

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
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)	
Promoting Spectrum Access for Wireless Microphone Operations)	GN 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)	ET 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)	GN Docket No. 12-268
)	

CONSOLIDATED REPLY OF SHURE INCORPORATED

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Dated: March 10, 2016

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SUMMARY

Shure Incorporated (“Shure”) appreciates the Commission’s efforts to balance the competing spectrum interests in rendering decisions in these two proceedings and generally supports many important steps taken.

Shure urges reconsideration of discrete issues to ensure the continued design and manufacture of Part 74 wireless microphones, as well as to enable wireless microphone use of supplemental spectrum made available given the imminent loss of 600 MHz frequencies repurposed for cellular service. The instant record offers overwhelming support for these revisions. Specifically:

- The Commission should promptly adopt the out-of-band emission (“OOBE”) limits provided in ETSI Standard EN 300 422 -1, Section 8.4.3 for Part 74 wireless microphones. The inadvertently adopted OOBE limit beyond plus or minus one megahertz from center frequency prohibits the design and manufacture of wireless microphones. This outcome is inconsistent with the Commission’s recognition of the importance of wireless microphones, and its stated goal to identify adequate spectrum for their future operation. No substantive opposition to the adoption of the ETSI OOBE limits occurred. CTIA raised an objection, but bases its argument entirely on controversial and discredited analyses, while concurrently promoting far more relaxed emission limits for its own constituents even when operating next to sensitive safety-of-life spectrum uses in other bands.
- The Commission should eliminate the 30 megahertz limit on 1.4 GHz spectrum use for licensed wireless microphones at a particular location. No comment was sought on such a limit, the record does not support such a limit, and the incumbent has reaffirmed support for wireless microphone use across the entire 1.4 GHz band pursuant to coordination.

The record also reflects continued support for reconsideration or clarification of specific issues concerning Part 15 wireless microphone use, including clarification that Part 15 antenna connector requirements do not apply to microphones, continuation of previously approved Part 15 low power levels up to 50 mW in guard bands, manufacturer flexibility to undertake radiated

or conducted measurements depending on the device under test, that cut-off dates do not apply to 600 MHz band microphones that can tune to permitted frequencies, and retention of channel reservations for professional unlicensed wireless microphone users. With respect to database issues, Shure also reaffirms support for its original proposal requiring 20-minute database rechecks.

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CONSOLIDATED REPLY OF SHURE INCORPORATED

Shure Incorporated (“Shure”), by its undersigned counsel, hereby provides these consolidated reply comments to the Oppositions and Comments filed in connection with the above-referenced proceedings.¹ Shure appreciates the Commission’s efforts to balance the

¹ See *Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket Nos. 14-166 and 12-268, Report and Order, 30 FCC Rcd 8739 (rel. Aug. 11, 2015) (“*Wireless Microphone Order*”); see also *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 Amendment of Part 74 of the Commission’s Rules for Low*

competing spectrum interests in rendering decisions in these two proceedings and generally supports many important steps taken, including the attempt to identify certain guard band spectrum in which wireless microphones could operate and the identification of supplemental spectrum for wireless microphone operations. However, the new set of rules governing Part 15 operations and operations in new supplemental spectrum unnecessarily limit wireless microphone operations and equipment, and impose undue hardships on manufacturers and users now and in the future in an industry already subject to extreme change as a result of the Commission's decisions.

