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

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

REPORT AND ORDER

Adopted: August 5, 2015 **Released: August 11, 2015**

By the Commission: Chairman Wheeler and Commissioners Clyburn and Pai issuing separate statements; Commissioner O'Rielly approving in part, dissenting in part, and issuing a statement.

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I. INTRODUCTION

1. In this Report and Order, we take several steps to accommodate the long-term needs of wireless microphone users.[1] 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. They 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. In particular, we provide additional opportunities for wireless microphone operations in the TV bands following the upcoming incentive auction,[2] and we provide new opportunities for wireless microphone operations to access spectrum in other frequency bands where they can share use of the bands without harming existing users.

2. The repurposing of broadcast television band spectrum for wireless services set forth in the *Incentive Auction R&O*, will significantly alter the regulatory environment in which wireless microphones operate.[3] Currently, wireless microphone users rely heavily on access to unused channels in

[1] When we use the term "wireless microphones" in this proceeding, we collectively refer to wireless microphones and related audio devices. *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, 12346 ¶ 5 n.6 (2014) (*NPRM*).

[2] *See* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order*, 29 FCC Rcd 6567, 6704 ¶ 316 (2014) (*Incentive Auction R&O*) (stating the Commission's intent to initiate a proceeding to explore steps to accommodate the long-term needs of wireless microphone users).

[3] *See generally id.* at 6696-6704 ¶¶ 299-316, 6844-6847 ¶¶ 682-688. *See also* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Second Order on*

(continued….)

the television bands. Following the incentive auction, with the repacking of the television band and the repurposing of current television spectrum for wireless services, there will be fewer frequencies in the UHF band available for use for wireless microphone operations. The Commission took several steps in the *Incentive Auction R&O* to accommodate wireless microphone operations – including providing more opportunities to access spectrum on the channels that will remain allocated for television post-auction and making the 600 MHz Band guard bands available for wireless microphone operations – while also recognizing that the reduction of total available UHF band spectrum will require many wireless microphone users to make adjustments over the next few years regarding the spectrum that they access and the equipment they use.[4] To facilitate wireless microphone users' ability to make these adjustments, the Commission provided that users could continue to access spectrum repurposed for wireless services during the post-auction transition period, under specified conditions, as they transition affected services to alternative spectrum.[5]

3. This proceeding was initiated to explore steps to address wireless microphone users' longer term needs.[6] The actions we are taking in this Order make additional spectrum resources available to accommodate wireless microphones users' needs over the long term.[7] Our goal is to enable the development of a suite of devices that operate in different bands and can meet wireless microphone users' various needs while efficiently sharing the spectrum with other users.

II. BACKGROUND

4. In this proceeding we use the term "wireless microphones" to reference wireless microphones and other related wireless audio devices.[8] As we discussed in more detail the *NPRM*, 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

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Reconsideration, 30 FCC Rcd 6746, 6803-6806 ¶¶ 126-130 (2015) (denying petitions for reconsideration affecting wireless microphones).

[4] *See Incentive Auction R&O*, 29 FCC Rcd at 6696-6704 ¶¶ 299-315.

[5] *See id.* at 6844-6847 ¶¶ 682-688 (wireless microphone users may continue to access the repurposed 600 MHz band during the post-auction period provided that they do not cause harmful interference to any 600 MHz band licensee's operations).

[6] *Id.* at 6704 ¶ 316.

[7] In addition to the actions we are taking in this proceeding, we are taking several steps in the *Part 15 Report and Order* that affect wireless microphone operations in the TV bands, the 600 MHz Band guard bands (including duplex gap), and the spectrum repurposed for 600 MHz Band wireless services. *See generally* 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; 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; and Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Report and Order,* __ FCC Rcd __ (Part 15 Report and Order) (released Aug. 11, 2015) (FCC 15-99). With respect to wireless microphones, that order generally addresses technical rules for unlicensed wireless microphones in the TV bands and for wireless microphone operations in the 600 MHz Band guard bands (including the duplex gap) and repurposed 600 MHz wireless band. We cross-reference that proceeding where appropriate.

[8] The devices encompassed under the term "wireless microphones" include wireless microphones and other related wireless audio devices such as cue and control communications, synchronization of TV camera signals, and in-ear monitors. These devices are, for instance, authorized on a licensed basis under the rules applicable for "low power auxiliary stations" under the Commission's Part 74 rules. *See* 47 C.F.R. § 74.801 (defining "low power auxiliary station"). They operate in several different bands, both on licensed and unlicensed basis, under pursuant to the applicable rules in those bands. To the extent that the devices serve to provide these same or similar types of functions, we refer to them generally as wireless microphones.

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.

A. Wireless Microphone Operations

5. Under current rules, the Commission has authorized wireless microphones to operate both on a licensed basis, limited to specified users, and on an unlicensed basis. The table below sets forth the bands in which wireless microphones and related audio devices generally operate today pursuant to the Commission's rules.[9]

Frequency Band	*Licensed/unlicensed*	*Rule Part*
26.1-26.48 MHz (VHF)	Licensed	Part 74
161.625-161.775 MHz (VHF)	Licensed	Part 74
Portions of 169-172 MHz band (VHF)	Licensed	Part 90
88-108 MHz (FM)	Unlicensed	Part 15
450-451, 455-456 MHz (UHF)	Licensed	Part 74
54-72, 76-88, 174-216, 470-608, 614-698 MHz (VHF and UHF)	Licensed and unlicensed	Part 74 and Part 15 (waiver)
944-952 MHz (UHF)	Licensed	Part 74
902-928 MHz, 2.4 GHz, 5 GHz (ISM bands)	Unlicensed	Part 15
1920-1930 MHz (unlicensed PCS)	Unlicensed	Part 15
Ultra-wideband (3.1-10.6 GHz)	Unlicensed	Part 15

6. *Recent actions affecting operations in the TV bands.* Most wireless microphones users today operate their devices on a secondary basis in the TV bands, with most operations occurring in the UHF TV bands.[10] Recent actions taken by the Commission in three proceedings affecting the TV bands spectrum – which have involved the repurposing of UHF TV band spectrum for wireless services in the 700 MHz band (channels 52-69, the 698-806 MHz band),[11] the development of rules for TV white space devices in the TV bands,[12] and the repurposing of the 600 MHz Band following the upcoming incentive auction[13] – have affected and will affect the future availability of spectrum for wireless microphone users and uses in these bands.[14] These proceedings inform the instant proceeding, providing the backdrop for

[9] *See generally NPRM*, 29 FCC Rcd at 12346-49 ¶¶ 6-15. Apart from operating wireless microphones in these bands, some wireless microphone users have gained access to other bands, such as the 1435-1525 MHz band, for temporary operations under specified conditions. *Id.* at 12349 ¶ 16.

[10] *See generally id.* at 12349-52 ¶¶ 17-29.

[11] *See generally* In the Matter of 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, ET Docket No. 10-24, *Report and Order and Further Notice of Proposed Rulemaking*, 25 FCC Rcd 643, 652-691 ¶¶ 20-106 (2010) (*TV Bands Wireless Microphones R&O and Further Notice*).

[12] *See generally* Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, ET Docket No. 04-186 and 02-380, *Second Memorandum Opinion and Order*, 25 FCC Rcd 18661 (2010) (*TV White Spaces Second MO&O*). These devices have commonly been referenced as "TVWS devices," but going forward will be referenced as "white space devices." *See* Part 15 Report and Order, paragraph 23.

[13] *See generally Incentive Auction R&O*, 29 FCC Rcd at 6696-6704 ¶¶ 299-316, 6844-6847 ¶¶ 682-688.

[14] *NPRM*, 29 FCC Rcd at 12347-12348 ¶¶ 10-12.

many of the issues we are addressing in our efforts here to accommodate wireless microphone users and uses both in the near and longer term.

7. In the *Incentive Auction R&O* (GN Docket No. 12-268) adopted in May 2014, the Commission adopted rules to implement the broadcast television spectrum incentive auction, which will involve reorganizing the existing television band and repurposing a portion of the UHF television band for new wireless broadband services, and which will affect wireless microphone operations across the current TV bands.[15] As part of its decision, the Commission took several actions to accommodate wireless microphone operations, including making rule revisions to provide additional opportunities for wireless microphone operations in the bands that will remain allocated for television following the incentive auction,[16] permitting wireless microphone operations in the newly-designated 600 MHz Band guard bands,[17] and providing for a transition period to give wireless microphone users that will need to cease operating in the spectrum repurposed for 600 MHz Band wireless services sufficient time to replace their equipment and move operations to other spectrum bands available for wireless microphone uses.[18]

8. Finally, concurrent with adoption of the *Incentive Auction R&O*, the Commission adopted the *TV Bands Wireless Microphones Second R&O* (part of WT Dockets 08-166 and 08-167, ET Docket No. 10-24) to broaden the eligibility for wireless microphone operations in the TV bands to include entities that regularly utilize a substantial number of wireless microphones for large events and productions and which have the same needs for interference protection as existing low power auxiliary station (LPAS) licensees. Specifically, the Commission expanded Part 74 LPAS eligibility to include qualifying professional sound companies and operators of large venues that routinely use 50 or more wireless microphones.[19]

B. Wireless Microphones NPRM

9. In the *NPRM*, we examined wireless microphone users' needs and technologies that can address them, and sought broad comment on a variety of existing and new spectrum bands that might accommodate those needs in the future. We presented an overview of current wireless microphone operations, and observed that most wireless microphone operations today occurred in the TV bands. We also generally discussed wireless microphone operations in other bands, both on a licensed and an unlicensed basis. We discussed the many different types of users and uses (e.g., broadcasters, major sports leagues and theater/entertainment venues, houses of worship, conference centers, corporations, schools, etc.), different types of wireless microphones serving specific needs and applications (from

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[15] *See generally Incentive Auction R&O*, 29 FCC Rcd 6567. *See also* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Second Order on Reconsideration*, 30 FCC Rcd at 6803-6806 ¶¶ 126-130 (2015) (affirming decisions affecting wireless microphones).

[16] *Id.* at 6697-6702 ¶¶ 303-311.

[17] *Id.* at 6703-6704 ¶¶ 313-315.

[18] *Id.* at 6847 ¶¶ 686-688. In June 2015, following up on the intent stated by the Commission in the *Incentive Auction Report and Order*, the Commission adopted a Notice of Proposed Rulemaking seeking comment on preserving a vacant TV channel for shared use by wireless microphones and unlicensed white space devices following the auction. Amendment of Parts 15, 73 and 74 of the Commission's Rules to Provide for the Preservation of One Vacant Channel in the UHF Television Band for Use by White Space Devices and Wireless Microphones; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, MB Docket No. 15-146, GN Docket No. 12-268, 30 FCC Rcd 6711 (2015).

[19] *See generally* In the Matter of 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, ET Docket No. 10-24, *Second Report and Order*, 29 FCC Rcd 6103 (2014) (*TV Bands Wireless Microphones Second R&O*). No parties sought reconsideration of this decision.

extremely sophisticated, high fidelity microphones used in a professional setting, to microphones that do not require the same level of audio quality or performance to meet particular needs), and varying operational environments (both outdoor and indoor). We also noted that there had been many technological advances in recent years, and that many operations were being migrated to bands outside of the TV bands, including in bands available for unlicensed operations. Given that wireless microphones serve the needs of diverse users for different types of applications, and make use of several different frequency bands, we sought to develop a full record and framework for how best to accommodate these needs in the near and over the long term.[20] In response to the *NPRM*, we received nearly 90 comments and 17 reply comments.

III. DISCUSSION

10. In this Report and Order, we take several actions to accommodate wireless microphone users' needs in the coming years. Many types of users employ wireless microphones in a variety of settings. Wireless microphone operations range from professional uses, with the need for numerous high-performance microphones along with other microphones, to an individual consumer's use of a handheld microphone at a conference or in a karaoke bar. Through these actions, we seek to enable wireless microphone users to have access to a suite of devices that operate effectively and efficiently in different spectrum bands and can address their respective needs.

11. As discussed below, we adopt several changes in our rules for operations in the TV bands, where most wireless microphone operations occur today. With respect to the TV bands, we revise our rules to provide more opportunities to access spectrum by allowing greater use of the VHF channels and more co-channel operations without the need for coordination where use would not cause harmful interference to TV service. We also expand eligibility for the licensed use of the duplex gap to all entities now eligible to hold LPAS licenses for using TV band spectrum. We also will require new wireless microphones operating in the TV bands and certain other bands to meet the more efficient analog and digital ETSI standards, which will ensure more efficient use of the spectrum. In addition, we address consumer education and outreach efforts that can help consumers 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. We also take several additional actions with respect to other spectrum bands currently available for wireless microphone operations to enable greater use of these bands to accommodate wireless microphone uses in the future. Specifically, we adopt revisions to provide new opportunities for such use in the 169-172 MHz band and the 944-952 MHz band. Finally, we open 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.

A. Promoting Technological Advances

12. In the *NPRM*, we inquired about advances in the state of analog and digital wireless microphone technologies and the extent to which these technologies could be made more efficient for different types of operations, thereby increasing the number of microphones that could access a given amount of spectrum. In particular, we asked whether we should adopt more spectrally efficient analog and digital emission masks for operations in certain bands.[21] We also sought comment on other technological advances that could promote more opportunities for accommodating wireless microphone operations in different bands over the long term – including development of equipment with replaceable components, expanding the tunability of equipment within bands, the development of multi-band equipment, the use of databases, or the use of electronic keys or similar mechanisms.[22]

[20] *See generally NPRM*, 29 FCC Rcd 12343.

[21] *Id.* at 12356-57 ¶¶ 51-60.

[22] *Id.* at 12358-59 ¶¶ 61-67.

13. Wireless microphone manufacturers assert that significant steps have already been taken to make for more efficient use of available spectrum, including the increasing use of newer digital technologies that can greatly expand the number of microphones on a TV channel for many types of applications that do not require the highest sound fidelity.[23] Several also state that more devices are increasingly being designed for operations in bands outside of the TV bands, including in bands permitting unlicensed operations, and that these new devices can efficiently and effectively accommodate many wireless microphone users' needs.[24] Wireless microphone manufacturers generally asserted that adopting rules that require specific features (e.g., modular components, use of multi-band equipment, requirement for database connectivity, or use of electronic keys) are unnecessary and could impair design features and add costs and complexities.[25]

14. While many wireless microphone manufacturers explain that they are already committed to harnessing technological advances in this area, we reiterate the importance of improved spectral efficiency, spectrum sharing, and flexibility. We expect wireless microphone manufacturers to continue to take advantage of technological advances to promote more efficient use of spectrum available for wireless microphone operations. To further promote efficient use, we also are taking the step of adopting the more efficient ETSI standards for wireless microphones in several bands, as discussed below. We also anticipate that future technological advances will enable wireless microphones to more effectively share the available spectrum resource, and require use of certain technological advances to protect incumbent operation when authorizing wireless microphone users to access the 1435-1525 MHz band spectrum in the future.[26]

B. Operations in Specific Bands

15. In the sections below, we address the actions that we are taking in this Report and Order with respect to wireless microphone operations in different spectrum bands. We discuss each of the bands on which we sought comment in the *NPRM*, and our decisions regarding these bands and any revisions that we are adopting.

1. VHF/UHF Television Bands

a. Background

16. The Commission's current Part 74, Subpart H rules authorize operations of wireless microphones and other LPAS on a licensed basis in the bands allocated for TV broadcasting (Channels 2-51, except channel 37).[27] These LPAS devices are intended to transmit over distances of approximately 100 meters. In addition to wireless microphones, these LPAS devices include such uses as cue and control communications and synchronization of TV camera signals.[28] The Commission's rules permit licensed LPAS operations on a secondary, non-exclusive basis.[29] Entities eligible to hold these LPAS

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[23] *See, e.g.*, Shure Comments at 26 (stating that over the last five years, Shure and other manufacturers have achieved roughly a two-fold improvement in professional audio wireless microphone efficiency, such that current generation hardware enables a six-megahertz TV channel to accommodate between 14-16 professional audio wireless microphone channels).

[24] *See, e.g.*, Lectrosonics Comments at 9; Sennheiser Comments at 6; Shure Comments at 8-9, 36.

[25] *See, e.g.*, Sennheiser Comments at 13-14; Shure Comments at 28-29.

[26] See Section III.B.7, below.

[27] 47 C.F.R. §§ 74.801 *et seq.* ("Subpart H – Low Power Auxiliary Stations").

[28] 47 C.F.R. § 74.801 (definition of "low power auxiliary station").

[29] *See generally* 47 C.F.R. §§ 74.801 *et seq.* (Subpart H – Low Power Auxiliary Stations). The Commission's rules provide that LPAS operations are limited to locations removed from existing co-channel TV broadcasting stations by not less than certain distances specified in the rules (unless otherwise authorized), *id.* § 74.802(b), that LPAS licensees will not be granted exclusive frequency assignments, *id.* § 74.802(d), that selection of frequencies for

(continued….)

licenses include broadcasters, television producers, cable producers, motion picture producers, and qualifying professional sound companies and operators of large venues.[30] Since 2010, the Commission also has permitted unlicensed operations of wireless microphones in the core television bands (channels 2-51, except channel 37) pursuant to a limited waiver and certain Part 15 rules until such time as final rules for unlicensed operations under Part 15 are adopted.[31]

17. Under the Part 74 LPAS rules, licensed wireless microphones are permitted to operate with a maximum bandwidth of 200 kHz (made up of one or more 25 kHz segments).[32] In the VHF band (channels 2-13, which include the 54-72 MHz, 76-88 MHz, and 174-216 MHz frequencies) power levels are limited to 50 mW, whereas in the UHF band (channels 14-51, except channel 37, which include the 470-608 MHz and 614-698 MHz frequencies), power levels can range up to 250 mW.[33] The power levels for unlicensed wireless microphone operations pursuant to waiver, however, are limited to no more than 50 mW throughout the TV bands (both VHF and UHF).[34] Licensed and unlicensed wireless microphones may operate co-channel with television stations at locations that are separated from television stations by at least 4 kilometers from their protected contours.[35] In addition, licensed LPAS users may operate on a co-channel basis even closer to television stations provided that such operations have been coordinated with affected broadcasters.[36]

18. The particular television channels available for wireless microphone operations will vary depending on the specific location. In many instances these channels also are available for use by unlicensed white space devices.[37] The Commission currently designates the two unused television channels (where available) nearest channel 37 (above and below) for wireless microphone uses,

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operations shall be guided by the need to avoid interference with TV broadcast reception, and that station usage is "secondary to TV broadcasting and land mobile stations" operating in the spectrum allocated for TV broadcasting and "must not cause harmful interference." *Id*. § 74.803(b). In 2014, the Commission first permitted licensing of the qualifying professional sound companies and operators of large venues. *See generally TV Bands Wireless Microphones Second Report and Order*, 29 FCC Rcd 6103.

[30] 47 C.F.R § 74.832(a).

[31] *TV Bands Wireless Microphones R&O and Further Notice.* In the Further Notice portion of that order, the Commission sought comment on appropriate final rules for unlicensed operations in these TV bands, proposing technical rules for "Wireless Audio Devices" that could use either analog or digital modulation techniques. *TV Bands Wireless Microphones R&O and Further Notice*, 25 FCC Rcd at 692-696 ¶¶ 109-123. As noted above, in 2014 the Commission issued the *Part 15 NPRM* seeking comment on codifying the rules for unlicensed wireless microphone operations in the TV bands, 600 MHz guard bands, and repurposed 600 MHz Band spectrum following the incentive auction. *See Part 15 NPRM*, 29 FCC Rcd at 12292-99 ¶¶ 145-169. In the Part 15 Report and Order, adopted concurrently with the instant order, the Commission adopts the applicable rules for unlicensed wireless microphone operations in these bands. *See* Part 15 Report and Order, Section IV.A.4.

[32] 47 C.F.R. § 74.802(c).

[33] 47 C.F.R. § 74.861(e).

[34] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 684 ¶ 84.

[35] *See* 47 C.F.R. § 74.802(b)(1) (as newly revised by the *Incentive Auction R&O*). See *Incentive Auction R&O*, 29 FCC Rcd at 6698-6699 ¶¶ 305-306.

[36] *Incentive Auction R&O*, 29 FCC Rcd at 6699-6700 ¶ 307; 47 C.F.R. § 74.802(b)(2) (as revised by the *Incentive Auction R&O*).

