

FCC FACT SHEET*

Promoting Spectrum Access for Wireless Microphone Operations et al.

Order on Reconsideration and Further Notice – GN Docket No. 14-166, ET Docket No. 14-165 et al.

Background: The Commission has taken several actions through the years to accommodate wireless microphone users’ needs by providing access to spectrum in various frequency bands – both on a licensed and unlicensed basis. Wireless microphone operations range from broadcasting and other professional uses with a need for high-performance microphones, such as live theatre, to individual consumers’ use of handheld microphones at a conference or in a karaoke bar. Wireless microphones enhance event productions in a variety of settings, including music venues, film studios, conventions, corporate events, and houses of worship.

What the Order On Reconsideration Would Do:

- Address five petitions for reconsideration involving wireless microphone issues decided in two earlier Commission orders concerning licensed and unlicensed wireless microphone operations in the TV bands, the repurposed 600 MHz band, and several other frequency bands.
- Address various technical and operational rules and provide revisions and clarifications regarding wireless microphone operations.
- Affirm the Commission’s decision not to permit *unlicensed* small theater, music, and performing arts organizations to register in the white spaces database to get interference protection from white space devices when operating in the TV bands.
- Affirm the Commission’s decision to limit licensed wireless mic users to access no more than 30 megahertz of spectrum in the 1435-1525 MHz band, while clarifying how that limit would apply to particular users in the same general location/area in order to facilitate each user’s access to spectrum resources.

What the Further Notice of Proposed Rulemaking Would Do:

- Propose permitting professional theater, music, performing arts organizations, and similar organizations to obtain a Part 74 license to operate wireless mics in small towns and at smaller venues, based on the applicant’s demonstrated need and requisite professional ability to operate in the bands.

* This document is being released as part of a “permit-but-disclose” proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in GN Docket No. 14-166 and in ET Docket No. 14-165, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission’s *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission’s meeting. See 47 CFR § 1.1200 *et seq.*

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Promoting Spectrum Access for Wireless Microphone Operations)	GN Docket No. 14-166
)	
Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and)	ET Docket No. 14-165
)	
Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap)	
)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions)	GN Docket No. 12-268
)	
Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band)	WT Docket No. 08-166 (Terminated)
)	
Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition)	WT Docket No. 08-167 (Terminated)
)	
Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones)	ET Docket No. 10-24 (Terminated)
)	

**ORDER ON RECONSIDERATION AND
FURTHER NOTICE OF PROPOSED RULEMAKING***

* This document has been circulated for tentative consideration by the Commission at its July open meeting. The issues referenced in this document and the Commission's ultimate resolution of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairman has determined that, in the interest of promoting the public's ability to understand the nature and scope of issues under consideration by the Commission, the public interest would be served by making this document publicly available. The Commission's *ex parte* rules apply and presentations are subject to "permit-but-disclose" *ex parte* rules. *See, e.g.*, 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. *See* 47 CFR §§ 1.1200(a), 1.1203.

Adopted: []

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By the Commission:

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I. INTRODUCTION

1. In the Order on Reconsideration, we address the four petitions for reconsideration of the *Wireless Microphones R&O* concerning licensed wireless microphone operations in the TV bands, the 600 MHz “duplex gap,” and several other frequency bands, as well as three petitions for reconsideration of the *TV Bands Part 15 R&O* concerning unlicensed wireless microphone operations in the TV bands,

the 600 MHz guard bands and duplex gap, and the 600 MHz service band.¹ Because these petitions involve several overlapping technical and operational issues concerning wireless microphones, we consolidate our consideration of them in this one order.²

2. Specifically, we make technical revisions to the spurious emission limits that the Commission had adopted for licensed wireless microphone operations in several frequency bands and for unlicensed wireless microphone operations in the TV bands, and the 600 MHz guard band and duplex gap.³ With respect to licensed and unlicensed wireless microphone operations in the TV bands, the 600 MHz guard band and duplex gap, and the 600 MHz service band (during the post-auction transition

¹ See *Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 14-166 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 8739 (2015) (*Wireless Microphones R&O*); *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-165 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 9551 (2015) (*TV Bands Part 15 R&O*). When we use the term “wireless microphones” in these proceedings, we collectively refer to wireless microphones and related wireless audio devices such as cue and control communications, synchronization of TV camera signals, and in-ear monitors. As discussed in the *Wireless Microphones R&O*, following the close of the broadcast television incentive auction, wireless microphones will be authorized to operate in the reconfigured TV bands (TV bands) which continue to be allocated for television services, and in the 600 MHz guard band(s) and duplex gap. Wireless microphones also are permitted to operate under certain conditions, and only for a limited period of time, in the spectrum band that is reallocated for 600 MHz wireless services (600 MHz service band). See *Wireless Microphones R&O*, 30 FCC Rcd at 8743, para. 7 & nn.16-18.

Audio-Technica, Sennheiser, Lectrosonics, and Shure filed petitions for reconsideration of the *Wireless Microphones R&O* (GN Docket No. 14-166 and GN Docket No. 12-268), while Audio-Technica, Sennheiser, and Shure filed petitions for reconsideration of the *TV Bands Part 15 R&O* (ET Docket No. 14-165 and GN Docket No. 12-268). Audio-Technica and Sennheiser each filed a consolidated petition that addressed issues in both proceedings. See Audio-Technica Consolidated Petition; Sennheiser Consolidated Petition. Lectrosonics filed a petition for reconsideration of the *Wireless Microphones R&O*. See Lectrosonics Petition. Shure filed two different petitions, one in each proceeding. See Shure Wireless Mics Petition and Shure Part 15 Petition, respectively.

² In addition to issues pertaining to wireless microphone operations, the *TV Bands Part 15 R&O* addressed a variety of issues on unlicensed operations in the TV Bands, the 600 MHz guard bands and duplex gap, the future 600 MHz band, and Channel 37. See generally *TV Bands Part 15 R&O*. Apart from the three petitions for reconsideration of the *TV Bands Part 15 R&O* that concern unlicensed wireless microphones, seven petitions for reconsideration address other issues in that order that focus generally on white space device operations. These are the petitions filed by Carlson Wireless Technologies, Inc. and Cal.net, Inc. (Carlson); GE Healthcare (GEHC); Google, Inc. (Google); Microsoft Corp. (Microsoft); National Association of Broadcasters (NAB); Wireless Internet Service Providers Association (WISPA); and the WMTS Coalition (WMTS). These latter petitions of the *TV Bands Part 15 R&O* will be addressed separately at a later date. We note that one of the issues raised in this proceeding concerned how quickly the white space databases would be required to register TV channels for licensed wireless microphones in order to provide them protection from interference by white space devices. We intend to address this particular issue when we address the issues raised in these latter petitions.

³ Under Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Spectrum Act), the duplex gap is deemed a guard band. See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567, 6607-08, para. 89 (2014) (citing Spectrum Act, Pub. L. No. 112-96, § 6407, 126 Stat. 156, 231-32 (2012) (codified at 47 U.S.C. § 1454)) (*Incentive Auction R&O*); *aff'd, Nat'l Assoc. of Broadcasters, et al v. FCC*, 789 F.3d 165 (D.C. Cir. 2015). For purposes of clarity, we distinguish here between the 600 MHz guard band that separates broadcast services from other services and the duplex gap between the 600 MHz service downlink and uplink.

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period),⁴ we clarify the applicable output power measurements; clarify how certain antenna-related Part 15 rules apply with respect to unlicensed wireless microphones; and revise and clarify the requirements for existing and legacy unlicensed wireless microphones during and after the post-auction transition period. While we decline to permit wireless microphone users that operate on an unlicensed basis in these bands to register their operations in the white spaces databases to obtain interference protection from white space devices, we adopt a Further Notice of Proposed Rulemaking (Further Notice) in which we propose to permit certain qualifying professional theaters, music, and performing arts organizations to obtain a Part 74 license that would allow them as licensees to obtain such interference protection in the TV bands and, when needed, also to operate in other spectrum bands available for licensed wireless microphone operations under Part 74. In addition, with respect to licensed wireless microphone operations in other frequency bands, we adopt revisions to the channelization plan for licensed wireless microphone operations in the 169-172 MHz band, generally affirm but provide clarifications regarding the 30-megahertz limit placed on licensed wireless microphone users' access to spectrum in the 1435-1525 MHz band, and clarify coordination requirements and operational limitations for licensed wireless microphone operations in the 941.5-944 MHz band. With these various revisions and clarifications, we finalize the technical rules for wireless microphone operations and, combined with the Further Notice, we promote our goal of accommodating wireless microphone users' needs through access to spectrum resources following the incentive auction and reconfiguration of the TV bands.

3. We also terminate proceedings begun in 2008 and 2010 that concerned various wireless microphone issues.⁵ All of the issues that remained in those proceedings have been subsumed in the proceedings addressed in the instant Order on Reconsideration.⁶

II. ORDER ON RECONSIDERATION

A. Background

4. Through the years, the Commission has taken several actions to accommodate wireless microphone users' needs by providing access to spectrum in various frequency bands, both on a licensed

⁴ Following the close of the broadcast incentive auction on April 13, 2017, the 600 MHz Band Plan is now finalized. It establishes the frequencies associated with the 600 MHz guard band, the 600 MHz service band, and the 600 MHz duplex gap. In addition, the 39-month post-incentive auction transition period is now established, with the transition period ending on July 13, 2020. *Incentive Auction Closing and Channel Reassignment Public Notice*, AU Docket No. 14-252, GN Docket 12-268, WT Docket No. 12-269, MB Docket No. 16-306, Public Notice, DA 17-314 (MB/WTB rel. April 13, 2017) (*Closing and Channel Reassignment PN*). Only one 600 MHz guard band is established next to Channel 37 under the adopted 600 MHz Band Plan, although there would have been more than one such guard band under other possible outcomes of the incentive auction. *See Incentive Auction R&O*, 29 FCC Rcd at 6585-86, paras. 46-48,

⁵ *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*, WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24, Report and Order and Further Notice of Proposed Rulemaking, 25 FCC Rcd 643, 644-45, 682-87, paras. 2, 81-90 (2010) (*TV Bands Wireless Microphones R&O and Further NPRM*); *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*, WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24, Second Report and Order, 29 FCC Rcd 6103 (2014) (*TV Bands Wireless Microphones Second R&O*).

⁶ Those remaining issues included codification of the rules for unlicensed wireless microphone operations in the TV bands, whether to take steps to promote more efficient use of spectrum by wireless microphones, and whether to provide access to additional spectrum for wireless microphone operations outside of the TV bands. *See TV Bands Wireless Microphones R&O and Further NPRM*, 25 FCC Rcd at 645-46, 692-96, 702-04, paras. 4, 109-123, 145-151. The proceedings addressed in the instant Order on Reconsideration, begun in 2014, address these issues.

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and an unlicensed basis.⁷ Wireless microphones play an important role in enabling broadcasters and other video programming networks to serve consumers, including as they cover breaking news and live sports events. Many types of users employ wireless microphones – both licensed and unlicensed – in a variety of settings. Wireless microphone operations range from professional uses, with the need for numerous high-performance microphones, to an individual consumer’s use of a handheld microphone at a conference or in a karaoke bar. Wireless microphones enhance event productions in a variety of settings – including theaters and music venues, film studios, conventions, corporate events, houses of worship, and Internet webcasts. They also help create high quality content that consumers demand and value.⁸ Most recently, in August 2015, the Commission adopted two related orders, the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, that revised our rules, respectively, with regard to licensed wireless microphone operations in various different frequency bands and unlicensed wireless microphone operations in the TV bands and the 600 MHz guard bands and duplex gap.

5. In the *Wireless Microphones R&O*, the Commission took several actions to accommodate licensed wireless microphone users’ needs in various frequency bands.⁹ Generally, it sought to enable these wireless microphone users to have access to different spectrum bands to address the needs of the various types of wireless microphone users.¹⁰ With respect to the TV bands, it revised our rules to provide more opportunities for licensed wireless microphone users to access spectrum by allowing greater use of very-high frequency (VHF) channels and providing for closer co-channel operation without the need for coordination where such use poses little risk of causing harmful interference to TV service.¹¹ The Commission also expanded eligibility for licensed use of the 600 MHz duplex gap to all entities now eligible to hold Part 74 Low Power Auxiliary Station (LPAS) licenses for using TV band spectrum.¹² It required new wireless microphones operating on a licensed basis in the TV bands and in certain other bands to meet the stringent analog and digital European Telecommunications Standards Institute (ETSI) technical standards pertaining to the applicable emission mask for wireless microphones, which will ensure more efficient use of the spectrum by these devices, and specified certain out-of-band emissions (OOBE) limits.¹³ In addition, the Commission addressed consumer education and outreach efforts to help wireless microphones transition out of the TV band spectrum that is repurposed for wireless services, and equipment certification procedures that will apply to wireless microphones in the future.¹⁴ Further, it took several additional actions with respect to other spectrum bands currently available for licensed wireless microphone operations to enable greater use of these bands to accommodate wireless microphone uses in the future. Specifically, it adopted revisions to provide new opportunities for such use in the 169–172

⁷ The Commission has authorized wireless microphone operations in different spectrum bands to accommodate the growing use of these devices by different users. The technical and operational rules for wireless microphone operations in these different bands have varied, depending on the band, and generally are designed to enable wireless microphone users to operate in shared bands along with other users. *See generally Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 14-166 and GN Docket No. 12-268, Notice of Proposed Rulemaking, 29 FCC Rcd 12343, 12346-49, paras. 6-15 (2014) (general discussion of wireless microphones) (*Wireless Microphones NPRM*).

⁸ *See Wireless Microphones R&O*, 30 FCC Rcd at 8740, para.1.

⁹ *See generally id.*, 30 FCC Rcd 8739.

¹⁰ *Id.* at 8744, para. 10.

¹¹ *Id.* at 8745-51, paras. 16-28.

¹² *Id.* at 8755-56, paras. 38-40. The 600 MHz duplex gap is the spectrum separating the 600 MHz service uplink and downlink bands. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9553 n.4.

¹³ *See, e.g., Wireless Microphones R&O*, 30 FCC Rcd at 8752-53, paras. 29-32 (adopting ETSI standard for licensed wireless microphone operations under the Part 74 LPAS rules).

¹⁴ *See id.* at 8756-66, paras. 41-63.

MHz band and the 944–952 MHz band.¹⁵ Finally, the Commission opened up portions of three other sets of spectrum bands – the 941-944 MHz and 952–960 MHz bands (on each side of the 944-952 MHz band), the 1435-1525 MHz band, and the 6875-7125 MHz band – for sharing with licensed wireless microphone operations under specified conditions.¹⁶

6. In the *TV Bands Part 15 R&O*, adopted concurrently with the *Wireless Microphones R&O*, the Commission established rules on a broad range of issues pertaining to unlicensed operations, under Part 15 of the Commission’s rules, in the TV bands, the 600 MHz guard bands and duplex gap, the 600 MHz service band, and Channel 37.¹⁷ While most of the *TV Bands Part 15 R&O* addressed issues pertaining to unlicensed white space operations,¹⁸ several portions focused on unlicensed wireless microphone operations and on licensed wireless microphone operations on a few overlapping issues (such as the technical rules for operations on a portion of the 600 MHz duplex gap¹⁹). In particular, the Commission took actions to continue to accommodate unlicensed wireless microphone use in the TV bands, the 600 MHz guard bands and duplex gap, and the 600 MHz service band, while doing so in a manner that also protects licensed users from harmful interference. It codified unlicensed wireless microphones operations under Part 15 (in place of a waiver adopted in 2010), bringing these devices under the Commission’s general policy tenets for unlicensed devices (i.e., they are not entitled to interference protection and they must not cause harmful interference to authorized services). It established various technical rules for low power operations of wireless microphones in these bands, and specified frequency and distance separations as needed to protect authorized services.²⁰ It also required that unlicensed wireless microphone users access the white space databases to identify frequencies available for their use in the 600 MHz guard bands and duplex gap and in the 600 MHz service band,²¹ and eliminated the ability of certain unlicensed wireless microphone users to register in the white spaces databases for interference protection from unlicensed white space devices.²² Finally, it required unlicensed wireless microphone users to operate only properly certified equipment after a transition period.²³

7. In December 2015, Audio-Technica and Sennheiser each filed a consolidated petition for reconsideration of the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, Lectrosionics filed a petition for reconsideration of the *Wireless Microphones R&O*, and Shure filed separate petitions for

¹⁵ See *id.* at 8768-72, paras. 70-84.

¹⁶ See *id.* at 8772-77, paras. 85-95 (portions of the 941-944 MHz and 952-960 MHz bands), 8779-86, paras. 105-122 (1435-1525 MHz band), 8786-90, paras. 126-132 (6875-7125 MHz band).

¹⁷ As noted above, at the time this order was issued, it was not known whether there would be more than one 600 MHz guard band (not including the duplex gap), which was dependent on the ultimate 600 MHz Band Plan established following the close of the incentive auction. See *Incentive Auction R&O*, 29 FCC Rcd at 6585-86, paras. 46-48.

¹⁸ See generally *TV Bands Part 15 R&O*, 30 FCC Rcd 9551. In substantial part, the order concerned unlicensed white space device access to spectrum in the TV Bands, the 600 MHz guard bands and duplex gap, the 600 MHz service band, and Channel 37. See generally *id.*

¹⁹ The Commission adopted the technical rules for unlicensed and licensed wireless microphone operations in different portions of the 11-megahertz 600 MHz duplex gap, wherein the rules are designed to protect adjacent licensed services from harmful interference. See *id.* at 9614-9617, paras. 151-156.

²⁰ *Id.* at 9587-93, paras. 94-111, 9607-17, paras. 136-156.

²¹ *Id.* at 9617-19, paras.157-162, 9628-31, paras.187-192.

²² *Id.* at 9658-61, paras. 260-269.

²³ *Id.* at 9665-66, paras. 281-286.

reconsideration of the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*. Several parties commented on the petitions in these two proceedings that pertain to wireless microphones.²⁴

B. Discussion

8. This Order on Reconsideration addresses petitions for reconsideration (including two consolidated petitions) that pertain to licensed and unlicensed wireless microphone operations under the rules adopted in August 2015 in the *Wireless Microphones R&O* and the related *TV Bands Part 15 R&O*.²⁵ We discuss these petitions and the issues they raise in the sections below. First, we address issues raised concerning the spurious emission limit that applies with respect both to (1) licensed wireless microphones that operate pursuant to the Commission's Part 74 LPAS rules in the TV bands and the 600 MHz duplex gap, as well as in several other frequency bands (i.e., the 941.5-944 MHz band, 944-952 MHz band, portions of the 952-960 MHz band, the 1435-1525 MHz band, and portions of the 6875-7125 MHz band) and (2) unlicensed wireless microphone operations in the TV bands and the 600 MHz guard band and duplex gap. We then discuss issues that pertain to rules adopted for licensed and unlicensed wireless microphone operations in the TV bands and the 600 MHz guard band and duplex gap. We follow with a discussion of rules concerning licensed wireless microphone operations, respectively, in the 169-172 MHz band and in the 1435-1525 MHz band. In addition to addressing the petitions for reconsideration, we clarify the coordination procedures and operational limitations for licensed wireless microphone operations in the 941.5-944 MHz band.

1. Spurious Emission Limits for Licensed Wireless Microphones in Various Frequency Bands and for Unlicensed Wireless Microphones in the Television Bands and 600 MHz Guard Band/Duplex Gap

9. *Background.* To promote more efficient use of available spectrum by wireless microphones, the Commission adopted new emission mask rules in 2015 for licensed and unlicensed wireless microphones that operate in certain frequency bands.²⁶ Specifically, in the *Wireless Microphones R&O*, it adopted the ETSI standard for emission masks for analog and digital wireless microphone devices that are certified to operate on a licensed basis under Part 74 LPAS rules in the TV bands and the 600 MHz duplex gap, and in several other frequency bands outside of these bands (i.e., the 941.5-944 MHz Band, 944-952 MHz Band, portions of the 952-960 MHz Band, the 1435-1525 MHz Band, and portions of the 6875-7125 MHz Band).²⁷ In the *TV Bands Part 15 R&O*, the Commission

²⁴ Parties commenting on the petitions concerning the *Wireless Microphones R&O* include the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), Aerial Video Systems (AVS), Broadcast Sports International (BSI), CTIA, and the Madison Square Garden Company (MSGC). Parties commenting on the petitions concerning wireless microphone issues decided in the *TV Bands Part 15 R&O* include CTIA, the Performing Arts and Theater Groups, Key Bridge, and the Wireless Internet Service Providers Association (WISPA).

²⁵ See note 1 (identifying the petitioners and petitions).

²⁶ As noted above, wireless microphones operations are authorized in several different frequency bands, under different sets of rules, on a licensed or unlicensed basis. The ETSI emission mask standard only applies to wireless microphone operations in certain of these bands.

²⁷ *Wireless Microphones R&O*, 30 FCC Rcd at 8752-8753, para. 32 (TV bands); 8772, para. 83 (944-952 MHz band); 8776, para. 94 (941.5-944 MHz, 952.85-956.25 MHz, and 956.45-959.85 MHz bands); 8784, para. 116 (1435-1525 MHz band); 8790, para. 132 (6875-6900 MHz and 7100-7125 MHz bands). The ETSI emission mask also applies to newly certified Part 74 devices that operate in the 600 MHz band (where operations are permitted during the 39-month post-auction transition period, but no longer). The Commission also applied this ETSI standard to certain licensed wireless microphone operations in the 169-172 MHz band under Part 90. *Wireless Microphones R&O*, 30 FCC Rcd at 8770, para. 76 (the ETSI standard applies to the extent that the wireless microphone bandwidth exceeded 54 kHz); see also 47 C.F.R. 74.861(d); 90.265(b)(3). For licensed wireless microphones in the TV bands, the 600 MHz duplex gap, and the 944-952 MHz band, the new requirements apply nine months following release of the *Channel Reassignment PN*. *Wireless Microphones R&O*, 30 FCC Rcd at 8752-8753, para. 32; for wireless microphones that operate on a licensed basis in the other, newly designated bands, the standard applies

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adopted this same ETSI emission mask standard for unlicensed wireless microphones that are certified to operate under our Part 15 rules in the TV bands and the 600 MHz guard bands and duplex gap.²⁸ It found that requiring wireless microphones to meet the ETSI emission mask, which is tighter than the Commission's previously-existing emission mask, would protect authorized services in adjacent bands from harmful interference and would improve spectrum sharing by wireless microphones.²⁹ In both of these proceedings, in addition to this ETSI emission mask standard, it also adopted a spurious emission limit that required, outside of the frequency range where the ETSI mask is defined (one megahertz above and below the wireless microphone carrier frequency), that wireless microphone emissions comply with the same limit as the edge of the ETSI masks, specifically 90 dB below the level of the unmodulated carrier (-90 dBc).³⁰

10. *Petitions for reconsideration.* Audio-Technica, Lectrosonics, Sennheiser, and Shure each submitted a petition for reconsideration of the Commission's decision to adopt a requirement that licensed and unlicensed wireless microphones meet a -90 dBc spurious emission limit outside of the frequency range where the ETSI masks are defined (one megahertz above and below the wireless microphone carrier frequency). These petitioners argue that the Commission erred in adopting this particular limit and state that we should replace it with the spurious emission limits for wireless microphones that are set forth in ETSI EN 300-422-1. Petitioners argue that the limit adopted beyond the edge of the ETSI mask is impractical, would be onerous to implement, had no record support, is unnecessary to protect against harmful interference to other operations, and is inconsistent with global standards that are appropriate for wireless microphones and reflected in ETSI standards.³¹ Audio-Technica and Shure argue that the Commission's spurious emission limit, which is more stringent than that required under ETSI, would require redesign of wireless microphones, may be technically infeasible, and would impose unnecessary cost penalties on wireless microphone manufacturers.³² Audio-Technica contends that wireless microphones sold in the United States already comply fully with the ETSI standard for emission masks, which we adopted, and the ETSI spurious emission limits, which have been implemented in Europe.³³ Lectrosonics argues that the difficulty in complying with the Commission's limit is not in the vicinity of the ETSI emission mask but in the more distant frequency range where harmonics³⁴ of the carrier frequency fall.³⁵ Shure asserts that by adopting a spurious emission limit that is relative to transmitter

upon the effective date of the *Wireless Microphones R&O*. *Id.* at 8776-8777, para. 94. For unlicensed wireless microphones, the standard applies upon the effective date of the *TV Bands Part 15 R&O*. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9590, para. 101 and 30 FCC Rcd at 9668, para. 295. The emission mask is defined in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2011-08).

²⁸ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9590, para 101. The ETSI emission mask also applies to newly certified devices certified under Part 15 to operate in the 600 MHz band (where operations are permitted during the post-auction transition period, but no longer).

²⁹ *See, e.g., Wireless Microphones R&O*, 30 FCC Rcd at 8752-53, para. 32 (adopting ETSI emission mask in TV bands); *TV Bands Part 15 R&O*, 30 FCC Rcd at 9590, para 101.

³⁰ *See Wireless Microphones R&O*, 30 FCC Rcd at 8752-53, para. 32; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9590, para 101; *see also TV Bands Part 15 R&O* at 9608, para.141.

³¹ Audio-Technica Consolidated Petition at 3-5; Lectrosonics Wireless Microphones Petition at 2-3; Sennheiser Consolidated Petition at 6-7 (spurious emission limit was never proposed, and adoption violates the Administrative Procedure Act); Shure Wireless Microphones Petition at 4.

³² Audio-Technica Consolidated Petition at 3-4; Shure Wireless Microphones Petition at 6.

³³ Audio-Technica Consolidated Petition at 3-4.

³⁴ Harmonics are emissions generated by a transmitter at integral multiples of the carrier frequency. In a transmitter operating at 600 MHz, the second harmonic would occur at 1200 MHz, the third harmonic at 1800 MHz, the fourth at 2400 MHz, etc.

³⁵ Lectrosonics Wireless Microphones Petition at 2.

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power output rather than a fixed level, the Commission inadvertently adopted a limit that discourages spectral efficiency, penalizing lower powered transmitters that enable end users to reuse frequencies more efficiently and conserve battery life.³⁶ Audio-Technica contends that the ETSI spurious emission limits have been proven in practice to protect adjacent services, including LTE, TV broadcast and others.³⁷

11. In its opposition, CTIA argues that the additional spurious emission limits that the Commission adopted for wireless microphones should not be revised or relaxed, claiming that these limits are less stringent than those that CTIA had determined through independent testing to be necessary to protect adjacent 600 MHz wireless broadband operations.³⁸ CTIA also argues that wireless microphone manufacturers have not adequately justified their requests for reconsideration of adopted limits, asserting that manufacturers rely solely upon financial considerations and unsubstantiated claims of possible technical infeasibility while providing no technical information to demonstrate that we can relax these limits and still protect 600 MHz licensees from interference. CTIA contends that if we were to consider any changes to spurious emission limits, we should instead strengthen the requirements to protect 600 MHz wireless operations.³⁹ AFTRCC, focusing on licensed wireless microphone operations in the 1435-1525 MHz band, notes that any relaxation of the wireless microphone emissions limits outside of the ETSI mask would have to be taken into account, and could make it more difficult for AFTRCC to coordinate proposed wireless microphone uses in a manner that protects primary aeronautical mobile telemetry (AMT) operations in the band.⁴⁰

12. Audio-Technica, Sennheiser, and Shure each responded to CTIA, challenging its testing and questioning the desirability and necessity of wireless microphones meeting the -90 dBc requirement.⁴¹ These parties argue that the test report CTIA cites contains numerous erroneous technical assumptions and deficiencies such as an unrealistically low path loss, exaggerated sensitivity for wireless equipment, and a failure to recognize that numerous other radio frequency devices already are permitted to produce higher emissions than they claim are necessary.⁴² Wireless microphone manufacturers argue that the spurious emission limit adopted is not necessary to prevent harmful interference, and that the ETSI standard for spurious emission limits as applied in Europe would be sufficient.⁴³ Audio-Technica states that the ETSI spurious emission limits have been used for years in Europe and proven in practice to be sufficient to protect adjacent services.⁴⁴ Shure states that CTIA fails to address why wireless microphones should be subject to very restrictive spurious emission limits when cellular services co-exist with a multitude of Part 15 devices subject to less restrictive limits, and notes that wireless microphones produce emissions below the limits in Section 15.209 of the rules.⁴⁵

13. *Discussion.* On reconsideration, we replace the spurious emission limits that were adopted with the ETSI spurious emission limits for licensed and unlicensed wireless microphones. Specifically, we will require emissions more than one megahertz above and below a wireless microphone

³⁶ Shure Wireless Microphones Petition at 3.

³⁷ Audio-Technica Consolidated Petition at 5.

³⁸ CTIA Consolidated Opposition at 5. CTIA states that that an OOB limit of -89 dBm/100 kHz would be necessary to adequately protect LTE equipment from interference.

³⁹ CTIA Consolidated Opposition at 5-6.

⁴⁰ AFTRCC Wireless Microphones Comments at 5.

⁴¹ Audio-Technica Consolidated Reply at 2-4; Sennheiser Consolidated Reply at 2-4; Shure Consolidated Reply at 3-8.

⁴² Audio-Technica Consolidated Reply at 3; Sennheiser Consolidated Reply at 3; Shure Consolidated Reply at 5-6.

⁴³ Sennheiser Opposition at 4; Sennheiser Reply at 2; Audio-Technica Reply at 2-3.

