands and duplex gap; 2) allowing either conducted power or radiated (EIRP) power measurements; 3) grandfathering equipment tunable to permitted frequencies; and 4) preserving a path for protection of unlicensed users. Sennheiser also urges the Commission to ensure that the database system can reliably and responsively protect wireless microphones, and opposes any increase in the permissible antenna heights for fixed white space devices.

Respectfully submitted,

/s/

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