[37] Under current rules, some unused TV channels available for use by wireless microphones are not available for white space devices. These devices The Part 15 Report and Order revises these rules to make more unused TV channels available for white space devices. *See* Part 15 Report and Order, Sections IV.A.1, IV.A.3.

prohibiting white space devices on those channels.[38] As discussed in the *Incentive Auction R&O*, following the incentive auction, these two channels will no longer be designated exclusively for wireless microphones following the repacking of the TV bands.[39] On channels where both wireless microphones and white space devices may operate, licensed LPAS operators – including the newly eligible professional sound companies and venue licensees – will be able to register to obtain protection from interference from white space devices by reserving channel(s), on an as-needed basis, at specified locations and times of operation in the broadcast TV bands databases.[40] In addition, under existing rules certain qualifying unlicensed wireless microphone operators can obtain interference protection from unlicensed white space devices at specified times by registering with the Commission, enabling them to have their operations included within the broadcast TV bands databases.[41] The Commission also indicated that it would be taking steps in the Part 15 proceeding to make improvements to the registration system in the TV bands databases to enable more timely and effective reservation of channels that would be protected from unlicensed white space device operations.[42]

19. As set forth in the *Incentive Auction R&O*, the current VHF/UHF television bands (channels 2-51, except channel 37) will be reorganized following the upcoming incentive auction. As a result of this auction, the amount of spectrum allocated for television services will be reduced and repacked, some of the current TV bands spectrum will be designated for 600 MHz Band guard bands (including the duplex gap), and other TV bands spectrum will be repurposed for 600 MHz Band wireless services. As discussed below, these revisions will affect wireless microphone operations, which currently operate throughout in existing TV bands, in several ways. In the *NPRM*, we sought comment on wireless microphone operations with respect to each of these bands – the TV bands, the 600 MHz Band guard bands, and the 600 MHz Band being repurposed for wireless services.

b. Discussion

20. In this section, we set forth Part 74 rule revisions to accommodate licensed wireless microphone (and other LPAS) operations in the VHF and UHF spectrum in the repacked TV bands that will continue to be available for TV broadcast services following the incentive auction. As explained in the *NPRM*, we are not addressing in this proceeding certain issues relating to wireless microphone operations in the TV bands and in the repurposed 600 MHz Band since these matters are being addressed instead in the Part 15 proceeding.[43] In particular, we do not here address the rules for unlicensed wireless microphone operations in the TV bands and the repurposed 600 MHz Band, which are addressed as part of the Part 15 Report and Order.[44] Similarly, we do not address in this proceeding the technical rules for operations of unlicensed wireless microphones in the guard bands, including the duplex gap.[45] Nor do we

[38] *TV White Spaces Second MO&O*, 25 FCC Rcd at 18671-18677 ¶¶ 25-36; 47 C.F.R. §15.707(a); *see also id.* § 15.712(f)(2).

[39] *Incentive Auction R&O*, 29 FCC Rcd at 6701-6702 ¶¶ 309-310.

[40] *TV White Spaces Second MO&O*, 25 FCC Rcd at 18675-18676 ¶ 33; 47 C.F.R. § 15.712(f) and 713(h)(8).

[41] *TV White Spaces Second MO&O*, 25 FCC Rcd at 18675-18676 ¶¶ 32-33; 47 C.F.R. § 15.713(h)(9). Wireless microphone use also is authorized on licensed and unlicensed bases on frequencies outside of the core TV bands.

[42] *Incentive Auction R&O*, 29 FCC Rcd at 6702 ¶ 311, 6845-6846 ¶ 685. In the *Part 15 NPRM*, the Commission proposed steps to enable more timely registration for protection in the databases, while also proposing to eliminate registration by unlicensed wireless microphone users for protection. *Part 15 NPRM*, 29 FCC Rcd 12304-08 ¶¶ 184-196. In the Part 15 Report and Order, the Commission adopted changes to the database procedures, and eliminated registration by unlicensed wireless microphone users for protection. *See* Part 15 Report and Order, Section IV.E.2.

[43] *NPRM*, 29 FCC Rcd at 12362 ¶ 74.

[44] Part 15 Report and Order, Sections IV.A 4 and IV.C.2 (Wireless microphones in the TV bands and repurposed 600 MHz Band).

[45] *Id.*, Section IV.B(Wireless microphones in the 600 MHz guard bands and duplex gap).

address here the technical rules for licensed wireless microphone operations in the duplex gap, since the technical issues relating to their operations are intertwined with the technical issues concerning unlicensed operations in the duplex gap and protection of licensed operations outside of the duplex gap.[46] Finally, we address revisions pertaining to the white spaces databases in the Part 15 Report and Order.[47]

(i) TV Bands

(a) VHF band revisions

21. *Background.* Under the existing technical rules for LPAS operations under Part 74, licensed wireless microphone users that operate on a secondary basis in the VHF band (channels 2-13) operate generally under the same technical rules as for operations in the UHF bands.[48] However, with respect to power levels, VHF band operations are restricted to no more than 50 mW, well below the 250 mW levels permitted for operations in the UHF bands.[49]

22. In the *NPRM*, we sought comment on the potential for expanding use of VHF television channel spectrum for wireless microphone operations. In particular, we asked whether we should revise the power limits for LPAS operations in the VHF band to conform to those applicable for LPAS devices in the UHF television band. We asked whether allowing higher power limits would raise concerns regarding potential interference to TV stations operating in the VHF bands or the wireless video assist devices that operate in the upper VHF band. We also sought comment on the minimum co-channel separation distance, and whether it would need to be increased. In addition, we invited comment on other rule revisions that would facilitate more use of this spectrum.[50]

23. Audio-Technica, Lectrosonics, Sennheiser, and Shure support an increase of permitted power levels for VHF operations from 50 mW to 250 mW to be consistent with UHF LPAS operations, arguing that such revisions would enhance the usefulness of this spectrum for various wireless microphone applications.[51] CEA also generally supports expanding use of the VHF spectrum for wireless microphones provided that any revisions would be based on adequate technical analysis of the interference risks to VHF television reception.[52] Lectrosonics states than any increase in power levels would require reconsideration of the existing 4 km co-channel separation distance between VHF wireless microphones and VHF TV stations to prevent interference to the latter, and recommends implementation of a tiered separation requirement in which the separation distance would vary with the power level.[53] CEA generally supports this approach, and argues that the Commission could also authorize higher VHF LPAS device power levels based on greater frequency separation or use a combined approach by adopting tiers for both geographic and frequency separation. However, CEA cautions that any action taken by the

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[46] *Id.*, Section IV.B.2 (Licensed wireless microphones in the duplex gap).

[47] *Id.*, Section IV.E.2 (Changes to database procedures).

[48] *See* 47 C.F.R. § 74.861; *NPRM*, 29 FCC Rcd at 12362 ¶ 76. This VHF spectrum includes the 54-72 MHz, 76-88 MHz, and 174-216 MHz bands.

[49] *Compare* 47 C.F.R. § 74.861(e)(1) (permitting 50 mW on VHF channels) *with* § 74.861(e)(2) (permitting 250 mW on UHF channels). This distinction was included in the rules established in 1986. *See* Review of Subpart H, Part 74 of the Commission's Rules; Low Power Auxiliary Stations, MM Docket No. 86-12, *First Report and Order*, 2 FCC Rcd 345 (1986).

[50] *NPRM*, 29 FCC Rcd at 12362-63 ¶¶ 77-78; *see* 47 C.F.R. § 74.870(c) ("Wireless video assist devices").

[51] Audio-Technica Comments at 22; Lectrosonics Comments at 13-15 (increase would help to compensate for antenna efficiency deficits and increase the performance of VHF wireless microphone systems enough to make them a viable alternative to UHF systems for many applications); Sennheiser Comments at 17; Shure Comments at 30.

[52] CEA Comments 3-7.

[53] Lectrosonics Comments at 14-15 (proposing that the separation distances would increase if the wireless microphones operated at power levels greater than 50 mW).

Commission to increase the VHF spectrum available to wireless microphone users would carry some associated risk of interference to VHF TV broadcasts, and that balancing that tradeoff would require careful consideration of a number of technical factors, including permitted power levels, separation distances, and receiver sensitivity.[54] Sennheiser disagrees that the existing 4 km separation distance needs to be increased, as Sennheiser maintains that the 4 km is based on an overly conservative methodology that is relevant not to wireless microphones, but rather to higher-power white space devices.[55] As an alternative approach, Shure suggests retaining the VHF power level at 50 mW, but revising the Commission's Part 74 LPAS rules to allow output power to be measured on either a conducted or radiated (EIRP) basis. Shure maintains that this rule change, combined with harmonizing power limits throughout the VHF and UHF bands, would help wireless microphones with small internal or external antennas overcome some of the efficiency loss that results from the longer wavelengths in VHF frequencies.[56]

24. *Discussion.* We are revising our rules to provide more opportunities for licensed wireless microphone use of these VHF channels. While we are not permitting power levels of up to 250 mW conducted power, we are revising the rules that currently measure the 50 mW limit in terms of conducted power,[57] to specify the 50 mW limit in terms of EIRP, as suggested by Shure.[58] Several reasons inform this approach. As noted by Shure, specifying the power levels in terms of EIRP instead of conducted power will be particularly beneficial to wireless microphone users in the VHF band, where the efficiency of antennas is lower due to the longer radio wavelengths. This approach will allow manufacturers to adjust the conducted power output of a device to compensate for low antenna efficiency, thus helping address wireless microphone operators' interest in making greater use of this spectrum without the need for a larger antenna.[59] By revising the rules to specify the current 50 mW power limits in terms of EIRP, we address CEA's concerns that wireless microphone operations do not increase the potential for interference to TV broadcasts.[60] This revision represents a balance in addressing the concerns raised, and will increase the performance and usability of wireless microphones operating on this VHF spectrum without significantly increasing the risk of interference to TV. Specifying the power limit in terms of EIRP also ensures uniformity in the maximum radiated power for wireless microphone operations (licensed and unlicensed) in the VHF band.[61] The change we are making does not necessitate any increase in the four kilometer separation distance between wireless microphones and co-channel TV contours since we are not allowing any higher EIRP than the Commission assumed in establishing this

[54] CEA Comments at 2-6.

[55] Sennheiser Reply Comments at 9.

[56] Shure Comments at 30-31.

[57] *See* 47 C.F.R. § 74.861(a) and (e).

[58] *See* Shure Comments at 30-31. The EIRP (effective or equivalent isotropically radiated power) is a characterization of the power radiated from an antenna. It is a function of the antenna input power and the antenna gain. For example, a wireless microphone with an antenna input power of 50 milliwatts and an antenna gain of -3 dBi would have an EIRP of 25 milliwatts.

[59] Specifying a conducted power limit without any antenna gain requirement means that different devices operating at the same conducted power level could in fact be radiating at higher or lower power levels depending on their antenna gain. For example, a device with a 50 milliwatt conducted power output into an antenna with a gain of 0 dBi would have an EIRP of 50 milliwatts, while if the same device had an antenna with a gain of -3 dB, the EIRP would be 25 milliwatts, and if it had an antenna with a gain of 3 dB, the EIRP would be 100 milliwatts.

[60] *See* Shure Reply Comments at 31.

[61] In the Part 15 Report and Order, we specify the applicable 50mW power limits for unlicensed wireless microphone operations only in terms of EIRP. Part 15 Report and Order, Section IV.A.4. *See* Shure Reply Comments at 31.

distance.[62] We will accept applications to certify LPAS devices under this rule as soon as it becomes effective, and we will require applications to certify under this revised rule nine months following release of the *Channel Reassignment PN* to conform the date with related certification requirements we are adopting.[63]

(b) Licensed co-channel operations closer than specified separation distances

25. *Background.* In the *Incentive Auction R&O*, the Commission permitted licensed wireless microphone users to operate closer to television stations than permitted under the revised separation distances (i.e., no closer than 4 kilometers from the outside of the digital television contours) provided that they coordinated their operations with affected broadcasters.[64] The Commission noted, however, that several commenters had proposed to permit wireless microphone operations on a co-channel basis without requiring coordination, such as in locations where the TV signal falls below specified threshold, where the microphones are shielded from the TV signals due to building attenuation, or where no over-the-air television receivers are in operation.[65]

26. In the *NPRM*, we sought to develop a more extensive record on whether to permit licensed wireless microphone operations on a co-channel basis closer than the generally applicable separation distances set forth in our rules, without the need for coordination, noting our goal to provide more opportunities for licensed wireless microphone operations in the spectrum that will continue to be allocated for television services to the extent such operations would not cause harmful interference to TV operations.[66] In particular, we proposed to allow LPAS licensees to operate co-channel with television closer to the television station than provided by the separation distance rules in locations in which the co-channel TV signal is below a specified threshold. We sought comment on the suitable TV signal threshold, and whether other safeguards would ensure that licensed wireless microphone operators do not otherwise cause harmful interference to TV reception. We limited this proposal to licensed wireless microphone users, whom we would expect to have the requisite wireless microphone systems, as well as technical and operational abilities, to be able to determine the level of the co-channel TV signals at a given location, and thus would be able to comply with such a threshold. We also asked whether we should require licensed wireless microphone users to register their co-channel operations in the TV bands databases to provide information to any television licensee concerned about possible harmful interference. As an alternative, we sought comment on whether to permit co-channel licensed wireless microphone operations in indoor venues, such as in theaters or music auditoriums. We also invited comment on other approaches.[67]

27. Audio-Technica and Sennheiser support allowing licensed LPAS users to operate co-channel inside the television contour, without coordination with television stations, in areas where the television signal falls below a specified threshold.[68] Sennheiser specifically supports the -80 dBm over

[62] This separation distance was established based on the co-channel separation distance required for a white space device operating power level of 4,000 milliwatts EIRP, which is the same as the total power from 16 LPAS devices operating in a TV channel at 250 milliwatts EIRP. *See Incentive Auction R&O*, 29 FCC Rcd at 6698-6699 ¶¶ 305-306.

[63] See Section III.B.1.d(ii)(b) below, as well as the Part 15 Report and Order, Section IV.F.2.

[64] *Incentive Auction R&O*, 29 FCC Rcd at 6699-6700 ¶ 307.

[65] *NPRM*, 29 FCC Rcd at 12363 ¶ 80.

[66] *Id.*, 29 FCC Rcd at 12363 ¶ 81.

[67] *See id.*, 29 FCC Rcd at 12363-64 ¶¶ 82-86.

[68] Audio-Technica Comments at 22; Sennheiser Comments at 18.

200 kHz threshold, asserting that this approach should apply for both indoor and outdoor locations.[69] Shure supports expansion of licensed LPAS co-channel operations under a framework that would permit such operations on a secondary, non-interference basis, subject to registration of the sites and frequencies in the white spaces databases so that television broadcasters have the ability to identify co-channel uses if necessary.[70] CEA is concerned that any changes provide adequate protection to TV in the VHF channels, and notes that the Commission seeks to encourage broadcasters to bid for reassignment in that spectrum.[71] CEA argues that permitting licensed wireless microphone co-channel operations inside of the DTV contour, based on signal thresholds, involves potentially unworkable complexity, and argues that the -80 dBm over 200 kHz threshold, which is higher than the minimum ATSC A/74 performance guidelines for DTV receiver sensitivity, would create the potential for harmful interference from wireless microphones to DTV receivers.[72] CEA also maintains that setting a signal threshold involves making numerous assumptions about the deployment, design, and configuration of television receivers and wireless microphone transmitters, and thus any benefits of this approach are uncertain.[73] In reply comments to CEA's concerns, Sennheiser asserts that the over-the-air television reception with which CEA is concerned generally is designed for home viewing, where wireless microphones would not be used, but states that it does not object to increasing the required threshold to -84 dBm, so that it exceeds the threshold of visibility of the ATSC A/74 guidelines.[74] Sennheiser also argues that, because the signal threshold approach would be sufficient to protect DTV receivers, licensed LPAS operators should not be encumbered by the database registration process.[75]

28. *Discussion.* We will permit closer co-channel operations by licensed wireless microphone operators on any TV channel where the TV signal falls below a threshold of -84 dBm over the entire TV channel, provided certain conditions are met. Such operations will be limited to systems operating at an indoor location, and not in an itinerant fashion where the signal threshold could be ever-changing, and the location is not being used for over-the-air television viewing. We also require that the licensed operators have the requisite wireless microphone systems for determining the threshold at the location, as well as the professional qualifications for evaluating the signals, and that the signals be measured where the wireless microphones would be operated at the location, and must be scanned across the full six-megahertz TV channel; to the extent directional antennas are employed, they must be rotated to the place of the maximum signal at the location. We believe this approach for licensed wireless microphone operations is reasonable for several reasons. As Sennheiser points out, the signals would exceed the threshold of visibility under the ATSC guidelines. The location of operations is indoors and contained, and wireless microphone signals do not do not generally transmit beyond very limited distances (e.g., generally ranging between 100-300 feet) at low levels. In addition, we expect that there would be significant attenuation of the wireless microphone signal, both around the microphone (e.g., loss because it is hand-held, or because of body loss) and as a result of building and other attenuation, thus further reducing the likelihood of harming TV viewers outside of the location.

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[69] Sennheiser Comments at 18.

[70] Shure Comments at 31-32 (recommending that we adopt an automated database registration process for such operations).

[71] CEA Comments at 2, 4.

[72] CEA Comments at 7-8 (also noting that the median signal sensitivity of 12 recent-model DTV receivers is -86.2 dBM over a 6-megahertz channel, which was better than the A/74 minimum performance guidelines). *See* Advanced Television Systems Committee, Inc., *ATSC Recommended Practice: Receiver Performance Guidelines, Document A/74:2010* (April 7, 2010), *available at* http://www.atsc.org/cms/standards/a_74-2010.pdf.

[73] CEA Comments at 7-8.

[74] Sennheiser Reply Comments at 9-10.

[75] *Id.*

(c) Adoption of ETSI emission mask standards for analog and digital wireless microphones

29. *Background.* The technical rules applicable to Part 74 LPAS devices operations in the TV bands set forth specified out-of-band emission mask requirements for wireless microphones, regardless of whether the device is analog or digital.[76] These rules have not been revised since 1987.[77]

30. In the *NPRM*, we proposed revising the emission masks applicable to wireless microphones and LPAS devices, with respect to both analog and digital wireless microphones, to comply with the applicable ETSI standards for analog and digital wireless microphones that operate over 200 kHz channels. Specifically, we proposed to require that emissions from analog and digital unlicensed wireless microphones comply with the emission masks in Section 8.3 of ETSI EN 300 422-1, *Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement.*[78] Because the ETSI emission masks are defined only over a frequency range of plus or minus one megahertz from the wireless microphone carrier frequency, we sought comment on the emission limits that should apply outside of this frequency range. In addition to the ETSI standards, or as an alternative, we inquired whether there are other technical standards that we should adopt to promote more efficient use of the spectrum available for wireless microphone operations in the TV bands. Finally, we asked that, if we were to decide to adopt revised standards, how quickly we should require new devices to comply with the new standards.

31. Adeunis, Audio-Technica, Sennheiser, and Shure generally support adoption of the ETSI standards for analog and digital wireless microphones for licensed wireless microphone operations in the TV bands.[79] Sennheiser says that its wireless microphones have met the ETSI mask standards for decades, and suggests that most manufacturers already meet these standards.[80] Shure supports the standards with "modest adjustments."[81] Adeunis agrees that adopting these standards for emission masks would likely result in more efficient use of the spectrum, but proposes that the channel limits should be expanded from 200 kHz to 500 kHz.[82] Lectrosonics, however, is concerned that adoption of these masks, particularly for unlicensed wireless microphones, would require a change in design that could render its legacy models incapable of operation with newer models.[83]

32. *Discussion.* To promote more efficient use of the limited TV band spectrum available for wireless microphones, we are adopting the ETSI standard emission masks for LPAS devices used by

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[76] *See* 47 C.F.R. § 74.861(e)(6).

[77] *See* Review of Subpart H, Part 74 of the Commission's Rules, Low Power Auxiliary Stations, MM Docket No. 86-12, *First Report and Order*, 2 FCC Rcd 345 (rule on emission mask codified in section 74.861(d)).

[78] ETSI EN 300 422-1, *Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement.* This standard is available at www.etsi.org. In the Part 15 NPRM, we also proposed to apply the ETSI emission masks to unlicensed wireless microphone operations in the TV bands.

