

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

In the Matter of)	
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)	
Amendment of Part 15 of the Commission's)	ET Docket No. 14-165
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 Power Auxiliary Stations in)	
The Repurposed 600 MHz Band and 600)	
MHz Duplex Gap)	
)	
Expanding the Economic and Innovation)	GN Docket No. 12-268
Opportunities of Spectrum Through)	
Incentive Auctions)	

COMMENTS OF SHURE INCORPORATED

Mark Brunner
Senior Director, Global Brand Management

Catherine Wang
Timothy Bransford

Edgar Reihl
Director, Spectrum Policy

Morgan, Lewis & Bockius LLP
2020 K Street, N.W.
Washington, DC 20006
Bus.: 202.373.6000
Fax.: 202.373.6001

Counsel to Shure Incorporated

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SUMMARY

This NPRM proposes sweeping changes to the Part 15 White Spaces rules put in place just a few short years ago in order to prepare for a reduction in available UHF spectrum as a result of the incentive auction and broadcast repacking. Shure appreciates the necessity of this review and supports the Commission in these challenging efforts. While the NPRM proposes many reasonable and sensible changes (including improvement to database operations, 4 MHz of duplex gap spectrum for licensed wireless microphone operations, adoption of tighter ETSI masks for digital and analog wireless microphones, etc.), in many key respects, the proposals go well beyond what is needed to accommodate the auction and repacking and substantially relax technical and other protections of wireless microphones disproportionately disadvantaging wireless microphone users and manufacturers in favor of a hoped-for expansion of unlicensed white space device (“WSD”) operations. The NPRM offers no new testing data, no new scientific evidence, and no evidence that incumbent services operating in the white spaces are any less in need of interference protections than they were when the white spaces Part 15 rules were adopted.

Many of the proposed Part 15 rule changes do not adequately address the important needs of wireless microphones, a long-time incumbent service, that today are critical production tools essential to activities in many sectors—broadcast, entertainment, religious, commercial, educational, and civic—and wireless microphone use continues to expand rapidly to meet increasing demand for more sophisticated productions and advanced audio services. Indeed, adoption of several major proposals in the NPRM would put at risk the future of U.S. leadership in global multimedia and entertainment.

The significant gains in wireless microphone efficiency, recent expansion of wireless microphone license eligibility, and the recent initiation of a proceeding to consider additional non-UHF spectrum that could be made available to wireless microphones sometime in the future are helpful, but they cannot compensate for the dramatic reduction in interference-free UHF frequencies available to wireless microphone operations that will result if many of the NPRM proposals are adopted. Further, the impact of the proposed changes will be particularly onerous given that many wireless microphone users were recently forced to discard perfectly operable 700 MHz equipment and reinvest in *new* equipment much of which, at the encouragement of the Commission, operates in UHF channels below channel 21 spectrum in which the NPRM proposes to eliminate many wireless microphone protections.

In particular, the NPRM does not adequately provide for UHF wireless microphone spectrum resources and Shure opposes rule changes that would:

- eliminate the two wireless microphone reserve channels,
- eliminate the prohibition on portable WSDs below channel 21 and the prohibition on fixed WSD operations on channels adjacent to broadcast signals (both of which were conceived as important spectrum options for wireless microphone operations),
- allow WSDs to operate at increased power (in some cases, substantially increased power, which undermines the utility of the shared spectrum for unlicensed wireless microphones)
- allow WSDs to use significantly increased antenna heights (which would undermine the utility of shared spectrum for unlicensed wireless microphones)

- allow fixed WSDs to operate where there are two, rather than three, vacant channels.

Wireless microphone operators will need access to all possible UHF spectrum options, including small slices of spectrum, in order to avoid severe disruption of existing operations following the incentive auction and spectrum repacking. In that regard, Shure supports the division of spectrum in the duplex gap and lower guard band between wireless microphones and WSDs and supports creation of a nationwide uniform band for the duplex gap. Registered wireless microphones should be able to reserve spectrum in the lower guard band similar to unoccupied TV channels. Wireless microphones should be permitted to operate throughout the guard bands reserving a 100 kHz buffer to adjacent services. In particular, wireless microphones should be able to operate in the 3 MHz guard bands adjacent to channel 37 should they be required (reserving a 100 kHz buffer to protect wireless services) that could be a source of much needed spectrum wireless microphones and would otherwise lie fallow.

With respect to other rule proposals, Shure strongly opposes measures that would require wireless microphones to be controlled by a database, thus requiring fundamental architectural redesign of a globally established and widely deployed product category to incorporate the ability to access and respond to a database. Such a rule would cause significant dislocation and disruption to users and manufacturers with little benefit.

Shure urges the Commission to retain the existing 50 mW power limit, measured on a conducted or EIRP basis, for unlicensed wireless microphone equipment; there is no evidence that a reduction is necessary and the proposed restrictive 20 mW limit would significantly inhibit coexistence in shared spectrum with WSDs operating at higher powers.

Other proposals to relax the technical and operating requirements for unlicensed devices in the white spaces rules need further refinement. The NPRM's proposal to permit relaxed WSD location accuracy requirements should be permitted only if it is coupled with an expansion of the protection zones to account for greater uncertainty in location. Shure also suggests that the definition of "rural" area be revised to take into account population. As proposed, WSD operating in "rural" areas could operate at higher power, with higher antennas, etc. and further review of the application of the proposed rural definition is necessary to determine whether it effectively prevents interference to incumbent services.

Shure strongly opposes the proposal to eliminate the unlicensed wireless microphone registration process. License eligibility expansion does not fully address high-priority events with smaller scope audio requirements. The Commission has made virtually no provision for interference-free operation of unlicensed wireless microphones and a process to address special circumstances will be even more important once new rules are put in place.

Shure opposes the proposal to single out wireless microphones from all other incumbent operations protected by the white spaces database and require them to pay new fees to the white spaces database operators contrary to the rules and policies adopted just a few short years ago. The Commission's only stated rationale for this measure is that wireless microphones like WSDs benefit from the database. However, many other incumbent services -- full power TV, low power TV, translators, public land mobile service, commercial mobile radio service, offshore radio and cable headends, among others also benefit from the database. Singling out wireless microphones as the one incumbent

authorized service that must pay a fee to the databases is not warranted by fact or law and would be bad public policy.

Finally, Shure opposes transition measures that would effectively strand wireless microphone equipment currently in the field, hurting users and industry by fracturing the wireless microphone market while allowing vacant UHF spectrum to lie fallow. In the repurposed 600 MHz band, wireless microphone users should be able to access frequencies until the database reflects that a carrier has commenced actual commercial operations on them. In other words, the rules should permit the operation of wireless microphones in auctioned frequencies until the end of the 39 month transition window that begins with the release of the *Channel Reassignment PN* or up to the date upon which a carrier has commenced actual commercial service in repurposed spectrum.

Shure also recommends that the Commission allow the operation of wireless microphones that operate in a portion of the repurposed 600 MHz band if the equipment can be tuned to operate in permitted frequencies in the guard bands, including duplex gap. Shure opposes the ideas of rules that require “guard band only” equipment re-certification to avoid hardship on users and to ensure that fielded equipment remains viable to operate in the guard bands. The Commission can adopt appropriate wireless microphone procedures to ensure that users are aware of the obligation to limit operation to specific bands under the rules.

Given the very significant recent costs and disruptions placed on the wireless microphone industry and operators, coupled with the increasing use of this service, Shure urges the Commission to proceed cautiously and ensure that wireless microphones will continue to have access to clean UHF spectrum where possible and refrain from imposing

any new burdensome and unnecessary requirements on wireless microphone users and manufacturers.

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COMMENTS OF SHURE INCORPORATED

Shure Incorporated (“Shure”), by its undersigned counsel, hereby submits these Comments in response to the Notice of Proposed Rulemaking (“NPRM”) in the above-captioned proceeding.¹ This NPRM proposes sweeping changes to the existing Part 15 White Spaces rules to accommodate the impending reduction in UHF frequencies available for white space devices (“WSDs”) and wireless microphone operations due to the TV

¹ 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 Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap, ET Docket No. 14-165, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Notice of Proposed Rulemaking*, FCC 14-144 (released Sep. 30, 2014) (“NPRM”).

broadcast incentive auction and associated repacking of broadcast TV channels.² While Shure appreciates the necessity of this review and supports the Commission in these challenging efforts, it submits that, overall, the proposed Part 15 rule changes do not adequately address the important needs of wireless microphones, a long-time incumbent service, and, in many respects, disproportionately disadvantages wireless microphone users and manufacturers. Shure looks forward to working with the Commission in this and related wireless microphone matters to develop a balanced approach that avoids extreme dislocation and burdens on this important service and the millions of Americans who rely every day on high-quality audio in television, films, music, sports, theater, business, religious, educational and civic programming and events.

I. Introduction

For nearly 90 years, Shure has been a respected U.S. manufacturer of high-quality audio equipment. Today, headquartered in Niles, Illinois, Shure is a global leader in innovative audio electronics, including professional wireless microphones and related audio products.

