

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554**

In the Matter of)	
)	
Promoting Spectrum Access for Wireless Microphone Operations)	GN Docket No. 14-166
)	
)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions)	GN Docket No. 12-268
)	

PETITION FOR RECONSIDERATION

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SUMMARY

Shure applauds the Commission's efforts to identify supplemental spectrum and promulgate additional rules for wireless microphone operations, given that up to 120 megahertz of UHF spectrum presently available for wireless microphone use will be repurposed in the near term for exclusive cellular broadband use. Given the complexity of the proceeding from a technical and policy standpoint, Shure has identified a handful of discrete and noncontroversial issues for which this Petition seeks reconsideration. Specifically, Shure urges the Commission to reconsider the following:

First, the instant record does not support a 90 dB reduction in out-of-band emissions ("OOBE") relative to carrier levels ("-90 dBc") beyond plus or minus one (1) megahertz from a transmitter's center frequency. It is impractical to manufacture wireless microphones to meet such a limit. Instead, the Commission should adopt European Telecommunications Standards Institute ("ETSI") limits for wireless microphone out-of-band emissions, as provided in Sections 8.3 and 8.4 of ETSI EN 300 422-1 v1.4.2, which would provide marked reductions in spurious emissions relative to the existing Part 74 limits. **If this requirement is not amended to reflect the entire ETSI OOBE limit as stated in the standard, it will not be feasible for industry to manufacture wireless microphones in the future.**

Second, licensed wireless microphones require full use of the 1435-1525 MHz band where coordination with incumbent spectrum users permits, and Shure urges elimination of the 30 megahertz limitation on use of this band at a particular location. The Commission did not seek comment on a 30 megahertz limitation for wireless microphone use of the band, comment was not provided on such a limitation, and no technical or policy justification otherwise exists for such a limitation. The Commission itself identifies the 1435-1525 MHz band as ideal for

large-scale and super-scale events where far more than 30 megahertz of supplemental spectrum will be required in order to support professional audio wireless microphones, and the Aerospace and Flight Test Radio Coordinating Council (“AFTRCC”) enthusiastically supports full use of the band for coordinated licensed wireless microphone operations given the robust electronic safeguards that are being developed to provide incumbent aeronautical telemetry spectrum users with comprehensive interference protection.

Finally, for wireless microphones operating in the VHF television band, transmitter power output should be measurable on either a conducted or radiated (Effective Isotropic Radiated Power “EIRP”) basis. This flexibility is needed to allow manufacturers to develop products that will satisfy user expectations and requirements for operation in this band. Accordingly, Shure recommends adoption of the test methods described in Section 8.2 of ETSI EN 300 422-1 v1.4.2 (2011-08).

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PETITION FOR RECONSIDERATION

Shure Incorporated (“Shure”), by its undersigned counsel and pursuant to Section 1.429 of the Commission’s Rules, 47 C.F.R. § 1.429, hereby respectfully submits this Petition for Reconsideration (“Petition”) of the Commission’s Report and Order in the above-captioned dockets released on August 11, 2015 (“Order”).¹

I. INTRODUCTION

In the Order, the Federal Communications Commission (“FCC” or “Commission”) established a substantial set of rules intended to maximize efficiency and productivity within existing Very High Frequency (“VHF”) and Ultra High Frequency (“UHF”) TV bands available for wireless microphone use and identified supplemental spectrum for wireless microphone operations, given that up to 120 megahertz of UHF spectrum presently available for wireless microphone use will be repurposed in the near term for exclusive cellular broadband use.²

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) (“Order”).

² See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd 6567 (2014) (“*Incentive Auction R&O*”).

As a leading global manufacturer of Part 74 low power auxiliary wireless microphone devices in the United States, Shure has participated heavily in the instant proceeding, meeting with the Office of Engineering and Technology (“OET”) prior to the release of the initial Notice of Proposed Rulemaking (“NPRM”)³ to discuss technological developments and options for future supplemental bands for secondary wireless microphone allocations, working with incumbent spectrum users to collaborate on spectrum sharing, and conducting extensive outreach with the wireless microphone user community. Accordingly, Shure appreciates the significant Commission resources dedicated to the instant proceeding, and strongly believes that the Order establishes a solid foundation for improved efficiency in VHF/UHF bands and viable supplemental allocations in several important new bands.

Given the complexity of the proceeding from a technical and policy standpoint, the large number of bands evaluated by the Commission, and the compressed timeline for developing the Order, Shure has identified a handful of discrete and noncontroversial issues for which this Petition seeks reconsideration as further discussed herein.