[79] Audio-Technica Comments at 22; Sennheiser Comments at 11; Shure Comments at 32-33.

[80] Sennheiser Comments at 11.

[81] Shure Comments at 32-33. More specifically Shure urges the Commission to adopt for analog emissions Section 8.3.1.2 of ETSI standard EN300 422-1 v1.3.2 for all 200 kHz wireless microphones regardless of the operating frequency, adopt the digital mask Section 8.3.2.2 of that standard for digital emissions below 1 GHz, and apply the emission limits in FCC rule section 15.209 beyond +/- 1 MHz from the carrier or center frequency

[82] Adeunis Comments at 10-11.

[83] Lectrosonics Comments at 17-18.

wireless microphone licensees under our Part 74 rules.[84] Specifically, we will require that emissions from analog and digital unlicensed wireless microphones comply with the emission masks 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.*[85] Requiring wireless microphones to meet these tighter emission requirements will protect authorized services in adjacent bands from harmful interference, and will improve spectrum sharing by wireless microphones. Outside of the frequency range where the ETSI masks are defined (one megahertz above and below the wireless microphone carrier frequency), we will require that emissions comply with same limit as the edge of the ETSI masks, specifically, 90 dB below the level of the unmodulated carrier. We are incorporating the emission mask requirements set forth in ETSI EN 300 422-1 v1.4.2 (2011-08) s into the Part 74 Subpart H LPAS rules by reference and adding it to the list of measurement procedures in Section 74.861.[86] We are not persuaded by Lectrosonics that existence of its legacy unlicensed wireless microphones that would not be compliant with the new standard should prevent us from establishing a more efficient standard for wireless microphone devices going forward. We will require the LPAS devices comply with this standard no later than nine months following release of the *Channel Reassignment PN*.[87]

(d) Other TV Bands revisions

33. *Background.* In the *NPRM*, we also sought comment generally on whether the Commission should adopt any other rule revisions for operations of wireless microphones in the TV bands spectrum that would facilitate more effective and efficient operations in these bands. We asked that commenters provide detailed information on reasons for the proposed changes as well as the types of specific rules that they advocate.[88]

34. The Nuclear Energy Institute and Utilities Telecom Council (NEI/UTC) and Robert Bosch, LLC (Bosch) request that we affirm that nuclear plants may continue to operate pursuant to the terms of a waiver currently applicable to nuclear power plants.[89] In October 2010, the Commission's Office of Engineering and Technology (OET) and Wireless Telecommunications Bureau (WTB) modified the Commission's waiver that permitted unlicensed wireless microphone operations in the TV bands[90] to permit nuclear power plants to operate low power auxiliary devices, particularly wireless headsets, on a unlicensed basis in the TV band spectrum with a transmit power of up to 100 mW inside nuclear power plant buildings without having to meet the existing television station co-channel separation

[84] *See* Part 15 Report and Order, Section IV.A.4 (adopting ETSI emission mask standard for unlicensed wireless microphone operations).

[85] This standard is available at www.etsi.org. For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the below 1 GHz digital emission mask contained in Section 8.3.2.2 of the standard (Figure 4). We are also adopting this requirement for unlicensed wireless microphone operations in the TV bands. *See* Part 15 Report and Order, Section IV.A.4.

[86] *See* 47 C.F.R. §§ 15.31 and 15.38. Section 15.31 lists the various measurement procedures that are used to determine compliance with the Part 15 rules. Section 15.38 lists the materials that have been incorporated into the rules by reference.

[87] See Section III.B.1(ii)(b) below, as well the Part 15 Report and Order, Section IV.F.2.

[88] *NPRM*, 29 FCC Rcd at 12366 ¶ 93.

[89] *See* NEI/UTC Comments at 2-3, 8; Bosch Reply Comments at 2.

[90] Earlier in 2010, the Commission adopted a limited waiver permitting wireless microphone operations in the TV bands on an unlicensed basis, at power levels limited to 50 mW, subject to certain Part 15 rules. See paragraph 16 above; *see also TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 684 ¶ 84.

distance rules.[91] In 2014, in the *TV Bands Wireless Microphones Second R&O and Further Notice*, the Commission further modified this waiver, pending the resolution of the instant proceeding, to permit nuclear power plants to operate in the TV bands with 100 mW power for both indoor and outdoor operations.[92] The Commission found that such operations would not interfere with other users in the TV bands because the locations of nuclear power plants are known and generally in remote areas, and the equipment operates with relatively low power.[93] In their comments, NEI/UTC also request clarification of the existing waiver. Specifically, they request that the existing waiver, which when first granted in 2010 states that it permits operation on "television frequencies below 698 MHz," be deemed to allow them to continue to operate on all frequencies below 698 MHz, including those ultimately repurposed for 600 MHz wireless services. They request that under the waiver they be permitted to continue to operate in the repurposed 600 MHz band, limited to indoor operations, after the transition period.[94]

35. NEI/UTC assert that experience demonstrates that the Bosch RTS Telecom (formerly Telex)[95] wireless headsets in use pursuant to the waiver are uniquely suited to the needs of nuclear power plant operations, and are extremely unlikely to cause interference to other spectrum users. They state that no other equipment provides the same functionality,[96] and that use of UHF equipment is vital in order to be compatible with other electronic equipment used in nuclear plants and to avoid multipath interference and reflected signals within reactor containment buildings' domed ceilings.[97] They also note that nuclear plant structures are generally located in remote areas and attenuate the signals to extremely low levels beyond the plants' security perimeters,[98] and that no interference has been reported from nuclear plants' use of the headsets pursuant to the waiver and earlier experimental licenses.[99] As an alternative to their waiver request, NEI/UTC asked that we extend to nuclear power plants eligibility for licensing under Part 74.[100] No other parties commented on these requests or objected to them.

36. *Discussion.* We conclude that extending the existing waiver of the Commission's rules to permit nuclear power plants the continued use of spectrum in the core TV bands would serve the public interest. Consequently, we hereby grant a permanent waiver of the Commission's rules to allow the continued use of wireless headsets at nuclear power plants, under the same conditions as the current

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[91] *See* Letter from Julius Knapp, Chief, OET, FCC, and Ruth Milkman, Chief, WTB, FCC to J. Jeffrey Craven, 25 FCC Rcd 15581, 15581-82 (OET/WTB 2010) (among the grounds for adopting the waiver was the consensus plan endorsed by NAB, MSTV, and SBE indicating their support for operations of the telex equipment on television frequencies without need for coordination; the waiver provided that operations would be permitted on "television frequencies below 698 MHz"). Recognizing that there could be instances where a power level higher than 50 mW might be needed and could be allowed without causing interference, the Commission delegated authority to the OET and WTB to modify the waiver on a case-by-case basis. *TV Bands Wireless Microphones R&O and Further Notice*, 25 FCC Rcd at 684 ¶ 85.

[92] *See* Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, *Second Report and Order*, ET Docket No. 10-24, 29 FCC Rcd 6103, 6113-14 ¶¶ 25-26 (2014) (*TV Bands Wireless Microphones Second R&O*).

[93] *Id.* at 6114 ¶ 26.

[94] NEI/UTC Comments at 8-10.

[95] *See* Bosch Reply Comments at 3 n.2.

[96] *See* NEI/UTC Comments at 3; Bosch Reply Comments at 9.

[97] *See* NEI/UTC Comments at 3-4, 8, 15; Bosch Reply Comments at 10.

[98] *See* NEI/UTC Comments at 8, 12-13; Bosch Reply Comments at 9.

[99] *See* NEI/UTC Comments at 5, 13; Bosch Reply Comments at 11.

[100] *See* NEI/UTC Comments at 12, 14.

waiver,[101] in the spectrum that will continue to be allocated for television following the incentive auction. In addition, this waiver will permit nuclear power plants to continue to access the spectrum repurposed for 600 MHz wireless service during the transition period, but no later, provided that they meet the conditions for secondary operations in this band.[102] The terms of this this waiver do not extend to include operations in the 600 MHz guard bands, including the duplex gap, which will no longer be allocated for broadcast TV.[103] As discussed in the Part 15 Report and Order, wireless microphone operations in these bands will be limited to 20 mW EIRP,[104] which is more restrictive than allowed for wireless microphones in the TV bands. Further, we are not granting, under the terms of this waiver, any right to continue to operate in the 600 MHz Band after the end of the post-auction transition period. Unlike the waiver we are granting, nothing in the record before us indicates whether the 600 MHz wireless licensees might agree to NEI/UTC's request relating to this issue, so we decline to grant this additional request at this time.[105]

37. In granting this permanent waiver, we decline to revise the Part 74 LPAS rules to provide for such operations on a licensed basis. The Commission previously declined to make nuclear plants eligible under Part 74,[106] and the issues raised regarding the use of these particular devices involve considerations unique to the nuclear power industry, and do not apply to other part 74 LPAS licensees. Further, in light of our grant of a permanent waiver with the associated conditions, licensee status is not necessary.

c. Eligibility for Licensed Operations in the Duplex Gap

38. *Background.* In the *Incentive Auction R&O*, the Commission provided that broadcasters and cable programming networks using wireless microphones on a licensed basis would be able to obtain interference protection from unlicensed devices in a portion of the duplex gap at specified times and locations, on an as-needed basis.[107] In the *NPRM*, we sought comment on whether we should expand eligibility for licensed wireless microphone operations in the duplex gap to include all of the entities now eligible for Part 74 LPAS licenses in the TV bands. In particular, we asked whether such expanded eligibility would create problems for broadcasters or cable programming networks operating on this

[101] This permanent waiver substantially grants the relief sought by NEI/UTC in their request for a waiver to permit nuclear power plants to be licensed under Part 90 to operate the Telex headsets indoors. *See* Petition for Waiver (filed July 16, 2009; revised Sept. 23, 2009); *see also* Wireless Telecommunications Bureau Seeks Comment on Request by Nuclear Energy Institute and Utilities Telecom Council for Waiver to Permit Use of Part 74 Two-Way Wireless Headsets and Intercom Devices Inside Nuclear Power Plants, *Public Notice*, WT Docket No. 09-176, 24 FCC Rcd 12387 (WTB MD 2009). We therefore dismiss the waiver request as moot to the extent of the relief set forth above, and otherwise deny the request.

[102] *See Incentive Auction R&O*, 29 FCC Rcd at 6846 ¶ 687; see paragraph 41 below (wireless microphone will not be entitled to any interference protection from operations of the primary 600 MHz licensees, and they will be required to cease any operations in the 600 MHz Band if their operations cause harmful interference to any 600 MHz licensee's operations).

[103] We recognize, however, that there may be instances where the incentive auction results in the amount of spectrum allocated for broadcast TV in a particular area being insufficient to support the communications for which nuclear power plants use wireless headsets. We find that such instances should be evaluated based on their individual facts and circumstances to ensure that interference will not occur.

[104] *See* Part 15 Report and Order, Sections IV.A.1, IV.A.2.

[105] We encourage the nuclear plant industry work with the new 600 MHz band licensees (and vice versa) if the nuclear plant users determine that operations limited to the TV bands will not be sufficient post-transition.

[106] *See TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6113-14 ¶ 26.

[107] *Incentive Auction R&O*, 29 FCC Rcd at 6703-04 ¶ 314. As noted above, we are addressing the technical issues concerning licensed wireless microphone operations in the duplex gap in the companion Part 15 Report and Order.

spectrum, or whether these different users generally operate at different locations, such that their respective operations would not likely interfere with each other.[108]

39. In their comments, Lectrosonics and Sennheiser recommend that access to spectrum in the duplex gap be made available to all entities eligible to hold a Part 74 LPAS license, arguing that they require such access because of spectrum losses that they are incurring elsewhere.[109] Sennheiser contends that permitting such access would not create interference problems for broadcasters and cable operators because those entities have shared other frequencies with licensed wireless microphone users for years.[110] We received no comments opposing this expansion of eligibility to include entities currently eligible to hold Part 74 LPAS licenses for operation in the TV bands.[111] In addition, a broad coalition of broadcasters, newscasters, large event spectrum coordinators and producers, other wireless microphone users, and wireless microphone manufacturers ("Professional Audio Community") indicate their general support for licensed wireless microphone operations in the duplex gap restricted to licensed LPAS entities.[112]

40. *Discussion.* As discussed in the *Incentive Auction R&O*, we provided that broadcasters and cable programming networks using wireless microphones on a licensed basis could operate in a portion of the duplex gap, where they would be protected from interference by unlicensed devices in order to have access to spectrum for certain programming, including emergency information.[113] We conclude that expanding eligibility to the other licensed Part 74 entities should not cause any problems for broadcasters and cable programming networks since the licensed entities will be obligated to coordinate their operations when and where necessary.[114] We note that, as a general matter, these different licensees will likely operate at different locations and not interfere with each other.

d. Transition Out of the 600 MHz Band Repurposed for Wireless Services

(i) Background

41. Following the upcoming incentive auction, certain existing television channels in the UHF band will be repurposed for 600 MHz Band wireless services. In the *Incentive Auction R&O* the Commission provided for a multi-year period to help smooth the transition as wireless microphone operators take steps to obtain new equipment and transition out of the use of this spectrum no later than the end of post-auction transition period (i.e., 39 months after the issuance of the *Channel Reassignment PN*).[115] Specifically, following the auction these operators may continue to access the 600 MHz Band

[108] *NPRM*, 29 FCC Rcd at 12366 ¶ 95. As noted above, we address the technical rules for licensed wireless microphone operations in the duplex gap in the Part 15 Report and Order. See paragraph 20 above.

[109] Lectrosonics Comments at 18; Sennheiser Comments at 18.

[110] Sennheiser Comments at 18.

[111] Open Technology Institute/Public Knowledge express concerns about permitting licensed wireless microphone operations in the duplex gap. Open Technology Institute/Public Knowledge Reply Comments at 2. These comments are filed in this proceeding as well as the Part 15 proceeding. Their concerns are addressed in the Part 15 Report and Order.

[112] Letter from Catherine Wang, Counsel, Shure Inc., to Marlene Dortch, Secretary, FCC, filed June 22, 2015, attachment entitled "Professional Audio Community – Spectrum Discussion" at 4 ("Professional Audio Community June 22 *Ex Parte*").

[113] *Incentive Auction R&O*, 29 FCC Rcd at 6703-04 ¶ 314.

[114] *See* 47 C.F.R. § 74.803(a) (LPAS licensees shall endeavor to select frequencies or schedule operations in such a manner as to avoid mutual interference).

[115] *Incentive Auction R&O*, 29 FCC Rcd at 6846-47 ¶¶ 686-688.

during the transition period, but no later, subject to certain conditions.[116] To the extent that either licensed or unlicensed wireless microphone users operate in the 600 MHz Band during this transition period, then consistent with their secondary or unlicensed status they will not be entitled to any interference protection from operations of the primary 600 MHz licensees, and they will be required to cease any operations in the 600 MHz Band if their operations cause harmful interference to any 600 MHz licensee's operations.[117]

42. In the *NPRM*, we sought comment on how best to facilitate a smooth transition as wireless microphone and other LPAS users cease their operations on the repurposed 600 MHz Band frequencies no later than the end of the post-auction transition period.[118] We indicated that achieving a smooth transition will involve actions by the Commission, by manufacturers and distributors of wireless microphones, and by the various wireless microphone operators themselves, both licensed and unlicensed users. Even though the specific UHF band frequencies repurposed for 600 MHz Band wireless services will not be known until following the auction, beginning preparation for transition as soon as possible will contribute to a smoother transition.[119] We observed that some wireless microphones are likely to be capable of operating on repurposed channels, while others will not.[120] We also pointed out that although the specific frequencies on which particular wireless microphones operate may be identified in the owner's manual, the channels often are not evident on the devices themselves.[121]

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[116] This 39-month transition period will commence once the Commission releases the *Channel Reassignment PN*. *Incentive Auction R&O*, 29 FCC Rcd at 6846 ¶ 687. No petitioner petitioned for reconsideration of the Commission's decision to require wireless microphone operations to cease in the 600 MHz Band no later than the end of the 39-month transition period, and the Commission did not revise this decision. *See* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Second Order on Reconsideration*, 30 FCC Rcd 6746 at 6801-6806 ¶¶ 122-130 (2015) (discussion of petitions for reconsideration relating to wireless microphones).

[117] *Incentive Auction R&O*, 29 FCC Rcd at 6846-6847 ¶¶ 686-688.

[118] *NPRM*, 29 FCC Rcd at 12366 ¶ 96. Our request for comments also extended to the operation of wireless video assist devices under Part 74, Subpart H rules, including each of the steps on which we seek comment or present proposals for the purpose of achieving a smooth transition for these licensed operations out of the 600 MHz Band. *Id.* at n.93. Wireless video assist devices must cease operations in the 600 MHz Band no later than the end of the post-auction transition. *Id.*; *see also Incentive Auction R&O*, 29 FCC Rcd at 6846 ¶ 687 & n.1904.

[119] *NPRM*, 29 FCC Rcd at 12366 ¶ 96. Until the upcoming incentive auction is completed and the *Channel Reassignment PN* has been issued establishing the final 600 MHz Band plan, the specific UHF frequencies that are being repurposed for wireless services will not be known. Under the band plan adopted in the *Incentive Auction R&O*, the Commission will offer a uniform number of licenses in most markets and, in order to accommodate market variation, some impaired spectrum blocks, or alternatively, fewer spectrum blocks, in constrained markets where less spectrum is available. *Id.* at 12367 ¶ 98; *see also Incentive Auction R&O*, 29 FCC Rcd at 6605 ¶ 82, 6872 ¶ 525.

[120] *NPRM*, 29 FCC Rcd at 12367 ¶ 99. Wireless microphones operating in the TV bands often are designed to operate on specific sets of TV channels. Depending on the make and model, wireless microphones may be designed to operate on a narrow range of frequencies in the TV bands, or on a wider range of channels. Some, for example, may be capable of operating only on VHF channels (or a subset of VHF channels), or only on a portion of the lower UHF channels (e.g., channels 14-17), the middle UHF channels (e.g., channels 30-34), or only on some upper portion of UHF channels (e.g., channels 47-51), while others may operate across many channels or the even entire UHF band. *NPRM*, 29 FCC Rcd at 12351 ¶ 24, 12367 ¶ 99.

[121] *Id.* at 12367 ¶ 99.

(ii) Discussion

(a) Consumer education and outreach; disclosure requirements

43. We specifically sought comment in the *NPRM* on how best to inform users of wireless microphones on the changes following the auction that will affect their use of wireless microphones in the TV band spectrum that is being repurposed, including the steps necessary to prevent interference to new wireless operations in the 600 MHz spectrum, consistent with the Commission's goals expressed in the *Incentive Auction R&O*. We anticipated a need for education and outreach directed at wireless microphone users, and that this should commence before the auction and continue even beyond the end of the 39-month transition period. We proposed that these education and outreach efforts should be undertaken by the Commission, manufacturers, wireless microphone users groups, and relevant trade publications and other possible sources of information for wireless microphone users. As a companion to these efforts, we also proposed requiring that written disclosures accompany new devices at the point of sale to provide further education to wireless microphone users on the devices' operations.[122] In considering these actions, we drew extensively from the approach that the Commission took with respect to the transition of wireless microphones out of the 700 MHz band.[123] Our goals were to make information available so users, particularly unlicensed users, are aware that they must not cause harmful interference to new wireless operations in the 600 MHz band, and must cease operating their wireless microphones on the repurposed 600 MHz Band allocated for 600 MHz Band wireless services no later than the end of the transition period (*i.e.*, 39 months after the release of the *Channel Reassignment PN*); to set in motion a process so they are aware of relevant factors concerning the operation of wireless microphones that are currently in use; and to establish a means for users to locate additional spectrum and equipment for their operations that will be available for their use. We believed that a successful consumer education and outreach campaign would involve the Commission staff working with a broad group of interested entities, including wireless microphone manufacturers, wireless microphones users, and user representatives.[124]

44. We sought comment on the particular actions that wireless microphone manufacturers, distributors, retailers, and other entities comprising the wireless microphone community should take to inform the wide range of wireless microphone users about the ongoing developments concerning wireless microphone use – particularly the need to vacate the repurposed 600 MHz Band, the timetable for doing so, and the conditions for operating in the band during the transition period. We asked what specific information should be provided to wireless microphone users to ensure that they know the requirements for operating in the repurposed spectrum during the transition period and the need to exit the band by the end of the transition, as well as what steps can be taken to provide wireless microphone users with

[122] *Id.* at 12368 ¶ 102. We also stated that these efforts also should cover the operation of wireless video assist devices under the Part 74, Subpart H rules. *Id.* at n.101; *see* 47 C.F.R. §§ 74.801, 74.870.