⁴⁴ Audio-Technica Consolidated Reply at 2-3.

⁴⁵ Shure Consolidated Reply at 5-6.

carrier frequency (i.e., outside the defined ETSI mask) to comply with the limits in Section 8.4 of ETSI EN 300 422-1. The limit in the majority of the TV bands, including the 600 MHz Band, is four nanowatts (-54 dBm) effective radiated power (ERP), the limit at all other frequencies below 1,000 MHz is 250 nanowatts (-36 dBm) ERP, and the limit at frequencies above 1,000 MHz is 1 microwatt (-30 dBm).⁴⁶ We are persuaded that the Commission's earlier specification of a -90 dBc limit at all frequencies more than one megahertz above and below the carrier frequency is not necessary to protect wireless services in adjacent frequency bands or in shared bands, and that the ETSI spurious emission limit will provide sufficient protection for these services.⁴⁷ In revising our rule to reflect the ETSI spurious emission limits, we also harmonize with the standards that apply to this industry in other countries.

14. We find that the ETSI spurious emission limits are more appropriate than the -90 dBc limit because they are independent of the wireless microphone power, whereas the -90 dBc limit is relative, meaning lower power wireless microphones would have to meet a more stringent limit than higher power wireless microphones.⁴⁸ While a relative emission limit is appropriate for defining a mask to ensure that wireless microphones use spectrum efficiently, our adoption of absolute emission limits outside this mask will ensure that all wireless microphones, regardless of power, are subject to the same limit to prevent harmful interference to authorized services. Additionally, because the ETSI spurious emission limits are higher at frequencies outside of the TV bands, wireless microphone manufacturers will be able to more easily comply with these limits than with the -90 dBc limit at harmonics of the carrier frequency.

15. We find that adopting the ETSI spurious emission limits will not result in harmful interference to services in adjacent frequency bands, including the 600 MHz service band, about which CTIA expresses concern, or in the other bands that could experience the harmonics of the wireless microphone carrier frequency. In the 600 MHz band, the ETSI spurious emission limit for a 20 mW EIRP wireless microphone is slightly higher than the -90 dBc limit.⁴⁹ However, we expect that as a practical matter, the spurious emissions that fall in the 600 MHz service band will not be significantly higher than the current rule allows. The reason is that wireless microphones must incorporate tight filtering to comply with the ETSI emission mask within one megahertz of the carrier frequency, so emissions at the edge of the mask will be at or below -90 dBc and will continue to roll off beyond the edge.⁵⁰ The Commission recognized in its analysis in the *TV Bands Part 15 R&O* that such roll-off would

⁴⁶ ETSI EN 300 422-1 at 28, Table 3. The four nanowatt (-54 dBm) limit applies in the bands 47-74 MHz, 87.5-137 MHz, 174-230 MHz, and 470-862 MHz, which includes all of the United States TV bands with the exception of channel 5 (76-82 MHz) and most of channel 6 (82-88 MHz).

⁴⁷ We disagree with Sennheiser that the Commission lacked notice to adopt the -90 dBc spurious emission limit. *TV Bands Part 15 NPRM*, 29 FCC Rcd at 12294, para. 155 (seeking comment on a -90 dBc spurious limit).

⁴⁸ Shure Wireless Microphones Petition at 3.

⁴⁹ 20 mW EIRP is equivalent to 13 dBm EIRP or 11 dBm ERP. The emission level at the edge of the ETSI mask would be 11 dBm - 90 dB = -79 dBm ERP, measured in a 1 kHz bandwidth. The ETSI spurious emission limit in the 600 MHz band is 4 nanowatts (-54 dBm) ERP, measured in a 100 kHz bandwidth. Assuming the energy of the spurious emission is spread uniformly throughout the measurement bandwidth, the limit is equivalent to -74 dBm measured in a 1 kHz bandwidth. Thus, the ETSI spurious emission limit in this case would be 5 dB greater than the -90 dBc limit.

⁵⁰ We note that, well beyond this edge, the emissions will increase again at the harmonics of the particular wireless microphone transmitter frequency. While harmonics of the fundamental frequency of a transmitter tend to be higher than other spurious emissions, we do not expect any harmful interference to occur to other services. The second harmonic of wireless microphone transmitters in the TV bands (whether in the VHF or UHF bands) do not fall within the new 600 MHz service band. For instance, the second harmonic for the lowest frequency of the UHF TV band is 940 MHz (470 MHz x 2), which falls well outside of the new 600 MHz service band and will not affect those operations. We acknowledge that these harmonics could fall into bands used by other services, but under the revisions that we adopt here, the limits are still much more stringent than the spurious emission limits with which all wireless microphones under the long-standing LPAS Part 74 rules have had to comply (i.e., $43 + 10 \cdot \log_{10} P$ dB

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occur, resulting in emissions even less than -90 dBc in the adjacent bands, although it chose not to include this factor in our analysis.⁵¹ Thus, we conclude that adopting the ETSI spurious emission limits will not result in any significant increase in the level of emissions that wireless microphones would emit in adjacent frequency bands due to the need for sharp filtering, and will therefore not significantly increase the likelihood for harmful interference to 600 MHz band services.⁵² The Commission's analysis in the *TV Bands Part 15 R&O* demonstrated that the distance at which harmful interference is likely to occur to adjacent channel wireless services due to spurious emissions from a 20 mW wireless microphone at a level of -90 dBc is extremely short, i.e., less than 0.1 meters (4 inches).⁵³ From a practical standpoint, there is little likelihood that a person using a wireless microphone would be located this close to someone else using a wireless device. Wireless microphone signals are subject to significant attenuation due to their operation in close proximity to a person's body, in addition to other factors including antenna polarization mismatch and shadowing from walls, objects or other people.⁵⁴ We also note that the analysis of the potential for wireless microphones to interfere with 600 MHz band services was based on a scenario where a wireless handset is operating at a very low received signal level, but that handsets commonly operate at higher levels than assumed.⁵⁵ For these reasons, even if there were a slight increase in wireless microphone spurious emissions due to our adoption of the ETSI limits, we find that the likelihood of this change resulting in harmful interference to wireless services in the 600 MHz band is extremely low.

16. Similarly, we do not expect that adopting the ETSI spurious emission limits would result in any increased likelihood for harmful interference to other operations outside of the specific frequencies in the 1435-1525 MHz band on which particular wireless microphones operate. The need for sharp filtering to meet the limits at the edge of the ETSI mask will ensure that emissions in adjacent frequency bands are generally below these limits.⁵⁶ Further, as discussed above, the ETSI mask and spurious emission limits are tighter than the Part 74 limits under which licensed wireless microphones have been

below the mean output power or -13 dBm). The spurious emission limits that we are adopting (-54 dBm in the TV and 600 MHz bands, -36 dBm at other frequencies below 1 GHz and -30 dBm at frequencies above 1 GHz) are lower (by 41 dB, 23 dB and 17 dB, respectively) than the limits that these existing wireless microphones were certified to meet, so we are confident that with the spurious emission limits that we are adopting, services on harmonic frequencies of wireless microphones will have a very low potential of receiving harmful interference.

⁵¹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9608-09, para. 141. The Commission chose not to assume a slope loss factor because it did not previously require applicants for certification of wireless microphones to show compliance with the ETSI emission mask. However, based on its examination of several wireless microphone certification applications, it appeared that the equipment would comply with the ETSI mask and continue to roll off beyond the edge of the mask.

⁵² CTIA Consolidated Opposition at 3.

⁵³ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9609, para. 142. The analysis showed that these distances would be even shorter if we considered the expected emission roll-off beyond the edge of the emission mask.

⁵⁴ *Id.* at 9608, para. 141.

⁵⁵ *Id.* at 9598, para. 121, 9608, para. 141. The Commission assumed a wireless handset sensitivity of -97 dBm, but noted that LTE receivers commonly operate with a higher receive level because wireless carriers design their networks to provide better coverage than the minimum signal levels at which equipment is expected to operate. The Commission stated that it is not unreasonable to assume that a handset will typically operate at a level that is at least 10 dB higher than the minimum.

⁵⁶ Wireless microphones in the 1435-1525 MHz band are permitted to operate with up to 250 milliwatts. A level of 250 mW EIRP is equivalent to 24 dBm EIRP or 22 dBm ERP. The emission level at the edge of the ETSI mask would be 22 dBm - 90 dB = -68 dBm ERP, measured in a 1 kHz bandwidth. The ETSI spurious emission limit above 1000 MHz is 1 microwatt (-30 dBm) ERP, measured in a 1 MHz bandwidth. Assuming the energy of the spurious emission is spread uniformly throughout the measurement bandwidth, the limit is equivalent to -60 dBm measured in a 1 kHz bandwidth. Thus, the ETSI spurious emission limit in this case would be 8 dB greater than the -90 dBc limit.

certified. We therefore do not anticipate that adoption of the ETSI spurious emission limits for equipment operating in the 1435-1525 MHz band will have any impact on the coordination of wireless microphone operations by AFTRCC.

2. Wireless Microphone Operations in the Television Bands and 600 MHz Guard Band and Duplex Gap

17. Petitioners focused on five issues that pertain to licensed and unlicensed wireless microphone operations in the TV bands and in the 600 MHz guard bands and duplex gap. Specifically, as addressed below, these include: (1) the output power measurement for licensed wireless microphone operations in the VHF TV Band, and for unlicensed wireless microphone operations throughout the TV Bands (both VHF and UHF); (2) the output power levels for wireless microphone operations in the 600 MHz guard bands and duplex gap; (3) the applicability of Part 15 antenna connector rules for unlicensed wireless microphone operations; (4) the operation of existing or legacy unlicensed wireless microphone equipment after the end of the post-auction transition period; and (5) whether certain wireless microphone users that operate on an unlicensed basis can reserve TV channels in the white spaces database to protect their operations from interference.

a. Output Power Measurement

(i) Licensed Wireless Microphone Operations in the VHF TV Bands

18. *Background.* In the *Wireless Microphones R&O*, the Commission sought to provide more opportunities for licensed wireless microphone operations in the VHF TV band. To do so, it revised the then-applicable 50 mW output power limits for licensed wireless microphone operations in the VHF band, historically specified in terms of conducted power, to specify those 50 mW limits, instead, in terms of effective isotropically radiated power (EIRP). The Commission reasoned that revising the applicable power limits to 50 mW EIRP would be an effective way to allow wireless microphone manufacturers to adjust the conducted power output of wireless microphones to compensate for low antenna efficiency in the VHF band, and would enable greater use of this portion of the TV bands by reducing the need for a relatively large antenna, which could impede making productive use of this spectrum.⁵⁷ It also noted that specifying the applicable power limit in terms of EIRP for licensed wireless microphone operations in the VHF band would provide uniformity in the VHF band for both licensed wireless microphone operations under Part 74 and unlicensed wireless microphone operations under Part 15, as the *TV Bands Part 15 R&O* also specified the power limit in terms of EIRP (see discussion below).⁵⁸

19. *Petitions for reconsideration.* Audio-Technica, Lectrosonics, and Shure each submitted a petition for reconsideration regarding the revised rule specifying output power limits in the VHF band in terms of EIRP for licensed wireless microphone operations under Part 74. While they agree that specifying the permitted output power limit in terms of EIRP is a positive step for enabling more use for certain types of wireless microphone applications in the VHF band, they request that the Commission also continue to permit wireless microphone manufacturers the option of measuring the output power on either a radiated (EIRP) basis or a conducted basis for different types of wireless microphone applications.⁵⁹ No commenters oppose the petitioners on this issue.

⁵⁷ *Wireless Microphones R&O*, 30 FCC Rcd at 8748-50, paras. 21-24.

⁵⁸ *Id.* at 8749-50, para. 24; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9589, para. 99 (specifying that unlicensed wireless microphone operations at a power level of up to 50 mW EIRP would be permitted in both the VHF and UHF TV bands).

⁵⁹ Audio-Technica Consolidated Petition at 6-7 (urging the Commission to permit the option of measuring power on either an EIRP or conducted basis in all bands); Lectrosonics Wireless Microphones Petition at 3-4 (requesting that the limit be specified as 50mW conducted power or 50 mW EIRP, with the option to measure it either way in compliance testing); Shure Wireless Microphones Petition at 11 (requesting that manufacturers have the flexibility

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20. Audio-Technica, Lectrosonics, and Shure observe that an output power limit specified in terms of EIRP serves to facilitate and encourage the use of the VHF band for certain types of wireless microphone operations, such as where the transmitters typically are worn on the body and larger antennas are not practical.⁶⁰ Petitioners note that when the power limit is specified in terms of EIRP, manufacturers are able to increase the conducted power output to compensate for some of the inherent antenna inefficiency issues that arise in the VHF band (when compared to the UHF band).⁶¹ At the same time, petitioners argue that permitting a conducted power measurement, as under the previous long-standing rule, is more appropriate for a number of other types of uses in that band under the Part 74 LPAS rules. In applications such as interruptible foldback systems (IFBs)⁶² and in-ear monitor devices (IEMs),⁶³ where the transmitter is a fixed location and the receiver is worn on the body, they argue that an EIRP limit is unnecessarily restrictive because it implies that an integral antenna must be used, and can limit optimal performance of the devices.⁶⁴ Petitioners therefore contend that wireless microphone manufacturers should have the flexibility to choose whether to use EIRP or conducted power in determining their compliance with the power limit. Lectrosonics asserts that providing manufacturers the option of measuring the power in a conducted test raises no interference concerns because the previous 50 mW conducted power limit was never a cause for concern in the past for VHF broadcasting.⁶⁵ Audio-Technica also suggests that, if the Commission is concerned about the possible variation in transmit power that could result from a choice between EIRP and conducted power, we could look to the method for determining the output power specification for wireless microphones specified in the ETSI EN 300-422-1 standard, which would provide for standardized measurements and compliance.⁶⁶

21. *Discussion.* To address petitioners' concerns, we clarify that manufacturers may show compliance with the 50 mW EIRP limit for licensed wireless microphones operating in the VHF band by

to measure output power using either a radiated (EIRP) or conducted basis in the VHF bands, giving users the flexibility to use equipment certificated on either a radiated or conducted basis). *See also* Letter from Laura Stefani, Counsel to Sennheiser, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165, GN Docket No. 14-166, and GN Docket No. 12-268 (Sept. 26, 2016) at 1 (Sennheiser Consolidated Sept. 26, 2016 *Ex Parte*); Letter from Catherine Wang, Counsel for Shure, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165, GN Docket No. 14-166, and GN Docket No. 12-268 (October 4, 2016) at 5 (requesting clarification that manufacturers have the flexibility to use either conducted or radiated measurements) (Shure Consolidated Oct. 4, 2016 *Ex Parte*).

⁶⁰ Audio-Technica Consolidated Petition at 6-7; Lectrosonics Wireless Microphones Petition at 3; Shure Wireless Microphones Petition at 11.

⁶¹ Audio-Technica Consolidated Petition at 6-7; Lectrosonics Wireless Microphones Petition at 3-4; Shure Wireless Microphones Petition at 11 (antenna efficiency can be very low in VHF band applications, making it difficult or impossible to replicate the performance of UHF band wireless microphones; measuring output power on an EIRP basis can help engineers design equipment that overcomes some of the inherent antenna inefficiency problems in the VHF band).

⁶² An IFB is a monitoring and cueing system used in television, filmmaking, video production, and radio broadcast for one-way communication from the director or assistant director to on-air personnel or to a remote location.

⁶³ An IEM is a device used by musicians, audio engineers, and audiophiles to listen to music or to hear a personal mix of vocals and stage instrumentation for live performance or recording studio mixing.

⁶⁴ Audio-Technica Consolidated Petition at 6-7; Lectrosonics Wireless Microphones Petition at 3-4 (EIRP is unnecessarily restrictive because it implies that transmitter antennas be integral (non-detachable), or use non-standard connectors, which is impractical for these operations where the transmitter is enclosed in a rack or equipment closet and the antenna must be located elsewhere, connected by a co-axial cable).

⁶⁵ Lectrosonics Wireless Microphones Petition at 3-4.

⁶⁶ Audio-Technica Consolidated Petition at 7; *see* ETSI EN 300 422-1 v1.4.2 (2011-08), Section 8 (Rated Output Power). Under this section, manufacturers have the flexibility to submit measurements using either conducted power or EIRP.

(continued...)

making either radiated or conducted measurements.⁶⁷ For example, manufacturers may perform radiated emission measurements on equipment with a permanently attached antenna, or on equipment that uses a detachable antenna with the antenna connected to it, and determine the EIRP from the measurement results.⁶⁸ Alternatively, manufacturers may measure the conducted power at the transmitter antenna port and then calculate the EIRP from the conducted power and the maximum gain of the transmit antenna in dBi.⁶⁹ We agree with petitioners that permitting wireless microphone manufacturers the flexibility to certify equipment by determining power in either test configuration would best serve our goal of promoting opportunities for different types of licensed wireless microphone applications in the VHF band. We do not intend to unnecessarily restrict use of this band for certain types of wireless microphone applications. Permitting different options for measuring output power raises no interference concerns, because either method can be used to determine the EIRP of a wireless microphone. Finally, because we also are clarifying that for unlicensed wireless microphone operations in the TV bands (VHF and UHF) output power can be measured in either a conducted or radiated test configuration for comparison to the 50 mW power limit, as discussed immediately below, our output power requirements for wireless microphone operations in the VHF band, whether for licensed or unlicensed operations, will be uniform.

(ii) Unlicensed Wireless Microphone Operations in the TV Bands

22. *Background.* In the *TV Bands Part 15 R&O*, the Commission adopted rules to permit unlicensed wireless microphone operations with a power level of up to 50 mW EIRP in the TV bands, both the VHF and UHF bands.⁷⁰ In specifying the output power limit in terms of EIRP instead of conducted power, it noted that specifying the limit as EIRP would ensure uniformity in the maximum radiated power for all unlicensed wireless microphone operations, that the specification of EIRP instead of conducted power would be particularly useful in the VHF band for wireless microphone operations (because manufacturers could adjust the conducted power to partially compensate for low antenna efficiency), and that specification of EIRP is consistent with other Part 15 rules, which generally specify radiated emission limits in a form that considers both power and antenna gain (e.g., field strength, EIRP, or a combination of both). It also indicated that specifying power limits for unlicensed wireless microphones only in terms of EIRP, rather than in terms of either EIRP or conducted power, could reduce the burden of compliance.⁷¹

23. *Petitions for reconsideration.* Audio-Technica and Shure each submitted a petition for reconsideration on this decision, requesting that manufacturers be permitted to make either conducted

⁶⁷ In specifying the output power limits in terms of EIRP, the Commission did not state any intent to restrict the particular method for demonstrating compliance with that requirement. See *Wireless Microphones R&O*, 30 FCC Rcd at 8749, para. 24.

⁶⁸ The Office of Engineering and Technology published a bulletin that provides guidelines for determining the EIRP of an RF transmitting system. Knowledge Database (KDB) Publication 412172, *Determining ERP and EIRP*, August 7, 2015. This bulletin is available at <http://www.fcc.gov/labhelp>.

⁶⁹ KDB Publication 412172 describes how to determine EIRP from conducted measurements as well as from radiated measurements. The gain of a transmit antenna may vary with both direction and frequency, so the maximum gain of an antenna must be used in determining compliance with the limit.

⁷⁰ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9589, para. 99. The 50 mW power limits for unlicensed wireless microphone operations in the TV bands differ in certain respects from the Part 74 rules for licensed operations in the TV bands, which in the UHF bands permit up to 250 mW, measured in terms of conducted power. See 47 CFR § 74.861(e)(1). Unlicensed wireless microphones that operate in the 600 MHz service band during the post-auction transition period are allowed to operate at power levels permitted by the 2010 waiver, which allowed use of power levels measured in terms of conducted power instead of EIRP. See *TV Bands Part 15 R&O*, 30 FCC Rcd at 9630, n.484.

⁷¹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9589, para. 99.

(continued...)

power or radiated emission measurements to determine compliance with the 50 mW output power limit for unlicensed wireless microphones. Audio-Technica urges us to allow these options for the same reasons that it set forth with respect to licensed VHF wireless microphones (discussed above).⁷² Shure observes that TV bands wireless microphones are used in a variety of ways that necessitate the use of various kinds of antennas (e.g., internal or external) according to the particular application, and that manufacturers should have the flexibility to make either conducted or radiated power measurements to determine compliance with the power limit for unlicensed wireless microphones.⁷³ Shure also asserts that it is critical that the Commission not mandate separate testing procedures and requirements for licensed wireless microphone operations under Part 74, which continue to have a conducted power limit in the UHF band (albeit with higher permitted levels), and unlicensed wireless microphones.⁷⁴ Shure requests that manufacturers be afforded the flexibility to use either conducted or radiated measurements as specified in Section 8 “Rated Output Power” of ETSI EN 300-422-1 regarding wireless microphones.⁷⁵ Additionally, Shure states that it is unaware of any commenter who supports a regulatory approach that would require output power to be measured solely on a radiated basis.⁷⁶ Sennheiser supports these petitions for reconsideration on this issue.⁷⁷ No commenter opposes what the petitioners propose.

24. *Discussion.* On reconsideration, we address petitioners’ concerns by clarifying that wireless microphone manufacturers may show compliance with the 50 mW power limit for unlicensed wireless microphones operating in the VHF or UHF band by making either conducted or radiated measurements.⁷⁸ As discussed above for licensed wireless microphones in the VHF TV band, manufacturers may perform radiated emission measurements on equipment and determine the EIRP from the results, or may measure the conducted power at the transmitter antenna port and then determine the EIRP from the conducted power and the maximum gain of the transmit antenna in dBi. We agree with petitioners that permitting wireless microphone manufacturers the flexibility to determine compliance with the limit through either conducted or radiated emission measurements would best serve our goal of promoting opportunities for different types of unlicensed wireless microphone applications.

25. We recognize that there is a difference in how the power limits are specified in the rules for licensed and unlicensed wireless microphones in the UHF TV band (conducted power vs. EIRP), but find that the flexibility that we allow to make either conducted or radiated measurements to meet the respective limits will allow wireless microphone manufacturers to use the same test methodology to demonstrate the compliance of both licensed and unlicensed wireless microphones.⁷⁹ This will ensure that manufacturers can continue to make the same equipment for both licensed and unlicensed use (except

⁷² Audio-Technica Consolidated Petition at 6-7.

⁷³ Shure Part 15 Petition at 11.

⁷⁴ *Id.* As noted above, under Part 74 rules, licensed wireless microphone operations are permitted up to 250 mW conducted power. See 47 CFR § 74.861(e)(1).

⁷⁵ Shure Part 15 Petition at 11; see also Shure Consolidated Oct. 4, 2016 *Ex Parte* at 5 (clarifying that Shure was not seeking adoption of specific language in ETSI, but instead the flexibility to use either).

⁷⁶ Shure Part 15 Petition at 11.

⁷⁷ Sennheiser Consolidated Opposition and Response at 6.

⁷⁸ In the *TV Bands Part 15 R&O*, the Commission did not evince an intent to limit the method that manufacturers can use for establishing compliance with the EIRP power limit. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9589, para. 99. And, as discussed above, existing procedures already allow manufacturers the flexibility of showing compliance through either radiated or conducted measurements. See paragraph [21] & n.[68] (citing KDB Publication 412172).

⁷⁹ In the case in which a wireless microphone manufacturer chooses to make conducted power measurements, it can calculate the EIRP of the wireless microphone by adding the antenna gain. Alternatively, if a manufacturer chooses to make radiated measurements to determine the EIRP of a wireless microphone, it can calculate the conducted power output by subtracting the antenna gain.

insofar as licensed users are permitted to operate at higher power in the UHF TV band). Either measurement approach can reliably establish compliance with the EIRP limits for wireless microphones. Finally, while we are not specifically requiring the use of the ETSI EN 300-422-1 output power measurement procedures, we recognize that this standard allows the option of either conducted or radiated power measurements for wireless microphones. Thus, the flexibility that we allow a wireless microphone manufacturer in choosing the method of power measurements is consistent with the method employed in other countries in the global marketplace. This flexibility also is consistent with the American National Standards Institute (ANSI) C63.10-2013 measurement procedure that the Commission uses for testing Part 15 intentional radiators, as well as Office of Engineering and Technology published guidance for measurements relating to EIRP limits.⁸⁰

b. Output Power Levels for Wireless Microphones in the 600 MHz Guard Band and Duplex Gap

26. *Background.* In the *TV Bands Part 15 R&O*, the Commission provided for unlicensed wireless microphone operations in the 600 MHz guard bands and in one portion of the duplex gap under specified technical rules, and provided for licensed wireless microphone operations under the same technical rules in another portion of the duplex gap.⁸¹ In these bands, it limited all wireless microphone operations to an output power level of 20 mW EIRP. It noted that wireless microphone power limits in the guard band(s) would be lower than the levels permitted under the existing Part 74 rules (50 mW conducted power in the VHF TV band and 250 mW conducted power in the UHF TV band) or under the Part 15 waiver that had been in place for unlicensed wireless microphone operations (50 mW conducted power in both TV bands), and that this lower power level was necessary in order to protect adjacent band wireless downlink services from harmful interference.⁸² It also noted that many wireless microphones operate at power levels between 10 and 20 mW, and that limiting the power of wireless microphones to 20 mW EIRP in both the guard bands and duplex gap can help enable coexistence between those microphones and white space devices by making the power levels of that equipment more comparable.⁸³ The Commission explained that we were specifying the power limit in terms of EIRP – rather than conducted power as proposed in the *Notice* – to be consistent with our treatment of unlicensed wireless microphones in the TV bands.⁸⁴ Moreover, it noted that specifying wireless microphone power in terms of EIRP would benefit wireless microphone manufacturers by ensuring that they can design equipment that operates with a maximum radiated power of 20 mW, even if the equipment requires the use of a less efficient antenna, *i.e.*, one with a gain of less than 0 dBi.⁸⁵

27. *Petitions for reconsideration.* Audio-Technica and Shure each filed a petition for reconsideration regarding the output power levels for wireless microphone operations in these bands. In addition to requesting that the output power measurements be measured in terms either of EIRP or

⁸⁰ The Commission uses the ANSI C63.10-2013 measurement procedure to determine the compliance of Part 15 intentional radiators with the technical requirements. 47 CFR § 15.31(a)(3). As noted above, Office of Engineering and Technology KDB Publication 412172 describes how to determine EIRP using either conducted or radiated measurements. The Commission will accept data which have been measured in accordance with: (1) procedures set forth in bulletins or reports prepared by the Commission's Office of Engineering and Technology; (2) procedures acceptable to the Commission and published by national engineering societies; or (3) any other measurement procedure acceptable to the Commission. 47 CFR § 2.947(a).

⁸¹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9607-11, paras. 139-144, 9613, paras. 148-49 (guard bands), 9614-17, paras. 151-56 (duplex gap). As noted above, the guard bands are between wireless downlink services and the TV band, and the duplex gap is between wireless downlink services and wireless uplink services.

⁸² *Id.* at 9593, para. 111.

⁸³ *Id.* at 9607-08, para. 139. White space devices are limited to 40 mW EIRP in these bands.

⁸⁴ *Id.* at 9593, para. 111, 9607-11, paras. 139-144.

⁸⁵ *Id.* at 9607-08, para. 139.

conducted power in these bands (for the reasons articulated above),⁸⁶ they also contend that 20 mW of power is insufficient for effective wireless microphone operations, and that the Commission should instead establish power limits of 50 mW.⁸⁷ Audio-Technica focuses on the duplex gap, arguing that 20 mW is not enough power to operate effectively in what is likely to be compromised spectrum where the noise floor will be high and there will be significant ambient noise. Audio-Technica asserts that requiring a 20 mW power level will force the complete re-design of all wireless microphone models, and recommends a 50 mW power level to allow current designs to remain in place.⁸⁸ Shure agrees with this recommendation, arguing that body attenuation reduces a wireless microphone signal by 8 to 18 dB, so that 50 mW wireless microphones can coexist with white space devices in both the guard band(s) and duplex gap. Shure maintains that wireless microphone power of 20 mW in these bands is insufficient, as this spectrum will be subject to interference from both much higher power adjacent channel wireless operations and higher power co-channel white space devices.⁸⁹

28. CTIA opposes the petitions on the grounds that permitting wireless microphone operations at power levels of 50 mW would weaken the technical rules that restricted operations to 20 mW EIRP in order to protect licensed 600 MHz systems from harmful interference. CTIA contends that wireless microphone manufacturers have provided no technical data to support their assertions that they will be forced to redesign all wireless microphone models and/or design a new wireless microphone model for operation in the 600 MHz guard bands and duplex gap. CTIA also asserts that wireless microphone manufacturers have failed to offer data in support of their assertion that wireless microphones can operate at higher power levels and still comply with the Spectrum Act, and that they are simply restating arguments already considered and rejected by the Commission.⁹⁰ In its opposition comments, however, Sennheiser supports these petitions, stating that wireless microphones have operated for decades at power levels up to 250 mW when adjacent to other services, and that 20 mW is insufficient power for wireless microphone operations to obtain an adequate carrier-to-noise ratio in these bands. It also contends that wireless microphone operations operating at 50 mW would not cause harmful interference to 600 MHz band wireless licensees, especially considering the 1 megahertz buffer separating wireless microphone operations from the 600 MHz band downlinks.⁹¹ Sennheiser asserts that the 20 mW limit was adopted without any evidence that it is necessary to protect wireless handsets.⁹²

29. *Discussion.* We deny the requests to increase the 20 mW EIRP power level of wireless microphones that will operate in the 600 MHz guard band and duplex gap. The Commission chose this power level to avoid interference to licensed wireless services in the adjacent bands based on a detailed technical analysis described in the *TV Bands Part 15 R&O*.⁹³ No party provided an analysis demonstrating that the maximum power could be increased without causing harmful interference to licensed wireless services. The fact that some wireless microphones can operate at higher power levels (50 mW or 250 mW) adjacent to occupied TV channels or services in other bands does not, by itself, demonstrate that wireless microphones can operate at the same power level next to wireless services that will be adjacent to the 600 MHz guard band and duplex gap without causing harmful interference. We

⁸⁶ Audio-Technica Consolidated Petition at 6-7 (measuring power limits in term of conducted power should be permitted in “all bands”); Shure Part 15 Petition at 11 (either conducted or EIRP power measurements should be permitted for Part 15 wireless microphones).