Shure was deeply involved in the development of the TV band White Spaces rules, working closely with the Commission³ and various stakeholders contributing technical analysis⁴ and real-world experience necessary to develop rules that enable new WSDs to operate on unassigned UHF television channels (470-698 MHz) while ensuring that

² Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Report and Order*, 29 FCC Rcd 6567, ¶ 11 (June 2, 2014) (“*Incentive Auction Order*”).

³ As a leading global manufacturer of high quality advanced audio equipment, Shure is also actively engaged in related spectrum proceedings in several jurisdictions outside the United States.

⁴ Shure was involved in all phases of FCC laboratory and field testing to evaluate the viability of different cognitive radio technologies proposed for White Space operation, contributed extensive engineering resources and hardware to the FCC test effort, and coordinated FCC field tests at FedEx Field (home of the NFL Redskins) and Broadway to evaluate cognitive radio technologies in real-world environments.

incumbent television receivers, wireless microphones, and multiple other services, have meaningful protection from harmful interference.⁵ When the Commission announced a decision to ban wireless microphone operations in the 700 MHz band after a short transition period, Shure was instrumental in assisting users to transition away from that band in compliance with the Commission’s decision.⁶ As discussed herein, with the encouragement of the Commission, many of those users invested in new replacement equipment operating in UHF spectrum that the Commission now proposes should not entail wireless microphone protections.

In preparation for a change in UHF spectrum use as a result of the incentive auction and broadcast repacking, the NPRM essentially proposes an overhaul of the white spaces rules that includes many reasonable and sensible changes but, in key respects, goes well beyond what is needed to accommodate the auction and repacking and substantially relaxes technical and other protections of incumbent services, including particularly wireless microphone operations, in favor of a hoped-for expansion of unlicensed WSD operations. In particular, the NPRM proposes to eliminate wireless microphone reserve channels, eliminate the prohibition on portable WSDs below channel 21 and the prohibition on fixed WSD operations on channels adjacent to broadcast signals (both of

⁵ Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices below 900 MHz and in the 3 GHz Band, *Second Memorandum Opinion and Order*, 25 FCC Rcd 18661, ¶¶ 29, 31 (Sep. 23, 2010) (“*White Spaces Order*”). Shure also participated in the Commission’s proceedings regarding wireless microphone operations in the 700 MHz band, wireless microphone license eligibility, initial incentive auction preparations and multiple other proceedings that bear on wireless microphone spectrum, licenses and operations.

⁶ See Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band, Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, Amendment of Parts 15, 74 and 90 of the Commission’s Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, *Report and Order and Further Notice of Proposed Rulemaking*, 25 FCC Rcd 643, ¶ 2 (Jan. 15, 2010) (“*Wireless Microphone 700 MHz Order*”); see also *FCC News Release*, FCC Adopts Order to Prohibit the Distribution and Sale of Devices Operating in the 700 MHz Frequency and to Clear the Band for Public Safety and Next Generation Consumer Uses (rel. Jan. 15, 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-295737A1.pdf.

which were conceived as important spectrum options for wireless microphone operations), to designate up to 23 MHz in guard band and other spectrum for unlicensed use, eliminate the unlicensed wireless microphone registration system for special events, and allow WSDs to operate at increased power (in some cases, substantially increased power) and at significantly increased antenna heights. In addition, the Commission proposes to implement a requirement that wireless microphones be controlled by the geolocation database, a requirement that would force a reengineering of fundamental wireless microphone architecture and strand virtually all equipment in the field, and new equipment certification requirements that would nullify with one fell swoop the equipment authorizations of a significant amount of fielded wireless microphone equipment operating in the UHF band. Finally, the Commission proposes that wireless microphone operations be singled out from all other incumbent operations protected by the white spaces database and be required to pay new fees to the white spaces database operators contrary to the rules and policies adopted just a few short years ago.

Shure is deeply concerned that key elements of the NPRM proposals would cause significant harm to the wireless microphone community and should not be adopted as proposed. Shure strongly believes that the Commission must balance the public interest in developing spectrum for additional wireless services -- licensed and unlicensed -- with the public interest need to support existing and expanding uses of UHF spectrum by wireless microphone users and other incumbents.

II. The Wireless Microphone Community Has Been Disproportionately Burdened with Changing Regulatory Policies and Should Not be Subject to Further Harm that Would Result from Many of the Proposed Onerous Rule Amendments

The Part 15 rule changes proposed in this proceeding will have broad impact on existing and future wireless microphone operations -- a service that has successfully shared TV broadcast spectrum for decades to provide advanced audio services to a wide range of needs in TV, film, music, theater, sports, etc. Today, wireless microphones play a critical role in countless productions important to many walks of American life.⁷ Shure supports the Commission's efforts to modernize the nation's spectrum management policies but many of the rules proposed in this proceeding, if adopted, would severely undermine these important services, harming users, American audiences, and the wireless microphone industry. Indeed, the current U.S. leadership in global multimedia and entertainment is at stake.

Over the past seven years, the Commission has dramatically changed the rules that apply to wireless microphones. Just a few short years ago, after a lengthy proceeding involving hundreds of parties, thousands of pages of input, and multiple rounds of technical testing, the Commission recognized the importance of wireless microphones used for news, entertainment, sports, business, educational, civic and cultural productions and adopted "white spaces" rules that would protect incumbent users of UHF spectrum and in particular

⁷ These productions include, for example, major broadcast events (*e.g.*, the national political conventions and campaign coverage, the upcoming Grammy and Oscar awards shows, etc.), major music productions (*e.g.*, the 2014 Bruce Springsteen tour), theater (*e.g.*, matinee and nightly shows on Broadway and Cirque du Soleil in Las Vegas and elsewhere), sports (*e.g.*, 2015 NFL Super Bowls and play-off games, college basketball) productions, large houses of worship (*e.g.*, Lakewood Church, Second Baptist Church), business conventions and major product launches (*e.g.*, 2014 CES and the launch of the Apple iPhone 6). These and similar events occur weekly and sometimes daily and are extremely wireless-microphone intensive. In some cases, hundreds of wireless microphone channels are necessary to support such productions.

ensure that UHF spectrum would continue to be available to support wireless microphone operations even as new services started to share the spectrum.⁸ Among other protections, the Commission concluded that two UHF channels would be available in every market to support wireless microphone operations.

The Commission now proposes to eliminate these reserve channels along with a host of other rule protections resulting in harm to wireless microphone users, manufacturers, and the millions of consumers who demand the many productions of which wireless microphone operations are an integral part. These proposed rule changes are even more troubling in view of the fact that the Commission recently forced many wireless microphone users to discard perfectly operable equipment and reinvest in *new* equipment when it announced that 700 MHz band wireless microphone operations would be banned. With the encouragement of the Commission, users purchased much of the new replacement equipment tuned to operate in the 600 MHz band, and particularly below channel 21. Wireless microphone users and manufacturers now face another round of major rule changes (including some that are a complete reversal of rules adopted a short time ago) that could, once again, render operable equipment noncompliant. Those changes, if adopted, would be inconsistent with the Commission's recognition of the importance of wireless microphones⁹ and the public interest.

⁸ Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices below 900 MHz and in the 3 GHz Band, *Second Memorandum Opinion and Order*, 25 FCC Rcd 18661, ¶¶ 29, 31 (Sept. 23, 2010).

⁹ See 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. 12-168, *Notice of Proposed Rulemaking*, FCC 14-145, ¶ 4 (rel. Sept. 30, 2014) ("*Wireless Microphone Future Spectrum Notice*"). "Wireless microphones play an important role in enabling broadcasters and other video programming networks to serve consumers, including as they cover breaking news and broadcast live sports events. They enhance event productions in a variety of settings -- including theaters and music venues, film studios, conventions, corporate events, houses of worships, and internet webcasts. They also help create high quality content that consumers demand and value." *Id.* at ¶ 1.

A. Significant Gains in Wireless Microphone Efficiency Cannot Compensate for a Dramatic Decrease in Available, Clean UHF Spectrum

Over the past decade, Shure and other wireless microphone manufacturers continued important development efforts and investments toward advanced technologies that substantially increase the number of microphones that can use a given amount of spectrum without sacrificing professional quality.¹⁰ Those advances have been significant, and are expected to continue, but in all cases require clean, interference-free spectrum.¹¹ In any event, such efficiency gains cannot make up for a radical reduction in UHF spectrum. Efficiency gains are only achievable under very consistent conditions and require clean, stable UHF spectrum. Wireless microphone operations relegated to shared spectrum through changes in the white space rules will not be able to take full advantage of the newer technologies that deliver greater microphone efficiency.

¹⁰ Over the last five (5) years Shure and other wireless microphone manufacturers have achieved a roughly two-fold improvement in professional audio wireless microphone efficiency. Specifically, using current generation hardware a six (6) megahertz UHF channel can now accommodate between 14-16 professional audio wireless microphone channels. (Using earlier generation equipment, saturation of a UHF channel generally occurred between 6-8 professional audio wireless microphones.) In special circumstances where intermodulation is effectively controlled, wireless microphones can operate in close proximity with significantly greater density. For those special operating conditions, Shure offers a high-density wireless microphone system that enables the operation of 40+ microphones on an individual UHF channel.