[123] *See NPRM*, 29 FCC Rcd at 12369-71 ¶¶ 106, 110-111 & nn. 105-108 (citing actions taken by the Commission in 2010 in the *TV Bands Wireless Microphones R&O*). In the *TV Bands Wireless Microphones R&O*, the Commission relied on Section 302 of the Communications Act when taking actions to protect consumers. *TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 673-74 ¶¶ 64-64. Section 302 of the Communications Act of 1934, as amended, authorizes the Commission "consistent with the public interest, convenience, and necessity, [to] make reasonable regulations . . . governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications" and these regulations "shall be applicable to the manufacture, import, sale, offer for sale, or shipment of such devices . . . , and to the use of such devices." 47 U.S.C. § 302a(a). The Act further provides that "[n]o person shall manufacture, import, sell, offer for sale, or ship devices . . . , or use devices, which fail to comply with regulations promulgated pursuant to this section." 47 U.S.C. § 302a(b).

[124] *NPRM*, 29 FCC Rcd at 12368 ¶ 103.

information on the transition prior to the auction.[125] In particular, we inquired whether it would it be beneficial for wireless microphone users to have access to a database or some form of online mapping tool to help users that enter the location and operating frequencies to determine whether they can continue to operate in the repurposed 600 MHz Band during the transition period, and if so, who should be responsible for developing and maintaining (hosting) it. Similarly, we asked whether the Commission should work with wireless microphone manufacturers to obtain information on models of wireless microphones that the Commission could list on its website in order to facilitate a smooth transition from the 600 MHz Band.[126] In addition to steps that may involve manufacturers, we sought comment on what steps other parties associated with the sale and operation of wireless microphones (e.g., trade associations, user groups, or industry associations), may be able to take to provide users with information relevant to the transition.[127]

45. We also invited specific comment on what additional information we should make available for wireless microphone users, including Commission-issued consumer "fact sheets" and "frequently asked questions" (FAQ's) which would address, among other matters, information on operation in the 600 MHz Band, the reason for the need to operate on frequencies outside of that band following the transition, the availability of other frequency bands for wireless microphone use, and the need to comply with Commission rules.[128]

46. Finally, we proposed to revise our point-of-sale disclosure requirement that the Commission adopted in the *TV Bands Wireless Microphones R&O* in order to provide information to wireless microphone users that may have to purchase or lease new equipment so that they can vacate the repurposed 600 MHz Band.[129] Specifically, with regard to sales of wireless microphones that are capable of operating in repurposed spectrum, we proposed to require that such sales include point-of-sale disclosures that inform buyers that they are buying a microphone that cannot be used in certain frequencies following the transition. We also sought comment on how point-of-sale disclosures could be designed to effectively address any ban on manufacturing and marketing of wireless microphones that are capable of operating in the repurposed 600 MHz Band. We also proposed that the revised point-of-sale disclosures direct buyers to the manufacturer's toll free telephone number or the manufacturer's website where the buyer can obtain more detailed information on the extent to which the microphone may be affected by repurposing the 600 MHz Band, and asked whether we should retain the existing language in the point-of-sale disclosure requirement that includes the Commission's toll free number and the Commission's website where users can obtain additional information on the operation of wireless microphones during the transition period and after the transition period.[130] We proposed that the effective

[125] *Id.* at 12368-69 ¶ 104.

[126] *Id.* at 12368 ¶¶ 105-106.

[127] *Id.* at 12369-70 ¶ 107.

[128] *Id.* at 12370 ¶ 108.

[129] *Id.* at 12370-71 ¶ 110. In the *TV Bands Wireless Microphones Report and Order*, the Commission adopted a point-of-sale requirement to help assure that consumers were informed of their rights and obligations if they chose to operate wireless microphones and other low power auxiliary stations in the core TV bands (defined in the rule as channels 2-51, excluding channel 37). *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 688-91 ¶¶ 95-106. Specifically, the Commission adopted a requirement for manufacturers and distributors of wireless microphones that operate in the core TV bands to provide a written disclosure informing consumers of the requirements for operating devices in that spectrum and to display the disclosure at the point of sale and on their websites. *See id.* at 688-89 ¶ 96; 47 C.F.R. § 15.216. The Commission also provided that persons who manufacture or market wireless microphones destined for export and capable of operating in the 700 MHz Band must include labeling stating that the devices cannot be used in the United States. *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 674 ¶ 64; *see also* 47 C.F.R. § 74.851(h).

[130] *NPRM*, 29 FCC Rcd at 12371 ¶ 111.

date for any disclosure requirement, including a point-of-sale requirement, which we may adopt in connection with this or a related proceeding, would be 18 months after the release of the *Channel Reassignment PN*, and sought comment on possible alternative dates as well. We requested comment on the particular factors that should enter into this determination.[131]

47. Mobile Future expresses concern that wireless microphone users will purchase wireless microphones that operate in the 600 MHz repurposed for wireless services, and then may continue to operate the wireless microphones, after the end of the post-auction transition, potentially harming licensed wireless operations and harming consumers.[132] It states the Commission should require wireless microphone manufacturers to educate consumers on the steps necessary to prevent interference in to wireless service providers in the repurposed 600 MHz Band, and at a minimum include a requirement that manufacturers post information on their websites and provide full point-of-sale disclosure regarding the need to cease operations at the conclusion of the post-action transition period as soon as practicable following issuance of the *Channel Reassignment PN*. It also asserts the Commission should take all necessary steps to promote a smooth transition.[133] SBE expresses concern that educating unlicensed wireless microphone users, who generally are non-technical, is challenging, and recommends that the Commission should step up its enforcement for any non-compliance. SBE notes that it, along with NAB and the National Cable Telecommunications Association have in the past provided, and will continue to provide, regulatory updates to licensees, including entities eligible to hold LPAS licenses, to contribute to the successful education of these groups.[134] Sennheiser recommends that the Commission bolster the overall educational campaign by posting information on its website targeted to wireless microphone users which could easily be found by consumers in readily accessible language.[135]

48. Sennheiser and Shure also detail the kinds of steps each manufacturer will undertake to inform wireless microphone users about transitioning out of the 600 MHz Band. Sennheiser indicates that it will conduct a comprehensive education campaign similar to the one conducted with the 700 MHz Band transition, which included: buying full page ads in all the industry's major publication, launching an educational seminar national tour, developing educational web site pages; and making a series of direct mailings to dealers and end users. Sennheiser also states that when the possibility that the 600 MHz band would be repurposed became clear, it began recommending that customers purchase models that operate in ranges other than 600 MHz, and that, since that time, this announcement has remained posted on Sennheiser's U.S. website, along with a comprehensive summary of incentive auction issues relevant to wireless microphone users. Sennheiser also has again conducted educational seminars as well as participated in trade show and industry group panels and workshops discussing the changes to the regulatory environment.[136] Shure, in turn, also indicates that it would undertake an outreach effort comparable to the program implemented to inform wireless microphone users that they needed to cease operations in the 700 MHz Band in 2010. Shure states that its program will involve individual meetings with distributers, resellers and end users, webinars explaining 600 MHz Band transition issues, information dissemination with industry trade press and presentations and education at tradeshows and industry events. Shure also notes that it provides online support and tools to its customer base, including the state-of-art Frequency Finder portal that serves as a near real-time resource for professional audio

[131] *Id.* at 12371 ¶ 112.

[132] Mobile Future Comments at 4 (arguing that the Commission should prohibit the manufacture, import, and sale of wireless microphones that operate in the repurposed 600 MHz band no later than six months after the issuance of the *Channel Reassignment PN*). *See also* CTIA Comments at 43-45 (advocating same position in order to expedite that transition of wireless microphone operations out of the 600 MHz band).

[133] Mobile Future Comments at 5-6.

[134] SBE Comments at 16-17.

[135] Sennheiser Comments at 19.

[136] *Id.*.

customers attempting to identify available local channels for microphone use. In anticipation of the 600 MHz transition, Shure says that it proactively will update online resources and tools to ensure that they appropriately identify available frequencies throughout the transition, including channels that become restricted as new entrants power up network operations.[137] Finally, Lectrosonics also notes that it plans to work closely with trade media outlets to inform wireless microphone users about the need to transition out of the 600 MHz band, and recognizes that timely and careful dealer and distributor notices will be need to be employed.[138]

49. *Discussion.* As set forth in the *NPRM*, consumer education regarding the operations of wireless microphones following the incentive auction is important. Consumers will need to be informed of the many changes that will affect their use of the current TV bands that is being repurposed, including their use of the 600 MHz guard bands and duplex gap, their continued use of repurposed 600 MHz Band during the post-auction transition period (i.e., the 39 months following issuance of the *Channel Reassignment PN*), and their need to cease operations in the 600 MHz Band no later than the end of the post-auction transition period. The steps required are similar to those taken in 2010 to inform consumers about their use of the TV bands that were repurposed for 700 MHz Band wireless services.

50. *Disclosure Requirement*. We require anyone selling, leasing, or offering for sale or lease wireless microphones that operate in the 600 MHz Band to provide certain disclosures to consumers, pursuant to Section 302.[139] These entities must display the Consumer Disclosure, the text of which will be developed by Commission staff, at the point of sale or lease,[140] in a clear, conspicuous, and readily legible manner. In addition, the Consumer Disclosure must be displayed on the website of the manufacturer (even in the event the manufacturer does not sell wireless microphones directly to the public) and of dealers, distributors, retailers, and anyone else selling or leasing the devices. We find that these disclosures are necessary to ensure that consumers are informed that the wireless microphones may be used, under specified conditions, no longer than the post-auction transition period, and to help ensure that wireless microphone users comply with their obligation during the transition period and cease operating on the 600 MHz band after the end of the transition period.[141] We delegate authority to the Consumer and Governmental Affairs Bureau, working with the Wireless Telecommunications Bureau and the Office of Engineering and Technology, to prepare the specific language, following issuance of the *Channel Reassignment PN*, that must be used in the Consumer Disclosure and publish it in the Federal Register. As discussed above, there is more than one way in which the point-of-sale Consumer Disclosure may be provided to potential purchasers or lessees of wireless microphones, but each of them must satisfy all the requirements noted above, including that the disclosure be provided in writing at the point of sale in a clear, conspicuous, and readily legible manner. One way to fulfill this disclosure requirement would be to display the Consumer Disclosure in a prominent manner on the product box by using a label (either printed onto the box or otherwise affixed to the box), a sticker, or other means. Another way to fulfill the disclosure requirement would be to display the text immediately adjacent to each wireless microphone offered for sale or lease and clearly associated with the model to which it

[137] Shure Comments at 19-20.

[138] Lectrosonics Comments at 7.

[139] 47 U.S.C. § 302a.

[140] By "point of sale or lease" we mean the place or website where wireless microphones are displayed or offered for consumers to purchase or lease.

[141] As discussed in Section III.B.1.d(ii)(b) below, we have determined not to shorten our proposed deadlines for terminating equipment certification, manufacturing and marketing, as advocated proposed by Mobile Future and CTIA, in light of the need for existing devices until new products become available. A critical part of our balancing of this need against our obligation to ensure against harmful interference is the kind of disclosure program employed in the 700 MHz transition by manufacturers and others who sell or offer to sell wireless microphones that we proposed in the *NPRM*.

pertains. For wireless microphones offered online or via direct mail or catalog, the disclosure must be prominently displayed in close proximity to the images and descriptions of each wireless microphone. We will require manufacturers, dealers, distributors, and other entities that sell or lease wireless microphones for operation in the 600 MHz Band to comply with the disclosure requirements no later than three months following issuance of the *Channel Reassignment PN*, and we encourage these entities to provide consumers with the required information earlier.[142]

51. *Consumer Outreach*. In addition, we find that several means should be employed to provide as much notice as possible to users of the need to clear the 600 MHz Band of wireless microphones. We direct CGB, working with WTB and OET, to establish a webpage on the Commission's website, and prepare and release consumer publications, including a Consumer Fact Sheet and answers to Frequently Asked Questions (FAQs), that inform the public of our decisions affecting wireless microphone operations in the repurposed 600 MHz Band and the guard bands, as set forth in the *Incentive Auction R&O*, this Report and Order, and the Part 15 Report and Order.[143] We further direct Commission staff to identify and contact organizations that represent entities that are known to be users of wireless microphones in the 600 MHz Band, including groups that represent theaters, houses of worship, and sporting venues. We will inform these entities of our decisions affecting wireless microphone operations in the repurposed spectrum and available resources for information on options for wireless microphone use going forward.

52. Further, we expect all manufacturers of wireless microphones to make significant efforts to ensure that all users of such equipment capable of operating in the 600 MHz Band are fully informed of the decisions affecting them, as set forth in the *Incentive Auction R&O*, this Report and Order, and the Part 15 Report and Order. Specifically, we expect these manufacturers, at a minimum, to ensure that these users are informed of the need to clear the 600 MHz Band. Manufacturers also should inform users of wireless microphones that they may continue to operate in the 600 MHz Band until the end of the post-auction transition period, but only subject to the conditions set forth in these orders, including the early clearing mechanisms. Further, we expect all manufacturers to contact dealers, distributors, and anyone else who has purchased wireless microphones, and inform them of our decisions to help clear the 600 MHz Band. Manufacturers should also provide information on these decisions to any users that have filed warranty registrations for 600 MHz Band equipment with the manufacturer. We also expect manufacturers to post this information on their websites and include it in all of their sales literature.

53. In addition, we note that manufacturers may choose to offer rebates and trade-in programs for any 600 MHz Band wireless microphones, similar to what was done with respect to transitioning wireless microphone users out of the 700 MHz band. We encourage them to consider creating e or establishing such programs here. In contacting dealers and distributors, we expect manufacturers to inform these entities that they should: (1) inform all customers who have purchased wireless microphones that are capable of operating in the 600 MHz Band of our decision to clear the 600 MHz Band of such devices; (2) post such information on their websites; (3) include this information in all other sales materials; (4) provide information in sales materials, including on their websites, on the availability of any manufacturer rebate offerings and trade-in programs related to wireless microphones operating in the 600 MHz Band; and (5) comply with the disclosure requirements that we are adopting in this Report and Order.

[142] This disclosure requirement requires approval from the Office of Management and Budget (OMB) as a new information collection under the Paperwork Reduction Act (PRA). The effectiveness of the foregoing requirement accordingly is contingent on OMB approval, which we will announce by public notice.

[143] See Part 15 Report and Order, Sections IV.A.4, IV.B, IV.C.2, and IV.F.2 (discussing various requirements relating to unlicensed wireless microphones).

(b) Post-auction prohibition of the certification, manufacture, or marketing of LPAS devices operating on the 600 MHz Band

54. *Background.* All wireless microphones that now operate in the TV bands are certified as compliant with Part 74, Subpart H of the Commission's rules. The Commission decided in the *Incentive Auction R&O* that all wireless microphones that operate in the portion of the TV bands that will be repurposed 600 MHz Band for licensed wireless services may continue to operate in that spectrum during the post-auction transition period but must cease those operations no later than 39 months after release of the *Channel Reassignment PN*.[144] At the end of the post-auction transition, licensed microphones will be permitted to operate in a portion of the duplex gap, and unlicensed wireless microphones will be permitted to operate in the guard bands and duplex gap, pursuant to the rules adopted in the Part 15 Report and Order.[145]

55. In the *NPRM*, we proposed to establish cutoff dates for the certification, manufacturing, and marketing of wireless microphones in the repurposed spectrum to ensure that manufacturers cease making and marketing equipment for operation in repurposed 600 MHz Band spectrum to ensure that manufacturers cease making marketing equipment that cannot be legally used after a certain date.[146] Because similar technical requirements would apply to both licensed and unlicensed wireless microphones, we proposed to apply to both the same transition rules for certification, manufacturing, and marketing in order to be the least disruptive to wireless microphone manufacturers and users. We proposed taking this action pursuant to our authority under Section 302(a) of the Communications Act.[147] This Report and Order addresses these issues for licensed wireless microphones generally, and the Part 15 Report and Order addresses these issues for unlicensed wireless microphones.[148]

56. In this proceeding, we proposed that parties could no longer submit applications to certify Part 74 wireless microphones that operate in repurposed TV spectrum beginning nine months after the release of the *Channel Reassignment PN*, when the particular frequencies that will need to be vacated will first be identified.[149] We also proposed that we not certify wireless microphones under Part 74 that would operate in the 600 MHz guard bands or the unlicensed portion of the duplex gap. We also inquired

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[144] *See Incentive Auction R&O,* 29 FCC Rcd at 6846 ¶ 687.

[145] Part 15 Report and Order, Sections IV.B.1, IV.B.2.

[146] *NPRM*, 29 FCC Rcd at 12372 ¶¶ 114-15. Because wireless microphones will no longer be authorized to operate in the 600 MHz Band beyond 39 months after the release of the *Channel Reassignment PN*, we proposed revising our rules to prohibit the certification, manufacture, import, sale, lease, offer for sale or lease, or shipment (collectively, "manufacture or marketing") of wireless microphones devices intended for use in the repurposed 600 MHz Band in the United States. *Id.* Our proposals also addressed the operation of wireless video assist devices under the Part 74, Subpart H rules. *Id.* at 12372 n.115; *see* 47 C.F.R. §§ 74.801, 74.870.

[147] *NPRM*, 29 FCC Rcd at 12372 ¶ 115. The Communications Act of 1934, as amended, authorizes the Commission "consistent with the public interest, convenience, and necessity, [to] make reasonable regulations . . . governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications" and these regulations "shall be applicable to the manufacture, import, sale, offer for sale, or shipment of such devices . . . , and to the use of such devices." 47 U.S.C. § 302a(a). The Act further provides that "[n]o person shall manufacture, import, sell, offer for sale, or ship devices . . . , or use devices, which fail to comply with regulations promulgated pursuant to this section." 47 U.S.C. § 302a(b). *See also id.* § 303(f) (authorization to make such regulations not inconsistent with law as the Commission "may deem necessary to prevent interference between stations").

[148] See Part 15 Report and Order, Section IV.F.2 (Equipment certification/wireless microphones).

[149] *NPRM*, 29 FCC Rcd at 12373-73 ¶ 116. We noted however, that some frequencies may not be cleared nationwide as a result of the incentive auction, creating some impaired blocks in the 600 MHz Band. *Id.*

whether parties should not be able to submit applications to certify wireless microphones that operate in repurposed TV spectrum later than 24 months after the effective date of the service rules that we adopt for licensed wireless microphones, and microphones that do not comply with the new rules may not be manufactured and marketed later than 33 months after the effective date of the service rules we adopt in this proceeding. We also proposed that the effective date of any prohibition on manufacturing or marketing these devices will be 18 months after the release of the *Channel Reassignment PN*.[150] In addition, we requested comment on the economic costs and benefits of different effective dates for the proposed prohibition on manufacturing or marketing. Finally, to the extent that the Commission determines to prohibit such manufacture or marketing, we proposed that any such ban would not apply to devices manufactured in the United States solely for export.[151]

57. Sennheiser generally supports the proposed cutoff dates for certification of wireless microphones that would operate in the 600 MHz Band, at nine months following release of the *Channel Reassignment PN*, and for manufacturing and marketing of these devices at 18 months following this release.[152] CTIA and Mobile Future argue that these dates should be sooner, such that no new wireless microphones should be certified that are inconsistent with the post-auction 600 MHz Band as of the date of release of the *Channel Reassignment PN*, and that manufacturing and marketing of inconsistent microphones should cease six months after release of the *Channel Reassignment PN*.[153]

58. *Discussion.* We adopt our proposals for establishing cutoff dates for the certification, manufacturing and marketing of licensed wireless microphones in the TV bands, the guard bands (including the duplex gap), and the repurposed 600 MHz Band. We adopt transition rules for the TV bands, the guard bands (including the duplex gap), and the repurposed 600 MHz Band that will allow us to gradually phase out older microphones and introduce new ones that are compliant with the technical rules for Part 74 wireless microphones that we adopt in this proceeding[154] and for unlicensed wireless microphones generally and for licensed wireless microphones in the duplex gap that we adopt in the Part 15 Report and Order.[155] We are aligning the transition periods as closely as possible with the post-auction transition schedule because this will ensure compliance with the post-auction 600 MHz Band plan and be less disruptive to wireless microphone manufacturers and users.