II. THE SUCCESSFUL IMPLEMENTATION OF ETSI WIRELESS MICROPHONE MASKS REQUIRES A REVISION TO ADOPTED OUT-OF- BAND EMISSION (OOBE) LIMITS

To “promote more efficient use of the limited TV band spectrum available for wireless microphones” the Commission adopted new analog and digital emission masks pursuant to Section 8.3 of ETSI EN 300-422 v1.4.2 (2011-08) (“ETSI masks”).⁴ The record reflects that major wireless microphone manufacturers overwhelmingly support the adoption of ETSI masks

³ 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, Notice of Proposed Rulemaking, 29 FCC Rcd 12343 (rel. Sep. 30, 2014) (“NPRM”).

⁴ Order at ¶ 32; see also ETSI EN 300 422-1, Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. This standard is available at: www.etsi.org.

and Shure reaffirms its enthusiastic support for these masks herein.⁵ The efficiency benefits of adopting contemporary ETSI masks will be immediate while imposing minimal burden on equipment manufacturers. Moreover, the adoption of ETSI masks will not degrade the performance of pro-audio wireless microphones or inject latency, and will be transparent to end users.

Shure urges reconsideration of one discrete aspect of the Commission's implementation of the ETSI masks. Specifically, no support exists in the instant record for the Order's requirement that "[o]utside the frequency range where the ETSI masks are defined (one megahertz above and below the wireless microphone carrier frequency), we will require that emissions comply with the same limit as the edge of the ETSI masks, specifically, 90 dB below the level of the unmodulated carrier."⁶ **Wireless microphone manufacturers cannot design and manufacture handheld and body-worn transmitters that satisfy such an extreme and sweeping limitation on spurious emissions.** Moreover, by adopting an OOBE limit that is relative to transmitter power output rather than a fixed level, the Commission has inadvertently adopted an emission limit that discourages spectral efficiency, penalizing lower powered transmitters by making it more difficult for them to meet the limit. Operating with lower power, when practical, allows end users to reuse frequencies more efficiently and conserves battery life. Alternative OOBE limits that markedly reduce spurious emission levels from wireless microphones (relative to current Part 74 limits) under Section 15.209 of the Commission's rules or adoption of the OOBE limits in the ETSI EN 300-422 standard were proposed to the

⁵ See, e.g., *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, Comments of Shure Incorporated at 32-33 (filed Feb. 4, 2015) ("*Shure Comments*"); Comments of Sennheiser Electronic Corporation 11 (filed Feb. 4, 2015); Comments of Audio-Technica U.S., Inc. at 22 (Filed Feb. 4, 2015).

⁶ Order at ¶ 32.

Commission. **The ETSI OOB limits enjoy widespread industry support and should be adopted on reconsideration.**

A. The Record Does Not Support Establishing OOB Limits at -90 dBc

No basis exists in the record to adopt a -90 dBc OOB limit for wireless microphones. The Commission sought comment on whether -90 dBc or another alternative OOB limit should be applied beyond plus and minus one (1) megahertz from the center frequency to future Part 74 wireless microphones.⁷ No support was offered for the -90 dBc level. Instead, substantive comments addressing the issue supported alternative limits that provide marked improvements in efficiency while still making it possible for manufacturers to design and manufacture professional wireless microphones that will satisfy end user form factor and performance requirements.⁸

B. The Adoption of a -90 dBc Limit Presents an Onerous and Impractical Requirement for Wireless Microphones

By coupling transmitter output power with OOB, the Commission inadvertently promotes higher power levels and less efficient use of finite spectrum resources. For example, a wireless microphone operating with 50 mW of power must limit OOB beyond +/- 1 megahertz to -73 dBm, a wireless microphone operating with 10 mW of power must limit OOB beyond +/- 1 megahertz to -80 dBm, and a wireless microphone operating with 1 mW of power must limit OOB beyond +/- 1 megahertz to -90 dBm. Discouraging the manufacture of wireless microphones with lower output levels contradicts the Commission's longstanding policy goal of

⁷ NPRM at ¶ 91.