For that reason, Shure sought reconsideration or clarification so that: the onerous Part 15 antenna connector limitations do not apply to unlicensed wireless microphones; microphones operating in the guard bands and duplex gap will be able to operate at previous Part 15 low power levels up to 50 mW; manufacturers have the flexibility to undertake radiated or conducted measurements depending on the device under test; cut-off dates are not applied to 600 MHz band microphones that can tune to permitted frequencies; and professional unlicensed wireless microphone users have an option to seek channel reservations to modest amounts of clean spectrum for special circumstances. With respect to database issues, Shure also argued that the Commission erred in not adopting its original proposal requiring 20-minute rechecks. The record in these proceedings evidence significant support, albeit not exclusive, from multiple

Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap, Docket No. 14-165, GN Docket No. 12-268, Report and Order, 30 FCC Rcd 9551 (rel. Aug. 11, 2015) (“*Unlicensed Order*”); Comments and Response of Shure Incorporated; Docket No. 14-166 (filed Feb. 29, 2016) (“*Shure Comments*”); Opposition to Petitions for Reconsideration of National Association of Broadcasters, Docket No. 14-165 (filed Feb. 29, 2016) (“*NAB Opposition*”); Opposition and Response of Sennheiser Electronic Corporation, Docket Nos. 14-165 and 14-166 (filed Feb. 29, 2016) (“*Sennheiser Opposition*”); Opposition and Reply of CTIA to Petitions for Reconsideration, Docket Nos. 14-165 and 14-166 (filed Feb. 29, 2016) (“*CTIA Opposition*”); Opposition of Broadcast Sports International to Petition for Reconsideration, Docket No. 14-166 (filed Feb. 29, 2016) (“*Broadcast Sports Opposition*”); Opposition of Aerial Video Systems to Petition for Reconsideration, Docket No. 14-166 (filed Feb. 29, 2016) (“*Aerial Video Systems Opposition*”); Comments of Aerospace and Flight Test Radio Coordinating Council, Inc. on Petitions for Reconsideration, Docket No. 14-166 (filed Feb. 29, 2016) (“*AFTRCC Comments*”).

stakeholders for the sensible measures outlined in Shure’s Petition and Shure will not recount that support in detail here.² Shure herein addresses in more detail stated opposition to its request to correct one onerous aspect of the out-of-band emission (“OOBE”) limits included in the Commission’s *Wireless Microphone Order* and eliminate an unnecessary 30 MHz limitation on wireless microphone operation in the 1.4 GHz band. Shure also clarifies its request with respect to the use of special temporary authority (“STA”) in the 1.4 GHz band.

I. THE COMMISSION SHOULD REJECT CTIA’S ARGUMENTS FOR RETAINING THE ONEROUS OUT-OF-BAND EMISSION LIMITS INADVERTENTLY ADOPTED FOR WIRELESS MICROPHONES

To ensure the future viability of professional audio wireless microphone use, Shure urges the Commission to promptly amend its OOBE limits for Part 74 wireless microphones beyond plus or minus one megahertz from center frequency to reflect the contemporary and spectrally efficient European Telecommunications Standards Institute (“ETSI”) emission limits.³ CTIA’s arguments for retaining onerous OOBE limits that will effectively prevent the design and manufacture of wireless microphones are based on inapplicable and dubious studies, technically unsound, and undermined by its own advocacy in other proceedings, which support far more relaxed emission limits for higher powered and more prolific cellular handheld devices. CTIA’s recommendations also hinder the Commission’s goals of promoting spectral efficiency, given that the -90 dBc level included in the Commission’s Order actually encourages operation with maximum output power permissible under the rules by relaxing OOBE for stronger signals.

² See, e.g., Petition for Reconsideration of Audio-Technica U.S., Inc., Docket No. 14-165 at 8-10 (filed Dec. 17, 2015) (“*A-T Petition*”); Consolidated Petition for Reconsideration of Sennheiser Electronics Corporation, Docket No. 14-165 at 9-10 (filed Dec. 17, 2015) (“*Sennheiser Petition*”); Petition for Reconsideration of National Association of Broadcasters, ET Docket No. 14-165 at 4-7 (filed Dec. 23, 2015).

³ Specifically, Shure urges adoption of OOBE limits provided in ETSI EN 300 422 -1, Section 8.4.3; Attachment 1.0 to this pleading provides this standard for reference.