¹¹ The use of digital technology for wireless audio has increased and while that technology has improved, it remains subject to significant technology challenges. The inter-play of various design elements (source code compression, modulation, IMD, and batteries) makes it difficult to simultaneously achieve spectrum efficiency while providing the low latency necessary for live performances at a reasonable cost without creating an unreasonably complex system. In addition, any efficiencies that could be achieved through digital technology will be impossible in situations where spectrum is subject to interference. Given all of these challenges, some digital wireless microphones in operation today are less spectrally efficient than analog models of comparable performance and audio quality.

B. Changes in Part 74 License Eligibility and Inquiries into Additional Spectrum that Could Be Made Available in the Long Term for Wireless Microphone Operations Cannot Compensate for a Dramatic Reduction in Available, Clean UHF Spectrum

The NPRM's proposals would repeal important protections recently put in place in the white spaces proceeding to safeguard wireless microphone and other incumbent operations operating in a shared spectrum environment and potentially render wireless microphone equipment useless under the rules, once again. While the incentive auction and repacking process will certainly result in a reduction of available UHF spectrum, nowhere in the NPRM does the Commission offer compelling reasons why it should now reverse course on many of the fundamental protections so carefully crafted after more than six years of industry and Commission evaluation and multiple rounds of testing. There is no new testing data, no new scientific analysis, no evidence that incumbent services operating in the white spaces are any less in need of interference protections than they were in 2008 and 2010. Indeed, the demand for productions using wireless microphones has soared.¹² The wireless microphone community is expected to benefit from the recent rule changes expanding wireless microphone license eligibility to a broader class of professional audio users (enabling them to reserve frequencies in the geolocation database)¹³ and the inquiry just now beginning into what *additional* non-UHF spectrum

¹² Even with access to existing 600 MHz spectrum, increasing demand has led some wireless microphone users to seek special temporary authority ("STA") for supplemental, non-broadcast spectrum for low power broadcast auxiliary equipment and wireless microphones. For example, the FCC has approved 59 STA requests submitted by Broadcast Sports, Inc. in 2013 and 2014 for 1.4 GHz and 2.3 GHz frequencies at televised golf and automobile racing events. See, e.g., Office of Engineering and Technology, File No. 0069 EX-ST-2014, Call Sign WH9XGD (authorizing the use of non-broadcast spectrum for the production of a variety of automobile racing and golf events).

¹³ Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band, Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, Amendment of Parts 15, 74 and 90 of

could be made available to support expanded wireless microphone operations.¹⁴ However, these measures should not be considered as a solution that compensates for the proposed dramatic roll back in wireless microphone protections in the white spaces rules affecting the UHF band and other reductions in access to UHF spectrum where the vast majority of wireless microphone operations are today.

Given the very significant recent burdens placed on wireless microphone users and industry and the increased use of this service, Shure urges the Commission to proceed cautiously and ensure that wireless microphones will continue to have access to clean UHF spectrum where possible and refrain from imposing any new burdensome and unnecessary requirements on wireless microphone users and manufacturers.

C. Experience with the White Spaces Databases Is Still New and Mixed and Does Not Justify Making Major Rule Changes that Rely on Successful Database Performance

Throughout the NPRM, the Commission justifies proposed rule changes based on experience with the deployment of white space devices (“WSDs”) and the operation of the geolocation database.¹⁵ However, today there are relatively few WSDs deployed in the

the Commission’s Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, *Second Report and Order*, 29 FCC Rcd 6103, ¶¶ 10-24 (June 2, 2014) (“*Wireless Microphone Licensing Order*”).

¹⁴ See 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. 12-168, *Notice of Proposed Rulemaking*, FCC 14-145, ¶ 4 (rel. Sept. 30, 2014) (“*Wireless Microphone Spectrum NPRM*”).

¹⁵ See, e.g., *NPRM*, at ¶ 3 (“Our experience with the development and deployment of white space devices in the TV bands leads us to consider changes to our Part 15 rules”); *id.* at ¶ 12 (“We have gained considerable experience with the white spaces databases’ ability to manage wireless microphone channel reservation in the TV bands, and we proposed changes to improve this function.”); *id.* at ¶ 16 (“Since the rules for these types of devices were finalized in 2008, we have gained considerable experience with the development and deployment of these unlicensed devices. . . . Accordingly, we propose modifications to our rules in Part 15, Subpart H”); *id.* at ¶ 21 (“Now that we have some experience with white space devices in the TV bands, we are proposing changes”); *id.* at ¶ 30 (“Since the time the Commission made these decisions, it has . . . had extensive experience working with [the] databases. Based on that experience, we have a high degree of confidence that the databases can reliably protect PLMRS/CMRS operations.”); *id.* at ¶¶ 192-93 (citing experience with the databases in proposing to reduce the channel re-check time interval).

marketplace -- the Commission has granted equipment certification to only 15 fixed WSDs¹⁶ -- and the databases themselves are still quite new. While Shure supports the database governance process for sharing spectrum and continued improvement of the parameters that apply to database operations, there simply is not enough practical, real world experience with the operation of WSDs on spectrum shared with wireless microphones and other incumbent services or a track record of the ability of the databases to successfully manage shared spectrum use to justify many of the more onerous rule changes proposed in this proceeding.

III. The Proposed Part 15 Rule Changes Leave Insufficient Spectrum Resources for Wireless Microphone Operations Thereby Harming Wireless Microphone Users and the Millions Who Rely on Them

The vast majority of licensed and unlicensed wireless microphones used for purposes of professional audio rely on UHF spectrum. For decades these microphones have operated in the UHF band due to superior propagation characteristics, practical antenna requirements, and relatively low ambient RF noise levels. Wireless microphone operators will need access to all possible UHF spectrum options, including small slices of spectrum, in order to avoid severe disruption of existing operations following the Incentive Auction and spectrum repacking. Despite the continued increase in wireless microphone use across multiple applications, without specific justification, the Commission now proposes to eliminate or dramatically reduce wireless microphone protections in the UHF by eliminating rules that

¹⁶ The Commission's database reflects grants for fixed WSDs to Redline Communications, Koos Technical Services, Carlson Wireless Technologies, Meld Technology, Adaptrum, Inc. and 6Harmonics, Inc.

- Reserve the first two vacant TV channels above and below channel 37 for wireless microphone use,
- Designate operations below channel 21 as off limits to portable white space devices,
- Prevent fixed white space devices from operating on channels adjacent to DTV channels.

The proposed changes, if implemented, will eliminate spectrum resources critical to wireless microphone operations generally and in particular to unlicensed wireless microphone operations which have little recourse to other interference-free spectrum.

A. The Commission Should Retain the Two Wireless Microphone Reserve Channels

The Commission proposes to eliminate the two reserve channels for wireless microphone operations established just a few years ago to provide a “safe harbor” when it changed the rules to permit unlicensed WSDs to share locally unused TV channels with wireless microphones. These reserve channels are critical to wireless microphone operations -- especially to unlicensed operations that do not have access to the database reservation system. Although there are many instances where important unlicensed uses require protection from WSD interference and would resort to the reserve channels, the Commission has not identified any other comparable spectrum where unlicensed wireless microphone users would have access to interference-free spectrum. Examples of unlicensed uses at risk are a microphone used by a presidential candidate at Town Hall meetings on the campaign road, Tim Cook’s¹⁷ microphone at an important Apple product launch or investor meeting, or the solo artist at a live performance. All warrant protection

¹⁷ See, e.g., Apple Watch unveiled by CEO Tim Cook – video, THE GUARDIAN (Sept. 9, 2014), <http://www.theguardian.com/technology/video/2014/sep/09/apple-watch-ceo-tim-cook-video>.

from interference by registration in the database. Moreover, the NPRM proposes other rule changes that effectively close other opportunities to access clean UHF spectrum, including elimination of the rules prohibiting fixed WSDs on channels adjacent to television, rules prohibiting portable WSDs from operating on channels below channel 21, and the microphone registration system that provides a process for those users who are not eligible for a Part 74 license -- even under updated rules -- to register for protection during important events. Together, these changes leave unlicensed wireless microphones no recourse for protection and are inequitable.

B. The Anticipated “Naturally Occurring” White Space Channel is not Currently a Reliable Spectrum Resource for Wireless Microphone Operations

In the face of the radical reduction of available UHF spectrum, the NPRM suggests that wireless microphone users can anticipate a white space channel to be available in every market as a reliable spectrum resource.¹⁸ This inchoate plan cannot reasonably be considered as a current part of the solution for wireless microphones. Although the FCC alludes to an available channel, it cannot determine at this point whether at least one channel will in fact be available in every market and, if so, which channel would be available in what market. Not all channels are “equal” for operating purposes and a channel in the lower VHF range (channels 2-6), for example, would be essentially unusable for wireless microphones due to equipment and operating constraints. Indeed, the Commission acknowledges in the NPRM that “for engineering reasons, there may be a few areas with no spectrum available in the television bands for unlicensed devices and

¹⁸ NPRM at ¶ 26.

wireless microphones to share.”¹⁹ In any event, the Commission has suggested that this channel would be shared between unlicensed white space devices and wireless microphones, with the provision for licensed wireless microphones to reserve the channel in the geolocation database. That sharing arrangement would undercut the utility of this channel for important unlicensed wireless microphone operations that are not eligible to make reservations in the database.