⁸ For example, Shure proposed the adoption of out-of-channel OOB limits applied under contemporary Part 15 rules. See *Shure Comments* at 33, proposing the use of Part 15.209 out-of-channel emission limits beyond +/- one megahertz from the carrier center frequency. 47 CFR § 15.209.

promoting spectral efficiency,⁹ and presents practical problems for wireless microphone manufacturers, users, and frequency coordinators that wish to operate with low power output levels, where practical, to enable maximum frequency reuse in larger venues.¹⁰

Even if the -90 dBc OOB limit promoted efficient spectrum use – which it does not – the limit still represents a far more onerous restriction on OOB than what the Commission has imposed on other recent handheld and/or body-worn devices, including devices with significantly more power and higher density deployments than wireless microphones. For example:

- In 2012, for terrestrial cellular operations in Advanced Wireless Service 4 (“AWS-4”) frequencies (2000-2020 MHz and 2180-2200 MHz), the Commission imposed an OOB limit of $43 + 10 \log_{10}(P)$ dB.¹¹
- Earlier in 2015, the Commission adopted an OOB limit of -40 dBm/MHz for new Citizens Broadband Radio Service (“CBRS”) end user devices operating in the 3550-3700 MHz frequency range.¹²

Given that end user devices operating in AWS-4 and CBRS bands will be higher powered, more likely to be operated outdoors and almost certainly more prolific in terms of unit volume compared to professional wireless microphones, a more rigorous OOB limit would offer other

⁹ See, e.g., *Order* at ¶ 10 (noting that the Order is intended to “enable wireless microphone users to have access to a suite of devices that operate effectively and efficiently in different spectrum bands and can address their respective needs.”).

¹⁰ At larger venues, low-power wireless microphones may operate co-channel if adequate physical separation and/or blockage permits.

¹¹ See *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, WT Docket No. 12-70, Report and Order and Order of Proposed Modification, 27 FCC Rcd 16102, at ¶59 (rel. Dec. 17, 2012) (“This limit of $43 + 10 \log_{10}(P)$ dB is consistent with other CMRS bands.”).

¹² See Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band, GN Docket No. 12-354, Report and Order, 30 FCC Rcd 3959, at ¶ 184 (rel. Apr. 21, 2015).

spectrum users more protection and be more appropriate for these services relative to low-power, low-density and largely indoor-operated wireless microphones.

In order to comply with the -90 dBc limit, a wireless microphone with the frequency agility necessitated by today's crowded spectrum bands would be the size of a rack-mounted test instrument and infeasible from a cost and form factor perspective. **If the Commission does not amend the -90 dBc OOB limit to the ETSI levels, it will be impossible for industry to continue to manufacture these products in the future.**

C. Adopting ETSI OOB Limits Will Improve Spectrum Efficiency without Adversely Affecting Wireless Microphone Manufacturability

Shure continues to support the introduction of reasonable alternative out-of-channel OOB limits that would improve the suppression of spurious emissions without adversely affecting pro-audio wireless microphone manufacturability, form factor, or performance. Shure strongly supports the adoption of the spurious emission limits in the ETSI EN 300-422 standard,¹³ which would further the objective of having a uniform testing standard for wireless microphones, and which can be implemented without adversely affecting wireless microphone performance. The adoption of a uniform test standard will have numerous benefits, including lower development and test costs for manufacturers, which will pass through to end users. In its original comments Shure proposed the adoption of Section 15.209 OOB limits,¹⁴ which currently apply successfully to contemporary unlicensed digital transmitters. However, the ETSI limits are more stringent and are widely in use within the wireless microphone industry.

¹³ ETSI EN 300-422 out-of-channel limits provided for reference in Attachment A.

¹⁴ See 47 C.F.R. § 15.209.

As illustrated in Table 1.0 below, the ETSI EN 300-422 OOB limits dramatically reduce spurious emissions relative to the soon to be retired limits in Part 74.

Table 1.0

Relevant Standard	Limit in UHF Band	Limit Above 1 GHz
Part 74 (current)	-13 dBm*	-13 dBm*
ETSI	-54 dBm	-30 dBm

*at 50 mW Transmitter Power Output (TPO)

III. ELIMINATION OF THE 30 MEGAHERTZ USE LIMIT AND HARMONIZATION OF SERVICE RULES WILL IMPROVE THE VIABILITY AND UTILITY OF THE 1435-1525 MHz BAND

A. The Record Does Not Support a 30 Megahertz Limitation on 1435-1525 MHz Spectrum Use, Which Hinders the Commission’s Policy Goals and Diminishes the Band’s Utility

The Commission unnecessarily and arbitrarily reduced the viability of the 1435-1525 MHz band as supplemental spectrum for licensed microphone operations when it restricted “all microphones operating in a particular area to access no more than 30 megahertz” in the band.¹⁵ To Shure’s knowledge, no basis exists in the record for the 30 megahertz limit. The Commission did not seek comment on restricting secondary wireless microphone access to the band in such a manner, nor did the Order cite to any comments filed in support of such a limitation. As such, the Commission should correct this inadvertent oversight by making the entirety of the 1435-1525 MHz band available to licensed wireless microphones users pursuant to successful coordination with AFTRCC and federal and non-federal incumbent users.