Instead of engaging in a productive dialogue with respect to best engineering spectrum management practices and practical OOB limits for handheld devices, CTIA's arguments evidence a disingenuous effort to prevent wireless microphone use as much as possible in VHF/UHF spectrum, including spectrum far removed from the repurposed 600 MHz band. Unnecessarily burdening the manufacture and use of wireless microphones in VHF/UHF spectrum, however, only complicates the task of migrating wireless microphone users out of repurposed 600 MHz spectrum. Implementing a regulatory scheme that requires wireless microphone end users to discard equipment that they were only recently encouraged by Commission policies to purchase in the 600 MHz band remains a challenge.⁴ This task becomes even more difficult if these end users cannot purchase replacement equipment because no manufacturer can design and build a device due to draconian OOB levels adopted inadvertently.

A. CTIA Wrongly Bases Its Advocacy for Imposing Onerous OOB Limits on ALL Part 74 Wireless Microphones on Discredited Analyses that Fails to Address Existing Spurious Emission Levels in Real-World Environments

CTIA bases its argument for retaining a -90 dBc limit on supposedly "extensive test data demonstrating the necessity of strict OOB limits for wireless microphones" provided by V-COMM.⁵ The evaluation undertaken by V-COMM underpinning CTIA's argument, however, was highly controversial and widely disputed,⁶ and exclusively studied unlicensed wireless

⁴ In November 2008 the Commission promoted 600 MHz wireless microphone operations by creating reserve channels for microphone use free from Part 15 TV White Space operations centered around Channel 37 at 608-614 MHz; *See Unlicensed Operation in the TV Broadcast Bands*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, ¶ 157 (Nov. 14, 2008).

⁵ *See CTIA Opposition* at 5; *see also* Comments of CTIA – The Wireless Association, Docket Nos. 14-165 and 14-166, Appendix B (filed Feb. 4, 2015) ("V-COMM Study").

⁶ *See, e.g.*, Ex Parte Presentation of Shure Incorporated, Docket Nos. 14-165 and 14-166, Exhibit 1, Wireless Microphones in the 600 MHz Duplex Gap and Guard Bands (filed Apr. 13, 2015) ("*Microphone OOB Study*") (explaining various problems and inaccuracies in the V-COMM Study, including basic flaws in path-loss

microphones operating in the 600 MHz guard bands and the mid-band gap between 600 MHz uplink and downlink allocations.⁷ Shure and other commenters identified numerous technical inaccuracies and deficiencies with respect to the V-COMM study, including:

- Inaccurate assumptions with respect to OOBE propagation, grossly miscalculating path loss and underestimating wireless microphone user body attenuation.⁸
- Instead of using proven 3GPP measurements for in-band blocking, without explanation or justification, V-COMM developed a scheme with exaggerated levels of sensitivity.⁹
- V-COMM failed to consider OOBE from real-world devices relative to levels from wireless microphones.¹⁰

Given the significant problems Shure and other interested parties in the proceeding previously elaborated, V-COMM's study offers no useful metrics to evaluate wireless microphone OOBE into any adjacent spectrum use, and the Commission's *Wireless Microphone Order* appropriately avoids any reference to the flawed study.

Moreover, neither the V-COMM study nor any other filing made by CTIA in the instant proceeding addresses why wireless microphones should be subject to draconian OOBE levels when cellular services co-exist with a vast multitude of devices regulated under more reasonable emission limits imposed in FCC Rule Sections 15.109 and 15.209.¹¹ As confirmed by Shure during anechoic chamber testing in 2015, LED lighting, desktop computers and video walls all generate far higher levels of spurious emissions into the 600 MHz band relative to wireless

calculations and other fundamental assumptions); *see also* Reply Comments of Microsoft Corporation, Docket 14-165, at 10 (filed Feb 2, 2015) explaining that V-COMM's "testing parameters [] bear little resemblance to real-world operating conditions" among other problems with the V-COMM Study).

⁷ *See, e.g., V-Comm Study* at 3 (clarifying that testing involved only wireless microphone signals in the proposed 600 MHz guard bands or duplex gap).