⁸⁷ Audio-Technica Consolidated Petition at 7-8; Shure Part 15 Petition at 8-9.

⁸⁸ Audio-Technica Consolidated Petition at 7-8.

⁸⁹ Shure Part 15 Petition at 8-9.

⁹⁰ CTIA Consolidated Opposition at 6-7.

⁹¹ Sennheiser Consolidated Opposition at 5; Sennheiser Consolidated Reply at 5.

⁹² Sennheiser Consolidated Reply at 5.

⁹³ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9607-11, paras. 139-144.

recognize Shure's arguments about the significant attenuation of signals from hand-held and body-worn wireless microphones.⁹⁴ However, it previously made these arguments in this proceeding and the Commission included the attenuation factors recommended by Shure in our analysis in the *TV Bands Part 15 R&O*.⁹⁵ That analysis also took into consideration the one megahertz frequency separation between wireless microphones and wireless services that Sennheiser raised in its petition.⁹⁶

30. As the Commission previously noted, many existing wireless microphones operate at power levels of 20 mW EIRP or less, and we believe that this level will therefore be useful in the 600 MHz guard band and duplex gap.⁹⁷ Our equipment authorization records indicate that a number of wireless microphones have been approved for operation in the TV bands at this power level. Further, we note that operating in the 600 MHz guard band and duplex gap is only one of several options for wireless microphone users. Users that may need more power for their various applications can use available spectrum in the TV bands where a maximum of 50 mW and 250 mW are permitted on an unlicensed and licensed basis, respectively. Consistent with our actions discussed above for licensed wireless microphones in the VHF band and for unlicensed wireless microphones in the UHF and VHF TV bands, we will allow manufacturers of licensed and unlicensed wireless microphones that operate in the 600 MHz guard band and duplex gap the option to demonstrate compliance with the 20 mW EIRP power limit through either conducted power or radiated measurements.

c. Unlicensed Wireless Microphones and the Part 15 Antenna Connector Rules

31. *Background.* In the *TV Bands Part 15 R&O*, the Commission codified the rules for unlicensed wireless microphone operations in the TV bands under Section 15.236 of our Part 15 rules,⁹⁸ and provided for a transition period after which these unlicensed users may only use Part 15-certified wireless microphones.⁹⁹ Prior to the end of the 39-month post-auction transition period, unlicensed wireless microphone users are allowed to continue to operate wireless microphones that have been certified as LPAS devices under Part 74, pursuant to the waiver granted unlicensed users in the 2010 *TV Bands Wireless Microphones R&O and Further NPRM*, so long as the unlicensed users comply with other operational requirements that apply to unlicensed wireless microphone use.¹⁰⁰

32. In codifying the rules for unlicensed wireless microphones under the Part 15 rules in the *TV Bands Part 15 R&O*, there was no discussion with respect to the general restrictions set forth in other Part 15 rules that pertain to antenna connectors and antenna types, including those specified in Sections

⁹⁴ Shure Part 15 Petition at 9.

⁹⁵ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9608, 9610, paras. 141, 143.

⁹⁶ *Id.* at 9607-08, paras. 139-140.

⁹⁷ *See id.* at 9607, para. 139.

⁹⁸ *Id.* at 9665, para. 281; 47 CFR § 15.236.

⁹⁹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9665, para. 281.

¹⁰⁰ *Id.*; *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*, WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24, Report and Order and Further Notice of Proposed Rulemaking, 25 FCC Rcd 643, 682-87, paras. 81-90 (2010) (*TV Bands Wireless Microphone R&O and Further NPRM*) (establishing a waiver to permit unlicensed wireless microphone operations in the TV bands). The 2010 waiver required that unlicensed wireless microphone users operate the devices consistent with the rules ultimately adopted for unlicensed wireless microphone operations under Part 15 rules in the broadcast television bands. *Id.* at 682, para. 81. These rules, in turn, ultimately were adopted in 2015 in the *TV Bands Part 15 R&O*. *See TV Bands Part 15 R&O*, 30 FCC Rcd at 9666, para. 285.

15.203 and 15.204. In particular, Section 15.203 provides that an intentional radiator be designed to ensure that no antenna other than that furnished shall be used with the device. The use of a permanently attached antenna or an antenna with a unique connector will comply with these requirements, while the use of a standard antenna jack or electrical connector is prohibited.¹⁰¹ Section 15.204(c) provides that an intentional radiator may be operated only with the antennas with which it is authorized, and that an intentional radiator may be authorized with multiple antenna types (including those with different antenna gain).¹⁰² Because these rules are generally applicable to Part 15 intentional radiators, they apply to unlicensed wireless microphones operating under Section 15.236 absent an exclusion in the rules.

33. *Petitions for reconsideration/clarification.* Audio-Technica, Sennheiser, and Shure request that the Commission clarify that the general restrictions on the use of standard antenna connectors with Part 15 devices do not apply to wireless microphones that are authorized to operate on an unlicensed basis under Section 15.236 of the Part 15 rules.¹⁰³ They note that licensed wireless microphones in the TV bands operating under Part 74 have long made use of standard antenna connectors for various types of operations, and that these same types of operations, if on an unlicensed basis under Part 15, would be unnecessarily prohibited if Section 15.203 of the Commission's rules, or related requirements under Section 15.204, were deemed applicable.¹⁰⁴ Audio-Technica and Sennheiser point out that when first authorizing unlicensed wireless microphone operations in the TV bands in 2010, the Commission effectively waived the Part 15 antenna connector restrictions in permitting use of wireless microphones certified under Part 74 rules, which have no such restrictions, and that in proposing to codify unlicensed operations under the Part 15 rules the Commission gave no indication that the Part 15 restrictions relating to antenna connectors would be applied to wireless microphones that operated on an unlicensed basis.¹⁰⁵

34. Each petitioner notes particular wireless microphone operations in the TV bands that make use of antenna connectors of various types, and that wireless microphones are functionally unique when compared to general Part 15 consumer products.¹⁰⁶ Audio-Technica asserts that antenna combiners in multi-channel setups, use of omnidirectional or unidirectional antennas, and readily available replacements are necessary in order to accomplish satisfactory wireless microphone performance depending on the particular situation.¹⁰⁷ Shure states that the distinct performance requirements and use models for these devices, which include common use of antenna connectors, means that the Commission should regulate unlicensed wireless microphones in the same manner as Part 74 LPAS devices. Shure also expresses specific concerns regarding in-ear monitor devices, which differ from handheld or bodypack wireless microphones. In the case of in-ear monitors, Shure states that external transmitters are used to increase the spectrum efficiency over that of standalone systems. It notes that in venues where several co-located in-ear monitor transmitters are used, intermodulation distortion can be created if multiple transmitters are operated together in the same rack with individual antennas, that external

¹⁰¹ 47 CFR § 15.203.

¹⁰² 47 CFR § 15.204(c). If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator. *Id.*

¹⁰³ Audio-Technica Consolidated Petition at 8-10; Sennheiser Consolidated Petition at 9-10; Shure Part 15 Petition at 3-7. Each petitioner styles its filing as a "reconsideration" but specifically requests "clarification" regarding this issue. For example, Shure "requests reconsideration as appropriate, or in the alternative, clarification that limitations on the use of standard antenna jacks and electrical connectors ('connectors') applied to transmitters regulated under Part 15 rules have not been inadvertently extended to unlicensed wireless microphones operating in the TV bands." Shure Part 15 Petition at 3.

¹⁰⁴ Audio-Technica Consolidated Petition at 8-10; Sennheiser Consolidated Petition at 9-10; Shure Part 15 Petition at 3-7.

¹⁰⁵ Audio-Technica Consolidated Petition at 8-9; Sennheiser Consolidated Petition at 9.

¹⁰⁶ Audio-Technica Consolidated Petition at 9; Sennheiser Consolidated Petition at 9-10.

¹⁰⁷ Audio-Technica Consolidated Petition at 9-10.

transmitter combiners are used to combine the transmitter signals with far-reduced levels of intermodulation distortion to make more efficient use of the spectrum, and that typical signal combiners are operated with coaxial cable inputs from transmitter systems.¹⁰⁸ Thus, petitioners contend that restricting the use of antenna connectors in accord with Part 15 rules would cause an unnecessary burden on wireless microphone manufacturers and unlicensed wireless microphone operations without providing human safety benefits or meaningful spectral efficiency gains, and that specifying different technical rules for unlicensed wireless microphone operations under Part 15 that differ from licensed operations under Part 74 is inconsistent with the Commission's policy of harmonizing those rules to the extent possible.¹⁰⁹ Petitioners also contend that exempting unlicensed wireless microphone operations from the Part 15 restrictions on standard antenna connectors would raise no concerns about potential harmful interference to other operations since wireless microphones have operated in these bands for years under Part 74 without causing such interference.¹¹⁰ We received no comments on these petitioners' requests on this issue.

35. In subsequent submissions, Shure provides additional explanation for its request for exemption from Sections 15.203 and 15.204(c) requirements, discussing its different concerns based on the particular use scenarios for wireless microphone operations (e.g., handheld wireless microphones, in-ear monitors). Shure asserts that the Section 15.203 prohibition on standard antenna jacks and connectors would be problematic because they perform important circuit design (e.g., antenna impedance matching) and product application functions. Focusing on handheld and bodypack wireless microphones, Shure states that these wireless microphones are practically restricted from utilizing high-gain antennas and need to operate with as little power as possible to maximize battery life and minimize intermodulation distortion between transmitters in multi-channel setups to allow for maximum frequency reuse. It further states that handheld and bodypack wireless microphone constraints, user mobility, and battery life requirements preclude the addition of external amplifiers that could otherwise inadvertently expose users or third parties to levels of energy exceeding the safe limits for human exposure, or could create interference to other services.¹¹¹ With regard to its request for exclusion from Section 15.204(c) requirements, Shure focuses on in-ear monitor applications. It argues that applying Section 15.204(c) to in-ear monitors, which typically involve the use of directional antennas with the transmitters, would require that all combinations of the in-ear monitor transmitter, antenna combiners, coaxial cables, and transmitting antennas be tested, approved and certified at one time, resulting in dozens of configurations.¹¹² Shure believes that, based on years of incident-free operation by both licensed and unlicensed operators, specific instructions in user manuals and other technical documentation regarding

¹⁰⁸ Shure Part 15 Petition at 5.

¹⁰⁹ *Id.* at 3-6.

¹¹⁰ Audio-Technica Consolidated Petition at 9-10.

¹¹¹ Letter from Catherine Wang, Counsel to Shure, Inc., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165, GN Docket No. 14-166, and GN Docket No. 12-268, at 2 (filed Oct. 4, 2016) (Shure Oct. 4, 2016 *Ex Parte*). *See also* Letter from Catherine Wang, Counsel for Shure, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165, GN Docket No. 14-166, and GN Docket No. 12-268 (June 29, 2016) (Shure Consolidated June 29, 2016 *Ex Parte*).

¹¹² Shure Oct. 4, 2016 *Ex Parte* at 4. Shure states that application of Sections 15.203 and 15.204 to unlicensed wireless microphones is problematic in light of increasing interference to wireless microphones from LED video walls at many venues, particularly to in-ear monitoring systems. It states that to combat this interference, users locate an in-ear monitor transmitting antenna as close to a performer as possible. Because the in-ear monitor transmitter is typically located offstage, the transmitting antenna is connected with a long run of coaxial cable, which may typically be 50-200 feet with a signal loss of approximately 6-15 dB at 600 MHz. Shure states that to make up for the 6-15 dB loss of signal and simultaneously direct the ear-monitor signal at the performer, directional antennas are typically used with an ear-monitor transmitter.

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proper combinations of antennas, combiners, and cables will ensure compliance with the Part 15 rules.¹¹³ In sum, Shure argues that unlicensed wireless microphones should be exempted from Sections 15.203 and 15.204(c) to permit wireless microphones, including in-ear monitor systems, to utilize the same hardware, whether certified under Part 74 or Part 15 of the rules.¹¹⁴

36. *Discussion.* Upon consideration of these petitions, we exempt unlicensed wireless microphones operating under Section 15.236 from the antenna connector restrictions set forth in Section 15.203. We are persuaded by petitioners that certain types of wireless microphones, whether for licensed or unlicensed operations, need detachable antennas to function effectively in the field, and that imposing a unique connector requirement is not necessary to prevent harmful interference to authorized services.¹¹⁵ Requiring unique antenna connectors for wireless microphones certified under Part 15 is impractical because they have different application requirements when compared with other consumer products authorized under Part 15. For example, wireless microphones may be used with antenna combiners that combine the outputs of multiple wireless microphones for transmission through a single antenna. Users also may need the ability to quickly swap an antenna for a different type (e.g., omnidirectional or unidirectional), and have readily available replacements when necessary (e.g., for a broken antenna). Such applications, which require the use of detachable antennas and may be critical for operating wireless microphones, could be inhibited if each make or model of wireless microphone used different connectors. We believe that exempting Part 15 wireless microphones from the requirements of Section 15.203 is not likely to result in harmful interference since wireless microphones with standard antenna connectors have been approved for use for many years under Part 74 of the rules, and the Commission has permitted unlicensed use of such equipment since 2010 with no demonstrated cases of abuse (e.g., adding high-gain antennas or external amplifiers) resulting in harmful interference to other services.¹¹⁶

37. Because the licensed and unlicensed wireless microphones that operate in the TV bands generally are the same devices (though higher power is permitted in the UHF band for licensed wireless microphones), we expect that many unlicensed wireless microphones will also be certified under Part 74, which does not require permanently attached antennas or unique antenna connectors. Also, many of the same types of entities that operate wireless microphones on a licensed basis under Part 74 (e.g., theater groups, musical productions) will operate wireless microphones on an unlicensed basis under Part 15, either because they do not meet the threshold for Part 74 licensing eligibility, or because certain frequency bands (the 600 MHz guard band and a portion of the duplex gap) are available only for unlicensed use. In addition, as Shure notes, wireless microphone manufacturers have an incentive to produce small equipment with small antennas and low power consumption to satisfy the requirements of users, and users have no incentive to install larger, higher-gain antennas or to use high-gain amplifiers that increase power consumption.¹¹⁷ For the reasons stated above, we find that we should exempt unlicensed wireless microphones from the requirement in Section 15.203 that the device must incorporate a permanently attached antenna or a unique antenna connector. By doing so, we can harmonize the Part 15 and 74 rules in this respect, which will foster efficiency in the design and manufacture of wireless microphones.

38. We are not exempting unlicensed wireless microphones from the requirements of Section 15.204 because these requirements are necessary to ensure that manufacturers provide information about the types of antennas and cables that may be used with a device to ensure compliance with the EIRP

¹¹³ *Id.*

¹¹⁴ Letter from Catherine Wang, Counsel to Shure, Inc., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 14-165 and 166 at 4 (filed Oct. 4, 2016) (Shure Oct. 4, 2016 *Ex Parte*).

¹¹⁵ See Audio-Technica Consolidated Petition at 9; Shure Part 15 Petition at 6-7; Shure June 29, 2016 *Ex Parte* Letter at 2.

¹¹⁶ Shure June 29, 2016 *Ex Parte* Letter at 3-4.

¹¹⁷ *Id.* at 2-3.

limits applicable to unlicensed wireless microphones (as discussed above).¹¹⁸ We acknowledge Shure's concerns about the procedures for certifying in-ear monitors since this type of equipment is often used in different configurations than other wireless microphones, involving the use of a high gain directional antenna and a long cable connecting the transmitter to a remote antenna, where the length of the connecting cable (and the associated cable loss) can differ depending on the particular use scenario (e.g., staging, set up, intermodulation issues) at each location.¹¹⁹ We find that the current equipment authorization rules and procedures, described in more detail below, are not overly burdensome and provide sufficient flexibility to address Shure's concerns with respect to the certification of in-ear monitors.

39. As a general matter, applicants for certification must test equipment for compliance in the worst case configuration as determined by the manufacturer, e.g., using the highest gain of each antenna type as required by Section 15.204(c) and, where use of a cable is involved, the lowest loss cable associated with each antenna type, to ensure that the system is operated at radiated power output levels in compliance with the rules. Operators of certified equipment must use an antenna with the same or lower gain, and a cable with the same or higher loss, than was approved with the system. We do not believe that this approach is burdensome for equipment manufacturers or users since it does not require testing of every possible antenna and cable combination, and it gives users the ability to use different antennas or cable lengths within the limits of what the equipment certification allows.

40. We recognize that, in practice, the length of the cables used for particular scenarios can differ. For instance, in cases where a cable that is significantly longer than the one with which the equipment was certified must be used, the higher cable loss could reduce the EIRP significantly below the maximum permitted by the rules. We believe that the majority of entities using in-ear monitors in the situations that Shure describes are professional users,¹²⁰ and many – if not most – of these users are eligible for Part 74 licenses because they operate at large venues that use more than 50 wireless microphones on a regular basis.¹²¹ However, we also expect that Shure and other manufacturers may seek to certify in-ear monitors under Part 15 because there are some wireless microphone users who are not eligible for a Part 74 license and may need to use in-ear monitors in varying configurations that Shure describes, and because certain frequency bands are available for unlicensed use only (e.g., the 600 MHz guard band and a portion of the duplex gap). To the extent that Part 15 certified equipment will be professionally installed, existing procedures allow the installer to configure the equipment in accordance with the manufacturer's instructions to ensure that the equipment will comply with the Part 15 rules in the configuration in which it will be used.¹²² The professional installer can thus compensate for factors such as higher cable loss to ensure that the equipment operates at up to, but no greater than, the power levels permitted by the rules.¹²³ While an applicant for certification of equipment that will be professionally

¹¹⁸ 47 CFR § 15.204(c). A device may be certified with multiple antenna types and must be tested with the highest gain antenna of each type to ensure the device complies with the limits.

¹¹⁹ Because unlicensed wireless microphone power limits are specified in terms of EIRP, the transmitter conducted power, cable loss and antenna gain must all be considered in determining compliance with the EIRP limit. EIRP is the transmitter conducted power output minus the cable loss plus the antenna gain.

¹²⁰ See Shure Part 15 Petition at 5 (the majority of cases involving distinct performance requirements and use models involve operations in “demanding professional audio environments”).

¹²¹ We also note, below, that entities that can establish that they have similar professional needs for Part 74 licenses may seek to obtain a waiver to obtain Part 74 licenses.

¹²² The instructions could address factors such as the appropriate cabling, antennas, or power adjustments necessary to ensure compliance with the rules. Guidance for software configuration of equipment is provided in KDB Publication Number 594280 D01, available at <https://www.fcc.gov/labhelp>.

¹²³ An applicant for certification of equipment that will be professionally installed must provide a justification for the use of professional installation. The grant of certification is conditioned on the use of professional installation

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installed must submit certain additional information (e.g., a justification for professional installation and a description of instructions to installers), we do not believe these requirements are overly burdensome on applicants.

d. Operations of Existing/Legacy Wireless Microphone Equipment after the End of the Transition Period

41. *Background.* In both the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, the Commission established a cutoff date for the certification, manufacture, and marketing of both licensed and unlicensed wireless microphones that do not comply with revised Part 74 rules (for licensed operations) and new Part 15 rules (for unlicensed operations).¹²⁴ In particular, it provided that wireless microphone manufacturers could no longer submit applications for certification of wireless microphone devices that did not comply with the new rules – which include new bands of operations (i.e., reconfigured TV bands and the 600 MHz guard band and duplex gap, but not the 600 MHz service band) at specified power levels – beginning nine months after the release of the *Channel Reassignment PN* (which was released on April 13, 2017, and identifies the frequencies for the TV bands, 600 MHz guard band and duplex gap, and 600 MHz service band).¹²⁵ It also required that manufacture and marketing of any licensed or unlicensed wireless microphones that operate in the repurposed 600 MHz service band must cease no later than 18 months after release of the *Channel Reassignment PN*. Further, it established transition rules that require that licensed and unlicensed wireless microphone operations in the 600 MHz service band cease no later than the end of the post-auction transition period, i.e., 39 months after the issuance of the *Channel Reassignment PN* (or cease earlier where 600 MHz service band licensees have commenced operations).¹²⁶ Through these provisions, the Commission sought to ensure an orderly transition to gradually phase out older microphones and introduce new ones that are compliant with the new technical rules for licensed and unlicensed operations.¹²⁷

42. In the *TV Bands Part 15 R&O*, the Commission also established certain specific requirements concerning the equipment operated by unlicensed wireless microphone users following the auction.¹²⁸ It permitted unlicensed users to operate wireless microphone equipment previously certified under Part 74 (under the conditions permitted under the waivers already in place for unlicensed wireless

for the equipment. The Office of Engineering and Technology's Laboratory can provide further guidance to applicants on the equipment certification procedures.

¹²⁴ See *Wireless Microphones R&O*, 30 FCC Rcd at 8764-65, paras. 58-60; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9666-69, paras. 284-288.

¹²⁵ See *Wireless Microphones R&O*, 30 FCC Rcd at 8764, para. 59; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9665, para. 281; *Closing and Channel Reassignment PN*, DA 17-314, para. 15. However, we will require that applications to certify wireless microphones that would operate in the repurposed 600 MHz service band be filed no later than 24 months after the effective date of the new rules, if that date precedes nine months after release of the *Channel Reassignment PN*. See *Wireless Microphones R&O*, 30 FCC Rcd at 8764, para. 59; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9665, para. 281.

¹²⁶ *Wireless Microphones R&O*, 30 FCC Rcd at 8764-65, para. 60; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9630-31, para. 192; 47 CFR §§ 15.236(c)(2); 74.802(f). Subsequent to issuance of the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, the Commission defined when and in what areas 600 MHz service licensees are deemed to “commence operations” for the purpose of establishing when wireless microphone users must cease operating in areas of the 600 MHz service band, and it also required that secondary and unlicensed users (including wireless microphone operations) must cease operations in areas where the 600 MHz service licensees are conducting their first field application testing. See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 300 FCC Rcd 12025 (2015) (*Commencing Operations R&O*).

¹²⁷ *Wireless Microphones R&O*, 30 FCC Rcd at 8764, para. 58; *TV Bands Part 15 R&O*, 30 FCC Rcd at 9666, para. 284.

¹²⁸ See generally *TV Bands Part 15 R&O*, 30 FCC Rcd 9551.

(continued...)

microphone operations) in the TV bands, and in the 600 MHz service band as well until operations must cease (i.e., no later than 39 months after release of the *Channel Reassignment PN*). It concluded that unlicensed users' continued use of these wireless microphones during the post-auction transition period is unlikely to cause harmful interference to licensed users.¹²⁹ It also stated that unlicensed wireless microphone users could not continue to operate wireless microphone equipment that can operate in any portion of 600 MHz service band after the specified cutoff dates, even if it could be tuned to operate outside of the 600 MHz service band.¹³⁰ It found this appropriate because of our concern that some unlicensed wireless microphone users would not be aware of the need to retune such microphones to operate on permissible frequencies, and that failure to do so could cause harmful interference to new 600 MHz wireless services.¹³¹

43. *Petition for reconsideration.* Shure filed a petition for reconsideration of the Commission's decision to prohibit unlicensed wireless microphones users from operating equipment if it is certified to operate in any part of the 600 MHz service band, even if it could be tuned to operate outside of this band. Shure contends that this rule imposes a significant burden on these users, and would compel them to discard working equipment well before the end of its useful life.¹³² Specifically, Shure requests that unlicensed wireless microphone users be allowed to continue to use this equipment to the extent that any existing labels for the particular wireless microphones provide specific frequency information, or wireless microphone manufacturers provide supplementary information to users, that will help these users identify operating frequencies available to them outside of the 600 MHz service band that would enable them to be compliant with the new rules. Shure asserts that such information can be effectively provided to end users in a number of ways, such as printed guides for distribution at retail outlets, on manufacturers' web sites, or by relabeling retuned equipment to show operating frequencies.¹³³

44. Sennheiser voices support for Shure's petition, and focuses on the financial hardship that would be imposed if wireless microphones that can operate in portions of the 600 MHz service band would have to be prematurely discarded. Sennheiser also argues that wireless microphone users have successfully avoided operations on occupied channels for many years, preventing interference to TV and land mobile services, and that there is no reason that wireless microphones cannot successfully be operated so as to avoid the incoming 600 MHz service wireless licensees.¹³⁴ In subsequent submissions, both Shure and Sennheiser indicate that some existing wireless microphone equipment that operates in the 600 MHz service band can be modified in the field by software to make these devices compliant with the new rules applicable for wireless microphone operations.¹³⁵ No party filed an opposing comment to Shure's or Sennheiser's submissions on this issue.

45. *Discussion.* We clarify the applicable rules for unlicensed wireless microphone users with regard to continued operation of Part 74-certified equipment during the post-auction transition period and after the end of this period. We also discuss procedures by which existing/legacy equipment that has

¹²⁹ *Id.* at 9666, para. 285.

¹³⁰ *Id.* at 9666, para. 286; 47 C.F.R. § 15.37(i) (transition rules applicable to unlicensed wireless microphones). We noted that this approach would allow use of the FCC identification (ID) number to identify the wireless microphones that could be operated. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9666, para. 2283 & n.694. In the *Wireless Microphones R&O*, the Commission did not establish a similar obligation for licensed users that operate wireless microphones in the TV bands under Part 74.

¹³¹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9667-68, para. 288.

¹³² Shure Part 15 Petition at 12.

¹³³ *Id.* at 13.

¹³⁴ Sennheiser Consolidated Opposition at 6-7.

¹³⁵ Shure Consolidated *Ex Parte* filed May 12, 2016 at 1-2 (discussing "infield" modifications to the wireless microphone equipment); Sennheiser Consolidated *Ex Parte* filed May 18, 2016 at 1.

been certified under Part 74, such as that which has been designed to operate in portions of the 600 MHz service band, can be modified in the field by the manufacturers for use under the new Part 15 rules, and the conditions under which unlicensed wireless microphone users may continue to use any existing/legacy Part 74-certified equipment.

46. First, we clarify that, under the waiver in place at the time we adopted the *TV Bands Part 15 R&O*, unlicensed wireless microphone users can continue to operate equipment that had been certified under Part 74, including equipment that can operate in portions of what becomes the 600 MHz service band following the auction, until the end of the 39-month post auction transition (provided other conditions for operation are met).¹³⁶ After this transition period, however, unlicensed wireless microphone users are only authorized to operate wireless microphone equipment that has been certified under our Part 15 rules, either as new equipment or as existing/legacy Part 74-certified equipment that now complies with the Part 15 rules (and thus would not be capable of operating in the 600 MHz service band, and instead would be designed to comply with the applicable technical rules, including authorized output power levels, for unlicensed operations in the TV bands or in the 600 MHz guard band and duplex gap). We conclude that this approach will achieve an orderly transition following the auction that balances the needs of current unlicensed wireless microphone users, who otherwise could incur unduly burdensome costs in discarding equipment that can effectively be modified to comply with the applicable Part 15 requirements, and the needs of the future 600 MHz service band licensees that will be providing wireless service in the coming years. We note that, during the 39-month post-auction transition period, unlicensed wireless microphone users must check the white spaces databases, prior to operating in the 600 MHz service band, to identify the channels available for use at their particular locations, which is a requirement designed to protect any 600 MHz service licensee that commences operations or conducts first field application (FFA) testing during this period.¹³⁷

47. We also revise our requirements concerning the use by unlicensed wireless microphone users of existing/legacy equipment that was originally certified under Part 74 and designed to operate on frequencies that include frequencies in the 600 MHz service band. Specifically, to the extent that such equipment can be, and is, effectively modified (e.g., through software changes) and certified as compliant with the new Part 15 rules, we will permit unlicensed wireless microphone users to continue to use the modified equipment, which will only operate on frequencies permitted for their use, after the end of the post-auction transition period. We agree with Shure and Sennheiser that unlicensed wireless microphone users should not have to have to discard existing or legacy equipment simply because it originally had been designed to operate, at least in part, on frequencies that become repurposed for the 600 MHz wireless services following the auction. As discussed above, these manufacturers have represented that many wireless microphone models, which have been certified under Part 74, have the capability to be modified in the field to change the frequency range of operations to match the reconfigured band plan determined in the incentive auction (with respect to the TV bands, the 600 MHz guard band and duplex gap, and the 600 MHz service band) and comply with the applicable technical rules for wireless microphone operations under the revised Part 74 and/or new Part 15 rules.¹³⁸ Accordingly, we will allow manufacturers to modify this existing Part 74-certified wireless microphone equipment so that the equipment is no longer capable of operating in the 600 MHz service band and can be certified under the Part 15 rules (for operation in the TV bands and the 600 MHz guard band and duplex gap under prescribed rules, including compliance with the applicable output power limits and ETSI emission

¹³⁶ See *TV Bands Part 15 R&O*, 30 FCC Rcd at 9666, para. 285. We will revise section 15.37 to clarify this requirement.