Shure supports the notion that each market should have one (or more) UHF channels available for wireless microphone operations and urges the Commission to establish rules that identify such channels. The rules should specify that unlicensed white space device operations are not permitted in that channel. Exclusive wireless microphone use is important to ensure that a much-needed source of clean spectrum would be available, particularly to unlicensed microphones. Although the rules specify that only licensees that routinely use 50 or more “wireless microphones”²⁰ are eligible to obtain a license necessary to reserve frequencies in the geolocation database,²¹ there are many instances in which interference protection is critical even though fewer than 50 microphone frequencies are used. Further, as explained above, an interference-free

¹⁹ *Id.*

²⁰ “Wireless microphones” as used herein includes a variety of audio devices authorized under Part 74 and/or Part 15 of the Commission’s Rules as secondary users of locally unoccupied television channels. In addition to microphones, this equipment includes in-ear monitors, wireless intercoms, wireless assist video devices (“WAVDs”) and wireless cueing (“IFB”) systems. This working definition is consistent with the definition of wireless microphone in the NPRM. *See NPRM* at ¶ 148 (proposing to define a wireless microphone as “a device that converts sound into electrical audio signals that are transmitted using radio signals to a receiver which converts the radio signals back into audio signals that are sent through a sound recording or amplifying system.”).

²¹ 47 C.F.R. § 74.801 (including in the definitions of a “large venue owner or operator” and a “professional sound company” the criterion that they “routinely use 50 or more low power auxiliary station devices”); 47 C.F.R. § 74.832(a) (“A license authorizing operation of one or more low power auxiliary stations will be issued only to the following . . . (7) Large venue owners or operators . . . (8) Professional sound companies . . .”); *see also Wireless Microphone 700 MHz Order*, ¶ 11 n.28 (“A professional sound company or venue that does not usually use 50 or more wireless microphones would therefore not qualify for a license under our revised eligibility standard.”).

environment is essential to support the high-efficiency wireless microphone technologies being introduced. Until the Commission confirms existence of and specifies the rules that will apply to the “naturally occurring” channel in each market, however, wireless microphone users and manufacturers cannot rely on this channel as a part of the available spectrum solution for wireless operations.

C. Wireless Microphones Need Access to the Duplex Gap and Lower Guard Band

The Commission seeks comment on the proposal to partition the 11 MHz gap between the wireless uplink and downlink (*i.e.*, the duplex gap)²² and to permit unlicensed devices, including WSDs and wireless microphones, to operate in the upper 6 MHz nearest the wireless uplink and licensed wireless microphones to operate in the lower 4 MHz leaving a 1 MHz buffer between licensed wireless microphones and wireless downlink services. The Commission also proposes to permit unlicensed devices, including WSDs and wireless microphones to operate in the guard band between the wireless downlink service and the TV band which, depending on the amount of spectrum that is recovered in the auction, may vary between 11, 9, 7 or 3 MHz.²³ The Commission proposes different spectrum buffers for each recovery scenario.

1. The Commission Should Adopt a Uniform, Nationwide Band Plan for the Duplex Gap and Permit Database Reservation of the Lower Guard Band.

Shure generally supports this division of spectrum between wireless microphones and WSDs in the duplex gap and lower guard band, recognizing that the effects of LTE

²² NPRM at ¶¶ 91-95.

²³ NPRM at ¶ 78. A 3 MHz guard band would occur if exactly 84 MHz of spectrum were recovered in the auction. *Id.*

emissions have the potential to degrade the quality of operations in these bands for both services if not carefully controlled. The proposed 4 MHz of interference-free spectrum designated for licensed wireless microphones will be critical for newsgathering and other professional licensed users faced with a severe UHF spectrum shortage and time sensitive operations. Unlicensed wireless microphones will face a challenge in the 6 MHz designated for unlicensed devices given that the NPRM's proposal does not contemplate any protections against WSD interference. In order to foster stability and predictability for both wireless microphone operators and manufacturers, Shure strongly favors the creation of a nationwide uniform band for the duplex gap including uniform designation of the 4 MHz licensed wireless microphone and 6 MHz unlicensed device bands. Due to the fact that the lower guard band is unlikely to be uniform nationwide, Shure believes that registered wireless microphone operations should have the ability to seek reservation of this spectrum in the geolocation database, similar to the procedure for unoccupied TV channels.

2. Wireless Microphones Should be Permitted to Operate Throughout the Guard Bands Reserving a 100 kHz Buffer to Adjacent Services

Wireless microphone emissions do not warrant a substantial spectrum buffer between services and the rules for all guard bands -- the duplex gap, the lower guard band and the guard band(s) around channel 37 -- should permit wireless microphones to operate in spectrum nearest to adjacent services reserving a 100 kHz buffer to protect LTE wireless services from interference. As discussed in more detail below, the proposed tighter ETSI mask for wireless microphones will ensure that emissions are tightly confined within a 200 kHz occupied bandwidth. The tighter mask will greatly reduce the need for

substantial spectrum buffers between services thereby enabling wireless microphones to squeeze more utility out of spectrum adjacent to other services. Shure's products have been manufactured in compliance with the ETSI mask for some time and experience shows that wireless microphones are able to operate as close as 100 kHz to broadcast TV with no interference and adjacent to channel 37, Radio Astronomy and wireless medical telemetry (WMTS) with no guard band or buffer. Wireless microphones raise far less risk of interference to adjacent wireless services than WSDs.²⁴ Shure recognizes that LTE emissions will be present in some of the spectrum abutting the guard bands but there may still be some opportunity for successful wireless microphone operations in certain circumstances and the rules should not foreclose this possibility. Given the radical reduction in UHF spectrum from the incentive auction and repacking, the Commission should consider all reasonable measures to enable wireless microphones to maintain access to UHF spectrum where possible provided nearby services are not subject to interference. This objective is furthered by adopting a reduced 100 kHz buffer between wireless microphones and all adjacent licensed services and by maintaining the 3 MHz buffer proposed for WSDs.

3. The Commission Should Not and Need Not Satisfy the Spectrum Act Database Requirement by Imposing New Onerous Database Control Requirements on Wireless Microphones Operating in the Duplex Gap or Other Guard Bands

The NPRM seeks comment on how wireless microphones can comply with the requirement of the Spectrum Act that unlicensed devices operating in the guard bands rely

²⁴ Letter from Dean Brenner, Senior Vice President, Government Affairs, Qualcomm Inc., to Marlene H. Dortch, Secretary, FCC, enclosure slide 13, GN Docket No. 12-268 (filed Feb. 19, 2014) ("To the extent anything is placed in the guard band or duplex gap, wireless microphones and WMTS are preferable, because their operations can be limited to certain geographic areas[.]").

on a database “or subsequent methodology.”²⁵ At the outset, the Commission should recognize that the Spectrum Act language lays out general principles without mandating the specific details of implementation. In this case, the Spectrum Act directs the FCC only generally to ensure that unlicensed devices rely on a means -- whether a database or other method -- in order to prevent interference to other services. This reasonable approach reflects the challenge of legislating regulatory solutions on technology issues without inadvertently mandating a specific approach that may quickly be superseded by new technical advancements or strategies that can better meet the overall intent of the legislation.²⁶ For this reason, the Spectrum Act leaves the FCC with discretion broad enough to define how unlicensed devices should avoid interference in a shared band, including either through a manual check of a database or by taking advantage of an advancement or strategy not fully apparent at the time of enactment, *i.e.*, a “subsequent methodology.”

The Commission specifically asks whether wireless microphones should be automatically controlled by a database through direct access to the database in the same manner as WSDs, or would a manual check by wireless microphone users or the creation of a nationwide uniform 6 MHz block in the duplex gap qualify as a “subsequent

²⁵ *NPRM* at ¶ 164; Title VI – Public Safety Communications and Electromagnetic Spectrum Auctions, Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6407(c)-(d), 126 Stat. 156, 231-32 (2012) (“*Spectrum Act*”) (codified at 47 U.S.C. § 1454(c)-(d)).

²⁶ See YULE KIM, CONG. RESEARCH SERV., Order Code 97-589, STATUTORY INTERPRETATION: GENERAL PRINCIPLES AND RECENT TRENDS 2 (2008), available at <https://www.fas.org/sgp/crs/misc/97-589.pdf> (“A cardinal rule of construction is that a statute should be read as a harmonious whole, with its various parts being interpreted within their broader statutory context in a manner that furthers statutory purposes.”); see also *id.* at 6 (“Words that are not terms of art and that are not statutorily defined are customarily given their ordinary meanings, often derived from the dictionary.”); *Methodology Definition*, Merriam-Webster.com, <http://www.merriam-webster.com/dictionary/methodology> (last visited Feb. 3, 2015) (“a set of methods, rules, or ideas that are important in a science or art : a particular procedure or set of procedures”).

methodology”?²⁷ Shure strongly opposes any rule change that would require a fundamental architectural redesign of wireless microphones to incorporate control by a database by including the ability to access and respond to a database. Wireless microphones have never been subject to a database control requirement and no wireless microphone equipment currently on the market at any price tier incorporates such functionality. The majority of wireless microphones operate indoors on an itinerant basis, in contrast to WSDs which are networked together and incorporate geolocation and Internet access technology. Such a requirement would impose artificial technical design requirements on a globally established and widely deployed product category for no meaningful policy benefit that could not be achieved more easily. Requiring a direct Internet connection that would enable automatic database control in wireless microphone equipment would compel a substantial redesign and add significant cost and complexity to wireless microphone systems and operating procedures.