A 30 megahertz limit on wireless microphone use of the 1425-1525 MHz frequency range undermines the Commission’s stated policy goals of accommodating the long-term needs

¹⁵ Order at ¶ 118.

of wireless microphone users and creating spectrum well-suited for large-scale events where 100 or more microphones must operate concurrently.¹⁶ The NPRM expressly identifies the 1435-1525 MHz band as ideal for large-scale events where microphones are heavily used, including major sporting events and during large theatrical performances.¹⁷ Establishing a 30 megahertz limitation undermines this goal by artificially capping the number of wireless microphones that can be accommodated by the 1435-1525 MHz band. Contemporary large-scale and super-scale events can employ upwards of 500 wireless microphones, and certain fixed areas with high density microphone deployments (e.g., Broadway or Las Vegas Strip) may involve thousands of wireless microphones.¹⁸ As the Commission itself notes, professional wireless microphone users have traditionally utilized the 1435-1525 MHz band to “supplement their access to other spectrum resources (primarily in the TV bands)” for the coverage of large events and recognizes that STAs provide applicants access to up to 90 megahertz of spectrum in the band.¹⁹ To facilitate the Commission’s goal of creating a band capable of supporting large-scale and super-scale events, where coordination with AFTRCC and federal users permits, access to the full 1435-1525 MHz band should be available to licensed wireless microphone users to help offset the up to 120 megahertz of spectrum repurposed during the 600 MHz Incentive Auction.²⁰

Shure submits that a 30 megahertz limit offers the incumbent aeronautical telemetry community no additional interference protection. Shure, AFTRCC and involved third parties in the wireless microphone and aerospace industry have worked closely during the last calendar

¹⁶ See *NPRM* at ¶ 182; *Order* at ¶¶ 1, 107.

¹⁷ See *NPRM* at ¶ 178.

¹⁸ Conventional wireless microphones used for sound reinforcement as well as devices used for cue and control communications, synchronization of TV camera signals, and in-ear monitors fall with the Commission’s broad definition of a “wireless microphone.” See *NPRM*, n. 6.

¹⁹ See *NPRM* at ¶ 176.

²⁰ See *Incentive Auction R&O*, 29 FCC Rcd at 6696, ¶ 299 *et seq.*

year to develop electronic safeguards that will provide AFTRCC's constituents and federal users with unprecedented protection from interference related to the operation of wireless microphones in the 1435-1525 MHz.²¹ These electronic safeguards will ensure that only licensed, successfully coordinated wireless microphones with a valid certificate from AFTRCC have transmit capability. Moreover, transmit authority will be geolocation restricted, and granted for finite periods of time. Given the unprecedented level of security these electronic safeguards will provide, an FCC limit on use offers no further interference protection. Instead, such a limit only frustrates the Commission's own policy goals and hinders secondary use of the band.

B. Consolidation of Wireless Microphone Operations in the 1435-1525 MHz Band Under Permanent Part 74 Rules Will Better Protect Incumbent Users and Ensure Spectral Efficiency

Although Shure applauds Commission efforts to accommodate wireless microphone and wireless video operations in the 1435-1525 MHz band pursuant to Special Temporary Authority ("STA"), requiring wireless microphone licensees to obtain supplemental access to the 1435-1525 MHz band through the STA process²² to support large-scale events where the coordination process and required protections are already in place for the secondarily licensed spectrum is inefficient and burdensome for wireless microphone licensees and AFTRCC alike. Moreover, Part 5 rules were never intended for the long-term operation of commercial wireless transmitters. Indeed, commercial service involving the lease or sale of hardware for profit is prohibited under FCC rules and is contrary to longstanding FCC policies with respect to Part 5 experimental licensing rules.²³ As the Commission has recognized, commercial businesses should not be

²¹ See, e.g., *Promoting Spectrum Access for Wireless Microphone Operations*, GN Docket No. 14-166, AFTRCC Notice of Ex Parte Presentation at 1-2 (filed June 15, 2015) (identifying proposed conditions for secondary, licensed wireless microphone operation in the 1435-1525 MHz band).