¹³⁷ *Id.* at 9630-31, para. 192, 9659, para. 263; see *Commencing Operations R&O*, 30 FCC Rcd at 12028-35, paras. 7-20 (secondary and unlicensed users must cease operations in areas where the 600 MHz service licensee commences operations or conducts first field application testing).

¹³⁸ Shure Consolidated *Ex Parte* filed May 12, 2016 at 1-2; Sennheiser Consolidated *Ex Parte* filed May 18, 2016 at 1.

mask).¹³⁹ If, for instance, these modifications can be accomplished through software changes to devices that remain in the field (e.g., through downloaded software changes), then we will permit manufacturers to obtain approval through the permissive change process, and indicate under the existing FCC ID number for that device that, with the modification, the device would be Part 15 compliant.¹⁴⁰ Similarly, for any existing/legacy Part 74-certified equipment that originally was designed to operate only in parts of the current TV bands that remain available for unlicensed wireless microphone operations but would not otherwise be compliant with the new Part 15 rules, we allow wireless microphone manufacturers to modify such equipment to make necessary changes (e.g., modifications to comply with the specified lower output power limits in the guard bands and duplex gap) so that it can comply with the Part 15 rules for such use. To the extent that no equipment modification or hardware changes are necessary (e.g., the existing/legacy equipment operates only on reconfigured TV band spectrum) and the equipment meets the other technical requirements for Part 15 operations (e.g., maximum output power levels and ETSI emission mask), then the manufacturer can file the necessary application for permissive change to establish this, and the record associated with the FCC ID number for this previously certified Part 74 device can be updated to reflect that the device is compliant with the Part 15 rules.¹⁴¹ After the end of the post-auction transition period unlicensed wireless microphone users will be permitted to operate existing/legacy wireless microphone equipment provided that the necessary steps have been taken so that it has been certified as compliant with the applicable Part 15 rules.¹⁴²

48. If, however, the existing equipment that operates in the 600 MHz service band cannot be modified to comply with the Part 15 rules, the unlicensed wireless microphone users will continue to be prohibited from operating that device after the end of the 39-month post-auction transition period. This

¹³⁹ If the necessary changes require any hardware changes to the device, then the manufacturer can make those changes to the equipment, and we would issue a new FCC ID number certifying the device as compliant with the new Part 15 rules for unlicensed wireless microphones.

¹⁴⁰ The permissive change process is set forth under our rules in Section 2.1043 regarding changes in certificated equipment. 47 C.F.R. § 2.1043. This section defines three classes of changes that may be made to a certified device without obtaining a new grant of equipment certification and labeling the equipment with a new FCC ID. *Id.* The OET Laboratory guidance KDB Publication 178919 (available at www.fcc.gov/labhelp) provides the types of changes which are permitted to equipment that previously has been approved. If a manufacturer proposes to use a procedure not included in the current Commission guidance, a pre-approval guidance for the change procedure can only be obtained following an inquiry. The grant of authorization for the modified device will specify under which rule parts the device has been authorized to operate.

¹⁴¹ Wireless microphone manufacturers are invited to make inquiries to the OET Laboratory for guidance on any questions that arise on this process. Inquiries can be made online through the portal at www.fcc.gov/labhelp.

¹⁴² We note, of course, that wireless microphone manufacturers similarly are allowed to modify existing/legacy Part-74 compliant devices to make any necessary changes (e.g., eliminating the capability of operating in the 600 MHz service band; meeting the output power limits in the licensed portion of the duplex gap), so that they can establish that particular legacy equipment can be made compliant with the revised Part 74 rules. As with unlicensed microphones (discussed above), if these modifications can be accomplished through software changes to devices that remain in the field (e.g., through downloaded software changes), then we will permit manufacturers to obtain approval through the permissive change process, and indicate under the existing FCC ID number for that device that, with the permissible modification, the device would be Part 74 compliant. To the extent that no equipment modification or hardware changes are necessary, and the equipment meets the other technical requirements for Part 74 operations (e.g., maximum output power levels and ETSI emission mask), then the manufacturer can file the necessary application for permissive change to establish this, and the record associated with the FCC ID number for this previously certified Part 74 device can be updated to reflect that the device is compliant with the revised Part 74 rules. And, as with unlicensed wireless microphones discussed above, to the extent that hardware changes are necessary for existing/legacy Part 74-certified equipment to be compliant with the revised Part 74 requirements, we would issue a new FCC ID number certifying the device as compliant with the revised Part 74 rules for licensed wireless microphones. Finally, we note that wireless microphone manufacturers may be able to establish that particular equipment complies with the requirements of both Part 74 and Part 15 rules, and can be so certified.

(continued....)

requirement is consistent with our general Part 15 requirement that unlicensed equipment must be constructed such that controls readily accessible to the user cannot cause the equipment to operate in violation of the technical rules.¹⁴³ While we agree with Shure that providing additional frequency labeling or other supplementary material may be beneficial in helping unlicensed wireless microphone users select appropriate operating frequencies, such as operations on available 600 MHz frequencies during the post-auction transition period, we disagree that those steps alone are a sufficient alternative to the requirements that we have discussed above. We find that, after the end of the post-auction transition period, requiring unlicensed wireless microphone users to operate equipment that has been certified as compliant with the Part 15 rules (e.g., equipment that necessitated modification with respect to elimination of operations in the 600 MHz service band, or equipment that meets the output power limits of 20 mW EIRP if operating in the guard band or unlicensed portion of the duplex gap) is an appropriate and balanced approach that achieves our goal of ensuring that unlicensed wireless microphone operations in the future will not cause harmful interference to new 600 MHz wireless services or to broadcast licensees operating in the TV bands.¹⁴⁴

49. Wireless microphone manufacturers will have a critical role to play with respect to ensuring that unlicensed users can determine whether they can continue to use existing/legacy devices after the end of the post-auction transition period.¹⁴⁵ Wireless microphone manufacturers have the requisite knowledge about their respective companies' wireless microphone devices. To meet their obligations, unlicensed users seeking to operate existing/legacy equipment will need to know whether their particular devices can be, and ultimately are, certified as Part 15 compliant. Accordingly, we expect that all wireless microphone manufacturers make the necessary information available about their existing/legacy models so that users can determine what is required of them in order to meet their respective obligations.¹⁴⁶ This information should include information on their companies' particular devices, including (1) which devices will need to be modified, through hardware and/or software changes, to comply with Part 15 requirements in order to be certified as Part 15-compliant, and the process by which the manufacturers and the unlicensed users will achieve this; (2) which devices will not need to be modified to comply, but will be certified as compliant with the Part 15 rules during the transition period; and (3) which devices will not comply, and cannot be certified as compliant with Part 15 requirements (and accordingly cannot be used after the end of the post-auction transition period). Providing this information can be achieved in different ways, such as posting the necessary information on websites, ensuring that customer helplines can help inform users, or contacting known customers directly, depending on the situation.

50. Unlicensed wireless microphone users with existing/legacy Part 74-certified equipment also must do their part by examining their various devices and taking any necessary actions to ensure that, after the end of the post-auction transition, they only operate such microphones that comply with Part 15 requirements. They should be in contact with the manufacturer(s) of their wireless microphones to obtain

¹⁴³ 47 C.F.R. § 15.15(b).

¹⁴⁴ In keeping with this requirement, Part 74 licensees seeking to operate wireless microphones in the 600 MHz guard band or in the duplex gap after the end of the post-auction transition period may only operate equipment that has been certified as compliant with the Part 15 rules for operations in guard bands and unlicensed portion of the duplex gap, and compliant with the new Part 74 requirements for operations in the licensed portion of the duplex gap.

¹⁴⁵ We anticipate that in many cases the unlicensed wireless microphone user may not have the information, knowledge, or ability to determine whether their existing/legacy devices comply with the Part 15 rules following the incentive auction.

¹⁴⁶ This consumer outreach is consistent with, and will supplement, the consumer outreach discussed in the *Wireless Microphones R&O* regarding expectations that wireless microphone manufacturers make significant efforts to inform wireless microphone users of the need to clear the 600 MHz service band of wireless microphone operations by no later than the end of the post-auction transition period. See *Wireless Microphones R&O*, 30 FCC Rcd 8762, paras. 51-53.

information on their particular devices, the extent to which they can be made to comply with the Part 15 requirements, and the steps they should take to modify any devices to bring them into compliance. Unlicensed wireless microphone users must ensure that any existing/legacy device that they plan to use complies with the Part 15 requirements and has been so certified (either because it has been modified, where necessary, or otherwise has been certified as compliant with the Part 15 requirements with respect to the particular frequencies on which it operates), and that they cease operating any other wireless microphone devices that do not comply with the Part 15 requirements. We note that, as wireless microphone manufacturers develop new devices that comply with the Part 15 rules for operations in the TV bands, the 600 MHz guard band, and the duplex gap, unlicensed wireless microphone users who need to replace particular existing/legacy wireless microphones will be able to obtain new Part 15-compliant microphones before the end of the 39-month post-auction transition period to access the spectrum available for such operations.

51. Finally, we remind manufacturers, and entities that sell, lease, or offer for sale or lease wireless microphones, that marketing of any unlicensed or licensed wireless microphones that do not comply with the Part 15 or revised Part 74 rules (respectively) must cease no later than 18 months after release of the *Channel Reassignment PN* (i.e., October 13, 2018).¹⁴⁷ Thus, to the extent that existing/legacy wireless microphones that were originally designed to operate on any frequencies that will no longer be available for use (e.g., devices that are capable of operating on portions of the 600 MHz service band) as a result of the incentive auction, such devices cannot be sold or leased unless the device subsequently has been modified to comply with the new Part 15 and/or the revised Part 74 requirements for wireless microphone operations. We direct the Consumer and Governmental Affairs Bureau (CGB), working with the Office of Engineering and Technology (OET) and the Wireless Telecommunications Bureau (WTB), to include discussion of these issues associated with the use of existing and legacy wireless microphones as part of its overall consumer outreach efforts pertaining to the transition of unlicensed and licensed wireless microphone operations that will follow the incentive auction and reconfiguration of the existing TV bands.¹⁴⁸

e. Reservation of TV Channels for Certain Unlicensed Wireless Microphone Operations

52. *Background.* Under our rules, licensed wireless microphone users operating in the TV bands (and the 600 MHz service band during the post-auction transition period) are permitted to register their operations on available channels at specified locations and times, in the white spaces databases in order to protect their operations from potential interference from unlicensed white space devices.¹⁴⁹ In codifying rules for unlicensed wireless microphone operations under Part 15 in the *TV Bands Part 15 R&O*, the Commission eliminated the rule adopted in 2010¹⁵⁰ that had permitted certain qualifying unlicensed wireless microphone users also to register their operations for such protection.¹⁵¹ It determined that their unlicensed operations should be subject to the same general conditions as apply to unlicensed white space devices (i.e., they may not cause interference to authorized services and must

¹⁴⁷ See discussion in paragraph [41], above.

¹⁴⁸ See *Wireless Microphones R&O*, 30 FCC Rcd at 8762, paras. 51-53.

¹⁴⁹ 47 CFR § 15.713(h)(8). The Commission affords these licensees protection from interference just as it affords other licensed users in the TV bands protection from interference from unlicensed white space devices. 47 CFR §§ 15.713(a)(1), 15.713(b).

¹⁵⁰ See *Unlicensed Operation in the TV Broadcast Bands and Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz band*, ET Docket Nos. 04-186 and 02-380, Second Memorandum Opinion and Order, 25 FCC Rcd 18661, 18674-75, paras. 31-32 (2010) (*TV Bands White Spaces Second MO&O*); 47 CFR § 15.713(h)(9).

¹⁵¹ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9660, para. 266 (eliminating 47 CFR § 15.713(h)(9)).

accept any interference from other unlicensed devices) as it sought to balance the interests between the licensed and unlicensed entities' access to the spectrum in the reconfigured TV bands.¹⁵²

53. In the *TV Bands Part 15 R&O*, the Commission noted that, in permitting registration of unlicensed wireless microphone operations in the TV bands in 2010, the Commission had made clear in the *TV Bands White Spaces Second MO&O* that such registration would be limited to venues or productions that needed large numbers of microphones that could not be sufficiently accommodated when making use of the vacant TV channels that were not available for white space device use (i.e., the two TV channels "reserved" for wireless microphone operations near Channel 37, plus any other vacant TV channels that could not be used by white space devices).¹⁵³ The Commission further observed that in the 2014 *TV Bands Wireless Microphones Second R&O* the Commission had expanded eligibility for Part 74 wireless licenses to include professional sound companies and owners and operators of large venues that routinely use 50 or more wireless microphones where the use of such devices is an integral part of major events or productions, and that this decision would enable many of the unlicensed wireless microphone users that had qualified to register for protection in the white spaces database now to register their operations as Part 74 licensees.¹⁵⁴ The Commission also noted that unlicensed wireless microphone users would likely be able to access some portions of 600 MHz guard band spectrum that would be interference-free from white space device operations and thus exclusively available for wireless microphone operations.¹⁵⁵

54. *Petition for reconsideration.* Shure requests reconsideration of the Commission's decision to no longer permit certain unlicensed wireless microphone users to register operations on available TV channels to obtain interference protection from white space devices, which protect such operations in the TV bands as well as in the 600 MHz service band during the post-action transition period. In particular, Shure recommends that we reinstate a reservation system for certain unlicensed wireless microphone users or, alternatively, provide a more limited reservation system that would make registration protection available in special circumstances requiring a high degree of reliability for a user

¹⁵² *Id.* at 9659-60, paras. 262-266 (deciding not to provide interference protection to one unlicensed user over another, and to maintain the distinction between licensed and unlicensed wireless microphone users).

¹⁵³ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9658, para. 260 & n.656. Beginning in 2010, the Commission had permitted parties operating large numbers of wireless microphones on an unlicensed basis to register their operating locations in the white space database under certain circumstances. See *TV Bands White Spaces Second MO&O*, 25 FCC Rcd at 18674-75, paras. 31-32; 47 CFR § 15.713(h)(9). In particular, unlicensed users would have to establish that they qualified for registration by first filing requests with the Commission and obtaining approval to register. *TV Bands White Spaces Second MO&O*, 25 FCC Rcd at 18674-75, paras. 31-33. Registration was limited to venues of events, productions, and shows that used large numbers of microphones that could not otherwise be accommodated on the two TV channels then "reserved" for wireless microphone operations and on the other TV channels that were not available for white space device use at a specified venue. See *Office of Engineering and Technology and Wireless Telecommunications Bureau Announce the Initial Launch of Unlicensed Wireless Microphone Registration System*, ET Docket No. 04-186, Public Notice, DA 12-1514, 27 FCC Rcd 11163, 11164 (OET/WTB 2012); *Office of Engineering and Technology and Wireless Telecommunications Bureau Announce Nationwide Launch of Unlicensed Wireless Microphone Registration System*, ET Docket No. 04-186, Public Notice, DA 12-1957, 27 FCC Rcd 15102, 15103-04 (OET/WTB 2012).

¹⁵⁴ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9659, para. 264. See generally *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*, WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24, Second Report and Order, 29 FCC Rcd 6103 (2014) (*TV Bands Wireless Microphones Second R&O*).

¹⁵⁵ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9660, para. 267 (depending on the auction results and the final band plan, there likely will be spectrum segments in the 600 MHz guard bands that will accommodate wireless microphone use but not white space devices).

(continued....)

that does not typically use 50 or more microphones.¹⁵⁶ While Shure applauds the Commission's 2014 action in the *TV Bands Wireless Microphones Second R&O* to expand the eligibility for licensed wireless operations to include professional sound companies and owners and operators of large venues that routinely use 50 or more wireless microphones where the use of such devices is an integral part of major events or productions,¹⁵⁷ Shure maintains that our decision in the *TV Bands Part 15 R&O* means that important professional productions in the civic, cultural, religious, corporate, education, and entertainment sectors that routinely use fewer than 50 wireless microphones are now without interference-free wireless microphone operations that they claim is warranted.¹⁵⁸ Shure also notes that, with the elimination of two "reserved" TV channels for wireless microphones following the incentive auction, along with the decision in the *TV Bands Part 15 R&O* to open up more of the TV bands to personal/portable white space devices by allowing them to operate on vacant TV channels 14-20, unlicensed wireless microphone users have access to fewer vacant TV channels that would be free from interference from white space devices.¹⁵⁹

55. Sennheiser, the Performing Arts and Theater Groups, and Key Bridge support Shure's request.¹⁶⁰ Sennheiser asserts that the 50 microphone license eligibility requirement excludes hundreds of unlicensed performing arts companies, many of which stage highly sophisticated productions.¹⁶¹ The Performing Arts and Theater Groups – a diverse group of professional non-profit theater, music, and performing arts organizations – state that they regularly present stage productions that use fewer than 50 wireless microphones in the TV bands for high-quality sound for their audiences, and contend that they should be able to register their operations in the white space databases to prevent interference and disruption to the performances.¹⁶² They also note that theaters and performance venues throughout the

¹⁵⁶ Shure Part 15 Petition at 13-15.

¹⁵⁷ *Id.* at 14. See generally *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-12, paras. 10-24.

¹⁵⁸ Shure Part 15 Petition at 14.

¹⁵⁹ *Id.* In the 2014 *Incentive Auction Report and Order*, the Commission decided to eliminate the two vacant TV channels near Channel 37 available for wireless microphone operations. See *Expanding the Economic and Innovation Opportunities of Spectrum through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567, 6701-02, paras. 309-310 (2014); *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Second Order on Reconsideration, 30 FCC Rcd 6746, 6803-05, paras. 126-128 (2015) (affirming decision to eliminate the two vacant TV channels near Channel 37 previously available for wireless microphone operations in the TV bands). In the *TV Bands Part 15 R&O*, the Commission revised the Part 15 rules to expand the vacant TV channels where personal/portable white space devices could operate to include TV channels 14-20, which previously may only have been available for wireless microphone operations. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9585-86, paras.87-90.

¹⁶⁰ Sennheiser Consolidated Opposition and Response at 7; Performing Arts and Theatre Groups Part 15 Reply at 2-3; Key Bridge Part 15 Reply at 2 (agreeing that the Commission should make some accommodation of unlicensed wireless microphone use in special circumstances). The Performing Arts and Theater Groups include – the Actor's Equity, the Alliance of Resident Theaters/New York, the Association of Performing Arts Presenters, the Broadway League, Dance/USA, the Educational Theater Association, the League of American Orchestras, OPERA America, the Performing Arts Alliance, the Recording Academy, SAG-AFTRA, and Theater Communications Group. *Id.* at 1.

¹⁶¹ Sennheiser Consolidated Opposition and Response at 7-8. Sennheiser also states that if the wireless microphones at these smaller venues are subject to harmful interference, this could affect the sound quality that is fed into assistive listening systems required by the Americans with Disabilities Act (ADA) for the hearing and visually impaired. *Id.*

¹⁶² Performing Arts and Theatre Groups Part 15 Reply at 2-3.

country have invested in assistive listening devices for those with diminished hearing.¹⁶³ WISPA, however, opposes Shure's petition to permit unlicensed wireless microphone users to reserve vacant TV channels, arguing that the Commission appropriately balanced the interests of licensed and unlicensed entities' access to spectrum in reconfigured TV bands that would have fewer vacant channels available for use.¹⁶⁴

56. *Discussion.* While we agree that professional theater, music, and performing arts organizations that operate unlicensed wireless microphones to deliver high quality sound for their audiences serve important needs, we nonetheless decline here to grant Shure's petition insofar as it requests that we to revise our new Part 15 rules to permit unlicensed wireless microphone users to register their unlicensed operations for protection from other unlicensed operations in the TV bands. We conclude that allowing these unlicensed users to obtain interference protection would be inconsistent with their unlicensed status. We instead seek to address the concerns raised in the petition through the further notice of proposed rulemaking (Further Notice) set forth in Section III below.

57. In the several actions that the Commission has taken related to the incentive auction and the reconfiguration of the TV bands, it has sought to balance different users' needs for access to spectrum. In the Commission's considerations regarding wireless microphones, it has recognized that following the incentive auction there will be fewer channels in the TV bands available for both wireless microphone and white space device operations. In expanding the eligibility for Part 74 wireless microphone licenses in 2014 to include professional sound companies and owners and operators of large venues that routinely use 50 or more wireless microphones in major events or productions, the Commission sought to address the needs of many unlicensed wireless microphone users that have similar needs to the other Part 74 wireless microphone licensees to provide high quality audio services for large scale performances and events.¹⁶⁵ And, in codifying the rules for unlicensed wireless microphone operations under Part 15 in the *TV Bands Part 15 R&O* in 2015, the Commission concluded it best, from a regulatory policy standpoint, to place all unlicensed users – whether wireless microphone or white space device users – under the same general unlicensed status vis-a-vis both unlicensed and licensed operations (i.e., unlicensed users may not cause harmful interference to authorized services and must accept any interference from other unlicensed devices). We continue to view this as the best approach for unlicensed wireless microphone users that operate under the Part 15 rules for unlicensed operations.

58. Although we are denying the petition insofar as Shure requests that the Commission permit wireless microphone users that operate on an unlicensed basis to register for interference protection, we understand that some entities that currently operate wireless microphones on an unlicensed basis may have needs identical or similar to the professional sound company/large venues that qualify for Part 74 wireless microphone licenses for operation in the TV band spectrum. As the Commission concluded when expanding the Part 74 license eligibility in 2014 for operation in the TV band, the routine use of 50 microphones is a "reasonable threshold" for identifying those entities that are more likely to require interference protection in order to ensure high-quality audio services for their productions.¹⁶⁶ No party sought reconsideration of this particular threshold established in that proceeding, and we cannot revisit that threshold absent additional notice.¹⁶⁷ We do, however, believe that some number of entities with identical or similar needs may be able to demonstrate to the Commission, on a case-by-case basis,

¹⁶³ They also note that theaters and performance venues throughout the country rely on wireless microphones as the source of high quality sound for assistive listening devices that they provide for those with diminished hearing. Performing Arts and Theatre Groups Part 15 Reply at 3-4.

¹⁶⁴ WISPA Part 15 Opposition at 4-5.

¹⁶⁵ *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-12, paras. 8-24.

¹⁶⁶ *Id.* at 6108-09, para. 16.

¹⁶⁷ That proceeding included a substantial record on different options for expanding Part 74 license eligibility that were evaluated at that time. Those options are not currently before us here.

(continued...)

that they may merit obtaining a Part 74 license for operations on vacant TV channels at particular venues at specified times, such that they should be permitted to register available TV channels for that purpose. These entities may use fewer wireless microphones but otherwise have the same needs as licensees that operate on TV channels, or the wireless microphones may be needed for major events or productions at a location with very limited spectrum availability. In the Further Notice set forth in Section III, below, we propose a path that will enable such qualifying entities to obtain a license under our Part 74 LPAS rules. Considering that the phased broadcast station transitioning to the repacked TV bands begins next year,¹⁶⁸ we intend to act quickly to issue an order addressing the proposal set forth in the Further Notice.

3. 169-172 MHz Band – Channelization Plan

59. *Background.* In the *Wireless Microphones R&O*, the Commission sought to promote more expansive use of spectrum in the 169-172 MHz band for licensed wireless microphone operations, which are authorized on a secondary basis, and to do so in a manner that does not interfere with the primary Federal operations or other secondary non-Federal services operating in the band.¹⁶⁹ Wireless microphone operations are not protected from, and must not cause harmful interference to, Federal operations or to other licensed non-Federal operations in the band, which include operations on 36 specified frequencies between 169.425 and 171.925 MHz for the purpose of transmitting hydrological or meteorological data (hydro channels), operations on nine frequencies between 170.425 MHz and 172.375 MHz for forest firefighting and conservation purposes (forest firefighting channels), and operations on frequency 170.150 MHz for public safety purposes and broadcast remote pickup stations in certain parts of the country.¹⁷⁰ Historically, wireless microphones operations have been limited to eight 54-kilohertz channels in the band (i.e., 169.445 MHz, 169.505 MHz, 170.245 MHz, 170.305 MHz, 171.045 MHz, 171.105 MHz, 171.845 MHz, and 171.905 MHz), which are available for use by a wide variety of users.¹⁷¹ In this proceeding, wireless microphone manufacturers requested that the Commission make as much of the band as possible available for wireless microphone use by allowing operations with bandwidths of up to 200 kilohertz, subject to appropriate technical or geographic limitations.¹⁷² In the *Wireless Microphones R&O*, the Commission revised the rules to permit wireless microphones to operate on four channels that have bandwidths of up to 200 kilohertz, creating channel centers for these new operations between the existing neighboring pairs of 54-kilohertz channels (i.e., 169.475, 170.275, 171.075, and 171.875 MHz) in order to prevent overlap with federal forest firefighting channels.¹⁷³ Under the applicable rules, wireless microphone license applications are subject to Government coordination.¹⁷⁴

¹⁶⁸ See *Closing and Channel Reassignment PN*, DA 17-314, para. 64 (the first phase of the broadcast transition provides that the Phase 1 testing period starts on September 14, 2018).

¹⁶⁹ *Id.* at 8768-70, paras. 70-77.

¹⁷⁰ See 47 C.F.R. §§ 90.265(a)(listing specified hydro channels); 90.265(c) (forest firefighting channels); 90.265(d) (public safety); 74.402(e)(8) (remote pickup stations). The other non-Federal operations in the band operate on 12.5 kilohertz channels. See *Wireless Microphones R&O*, 30 FCC Rcd at 8768, para. 71.

¹⁷¹ 47 C.F.R. § 90.265(b). The eight frequencies were identified by the National Telecommunications and Information Administration as suitable for non-Federal wireless microphone use. See *Allocation of Frequencies to Operate Low Power Wireless Microphones on a Secondary Non-Interference Basis in the 169-172 MHz Band*, 49 Fed. Reg. 20505, para. 1 (1984). Entities eligible to operate wireless microphones under the Part 90 rules include a variety of users, including those eligible to hold LPAS licenses under Part 74 as well as many other entities, such as state and local government entities; commercial entities in general; educational, philanthropic or ecclesiastical institutions; clergy; and hospitals, clinics, and medical associations. 47 C.F.R. §§ 90.20(a), 90.35(a). While all entities eligible for a license under Part 74 are also eligible under Part 90, the inverse is not true: many entities eligible under Part 90 are not eligible under Part 74. See *Wireless Microphones R&O*, 30 FCC Rcd at 8768, n.180.

¹⁷² See *id.* at 8769, para. 72.

¹⁷³ See *id.* at 8769-8770, paras. 75-76.

¹⁷⁴ 47 CFR § 90.265(b)(4).

60. *Petition for reconsideration.* In its petition for reconsideration, Sennheiser states that the specific center frequencies designated by the Commission for the four new 200-kilohertz wireless microphone channels, which are placed between existing neighboring pairs of 54-kilohertz channels, pose the potential for interference between operations on these channels, including interference caused by third order intermodulation (IM) products that constrain use of the band for professional wireless microphone operations.¹⁷⁵ Sennheiser further notes that the four neighboring pairs of 54-kilohertz channels also suffer from these same intermodulation effects.¹⁷⁶ It proposes that the Commission amend the rules to shift two of the neighboring 54-kilohertz channel pairs, along with two of the 200-kilohertz channels that would be between them, to different center frequencies in order to address the intermodulation issues, improve access to all of the wireless microphone frequencies in the band (both narrowband and broadband), and facilitate flexible and cost-effective wireless microphone designs.¹⁷⁷ In particular, Sennheiser proposes shifting the two 54-kilohertz channels centered at 169.445 MHz and 169.505 MHz to 169.545 MHz and 169.605 MHz, with the corresponding 200-kilohertz channel shifted to be centered at 169.575 MHz (moved from 169.475 MHz), and shifting the two 54-kilohertz channels centered at 170.245 MHz and 170.305 MHz to 169.995 MHz and 170.055 MHz, with the corresponding 200-kilohertz channel shifted to be centered at 170.025 MHz (moved from 170.275 MHz).¹⁷⁸ It notes that under these revisions the proposed channels do not overlap the federal forest fighting channels or the public safety operations at 170.150 MHz.¹⁷⁹

61. Audio-Technica, Lectrosonics, and Shure each agree that the current rules make full use of the available channels susceptible to IM products, and support revising existing center frequency assignments to enable interference-free operations that increase opportunities for wireless microphone use in the band.¹⁸⁰ Audio-Technica and Lectrosonics also support Sennheiser's specific proposal.¹⁸¹ No others commented on the proposed revisions.

62. *Discussion.* We agree with Sennheiser and other wireless microphone manufacturers that we should take steps to increase the usefulness of the 169-172 MHz band for wireless microphones by permitting wireless microphone operations under a different channel plan, one that eliminates intermodulation effects and thereby enables full use of the 54- and 200-kilohertz (narrowband and broadband) channels throughout the band. In revising our rules, we promote the goals set forth in the *Wireless Microphones R&O* to find additional ways to accommodate wireless microphone operations while protecting other licensed operations in the 169-172 MHz band, such as operations on forest fighting channels. In particular, we revise our rules as follows: we revise the center frequencies associated with two of the 200-kilohertz channels, shifting the authorization to operate on channels centered at 169.475

¹⁷⁵ Third order intermodulation products result from the combination of the fundamental frequencies of three transmitters, or the fundamental frequency of one transmitter with the second harmonic frequency of another. These products appear as spurious emissions that can cause interference if they fall on a frequency that is in use by another transmitter.