Further, a new rule imposing Internet-access requirements on wireless microphones would essentially invalidate all fielded gear for the affected spectrum bands, thus stranding a very substantial volume of equipment. Such a requirement could also further reduce the product availability for important wireless microphone operations if manufacturers are discouraged from investing resources in the redesign of wireless microphone equipment limited to such a small sliver of spectrum. As a practical matter, if new equipment is not developed, it will be very challenging for the Commission to manage a transition of prior-model equipment out of the band since users would not be able to look to alternative replacement equipment.

²⁷ *NPRM* at ¶ 164.

As outlined above, Shure favors the creation of a nationwide uniform band in the duplex gap in which wireless microphones may operate. With uniform nationwide band limits, no purpose would be served by requiring a microphone to query a database to determine if it could operate in that band since the answer would always be affirmative. This approach fits within the concept of “subsequent methodology” under the Spectrum Act as it is a band plan-based strategy that has become possible only as the Commission has developed its auction implementation plans. With respect to the lower guard band where the band edges may vary based on the amount of spectrum recovered in a market, Shure recommends that wireless microphone users be required to conduct an appropriate manual check of relevant databases to ensure that proposed operations do not interfere with licensed services.

4. The Onerous Reduced 20 mW Power Limit Proposed for Unlicensed Wireless Microphones in the Guard Bands is Unnecessary and Will Dramatically Undermine Utility of the Spectrum for Wireless Microphone Use

The NPRM proposes a 40 mW power limit for WSDs operating in the 6 MHz segment in the duplex gap and guard bands²⁸ but a much less viable 20 mW power limit for unlicensed wireless microphones. The 20 mW limit is inconsistent with the current rule that applies to unlicensed wireless microphone operations,²⁹ yet the NPRM fails to offer any technical analysis or cite any incidents of interference that would warrant adopting a greatly reduced power limit that deviates from the existing 50 mW power limit. The Commission suggests only that that the aggregate power level for wireless microphones

²⁸ NPRM at ¶ 96.

²⁹ 47 CFR § 15.717(b).

reduces this disparity.³⁰ This theoretical conclusion was not the result of actual measurement in a typical use case and ignores the fact that microphones are typically spread out, therefore it is unlikely that a cluster of them would be operated close to any one handset.

Shure strongly opposes this new requirement and urges the Commission to retain the existing 50 mW power limit for unlicensed wireless microphones in the duplex gap and guard bands. The proposed limit is too low and will in fact inhibit coexistence between microphones and WSDs in the duplex gap and guard bands by compromising wireless microphone performance. Further, if the Commission were to adopt this onerous reduced power limit -- once again -- many wireless microphone users would be forced to retire a significant amount of operating equipment unnecessarily. This arbitrary reduced limit would further create “niche” requirements with limited utility in a small sliver of spectrum that will make it very uneconomical and impracticable for wireless microphone manufacturers to invest in producing equipment designed to operate only in the duplex gap and guard bands.

5. For Better Accuracy, the Commission Should Permit Power to be Measured on an EIRP Basis at the Antenna

Shure also proposes that the Commission continue to permit the 50 mW power limit to be tested on a conducted basis measured at the microphone’s amplifier, or, alternatively, measured on an effective radiated basis at the microphone’s antenna. By permitting power to be measured on a radiated basis, the Commission ensures that form factor restricted wireless microphones enabled with compact, omni-directional antennas can still achieve

³⁰ *NPRM* at ¶ 160.

50 mW of effective radiated power in circumstances where antenna gain and internal loss within the device might have otherwise diminished the signal strength of the microphone significantly.

D. Wireless Microphones Can Operate in the 3 MHz Guard Bands Adjacent to Channel 37 Reserving a 100 kHz Buffer to Protect Wireless Services

The Commission has proposed to open Channel 37 to white space devices, but not to wireless microphones.³¹ Shure acknowledges that wireless microphones would not be able to fulfill the proposed requirement for database control that devices operating in this channel will require in order to protect WMTS and Radio Astronomy. Wireless microphones are not networked and could not today meet the requirement to interact with a database without wholesale redesign and significant added complexity and cost.

Under certain auction results, however, there may be a 3 MHz guard band designed to prevent WSD interference on one or both sides of channel 37.³² Wireless microphones can make use of these 3 MHz guard bands where WSDs will not be allowed to operate in order to protect wireless services. The NPRM proposes to permit unlicensed wireless microphones in the 2 MHz segment closest to channel 37 leaving a one MHz buffer to protect adjacent services.³³ While wireless microphones cannot meet the database control requirement for channel 37 obligations like WSDs, the rules should provide for wireless microphone access to the proposed 3 MHz guard bands immediately adjacent to Channel 37, subject to a 100 kHz buffer. Combined with adoption of the Commission's proposal to separate WSD operation from licensed wireless downlink operations by 3 MHz, the channel

³¹ *NPRM* at ¶¶ 97- 124.

³² *See NPRM* at ¶ 8.

³³ *NPRM* at ¶159.

37 guard band(s) could provide a much needed source of interference-free spectrum for wireless microphones -- especially unlicensed wireless microphones³⁴ -- that would experience significant disruption as a result of the incentive auction, the repacking process, and other proposed rule changes in the TV Band. Wireless microphones could make use of this guard band(s) that would otherwise lie fallow. As proposed, WSDs would potentially gain exclusive or shared access to a significant amount of UHF spectrum, including up to 23 MHz in channel 37, the 600 MHz guard band, and the majority of the duplex gap, in addition to the remaining white space channels (as well as spectrum potentially made available by virtue of changes in the rules affecting adjacent channel operations, operations below channel 21, and more favorable operating conditions through antenna height, power and other changes the Commission is considering).

Wireless microphones, as a low density, low power, localized service already subject to stringent emission standards,³⁵ today use unoccupied TV channels adjacent to channel 37 without interference to WMTS or Radio Astronomy operations. As discussed above, a 100 kHz buffer between wireless microphone operations and wireless downlink operations together with the widespread adoption of stringent emission requirements based on ETSI standards will ensure that neighboring operations will be adequately protected from wireless microphone emissions. Shure also notes that the nationwide uniformity of the channel 37 guard bands is a significant manufacturing and operating

³⁴ See *supra*, note 7. Many activities that rely on wireless microphones are conducted by users and organizations that would not qualify for a Part 74 license.

³⁵ See discussion *infra* Part III regarding adoption of stringent mask requirements based on European Telecommunications Standards Institute EN 300 422-1. European Telecommunications Standards Institute (“ETSI”), EN 300 422-1 V1.5.0 (2015) (“ETSI Standard”), available at http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/01.05.00_20/en_30042201v010500a.pdf.

advantage for wireless microphone equipment due to the stability and consistency of available spectrum.

E. The Commission Should Not Permit Portable WSDs to Operate Below Channel 21

In the 2008 White Spaces Order, the Commission struck an important balance among the need to create opportunities for new fixed and portable white space devices, the protection of TV broadcasting from interference, and the need to ensure available UHF spectrum for wireless microphones. In determining that portable white space devices would not operate below channel 21, the Commission said:

*“One of our considerations in this matter is to ensure that channels remain available for use by wireless microphones . . . [we understand] the important function that wireless microphones serve and find that it is in the public interest to preserve spectrum in the TV bands that is available for their use . . . We believe that if we restrict use of channels 5-20 to fixed devices on those channels to communications with other fixed devices we can meet the needs of those desiring to provide service at a distance and also limit the number of WSDs that could potentially conflict with wireless microphone use.”*³⁶

As the Commission noted, proponents of the WSD industry had in fact suggested this approach.³⁷ In rejecting other approaches to preserve spectrum for wireless microphone uses, the Commission explained that this plan would ensure that “wireless microphones will have access to those channels where WSDs are not allowed to operate.”³⁸ As a part of the transformation of the UHF band through introduction of the white spaces rules and the Commission declaration that wireless microphones would be banned from the 700 MHz

³⁶ Unlicensed Operation in the TV Broadcast Bands, Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, *Second Report and Order and Memorandum Opinion and Order*, 23 FCC Rcd 16807, ¶ 151 (Nov. 14, 2008) (“2008 White Spaces Order”) (emphasis added).

³⁷ *Id.* (referring to the White Space Coalition’s suggestion “to preserve unoccupied TV channel space below channel 21 for wireless microphones”).

³⁸ *Id.* at ¶ 200.

spectrum, the Commission encouraged wireless microphones to transition to operations using available frequencies under channel 21.