⁸ *See Microphone OOBE Study* at 11-25.

⁹ *See id.* at 6.

¹⁰ *See id.* at 8.

¹¹ *See* 47 CFR §§ 15.109 and 15.209.

microphones under the Commission's -90 dBc OOB limits adopted in this proceeding.¹² Devices regulated under Sections 15.109 and 15.209 are not just stronger emitters of OOB into the 600 MHz band relative to wireless microphones, however, they are also far more widely and densely deployed. Wireless handsets operate successfully in close proximity to laptop computers, LED lighting, and numerous other electronic devices. These devices are subject to the Commission's Part 15 Rules, which impose a limit of -49.2 dBm/100 kHz in the UHF band; much higher than the -90 dBc limit advocated by the CTIA.¹³

B. CTIA's Arguments for Imposing Extreme OOB Limits on Part 74 Wireless Microphones Are Technically Unsound, Promote Inefficient Spectrum Use and Conflict with Its Own Publicly Stated Prior Positions

CTIA makes inappropriate "apples to oranges" comparisons between alternative OOB limits within the occupied bandwidth and outside it that evidence its flawed analysis regarding wireless microphone emission measurements and spectrum management practices. CTIA argues that it proposed an OOB limit of -89 dBm/100 kHz and that the Commission "failed" to adopt this limit.¹⁴ CTIA fails to acknowledge, and appears to overlook altogether, that its argument makes an inappropriate comparison between two distinct types of emission measurement. Specifically, -89 dBm/100 kHz is a static spectral density measurement across 100 kilohertz of bandwidth. In contrast, the -90 dBc limit beyond +/- one megahertz adopted by the Commission does not consider spectral density and varies according to the output level of the transmitter, with OOB actually increasing or decreasing proportionally to adjustments in output power. Under

¹² See *Microphone OOB Study* at 6-11 (discussing real-world OOB generated by various devices regulated under Part 15 rule).

¹³ A limit of -90 dBc would equate to -90 dBm at a power of 1 mW, -80 dBm at a power of 10 mW, and -73 dBm at a power of 50 mW.

¹⁴ *CTIA Opposition* at 5.

these parameters, operation at *lower* output powers actually makes achieving the proposed -90 dBc beyond +/- 1 MHz limit much *more difficult*. Manufacturers have strong incentives to build equipment that operates at a variety of permissible power levels to maximize performance relative to spectral efficiency. Building and promoting equipment that operates with more output power than necessary in order to meet an OOB measurement outside the occupied bandwidth mask is contrary to both longstanding FCC policy and best practices with respect to frequency reuse and conservation within the wireless microphone community.¹⁵

Methodological inconsistencies and spectral efficiency arguments aside, CTIA's position in the instant proceeding conflicts with its longstanding position on promoting relaxed OOB limits for handheld devices that are more powerful and abundant relative to Part 74 wireless microphones. For example, in 2013 CTIA advocated aggressively for relaxed OOB limits for Advanced Wireless Service-3 ("AWS-3") handsets attenuated below transmitter power in watts by a factor of only $43 + 10 \log_{10}(P)$ dB ("43 log") outside of the licensee's frequency block, despite the proximity of AWS-3 handsets to sensitive safety-of-life and space-based services.¹⁶ There is no credible justification for CTIA to argue that mobile handsets operating with up to 1 Watt of output power and in close proximity to sensitive incumbent services deserve such relaxed OOB limits while Part 74 wireless microphones with far less power and a decades long track record of interference free operations in VHF/UHF TV bands and other spectrum should be subject to such extreme OOB limits.

¹⁵ See, e.g., *Examination of Exclusivity and Frequency Assignment Policies of the Private Land Mobile Radio Services*, Report and Order, 10 FCC Rcd 10076, ¶ 2 (Jun. 23, 1995) (discussing the Commission's broad goal of promoting spectral efficiency); see also *Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, Notice of Inquiry and Notice of Proposed Rulemaking, FCC 03-289, ¶¶ 5-7 (Nov. 13, 2003) (explaining the Commission's longstanding goal to promote efficiency).