59. We adopt the cutoff dates proposed in the *NPRM*. We will require applications to certify wireless microphones under the modified Part 74 rules nine months after the release of the *Channel Reassignment PN* or no later than 24 months after the effective date of the new rules, whichever occurs first. We will require that manufacturing and marketing of all Part 74 wireless microphones that would not comply with the rules for operation in the 600 MHz Band cease 18 months after release of the *Channel Reassignment PN* or no later than 33 months after the effective date of the new rules, whichever occurs first.

60. We recognize that it is important to provide manufacturers with sufficient time to design new products, obtain Commission certification, and commence manufacturing. It is equally important to allow manufacturers to sell existing devices that allow the public to continue providing service until new products are available in the marketplace. The cutoff dates that we adopt for certification, manufacturing and marketing of wireless microphones appropriately balance these two goals, and we disagree with the cutoff dates proposed by CTIA and Mobile Future. Manufacturers will not know what band plan they

[150] *Id.* at 12373 ¶ 117.

[151] *Id.* at 12373 ¶¶ 117-18.

[152] *See* Sennheiser Comments at 21.

[153] *See* CTIA Comments at 43-44, Mobile Future Comments at 3-4.

[154] The technical rules include the new emission mask for Part 74 wireless microphones. See discussion above.

[155] See Part 15 Report and Order, Section IV.F.2.

need to design and manufacture to until after the incentive auction is concluded, and it would be unreasonable to require that only certification applications complying with the new rules be accepted at the time the *Channel Reassignment PN* is released. Broadcast stations will be vacating the 600 MHz Band over a 39 month period after the release of the *Channel Reassignment PN*, and new wireless operations will be built out gradually as broadcast stations leave the band and most likely continuing beyond the 39 month transition period. It would be unreasonable to cut off manufacturing and marketing six months into the 39 month transition period since this would deny the public access to devices that would allow them to continue to provide service. We conclude that the cutoff dates we have chosen will encourage manufacturers to concentrate on developing wireless microphones that operate in compliance with new Part 74 and Part 15 rules and ensure that manufacturers cease making and marketing equipment that cannot be legally used after a certain date. Finally, as proposed in the *NPRM*, the prohibition on manufacture and marketing will not apply to devices manufactured in the United States solely for export.[156]

(c) Modification of LPAS licenses to remove authorization for operations on the 600 MHz Band

61. *Background.* In the *NPRM*, we proposed, pursuant to our authority under Section 316 of the Communications Act,[157] to modify existing LPAS licenses to the extent necessary to delete frequencies identified as repurposed for the 600 MHz Band in the *Channel Reassignment PN*, effective on the date that the post-auction transition period ends.[158] In addition, we proposed that, following these license modifications, the LPAS licenses will continue to include authorization to use all frequencies currently included in those licenses other than the repurposed 600 MHz Band.[159] Finally, we proposed that if a licensed user must cease operations of a wireless microphone prior to the end of the post-auction transition period (*i.e.*, because it causes harmful interference to any 600 MHz licensee's operations), the license relating to that wireless microphone will be modified automatically without Commission action to delete the authorization to operate on the repurposed 600 MHz Band, effective on the date that operations are required to cease.[160]

62. Mobile Future and Shure support our proposal to modify by rule LPAS licenses to delete frequencies in the repurposed 600 MHz band effective upon the conclusion of the post-auction transition period.[161] In addition, Mobile Future requests that the Commission automatically delete authorizations with respect to those frequencies in areas where they must cease operations to prevent harmful interference with 600 MHz band operations, asserting that removing these authorizations will help ensure that the Commission can bring appropriate enforcement actions if wireless microphone operators continue

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[156] *NPRM*, 29 FCC Rcd at 12373 ¶¶ 117-18.

[157] 47 U.S.C. § 316.

[158] *NPRM*, 29 FCC Rcd at 12373 ¶ 119. As noted in the *NPRM*, the Commission had already taken action in the *TV Bands Wireless Microphones Second Report and Order* adopted earlier this year to ensure that any LPAS licenses granted between the effective date of that order and the end of the post-auction transition period would be subject to the condition that operation in the repurposed 600 MHz Band must cease by the end of the post-auction transition period. *See id.*; *TV Bands Wireless Microphone Second R&O*, 29 FCC Rcd at 6114 ¶ 29. We proposed to modify, to the extent necessary, all other LPAS licenses granted prior to the effective date of *TV Bands Wireless Microphone Second Report and Order* that authorize operations on frequencies that will be repurposed for the 600 MHz Band. *NPRM*, 29 FCC Rcd at 12373-74 ¶ 119.

[159] *NPRM*, 29 FCC Rcd at 12374 ¶ 119. In connection with this proposal, we note that licensees whose authorization limits them in whole or in significant part to operations in the repurposed 600 MHz Band can seek to amend their licenses to include additional frequencies permitted under Subpart H if they wish. *Id.*

[160] *Id.*

[161] Mobile Future Comments at 4; Shure Comments at 18.

to operate on these specific frequencies.[162] NAB disagrees with requiring wireless microphone operations to cease no later than the end of the transition period, requesting instead that the Commission allow wireless microphones to continue to operate on the 600 MHz band spectrum until wireless licenses are actually ready to deploy in the area and the Commission has identified alternative bands to which wireless microphones can operate.[163] NFL, RTDNA, and Sennheiser each support this latter approach.[164]

63. *Discussion.* We adopt the proposal set forth in the *NPRM.* As set forth in the *Incentive Auction R&O*, during the transition period, wireless microphone users must cease operations if they would cause harmful interference to any 600 MHz wireless operations,[165] and if there are violations of this requirement we will enforce our rules accordingly. We decline the requests to permit wireless microphone operations in the 600 MHz Band following the transition period. As we explained in the *Incentive Auction R&O*, establishing a hard date by which all licensed and unlicensed wireless microphone operations must cease provides needed certainty and clarity about transitioning out of the band, [166] and no party petitioned for reconsideration of our decision on this matter.[167] Finally, we direct the Wireless Bureau to modify LPAS licenses to delete the affected frequencies from LPAS licensees' authorizations, effective at the end of the transition period.

2. Miscellaneous VHF/UHF Bands

a. 26.100-26.480 MHz, 161.625-161.775 MHz, 450-451 MHz, and 455-456 MHz Bands

64. *Background.* Wireless microphones operating pursuant to the Part 74 LPAS rules also are authorized to operate on a licensed basis in small portions of certain broadcast bands, including the 26.100-26.480 MHz, the 161.625-161.775 MHz, the 450-451 MHz, and the 455-456 MHz bands.[168] Eligibility for operating in these bands is limited to broadcasters and broadcast network entities.[169] While we did not propose any specific revisions concerning these rules in the *NPRM*, we sought comment on the current use of these bands for wireless microphone operations, and the more expansive use of these bands in the future. We asked where there are technological advances that may promote more intensive use, and requested comment on any potential revisions that we should make to facilitate the use of these bands for wireless microphone operations.[170]

65. BSI, SBE, Sennheiser, and Shure generally do not view these bands as an adequate alternative to accommodate an influx of wireless microphones shifting from the 600 MHz bands.[171] While Sennheiser and Shure do not completely discourage consideration of all these bands, they note

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[162] Mobile Future Comments at 4-5.

[163] NAB Comments at 3-4.

[164] NFL Reply Comments at 5 (this "use it until it's needed" approach to spectrum management maximizes efficiency and minimizes operational costs); RTDNA Reply Comments at 3; Sennheiser Reply Comments at 5 (would maximize the useful life of 600 MHz band equipment).

[165] *Incentive Auction R&O*, 29 FCC Rcd at 6846 ¶ 687.

[166] *Id.*

[167] *See* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Second Order on Reconsideration*, 30 FCC Rcd at 6801-6806 ¶¶ 122-130 (2015) (discussion of petitions for reconsideration relating to wireless microphones).

[168] *See* 47 C.F.R. § 74.802.

[169] 47 C.F.R. § 74.832(a), (d).

[170] *NPRM*, 29 FCC Rcd at 12374 ¶ 122.

[171] Shure Comments at 40-41; Sennheiser Comments at 21; SBE Comments at 12; BSI Comments at 13.

these lower frequencies have limited use and are capable of supporting only a few wireless microphones, if any.[172]

66. *Discussion.* Given commenters' general view that additional use of these bands is limited, and considering the small amount of spectrum they offer, revision of our rules to permit expanded operations in these bands would not yield much benefit. Furthermore, we have sought comment on revising the rules in these bands to allow for the use of digital technologies of Remote Pickup (RPU) stations in another rulemaking, which could result in more intensive use of these bands.[173] We therefore conclude that we will not make these bands available for wireless microphone operations other than as currently authorized, and subject to the outcome in the latter proceeding.

b. 88-108 MHz FM Band

67. *Background.* As discussed in the *NPRM*, wireless microphone operations have long been permitted in the 88-108 MHz FM band on an unlicensed basis under Section 15.239 of our Part 15 rules.[174] While we did not proposed any rule revisions in the *NPRM*, we sought comment on whether wireless microphone users continue to make use of this band for their operations and the extent to which existing or revised rules will be useful for accommodating wireless microphone users' needs in the future. To the extent that revisions were proposed, we requested that parties submit technical information in support of their proposals, as well as analysis of the benefits of such revisions and likely impact on FM broadcasters.[175]

68. We received few comments regarding wireless microphone use of this spectrum, with no commenter suggesting that the band offers potential for supporting significant future use. BSI states that the FM band is not useable for wireless microphones that support program production, and that there is no room in that band for wireless microphones generally, without fear of interference to and from FM broadcasters.[176] Similarly, SBE asserts that, while some unlicensed, low-power wireless microphones have been manufactured for the FM band, the potential for interference to FM radio reception in major markets is far too high to permit such use.[177] Moreover, Sennheiser contends that the FM band has exceedingly limited potential for wireless microphone use because antenna length requirements are very cumbersome for either worn or held microphones.[178] Along those same lines, Shure maintains that the wavelengths in the FM band are too long to be acceptable for most contemporary wireless microphone applications.[179]

69. *Discussion.* Based on the comments and record before us, and the apparently minimal opportunity for making use of this band, we decline to make any revisions to the rules applicable to wireless microphone operations in the 88-108 MHz FM band.

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[172] Sennheiser Comments at 21; Shure Comments at 10-11, 40-41.

[173] *See* Permitting Remote Pickup Broadcast Auxiliary Stations to Utilize Modern Digital Technologies, *et al.*, WT Docket No. 15-36, *Notice of Proposed Rulemaking and Order*, 30 FCC Rcd 2387 (2015).

[174] *NPRM*, 29 FCC Rcd at 12374-74 ¶ 123; 47 C.F.R. § 15.239 (devices.may operate on no more than a 200 kHz bandwidths, and field strength of emissions must not exceed 250 microvolts/meter at 3 meters).

[175] *NPRM*, 29 FCC Rcd at 12375 ¶ 124.

[176] BSI Comments at 13-14.

[177] SBE Comments at 12.

[178] Sennheiser Comments at 21.

[179] Shure Comments at 41.

3. 169-172 MHz Band

70. *Background.* Under the Commission's Part 90 rules, entities eligible to hold a Public Safety Pool or Industrial/Business Pool license may operate wireless microphone operations on a secondary basis on eight frequencies in the 169-172 MHz band, which is allocated primarily for Federal use.[180] Specifically, these rules permit wireless microphones to be operated on only eight frequencies: 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.[181] The emission bandwidth may not exceed 54 kilohertz, the frequency stability of the microphones must limit the total emission to within ± 32.5 kilohertz of the assigned frequency, and operations may not exceed an output power level of 50 mW.[182]

71. Wireless microphone operations are not protected from other licensed operations in the band, and must not cause interference to any Government or non-Government operations, and wireless microphone license applications are subject to Government coordination.[183] Other non-Federal operations in the band, which also are secondary to the Federal allocation, operate on 12.5 kilohertz channels,[184] and include (1) operations on 36 specified frequencies between 169.425 MHz and 171.925 MHz for the purpose of transmitting hydrological or meteorological data (hydro channels),[185] (2) operations on 9 frequencies between 170.425 MHz and 172.375 MHz for forest firefighting and conservation purposes (forest firefighting channels),[186] and (3) operations on frequency 170.150 MHz for public safety purposes[187] and broadcast remote pickup stations[188] in certain parts of the country. The current 169-172 MHz band wireless microphone channels overlap the hydro channels, but not the forest firefighting channels or public safety operations on frequency 170.150 MHz.

72. In the *NPRM*, we sought comment on the current use of spectrum in the 169-172 MHz band for wireless microphones, and how the spectrum potentially could be used more expansively and intensively without interfering with Federal operations or the other secondary non-Federal services.[189]

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[180] 47 C.F.R. § 90.265(b). 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 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.

[181] 47 C.F.R. § 90.265(b); *see also* 47 C.F.R. § 2.106, footnote US300.

[182] 47 C.F.R. § 90.265(b)(1)-(3).

[183] 47 C.F.R. § 90.265(b)(4).

[184] Although the other secondary licensees are required to operate on narrowband channels, the Commission did not require that wireless microphones operate in narrowband mode. *See* Amendment of Parts 2 and 90 of the Commission's Rules to Provide for Narrowband Private Land Mobile Radio Channels in the 150.05-150.8 MHz, 162-174 MHz, and 406.1-420 MHz Bands that Are Allocated for Federal Government Use, *Report and Order*, 20 FCC Rcd 5793, 5817 ¶ 64 (2005). The Federal systems in the band also are required to be capable of narrowband operations. *See id.* at 5799 ¶ 12.

[185] 47 C.F.R. § 90.265(a) (listing specified channels); *see also* 47 C.F.R. § 2.106, footnote US13.

[186] 47 C.F.R. § 90.265(c) (listing specified channels).

[187] 47 C.F.R. § 90.265(d).

[188] 47 C.F.R. § 74.402(e)(8).

[189] *NPRM*, 29 FCC Rcd at 12376-77 ¶¶ 128-29. The Commission previously sought comment on whether the Part 90 rules should facilitate broader wireless use in these frequencies, and commenters expressed concern that the band may not be a viable option where professional audio quality or a large number of devices is required. *See id.* at 12376 ¶ 127 (citing 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,

(continued….)

We asked what steps we could take to make the band a viable option for more wireless microphone users,[190] and sought comment on two specific approaches: allowing wireless microphone licensees to combine each of the four neighboring pairs of channels with each other, making four larger-bandwidth channels available on new channel centers between the existing assignable frequencies;[191] or making as much of the 169-172 MHz band as possible available for wireless microphone use and allowing operation with bandwidths of up to 200 kilohertz, subject to appropriate technical or geographic limitations.[192]

73. Audio-Technica, Sennheiser, and Shure support the suggested approach of making as much of the 169-172 MHz band as possible available for wireless microphone use and allowing operation with bandwidths of up to 200 kilohertz on center frequencies throughout the band.[193] Sennheiser states that wireless microphone use of the band has been minimal under existing rules because of the narrow allowable bandwidth, which is best used for communications grade audio systems (*e.g.*, intercom and cueing).[194] It and Audio-Technica also assert that the number of available channels is limited because no more than three or four of the frequencies can be used by a single entity at the same time due to intermodulation effects.[195] BSI and SBE, while not opposing the expanded use of the band, assert that wireless microphone operations in the band would be of limited usefulness because of the difficulty of coordinating with Government users, which is particularly difficult in real time because broadcasters' needs are itinerant and mobile.[196]

74. With regard to the specific rules, Shure proposes that 100-kilohertz guard bands be created at the top and bottom of the band by not allowing a center frequency below 169.100 MHz or above 171.900 MHz.[197] Finally, Shure and Sennheiser support authorizing these operations on an unlicensed basis pursuant to Part 15 of our rules on a non-interference, sufferance basis.[198]

75. *Discussion*. As noted above, the current 169-172 MHz band wireless microphone channels overlap the hydro channels, but not the forest firefighting channels. Making as much of the 169-172 MHz band as possible available for wireless microphone use and allowing operation with bandwidths of up to 200 kilohertz on center frequencies throughout the band, as advocated by the commenters, would result in wireless microphone channels overlapping forest firefighting channels. In another proceeding, a petition for rulemaking proposed to make the forest firefighting channels available for vehicular repeater

(Continued from previous page)
Including Wireless Microphones, and the Digital Television Transition; Amendment of Parts 15, 74, and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket Nos. 08-166 and 08-167, ET Docket No. 10-24, 25 FCC Rcd 643, 704 ¶¶ 150-51 (2010); The Wireless Telecommunications Bureau and the Office of Engineering and Technology Seek to Update and Refresh Record in the Wireless Microphone Proceeding, *Public Notice*, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24, 27 FCC Rcd 12067 (WTB/OET 2012)).

[190] *NPRM*, 29 FCC Rcd at 12376-77 ¶¶ 128-30.

[191] *Id.* at 12377 ¶ 131. For example, authorizations operating on frequencies 169.445 MHz and 169.505 MHz could be combined, allowing for operation with a bandwidth of almost 120 kilohertz on center frequency 169.475 MHz.

[192] *Id.* at 12377-78 ¶ 132.

[193] *See* Audio-Technica Comments at 23; Sennheiser Comments at 22; Shure Comments at 34.

[194] *See* Sennheiser Comments at 22.

[195] *See id.*; Audio-Technica Comments at 23.

[196] *See* Broadcast Sports, Inc. Comments at 13; Society of Broadcast Engineers, Inc. Comments at 12.

[197] *See* Shure Comments at 34.

[198] *See* Sennheiser Reply Comments at 11; Shure Comments at 35.

systems (VRS) and other mobile repeaters by other firefighters fighting in-building fires.[199] Despite the benefits that VRS use provides for first responders,[200] the Commission denied that portion of the rulemaking petition.[201] It noted concerns expressed by the National Telecommunications and Information Administration that an interference-free environment must be maintained on the forest firefighting channels because even VRS public safety operations on a secondary basis would pose a risk of creating conflicts with primary Federal safety operations.[202] Consistent with this precedent, we decline to allow wireless microphone operations on center frequencies throughout the band that would overlap forest firefighting channels.

76. We agree with commenters that we should promote more opportunities for wireless microphone use of this band. Consequently, we will pursue the approach of creating new channel centers between the existing neighboring pairs of channels (*i.e.*, 169.475, 170.275, 171.075, and 171.875 MHz). We conclude that the record supports permitting operation on these new channel centers with a bandwidth of up to 200 kilohertz, rather than merely combining the existing channels into new channels with a bandwidth of less than 120 kilohertz, because 200 kilohertz bandwidth will support higher audio quality, which could facilitate operation in the band by a wider range of users. Wireless microphones that have bandwidth exceeding 54 kilohertz will be required to comply with the emission masks in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2008-11) that we are adopting for licensed wireless microphone operations in the TV bands.[203]

77. In order to protect Federal operations and the other secondary non-Federal services, we reject the suggestion that we authorize wireless microphone operations in the 169-172 MHz band on an unlicensed basis pursuant to Part 15. Unlicensed operations would eliminate the Federal Government's ability to review and object to new assignments in this primary Federal band. Instead, these operations will be licensed pursuant to Part 90 and applications will be subject to Government coordination.

4. 944-952 MHz Band and Adjacent 941-944 MHz and 952-960 MHz Bands

78. In the *NPRM*, we sought comment on making revisions to the rules in the 944-952 MHz band and the two adjacent bands, the 941-944 MHz and 952-960 MHz bands, to accommodate additional licensed wireless microphone operations.

a. 944-952 MHz Band

79. *Background.* The Commission's Part 74, Subpart H rules authorize operations of wireless microphones on a licensed basis in the 944-952 MHz band.[204] These LPAS operations are authorized on a co-primary basis along with other Broadcast Auxiliary Services (BAS) consisting of fixed Aural Studio to Transmitter links (STL) stations and fixed Aural Intercity Relay Links stations (ICR).[205]

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[199] *See* Amendment of Sections 90.20(d)(34) and 90.265 of the Commission's Rules to Facilitate the Use of Vehicular Repeater Units, *Order and Notice of Proposed Rulemaking*, PS Docket No. 13-229, 28 FCC Rcd 13544, 13546 ¶ 3 (2013).