²² See *Order* at ¶ 118.

²³ The narrow exceptions to providing "for hire" services using experimental licenses under Part 5 rules do not apply to the current special temporary authorization ("STA") operations in the 1435-1525 MHz band.

permitted to abuse the Part 5 STA and experimental licensing rules to offer commercial services that would otherwise require a permanent license.²⁴ The FCC should therefore sunset this practice once permanent Part 74 rules are in place and certificated equipment is available for the 1435-1525 MHz band.

Permitting operation in the 1435-1525 MHz band pursuant to Part 5 STA rules does not provide incumbent aeronautical telemetry users with adequate interference protection. Current devices operated pursuant to Part 5 STA undergo no certification testing. Accordingly, no information is available with respect to emission masks and OOB limits for these devices. It is unclear if these devices even satisfy outgoing Part 74, technical requirements, let alone more rigorous requirements in the future.²⁵ Part 5 STA devices are operated solely on the honor system after a manual coordination with AFTRCC without electronic safeguards equivalent to those contemplated by the Order.²⁶ While the Commission's flexibility prior to the development of permanent Part 74 rules was admirable, now that rules are in place, ongoing commercial operations under Part 5 of the Commission's rules should sunset. Shure urges the Commission to discontinue the grant of Part 5 experimental licenses for commercial operations in the 1435-1525 MHz band within 36 months.²⁷

For example, among other reasons, Part 5 market trial rules specify that the equipment under test must comply with the permanent rules for the operation of the transmitter, which in the instant case would require the implementation of approved electronic aids to limit the operation of transmitters to coordinated/approved channels, locations and time periods. *See* 47 CFR § 74.803. Existing equipment involved in STA operations in the 1435-1525 MHz band has no such functionality.

²⁴ *See Amendment of Part 5 of the Commission's Rules to Revise the Experimental Radio Service Regulations*, ET Docket No. 96-256, Report and Order, 13 FCC Rcd 21391, ¶ 18 (1998).

²⁵ The typical request for STA for wireless microphone and/or video relay service in the 1435-1525 MHz band provides only power, ERP and occupied bandwidth. *See, e.g.*, File No. 0069-EX-ST-2014.

²⁶ *See Order* at ¶ 111.

²⁷ Shure remains supportive of Part 5 experimental authorizations assigned for legitimate research and development purposes within the scope and intent of the Commission's rules.

IV. THE COMMISSION SHOULD ALLOW MANUFACTURERS TO HAVE THE FLEXIBILITY TO USE RADIATED MEASUREMENTS FOR DEVICES THAT OPERATE IN THE VHF TELEVISION BANDS, BUT NOT IMPOSE A MANDATE

In the Order, the Commission amended its rules with respect to VHF microphones, “revising the rules that currently measure the 50 mW limit in terms of conducted power to specify the 50 mW limit in terms of EIRP.”²⁸ Shure urges the Commission to reconsider this revision and grant manufacturers the flexibility to measure output power using **either** a radiated (EIRP) **or** conducted basis in the VHF TV bands. This flexibility is crucial to enable the industry to design and manufacture VHF wireless microphone products that will meet the operational needs of a diverse set of users and applications, and is critical to encouraging the adoption of these products as an alternative to UHF band equipment.²⁹ Accordingly, Shure recommends adoption of the measurement procedures contained in Section 8 of ETSI EN 300 422-1 v1.4.2 (2011-08).

In its comments, Shure sought the flexibility to measure output using radiated (EIRP) *or* conducted levels in the VHF band as a way to facilitate and encourage use of the VHF bands for wireless microphones.³⁰ Antenna efficiency can be very low in VHF band applications (on the order of 2-5% typically), making it difficult (in some instances impossible) to replicate the performance of UHF band wireless microphones. Measuring output power on an EIRP basis can help engineers overcome some of the inherent antenna inefficiency problems in the VHF bands, given that some users cannot implement antennas that would be required to achieve reasonable efficiency (50% or greater). Accordingly, manufacturers and users of VHF equipment would

²⁸ Order at ¶ 24.

²⁹ Part 74 bands include the VHF and UHF TV bands as well as the 941.5-960 MHz range and 1435-1525 MHz range.

³⁰ See *Shure Comments* at 30.

benefit from having the flexibility to use equipment certificated on either a radiated or conducted basis.

Respectfully submitted,

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ATTACHMENT A

8.4.3 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