¹⁶ See Reply Comments of CTIA - The Wireless Association, Docket No. 13-185, at 15-17 (filed Oct. 28, 2013) (arguing that the Commission should adopt the standard OOB limits for commercial mobile devices and maintaining that there is "substantial spectral distance between the GPS spectrum and the AWS-3 bands").

C. Wireless Microphone Manufacturers and Operators Will Fully Cooperate with Other Spectrum Interests on OOBE Issues

AFTRCC explains in its comments that revisions to OOBE for wireless microphones operating in the 1435-1525 MHz may affect its coordination analysis.¹⁷ As the Commission's Order and rules make clear, aeronautical telemetry services enjoy priority in the 1435-1525 MHz band. No party in this proceeding -- perhaps other than CTIA¹⁸ -- challenged this priority. It follows that any adjustment to technical rules for wireless microphones operating on a secondary basis in the band merits AFTRCC review. The adjustment of the extreme and unprecedented OOBE limits as discussed above will not result in interference to aeronautical telemetry users as a practical matter and in any event will not alter the priority rights of those users relative to secondary wireless microphones. As such, the aeronautical telemetry community can rest assured that the wireless microphone community will be motivated, and indeed obligated, to address any specific concerns that may arise with respect to wireless microphone OOBE.

¹⁷ *AFTRCC Comments* at 5.

¹⁸ *See also* Comments of CTIA – The Wireless Association, Docket Nos. 14-165, 14-166, at 41-43 (filed Feb. 4, 2015) (urging the Commission not to make the 1435-1525 MHz band available for wireless microphone use “until it has been fully examined for its suitability to host licensed wireless services”).

II. NO PARTY ON OPPOSITION PROVIDES CREDIBLE TECHNICAL OR POLICY JUSTIFICATION FOR MAINTAINING A 30 MEGAHERTZ LIMITATION ON WIRELESS MICROPHONE USE OF 1.4 GHz SPECTRUM

On reconsideration Shure and other commenters urged the Commission to eliminate the limitation that licensed wireless microphone use no more than 30 megahertz of 1.4 GHz spectrum in a particular area.¹⁹ In comments filed in support of this proposed rule revision, Shure and other commenters explained that the 1.4 GHz band was intended by the Commission for use at large-scale and super-scale events where a 30 megahertz limitation would hinder production of an event and diminish the utility of the 1.4 GHz band. Comment was never sought on a 30 megahertz limitation and indeed the advocate and coordinating body for the primary service in the band, AFTRCC, supported full use of the band for wireless microphone operations when and where available pursuant to successful coordination.²⁰

Oppositions to reconsideration of the 30 megahertz limitation raise no meaningful technical or policy arguments. CTIA asserts that the 30 megahertz limitation is “well-supported by the record” but offers no evidence of such support or any relevant citation.²¹ In contrast, AFTRCC’s own comments concerning issues raised on reconsideration fully support wireless microphone use of the 1.4 GHz band without the limitation the FCC unexpectedly injected into the Wireless Microphone Order. Specifically, AFTRCC explained that as coordinator for the 1.4 GHz band:

[It] would treat a request for coordination of 60 MHz or 90 MHz the same, whether it consists of a request for coordination under the rule in question for 30 MHz and a separate request for the remainder pursuant to an STA application or whether it consists

¹⁹ See *Shure Petition* at 7-10; *Sennheiser Petition* at 3-6; Petition for Reconsideration of Lectrosonics, Inc., Docket No. 14-166, at 4-5 (filed Dec. 17, 2015); *A-T Petition* at 5-6.

²⁰ See Notice of Ex Parte Presentation of AFTRCC, Docket Nos. 14-166 and 12-268, at 2 (filed June 16, 2015).