[200] Mobile repeaters are beneficial for public safety because they can provide first responders with enhanced in-building radio coverage at emergency sites, thereby enabling first responders to remain in radio contact when they are inside a building. *Id.* at 13745 ¶ 1.

[201] *Id.* at 13752 ¶ 19.

[202] *Id.* at 13753 ¶ 19.

[203] For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the below 1 GHz digital emission mask contained in Section 8.3.2.2 of the standard (Figure 4). We also will require emissions beyond +/- 1 MHz from the carrier or center frequency to be attenuated by 90 dB.

[204] 47 C.F.R. § §§ 74.802(a); 74.831.

[205] *See* 47 C.F.R. § 74.502(b).

Entities eligible for a license to operate wireless microphones are limited to broadcast licensees and broadcast network entities.[206] LPAS devices using this particular band of spectrum may also be used to 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.[207] Under the applicable technical rules, the operating bandwidth for LPAS operations may not exceed 200 kHz, and the maximum transmitter power is 1 watt.[208] Several manufacturers have developed wireless microphones that use this band.[209]

80. In the *NPRM*, we sought comment on potential for more intensive use of this band for the licensed wireless microphone operations among the other BAS that use the band. We asked whether, considering that less spectrum may be available for wireless microphone operations in the UHF television bands, licensees expect to make greater use of this band in this band by migrating particular types of uses to this spectrum when they are spectrum-constrained in the TV bands, and whether this band is well-suited for high-quality uses. Because we had proposed adopting ETSI standards for operations in the TV bands, we also proposed adopting these standards for LPAS operations in the 944-952 MHz band.[210]

81. We also proposed expanding eligibility in the 944-952 MHz band to include all of the entities currently eligible under Part 74 for licensed operation of LPAS devices in the TV bands, given that their wireless microphone needs are similar to those of broadcasters and broadcast network entities. We asked whether technical limitations and other considerations should be weighed when assessing expansion of licensee eligibility in this band to ensure that such eligibility expansion would not be problematic for existing LPAS operations in this band.[211]

82. Adeunis, Audio-Technica, Lectrosonics, Sennheiser, Shure, SBE, as well as a broad coalition of broadcasters, newscasters, large event spectrum coordinators and producers, other wireless microphone users, and wireless microphone manufacturers ("Professional Audio Community") assert that more intensive use of the 944-952 MHz band, along with spectrum in the 941-944 MHz and 952-960 MHz bands, would be critical to accommodating licensed wireless microphone users' needs in the future.[212] Adeunis, Sennheiser, Shure, and the Professional Audio Community also support adoption of the ETSI standard for wireless microphone operations in this band,[213] while only Lectrosonics opposes imposition of the ETSI standard.[214] Finally, those commenters asserting the importance of making use of this band also supported expanding eligibility to include the set of entities currently eligible to hold Part 74 LPAS licenses in the TV bands.[215] SBE contends that coordination among the licensed wireless microphone users and other licensees in the band should be mandatory in order to avoid interference to

[206] 47 C.F.R. § 74.832(c)-(d).

[207] 47 C.F.R. § 74.831.

[208] 47 C.F.R. § 74.861(d)(1), (e)(5).

[209] *NPRM*, 29 FCC Rcd at 12378-79 ¶ 136.

[210] *Id.* at 12379 ¶¶ 137-38.

[211] *Id.* at 12379-80 ¶ 140.

[212] Adeunis Comments at 12; Audio-Technica Comments at 23; Lectrosonics Comments at 20; Sennheiser Comments at 22; Shure Comments at 36-38; SBE Comments at 12-13; *see also* Professional Audio Community June 22 *Ex Parte* Attachment at 5-6.

[213] Adeunis Comments at 13; Audio-Technica Comments at 22; Sennheiser Comments at 22; Shure Comments at 36; Professional Audio Community June 22 *Ex Parte* Attachment at 5-6.

[214] Lectrosonics Comments at 19-20.

[215] Adeunis Comments at 12; Audio-Technica Comments at 23; Lectrosonics Comments at 20; Sennheiser Comments at 23; Shure Comments at 36-38; SBE Comments at 12-13.

Aural Studio to Transmitter Links (STL) and fixed Aural Intercity Relay Links (ICR) in the band, and the Professional Audio Community supports coordination through SBE.[216]

83. *Discussion.* Consistent with this record and in accord with adoption of the ETSI standard on emission masks for LPAS devices in the TV bands. we will require that emissions from analog and digital wireless microphones comply with the emission masks in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2011-08),[217] for future wireless microphones that will use this band – applying these revised standards to new equipment certified under Part 74 in the 944-952 MHz band 9 months after issuance of the *Channel Reassignment PN*, consistent with the requirements for new equipment certified for LPAS devices that operate in the TV bands.[218] Further, we expand eligibility for operations in the 944-952 MHz band to include all entities currently eligible to hold LPAS licenses for operation in the TV bands. This step should help address the need for additional spectrum outside of the TV bands for this entire group of licensed users.

84. Licensed LPAS users operating in the 944-952 MHz band (as in the TV bands) are subject to the frequency selection requirements contained in Section 74.803 of our Rules.[219] SBE runs a local frequency coordination program for this band and asserts its coordination would have to be mandatory in order to avoid interference among different licensees.[220] Accordingly, we will also require wireless microphone users seeking access to this band to coordinate their proposed use through the local SBE coordinator.[221]

b. 941-944 MHz Band and 952-960 MHz Band

85. *Background.* The two bands immediately adjacent to 944-952 MHz band – the 941-944 MHz and the 952-960 MHz bands – are licensed for fixed services in varying bandwidths (from 12.5 kHz up to 200 kHz) in different areas and segments of these eleven megahertz.[222] Most of the spectrum in these two bands is licensed for Private Operational Fixed (including business industrial and public safety) and Common Carrier Fixed Microwave Services authorized under Part 101,[223] and fixed Aural Broadcast Auxiliary Services (STL and ICR) authorized under Part 74,[224] while smaller portions are authorized for Multiple Address Systems (MAS), which consist of point-to-multipoint Fixed Microwave Services authorized under Part 101 of the rules.[225]

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[216] SBE Comments at 13; Professional Audio Community June 22 *Ex Parte* Attachments at 6. In its comments, Shure supported requiring coordination through use of an online database. Shure Comments at 36. Shure subsequently joined the Professional Audio Community in supporting coordination through SBE. *See* Professional Audio Community June 22 *Ex Parte*.

[217] For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the below 1 GHz digital emission mask contained in Section 8.3.2.2 of the standard (Figure 4).

[218] Licensees may continue to use equipment certified prior to that date.

[219] *See* 47 C.F.R. § 74.803.

[220] SBE Comments at 13.

[221] These processes are described on SBE's website. *See* The Society of Broadcast Engineers, Frequency Coordination, http://www.sbe.org/sections/freq_local.php.

[222] *NPRM*, 29 FCC Rcd at 12380 ¶ 142.

[223] *Id.*at 12380 ¶ 142 & n.158 (citing Part 101, Subparts H & I).

[224] *Id.*at 12380 ¶ 142 & n.159 (citing Part 74, Subpart E).

[225] *See* Amendment of the Commission's Rules Regarding Multiple Access Systems, WT Docket No. 97-81, *Report and Order*, FCC No. 99-415, 15 FCC Rcd 11956, 11956 ¶ 1 (2000) (*MAS Report and Order*).

86. Specifically, most of the 941-944 MHz band – the two and a half megahertz between 941.5-944 MHz – is available for licensing for Private and Common Carrier Fixed Microwave Services or for broadcast auxiliary stations. Fixed point-to-point links in these bands are typically used for long distance low data-rate links between locations that have line of sight capability. They employ directional antennas and operate with fairly high effective isotropic radiated power. Receive antennas are also directional, affording some rejection of unwanted signals off-axis from the main lobe of the antenna. The other portion, the half megahertz between 941-941.5 MHz, is authorized for MAS operations, specifically communications from MAS master stations to remote stations; consequently, transmission from the master station is generally omni-directional, generally within a 25-mile radius, to many remote stations. MAS historically has been used by the power, petroleum, and security industries for various alarm, control, interrogation and status reporting requirements as well as by the paging industry, and the licensing scheme adopted by the Commission was designed to accommodate these past and present uses.[226] MAS licenses in this band are either geographically-based or site-based.

87. Most of the 952-960 MHz band – 6.8 megahertz of spectrum between 952.85-956.25 MHz and 956.45-959.85 MHz – is licensed for Private Operational Fixed Microwave Service (including business industrial and public safety) authorized under Part 101.[227] The remaining portions of the band are also authorized for MAS operations in three distinct portions, totaling 1.2 megahertz. The MAS bands are divided into two groups with differing licensing and service characteristics; these are commonly known as the 928/952/956 band – used for private internal or public safety communications, and the 928/959 MHz band – used by CMRS and paging network incumbents.[228] The MAS portions of these bands have historically been used by the power, petroleum, and security industries for various Supervisory Control and Data Acquisition (SCADA) operations as well as by the paging industry.[229] These licenses also could be either geographically-based or site-based.

88. In the *NPRM*, we proposed making unused portions of the 941-944 MHz and the 952-960 MHz bands available for licensed wireless microphone operations on a secondary basis, generally under the rules applicable for LPAS operations in the 944-952 MHz band, provided that incumbent users in the band could be protected from interference. We inquired about the extent to which there are many locations in these bands where spectrum is unused, potentially available, and in sufficient bandwidth (e.g., 200 kHz) suitable for wireless microphone uses similar to their uses in the TV bands and 944-952 MHz band.[230] Considering the different services and service rules that apply to portions of these bands, and the mix of point-to-point and point-to-multipoint services already operating in these bands, we asked whether specific sub-bands would be more suitable than others for sharing with wireless microphones. In this regard, we first inquired about those portions of the spectrum available for licensing for fixed microwave services, which constitutes the majority of the spectrum in these bands. We sought comment on the ability of wireless microphone users to determine the availability of suitable spectrum at particular locations in these portions of the band, and what issues or factors we should take into account to make spectrum available for wireless microphone operations while protecting the incumbent fixed services that operate in these bands. We then made similar inquiries about making the portions of the spectrum in these bands that are authorized for MAS operations available for wireless microphone operations. Considering that many MAS systems are used by utilities for SCADA operations, we sought comment on whether these existing users operate in the same general geographic areas as wireless microphone users,

[226] *See id.* at 11959 ¶ 4, 11964 ¶ 17.

[227] *See NPRM*, 29 FCC Rcd at 12381-82 ¶ 145 (citing Part 101, Subparts H & I).

[228] *See id.* at 12383 ¶¶ 146-47 (citing *MAS Report and Order,* 15 FCC Rcd at 11951 ¶ 4 n.1, 11967 ¶¶ 26-27). The portions of the 952-960 MHz used for MAS include 952-952.85 MHz (paired with the 928-928.85 MHz), 956.25-956.45 MHz and the 959.85-960 MHz (paired with the 928.85-929 MHz), amounting to 1.2 MHz total. *See id.*

[229] *See MAS Report and Order,* 15 FCC Rcd at 11959 ¶ 4, 11964 ¶ 17.

[230] *See NPRM*, 29 FCC Rcd at 12383 ¶¶ 149-150.

or whether the wireless microphone operations would be separated geographically because these are different types of uses. We also asked about other factors that we should consider when determining whether and how to permit wireless microphone operations in these MAS portions.

89. We also sought comment on designing rules that would be necessary to address any interference concerns with particular incumbent operations that could arise.[231] We asked whether certain types of services, such as fixed microwave services, would generally not be prone to interference, and whether others, such as MAS operations involving SCADA operations, could be more susceptible to interference and require more protected rules (e.g., rules to specify minimum separation distances, or create protection zones, or imposed greater limitations on power levels used by wireless microphones, or restricting use to indoors).[232] In addition, we sought comment on the technical rules that would apply to wireless microphone operations in these bands. We specifically asked whether wireless microphones should be permitted to operate under the same technical rules for LPAS operations that apply to operations in the 944-952 MHz band (e.g., power limits, maximum bandwidth, Out of Band Emissions (OOBE)), including the ETSI standards that we proposed to apply to such operations.[233] Finally, we sought comment on the equipment issues that would pertain to wireless microphone operations in these bands, including various issues relating to the certification process (e.g., whether manufacturers should be able to certificate equipment under the same rules and procedures for LPAS devices that operate in the 944-952 MHz band, or needed to develop new equipment for these bands that would be certificated in a different manner).[234]

90. Adeunis, Audio-Technica, Lectrosonics, Sennheiser, Shure, and SBE individually, along with the Professional Audio Community, agree that the 941-944 MHz and 952-960 MHz bands should be opened for wireless microphone use to parties eligible for Part 74 LPAS licenses and they argue this band would be critical for addressing their professional needs for licensed access.[235] Sennheiser and Shure also support expanding license eligibility in these bands to those entities eligible for LPAS licenses in the TV bands.[236] Adeunis, Lectrosonics, and Shure generally agree that they could construct radios to operate on an expanded 941-960 band without the necessity or expense of a major redesign and that such radios could be brought to market quickly.[237]

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[231] *See id.* at 12384 ¶ 155.

[232] *See id.*

[233] *See id.* at 12383 ¶¶ 149-150, 12383-84 ¶ 154, 12384 ¶ 156.

[234] *See id.* at 12384 ¶ 156.

[235] *See* Adeunis Comments at 12; Audio-Technica Comments at 23; Lectrosonics Comments at 20; Sennheiser Comments at 22; Sennheiser Reply Comments at 7; Shure Comments at iii, 36-38; Shure Reply Comments at 4, 7-8; and the Society of Broadcast Engineers (SBE) Comments at 12-13; *see also Pro Audio Community Jun. 22 Ex Parte* at 5.

[236] Sennheiser Comments at 22; Sennheiser Reply Comments at 11; Shure Comments at iii; 36, Shure Reply Comments at 7-8. SBE opposes use of the band by parties other than "broadcasters and Part 74 LPAS eligible" entities. *See* SBE Comments at 13.

[237] *See* Adeunis Comments at 12; Lectrosonics Comments at 20; Shure Comments at 36. Shure predicts the time-to-market for new microphones can vary between two to four years, whereas Sennheiser expects a minimum of three or up to five years. Shure Comments at 15; Sennheiser Comments at 16. Shure states its estimate can vary depending on whether off-the-shelf components are available or need to be engineered, and the complexity of the product line (handheld versus body worn), whether special technical requirements must be satisfied, the complexity of any regulatory obligations that must be met before marketing and sale; however, as a general rule, it states, products being developed for existing bands under established service rule will have a shorter time-to-market. *See* Shure Comments at 15 & n.30. Sennheiser states that overall the time to market for newly designed wireless microphones is at least several years, particularly for products that will operate on newly accessed bands. Sennheiser Reply Comments at 6.

91. UTC, Xcel, and Broadcast Sports Incorporated (BSI) oppose permitting LPAS operation in the MAS portions of the 941-944 and 952-960 bands due to the risk of interference posed by LPAS to utility-based SCADA operations, and because the band is so heavily occupied by Part 74 STL and ICR licensees, private and common carrier OFS, and MAS operations, that available spectrum would be limited.[238] UTC notes that a fundamental problem with LPAS operations is the lack of information about when and where they will be used and the likelihood of their inadvertent interference to SCADA infrastructure.[239] Adeunis, Lectrosonics, Sennheiser, and Shure all respond that wireless microphones could coexist with MAS licensees, given that such microphones have coexisted with studio-transmitter links in the past and that they operate at extremely low power at short ranges.[240] Xcel urges that if the Commission permits the proposed operations in the 941-944 MHz and 952-960 MHz bands, the Commission should adopt minimum separation distances between site-based incumbent operations and wireless microphones, and that it should also adopt protection zones around site-based operations, limitations on power levels for wireless microphones, and limit microphones to indoor use in frequencies used for MAS operations.[241]

92. With respect to interference, some commenters believe wireless microphone operations in these expanded bands would cause very little interference to existing operations in the bands or that such interference could be accommodated.[242] Shure asserts that 941-960 MHz band incumbents could easily be protected from interference from wireless microphones operating at low power over short distances because the majority of licensees in this band are for Fixed Point-to-Point Microwave services using directional antennas and fairly high effective isotropic radiated power; it notes that critical microwave public safety pool users are largely in the 941.0-941.5 MHz and 952-952.85 MHz bands authorized for MAS operations and are easily avoided.[243] Furthermore, Shure asserts licensees should be required to coordinate operations through the use of online databases to ensure interference protection for

[238] *See* UTC Reply Comments at 1, 33-4; Xcel Comments at 3; Broadcast Sports Incorporated (BSI) Comments at 13 UTC is the international trade association for the telecommunications and information technology interests of electric, gas, and water utilities, pipeline companies and other critical infrastructure companies. UTC Reply Comments at 1. Xcel, an electric and natural gas company based in Minneapolis, MN and serving millions of electricity customers, states it holds several licenses for Private Operational Fixed Point-to-Point Microwave Services between 941.5 and 944 MHz and 952.95-956.15 MHz and 956.55-959.75 MHz, as well as site-based MAS operations between 941-941.5 MHz and the 928/929/956 band. Xcel Comments at1-2. Xcel asserts its SCADA operations in particular are heavily dependent on MAS frequencies. Xcel Comments at 3. It states these SCADA systems enable it to monitor energy transmission and distribution operations in real time, allowing its equipment to quickly communicate with headquarters, identify problems, and take steps to prevent or contain outages. Xcel Comments at 3.

[239] UTC Reply Comments at 3-4.

[240] *See* Adeunis Reply Comments at 3; Lectrosonics Comments at 20; Sennheiser Comments at 23; Sennheiser Reply Comments at 13 (Sennheiser notes MAS operators do not explain why they believe interference from wireless microphones is certain); Shure Reply Comments at 4.

[241] Xcel Comment at 3-4.

[242] Sennheiser argues wireless microphones operated indoors should have very little chance of interfering with outdoor, high elevation receive site antennas. Sennheiser Reply Comments at 12; Adeunis responds that wireless microphones use very low power – 0.233 Watts in its case, and only have an 100 meter effective range in larger venues or arenas, making them unlikely to cause any interference to other users, such as Xcel. Adeunis Reply Comments at 3-4; *see also* Letter from Robert H. Jackson, Counsel, Adeunis-NA, Inc. to Marlene Dortch, Secretary, FCC, May 4, 2015 at 1-2.

[243] Shure Comments at 37.

other LPAS incumbents in the band.[244] SBE states it would require mandatory, real-time frequency coordination to avoid interference with STL and ICR operators that heavily use the band.[245]

93. As for the technical rules and parameters, while some proponents agree the same technical rules currently used in the 944-952 MHz bands should be applicable to these expanded bands,[246] some argue for variations on the technical specifications of wireless microphones utilizing these bands. For example, some believe that the ETSI emission standards should apply to use of the expanded 941-960 MHz band.[247] Adeunis opposes the 200 KHz channel limit currently in the rules and argues that using TDMA technology, a 500 KHz channel would provide higher quality service for as many as 20 devices using 25 KHz channels.[248] Shure recommends a channelization scheme should apply whereby 25 kHz blocks or sub-channels would be fit within a 200 kHz channel, and it argues that a 250 mW power limit should be implemented consistent with wireless microphone use in the broader UHF broadcast television band.[249]

94. *Discussion.* Based on the record before us, we will open most of the 941-944 and 952-960 MHz bands – the 2.5 megahertz of spectrum between 941.5-944 MHz and the 6.8 megahertz of spectrum between 952.85-956.25 MHz and 956.45-959.85 MHz – for use by wireless microphones and other LPAS license eligible entities currently operating in the TV broadcast bands and for whom we have expanded eligibility to operate in the 944-952 MHz bands. Because wireless microphones operate at low power over short distances, and fixed point-to-point systems employ directional antennas and operate with fairly high effective isotropic radiated power, we believe that the risk of interference between LPAS operations and fixed point-to-point operations is low, and commenters generally agree with that conclusion.[250] We find further support for our decision in parties' assurances that equipment to utilize these expanded bands could be brought to market quickly. Furthermore, we find that LPAS operations in the these bands should be subject to the same Part 74 technical rules that apply to LPAS operations in the 944-952 MHz band (e.g., the same power limits, maximum bandwidth, and coordination requirements). We also adopt the ETSI standard for emission masks in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2011-08); and will require emissions beyond +/- 1 MHz from the carrier or center frequency to be attenuated by 90 dB.[251] We will apply this standard to new licenses in the 941.5-944 MHz, 952.85-956.25 MHz and 956.45-959.85 MHz bands upon the effective date of this order. Consistent with the coordination requirements we adopted for the 944-952 MHz band, we will also require wireless microphone users

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[244] *Id.* at 36.