Wireless microphones will be protected in a variety of ways. The locations where wireless microphones are used, such as entertainment venues and for sporting events, can be registered in the database and will be protected as for other services. In addition, channels from 2 – 20 will be restricted to fixed devices, and we anticipate that many of these channels will remain available for wireless microphones that operate on an itinerant basis. In addition, in 13 major markets where certain channels between 14 and 20 are used for land mobile operations, we will leave 2 channels between 21 and 51 free of new unlicensed devices and therefore available for wireless microphones.³⁹

Today there is a significant inventory investment of new wireless microphone equipment operating in those frequencies, driven by the publication of the Commission's final white spaces rules and 700 MHz cutoff date. Following these announcements, Shure saw the sales of wireless microphones operating below channel 21 increase by a factor of four. It would be inequitable and a severe hardship to compromise wireless microphone operations in this spectrum at this time.

The many important daily wireless microphone operations that do not qualify under the Commission's 50 wireless system license eligibility requirement need the UHF channels below 21 to ensure interference-free operation from portable WSDs. With the proposed elimination of the two wireless microphone reserved channels, these users would suffer a twofold reduction in reliable, interference-free spectrum in which to operate.⁴⁰ Additionally, licensed users producing larger events have adopted the practice of generating band plans with the reserved wireless microphone channels and those available

³⁹ *Id.* at ¶ 1.

⁴⁰ Although Shure supports efforts to identify spectrum outside the UHF that may be useful for wireless microphones, those efforts may provide some spectrum relief to wireless microphones but identifying such spectrum, adopting rules, implementing transition of existing government and other users or sharing mechanisms can take multiple years. Those efforts are at the very beginning part of a contested multi-year regulatory process and no equipment development will begin, assuming the rules for such newly identified spectrum encourage manufacturers to make necessary investments, until that process is complete. As such, the prospect of making available additional spectrum resources to wireless microphones is only a potential long term solution.

below channel 21 as the foundation. For these reasons, Shure strongly opposes the proposal to eliminate the current prohibition on portable WSD operations in channels 14-20.⁴¹

IV. The Commission Should Align with Industry Efforts to Improve Efficiency By Adopting the ETSI Emission Masks for Digital and Analog Wireless Microphones

The wireless microphone industry has made dramatic strides in recent years to advance the state of the art. A combination of targeted regulatory changes and continuing industry innovations will lead to marked improvements in spectrum efficiency. The European Telecommunications Standards Institute (ETSI) has developed emission masks that significantly reduce the permissible out-of-band emissions a wireless microphone can generate. To that end, Shure supports the proposed adoption of the emission masks contained in ETSI EN 300 422-1 for analog and digital wireless microphones.⁴² This rule change would protect authorized services in adjacent bands from harmful interference and will improve spectrum sharing by wireless microphones through tighter spacing of wireless microphones. Many manufacturers already adhere to these limits.

V. The Commission Should Relax the White Spaces Requirements Only Where Absolutely Necessary and the Impact Has Been Technically Proven

The NPRM proposes multiple changes to the white spaces rules that would abandon many of the protections for wireless microphones inconsistent with the careful balance struck just a few short years ago when the rules were adopted. These proposed changes

⁴¹ For the reasons discussed in Part II.C.3 above, Shure also strongly opposes the suggestion wireless microphones should be automatically controlled by a database requiring a direct connection to the Internet for operations in channels 14-21. *See NPRM* at ¶ 164.

⁴² The ETSI standard includes separate masks for analog and digital emissions. *See ETSI Standard* at 19-21, 22-26, 34-35, 36, 38-40.

are not supported by new testing data, new scientific analysis, or any evidence that incumbent services operating in the white spaces are any less in need of interference protections than they were in 2008 and 2010. In fact, wireless microphone operations are in greater demand than ever before. Shure recognizes that some changes are warranted to accommodate the changes brought about by the incentive auction and repacking process but objects to proposed measures that would severely disadvantage wireless microphone operations and users without a countervailing public interest benefit.

A. The Commission Should Not Eliminate the Prohibition of Fixed WSD Operations on Adjacent Channels Below Channel 21

Shure opposes rule revisions that would allow fixed WSD operation on adjacent channels in channels below channel 21.⁴³ The UHF frequencies below channel 21 are a significant source of spectrum for wireless microphones in large part because the Commission encouraged wireless microphone users to look to TV channels 14-20 spectrum as partial replacement for banned operations in 700 MHz frequencies after decades of successful deployments in that band. It would be inequitable and a hardship to adopt rules that essentially force wireless microphone users out of the frequencies now. Above channel 21, wireless microphones -- and especially unlicensed wireless microphones -- face a more challenging interference environment based on the presence of portable WSDs. Below channel 21, wireless microphones and unlicensed wireless microphones in particular, can rely on spectrum absent of interference from portable WSDs, and from fixed WSDs in adjacent channels.

⁴³ See *NPRM* at ¶¶ 29-31.

The Commission also asks whether wireless microphones operating in channels 14-20 should be subject to a database control requirement. As set forth above, such a rule would be extremely burdensome, inequitable and, Shure submits, unnecessary. Wireless microphones have successfully operated in frequencies under channel 21 for years coexisting with television, public safety, CMRS, and more recently fixed WSDs. Imposing a database requirement on wireless microphone operations therefore would not serve the public interest.

B. The Commission Should Not Permit Fixed WSD Operations Where There are Two Rather than Three Vacant Channels

For similar reasons, Shure opposes the suggestion that fixed WSDs should now be permitted to operate with a maximum power of four watts EIRP at locations where there are two contiguous vacant channels rather than three. This proposal would also scale back significantly adjacent channel spectrum currently being used by wireless microphones and which will be even more critical in the radical reduction of available UHF spectrum resulting from the incentive auction and repacking process. Shure does not object to the application of intermediate power levels as long as the minimum protection zones are maintained, i.e., WSDs should not be permitted to operate closer than 400 meters/1km to wireless microphones regardless of intermediate power levels, and database functionality is demonstrated to enforce these protection zones.

C. Any Relaxation of WSD Location Accuracy Requirements Must be Coupled with an Expansion of the Protection Zones to Account for Greater Uncertainty in Location

The Commission proposes to relax the location accuracy for personal/portable WSDs from 50 meters and seeks input on what replacement value would be appropriate.

The rationale for this is the unavailability of GPS data indoors.⁴⁴ This proposed change raises the potential for greater interference to wireless microphone operations because the typical working range of a wireless microphone is only about 100 meters. Therefore a WSD that has a large location uncertainty could easily interfere with a wireless microphone without identifying the potential interference.

Shure does not oppose this change so long as the proposed rule is modified to address the heightened potential interference to wireless microphones. To address this problem, Shure recommends that the Commission require WSDs to be programmed to notify the database of its location accuracy and if it is less accurate than +/-50M, for example, the protection zone for wireless microphones must be increased proportionally. Thus, if the location accuracy is +/- 100 meters, the zone could be increased, e.g., from 400 meters to 450 meters.

D. The Commission Should Not Increase Permissible WSD Antenna Heights

The Commission asks whether it should adopt an increase in the allowable antenna height for fixed WSDs both in height above average terrain (“HAAT”) and above ground level (“AGL”).⁴⁵ Currently the rules permit antennas up to 30 meters AGL and 250 meters HAAT. To avoid increased risk of interference, Shure opposes a change in the antenna height rules.

These changes will substantially increase the transmission range of fixed WSDs thereby increasing the potential for interference to wireless microphones. The Commission has not provided analysis or test data demonstrating that such changes are

⁴⁴ *NPRM* at ¶ 76.

⁴⁵ *NPRM* at ¶ 47.

necessary and will not cause interference. Such a change is inappropriate in cities or suburban areas but may have utility in rural areas. However, as discussed below, the Commission's definition of "rural" needs to be reworked to more accurately limit the designation to areas of low population.

E. The Proposed Definition of "Rural" Would Not Accurately Target Unpopulated Areas and Dramatic Increases in Power for Fixed and Portable WSDs Should Not Be Permitted Under That Definition

The NPRM proposes various rule changes that would relax many of the operating parameters for WSDs operating in "rural areas" including permission for fixed WSDs to operate at powers up to 10 W EIRP. In order to simplify the definition of a rural area so that it could be calculated and applied easily by databases, the NPRM proposes to consider any location where "at least half of the TV channels are unused for broadcast services and available for white space use" as "rural."⁴⁶ This definition would include all TV channels, VHF and UHF. This definition, while simple should be considered further before adopting.

Shure does not object categorically to some relaxation of the white spaces rules in rural areas where the risk of interference is lower than in populated areas but at the outset Shure recommends that the definition of rural should incorporate population density per square mile to address these anomalies.⁴⁷ Further, rule changes should take into account the fact that important wireless microphone users -- including unlicensed users -- do in fact operate in rural areas and require protection from WSD interference. Examples are certain sporting events that occur in lightly populated areas (e.g., certain extreme sports competitions) and houses of worship. Retaining the prohibitions on portable WSDs and

⁴⁶ NPRM at ¶ 45.

⁴⁷ Shure acknowledges that such anomalies may diminish after channel repacking takes place, since channel utilization is likely to increase significantly.

fixed WSD on adjacent channels below channel 21 would ensure some protection even if other white space rules change.