²¹ *CTIA Opposition* at 8.

of a single request under a wireless microphone license to use 60 or 90 MHz of L-Band spectrum. If a proposed wireless microphone operation can be coordinated (and the equipment is certified to meet the L-Band authentication and geolocation verification requirements of the new rules) and if AFTRCC (and federal government coordinators) find it to not present an interference concern to planned AMT operations or other prior coordinated uses, AFTRCC submits that it should not matter whether the requested spectrum requested is greater or less than 30 MHz – or involves the entire 90 MHz band, for that matter.²²

In light of the reaffirmed support of the only incumbent interest with a primary allocation in the 1.4 GHz band, the lack of substantive opposition, and to ensure that the 1.4 GHz band has utility for wireless microphones at large-scale and super-scale events where spectrum is urgently needed given the looming repurposing of 600 MHz spectrum, Shure urges the Commission to eliminate the arbitrary 30 megahertz limitation adopted in the Microphone Order.

III. THE STA PROCESS SHOULD NOT UNDERMINE IMPLEMENTATION OF PERMANENT TECHNICAL AND OPERATIONAL RULES FOR WIRELESS MICROPHONES IN THE 1.4 GHz BAND

Both Aerial Video Systems and Broadcast Sports International filed oppositions to Shure’s Petition for Reconsideration which they describe as urging “the Commission [to] cease issuing STAs to commercial entities for video production in this band and elsewhere.”²³ Both object at great length to any suggestion that the Commission’s decision could be read to reduce or change in any way the use of the STA process or impose permanent equipment certification or technical requirements on equipment used to support video transmission in the 1.4 GHz band. To avoid any confusion and for the avoidance of doubt, Shure clarifies, as stated in its Petition, that it expressly supports consolidation of wireless microphone operations in the 1.4 GHz band

²² *AFTRCC Comments* at 3.

²³ *See* Opposition of Aerial Video Systems, Docket Nos. 14-166, 12-268, at 2 (filed Feb. 29,2016) ; Opposition of Broadcast Sports International, Docket Nos. 14-166, 12-268, at 2(filed Feb. 29,2016).

under permanent Part 74 rules²⁴ but that it is not addressing requirements that should apply to video transmissions. Given that Shure's view is not directed to video transmissions, and that both wireless audio and wireless video operations in the 1.4 GHz band are subject to AFTRCC approval and routinely coordinated on-site by professional frequency coordinators, the Commission need not address and should dismiss the Oppositions of Aerial Video Systems and Broadcast Sports International suggesting that wireless microphone operations be limited to 30 MHz in the 1.4 GHz band.

While Shure recognizes that the Commission may continue to authorize video transmission on an event-by-event basis under an STA process,²⁵ it is essential that the new rules governing wireless microphone operation and equipment in the 1.4 GHz band have uniform technical requirements for all products operating in the band which are not be undermined by authorizing a parallel STA process. Disparate treatment will quickly chill manufacturers' incentive to make the significant investment necessary to develop equipment that complies with new technical and operational rules for 1.4 GHz operation developed in the order and supported by AFTRCC.

²⁴ See *Shure Petition* at 9.

²⁵ See *Shure Comments* at 8-9 (noting that video producers should be able to continue to use the STA process to obtain spectrum access for video services in the band); *Order* at ¶ 112 (citing *Shure Comments*).

Respectfully submitted,

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Dated: March 10, 2016

ATTACHMENT 1

ETSI EN 300 422 -1, Section 8.4.3 OOBE Limits:

Table 3: Limits for spurious emissions

State	Frequency		
	47 MHz to 74 MHz 87,5 MHz to 137 MHz 174 MHz to 230 MHz 470 MHz to 862 MHz	Other Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Operation	4 nW	250 nW	1 μ W
Standby	2 nW	2 nW	20 nW

CERTIFICATE OF SERVICE

I, Tim Bransford, hereby certify that on March 10, 2016, I caused a copy of the Consolidated Reply of Shure Incorporated to be served via U.S. mail on the following:

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