¹⁷⁶ See Sennheiser Consolidated Petition at 8.

¹⁷⁷ *Id.* at 8-9.

¹⁷⁸ *Id.* at 9 & n.25.

¹⁷⁹ *Id.* at 8.

¹⁸⁰ Audio-Technica Wireless Microphones Comments at 1 (proposal would allow use of the designated frequencies simultaneously in the same area); Lectrosonics Wireless Microphones Comments at 1 (new wideband channels are not coordinated to be intermodulation free, and proposed shift of some of the frequency pairs corrects the situation); Shure Wireless Microphones Comments at 9 (agrees that rules for 200-kilohertz channels may be susceptible to interference related to IM products, reducing their utility for professional operations and subsequent product development investments; supports further examination of alternative center frequencies to enable interference-free operations).

¹⁸¹ Audio-Technica Wireless Microphones Comments at 1; Lectrosonics Wireless Microphones Comments at 1.

MHz and 170.275 MHz to 169.575 MHz and 170.025 MHz, and we permit 54-kilohertz operations on four new channels that would correspond with these 200-kilohertz channels, specifically authorizing such wireless microphone operations on frequencies centered at 169.545 MHz, 169.605 MHz, 169.995 MHz, and 170.055 MHz.¹⁸² We do not, however, revise our rules to eliminate the current authorizations to operate 54-kilohertz wireless microphones on the channels centered at 169.445 MHz, 169.505 MHz, 170.245 MHz, and 170.305 MHz. These channels will remain available for licensees that do not choose to obtain wireless microphones designed to operate on the newly-available channels. As we noted above, the 169-172 MHz band historically has permitted operations on these channels for various entities, including: state and local government entities; commercial entities in general; educational, philanthropic or ecclesiastical institutions; clergy; and hospitals, clinics, and medical associations. The approach we are taking serves to provide additional opportunities for wireless microphone licensees that purchase new equipment that can make full and efficient use of the band, whether for professional-quality 200-kilohertz microphones or for 54-kilohertz wireless microphones, while at the same time continues to allow other licensees to operate 54-kilohertz wireless microphones on any of the current 54-kilohertz channels.

63. We note that certain of the 54-kilohertz channels under our existing rules may overlap with one of the revised 200-kilohertz channels, and that operations on some of the existing 54-kilohertz channels potentially could continue to create intermodulation effects that could limit the full use of the 169-172 MHz band for wireless microphone operations.¹⁸³ Under existing requirements, all wireless microphone applicants and licensees must cooperate in the selection and use of frequencies in order to reduce interference and make the most effective use of the authorized facilities.¹⁸⁴ And, considering that wireless microphone users will be operating devices that operate at low power and transmit only short distances, and that the other operations in the band are not likely in the same areas, we do not anticipate that interference issues are likely to arise as a practical matter. In any event, we expect that different licensees that potentially could suffer or cause interference to one another to cooperate and resolve any potential problem by mutually satisfactory arrangements.¹⁸⁵

4. 1435-1525 MHz Band – Spectrum Availability

64. *Background.* In the *Wireless Microphones R&O*, the Commission authorized limited use of the 1435-1525 MHz band for licensed wireless microphone operations on a secondary basis in the band, provided that certain conditions and safeguards designed to protect the primary Aeronautical Mobile Telemetry (AMT) services in the band are met. It observed that the Commission's experience through the Special Temporary Authority (STA) process demonstrates that, under proper conditions, wireless microphones will be able to operate in this band without interfering with AMT operations.¹⁸⁶ The Commission limited eligibility to professional users licensed under our Part 74 LPAS rules, and emphasized that it was not opening up this band either for widespread use or for itinerant uses throughout the nation. It restricted use to specific fixed locations, such as large venues where there is a need to deploy large numbers of microphones (typically 100 or more) for specified time periods and indicated that access to the band is intended for situations in which the other available spectrum resources are

¹⁸² We revise the Table of Allocations footnote US 300 to reflect these changes, and to include the four channels that will be available for 200 kilohertz wireless microphone operations.

¹⁸³ We note that, under our existing rules, applications for 169-172 MHz wireless microphone frequencies need not be accompanied by evidence of frequency coordination. 47 C.F.R. § 90.175(j)(2).

¹⁸⁴ 47 C.F.R. § 90.173(b).

¹⁸⁵ *Id.*

¹⁸⁶ *Wireless Microphones R&O*, 30 FCC Rcd at 8779-8780, para. 105, 8784, para. 116 (discussing STA process). To accommodate this limited use, a new footnote, US84, was added to the Table of Frequency Allocations to explicitly permit secondary wireless microphone use in the 1435-1525 MHz band. *Id.* See also *id.* at 8785, para. 121 (discussing the secondary allocation, and noting that licensees would bear the future costs should there be regulatory changes affect authorized operations in the band).

insufficient.¹⁸⁷ It underscored that protection of the primary service is of paramount importance, required that wireless microphone use in the 1435-1525 MHz band be coordinated with the non-governmental coordinator for assignment of flight test frequencies in the band (i.e., AFTRCC) to permit authentication and location verification before a coordinated wireless microphone begins operation, and further required that wireless microphones be tunable across the entire 1435-1525 MHz band to facilitate coordination with incumbent users. In addition, it authorized “all wireless microphones operating in a particular area” to access no more than 30 megahertz in the band, which it stated would facilitate co-existence in the band by ensuring that wireless microphones could coordinate operations around AMT operations and by promoting the development of spectrally efficient technologies (e.g., digital technologies).¹⁸⁸ The Commission again emphasized that the STA process remains available to address extraordinary situations or special events requiring access to additional spectrum in the band for wireless microphone operations.¹⁸⁹

65. *Petitions for reconsideration.* Audio-Technica, Lectrosonics, Sennheiser, and Shure filed petitions requesting that we reconsider the decision to limit wireless microphone operations in a particular area to access no more than 30 megahertz of the 90 megahertz in the 1435-1525 MHz band.¹⁹⁰ They assert that this limitation conflicts with the Commission’s stated goal of providing access to this band to accommodate large numbers of wireless microphones (e.g., 100 or more) that may be needed at fixed locations or large venues at specified times, and that the Commission should not limit access to the entire band at particular locations where needed.¹⁹¹ Petitioners contend that there was no notice, and no basis in the record, for the 30 megahertz limitation.¹⁹² They further assert that the limitation is not necessary to protect the primary AMT users in the band since interference protection will be achieved through the coordination process with AFTRCC and the use of equipment that incorporates electronic safeguards on the specified frequencies, locations, and times of operation.¹⁹³ Audio-Technica states that operating more than 100 wireless microphones on 30 megahertz is not possible using current technology, and Shure asserts that some contemporary large-scale and “super-scale” events can employ upwards of 500 wireless microphones in certain areas with high-density microphone deployments (e.g., Broadway or the Las Vegas Strip), and may even involve significantly more.¹⁹⁴ Finally, Shure recommends that we cease our current policy of accommodating wireless microphones and wireless video operations in the 1435-1525 MHz band pursuant to STAs once the certificated wireless microphone equipment (incorporating electronic safeguards) is available, asserting that the STA process is inefficient and burdensome for wireless microphone licensees and AFTRCC alike.¹⁹⁵

¹⁸⁷ *Id.* at 8784, para. 117. As the Commission noted, this limitation to situations in which other spectrum resources are not sufficient is similar to our practice of limiting the issuance of STAs for wireless microphone operations to situations in which an entity represents that the other spectrum resources available to the requesting entity are insufficient for providing the desired level of coverage for the particular scheduled event. *Id.* at 8784 n.313 (citing *id.* at 8780 n.279).

¹⁸⁸ *Id.* at 8784-85, para. 118; 47 CFR § 74.803(d).

¹⁸⁹ *Wireless Microphones R&O*, 30 FCC Rcd at 8784-85, para. 118.

¹⁹⁰ Audio-Technica Consolidated Petition at 5-6; Lectrosonics Wireless Microphones Petition at 4-5, Sennheiser Consolidated Petition at 3-6, Shure Wireless Microphones Petition at 7-10.

¹⁹¹ Audio-Technica Consolidated Petition at 5; Lectrosonics Wireless Microphones Petition at 4-5; Sennheiser Consolidated Petition at 3-4; Shure Wireless Microphones Petition at 7-8.

¹⁹² Sennheiser Consolidated Petition at 4-5; Shure Wireless Microphones Petition at 7.

¹⁹³ Audio-Technica Consolidated Petition at 5-6; Sennheiser Consolidated Petition at 6; Shure Wireless Microphones Petition at 8-9.

¹⁹⁴ Audio-Technica Consolidated Petition at 5; Shure Wireless Microphones Petition at 8.

¹⁹⁵ Shure Wireless Microphones Petition at 9-10 (requesting sunset of this policy after three years).

(continued....)

66. Aerial Video Systems (AVS), Broadcast Sports International (BSI), and CTIA oppose removing the 30-megahertz limitation on the amount of spectrum available in a given area for licensed wireless microphone operations in this band.¹⁹⁶ AVS and BSI, each of which provide high-quality audio and video production services of broadcast, cablecast, and other video delivery systems, state that they are dependent on the use of STAs in the 1435-1525 MHz band in providing video production of large scale news, sporting, and entertainment events.¹⁹⁷ While concerned about the constraints placed on licensed wireless microphone operations with the reconfiguration of the TV bands, and the potential need for wireless microphone access to spectrum in the 1435-1525 MHz band for large-scale events, they also want to ensure that sufficient spectrum access in the band is maintained for video production through the existing STA process. They contend that the 30-megahertz limitation for wireless microphones was premised in part on the concerns that the Society of Broadcast Engineers, Inc. (SBE) had earlier expressed that the STA process be preserved for video productions as well, and assert that the Commission's limitation serves to balance these competing uses.¹⁹⁸ Finally, AVS and BSI object in particular to Shure's call for ending the STA process altogether.¹⁹⁹ For its part, CTIA maintains that the 30-megahertz limit on wireless microphone operations in this band would facilitate coexistence in the band when coordinating around AMT operations, and contends that the record provides support for the limitation, which is consistent with the Commission's stated policy objectives of promoting spectral-efficient and frequency-agile wireless microphones. CTIA also points out that in the *Wireless Microphones R&O* we stated that we envision only limited wireless microphone use of the 1435-1525 MHz band and did not intend to open the band for either widespread or itinerant wireless microphone use throughout the nation. Finally, CTIA cites the STA process as providing flexibility, should 30 megahertz be insufficient, for addressing extraordinary situations or special events requiring more spectrum access.²⁰⁰

67. The Madison Square Garden Company (MSGC) and AFTRCC filed comments on the petitions.²⁰¹ MSGC, which owns and operates several professional sports franchises and venues, contends that the 30 megahertz restriction would place an unreasonable burden on the type of large, professional entertainment productions that the Commission indicated it was seeking to accommodate with access in the 1435-1525 MHz band.²⁰² MSGC states that certain events (e.g., the Radio City Christmas Spectacular), which currently depend on fully utilizing vacant TV band channels (including channels in the 600-698 MHz band), employ over 500 wireless microphones, and that having the flexibility post-auction to access up to 90 megahertz in the 1435-1525 MHz band is needed; it contends that requiring the company to request STAs for access to more than 30 megahertz would be burdensome and a costly waste of time and resources for the company, Commission staff, and AFTRCC.²⁰³ AFTRCC, in turn, states that it does not oppose the petitioners' request for increased access to the 1435-1525 MHz band, indicating that, regardless of the amount of wireless microphone spectrum requested (e.g., whether for 30, 60, or 90 megahertz), AFTRCC will have to determine whether the coordination could be successfully

¹⁹⁶ AVS Wireless Microphones Opposition at 1-11, BSI Wireless Microphones Opposition at 1-11, CTIA Consolidated Opposition at 8-9.

¹⁹⁷ AVS Wireless Microphones Opposition at 1-2, 9; BSI Wireless Microphones Opposition at 1-2, 9.

¹⁹⁸ AVS Wireless Microphones Opposition at 3-8; BSI Wireless Microphones Opposition at 2-7.

¹⁹⁹ AVS Wireless Microphones Opposition at 8-11; BSI Wireless Microphones Opposition at 8-10.

²⁰⁰ CTIA Consolidated Opposition at 8-9.

²⁰¹ MSGC Wireless Microphones Comments at 1-3; AFTRCC Wireless Microphones Comments at 1-3.

²⁰² MSGC states that it is a leading provider of live sports and entertainment, and has a portfolio that includes sports terms (e.g., the New York Knicks, the New York Rangers), entertainment productions, and venues (e.g., Madison Square Garden, Radio City Music Hall, Beacon Theater, the Chicago Theater), and hosts or presents a broad array of events. MCGC Wireless Microphones Comments at 1-2.

²⁰³ Madison Square Garden Company Wireless Microphones Comments at 1-2.

accomplished depending on the specific circumstances of the request and the AMT operations in the area during the time requested.²⁰⁴ In comments, Sennheiser asserts that the STA option to accommodate wireless microphone requests for more than 30 megahertz of spectrum in a given situation adds complexity and cost to the 1435-1525 MHz band coordination process.²⁰⁵ In reply comments, Shure responds to AVS and BSI by clarifying that it supports consolidation of wireless microphone operations in the 1435-1525 MHz band under Part 74 rules – rather than via the STA process – but that it recognizes that we may continue to authorize video transmissions on an event-by-event basis under an STA process.²⁰⁶

68. *Discussion.* On reconsideration, we affirm the decision establishing a 30 megahertz limit on the amount of spectrum available for wireless microphone operations in the 1435-1525 MHz band at a particular location. We do, however, provide clarifications regarding how this limitation applies with respect to different wireless microphone users and to particular areas of operations, which should help accommodate more wireless microphone users that operate in the same general area and have a need for access to spectrum in this band. In those few extraordinary instances in which a particular licensed wireless microphone user can demonstrate that access to more than 30 megahertz of this band for a specified event is merited, the STA process remains available for addressing those needs.

69. In the *Wireless Microphones R&O*, the Commission stated that “all wireless microphones operating in a particular area” would be limited to access to no more than 30 megahertz in the 1435-1525 MHz band.²⁰⁷ In affirming the decision to place a limit on the amount of spectrum available for wireless microphone use in a particular area, we clarify that this 30-megahertz limit will be applied to each licensed wireless microphone user seeking access to spectrum in the 1435-1525 MHz band for its own wireless microphone operations at a particular location or venue. We conclude that the 30 megahertz limitation as clarified is reasonable and consistent with the Commission’s goals associated with operations in this band. We disagree with petitioners who argue there was insufficient notice or basis in the record for adopting a 30-megahertz limitation in the first place. In the *Wireless Microphones NPRM*, the Commission proposed only limited use of the 1435-1525 MHz band for wireless microphone use, stated that it was not proposing to open the band to widespread use,²⁰⁸ and noted its overarching goal of promoting efficient use of spectrum when accommodating wireless microphone operations.²⁰⁹ In response to the notice, and as discussed in the *Wireless Microphones R&O*, some commenting parties expressed concerns that accommodation of wireless microphones in the band not limit other secondary uses of the band (i.e., video services that access the band through the STA process), or objected to the Commission making the entire 90 megahertz available for wireless microphone use.²¹⁰ While the Commission did not specifically propose a 30-megahertz limit, the Commission made clear that in addition to its proposal regarding potential limits (e.g., restricting operations to specific, fixed locations at specific times²¹¹) it would consider “alternative proposals” on “any other regulatory or technical issues relevant to consideration” of whether to authorize wireless microphone operations in the 1435-1525 MHz

²⁰⁴ AFTRCC Wireless Microphones Comments at 3.

²⁰⁵ Sennheiser Consolidated Opposition and Response at 3.

²⁰⁶ Shure Consolidated Reply at 10-11.

²⁰⁷ *Wireless Microphones R&O*, 30 FCC Rcd at 8785, para. 118; 47 CFR § 74.803(d).

²⁰⁸ *Wireless Microphones NPRM*, 29 FCC Rcd at 12391, para. 182.

²⁰⁹ See generally *id.* at 12356-59, paras.50-67 (“Promoting Technological Advances”).

²¹⁰ *Wireless Microphones R&O*, 30 FCC Rcd at 8782-83, para. 111 (citing BSI, SBE, and CTIA comments); 8783-84, para. 115 (citing CTIA *ex parte*).

²¹¹ See *Wireless Microphones NPRM*, 29 FCC Rcd at 12391, para. 182.

band.²¹² As evidenced by commenter objections to making the entire 90 megahertz in the band available for wireless microphone use, this guidance was sufficient to apprise interested parties that the Commission might consider additional limitations for wireless microphone operations (like the 30-megahertz limitation) on the amount of spectrum that a licensee could access under a given license. As such, the Commission's decision to adopt the 30-megahertz limitation was, at a minimum, a logical outgrowth of the proposals made in the *Wireless Microphones NPRM*, and thus complied with notice requirements.²¹³

70. Moreover, the record contains ample basis to support the balance that the Commission sought to achieve when establishing the 30-megahertz limitation for operations in this band – i.e., accommodating wireless microphone operations through access to spectrum in this band along with other bands, while also promoting efficient spectrum use. The Commission's decision to limit spectrum access for wireless microphone operations in this band must be considered in the context of the access it provided to spectrum in several other bands. When authorizing access to spectrum in this band in the *Wireless Microphones R&O*, the Commission explained that access in the 1435-1525 MHz band is intended only for those situations where other available spectrum resources are insufficient, and that in providing access it was seeking to promote development of spectrally efficient wireless microphone technologies.²¹⁴ In the *Wireless Microphones R&O*, the Commission took several actions to promote the availability of other spectrum resources for licensed wireless microphone operations in the reconfigured TV bands, the 600 MHz duplex gap, the 900 MHz band (i.e., portions of the 941.5-944 MHz, 944-952 MHz, and 952-960 MHz bands), and other bands.²¹⁵ These other spectrum resources are likely to accommodate a significant number of wireless microphones, which should be sufficient to address most licensed wireless microphone users' needs in most situations, without any need for access to additional spectrum resources in the 1435-1525 MHz band. To the extent the available spectrum in these other bands may not be sufficient, access to as much as 30 megahertz in this band (i.e., one third of the spectrum in the band) would allow a user to use of a significant number of wireless microphones (e.g., as many as 100 according to Audio-Technica) in addition to the many wireless microphones likely to be accommodated through use of the other spectrum resources already available in other bands. By limiting a particular operator to access to no more than 30 megahertz of the spectrum in this band, we also promote our goals concerning efficient use of the spectrum in this band, and we help ensure that other licensed wireless microphone users can access portions of this spectrum for their needs as well. As pointed out by AVS and BSI, this limitation also can help users of video production services that at times seek access spectrum in this band through STAs, and thus serves to balance competing uses of this band. While there may be extraordinary situations or special events in which access to 30 megahertz in this band may be insufficient, for which the STA process remains available (as discussed below), we are not persuaded by petitioners that we should remove the general limitation and instead provide a particular user with general access to all 90 megahertz of spectrum in the band. In sum, we conclude that a 30-

²¹² *Id.* at 12393, para. 190. Under the Administrative Procedure Act (APA), an agency may satisfy notice requirements by providing “a description of the subjects and issues involved.” 5 U.S.C. § 553(b)(3). And while the notice “must be sufficient to fairly apprise interested parties of the[se] issues,” it need not specify “every precise proposal which (the agency) may ultimately adopt as a rule.” *Action for Children's Television v. FCC*, 564 F.2d 458, 470 (D.C. Cir. 1977) (first quoting S. Doc. No. 248, 79th Cong., 2d Sess. 258 (1946), and second quoting *California Citizens Band Association v. U.S.*, 375 F.2d 43, 48 (9th Cir. 1967)). See also *Agape Church, Inc. v. FCC*, 738 F.3d 397, 411 (D.C. Cir. 2013); *Consolidation Coal Co. v. Costle*, 604 F.2d 239, 248 (4th Cir. 1978).

²¹³ See *Covad Communications Co., v. FCC*, 450 F.3d 528, 548 (D.C. Cir. 2006) (holding that a final rule “need only be a ‘logical outgrowth’ of its notice”).

²¹⁴ *Wireless Microphones R&O*, 30 FCC Rcd at 8784, para. 117.

²¹⁵ See generally *id.* (providing additional access for licensed wireless microphone operations in several different spectrum bands).

megahertz limitation is balanced and reasonable, particularly with the clarification that follows regarding implementation of this limitation.

71. We also clarify how this general limitation will apply to different licensed wireless microphone users that may operate in the same general area or location. We recognize, as noted by the petitioner and commenters above, that in some areas of the country the spectrum available for licensed wireless microphone operations may be quite constrained (e.g., the theater district in New York City, or the Las Vegas strip). We also recognize that different users in that same general area or location may be seeking to access portions of the same general spectrum resource for their respective wireless microphone operations at a particular venue. While we are limiting each wireless microphone user's operations in a particular area or venue to access to no more than 30 megahertz in the band (i.e., one-third of the spectrum in the band), as discussed above, we clarify that different users in the same general area can each access up to 30 megahertz of the spectrum in the band for their respective wireless microphone operations. Licensed wireless microphone users seeking access would first need to coordinate with AFTRCC, which would have to determine whether to permit access to the 1435-1525 MHz band in that area during the specified period, and to indicate whether any specific frequencies in the 90 megahertz of spectrum in the band is unavailable for use.²¹⁶ All licensed users that have successfully coordinated with AFTRCC for access to the 1435-1525 MHz band for operations at their locations at specified times and circumstances would then be obligated, to the extent necessary, to coordinate their particular access to and use of up to 30 megahertz (one-third) of this available spectrum with the other licensed users in the same general area so as to minimize the potential for interference between and among the different operations.²¹⁷

72. As discussed above, there may be extraordinary situations for which a licensed wireless microphone user may need access to more than 30 megahertz of spectrum in the band for a specific event at a particular location or area. This could include the "super-scale" type of event referenced by Shure or the seasonal "spectacular" discussed by MSGC above.²¹⁸ For any such extraordinary event, the STA process remains available to meet these needs. In keeping with existing requirements for obtaining an STA, the wireless microphone licensee would need to demonstrate that all of the spectrum resources available to it for that event are insufficient to meet its needs. As discussed above, AVS, BSI, and others also are dependent on the use of STAs for operating in the 1435-1525 MHz band when providing video production services for certain large scale events. We agree with AVI and BSI that these types of STAs can serve the public interest in specified situations, and that they and similar entities should continue to be able to avail themselves of STAs on an as-needed basis in appropriate situations. Accordingly, we reject Shure's request that we eliminate use of STAs in this band for either wireless microphone or video production operations. We recognize that, for particular events, both professional wireless microphone users and professional video production services may seek access to spectrum in the 1435-1525 MHz band through STAs in the same general location or area. To the extent that these different entities may

²¹⁶ In its comments, AFTRCC indicates that its coordination of access to spectrum in a particular area turns on the specific circumstances of the request and the AMT operations in the area at the time of the request, regardless of the amount of spectrum requested (e.g., whether for 30, 60, or 90 megahertz) by a licensee. AFTRCC Wireless Microphones Comments at 3.

²¹⁷ Wireless microphone licensees have secondary, non-exclusive rights to access the spectrum. To the extent that two or more licensees are authorized to access spectrum following coordination with AFTRCC and need to operate in the same area, they would be required to select frequencies or schedule operations in a manner so as to avoid mutual interference, consistent with their non-exclusive rights to the spectrum. See 47 CFR § 74.803(a) (requiring LPAS licensees to select frequencies to avoid interference when operating in the same area). In the *Wireless Microphones R&O*, the Commission required that wireless microphones operating in this band must be tunable across the entire 1435-1525 MHz band. *Wireless Microphones R&O*, 30 FCC Rcd at 8785, para. 118.

²¹⁸ See paragraphs [65 and 67], above.

seek access to the 1435-1525 MHz band at the same location and time for scheduled events, we expect these users to coordinate their audio and video operations.

5. 941.5-944 MHz Band – Coordination with Federal Operations

73. *Background.* In the *Wireless Microphones R&O*, the Commission revised our rules to provide new opportunities for licensed wireless microphone operations in the bands adjacent to the 944-952 MHz band, which has long been available for wireless microphone operations under the Commission's Part 74 LPAS rules.²¹⁹ With regard to the 941.5-944 MHz band, it permitted licensed wireless microphone operations on a secondary basis – thereby requiring that incumbent users be fully protected from harmful interference from such operations – and applied the same technical rules (e.g., the same power limits, maximum bandwidth) and coordination requirements applicable to LPAS operations in the 944-952 MHz band.²²⁰ It noted that the 941.5-944 MHz band is licensed on a primary basis for Private and Common Carrier Fixed Microwave Services and to fixed Aural Broadcast Auxiliary Services under Part 74,²²¹ and that these operations are fixed point-to-point links that are typically used for long distance, low data-rate links that have a line of sight capability, and employ directional antennas and operate with a fairly high effective isotropic radiated power. In addition to these primary non-Federal incumbent services, Federal fixed services also operate in this band on a co-primary basis pursuant to similar technical rules.²²²

74. Consistent with the coordination requirements for LPAS operations in the 944-952 MHz band, the Commission specified that wireless microphone users seeking access to the 941.5-944 MHz band operate on a secondary basis vis-à-vis other incumbent uses and required that, prior to operation, they “consult local frequency coordination committees, where they exist, for information on frequencies available in the area.”²²³ While the local Society of Broadcasting Engineers (SBE) coordinator is the appropriate coordinator with respect to coordinating proposed wireless microphone operations with non-Federal operations,²²⁴ these coordinators do not coordinate proposed wireless microphone operations with the primary Federal incumbent users that may be affected. Instead, because the Federal government and the Commission each has jurisdiction over spectrum use in shared non-Federal/Federal bands, the practice used generally in such shared bands applies, whereby the Commission works directly with the National Telecommunications and Information Administration (NTIA) to coordinate proposed non-Federal license applicants with Federal incumbents.²²⁵ Moreover, the specific procedures used for coordinating Federal

²¹⁹ *Wireless Microphones R&O*, 30 FCC Rcd at 8772-77, paras. 85-95.

²²⁰ *Id.* at 8776, para. 94; 47 CFR § 74.803(c)(secondary status).

²²¹ *Wireless Microphones R&O*, 30 FCC Rcd at 8772, para. 85. The Private Operational Fixed Service (including business industrial and public safety) and Common Carrier Fixed Microwave Service are authorized under Part 101 (Subparts H and I), and the Fixed Aural Broadcast Auxiliary Services (Aural Studio to Transmitter links (STL) and fixed Aural Intercity Relay Links stations (ICR)) are authorized under Part 74 (Subpart E). *See id.*

²²² *See* 47 CFR § 2.106 (United States Table of Frequency Allocations) (listing Federal and non-Federal Fixed services as primary services in the allocation for the 941-944 MHz band); *Amendment of Parts 1, 21, 22, 74, and 94 of the Commission's Rules to Establish Service and Technical Rules for Government and non-Government Fixed Service Usage of the Frequency Bands 932-935 MHz and 941-944 MHz*, GN Docket No. 82-243, Second Report and Order, 4 FCC Rcd 2012, 2012 (1989) (establishing technical standards for non-Federal fixed service use of the 941-944 MHz band on a co-primary basis with Federal fixed service use, and noting that “the technical standards . . . for both [types of] users are similar to those currently in use in non-Government private operational fixed bands”).

²²³ 47 CFR § 74.803(c).

²²⁴ *See Wireless Microphones R&O*, 30 FCC Rcd at 8776, para. 94.

²²⁵ *See* Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA, September 2015 Revision), Chapter 4.1.2 (in the case of bands shared by Federal and non-Federal services, frequency assignments therein shall be subject to coordination between NTIA, via the Interdepartment Radio Advisory Committee, and the Commission).

(continued...)

and non-Federal operations in this shared band are well-established.²²⁶ Under these procedures, once the proposed non-Federal operations have been successfully coordinated among the non-Federal incumbent licensees, the applicant submits an application to the Commission, which then coordinates the proposed operations with the Federal Government. Specifically, this coordination occurs through the application filing process, whereby the Commission forwards the relevant information about the proposed operations (e.g., particular frequencies, power levels, area/location), set forth in the application, to NTIA and its Interdepartment Radio Advisory Committee (IRAC) to enable NTIA/IRAC to assess the compatibility of the proposed operations with the incumbent Federal use.²²⁷

75. *Discussion.* Given the need to coordinate the wireless microphone operations with the various incumbent primary Federal fixed services that may operate at different frequencies and locations throughout the 941.5-944 MHz band, we provide the following guidance.²²⁸ After coordination of proposed wireless microphone operations with incumbent non-Federal users through the local SBE coordinator, the applicant will file its application for an LPAS license with the Commission.²²⁹ In addition to the basic technical information (such as the particular frequencies and maximum power levels that the applicant proposes to use), the applicant is required to provide a description of the proposed location and area(s) of operation.²³⁰ To facilitate the Commission's coordination of the proposed wireless microphone operations with incumbent Federal users, each application should provide sufficient specificity regarding the proposed location(s) (e.g., venues) of the wireless microphone operations for which the applicant seeks authorization, and limit its request only to the area(s) necessary to meet its particular communications needs.²³¹ Providing such specificity is consistent with the approach used for coordinating co-primary non-Federal fixed service applications with Federal fixed operations in the band, and also is consistent with the approach taken with regard to secondary licensed wireless microphone operations in the 1435-1525 MHz band.²³² Finally, we note that, under the applicable LPAS rules, wireless microphone licensees are not granted exclusive frequency assignments for their secondary

²²⁶ *Amendment of Parts 1, 21, 22, 74, and 94 of the Commission's Rules to Establish Service and Technical Rules for Government and non-Government Fixed Service Usage of the Frequency Bands 932-935 MHz and 941-944 MHz*, GN Docket No. 82-243, Second Report and Order, 4 FCC Rcd 2012 (1989) (establishing procedures for sharing in the 941-944 MHz band among fixed Federal and fixed non-Federal usage on a co-primary basis) (1989 *Federal-Non-federal Sharing Second R&O*); Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA, September 2015 Revision), Chapter 4.3.14 ("Channeling Plan for Assignments in the Fixed Service in the Bands 932.4-935 MHz and 941.4-944 MHz").