VI. The Unlicensed Wireless Microphone Reservation System Should be Retained

Shure strongly opposes the NPRM's proposal to eliminate the unlicensed reservation system.⁴⁸ The Commission reasons that this system is no longer needed due to the recent decision to expand eligibility for Part 74 Low Power Auxiliary Service ("LPAS") licenses and access to the database registration system.

While the recent expansion of license eligibility brings the wireless microphone licensing scheme closer to international standards for professional use, it could be interpreted that only productions using "50 or more wireless microphones" are in need of interference protection.⁴⁹ However, a licensing requirement that relies on the number of microphones in use is often not a good barometer for assessing the critical nature of audio production for important events or the criticality of protecting the wireless microphone operation from interference. License eligibility expansion does not fully address high-priority events with smaller scope audio requirements. There are many productions in the civic, cultural, corporate, education and entertainment sectors where fewer than 50 microphone frequencies are used but the ability of the wireless microphone to operate without interference is absolutely critical to the event. In short, the assumption underlying the proposed elimination of the registration process does not withstand scrutiny.

Unfortunately, in this and other dockets, the Commission is proposing multiple rule amendments that essentially leave unlicensed wireless microphone users no option for

⁴⁸ *NPRM* at ¶185.

⁴⁹ *Wireless Microphone Licensing Order*, at ¶ 16.

interference-free operation, including the proposed elimination of the two reserved channels, and rule changes that would allow both fixed WSDs on adjacent channels, and portable WSD operations under channel 21 (both potentially at significantly higher powers). The Commission has made virtually no provision for interference-free operation of unlicensed wireless microphones. Against this background, the proposed elimination of the registration scheme that would address special situations would slam shut an important -- and perhaps the only -- opportunity for unlicensed users to ensure that wireless microphones can operate without interference at important events and should not be adopted.

The NPRM also states that the proposed elimination of the unlicensed wireless microphone registration process is warranted in light of the other NPRM proposals that unlicensed wireless microphones would “operate on an equal basis with white space devices in the TV bands, the 600 MHz guard bands and a portion of the duplex gap,” where wireless microphones would be required to interact with a database and operate under the same noninterference conditions as WSDs.⁵⁰ These proposals are ill-conceived and should not be adopted.⁵¹

The proposed 20 mW wireless microphone power limit does not put wireless microphones on an “equal” footing with WSDs operating at 40 mW and in fact the proposed disparate power levels between unlicensed wireless microphones and WSDs undercut the utility of this shared spectrum for wireless microphones. In this context, shared spectrum cannot offer wireless microphone users *any* assurance that wireless microphone operations will not be subject to frequent and unpredictable interference.

⁵⁰ NPRM, at ¶ 187.

⁵¹ See discussion *supra* Part II.C.3.

The proposal to require database control of wireless microphones by interaction with the database is particularly unwise and unworkable because it creates a government-enforced major redesign of wireless microphone equipment significantly impairing virtually all existing wireless microphone equipment, harming users, and injecting significant uncertainty in the development of future equipment. In any event, such proposals, even if adopted, do not warrant eliminating the unlicensed wireless microphone registration process. Particularly in the absence of reserve channels, there will continue to be instances in which important events using fewer than 50 wireless microphone frequencies require interference protection.⁵²

VII. Unlicensed Wireless Microphones Should Not be Singled Out Among Incumbents to Pay Fees to Databases

In addition to proposing that unlicensed microphones be subject to database control in order to operate in the duplex gap, guard bands, and elsewhere, the NPRM also proposes that database operators should be able to charge them a fee for this service, similar to the fees charged to WSDs.⁵³ At the outset, Shure strongly objects to proposed rules that would compel wireless microphones to be re-engineered into devices that must incorporate database control capability and further require unlicensed wireless microphone users to pay fees to access the databases.

That said, even if the Commission did impose this requirement on wireless microphone equipment and users across multiple industries, it should not then proceed to require unlicensed wireless microphone users to pay fees to access the databases. This ill-conceived series of proposals is a complete reversal of the Commission's decision in the

⁵² See examples cited *supra* note 7.

⁵³ NPRM, at ¶¶ 197-99.

2008 White Spaces Order that the geolocation database would be the mechanism to protect authorized services from interference arising from the introduction of new white space devices.⁵⁴ The Commission's only stated rationale for this turnabout is that "[b]oth wireless microphones and WSDs benefit equally from the information provided by the databases."⁵⁵ This reasoning distorts the purpose of the database -- to protect authorized incumbent operations that have operated for decades in the UHF channels in order to permit new devices to operate without disrupting those operations.⁵⁶ The Commission also completely ignores the fact that multiple incumbent services "benefit" from the database. The database is required to provide protection to frequencies used by full power television, low power television, TV translators, Public Land Mobile Service operating in channels 14-20, Commercial Mobile Radio Service operating in channels 14-20, Broadcast Auxiliary (including temporary links), Offshore Radio, cable headends and wireless microphones. Singling out wireless microphones as the one incumbent authorized service that must pay a fee to the databases is not warranted by fact or law and would be bad public policy.

VIII. Shure Supports the Proposed Improvements in Database Procedures

The NPRM proposes several improvements to the database operating procedures. First, the NPRM proposes an increase in the frequency at which fixed and Mode II personal/portable WSDs must recheck the database to no less than 20 minutes (rather than every 24 hours).⁵⁷ Second, the NPRM proposes to limit the time required for a low

⁵⁴ *2008 White Spaces Order*, at ¶ 47.

⁵⁵ *NPRM*, at ¶198.

⁵⁶ *See 2008 White Spaces Order* at ¶¶ 204-06.

⁵⁷ *NPRM*, at ¶ 190.

power auxiliary service (“LPAS”) registration made in one white space database to appear in all other white spaces databases.⁵⁸ The NPRM specifically proposes to eliminate rule sections that permit WSDs to continue operating until 11:59 PM on the following day when they can no longer establish contact with the database and by adopting a rule that requires database administrators to share registration information. Further, the NPRM proposes to require the databases to share information within ten (10) minutes. Together, these measures will ensure that a WSD ceases operation on a channel used by a wireless microphone within 30 minutes after a new registration is entered into the database. Finally, the NPRM proposes that WSDs obtain wireless microphone scheduling information for a period of 60 minutes (rather than 48 hours) beginning from the last time it accesses a database.⁵⁹

Shure supports these proposed improvements. At the outset, Shure points out that these improvements should *not* be considered as changes that compensate for the proposals that dramatically reduce wireless microphone especially unlicensed wireless microphones access to UHF spectrum or the proposals that would allow WSD access to previously clean spectrum or allow for higher powers or other measures.⁶⁰ These rule changes, if adopted, will still cause severe harm and dislocation in the wireless microphone community contrary to the public interest even if operation of the database is improved.

However, the proposed changes will allow the databases to be more effective shields against WSD interference to incumbent services and better fulfill the objective of more efficient shared use of spectrum. The spectrum needs of incumbent wireless microphones

⁵⁸ *Id.*

⁵⁹ NPRM, at ¶ 195.

⁶⁰ See discussion *supra* Part IV.

are highly variable and can change on an hourly basis, and sometimes more frequently. WSDs that rely on the geolocation database must be just as dynamic to avoid creating harmful interference. Many wireless microphone incumbents cannot predict their spectrum needs or precise location 24 hours in advance. For example, at many high-profile news events multiple ENG teams may deploy in close proximity to each other and require several clean channels to support their information gathering operations. Other wireless microphone users also routinely deploy on short notice and require clean channels immediately.⁶¹ A database that only updates once every 24 hours offers no meaningful protection to these incumbents.

To minimize the harmful effect of WSD interference on incumbent wireless microphones that have registered but are not yet reflected in the geolocation database, Shure supports the proposal to require database administrators to synchronize within 10 minutes and to require WSDs to access and check frequency availability in near real-time. These proposals achieve this goal. Given the nominal amount of information collected by a database administrator, there should be no objection to making registration information collected from wireless microphone incumbents available to WSDs.

IX. The Commission Should Not Adopt Onerous Transition Implementation Rules That Strand Wireless Microphone Equipment, Hurting Users and Industry by Fracturing the Wireless Microphone Market While Allowing Vacant Spectrum Where Wireless Microphones Have Operated to Lie Fallow

The wireless microphone community -- users, manufacturers and the millions of people who demand productions of which wireless microphones are an integral part --

⁶¹ Law enforcement applications, outdoor festivals, parades, golf tournaments, marathons and a variety of other events/applications involve wireless microphone use where the exact deployment of the microphone may be unknown until the user arrives on site.

face significant disruption and severe harm if the Commission adopts many of the proposals in the NPRM, including proposals that would radically reduce the clean UHF spectrum available for wireless microphone use, impose government-mandated redesign of wireless microphone equipment to incorporate database control, impose restrictive new power limits on unlicensed wireless microphones, and render noncompliant a substantial portion of recently purchased wireless microphone equipment across the country. Shure vigorously objects to a number of these proposed rule amendments and urges the Commission to refrain from implementation, or to adopt alternative rules which avoid significant adverse impact on the wireless microphone community. In addition to various substantive technical rule changes, the NPRM proposes burdensome transition rules which would worsen the already harmful impact on the wireless microphone community. In some cases, the Commission should not adopt the proposed transition rule because the proposed new spectrum plan, database requirement or other new substantive rules are ill-advised and would harm the public interest; in other cases, the transition rule itself is too burdensome or impracticable and should not be adopted.