[245] SBE Comments at 12-13. Lectrosonics also agrees a coordination requirement would be sufficient to prevent conflicts. Lectrosonics Comments at 20.

[246] *See* Sennheiser Comments at 22; Lectrosonics Comments at 20.

[247] Shure states that the spectrally efficient 200 kHz analog and digital masks provided in ETSI standard EN 300 422-1 v1.2.4 (2011-08), Sections 8.3.1.2. and 8.3.2.2, respectively, should apply. Shure Comments at 36; *see also* Sennheiser Comments at 22; Adeunis Comments at 13. In their June 22 Ex Parte, the combined Pro Audio Community asserted we should apply existing Part 74 technical rules to operations in these bands, but replace occupied bandwidth and spurious limits with the ETSI limits for all new equipment. *See* Professsional Audio Community June 22 *Ex Parte* at 5-6.

[248] Adeunis Comments at 12.

[249] Shure Comments at 36. Shure also argues licensees should be required to reduce co-channel power to 50 mW or block relevant frequencies in markets where public safety users occupy portions of the 941-944 MHz and or 952-960 MHz bands. *Id.* at 36, 37-38.

[250] *See id.* at 37, Lectrosonics Comments at 20.

[251] For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the below 1 GHz digital emission mask contained in Section 8.3.2.2 of the standard (Figure 4). See paragraph 32 above.

seeking access to the 941.5-944 MHz, 952.85-956.25 MHz and 956.45-959.85 MHz bands to coordinate their proposed use through the local SBE coordinator.[252]

95. We do not, however, open the remaining portions of the bands authorized for MAS operations, in three distinct portions totaling 1.7 megahertz, for licensed wireless microphone operations. Unlike with fixed point-to-point operations, we conclude that there is a greater risk of interference from a wireless microphone being operated at close proximity to a MAS remote station. Unlike fixed point-to-point operations (including BAS studio transmitter links), geographic area MAS licensees may add master and remote stations throughout their service area without prior Commission approval, and incumbent MAS licensees are allowed to expand their systems under certain circumstances.[253] Given the record before us, including the concerns of representatives of MAS interests, we conclude that proponents of using the MAS bands for wireless microphones have not demonstrated that they can coexist with MAS without causing interference. Furthermore, there is only a relatively small amount of spectrum in discrete segments potentially unused and available in this 1.7 megahertz.

5. Unlicensed Operations in the 902-928 MHz, the 2.4 GHz, and the 5 GHz Bands

96. The 902-928 MHz, 2.4 GHz (2400-2483.5 MHz), and 5 GHz (5725-5850 MHz) bands generally permit operations of unlicensed devices pursuant to two Part 15 rules, sections 15.247 and 15.249. Wireless microphones are among the devices that operate on an unlicensed basis in these bands under these rules.[254]

97. In the *NPRM*, we sought general comment on the current and potential uses of the band for various wireless microphone operations, the types of applications for which the bands are best suited, the limitations associated with use of these bands, and technological advances that have improved the ability to make use of the band for wireless microphone operations.[255] In requesting information on the use of these bands, we sought to develop a more complete record of how these bands are useful in meeting various needs of wireless microphone users. We did not propose to revise any of these Part 15 rules that apply to a broad range of unlicensed operations.

98. Sennheiser and Shure state that these bands can useful for certain types of wireless microphone operations. Sennheiser believes that all three bands would be appropriate for users that do not require high performance or critical links, including many corporations, school theaters, houses of worship, trade shows and conference centers, and hobbyists.[256] Shure states that these three bands have utility for wireless microphone applications where relaxation of one or more of the performance characteristics of a professional audio wireless microphone can be accommodated.[257] SBE agrees that use of these bands is not suitable for broadcast quality or production quality audio due to the unpredictable and generally high levels of noise in these bands from other users, and that at 5 GHz there are existing and planned U-NII, vehicle-to-roadside and other applications, which may make operations suitable only in certain portions of the bands.[258] Lectrosonics states that the 902-928 MHz and 2.4 GHz bands can be

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[252] These processes are described on SBE's website. *See* The Society of Broadcast Engineers, Frequency Coordination, http://www.sbe.org/sections/freq_local.php.

[253] *See* 47 C.F.R. §§ 101.1329, 101.1331.

[254] *See NPRM*, 29 FCC Rcd at 12385 ¶¶ 158-160, 12386 ¶ 161 (902-928 MHz band), 12386-87 (2.4 GHz band). 12387 ¶ 168 (5 GHz band).

[255] *Id.* at 12386 ¶¶ 162-163, 12387 ¶ 166-167, 12387-88 ¶ 169.

[256] Sennheiser Comments at 23.

[257] Shure Comments at 41-42.

[258] SBE Comments at 13-14.

problematic for wireless microphone operations because such operations in those bands can be subject to severe and uncontrollable interference from other devices using them.[259]

99. Shure and Adeunis support certain rule revisions. Shure recommends reducing the minimum bandwidth in the two lower bands from 500 kHz to 200 kHz to facilitate the development and manufacture of additional wireless microphone devices in these frequencies.[260] Adeunis supports that recommendation, and also proposes that we revise our rules for operations in the 902-928 MHz to accommodate certain types of wireless microphones that are deployed in similar bands in Europe.[261]

100. *Discussion.* We conclude that although the use of these bands at this time may be more appropriate for certain types of wireless microphone applications, they nonetheless can support devices that are part of the suite of wireless microphone devices that accommodate the needs of various users. We also anticipate that further technological advances can make improvements in performance, and hence make use of these bands more attractive for meeting many wireless microphone users' needs. As noted above, we did not propose make any revisions of the rules applicable for a wide range of unlicensed uses in these bands, and decline here to make any revisions. We generally are not inclined to make changes to these rules without demonstrated need that changes would benefit the many users of these bands.[262]

6. 1920-1930 MHz Unlicensed PCS Band

101. *Background.* The 1920-1930 MHz band is allocated to Fixed and Mobile services on a primary basis and is designated for use by Unlicensed Personal Communications Service (UPCS) devices under the Commission's Part 15 rules for unlicensed operations.[263] To facilitate the sharing of spectrum in the UPCS band, the current rules require use of a "listen-before-transmit" protocol that specifies a process for monitoring the time and spectrum windows that a transmission is intended to occupy for signals above a defined threshold.[264] Digital Enhanced Cordless Telecommunications (DECT) technology may be used in this band since it complies with the general rules for operating in this band. DECT-based radio technology facilitates voice, data, and networking applications with range requirements up to a few

[259] Lectrosonics Comments at 4.

[260] Shure Comments at 41-42.

[261] Adeunis Reply at 5.

[262] *See generally* Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval, ET Docket No. 03-201, *Order and Second Memorandum Opinion and Order*, 29 FCC Rcd 6366 (2014) (rejecting request for adoption of a "spectrum etiquette" requirement for unlicensed operations in the 902-928 MHz, 2.4 GHz, and 5.8 GHz bands).

[263] *NPRM*, 29 FCC Rcd at 12388 ¶¶ 170-172; *see* 47 C.F.R. §§ 2.106, 15.301. These rules provide that the 1920-1930 MHz band may be used for both asynchronous (generally data) and isochronous (generally voice) UPCS devices, with maximum and minimum emission bandwidths of 2.5 megahertz and 50 kilohertz, respectively. *See* 47 C.F.R. §§ 15.303(a) and (d); § 15.323(a). UPCS devices operating in the 1920-1930 MHz band are subject to the general conditions of operation for Part 15 devices in that they may not cause harmful interference to authorized radio services and must accept any interference received from them or from other Part 15 devices. *See* 47 C.F.R. § 15.5(b).

[264] To protect UPCS devices already using particular time and spectrum windows from transmissions from another device, each UPCS device must monitor the combined time and spectrum windows that it intends to use before beginning transmissions and defer use or find other spectrum windows if the monitored signal level is above a specified threshold. *See generally* 47 C.F.R. § 15.323(c)(1)-(12).

hundred meters.[265] DECT technologies minimize interference and can be particularly effective for voice communications, and many manufacturers make wireless microphones that use this spectrum.[266]

102. In the *NPRM*, we invited comment on the current and potential uses of the 1920-1930 MHz UPCS band for wireless microphone applications, advances in wireless microphone technologies making use of this spectrum, and the types of applications for which it may be best suited. We did not propose any revisions, but did ask generally whether the Commission should consider any technical revisions that could make this band more useful for wireless microphone applications without adversely affecting operations of other users in the band.[267]

103. Sennheiser notes that it has developed wireless microphone systems for unlicensed wireless microphone use by the types of users that also could make use of the 902-928 MHz, 2.4 GHz, and 5 GHz band spectrum, which as discussed above include corporations, school theaters, houses of worship, trade shows and conference centers, and hobbyists.[268] Shure states that the band has potential for expanded use of DECT wireless microphones used in corporate environments.[269] SBE notes that use of the 1920-1930 MHz band for electronic news gathering, professional broadcasting, and professional program production wireless microphone uses, might be compatible with the Part 15 rules for asynchronous and isochronous UPCS use.[270] CTIA, meanwhile, argues that the band is better used for other purposes, including as a protective guard band for existing commercial mobile services, maintaining that the adjacency of this band to licensed Broadband PCS wireless services means that it would present interference challenges for wireless microphone use.[271] Finally, Shure contends that the band could be made more useful for wireless microphone uses if paired with the 2020-2025 MHz band,[272] an idea supported by Sennheiser.[273]

104. *Discussion.* As discussed above, wireless microphone manufacturers are finding ways under the existing rules to make use of this unlicensed band to address particular types of wireless microphone users' needs. We encourage wireless microphone users to make use of this band where it can effectively serve their needs. We did not propose revisions to the rules in this band, and recognizing the many other applications that make use of this band, we will not make revisions at this time.

7. 1435-1525 MHz Band

105. *Background.* The 1435-1525 MHz band (1.4 GHz band) is shared by the Federal government and industry for aeronautical mobile telemetry (AMT) operations.[274] AMT systems are used

[265] In addition to use of the 1920-1930 MHz band in the United States, DECT devices also operate in Europe using the 1880-1900 MHz band, where they operate on an unlicensed basis. Many other countries, both in Asia and South America, also authorize DECT technologies in bands in the 1.9 GHz range. *See generally* http://www.dect.org.

[266] *NPRM*, 29 FCC Rcd at 12388-89 ¶¶ 172-173.

[267] *Id*. at 12389 ¶ 174.

[268] Sennheiser Comments at 23.

[269] Shure Comments at 42.

[270] SBE Comments at 14. *See* Sennheiser Reply Comments at 17 (opposing any effort by effort by SBE to limit wireless microphone use to broadcasters).

[271] CTIA Comments at 41-42.

[272] Shure Comments at 42.

[273] Sennheiser Reply Comments at 17.

[274] 47 C.F.R § 2.106, footnote US78 (stating that "…the frequencies between 1435 and 1525 MHz will be assigned for aeronautical telemetry and associated telecommand operations for flight testing of manned or unmanned aircraft and missiles, or their major components.")

for flight testing of manned and unmanned aircraft, missiles, and space vehicles, and associated communications such as range safety, chase aircraft, and weather data.[275] The Department of Defense (DOD) is the major Federal user of the band, although the National Aeronautics and Space Administration (NASA) and the Department of Energy (DOE) also have assignments within it.[276] The commercial aviation industry uses the band for flight testing of new and modified commercial, corporate, and general aviation aircraft at various facilities across the United States.[277] Both the FCC and NTIA recognize the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) as the non-governmental coordinator for assignment of flight test frequencies in the band.[278] Through the Special Temporary Authority (STA) process, professional sound engineering companies responsible for major event productions have obtained authority to operate both wireless microphones (and similar audio devices) and video equipment on a temporary basis (e.g., a few days or a week) to access this spectrum. These STAs supplement the parties' existing access to other spectrum resources (primarily the TV bands) for coverage of sporting and other public events at specified locations around the country.[279] Under existing practice, the applicants have had to demonstrate that they have fully coordinated their proposed spectrum use with AFTRCC before the Commission will grant a STA.[280] The STAs have provided the applicants access to up to 90 megahertz of spectrum in the 1435-1525 MHz band, and only when that spectrum is not subject to AMT use at the specified times and locations. Operators generally use equipment that has been specially developed or modified for use of the 1.4 GHz band spectrum.

106. In the *NPRM*, we proposed making the 1.4 GHz band spectrum available for use by wireless microphones on a secondary licensed basis, with use limited to licensed professional users at specified locations and times operating pursuant to specified safeguards designed to protect AMT use of the band.[281] We sought general comment on the suitability of this spectrum for wireless microphone operations, and stated our commitment to ensuring that any wireless microphones operating in this spectrum are spectrally efficient and frequency agile.[282]

107. While we sought to provide wireless microphone users in need of additional spectrum resources with access to the 1.4 GHz band spectrum to help accommodate those needs, we contemplated only limited use of this spectrum and did not propose to open it for either widespread or itinerant uses throughout the nation. In particular, we proposed that wireless microphone uses be restricted to specific fixed locations, such as large venues (whether outdoor or indoor), where there may a need to deploy large

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[275] *See id.*

[276] The DOD uses the band to support AMT in the flight testing of aircraft, spacecraft, and missiles at multiple test ranges and test facilities. While the DOD, NASA, and DOE assignments are distributed throughout the country, the majority are concentrated in California, Maryland, Florida, Nevada, and New Mexico.

[277] *See* 47 C.F.R. § 87.303(d).

[278] *See* Aerospace & Flight Test Radio Coordinating Council, *Letter*, 17 F.C.C. 2d 525, 525 (1969); *see also* Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, *First Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 08-59, 27 FCC Rcd 6422, 6457 ¶ 74 (2012).

[279] These authorizations, which have been issued as experimental STAs, have permitted the operation of video and audio feed equipment at a particular location for a limited duration. Generally, parties have represented in their applications that the other spectrum resources otherwise available to them at those locations are insufficient to enable them to provide the desired level of coverage for the golf match, NASCAR race, or other scheduled event that is taking place.

[280] *See, e.g.*, CP Communications STA for American Century Celebrity Golf Championship, Las Vegas, NV, July 14-23, 2013 (Call sign WG9XMC).

[281] *NPRM*, 29 FCC Rcd at 12390 ¶ 177.

[282] *Id.* at 12390-91 ¶¶ 178, 180.

numbers of microphones (e.g., 100 or more), and only at specified times.[283] We proposed limiting eligibility to professional users, including broadcasters, professional television and cable programmers, and professional sound engineering companies, and operators at major venues that manage and coordinate wireless microphone operations, i.e., the entities eligible for licensed LPAS operations in the TV bands.[284] In proposing to require prior coordination with AFTRCC, we sought comment on specific coordination mechanisms that would ensure that wireless microphone operations only occur at the locations and times where authorized, and would be effective in preventing the use of these devices at any other location or time without authorization.[285]

108. In considering the appropriate framework for wireless microphone operations in the band, we noted that the Commission already permits secondary, low power short-range Medical Body Area Network (MBAN) devices to share use of another band where AMT operations are primary (i.e., the 2360-2390 MHz band) pursuant to a specified coordination process.[286] We asked about the extent to which the rules for MBAN operations might serve as a model for rules that we should adopt for wireless microphone operations in the 1.4 GHz band.[287] MBAN device operators are required to register each device with the frequency coordinator and provide specified information – including the frequencies to be used, the location of the devices, the power levels used, and point of contact information regarding the entity responsible for the MBAN device operations.[288] MBAN devices also must cease transmission in the absence of a control message.[289] We further noted that, as part of the MBAN proceeding, the Commission had recognized that specific tools, such as electronic keys, could be useful to coordinators as they sought to achieve mutually agreeable coordination agreements.[290]

109. We sought comment on requiring that wireless microphone systems, which often are moved from one location to another (e.g., when used to cover different events), could only operate through use of an automatic mechanism (such as an electronic key, and location-awareness capability, or similar mechanisms) that would serve to prevent wireless microphones from operating unless on approved frequencies in the 1.4 GHz band at the approved location/venue(s) during approved time(s). In

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[283] *Id.* at 12391 ¶ 182.

[284] *Id.* at 12392 ¶ 186.

[285] *Id.* at 12391 ¶ 183.

[286] *NPRM*, 29 FCC Rcd at 12391 ¶ 181; *see generally* Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, ET Docket No. 08-59, *First Report and Order and Further Notice of Proposed Rulemaking*, 27 FCC Rcd 6422 (2012) (*MBAN First R&O*). MBAN device operators are required to register each device with the frequency coordinator and provide specified information – including the specific frequencies to be used, the location of the devices, the power levels used, and point of contact information regarding the entity responsible for the MBAN device operations.

[287] *NPRM*, 29 FCC Rcd at 12391-92 ¶ 184.

[288] *MBAN First R&O*, 27 FCC Rcd at 6450-6453 ¶¶ 62-67; 47 C.F.R. § 95.1223 ("Registration and frequency coordination in the 2360-2390 MHz Band"). The Commission codified certain coordination procedures as well, beginning with the initial determination of whether the MBAN location is within line-of-site of AMT operations, and the potential interference risks that would be associated with MBAN operations at that location. *MBAN First R&O*, 27 FCC Rcd at 6454 ¶ 69. If the MBAN operations would be within line-of-site of AMT operations, the frequency coordinators will assess the risk of interference using ITU-R M.1459, subject to accepted engineering practices and standards mutually agreeable to both the MBAN and AMT coordinators. *Id.*

[289] *MBAN First R&O*, 27 FCC Rcd at 6445-6446 ¶¶ 48-49; 47 C.F.R. § 95.628(c).

[290] *NPRM*, 29 FCC Rcd at 12391-92 ¶ 184. While the record of the proceeding included proposals for the use of an electronic key mechanism, the Commission decided to not codify such specific requirements in its final rules. It instead relied on frequency coordinators to work out the MBAN operating parameters through their agreements as needed. *MBAN First R&O*, 27 FCC Rcd at 6456 ¶ 72; 47 C.F.R. § 95.1223; *see also* 47 C.F.R. § 95.1225 ("frequency coordinator").

addition, we invited comment on whether we should adopt point-of-sale restrictions that would enable only entities licensed to operate in this band (discussed below) to obtain the devices.[291]

110. To the extent we decided to authorize wireless microphone operations in this band, we sought comment on the technical rules that would apply to devices that would use the band, including considerations designed to ensure that the primary AMT operations would be protected. We asked whether the technical rules should be the similar to those that apply to wireless microphones that operate in other bands, as well as whether ETSI standards should be adopted for those devices. To preserve maximum flexibility for wireless microphone operations in the band, we inquired whether we should require wireless microphones to have the capability of tuning across the band, as well as whether wireless microphones designed to operate in the 1.4 GHz band should have modular transmitting components that, if necessary, could be replaced to enhance frequency agility. In addition, we asked whether there should be an interim process for permitting wireless microphone operations in the band as any necessary new devices are being made, and what device certification process should be employed.[292] Finally, consistent with our proposal, we envisioned adding a secondary mobile except aeronautical mobile service allocation to the 1435-1525 MHz band for limited use under the service rules we adopt for the band.[293]

111. In their comments, Sennheiser and Shure support the Commission's proposal to permit wireless microphone operations by LPAS licensees in the 1.4 GHz band on a secondary basis following coordination, asserting that such authorization would be important for ensuring that sufficient spectrum will be available to address critical wireless microphone needs at specified locations and times for large scale-events.[294] The Aerospace and Flight Test Radio Coordinating Council (AFTRCC) also conditionally supports use of the 1.4 GHz band for licensed secondary wireless microphone operations provided that certain conditions and safeguards are established to ensure protection of the primary AMT services from harmful interference.[295] These safeguards include: permitting such use only on a limited basis and only by professional users eligible for LPAS licenses following successful coordination on manual, case-by-case basis;[296] requiring the use of specially designed integrated technology-based controls (e.g., use of an electronic key) that limit operations only to specified places and times;[297] and preventing resale of equipment to unqualified users, as well as use of existing equipment unless modified and certified to comply with the special equipment requirements.[298] In their initial comments, BSI and SBE generally oppose the Commission's proposal on the basis that the band has limited capacity for secondary uses and that the existing STA process is preferable, especially because it allows for video equipment use in the band at sporting and other public events where other spectrum options are limited; however, they state that, if permitted, wireless microphone operations should be limited to professional users at specified locations and times with appropriate safeguards that protect AMT operations.[299] CTIA, noting pending activity in the international telecommunications forum that is examining the suitability of

[291] *NPRM*, 29 FCC Rcd at 123932 ¶ 185.