²²⁷ See 1989 *Federal-Non-federal Sharing Second R&O*.

²²⁸ We are making modifications in the rules to reflect more explicitly the status in the band of the wireless microphone users and the Federal incumbents – *i.e.*, updating the table of allocations located at 47 CFR § 2.106 to reflect that low power auxiliary stations are permitted to operate on a secondary basis in this band, and adding to 47 CFR § 74.803(c) an express statement that such stations are secondary to Federal operations in the band.

²²⁹ Applications for LPAS licenses are filed using FCC Form 601 ("FCC Application for Radio Service Authorization").

²³⁰ See Instructions to Form 601, Schedule D, Items 3 and 4.

²³¹ There are a variety of ways in which an applicant can describe its proposed area of operation with a sufficient degree of specificity to enable the Commission to engage in an effective coordination process with NTIA. One is describing the proposed area of operation as a Kilometer Radius (KMRA) around a fixed location or center point. This approach provides the kind of specificity that, we believe, would serve to increase the chances for successful coordination among any fixed non-Federal or Federal incumbents around a proposed location. Limiting the radius of operation around each specific location only to that necessary to meet the applicant's specific communications requirements will minimize the potential for interference with any non-Federal or Federal incumbents and increase the likelihood of successful coordination.

²³² *Wireless Microphones R&O*, 30 FCC Rcd at 8784-85, paras. 116-118 (restricting use to specific fixed locations such as large venues; prohibiting itinerant operations of wireless microphones).

(continued...)

operations.²³³ Accordingly, the grant of a LPAS license to one entity for wireless microphone operations at a specified location (e.g., a venue) does not preclude the grant of additional LPAS licenses to other entities at the same location following successful coordination of their proposed operations with the primary users of the band.²³⁴

6. Updating Rules to Reflect the Close of the Incentive Auction

76. As discussed above, the broadcast television incentive auction closed on April 13, 2017.²³⁵ As a result, the 600 MHz Band Plan is now finalized, and the specific frequencies associated with the 600 MHz service band, the 600 MHz guard band, and the 600 MHz duplex gap are now established.²³⁶ Accordingly, we are updating various rule parts in Part 15 (affecting unlicensed wireless microphone operations) and Part 74 (affected licensed wireless microphone operations) to reflect the 600 MHz Band Plan.²³⁷ In addition, we update these rules to reflect specific calendar dates for compliance with various requirements that attach based on the date of release of the *Closing and Channel Reassignment PN* and the establishment of the post-auction transition period.²³⁸ Finally, we also take this opportunity to reinsert part of a rule provision that had been inadvertently deleted with the rule changes adopted in the *Wireless Microphones R&O*.²³⁹

²³³ See 47 CFR § 74.802(d).

²³⁴ Under these existing LPAS rules, if two or more wireless microphone licensees are authorized to operate in the same area, the licensees are obligated to select frequencies and schedule operations in a manner as to avoid mutual interference between their operations. 47 CFR § 74.803(a).

²³⁵ See *Closing and Channel Reassignment PN*, DA 17-314.

²³⁶ *Id.* at para. 15. The incentive auction resulted in a 600 MHz Band Plan in which 84 megahertz is repurposed pursuant to the 84-megahertz scenario discussed in the *Incentive Auction R&O*. *Incentive Auction R&O*, 29 FCC Rcd at 6586, para. 47.

²³⁷ Various rule provisions under our Part 15 and Part 74 rules relating to wireless microphones include “notes” that indicate that the specific frequencies will be established by a future public notice in the broadcast incentive auction proceeding (GN Docket No. 12-268), or effective dates that will be established with release of the *Closing and Channel Reassignment PN*. Now that this public notice has been released, we take the opportunity in this Order to update the rules by replacing these descriptive references with the specific frequencies and dates described by those references. As this is essentially a mechanical process of inserting specific information into rules in accordance with their existing terms, we find, for good cause, that the notice and public procedure specified in the Administrative Procedure Act (APA) are unnecessary, and that following such processes in this case would be contrary to the public interest because it would waste resources and delay making these perfunctory regulatory updates, with no countervailing benefit. See 5 U.S.C § 553(b)(B) (providing that notice and comment requirement of the Administrative Procedure Act does not apply when agency “for good cause finds . . . that notice and public procedure [for rulemaking action] are impracticable, unnecessary, or contrary to the public interest).

²³⁸ As discussed above, the Commission determined in the 2014 *Incentive Auction R&O* that various actions and compliance dates associated with the results of the incentive auction would be established with the release of the *Closing and Channel Reassignment PN* announcing the closing of the incentive auction. For wireless microphone operations, these include the final 600 MHz Band Plan, the dates that attach to the post-auction transition period, and the dates concerning compliance with the new technical requirements relating to wireless microphones.

²³⁹ Among the actions taken in the *Wireless Microphones R&O*, the Commission authorized licensed wireless microphone operations, on a secondary basis, in the 1435-1525 MHz band. See *Wireless Microphones R&O*, 30 FCC Rcd at 8784-85, paras. 116-118 & n.314. However, when seeking to reflect this new authorization in the rules, the Commission inadvertently replaced the entire text of Section 87.303(d)(1) of the rules – which included a full paragraph addressing the use of frequencies in the 1435-1525 MHz band, as well as the 2360-2395 MHz and 2345-2360 MHz bands, for aeronautical mobile telemetry (AMT) and associated telecommand operations for flight testing of aircraft and missiles – with one sentence that provided that “[f]requencies in the band 1435-1525 MHz are also available for [licensed wireless microphone] use on a secondary basis.” See *id.* at 8803 (Appendix A, paragraph 15). The Commission’s clear intent in the *Wireless Microphones R&O* had only been to add language in Section 87.303(d) to reflect the newly adopted authorization of licensed wireless microphone use of the 1435-1525 MHz

(continued....)

III. FURTHER NOTICE OF PROPOSED RULEMAKING

77. In this Further Notice, we propose to permit certain professional theater, music, performing arts, or similar organizations that operate wireless microphones on an unlicensed basis and that meet certain criteria to obtain a Part 74 license to operate in the TV bands (and the 600 MHz service band during the post-auction transition period), thereby allowing them to register in the white spaces databases for interference protection from unlicensed white space devices at venues where their events/productions are performed. In addition, we propose to permit these same users, based on demonstrated need, also to obtain a Part 74 license to operate on other bands available for use by Part 74 wireless microphone licensees provided that they meet the applicable requirements for operating in those bands.

A. Background

78. *Petitioner's request.* As an alternative to its request for reinstatement of a reservation system for those unlicensed wireless microphone users (which we deny for the reasons discussed above²⁴⁰), Shure requests that we provide a more limited reservation system that would make registration for interference protection for wireless microphone users in the TV bands available in special circumstances requiring a high degree of reliability for a user that does not typically use 50 or more microphones.²⁴¹ As Shure points out, the elimination of two “reserved” TV channels for wireless microphones in the TV bands following the incentive auction, combined with the decision in the *TV Bands Part 15 R&O* to open up more of the TV bands to personal/portable white space devices by allowing them to operate on vacant channels 14-20 in the repacked TV bands, results in unlicensed wireless microphone users having access to fewer vacant TV channels that would be free from interference from white space devices.²⁴²

band on a secondary basis, and not otherwise revise this rule; neither the *Wireless Microphones R&O* nor the underlying notice of proposed rulemaking in that proceeding had included any discussion of revisions to the existing rules for AMT or telecommand operations in the 1435-1525 MHz or other bands. Accordingly, in order to avoid any potential uncertainty regarding the applicable rule for AMT and telecommand operations in the 1435-1535 MHz and the other bands, we find, for good cause, that it is in the public interest to (a) restore the inadvertently deleted text of Section 87.303(d)(1) that contained the applicable rule provisions authorizing certain AMT and telecommand services in these bands, and (b) to include the one-sentence rule adopted by the Commission in the *Wireless Microphones R&O* authorizing licensed wireless microphone use of the 1435-1525 MHz band on a secondary basis as subsection (d)(4). See 5 U.S.C § 553(b)(B) (under the “good cause” exception, the APA notice and comment requirement does not apply when agency for good cause finds that notice and public procedures are impracticable, unnecessary, or contrary to the public interest).

²⁴⁰ See Section [II.B.2.e], above. As discussed above, Shure also petitioned for reconsideration of the Commission’s 2015 decision in the *TV Bands Part 15 R&O* to eliminate the rules adopted in 2010 in the *TV Bands White Spaces Second MO&O* that had permitted certain types of unlicensed wireless microphone users, upon case-by-case demonstration of particular need, to register TV channel operations in the white spaces databases to obtain interference protection from white space devices during specified major events/productions. *Id.*

²⁴¹ Shure Part 15 Petition at 13-15. As discussed earlier, Shure’s request is supported by Sennheiser, the Performing Arts and Theater Groups, and Key Bridge, who agree that the 50 microphone license eligibility requirement excludes many unlicensed performing arts companies that stage highly sophisticated productions and that professional non-profit theater, music, and performing arts organizations that regularly present stage productions that use fewer than 50 wireless microphones in the TV bands need high-quality sound for their audiences and should be able to register their operations in the white space databases to prevent interference and disruption to the performances. See Sennheiser Consolidated Opposition and Response at 7-8; Performing Arts and Theatre Groups Part 15 Reply at 2-3; Key Bridge Part 15 Reply at 2 (agreeing that the Commission should make some accommodation of unlicensed wireless microphone use in special circumstances).

²⁴² *Id.* See paragraph [54], above.

(continued...)

79. *Limited expansion of eligibility in 2014 for licensed wireless microphone operations under Part 74.* Under the Commission's Part 74 LPAS rules, licensed operations of wireless microphones are permitted on the TV band frequencies on a secondary, non-exclusive basis,²⁴³ with license eligibility restricted to a limited set of specified entities.²⁴⁴ Prior to 2014, eligibility was restricted to licensees of radio and broadcast television stations, broadcast television network entities, certain cable television system operators, and motion picture and television program producers.²⁴⁵ In 2014, in the *TV Bands Wireless Microphones Second R&O*, the Commission provided for a limited expansion of eligibility under Part 74, Subpart H, to include professional sound companies and venues that routinely use 50 or more wireless microphones for major events/productions where use of such devices is an integral part of these events/productions.²⁴⁶ When using frequencies in the TV bands, these licensed wireless microphone users may also register with the white spaces databases to receive interference protection from unlicensed white space devices in the TV bands at specified locations when these events/productions are performed.²⁴⁷

80. In providing for this limited expansion of license eligibility, the Commission explained that these particular entities share the need of the other eligible entities for regular and reliable high quality audio services that are free from interference, and often require a large number of wireless microphones to meet their needs. In particular, the Commission concluded that professional sound companies and venues that routinely use 50 or more wireless microphones at events/productions generally have the same needs for interference protection as existing Part 74 wireless microphone licensees, particularly given the spectrum requirements associated with use of a large number of wireless microphones. It explained that this limited expansion provided a meaningful benefit to entities that require the protection that a license affords without unduly reducing the amount of spectrum available for other uses in the television bands.²⁴⁸ The Commission explained that the eligibility threshold it adopted was limited to professional sound companies and venues that have the sophisticated knowledge and capability to manage use and coordination of a large number of wireless microphones, register qualifying events in the TV broadcast database, and comply with the applicable rules, including technical rules, for licensed wireless microphone operations. The Commission found that these types of professional users have experience in coordinating wireless microphone uses among themselves at venues or events, even in congested markets, and have similar needs to existing Part 74 wireless microphone licensees.²⁴⁹

81. The Commission provided guidance on what constituted an eligible venue under the revised eligibility rule.²⁵⁰ The Commission explained that an eligible venue does not have to own or

²⁴³ In addition to permitting operations in the television broadcasting bands, the LPAS rules also permit wireless microphone operations at 26.100-26.480 MHz, 161.625-161.775 MHz (except Puerto Rico and Virgin Islands), and 944.000-952.000 MHz. 47 CFR § 74.802.

²⁴⁴ See *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-08, paras. 8-14.

²⁴⁵ *Id.*; see 47 CFR § 74.832(a)(1)-(6).

²⁴⁶ See *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd 6103; see 47 CFR § 74.832(a)(7)-(8),

²⁴⁷ See *Unlicensed Operations in the TV Broadcast Bands and Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket Nos. 04-186 and 02-380, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, 16876, para. 198 (2008) (*TV Bands White Spaces Second MO&O*).

²⁴⁸ *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107, para. 9; see *id.* at 6106, para. 6 (noting than any "broad" expansion of eligibility could significantly reduce the amount of spectrum for other users of the TV bands, including white space devices).

²⁴⁹ *Id.* at 6107, para. 10.

²⁵⁰ Eligible venues were limited to those that routinely use 50 or more wireless microphones for major events/productions. *Id.* at 6107-08, paras. 12-13. The Commission also explained what constituted a professional sound company. *Id.* at 6107, para. 11. A professional sound company is defined as an entity that provides audio services that routinely use 50 or more wireless microphones and where the use of such devices is an integral part of

(continued....)

operate the wireless microphones itself to qualify for the LPAS license but must routinely host large-scale productions that require 50 or more of these devices.²⁵¹ The Commission determined that licenses issued to venue owners or operators are specific to a single venue and authorize operation only at that venue, but noted that such a venue could be comprised of more than one theater or stage area at the same location.²⁵² It concluded that routine use of 50 microphones was a reasonable threshold for identifying entities that are more likely to require interference protection in order to ensure high quality audio services.²⁵³ The Commission also found that the number of wireless microphones used is, as a general matter, an indicator of the complexity of productions and the need to ensure interference-free high audio quality. It further noted that interference protection is important for large, live performances because audiences expect performances of the highest caliber, and interference should not hinder such performances.²⁵⁴ As for the location of the venue, the Commission noted that it could include indoor or outdoor seated facilities (including auditoriums, amphitheaters, arenas, stadiums, theaters, and houses of worship), as well as indoor or outdoor venues without fixed seating (including convention centers, conference locations, amusement parks, fairgrounds, entertainment complexes, athletic facilities, educational centers, and government locations).²⁵⁵

82. *Recent revisions concerning licensed wireless microphone operations under Part 74.* As discussed above, in the *Wireless Microphones R&O* the Commission adopted various revisions in 2015 with regard to licensed wireless microphone operations under the Part 74 LPAS rules. With respect to the TV bands, it revised the rules to provide more opportunities for licensed wireless microphone users to access spectrum by allowing greater use of very-high frequency (VHF) channels, and by providing for closer co-channel operation without the need for coordination where the licensed wireless microphone user determines that the TV signals fell below a specified threshold (such that wireless microphone operations would pose little risk of causing harmful interference to TV service).²⁵⁶ The Commission also expanded eligibility for licensed use of the 600 MHz duplex gap to all entities eligible to hold Part 74 wireless microphone licenses for using TV band spectrum.²⁵⁷ In addition, outside of the TV bands the Commission opened up additional portions of the 900 MHz band (portions of the 941-944 MHz and 952-960 MHz bands on each side of the 944-952 MHz band), as well as portions of the 1435-1525 MHz band (with special equipment and coordination requirements) and the 6875-7125 MHz band, to permit use by licensed wireless microphone operations on a secondary basis under specified conditions.²⁵⁸

83. *Remaining available spectrum following the close of the broadcast television incentive auction and the repurposing/repacking of the TV bands.* On April 13, 2017, the broadcast television

major events or productions. Services by a professional sound company may include the provision of equipment, as well as engineering expertise and frequency coordination. A production company that provides its own audio services, such as a touring theater company or performer, also could be eligible for licensing under this definition. *Id.*

²⁵¹ *Id.* at 6107-08, para. 12.

²⁵² *Id.* at 6108, para. 13.

²⁵³ *Id.* at 6108-09, para. 16. The record had shown that large events and programs regularly utilize a substantial number of wireless microphones. *Id.*

²⁵⁴ *Id.*

²⁵⁵ *Id.* at 6107, para. 12.

²⁵⁶ *Wireless Microphone R&O*, 30 FCC Rcd at 8745-51, paras. 16-28; see 47 CFR § 74.802(b)(2).

²⁵⁷ *Wireless Microphone R&O*, 30 FCC Rcd at 8755-56, paras. 38-40. The 600 MHz duplex gap is the spectrum separating the 600 MHz service uplink and downlink bands. *TV Bands Part 15 R&O*, 30 FCC Rcd at 9553 n.4.

²⁵⁸ See *Wireless Microphone R&O*, 30 FCC Rcd at 8772-77, paras. 85-95 (portions of the 941-944 MHz and 952-960 MHz bands), 8779-86, paras. 105-122 (1435-1525 MHz band), 8786-90, paras. 126-132 (6875-7125 MHz band).

incentive auction closed, thereby (1) establishing the revised TV bands that will be repacked and will continue to be available for use by wireless microphones on a secondary licensed or an unlicensed basis, and (2) the 600 MHz Band Plan, which includes the limited spectrum that will be available for wireless microphone operations in the 600 MHz guard band and duplex gap after the end of the post-auction transition period.²⁵⁹ As a result of the repurposing of 84 megahertz of TV bands spectrum in the incentive auction, the spectrum in the revised and repacked TV bands (channels 2-36) available for licensed and unlicensed wireless microphone use will be substantially reduced in the coming years, although the specific amount of spectrum that remains available will vary depending on the particular locations of the users' wireless microphone operations. After the end of the post-auction transition period, the 600 MHz spectrum (what has been TV channels 38-51) available for wireless microphone operations will only include spectrum in the 600 MHz duplex gap (four megahertz for licensed wireless microphone operations, and six megahertz for unlicensed wireless microphones shared with white space devices) and the 600 MHz guard band (an additional two megahertz for unlicensed wireless microphone operations,²⁶⁰ which would be free from interference because the spectrum is not available for use by white space devices).

B. Discussion

84. We agree with Shure and commenters supporting its petition that certain unlicensed wireless microphone users that do not meet the 50 microphone threshold nonetheless have identical or similar needs for interference protection at their events/productions as do entities that currently qualify for Part 74 wireless microphone licenses. In many instances, the 50 microphone threshold is unnecessarily restrictive as it excludes many entities that have the need for professional high-quality audio for their events/productions. Therefore, we propose and seek comment on how best to accommodate these wireless microphone users to the extent that, based on demonstration of particular need, they should qualify for a license at their events/productions.

85. We recognize that the 50 microphone threshold is a proxy for the need for professional, interference-free high-quality audio events/productions.²⁶¹ Therefore we propose to allow certain theater, music, and performing arts organizations²⁶² that do not meet this threshold but are otherwise able to demonstrate they have these "professional" needs and capabilities to obtain a Part 74 license to operate in the TV bands and the 600 MHz duplex gap. This would address the specific concerns raised in the petition by allowing these users to register for interference protection from white space devices when operating in the TV bands. In addition, recognizing that under the revised/repacked TV bands and the particular 600 MHz Band Plan adopted there may only be a very limited amount of spectrum available on a protected basis in these bands at some locations, we also propose to allow such users access to other spectrum bands available to Part 74 wireless microphone licensees, including portions of the 900 MHz, 1435-1525 MHz, and 7 GHz band spectrum where the need and requisite capabilities are demonstrated. Furthermore, we seek comment on whether there also may be certain other, similar types of organizations that use wireless microphones for productions where professional-level high-quality audio service is

²⁵⁹ See *Closing and Channel Reassignment PN*, DA 17-314, para. 15 (600 MHz Band Plan).

²⁶⁰ *TV Bands Part 15 R&O*, 30 FCC Rcd at 9607-08, para. 139 (unlicensed wireless microphones may operate in the 600 MHz guard band, with a maximum power of 20 mW EIRP, provided that there is a one megahertz frequency separation from the 600 MHz wireless services downlink band); 47 C.F.R. §§ 15.236(c)(5), (d)(2).

²⁶¹ See *supra* paragraph [80]. See also *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107, para. 16. The Commission stated that the routine use of 50 microphones is a "reasonable threshold" for identifying those entities that are more likely to require interference protection in order to ensure high quality audio services for their productions. *Id.* (citing the example of live performances where audiences expect performance of the highest caliber).

²⁶² Such organizations could be non-profit or for-profit organizations.

required and these needs cannot otherwise be met, such that the organization also may merit such protection for the same reasons.

86. To fully account for those wireless microphone users with professional needs, we propose to revise the definition of both “large venue owner or operator” and “professional sound company” under our rules. We propose to define these terms to include *either* (a) wireless microphone users that routinely use 50 or more wireless microphones where the use is an integral part of the events/productions *or* (b) wireless microphone users that can demonstrate a need for and the capability to provide professional, high-quality audio that is integral to their events/productions. We note in order to be eligible for a venue license, the venue licensee would not have to own or operate the wireless microphones so long as those who operate the wireless microphones for events/productions at its venue would meet the requisite professional capabilities.²⁶³ With respect to the proposal for revising the eligibility for professional sound companies, we seek comment on how we would determine what types of entities would qualify.

87. To demonstrate a need for high-quality audio during events/productions under prong (b), an applicant for a Part 74 license would be required to show that its needs for high-quality audio services for its audiences are identical or substantially similar to those of current Part 74 licensees. Among other things, an applicant should address the nature of the venue(s) and its wireless microphone operations, the need for professional, high caliber audio quality and reliability for its particular types of events/performances, and its ability to comply with the licensee’s responsibilities. We seek comment on this approach and any proposed clarifications or modifications consistent with the goals we have enunciated.

88. Furthermore, to demonstrate the requisite capability to provide professional high quality audio under prong (b), an applicant for such a Part 74 license would need to demonstrate that it has the professional-level technical and operational capabilities to carry out its responsibilities associated with holding a license (e.g., coordination responsibilities, technical capabilities,²⁶⁴ and registration capabilities²⁶⁵). This criterion is meant to encompass users that have capabilities that are identical or similar to the professional sound companies/large venues that currently qualify for Part 74 licenses, but that do not meet the 50 microphone threshold. When providing for a limited expansion of Part 74 license eligibility in the *TV Bands Wireless Microphones Second R&O* to include professional sound companies and major venues, the Commission emphasized that the entities that were newly eligible must have sophisticated knowledge and capability to manage use and coordination of their microphones, register specific channels for qualifying events/productions in the white spaces databases, and comply with the applicable rules for licensed wireless microphone (LPAS) operations.²⁶⁶ We propose the same approach here. We seek comment on this approach and any further clarifications or modifications that may be helpful or appropriate.

89. As in the *TV Bands Wireless Microphones Second R&O*, we are only proposing a limited expansion of eligibility that strikes an appropriate balance in expanding licensee eligibility where there is a clear need for professional high-quality audio for particular events/productions, while ensuring that spectrum is shared effectively with existing wireless microphone licensees and remains available for other

²⁶³ See *supra* paragraph [81]; *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-07, para 12 (an eligible venue does not have to own or operate the wireless microphones itself to qualify for the LPAS license)

²⁶⁴ These include the technical capability to tune the device, as necessary, so as not to cause harmful interference to other licensed users in the bands allocated for broadcasting, or in the 600 MHz band during the post-auction transition period. See 47 CFR § 74.802(f).

²⁶⁵ See 47 CFR § 15.713(j)(8).

²⁶⁶ *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107, paras. 9-10; see also *id.* at 6104-05, para. 3 (reciting various requirements associated with licensed wireless microphone operations in the TV bands),

uses, such as by white space devices.²⁶⁷ We also note that these wireless microphone users also have access to additional spectrum in the TV bands and 600 MHz guard band where unlicensed white space devices cannot operate,²⁶⁸ as well as in various other bands that can be used to meet their particular needs.²⁶⁹

90. In addition to proposing to permit professional theater, music, and performing arts organizations that do not meet the 50 microphone threshold but meet the two-part test above to obtain a Part 74 license in the TV bands and the 600 MHz duplex gap, we also propose to permit these entities to qualify for a license in portions of the 900 MHz band, as well as in the 1435-1525 MHz and 6975-7125 MHz band, that also are available for Part 74 wireless microphone licensees, upon demonstrated need and ability to meet the necessary coordination and other requirements pertaining to each particular band. As we discuss above, under the revised/repacked TV bands and the particular 600 MHz Band Plan adopted, there may be some locations where the spectrum available to these qualifying users on a protected basis remains insufficient for their particular needs. With the adoption of the *Wireless Microphones R&O* in 2015, the Part 74 wireless microphone licensees were provided access to unused spectrum in significant portions of the 900 MHz band (i.e., 941.5-944 MHz band, 944-952 MHz band, the 952.850-956.250 MHz, and 956.450-959.850 MHz bands) on a secondary basis, so long as they would not cause harmful interference to the primary point-to-point licensees in the band.²⁷⁰ As concluded in that order, we believe that any risk of wireless microphone operations causing harmful interference to these primary licensees is low considering that wireless microphones operate at relatively low power over short ranges.²⁷¹ Providing this additional access to 900 MHz band spectrum may well be sufficient to address the needs of those newly eligible to the extent that they use only a limited number of wireless microphones at their venues. In 2015, the Commission also provided Part 74 wireless microphone licenses access to portions of the 1435-1525 MHz band, though it restricted such access only to highly professional users with specially designed equipment, and it imposed particularly stringent coordination requirements given the critical importance of preventing potential interference to primary aeronautical mobile telemetry users.²⁷² Finally, the Commission provided access to portions of the 6975-7125 MHz provided applicable

²⁶⁷ *Id.* at 6110, para. 20. Wireless microphone technology has improved substantially in recent years, and use of more spectrally-efficient wireless microphones for particular applications may be part of the solution in the spectrum-constrained environment. In earlier proceedings, the Commission noted that 6-8 high-fidelity analog wireless microphones operated on a six-megahertz TV channel, whereas in more recent years such analog microphones may allow twice that many on a channel. *See Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket Nos. 14-166 and 12-268, Notice of Proposed Rulemaking, 29 FCC Rcd 12343, 12356, para. 54 (2014).

²⁶⁸ At any particular location, there may be vacant TV channels that are available for wireless microphone operations but not available for white space device operations (based on applicable operational rules for white space device operations), and thus free from the potential for interference from white space devices. In addition, with the establishment of the 3-megahertz 600 MHz guard band above channel 37, there is additional spectrum available for wireless microphone operations that cannot be used by unlicensed white space devices. *See Closing and Channel Reassignment PN*, DA 17-314, para. 15.

²⁶⁹ As discussed in the *Wireless Microphones R&O*, unlicensed wireless microphone operations are permitted in several other frequency bands (e.g., the 902-928 MHz band, the 1920-1930 MHz band, and the 2.4 GHz band). *Wireless Microphones R&O*, 30 FCC Rcd at 8742, para. 5 & n.9.

²⁷⁰ *See generally id.* at 8770-77, paras.78-95 (discussion of the required coordination of proposed operations at particular locations to ensure that harmful interference would not result. *Wireless Microphones R&O*, 30 FCC Rcd at 8776-8777, para. 94. *See further* discussion of the 941.5-944 MHz band, above. As concluded in that order, we believe that any risk of wireless microphone operations causing harmful interference to these primary licensees is low considering that wireless microphones operate at relatively low power over short ranges. *Id.* at 8776-8777, para. 94.

²⁷¹ *Id.* at 8776-77, para. 94.

²⁷² *See Wireless Microphones R&O*, 30 FCC Rcd at 8784-86, paras. 116-122; *see* 47 CFR § 74.803(d).

coordination requirements could be met.²⁷³ We seek comment on whether we should authorize access to each of these bands and whether there is any reason to deny newly licensed Part 74 wireless microphone licensees access to those bands so long as they can demonstrate compliance with the coordination and other requirements of those bands. We ask that commenters explain their reasons for the approach they propose on this issue.

91. Through the proposed limited expansion of licensee eligibility discussed herein, we believe that the needs of qualifying organizations that are not currently eligible for Part 74 wireless microphone licenses can effectively be accommodated.

IV. PROCEDURAL MATTERS

A. Paperwork Reduction Analysis

92. This Order on Reconsideration contains new information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under Section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to comment on the new information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

93. With regard to the Order on Reconsideration, we have assessed the effects of various changes and clarifications to the *Wireless Microphones R&O* and *TV Bands Part 15 R&O* that might impose information collection burdens on small business concerns, and find that those changes and clarifications facilitate licensed and unlicensed wireless microphone use of various frequency bands and provide wireless microphone manufacturers with greater flexibility in designing products to meet market demands. We anticipate no adverse impacts on small business concerns with fewer than 25 employees.