A. The Proposed Cut-Off Periods

In the Incentive auction order, the FCC decided that wireless microphones that operate in the repurposed 600 MHz bands may continue to operate during the post-auction transition period but must cease operating no later than 39 months after release of the Channel Reassignment Public Notice.⁶² The NPRM proposes the same cut-off date for the certification, manufacturing, and marketing of Part 15 and Part 74 wireless microphones operating in the guard bands, including the duplex gap, the lower guard band, and the

⁶² *Incentive Auction Order* at ¶ 11.

repurposed 600 MHz band to ensure that manufacturers cease making and marketing equipment that cannot be legally used after a certain date.⁶³ The NPRM proposes the following other cut-off dates:

1. **Equipment Applications:** Nine (9) months after the Channel Assignment PN, or 24 months after the effective date of the service rules the Commission adopts in in proceeding, or on the earlier of the two dates, the Commission will cease accepting equipment certification applications under Part 15 for wireless microphone equipment operating in repurposed TV spectrum.⁶⁴
2. **Marketing and Manufacture:** Eighteen (18) months after release of the Channel Assignment PN or 33 months after the effective date of the service rules the Commission adopts in in proceeding, or the earlier of the two dates, marketing and manufacture of equipment that does not comply with the 600 MHz Band would be prohibited.
3. **Operation and Manufacture of Equipment Not Limited to Specified 600 MHz Frequencies:** The NPRM proposes that the same cut-off date applies to already certified equipment in the field that tunes to repurposed 600 MHz frequencies. At that time, users will be prohibited from using and manufacturers will be prohibited from marketing such equipment.
4. **Operation and Manufacture of Equipment Limited to Guard Bands:** However, such cut-off dates would not apply to equipment certified only to operate in the duplex gap or guard bands. The Commission's reasoning for this distinction is that this rule would force the separation of equipment and ensure that the Commission would be

⁶³ NPRM at ¶ 206.

⁶⁴ NPRM at ¶ 207.

able to distinguish easily which wireless microphones legally should be able to operate after the transition from those that cannot rather than having to determine the precise frequency to which a specific wireless microphone is tuned, which may not be indicated on the device.⁶⁵

B. Much of the 600 MHz Band Equipment in the Field is State-of-the-Art, Efficient Equipment Recently Purchased to Replace Equipment Rendered Noncompliant When 700 MHz Operations Were Banned

At the outset, Shure challenges any assumption in these proposed transition periods that the installed user base of wireless microphone equipment operating in the 600 MHz band employs outdated technology, are inefficient devices, or is in some other way inferior. A large percentage of the equipment operating in the 600 MHz Band was purchased in the last two to five years specifically to replace 700 MHz equipment whose operation was banned in 2010 at the conclusion of the digital television transition.⁶⁶ In Shure's experience, generally the replacement equipment is state-of-the-art, and quite spectrally efficient given the rigorous demands of professional audio microphone users. The cost of few (if any) of these 600 MHz microphones will have been amortized at the conclusion of the transition. Given the substantial and recent user investment in technologically advanced 600 MHz band microphones, users stand to suffer from another round of Commission policies that render perfectly operable wireless microphone equipment noncompliant. Shure accordingly urges the Commission to ensure that this equipment is not unnecessarily stranded and to improve the probability of a smooth transition by taking the following action with respect to 600 MHz band wireless microphones:

⁶⁵ NPRM, at ¶ 208.

⁶⁶ *Wireless Microphone 700MHz Order* at ¶ 2.

C. **Wireless Microphone Operations Should Have Access to the 600 MHz Band Until Commercial Wireless Services Commences**

In the repurposed 600 MHz band, wireless microphone users should be able to access frequencies until the database reflects that a carrier has commenced actual commercial operations on them. In other words, the rules should permit the operation of wireless microphones until the end of the 39 month transition window that begins with the release of the *Channel Reassignment PN* or up to the date upon which a carrier has commenced actual commercial service in repurposed spectrum. The NPRM proposes this transition approach for operations of *WSDs* and similar timing should apply for wireless microphones. For *WSDs*, the NPRM proposes that carriers will specify a polygon with at least 8 sides and up to 120 sides to identify area of operation. *WSDs* would not be permitted to operate on carrier channels within the polygon, subject to separation criteria. The NPRM states that this approach “will allow a licensee to define its operations area well in advance *without limiting the ability of white space devices to operate until the actual date when the 600 MHz wireless licensee commences operations.*”⁶⁷ The Commission here recognizes the priority of avoiding a transition that would allow significant amounts of UHF spectrum to lie fallow. That sound spectrum management principle should apply to ensure that wireless microphones users should not be forced to suffer the hardship of displacement, again, any earlier than is necessary. Accordingly, Shure proposes that wireless microphones be permitted to continue operating in repurposed spectrum until the date upon which the carrier notifies the Commission of the expected actual date of commercial operation.

⁶⁷ *NPRM*, at ¶ 181 (emphasis added).

D. Wireless Microphone Users Should Be Permitted to Check Databases and Other Frequency Resources Manually to Determine Carrier Service Dates

As outlined above, wireless microphone systems do not have Internet access functionality and the Commission should not mandate the fundamental technical redesign that incorporating such technology would entail. Wireless microphone users, including especially a broad class of professional users, routinely consult a host of frequency information sources to determine the channels most likely to be available for an event. Indeed, for decades the professional wireless microphone community has used spectrum shared with TV, PLMRS, CMRS, etc. to engineer extensive microphone-intensive events in large venues all the way to events using just one or two wireless microphones without interference and without resort to database control. To determine when and where a carrier will be planning to commence commercial service, wireless microphone users can check with the databases manually or access to information in their respective “frequency finders” that manufacturers make available to wireless microphone users to assist in determining which frequencies are occupied (by television and other services) in each market. Users today rely heavily on such resources to determine what equipment to use and for event planning. Manufacturers will reach out to wireless microphone users voluntarily and frequently, as they do today, to advise them of updated frequency look up sources.

E. Wireless Microphone Equipment Tunable to a Range of Frequencies Should Not be Banned From Operating in the Guard Bands, Including the Duplex Gap

The NPRM proposes rules that would disallow the marketing and operation of wireless microphones that operate in any portion of the repurposed 600 MHz band even if they could be tuned to operate in permitted frequencies in the guard bands, including the duplex gap.⁶⁸ The Commission reasons that this rule would enable the Commission to use equipment identification numbers to distinguish between wireless microphones legally able to operate after the transition from those that cannot, rather than having to determine the precise frequency to which a specific wireless microphone is tuned, which may not be indicated on the device.⁶⁹ However, this impractical rule, if adopted, would severely harm users by eliminating the ability to use existing equipment. Given the extensive installed base of 600 MHz equipment, the burdens caused by the Commission's recent "transition" of 700 MHz equipment, and the fact that some microphone operations will continue in portions of the 600 MHz band, the Commission should be careful to avoid imposing overreaching and unnecessarily onerous prohibitions on the operation of existing equipment. No wireless microphone equipment currently exists that would meet these requirements and the Commission should not assume that market forces will guarantee that such equipment will be developed.⁷⁰ Further, it is noteworthy that the NPRM does not propose to adopt comparable measures to ban certificated WSD equipment capable of operating in 600 MHz frequencies other than the 6 MHz in the duplex gap and lower guard band.

⁶⁸ *NPRM*, at ¶ 208.

⁶⁹ *Id.*

⁷⁰ The Commission should be aware that manufacturers are developing for global markets and U.S. uncertainty should not delay certification and roll out in other markets. It is noteworthy that Japan just opened up all UHF for wireless microphones.

Shure strongly urges the Commission not to adopt such measures and instead should endeavor to inform the public of the legal obligations associated with their equipment use. The Commission should not require the use and certification of guard band only equipment. If a wireless microphone has already been certificated for operation in frequencies that cover any portion of the duplex gap or guard bands, the operation of that microphone should be permissible subject to appropriate procedures to ensure that wireless microphone users are aware of the obligation to limit operation to specific bands

under the rules.⁷¹ Similarly, the Commission should permit wireless microphone equipment to obtain both Part 15 and Part 74 equipment authorizations.

Respectfully submitted,

Mark Brunner
Senior Director, Global Brand Management

Edgar Reihl
Director, Spectrum Policy

/s/ Catherine Wang
Catherine Wang
Timothy Bransford
Morgan, Lewis & Bockius LLP
2020 K Street, N.W.
Washington, DC 20006
Bus.: 202.373.6000
Fax.: 202.373.6001

Counsel to Shure Incorporated

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⁷¹ If the Commission determines that it should adopt this draconian rule notwithstanding the certainty that it will have a harsh impact on users, including unnecessary economic loss, and inhibit commercial production by manufacturers, the rules should allow manufacturers to implement firmware upgrades in the field for microphones that straddle 600 MHz boundary.