B. Final Regulatory Flexibility Analysis

94. The Regulatory Flexibility Act (RFA) requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.” According, we have prepared Final Regulatory Flexibility Analysis concerning the possible impact of the Order on Reconsideration on small entities. The Final Regulatory Flexibility Analysis is set forth in Appendix B.

C. Congressional Review Act

95. The Commission will send a copy of this Order on Reconsideration to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

V. ORDERING CLAUSES

96. IT IS ORDERED that, pursuant to Sections 1, 4(i), 4(j), 7(a), 301, 302, 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 157(a), 301, 302a, 303(f), 303(g), and 303(r), and Section 553(b)(B) of the Administrative Procedure Act, 5 U.S.C § 553(b)(B), this Order on Reconsideration IS ADOPTED.

97. IT IS FURTHER ORDERED that Parts 2, 15, 74, and 90 of the Commission’s Rules, 47 C.F.R. Parts 2, 15, 74, 87, and 90, ARE AMENDED as set forth in Appendix A.

98. IT IS FURTHER ORDERED that the rules adopted herein WILL BECOME EFFECTIVE 30 days after the date of publication in the Federal Register, except for Section 74.803(c)(2) of the rules, which contains a new information collection requirement that requires approval by the OMB

²⁷³ *See Wireless Microphones R&O*, 30 FCC Rcd at 8789-90, paras 131-132.

under the PRA, which WILL BECOME EFFECTIVE after the Commission publishes a notice in the Federal Register announcing such approval and the relevant effective date.

99. IT IS FURTHER ORDERED that, pursuant to Section 405 of the Communications Act of 1934, as amended, 47 U.S.C. § 405, and Section 1.429 of the Commission's rules, 47 C.F.R. § 1.429, the Petitions for Reconsideration of the Report and Order in GN Docket No. 14-166 and GN Docket No. 12-268, filed by Audio-Technica, U.S., Inc., Sennheiser Electronic Corporation, Lectrosonics, Inc., and Shure Incorporated, and the Petitions for Reconsideration of the Report and Order in ET Docket No. 14-165 and GN Docket No. 12-268, filed by Audio-Technica, U.S., Inc., Sennheiser Electronic Corporation, and Shure Incorporated ARE GRANTED IN PART AND DENIED IN PART to the extent described herein.

100. IT IS FURTHER ORDERED that, pursuant to Sections 1, 4(i), 4(j), 7(a), 301, 302(a), 303(f), and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 157(a), 301, 302a, 303(f), and 332, the Further Notice of Proposed Rulemaking is ADOPTED.

101. IT IS FURTHER ORDERED, pursuant to Sections 4(i) and (j) of the Communications Act, as amended, 47 U.S.C. §§ 154(i) and (j), and Sections 0.131 and 0.331 of the Commission rules, 47 C.F.R. §§ 0.131, 0.331, that WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24 ARE TERMINATED.

102. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Order on Reconsideration, including the Final Regulatory Flexibility Analysis, and the Further Notice of Proposed Rulemaking, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A**Final Rules**

For the reasons set forth in the preamble, the Federal Communications Commission amends parts 2, 15, 74, 87, and 90 of Title 47 of the Code of Federal Regulations to read as follows:

Part 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

1. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Section 2.106, the Table of Frequency Allocations, is amended as follows:

- a. Page 32 is revised.

- b. In the list of United States (US) Footnotes, footnotes US84 and US300 are revised.

§ 2.106 Table of Frequency Allocations.

The revisions read as follows:

* * * * *

5.323 942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322	5.325 942-960 FIXED MOBILE 5.317A	5.327 942-960 FIXED MOBILE 5.317A BROADCASTING	941-944 FIXED US268 US301 G2 944-960	941-944 FIXED US84 US268 US301 NG30 NG35 944-960 FIXED NG35	Public Mobile (22) Aural Broadcast Auxiliary (74E) Low Power Auxiliary (74H) Fixed Microwave (101)
5.323 960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328		5.320	960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328 US224		Aviation (87)
1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.328A			1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328A US224		
1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active)			1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) G132 SPACE RESEARCH (active) 5.332	1215-1240 Earth exploration-satellite (active) Space research (active)	
5.330 5.331 5.332 1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active) Amateur			1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 SPACE RESEARCH (active) AERONAUTICAL RADIONAVIGATION 5.332 5.335	1240-1300 AERONAUTICAL RADIONAVIGATION Amateur Earth exploration-satellite (active) Space research (active) 5.282	Amateur Radio (97)
5.282 5.330 5.331 5.332 5.335 5.335A 1300-1350 RADIOLOCATION AERONAUTICAL RADIONAVIGATION 5.337 RADIONAVIGATION-SATELLITE (Earth-to-space) 5.149 5.337A			1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation G2 US342	1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 US342	Aviation (87)
1350-1400 FIXED MOBILE RADIOLOCATION	1350-1400 RADIOLOCATION 5.338A		1350-1390 FIXED MOBILE RADIOLOCATION G2 5.334 5.339 US342 US385 G27 G114 1390-1395 5.339 US79 US342 US385 1395-1400 LAND MOBILE (medical telemetry and medical telecommand) 5.339 US79 US342 US385	1350-1390 5.334 5.339 US342 US385 1390-1395 FIXED MOBILE except aeronautical mobile 5.339 US79 US342 US385 NG338A	Wireless Communications (27)
5.149 5.338 5.338A 5.339	5.149 5.334 5.339				Personal Radio (95)

* * * * *

UNITED STATES (US) FOOTNOTES

* * * * *

US84 In the bands 941.5-944 MHz and 1435-1525 MHz, low power auxiliary stations may be authorized on a secondary basis, subject to the terms and conditions set forth in 47 CFR part 74, subpart H.

* * * * *

US300 The frequencies 169.445, 169.505, 169.545, 169.575, 169.605, 169.995, 170.025, 170.055, 170.245, 170.305, 171.045, 171.075, 171.105, 171.845, 171.875, and 171.905 MHz are available for wireless microphone operations on a secondary basis to Federal and non-Federal operations. On center frequencies 169.575 MHz, 170.025 MHz, 171.075 MHz, and 171.875 MHz, the emission bandwidth shall not exceed 200 kHz. On the other center frequencies, the emission bandwidth shall not exceed 54 kHz.

* * * * *

Part 15 – RADIO FREQUENCY DEVICES

3. The authority citation for part 15 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 304, 307, 336, 554a, and 549.

4. Section 15.37 is amended by revising paragraph (i) and (k) to read as follows:

§15.37 Transition provisions for compliance with the rules.

* * * * *

(i) Effective December 26, 2017, wireless microphones for which an application for certification is filed must comply with the requirements of §15.236. Manufacturing and marketing of wireless microphones that would not comply with the rules for operation in § 15.236 must cease no later than September 24, 2018. Only wireless microphones certified for operation under this part may be operated under this part as of July 13, 2020.

* * *

(k) *Disclosure requirements for unlicensed wireless microphones capable of operating in the 600 MHz service band.* Any person who manufactures, sells, leases, or offers for sale or lease, unlicensed wireless microphones that are capable of operating in the 600 MHz service band, as defined in this part, on or after July 13, 2017, is subject to the following disclosure requirements:

(1) ***

* * * * *

5. Section 15.203 is revised to read as follows:

§15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be

replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, §15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

6. Section 15.236 is amended by revising paragraphs (a)(2)-(4), (c)(1), (c)(3)-(5), (d)(2), and (g) to read as follows:

§ 15.236 Operation of wireless microphones in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz.

* * * * *

(a)(2) *600 MHz duplex gap.* An 11 megahertz guard band at 652-663 MHz that separates part 27 600 MHz service uplink and downlink frequencies.

(a)(3) *600 MHz guard band.* Designated frequency band at 614-617 MHz that prevents interference between licensed services in the 600 MHz service band and channel 37.

(a)(4) *600 MHz service band.* Frequencies in the 617-652 MHz and 663-698 MHz bands that are reallocated and reassigned for 600 MHz band services under part 27.

(a)(5) ***

(b) ***

(c) Operation is permitted on the following frequency bands.

(1) Channels allocated and assigned for the broadcast television service.

(2) ***

(3) The 657-663 MHz segment of the 600 MHz duplex gap.

(4) [Reserved]

(5) The 614-616 MHz segment of the 600 MHz guard band.

(6) ***

(d) ***

(2) In the 600 MHz guard band and the 600 MHz duplex gap: 20 mW EIRP.

* * *

(g) Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3 of ETSI EN 300 422-1 V1.4.2 (2011-08), *Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement*. Emissions outside of this band shall comply with the limits specified in Section 8.4 of ETSI EN 300 422-1 V1.4.2

(2011-08).

7. Section 15.711 is amended to revise paragraph (a) to read as follows:

§15.711 Interference avoidance methods.

* * *

(a) *Geolocation required.* White space devices shall rely on a geolocation capability and database access mechanism to protect the following authorized service in accordance with the interference protection requirements of §15.712: Digital television stations, digital and analog Class A, low power, translator and booster stations; translator receive operations; fixed broadcast auxiliary service links; private land mobile service/commercial radio service (PLMRS/CMRS) operations; offshore radiotelephone service; low power auxiliary services authorized pursuant to §§74.801 through 74.882 of this chapter, including licensed wireless microphones; MVPD receive sites; wireless medical telemetry service (WMTS); radio astronomy service (RAS); and 600 MHz service band licensees where they have commenced operations, as defined in §27.4 of this chapter. In addition, protection shall be provided in border areas near Canada and Mexico in accordance with §15.712(g).

(b) ***

* * * * *

8. Section 15.713 is amended to revise paragraph (j)(9) to read as follows:

§ 15.713 White space database.

* * * * *

(j)(9) [Reserved]

(i) * * *

* * * * *

Part 74 – EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTION SERVICES

9. The authority citation for part 74 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 307, 309, 310, 336, and 554.

10. Section 74.801 is amended by revising the definitions of the 600 MHz duplex gap, the 600 MHz guard bands, and the 600 MHz service band, and deleting the definition described as “NOTE TO DEFINITIONS OF 600 MHz DUPLEX GAP, 600 MHz GUARD BANDS, AND 600 MHz SERVICE BAND” to read as follows:

§ 74.801 Definitions

600 MHz duplex gap. An 11 megahertz guard band at 652-663 MHz that separates part 27 600 MHz service uplink and downlink frequencies.

600 MHz guard band. Designated frequency band at 614-617 MHz that prevents interference between licensed services in the 600 MHz service band and channel 37.

600 MHz service band. Frequencies in the 617-652 MHz and 663-698 MHz bands that are reallocated and reassigned for 600 MHz band services under part 27.

* * * * *

11. Section 74.802 is amended by revising paragraphs (a)(1) and (a)(2) to read as follows:

§ 74.802 Frequency assignment.

(a)(1) Frequencies within the following bands may be assigned for use by low power auxiliary stations:

26.100-26.480 MHz
 54.000-72.000 MHz
 76.000-88.000 MHz
 161.625-161.775 MHz (except in Puerto Rico or the Virgin Islands)
 174.000-216.000 MHz
 450.000-451.000 MHz
 455.000-456.000 MHz
 470.000-488.000 MHz
 488.000-494.000 MHz (except Hawaii)
 494.000-608.000 MHz
 614.000-698.000 MHz
 941.500-944.000 MHz
 944.000-952.000 MHz
 952.850-956.250 MHz
 956.45-959.85 MHz
 1435-1525 MHz
 6875.000-6900.000 MHz
 7100.000-7125.000 MHz

NOTE TO PARAGRAPH (a)(1): Frequency assignments in the 614.000-698.000 MHz band are subject to conditions established in proceedings pursuant to GN Docket No. 12-268. This band is being transitioned to the 600 MHz service band, the 600 MHz guard band, and the 600 MHz duplex gap during the post-incentive auction transition period (as defined in § 27.4 of this chapter), which began on April 13, 2017. Low power auxiliary stations must comply with the applicable conditions with respect to any assignment to operate on frequencies repurposed for the 600 MHz service band, the 600 MHz guard band, and the 600 MHz duplex gap, respectively. This rule will be further updated, pursuant to public notice or subsequent Commission action, to reflect additional changes that implement the determinations made in these proceedings.

(2) The 653.000-657.000 MHz segment of the 600 MHz duplex gap may be assigned for use by low power auxiliary service.

* * * * *

12. Section 74.803 is amended by revising subsections (c) and (d) to read as follows:

§ 74.803 Frequency selection to avoid interference.

* * * * *

(c) In the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 6875.000-6900.000 MHz, and 7100.000-7125.000 MHz bands low power auxiliary station usage is secondary to other uses (e.g. Aural Broadcast Auxiliary, Television Broadcast Auxiliary, Cable Relay Service, Fixed Point to Point Microwave) and must not cause harmful interference. In the 941.5-944 MHz band, low power auxiliary station usage also is secondary to Federal operations in the band. In each of these bands, applicants are responsible for selecting the frequency assignments that are least likely to result in mutual interference with other licensees in the same area. Applicants must consult local frequency coordination committees, where they exist, for information on frequencies available in the area. In selecting frequencies, consideration should be given to the relative location of receive points, normal transmission paths, and the nature of the contemplated operation.

(d) In the 1435-1525 MHz band, low power auxiliary station (LPAS) authorizations are limited to operations at fixed locations, and only to the extent that applicable requirements have been met for the proposed operations at those specified locations.

(1) Each authorization is limited to specific events or situations for which there is a need to deploy large numbers of LPAS for specified time periods, and use of other available spectrum resources at that particular location is insufficient to meet the LPAS licensee's needs.

(2) The access to spectrum in the band must be coordinated with the frequency coordinator for aeronautical mobile telemetry, the Aerospace and Flight Test Radio Coordinating Committee (AFTRCC) prior to operations at the specified location and period of time, with AFTRCC indicating whether any specific frequencies in the band are unavailable for use. LPAS devices must complete authentication and location verification before operations begin, employ software-based controls or similar functionality to prevent devices in the band from operating except in the specific channels, locations, and time periods that have been coordinated, and be capable of being tuned to any frequency in the band.

(3) LPAS users may have access to no more than 30 megahertz of spectrum (one third of the 1435-1525 MHz band) for their operations at the specified locations. Different users in the same general area each can access up to 30 megahertz of spectrum for their respective operations. All licensees that have successfully coordinated with AFTRCC for access to the 1435-1525 MHz band for operations at their specified locations in the same general area must, to the extent necessary, coordinate their particular access to and use of spectrum with other licensees to minimize the potential for interference between and among the different operations.

13. Section 74.831 is amended to read as follows:

§ 74.831 Scope of service and permissible transmissions.

The license for a low power auxiliary station authorizes the transmission of cues and orders to production personnel and participants in broadcast programs, motion pictures, and major events or productions and in the preparation therefor, the transmission of program material by means of a wireless microphone worn by a performer and other participants in a program, motion picture, or major event or production during rehearsal and during the actual broadcast, filming, recording, or event or production, or the transmission of comments, interviews, and reports from the scene of a remote broadcast. Low power

auxiliary stations operating in the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 6875-6900 MHz, and 7100-7125 MHz bands may, in addition, transmit synchronizing signals and various control signals to portable or hand-carried TV cameras which employ low power radio signals in lieu of cable to deliver picture signals to the control point at the scene of a remote broadcast.

14. Section 74.832 is amended by revising paragraph (d) to read as follows:

§ 74.832 Licensing requirements and procedures.

* * * * *

(d) Cable television operations, motion picture and television program producers, large venue owners or operators, and professional sound companies may be authorized to operate low power auxiliary stations in the bands allocated for TV broadcasting, the 653-657 MHz band, the 941.5-944 MHz band, the 944-952 MHz band, the 952.850-956.250 MHz band, the 956.45-959.85 MHz band, the 1435-1525 MHz band, the 6875-6900 MHz band, and the 7100-7125 MHz band. In the 6875-6900 MHz and 7100-7125 MHz bands, entities eligible to hold licenses for cable television relay service stations (see § 78.13 of this chapter) shall also be eligible to hold licenses for low power auxiliary stations.

* * * * *

15. Section 74.851 is amended to revise paragraphs (i), (j), (k), and (l) to read as follows:

§ 74.851 Certification of equipment, prohibition on manufacture, import, sale, lease, offer for sale or lease, or shipment of devices that operate in the 700 MHz or the 600 MHz Band; labeling for 700 MHz or 600 MHz band equipment destined for non-U.S. markets; disclosures.

* * * * *

(i) Effective January 13, 2018, applications for certification shall no longer be accepted for low power auxiliary stations or wireless video assist devices that are capable of operating in the 600 MHz service band or the 600 MHz guard band, or for low power auxiliary stations that are capable of operating in the 600 MHz duplex gap unless the operations are limited to the 653-657 MHz segment.

(j) Effective October 13, 2018, no person shall manufacture, import, sell, lease, offer for sale or lease, or ship low power auxiliary stations or wireless video assist devices that are capable of operating in the 600 MHz service band or the 600 MHz guard bands, or low power auxiliary stations that are capable of operating in the 600 MHz duplex gap unless the operations are limited to the 653-657 MHz segment. This prohibition does not apply to devices manufactured solely for export.

(k) Effective October 13, 2018, any person who manufactures, sells, leases, or offer for sale or lease low power auxiliary stations or wireless video assist devices that are destined for non-U.S. markets and that are capable of operating in the 600 MHz service band or the 600 MHz guard bands, or low power auxiliary stations that are capable of operating in the 600 MHz duplex gap unless such operations are limited to the 653-657 MHz segment, shall include labeling and make clear in all sales, marketing, and packaging materials, including online materials, relating to such devices that the devices cannot be operated in the United States.

(l) *Disclosure requirements for low power auxiliary stations and wireless video assist devices capable of operating in the 600 MHz service band.* Any person who manufactures, sells, leases, or offers for sale or lease low power auxiliary stations or wireless video devices that are capable of operating in the 600 MHz service band on or after July 13, 2017, is subject to the following disclosure requirements:

(1) * * *

* * * * *

16. Section 74.861 is amended by revising paragraphs (d)(3), (d)(4)(i)-(iii), and (e)(7) to read as follows:

§ 74.861 Technical requirements.

* * * * *

(d) * * *

(3) For the 26.1-26.480 MHz, 161.625-161.775 MHz, 450-451 MHz, and 455-456 MHz bands, the occupied bandwidth shall not be greater than that necessary for satisfactory transmission and, in any event, an emission appearing on any discrete frequency outside the authorized band shall be attenuated, at least, $43+10 \log^{10}$ (mean output power, in watts) dB below the mean output power of the transmitting unit. The requirements of this paragraph shall also apply to the applications for certification of equipment for the 944-952 MHz band until January 13, 2018.

(4) (i) For the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in Section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

(ii) For the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, and 1435-1525 MHz bands, digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in Section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

(iii) In the 6875-6900 MHz and 7100-7125 MHz bands, digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 5) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in Section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08).

(iv) * * *

(e) * * *

(1) * * *

(7) Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in Section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08). The requirements of this section (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter.

* * * * *

Part 87 – AVIATION SERVICES

17. The authority citation for part 87 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303, and 307(e) unless otherwise noted.

18. Section 87.303(d) is amended by revising (d)(1) and by adding (d)(4) to read as follows:

§ 87.303 Frequencies

* * * * *

(d)(1) Frequencies in the 1435-1525 MHz and 2360-2395 MHz bands are assigned in the mobile service primarily for aeronautical telemetry and associated telecommand operations for flight testing of aircraft and missiles, or their major components. Until January 1, 2020, the 2345-2360 MHz band is also available to licensees holding a valid authorization on April 23, 2015 for these purposes on a secondary basis. Permissible uses of these bands include telemetry and associated telecommand operations associated with the launching and reentry into the Earth's atmosphere, as well as any incidental orbiting prior to reentry, of objects undergoing flight tests. In the 1435-1525 MHz band, the following frequencies are shared on a co-equal basis with flight telemetering mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz. In the 2360-2395 MHz band, the following frequencies may be assigned for telemetry and associated telecommand operations of expendable and re-usable launch vehicles, whether or not such

operations involve flight testing: 2364.5, 2370.5 and 2382.5 MHz. All other mobile telemetry uses of the 2360-2395 MHz band shall be on a non-interfering and unprotected basis to the above uses.

* * *

(d)(4) Frequencies in the bands 1435-1525 MHz are also available for low power auxiliary station use on a secondary basis.

* * * * *

Part 90 – PRIVATE LAND MOBILE RADIO SERVICES

19. The authority citation for part 90 continues to read as follows:

AUTHORITY: Sections 4(i), 11, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 303(g), 303(r), and 332(c)(7), and Title VI of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat. 156.

20. Section 90.265 is amended by revising paragraphs (b) and (b)(1) to read as follows:

§ 90.265 Assignment and use of frequencies in the bands allocated for Federal use.

* * * * *

(b) The following frequencies are available for wireless microphone operations to eligibles in this part, subject to the provisions of this paragraph:

Frequencies (MHz)	
169.445	170.245
169.505	170.305
169.545	171.045
169.575	171.075
169.605	171.105
169.995	171.845
170.025	171.875
170.055	171.905

(1) On center frequencies 169.575 MHz, 170.025 MHz, 171.075 MHz, and 171.875 MHz, the emission bandwidth shall not exceed 200 kHz. On the other center frequencies listed in paragraph (b), the emission bandwidth shall not exceed 54 kHz.

* * * * *

APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Notice of Proposed Rulemaking (*Wireless Microphones NPRM*), *Promoting Spectrum Access for Wireless Microphone Operations*, GN Docket No. 14-166, and *Expanding the Economic and Innovation Opportunities of Spectrum through Incentive Auctions*, GN Docket No. 12-268;² and an IRFA was also incorporated in the companion *TV Bands Part 15 NPRM*.³ The Commission sought written public comment on the proposals in the *Wireless Microphones NPRM* and *TV Bands Part 15 NPRM*, including comment on the IRFAs. No comments were received in response to either IRFA. The Commission then set forth a Final Regulatory Flexibility Analysis (FRFA) in the Report and Order in each proceeding (*Wireless Microphones R&O* and *TV Bands Part 15 R&O*).⁴ No petitions for reconsideration were received in response to either FRFA. This present FRFA conforms to the RFA.⁵

A. Need for, and Objectives of, the Order on Reconsideration

2. This Order on Reconsideration responds to four petitions for reconsideration of the *Wireless Microphones R&O*, as well as three petitions for reconsideration of the *TV Bands Part 15 R&O* concerning unlicensed wireless microphone operations in the TV bands, the 600 MHz guard bands and duplex gap, and the 600 MHz service band.⁶ In response to these petitions, the Order takes the following actions: (1) replaces the spurious emission limits adopted in the *Wireless Microphones R&O* for licensed and unlicensed wireless microphones with the European Telecommunications Standards Institute (ETSI) spurious emission limits set forth in Section 8.4 of ETSI EN 300 422-1; (2) clarifies that wireless microphone manufacturers may show compliance with the 50 mW effective isotropically radiated power (EIRP) limit adopted in the *Wireless Microphones R&O* for licensed wireless microphones operating in

¹ See 5 U.S.C. § 603. The RFA, see 5 U.S.C. § 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² See *Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-166 and GN Docket No. 12-268, Notice of Proposed Rulemaking, 29 FCC Rcd 12343, 12403-18 (2014).

³ See *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-165 and GN Docket No. 12-268, Notice of Proposed Rulemaking, 29 FCC Rcd 12248, 12330-34 (2014).

⁴ See *Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-166 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 8739 (2015) (*Wireless Microphones R&O*); *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-165 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 9551 (2015) (*TV Bands Part 15 R&O*).

⁵ See 5 U.S.C. § 604.

⁶ See *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-165 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 9551 (2015) (*TV Bands Part 15 R&O*).

the VHF band by making either radiated or conducted measurements; (3) clarifies that wireless microphone manufacturers may show compliance with the 50 mW EIRP power limit adopted in the *Wireless Microphones R&O* for unlicensed wireless microphones operating in the VHF or UHF band by making either conducted or radiated measurements; (4) allows manufacturers of licensed and unlicensed wireless microphones that operate in the 600 MHz guards band and duplex gap the option to demonstrate compliance with the 20 mW power EIRP limit adopted in the *Wireless Microphones R&O* through conducted power measurements, as an alternative to EIRP measurements; (5) amends Section 15.203 of the Commission's rules to specify that the requirements of this section to use either a permanently attached antenna or a unique antenna connector do not apply to unlicensed wireless microphones operating under Section 15.236 of those rules (as codified in the *TV Bands Part 15 R&O*); (6) clarifies that, under the waiver in place at the time the Commission adopted the *TV Bands Part 15 R&O*, unlicensed wireless microphone users can continue to operate equipment that had been certified under Part 74, including equipment that can operate in portions of what becomes the 600 MHz service band following the incentive auction, until the end of the 39-month post auction transition; (7) describes a process by which certain professional theaters, music, and performing arts organizations that operate on an unlicensed basis may be able to obtain interference protection for their operations by applying for and obtaining a waiver of Part 74 license eligibility restrictions; (8) revises the center frequencies associated with two of the 200-kilohertz licensed wireless microphone channels in the 169-172 MHz band, and permits 54-kilohertz operations on four new channels that would correspond with these 200-kilohertz channels; and (9) clarifies how the 30 megahertz limit imposed by the *Wireless Microphones R&O* on licensed wireless microphone access to the 1435-1525 MHz band in a given geographic area applies with respect to different wireless microphone users and to particular areas of operations, to help accommodate more wireless microphone users that operate in the same general area.

3. Additionally, the Commission clarifies that applicants for LPAS licenses to operate wireless microphones on frequencies in the 941.5-944 MHz band are required to have their proposed operations successfully coordinated with Federal users prior to operating, consistent with the requirements that currently apply to the other non-Federal applicants and licensees that operate in this band.

4. The objectives of the Order on Reconsideration are to clarify and modify the Commission's rules so as to better facilitate licensed and unlicensed wireless microphone use of various frequency bands, and to ensure that wireless microphone use of those bands can take place on a non-interference basis to other users of those bands.

B. Statement of Significant Issues Raised by Public Comments in Response to the IRFA or Previous FRFA

5. There were no comments filed that specifically addressed the rules and policies proposed in either the *Wireless Microphones NPRM IRFA* or the *TV Bands Part 15 NPRM IRFA* or that specifically addressed the rules and policies adopted in either the *Wireless Microphones R&O FRFA* or the *TV Bands Part 15 R&O FRFA*.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

6. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA) and to provide a detailed statement of any change made to the proposed rules as a result of those comments.⁷ The Chief Counsel did not file any comments in response to either the proposed rules or the adopted rules in this proceeding.

⁷ 5 U.S.C. § 604(a)(3).

D. Description and Estimate of the Number of Small Entities to Which Rules Will Apply

7. The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the rules adopted herein.⁸ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁹ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.¹⁰ A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).¹¹

8. **Small Businesses, Small Organizations, and Small Governmental Jurisdictions.** Our action may, over time, affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three comprehensive, statutory small entity size standards.¹² First, nationwide, there are a total of 28.2 million small businesses, according to the SBA.¹³ In addition, a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹⁴ Nationwide, as of 2012, there were approximately 2,300,000 small organizations.¹⁵ Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁶ Census Bureau data for 2012 indicate that there were 90,056 local governments in the United States.¹⁷ In that year, the Census Bureau also estimates that the U.S. population was 313,998,379.¹⁸ Thus, each local government represented an average population of well under 50,000 (dividing 313,978,379 by 90,056 yields approximately 3,500), and we can conclude that most governmental jurisdictions are small.

9. **Low Power Auxiliary Station (LPAS) Licensees.** Existing LPAS operations are intended for uses such as wireless microphones, cue and control communications, and synchronization of TV camera signals. These low power auxiliary stations transmit over distances of approximately 100 meters.¹⁹ The appropriate LPAS size standard under SBA rules is for the category Wireless

⁸ 5 U.S.C. § 604(a)(3).

⁹ 5 U.S.C. § 601(6).

¹⁰ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

¹¹ 15 U.S.C. § 632.

¹² See 5 U.S.C. §§ 601(3)–(6).

¹³ See SBA, Office of Advocacy, “Frequently Asked Questions,” http://www.sba.gov/sites/default/files/FAQ_March_2014_0.pdf (last visited June 7, 2017; figures are from 2011).

¹⁴ 5 U.S.C. § 601(4).

¹⁵ NATIONAL CENTER FOR CHARITABLE STATISTICS, THE NONPROFIT ALMANAC (2012).

¹⁶ 5 U.S.C. § 601(5).

¹⁷ U.S. CENSUS BUREAU, GOVERNMENT ORGANIZATION SUMMARY REPORT: 2012 (rel. Sep. 26, 2013), http://www2.census.gov/govs/cog/g12_org.pdf (last visited June 7, 2017).

¹⁸ <https://www.census.gov/popclock>.

¹⁹ 47 CFR. § 74.801.

Telecommunications Carriers (except Satellite). The size standard for that category is that a business is small if it has 1,500 or fewer employees.²⁰ For this category, census data for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had employment of 999 or fewer employees.²¹ Thus, based on this data, we estimate that a majority of wireless firms can be considered small. There are more than 1,400 active LPAS licenses in all bands and more than 800 active LPAS licenses in the UHF spectrum,²² and we are confident that the great majority have employment of 999 or fewer employees.

10. Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing. This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment, including unlicensed devices. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, radio and television studio and broadcasting equipment.²³ The Small Business Administration has established a size standard for this industry of 750 or fewer employees. According to Census data for 2012, there were a total of 841 establishments in this category that operated for the entire year. Of this total, 819 establishments had employment of less than 500. Under this size standard the majority of such manufacturers can be considered small.

11. Other Communications Equipment Manufacturing. The Census Bureau defines this category as follows: “This industry comprises establishments primarily engaged in manufacturing communications equipment (except telephone apparatus, and radio and television broadcast, and wireless communications equipment).”²⁴ The SBA has developed a small business size standard for Other Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.²⁵ According to Census Bureau data for 2012, there were a total of 383 establishments in this category that operated for the entire year. Of this total, 379 establishments had employment below 500.²⁶ Thus, under this size standard, the majority of firms can be considered small.

12. Television Broadcasting. This Economic Census category “comprises establishments primarily engaged in broadcasting images together with sound. These establishments operate television broadcasting studios and facilities for the programming and transmission of programs to the public.”²⁷ The SBA has created the following small business size standard for Television Broadcasting firms: those having \$38.5 million or less in annual receipts.²⁸ The SBA has created the following small business size

²⁰ 13 CFR. § 121.201 (NAICS code 517210).

²¹ http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ5&prodType=table.

²² FCC, Universal Licensing System (ULS), available at <http://wireless.fcc.gov/uls/index.htm?job=home> (last visited June 7, 2017).

²³ <https://www.census.gov/cgi-bin/sssd/naics/naicsrch>.

²⁴ U.S. Census Bureau, *2012 NAICS Definitions: 334290 Other Communications Equipment Manufacturing*, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334290&search=2012> (last visited June 7, 2017).

²⁵ 13 CFR. § 121.201, NAICS code 334290.

²⁶ http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31SG2&prodType=table.

²⁷ U.S. Census Bureau, *2012 NAICS Definitions: 515120 Television Broadcasting*, (partial definition), <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=515120&search=2012> (last visited June 7, 2017).

²⁸ 13 CFR. § 121.201 (NAICS code 515120) (updated for inflation in 2010).

standard for Television Broadcasting firms: those having \$38.5 million or less in annual receipts.²⁹ The 2012 Economic Census reports that 1,975 television broadcasting establishments operated during that year. Of that number, 1,975 establishments had annual receipts of less than \$10 million per year. Based on that Census data we conclude that a majority of establishments that operate television stations are small.³⁰

13. The Commission, based on its own research, has estimated the number of licensed commercial television stations to be 1,388.³¹ In addition, according to Commission staff review of the BIA Advisory Services, LLC's *Media Access Pro Television Database* on March 28, 2012, about 950 of an estimated 1,300 commercial television stations (or approximately 73 percent) had revenues of \$14 million or less.³² We therefore estimate that the majority of commercial television broadcasters are small entities.

14. We note, however, that in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations must be included.³³ Our estimate, therefore, likely overstates the number of small entities that might be affected by our action because the revenue figure on which it is based does not include or aggregate revenues from affiliated companies. In addition, an element of the definition of "small business" is that the entity not be dominant in its field of operation. We are unable at this time to define or quantify the criteria that would establish whether a specific television station is dominant in its field of operation. Accordingly, the estimate of small businesses to which rules may apply does not exclude any television station from the definition of a small business on this basis and is therefore possibly over-inclusive to that extent.

15. In addition, the Commission has estimated the number of licensed noncommercial educational (NCE) television stations to be 396.³⁴ These stations are non-profit, and therefore considered to be small entities.³⁵

16. There are also 2,414 low power television stations, including Class A stations and 4,046 television translator stations.³⁶ Given the nature of these services, we will presume that all of these entities qualify as small entities under the above SBA small business size standard.

17. **Cable Companies and Systems.** The Commission has also developed its own small business size standards, for the purpose of cable rate regulation. Under the Commission's rules, a "small cable company" is one serving 400,000 or fewer subscribers, nationwide.³⁷ Industry data indicate that of

²⁹ 13 CFR § 121.201, NAICS code 515120.

³⁰https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ1&prodType=table.

³¹ See *FCC News Release*, Broadcast Station Totals as of December 31, 2013 (rel. January 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

³² We recognize that BIA's estimate differs slightly from the FCC total given.

³³ "[Business concerns] are affiliates of each other when one concern controls or has the power to control the other or a third party or parties controls or has to power to control both." 13 C.F.R. § 21.103(a)(1).

³⁴ See *FCC News Release*, Broadcast Station Totals as of December 31, 2013 (rel. January 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

³⁵ See generally 5 U.S.C. §§ 601(4), (6).

³⁶ See *FCC News Release*, Broadcast Station Totals as of December 31, 2013 (rel. January 8, 2014), http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0108/DOC-325039A1.pdf.

³⁷ 47 C.F.R. § 76.901(e). The Commission determined that this size standard equates approximately to a size standard of \$100 million or less in annual revenues. Implementation of Sections of the 1992 Cable Act: Rate Regulation, *Sixth Report and Order and Eleventh Order on Reconsideration*, 10 FCC Rcd 7393, 7408 (1995).

approximately 4,600 cable operators nationwide, all but eleven are small under this size standard.³⁸ In addition, under the Commission's rules, a "small system" is a cable system serving 15,000 or fewer subscribers.³⁹ Current Commission records show 4,600 cable systems nationwide.⁴⁰ Of this total, 3,900 cable systems have fewer than 15,000 subscribers, and 700 systems have 20,000 or more subscribers, based on the same records.⁴¹ Thus, under this standard, we estimate that most cable systems are small entities.

18. **Cable System Operators.** The Communications Act of 1934, as amended, also contains a size standard for small cable system operators, which is "a cable operator that, directly or through an affiliate, serves in the aggregate fewer than 1 percent of all subscribers in the United States and is not affiliated with any entity or entities whose gross annual revenues in the aggregate exceed \$250,000,000."⁴² The Commission has determined that an operator serving fewer than 677,000 subscribers shall be deemed a small operator, if its annual revenues, when combined with the total annual revenues of all its affiliates, do not exceed \$250 million in the aggregate.⁴³ Industry data indicate that of approximately 1,100 cable operators nationwide, all but ten are small under this size standard.⁴⁴ We note that the Commission neither requests nor collects information on whether cable system operators are affiliated with entities whose gross annual revenues exceed \$250 million,⁴⁵ and therefore we are unable to estimate more accurately the number of cable system operators that would qualify as small under this size standard.

19. **Direct Broadcast Satellite ("DBS") Service.** DBS service is a nationally distributed subscription service that delivers video and audio programming via satellite to a small parabolic "dish" antenna at the subscriber's location. DBS, by exception, is now included in the SBA's broad economic census category, Wired Telecommunications Carriers,⁴⁶ which was developed for small wireline firms. Under this category, the SBA deems a wireline business to be small if it has 1,500 or fewer employees.⁴⁷ To gauge small business prevalence for the DBS service, the Commission relies on data currently available from the U.S. Census for the year 2012. Census data for 2012 show that there were 3,117 firms that operated that year. Of this total, 3,083 operated with fewer than 1,000 employees. Based on this data, the majority of these firms can be considered small.⁴⁸ Currently, only two entities provide DBS service, which requires a great investment of capital for operation: DIRECTV and EchoStar Communications

³⁸ Industry Data, National Cable & Telecommunications Association, <https://www.ncta.com/industry-data> (last visited June 7, 2017); R.R. Bowker, *Broadcasting & Cable Yearbook 2010*, "Top 25 Cable/Satellite Operators," p. C-2 (data current as of December, 2008).

³⁹ 47 C.F.R. § 76.901(c).

⁴⁰ The number of active, registered cable systems comes from the Commission's Cable Operations and Licensing System (COALS) database on Aug. 28, 2013. A cable system is a physical system integrated to a principal headend.

⁴¹ August 5, 2015 report from the Media Bureau based on its research in COALS. See www.fcc.gov/coalsBureau.

⁴² 47 U.S.C. § 543(m)(2); see 47 C.F.R. § 76.901(f) & nn.1-3.

⁴³ 47 CFR. § 76.901(f); see Public Notice, *FCC Announces New Subscriber Count for the Definition of Small Cable Operator*, DA 01-158 (Cable Services Bureau, Jan. 24, 2001).

⁴⁴ R.R. Bowker, *Broadcasting & Cable Yearbook 2006*, "Top 25 Cable/Satellite Operators," pages A-8 & C-2 (data current as of June 30, 2005); Warren Communications News, *Television & Cable Factbook 2006*, "Ownership of Cable Systems in the United States," pp. D-1805 to D-1857.

⁴⁵ The Commission does receive such information on a case-by-case basis if a cable operator appeals a local franchise authority's finding that the operator does not qualify as a small cable operator pursuant to § 76.901(f) of the Commission's rules. See 47 CFR. § 76.909(b).

⁴⁶ See 13 CFR § 121.201 (NAICS code 517110).

⁴⁷ *Id.*

⁴⁸ http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

Corporation (“EchoStar”) (marketed as the DISH Network).⁴⁹ Each currently offers subscription services. DIRECTV⁵⁰ and EchoStar⁵¹ each report annual revenues that are in excess of the threshold for a small business. Because DBS service requires significant capital, we believe it is unlikely that a small entity as defined by the SBA would have the financial wherewithal to become a DBS service provider.

20. **Cable and Other Subscription Programming.** This industry comprises establishments primarily engaged in operating studios and facilities for the broadcasting of programs on a subscription or fee basis. The broadcast programming is typically narrowcast in nature (e.g., limited format, such as news, sports, education, or youth-oriented). These establishments produce programming in their own facilities or acquire programming. The programming material is usually delivered to a third party, such as cable systems or direct-to-home satellite systems, for transmission to viewers.⁵² The SBA size standard for this industry establishes as small any company in this category which receives annual receipts of \$38.5 million or less.⁵³ Based on U.S. Census data for 2012, a total of 725 establishments operated for the entire year.⁵⁴ Of that number, 13 establishments operated with annual receipts of \$25 million or less.⁵⁵ Based on this data, the Commission estimates that a small minority of establishments operating in this industry are small.

21. **Audio and Video Equipment Manufacturing.** This industry comprises establishments primarily engaged in manufacturing electronic audio and video equipment for home entertainment, motor vehicles, and public address and musical instrument amplification. Examples of products made by these establishments are video cassette recorders, televisions, stereo equipment, speaker systems, household-type video cameras, jukeboxes, and amplifiers for musical instruments and public address systems.⁵⁶ The SBA has classified the manufacturing of audio and video equipment under in NAICS Codes classification scheme as an industry in which a manufacturer is small if it has fewer than 750 employees.⁵⁷ Data contained in the 2012 U.S. Census indicate that 466 establishments operated in that industry for all or part of that year. In that year, 465 establishments had fewer than 500 employees.⁵⁸ Thus, under the applicable size standard, a majority of manufacturers of audio and video equipment may be considered small.

⁴⁹ See *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, Fifteenth Annual Report, MB Docket No. 12-203, 28 FCC Rcd 10496, 10507, para. 27 (2013) (“*15th Annual Report*”).

⁵⁰ As of June 2012, DIRECTV is the largest DBS operator and the second largest MVPD, serving an estimated 19.8% of MVPD subscribers nationwide. See *15th Annual Report*, 28 FCC Rcd at 687, Table B-3.

⁵¹ As of June 2012, DISH Network is the second largest DBS operator and the third largest MVPD, serving an estimated 13.01% of MVPD subscribers nationwide. *Id.* As of June 2006, Dominion served fewer than 500,000 subscribers, which may now be receiving “Sky Angel” service from DISH Network. See *id.* at 581, para. 76.

⁵² U.S. Census Bureau, *2012 NAICS Definitions: 515210 Cable and Other Subscription Programming*, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=515210&search=2012> (last visited June 7, 2017).

⁵³ See 13 CFR § 121.201 (NAICS code 515210).

⁵⁴ See U.S. Census Bureau, Table No. EC0751SSSZ1, Information: Subject Series - Establishment and Firm Size: Receipts Size of Establishments for the United States: 2007 (NAICS code 515210), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ1.

⁵⁵ https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ1&prodType=table.

⁵⁶ <http://www.census.gov/cgi-bin/sssd/naics/naicsrch>.

⁵⁷ 13 CFR § 121.201 (NAICS code 334310).

⁵⁸ https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_31SA1&prodType=table.

(continued....)

22. **Wireless Telecommunications Carriers (except satellite).** The Census Bureau defines this category as follows: “This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular phone services, paging services, wireless Internet access, and wireless video services.”⁵⁹ This industry also includes Personal Radio Services, which provide short-range, low power radio for personal communications, radio signaling, and business communications not provided for in other services. The Personal Radio Services include spectrum licensed under Part 95 of our rules.⁶⁰ These services include Citizen Band Radio Service (“CB”), General Mobile Radio Service (“GMRS”), Radio Control Radio Service (“R/C”), Family Radio Service (“FRS”), Wireless Medical Telemetry Service (“WMTS”), Medical Implant Communications Service (“MICS”), Low Power Radio Service (“LPRS”), and Multi-Use Radio Service (“MURS”).⁶¹ The appropriate size standard under SBA rules is for the category Wireless Telecommunications Carriers (except Satellite) is that a business is small if it has 1,500 or fewer employees.⁶² For this category, census data for 2012 show that there were 967 firms that operated for the entire year.⁶³ Of this total, 955 firms had employment of 1,000 or less.⁶⁴ Similarly, according to Commission data, 413 carriers reported that they were engaged in the provision of wireless telephony, including cellular service, PCS, and Specialized Mobile Radio (“SMR”) Telephony services.⁶⁵ Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.⁶⁶ Consequently, the Commission estimates that approximately half or more of these firms can be considered small. Thus, using available data, we estimate that the majority of wireless firms can be considered small.

23. However, we note that many of the licensees in these services are individuals, and thus are not small entities. In addition, due to the mostly unlicensed and shared nature of the spectrum utilized in many of these services, the Commission lacks direct information upon which to base a more specific estimation of the number of small entities under an SBA definition that might be directly affected by our action.

24. **Motion Picture and Video Production.** The Census Bureau defines this category as follows: “This industry comprises establishments primarily engaged in producing, or producing and distributing motion pictures, videos, television programs, or television commercials.”⁶⁷ The SBA has developed a small business size standard for this category, which is: all such businesses having \$30

⁵⁹ U.S. Census Bureau, *2012 NAICS Definitions: 517210 Wireless Telecommunications Carriers (except Satellite)*, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2012> (last visited June 7, 2017).

⁶⁰ 47 CFR Part 95.

⁶¹ The Citizens Band Radio Service, General Mobile Radio Service, Radio Control Radio Service, Family Radio Service, Wireless Medical Telemetry Service, Medical Implant Communications Service, Low Power Radio Service, and Multi-Use Radio Service are governed by subpart D, subpart A, subpart C, subpart B, subpart H, subpart I, subpart G, and subpart J, respectively, of part 95 of the Commission’s rules. *See generally* 47 C.F.R. Part 95.

⁶² 13 CFR § 121.201 (NAICS code 517210).

⁶³ http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ5&prodType=table.

⁶⁴ *Id.*

⁶⁵ *See Trends in Telephone Service* at Table 5.3.

⁶⁶ *See id.*

⁶⁷ U.S. Census Bureau, *2012 NAICS Definitions: 512110 Motion Picture and Video Production*, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=512110&search=2012> (last visited June 7, 2017).

million dollars or less in annual receipts.^{8,023} had annual receipts of \$24,999,999 or less.⁶⁸ Thus, under this size standard, the majority of such businesses can be considered small entities.

25. **Radio Stations.** The SBA defines a radio station as a small business if such station has no more than \$38.5 million in annual receipts.⁶⁹ Business concerns included in this industry are those “primarily engaged in broadcasting aural programs by radio to the public.”⁷⁰ Census data for 2012 show that 2,849 radio station firms operated during that year. Of that number, 2,806 operated with annual receipts of less than \$25 million per year.⁷¹ According to review of the BIA Publications, Inc. Master Access Radio Analyzer Database as of November 26, 2013, about 11,331 (or about 99.9 percent) of 11,341 commercial radio stations have revenues of \$35.5 million or less and thus qualify as small entities under the SBA definition. The Commission notes, however, that, in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations⁷² must be included. This estimate, therefore, likely overstates the number of small entities that might be affected, because the revenue figure on which it is based does not include or aggregate revenues from affiliated companies.

26. In addition, an element of the definition of “small business” is that the entity not be dominant in its field of operation. The Commission is unable at this time to define or quantify the criteria that would establish whether a specific radio station is dominant in its field of operation. Accordingly, the estimate of small businesses to which rules may apply does not exclude any radio station from the definition of a small business on this basis and therefore may be over-inclusive to that extent. Also, as noted, an additional element of the definition of “small business” is that the entity must be independently owned and operated. The Commission notes that it is difficult at times to assess these criteria in the context of media entities and the estimates of small businesses to which they apply may be over-inclusive to this extent.

27. **Electronics Stores.** The Census Bureau defines this economic census category as follows: “This U.S. industry comprises: (1) establishments known as consumer electronics stores primarily engaged in retailing a general line of new consumer-type electronic products such as televisions, computers, and cameras; (2) establishments specializing in retailing a single line of consumer-type electronic products; (3) establishments primarily engaged in retailing these new electronic products in combination with repair and support services; (4) establishments primarily engaged in retailing new prepackaged computer software; and/or (5) establishments primarily engaged in retailing prerecorded audio and video media, such as CDs, DVDs, and tapes.”⁷³ The SBA has developed a small business size standard for Electronic Stores, which is: all such firms having \$32.5 million or less in annual receipts.⁷⁴ According to Census Bureau data for 2012, there were 15,254 firms in this category that operated for the entire year.⁷⁵ Of this total, 15,165 firms had annual receipts of under \$25 million.⁷⁶ Thus, the majority of

⁶⁸https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ4&prodType=table.

⁶⁹ 13 CFR § 121.201, 2012 NAICS code 515112.

⁷⁰ U.S. Census Bureau, *2012 NAICS Definitions: 515112 Radio Stations*, <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=515112&search=2012> (last visited June 7, 2017).

⁷¹http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ5&prodType=tabl12

⁷² See n.14.

⁷³ U.S. Census Bureau, *2012 NAICS Definitions, 443142 Electronics Stores*, [http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=443142&search=2012 NAICS Search](http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=443142&search=2012%20NAICS%20Search) (last visited June 7, 2017).

⁷⁴ 13 CFR. § 121.201, NAICS code 443142.

⁷⁵https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_44SSSZ4&prodType=table.

⁷⁶ *Id.*

firms in this category can be considered small.

E. Description of Projected Reporting, Record Keeping, and Other Compliance Requirements for Small Entities

28. In the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, the Commission set forth the impact of its rule changes on wireless microphone users and manufacturers. The Order on Reconsideration in general provides these users and manufacturers increased flexibility with regard to measuring compliance with the applicable output power levels and clarifies how users can make greater use of the available spectrum in the 1435-1525 MHz band, all of which should prove beneficial with no additional reporting, record keeping, or compliance requirements. However, the Order's clarification that applicants for LPAS licenses to operate wireless microphones on frequencies in the 941.5-944 MHz band are required to have their proposed operations successfully coordinated with Federal users prior to operating will result in some LPAS applicants having to document their coordination with Federal users, if such users are operating in the same geographic area.

F. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

29. The RFA requires an agency to describe any significant alternatives that it has considered in developing its approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”⁷⁷

30. While the Order on Reconsideration generally upholds the rules adopted in the *Wireless Microphones R&O* and the *TV Bands Part 15 R&O*, it makes the changes and clarifications specified in Section A, paragraphs 2-3, *supra*, to those rules. These changes and clarifications facilitate licensed and unlicensed wireless microphone use of various frequency bands by permitting more flexibility in meeting the technical requirements relating to emission limits, more efficient use of the 169-172 MHz band, increased access to the 1435-1525 MHz band, and the possibility of interference protection for certain professional unlicensed wireless microphone users; resolving uncertainties in the rules regarding power requirements, when unlicensed microphones can continue to operate equipment certified under Part 74, and when wireless microphone applicants must coordinate; and providing wireless microphone manufacturers with greater flexibility in designing products to meet market demands. The Commission anticipates no adverse economic impact on small entities because, with one exception, the changes provide these entities benefits previously unavailable to them, as opposed to mandating new requirements on them. That exception involves the clarification that applicants for LPAS licenses to operate wireless microphones on frequencies in the 941.5-944 MHz band are required to have their proposed operations successfully coordinated with Federal users. However, the Commission believes that this requirement will impose only a *de minimis* burden. Significant alternatives considered include making no changes to the rules adopted in the *Wireless Microphones R&O* and in the *TV Bands Part 15 R&O* or making more extensive changes to those rules. However, the Commission finds that the relatively limited number of changes made in the Order and specified in Section A, paragraphs 2-3, *supra*, best balances the needs of wireless microphone users and manufacturers and other entities that use the same frequency bands by providing wireless microphone users and manufacturers increased flexibility to meet their requirements in those bands without impairing other entities' access to the bands.

⁷⁷ 5 U.S.C. § 603(c)(1)-(c)(4).

G. Report to Congress

31. The Commission will send a copy of the Order on Reconsideration, including this FRFA, in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act.⁷⁸ In addition, the Commission will send a copy of the Order including the FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Order and FRFA (or summaries thereof) will also be published in the Federal Register.⁷⁹

⁷⁸ See 5 U.S.C. § 801(a)(1)(A).

⁷⁹ See 5 U.S.C. § 604(b).

APPENDIX C

Proposed Rules

The Federal Communications Commission proposes to amend 47 CFR Part 74 as follows:

Part 74, Subpart H – LOW POWER AUXILIARY STATIONS

- 1. The authority citation for part 74 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303, 307, 309, 336, and 554.

- 2. Section 74.801 is amended by renaming the definition of “Large venue owner or operator” as “Venue owner or operator,” and by amending the definitions “Professional sound company” and “Venue owner and operator” to read as follows:

§ 74.801 Definitions

* * * * *

Professional sound company. Professional sound company refers to a person or organization that provides audio services that (a) routinely use 50 or more low power auxiliary station devices, where the use of such devices is an integral part of major events or productions, or (b) can demonstrate a need for, and the capability to provide, professional high-quality audio through use of low power auxiliary station devices, where the use is an integral part of events or productions. Routinely using 50 or more low power auxiliary station devices means that the professional sound company uses 50 or more such devices for most events or productions.

* * *

Venue owner or operator. A venue owner or operator refers to a person or organization that owns or operates a venue that (a) routinely uses 50 or more low power auxiliary station devices, where the use is an integral part of major events or productions, or (b) can demonstrate a need for, and the capability to provide, professional high-quality audio through use of low power auxiliary station devices, where the use is an integral part of events or productions. Routinely using 50 or more low power auxiliary station devices means that the venue owner or operator uses 50 or more such devices for events or productions.

* * * * *

- 3. Section 74.832 is amended to revise subsection 74.832(7) to read as follows:

§ 74.832 Licensing requirements and procedures

* * * * *

(a)(7) Venue owners or operators as defined in § 74.801.

* * * * *

APPENDIX D**Initial Regulatory Flexibility Analysis**

1. As required by the Regulatory Flexibility Act (RFA), the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this Further Notice of Proposed Rule Making (Further Notice).¹ Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments provided on the first page of this Further Notice. The Commission will send a copy of this Further Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).² In addition, the Further Notice and IRFA (or summaries thereof) will be published in the Federal Register.³

A. Need for, and Objectives of, the Proposed Rules

2. This proceeding is initiated to explore whether certain professional theater, music, performing arts, or similar organizations that operate wireless microphones on an unlicensed basis and meet certain criteria should be permitted to: (1) obtain Part 74 licenses in the TV bands to enable them to register in the white spaces databases for interference protection from unlicensed white space devices that operate in those bands, and to access the portion of spectrum available to licensed wireless microphone users in the 600 MHz duplex gap (specifically, the 653-657 MHz portion); and (2) obtain Part 74 licenses to operate in other bands available for use by Part 74 licensed wireless microphone licensees, including portions of the 900 MHz, 1435-1525 MHz, and 6975-7125 MHz bands, provided that they meet the applicable requirements for operating in those bands. We observe that use of unlicensed wireless microphones by these organizations significantly enhances event productions in a variety of settings, but recent actions by the Commission to repurpose portions of the TV bands for the 600 MHz wireless services (most frequencies corresponding to TV channels 38-51, which has been available for use by unlicensed wireless microphones) will reduce the frequencies available to these organizations.

B. Legal Basis

3. The proposed action is authorized under Sections 1, 4(i), 4(j), 7(a) 301, 302(a), 303(f), 307(e), and 332 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 157(a), 301, 302(a), 303(f), 307(e), and 332.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Will Apply

4. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.⁴ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁵ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁶ A small business

¹ See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

² See 5 U.S.C. § 603(a).

³ See *id.*

⁴ 5 U.S.C. § 603(b)(3).

⁵ 5 U.S.C. § 601(6).

⁶ 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more

(continued....)

concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.⁷

5. **Low Power Auxiliary Station (LPAS) Licensees.** The proposals set forth in the Further Notice will apply to certain theater, music production, and performing arts, and similar organizations that currently use wireless microphones on an unlicensed – rather than licensed – basis to meet their audio service needs because they fail to meet the 50 microphone license eligibility requirement to be a “large venue or operator” or “professional sound company” under the Commission’s Rules for Part 74 Low Power Auxiliary Stations.⁸ If the proposals are adopted, certain of these organizations would qualify for LPAS licenses, whose operations are intended for uses that include not only wireless microphones, but also cue and control communications and synchronization of TV camera signals. These low power auxiliary stations transmit over distances of approximately 100 meters.⁹ The appropriate LPAS size standard under SBA rules is for the category Wireless Telecommunications Carriers (except Satellite). The size standard for that category is that a business is small if it has 1,500 or fewer employees.¹⁰ For this category, census data for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had employment of 999 or fewer employees.¹¹ Thus, based on this data, we estimate that a majority of wireless firms can be considered small. There are more than 1,400 active LPAS licenses in all bands and more than 800 active LPAS licenses in the UHF spectrum.¹²

6. We anticipate that only a small percentage of all theater, music production, performing arts, and similar organizations that use unlicensed wireless microphones in their productions will qualify for Part 74 venue licenses and thus become LPAS licensees. Specifically, we estimate that the number of qualifying organizations will be fewer than 500 nationwide.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

7. Under the proposal set forth in the Further Notice, and consistent with the Commission’s general approach to permitting limited registration by certain qualifying unlicensed wireless microphone users, an unlicensed wireless microphone applicant for a Part 74 license to operate in the TV bands would be required to establish that: (1) it has identified all of the vacant TV channels in the repacked TV bands and the spectrum in the 600 MHz guard band available for unlicensed wireless microphone operations that is not shared with white space devices at its location, (2) it is already making full use of this available spectrum in these bands for its unlicensed wireless microphone operations, and (3) access to more spectrum in these bands is needed for its major events or productions, based on a showing of its particular needs at that specified location. Additionally, an unlicensed wireless microphone applicant for a Part 74 license to operate in the TV bands would be required to demonstrate in its application that its needs for high-fidelity audio services for its audiences are identical or substantially similar to those of current Part 74 licensees, and that it has the professional-level technical and operational capabilities to carry out its responsibilities as a licensee.

definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

⁷ Small Business Act, 15 U.S.C. § 632 (1996).

⁸ 47 CFR § 74.801.

⁹ *Id.*

¹⁰ 13 CFR § 121.201 (NAICS code 517210).

¹¹ http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_51SSSZ5&prodType=table.

¹² FCC, Universal Licensing System (ULS), available at <http://wireless.fcc.gov/uls/index.htm?job=home> (last visited June 7, 2017).

8. Similarly, an unlicensed wireless microphone applicant to obtain a Part 74 license to operate in other bands would be required to demonstrate that additional spectrum may be needed for its events/productions at its particular location. For instance, under the Commission's specific rules for operating wireless microphones in portions of the 900 MHz band and 6975-7125 MHz bands, wireless microphone licensees are required to coordinate their proposed operations to ensure that harmful interference would not result, and there are distinct equipment requirements and special coordination requirements that apply to any operation in the 1435-1525 MHz band. Accordingly, as an additional requirement for obtaining a Part 74 license for operation in the particular bands outside of the TV bands, an applicant for a Part 74 LPAS license would be required to demonstrate that it could meet these coordination requirements or other requirements (e.g., technical compliance) with respect to its proposed location of operation.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

9. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.¹³

10. In the Further Notice, we are attempting to satisfy a request from the wireless microphone industry that would afford certain unlicensed wireless microphone operators the opportunity to obtain licensed use of the TV bands, 600 MHz guard band, and portions of other bands. Accordingly, our proposal is intended to benefit those operators, rather than to impose new requirements on them. However, we need to ensure that this new licensed use can take place without preventing other uses of those bands, and also ensure that harmful interference is not caused to other users by those operators; e.g., by operating in close proximity to those other users. Thus, we have proposed what we believe are the minimum necessary coordination and other requirements on those operators to ensure that their proposed use of those bands will not impair access to those bands by other users. We are unaware of any alternative approaches that would provide the benefits of licensed use to those operators in a manner that would reduce the compliance burden on them, while also not impairing use of the bands proposed to be made available to them. However, we solicit comment on any such alternatives.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule

11. None.

¹³ See 5 U.S.C. § 603(c).