[292] *Id.* at 12391-92 ¶¶ 187-189.

[293] *Id.* at 12392 ¶ 190.

[294] Sennheiser Comments at 23-24; Shure Comments at 38-39 (noting large-scale events may require an increasing number of wireless audio channels). *See also* Audio-Technica Comments at 24 (fully supporting the Commission's proposal to investigate the option of allowing wireless microphones to operate on a secondary basis in this band).

[295] AFTRCC Comments at 2-11.

[296] *Id.* at 11-16.

[297] *Id.* at 17-23. AFTRCC asserts that, although the rules for MBANs equipment operations provide some general guidance, an electronic key or equivalent control mechanism should be required for wireless microphone operations in the 1.4 GHz band. *Id.* at 18-19.

[298] *Id.* at 12, 16, 24-25.

[299] BSI Comments at 14-15; SBE Comments at 14-15.

this band for commercial mobile services, objects to the Commission taking any action to accommodate wireless microphone operations until the band "has been fully examined for its suitability to host licensed wireless services."[300]

112. In reply comments, Sennheiser and Shure disagree with CTIA's position, citing the importance of wireless microphone operations, and contending that it raised no technical objections to the authorization of licensed wireless microphone operations in the 1.4 GHz band.[301] AFTRCC and Boeing also disagree with CTIA's position that the Commission should suspend making this band available at this time on a secondary basis, and observe that the U.S., in its 2015 World Radiocommunication Conference (WRC) position, does not support making the 1.4 GHz band available for commercial mobile services.[302] Also, in its reply comments, Shure states that BSI should be able to continue to use the STA process to obtain spectrum access for video services in the band.[303] AFTRCC and Boeing express their willingness to work with wireless microphone manufacturers to develop operating parameters, coordination methodologies, and control mechanisms that would be appropriate for protecting AMT services.[304]

113. More recently, in its *ex parte* presentation, AFTRCC (in conjunction with aviation and flight test interests) provided additional details about the conditions they believe necessary for accommodating professional wireless microphone operators in the 1.4 GHz band. These include: prior to operation for a specific time period and place, the user would have to request and successfully complete coordination with AFTRCC (and the federal government); the wireless microphones would be tunable across the entire 1435-1525 MHz band, which enables easier coordination because the demands and requirements of commercial and military flight testing are variable across the band; immediately prior to commencing operation pursuant to successful coordination, the user would have to register and authenticate the equipment at the coordinated location, with registration repeated regularly; and the equipment would need to be designed to have deactivation controls so that operations would cease without periodic registration and authentication.[305]

114. A broad coalition representing wireless microphone interests, including broadcasters and cable programming networks, large event spectrum coordinators and producers (including BSI and SBE), and wireless microphone manufacturers (including Sennheiser and Shure) also filed an *ex parte*, stating as a group that access to the spectrum in the 1.4 GHz band would be important for certain situations, voicing support for frequency coordination through AFTRCC in advance of using equipment, and agreeing to authenticate and verify location prior to operations. They also support applying the existing LPAS technical rules as modified by the ETSI emission masks for the new equipment.[306] More recently, Shure indicates that it is actively exploring technical and operational approaches that will ensure that wireless microphone users effectively coordinate with and protect incumbent users in the 1.4 GHz band.[307]

115. CTIA also submitted an *ex parte* letter related to the 1.4 GHz band, encouraging the Commission to recognize the international efforts to study whether this band is suitable for commercial

[300] CTIA Comments at 41-43 and n.116 (citing the ITU document "Revisions to Sharing Study Between LTE Systems and Aeronautical Mobile Telemetry Systems in the Band 1435-1525 MHz" (Feb. 2014)).

[301] Sennheiser Reply Comments at 16; Shure Reply Comments at 10-11.

[302] AFTRCC Reply Comments at 7-9; Boeing Reply Comments at 3-7.

[303] Shure Reply Comments at 8-9; *see also* Sennheiser Reply Comments at 15-16.

[304] AFTRCC Reply Comments at 2-7; Boeing Reply Comments at 6-7.

[305] Letter from Edward A. Yorkgitis, Jr., Counsel for AFTRCC, To Marlene Dortch, Secretary, FCC, filed June 16, 2015, at 3 (June 16 *Ex Parte*).

[306] Professional Audio Community June 22 *Ex Parte* Attachment at 7.

[307] Letter from Catherine Wang, Counsel for Shure, to Marlene Dortch, Secretary, FCC, filed June 25, 2015.

wireless service.[308] CTIA also urges the Commission to resist calls to substantially increase the allocation to wireless microphone use, such as by granting access to the entire 1.4 GHz band. Affording access to the full band, CTIA asserts, would be inconsistent with the Commission's goals, articulated in the *NPRM*, of promoting responsible spectrum management and encouraging spectral efficiency.[309] In its more recent *ex parte* CP Communications disagrees with CTIA's assertion that use of the 1.4 GHz would significantly expand the spectrum currently available for wireless microphones, particularly since access would be limited to only portions of the band, would require coordination, and would be significantly encumbered.[310]

116. *Discussion.* As proposed in the *NPRM*, we authorize limited use of the 1.4 GHz band for licensed wireless microphones operations, with secondary status in the band in the table of allocations, and only provided that certain conditions and safeguards designed to protect AMT services are met. Experience through the STA process demonstrates that, under proper conditions, wireless microphones will be able to operate in this band without interfering with the critical aeronautical flight test operations that rely on primary access to this spectrum. Eligibility to use this band will be restricted to professional users (to include broadcasters, professional television and cable programmers, and professional sound engineering companies, and operators at major venues that manage and coordinate wireless microphone operations). We also adopt Shure's recommendation, and will permit 200 kHz analog and digital masks and adopt the emission masks in Section 8.3 of ETSI standard EN 300-422-1 v1.4.2 (2011-08), with power levels of up to 250mW consistent with the rules for UHF operations in the TV bands.[311] To accommodate this limited use, we are adding a new footnote, US84, to the Table of Frequency Allocations. This footnote explicitly permits secondary wireless microphone use in the 1435-1525 MHz band, which is already allocated to the mobile service on a primary basis but restricted to aeronautical telemetry.

117. As we proposed in the *NPRM*, we are only authorizing limited use of this spectrum for licensed wireless microphone uses, where access may be important for certain specified events. We are not opening up this band either for widespread use or for itinerant uses throughout the nation. In particular, we are restricting use to specific fixed locations, such as large venues (whether outdoor or indoor), where there is a need to deploy large numbers of microphones (typically 100 or more) for specified time periods,[312] for situations in which the other available spectrum resources are insufficient.[313]

118. Protection of primary service in the band by this new secondary service is of paramount importance. Wireless microphone use in the band must be coordinated with the non-governmental coordinator for assignment of flight test frequencies in the band (i.e., AFTRCC), and authentication and location verification will be required before a coordinated wireless microphone begins operation.

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[308] Letter from Scott Bergmann, VP for Regulatory Affairs for CTIA, to Marlene Dortch, Secretary, FCC, filed July 10, 2015 (stating that granting access to the entire 1.4 GHz band "would replace capabilities present in the current regulations – twelve megahertz of spectrum capacity – with access to 90 megahertz").

[309] *Id.*

[310] Letter from Peter Tannenwald, Counsel for CP Communications, to Marlene Dortch, Secretary, FCC, filed July 14, 2015, at 2. *See also* Letter from Laura Stefani, Counsel for Sennheiser, to Marlene Dortch, Secretary, FCC, filed July 24, 2015, at 2.

[311] Shure Comments at 39. *See* Sennheiser Reply at 13-14 (suggesting support for adoption of ETSI standard). For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the below 1 GHz digital emission mask contained in Section 8.3.2.2 of the standard (Figure 4). We also will require emissions beyond +/- 1 MHz from the carrier or center frequency to be attenuated by 90 dB. These are the same emission masks requirements adopted for licensed wireless microphones in the TV bands, above.

[312] *NPRM*, 29 FCC Rcd at 12391 ¶ 182.

[313] This is similar to the current practice when wireless microphone operators obtain STAs. See note 279, above.

Wireless microphones operating in this band must also be tunable across the entire 1435-1525 MHz band,[314] as recommended by AFTRCC. This capability will facilitate coordination with incumbent users whose aeronautical testing may be variable across the band. Additionally, we will authorize all microphones operating in a particular area to access no more than 30 megahertz in the 1435-1525 MHz band. This requirement will facilitate coexistence in the band by ensuring that wireless microphones operating be able to coordinate around AMT operations and by promoting the development of spectrally efficient technologies (e.g., digital technologies). We also emphasize that the STA process remains available to address extraordinary situations or special events requiring more spectrum access.

119. We are convinced that many of the elements that led to the successful adoption of the final MBAN service rules will also promote licensed secondary wireless microphone use of the 1.4 GHz band. Chief among these will be the cooperation of the AMT community in recognizing opportunities to share use of the band in those locations and times that will not interfere with the critical existing primary use, and the implementation of a coordination process to allow for such determinations in a timely and effective manner. However, we recognize that this coordination scenario is different from the MBANs case in that the secondary use will not be restricted to indoor locations in relatively limited and well-defined geographic places (i.e., hospitals). We think there is good basis for AFTRCC's suggestions that equipment authentication be done through an automated mechanism and repeated regularly, that the equipment be designed to automatically cease operation in the absence of such registration and authentication, and that the equipment incorporate a geolocation capability more sophisticated than the manual entry of coordinates.[315] Accordingly, we will require manufacturers to design, and operators to use, software-based controls (or similar functionality) to prevent devices from operating in the band except in the specific channels coordinated with AFTRCC for any given location.

120. We will leave the details of these matters for resolution at a future time, to be informed by further negotiation between manufacturers and the flight test community. We also are not mandating, at this time, the use of a specific coordinator or coordinators to represent the wireless microphone community (analogous to the MBAN coordinator). The decision as to whether such a coordinator may be appropriate for the professional licensed wireless microphone user base (and consideration of whether such a coordinator would provide sufficient user oversight so as to allow greater flexibility in how 1.4 GHz wireless microphone equipment may be designed) will be better informed after further discussion by the interested parties.

121. Our intent is to provide a stable new environment for professional wireless microphone users, but we must also be mindful of the fact that, as noted above, wireless microphone use of the 1.4 GHz band will operate pursuant to a secondary allocation. In light of this regulatory status, and considering the history of wireless microphone users having to replace equipment as band availability has evolved, we strongly encourage parties designing equipment for this band to incorporate design elements – such as modular transmitting components or wider tuning capability extending to other bands – that will allow the greatest future flexibility should regulatory circumstances ever change. We remind licensees and manufacturers that they will bear the future cost of any such changes and, therefore, that relatively small upfront costs to increase flexibility may prevent much greater costs associated with replacing equipment in the unforeseeable future. We intend to continue a dialog with the wireless microphone community so that licensees and manufacturers will be able to anticipate, well in advance, any new developments (*e.g.,* the availability of other bands for wireless microphones) that might inform the design of new equipment.

122. While we conclude that the costs of the particular requirements we are establishing for wireless microphone use of the 1.4 GHz band are outweighed by the benefits of allowing licensed secondary use in a band that would otherwise not be available, we recognize that the requirements are

[314] As noted above, we are allocating the band on a secondary basis for licensed wireless microphone operations.

[315] AFTRCC June 16, 2015 *Ex Parte* at 3.

likely to limit 1.4 GHz wireless microphone use to a relatively limited community of professional users. The limited size of the user pool will facilitate coordinated use of the band and mitigate successfully AFTRCC's concerns regarding unauthorized users. We also expect wireless microphone manufactures to continue to innovate and find further operational efficiencies, and believe that they will be able to draw on the experiences of MBAN proponents as they develop equipment designed to operate in the AMT space. Finally, because we will continue to allow for the existing coordinated use of this band under the STA process, we are not establishing an interim process for permitting wireless microphone use under the new procedures pending the development of new equipment and final coordination and registration requirements.

8. 3.5 GHz Band

123. *Background.* In the *NPRM*, we noted the *3.5 GHz Band FNPRM* adopted earlier in 2014, in which the Commission sought comment various potential uses of the 3.5 GHz band as it developed rules for operating in that band.[316] We made clear that all of the issues regarding the policies and rules for operations in the 3.5 GHz proceeding would be decided in that proceeding, but nonetheless sought general comment on whether wireless microphone operations potentially could be employed in the 3.5 GHz band to help accommodate particular needs of users.[317]

124. Sennheiser states that the GAA regime specified for the 3.5 GHz band may only have limited appeal, given the high frequency range of the band, though may be useful to a limited number of certain heavy users for non-performance links, such as intercom channels.[318] Shure anticipates that, given the dynamic environment envisioned by the Commission for the 3.5 GHz band, with many different devices and applications operating concurrently, the band may more likely serve as a home for alternative wireless microphone uses with one or more of the performance parameters required by a professional audio wireless microphone relaxed.[319]

125. *Discussion.* In April 2015, the Commission adopted rules for commercial use of 150 megahertz in the 3.5 GHz band.[320] These rules specified a federal/non-federal sharing arrangement of that band as part of a broader three-tiered sharing framework, which included Priority Access and General Authorized Access (GAA) tiers of service for commercial wireless use.[321] This band potentially can provide opportunities for wireless microphone operations. Both tiers of service are open to any party eligible for a Commission license and could provide opportunities for wireless microphone operations.[322]

9. 6875-7125 MHz Band

126. *Background.* As we discussed in the *NPRM*, the 6875-7125 MHz band (7 GHz band) has long been authorized for shared co-primary use for fixed microwave operations among TV BAS stations (including television studio-transmitter links, television relay stations, and television translator relay

[316] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550- 3650 MHz Band, GN Docket No. 12-354, *Further Notice of Proposed Rulemaking*, 29 FCC Rcd 4273 (2014).

[317] *NPRM*, 29 FCC Rcd at 12393-94 ¶¶ 191-94.

[318] Sennheiser Comments at 25 (may be useful to Broadway or Las Vegas for use by non-performance links).

[319] Shure Comments at 43.

[320] Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550- 3650 MHz Band, GN Docket No. 12-354, *Report and Order and Second Further Notice of Proposed Rulemaking*, 30 FCC Rcd 3959 (2015).

[321] *Id*. at 3961-62 ¶¶ 1-4.

[322] *See* 47 C.F.R. § 96.5.

stations) under Part 74 and cable television relay stations (CARS) under Part 78 of our rules.[323] Broadcast network and cable entities may also use the band on a secondary basis for mobile or temporary fixed microwave operations for TV and CARS pickup stations.[324] In addition, broadcasters can operate certain BAS facilities in the 7 GHz band on a short-term, secondary basis without prior authorization for up to 720 hours a year. The BAS stations make it possible for television and radio stations and networks to transmit program materials from the sites of breaking news stories or other live events to television studios for inclusion in broadcast programs. The CARS stations enable cable operators to distribute programming to microwave hubs where it is impossible or too expensive to run cable and to cover live events.[325] In 2011, the Commission also authorized Fixed Services (FS) microwave operations under Part 101 (for Private, Common Carrier, or Public Safety microwave systems) to share use of the band, on a co-primary basis, but only in areas where BAS and CARS television pickup operations are not licensed and not on two 25 megahertz channels in the middle of the band reserved for TV pickup stations (channels at 6975-7000 MHz and 7000-7025 MHz).[326]

127. The 250 megahertz in the 7 GHz band is comprised of ten 25 megahertz channels. BAS and CARS licensees may be authorized to operate both fixed and mobile stations on any of these channels, and FS licensees on all but two of them (as noted above). The Commission has not otherwise adopted a formal, nationwide segmentation plan for the 7 GHz band to separate fixed and mobile operation.[327] BAS and CARS licensees are authorized to operate on 25 megahertz channels, FS operators may be authorized to operate on 25 megahertz channels or on smaller channels of 5, 8.33 or 12.5 megahertz.[328] Furthermore, all fixed BAS, CARS, and Part 101 FS stations must engage in the same frequency coordination process required of all Part 101 services, whereas temporary fixed or mobile TV pickup services continue to be subject to informal coordination procedures within their service areas.[329]

128. In the *NPRM*, we proposed to permit licensed wireless microphone operations on available channels in this band, on a secondary basis, for entities eligible to hold BAS or CARS licenses. Considering the likelihood of significant areas of unused spectrum throughout this band, we sought comment on whether spectrum in this band could be made available for relatively low power, short-range wireless microphone operations without interfering with existing services. Given that BAS and CARS licensees already use the 7 GHz band for certain types of video applications and programming production,

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[323] *NPRM*, 29 FCC Rcd at 12394 ¶ 194 & n.231 (citing Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees, WT Docket No. 10-153, *Report and Order, Further Notice of Proposed Rulemaking, and Memorandum Opinion and Order*, 26 FCC Rcd 11614, 11620 ¶ 10 (2011) (general discussion of rules for BAS and CARS services in the 6875-7125 MHz band) (*Wireless Backhaul R&O*); *see also* 47 C.F.R. §§ 74.600 *et seq.*; 47 C.F.R. § 78.18(a)(7)).

[324] *Id.* at 12394 ¶ 194 & n.226 (citing *Wireless Backhaul R&O*, 26 FCC Rcd at 11623-24, ¶¶ 17-18; *see also* 47 C.F.R. § 74.602(a) & 78.18(d)).

[325] *See NPRM*, 29 FCC Rcd at 12394 ¶ 194 & nn.226-229.

[326] *See NPRM*, 29 FCC Rcd at 12394 ¶ 194 & nn.230 & 232 (citing *Wireless Backhaul R&O*, 26 FCC Rcd at 11619-20 ¶ 9, 11623-30 ¶¶ 16-34; *see also* §§ 101.101; 101.147(a) & note 10).

[327] *See Wireless Backhaul R&O* at 11624 ¶ 21 (declining to adopt a formal band segmentation plan); s*ee also id* at 11627-28 ¶ 29 (generally retaining a 25 MHz bandwidth), 47 C.F.R. § 101.109(c) (setting aside 25 MHz as the maximum bandwidth for the 7 GHz band) & 47 C.F.R. 101.147(l)(1)-(4).

[328] *See id* at 11627-28 ¶ 29; 47 C.F.R. 101.147(l)(1)-(4).

[329] *See Wireless Backhaul R&O*, 26 FCC Rcd at 11623 ¶ 17, 11627 ¶ 28, n. 99 (citing 47 C.F.R. §§ 74.638, 78.36, and 101.103(d)) (stating that FS licensees must coordinate with co-primary Fixed Satellite Service licensees operating in those bands)); 11627 ¶¶ 27-28 (permitting an informal process for mobile services such that FS operators will coordinate new links with TV pickup stations within appropriate coordination zones of any new fixed links).

we asked whether there would be synergies in permitting wireless microphone operations that could supplement those existing applications.[330] We sought comment on particular rules that could facilitate wireless microphone operations in the band while also protecting existing services, specifically inquiring whether we should make spectrum in all of the 7 GHz band available for wireless microphone operations on a secondary, non-interfering basis, or only make certain portions of the 7 GHz band available for wireless microphone operations. We also sought comment on what technical rules (LPAS or otherwise) would best facilitate wireless microphone operations in the band, whether such rules should include the ETSI standards, and what if any interference criteria such as geographic exclusion zones or OOBE limits would protect incumbent services in the band.[331] Given that coordination among licensees currently is required, we asked to what extent formal or informal coordination of wireless microphone operations should be required – i.e., whether wireless microphone users could share operations among themselves on the same private-sector, frequency-coordinated basis that exists for the use of BAS mobile shared spectrum.[332] Finally, we sought comment on the availability of wireless microphone equipment for this band.[333]

129. In their comments, BSI, SBE, Sennheiser, and Shure support the use of a portion of the 7 GHz band for wireless microphones.[334] BSI, a producer of video and audio at large sports and entertainment events, states that events at large venues typically require at least 24 megahertz for wireless microphones,[335] asserting that the best option would be to reserve two of the thirteen megahertz channels (totaling 26 megahertz) for licensed wireless microphones in the 7 GHz band to allow nationwide use of the same channel.[336] In a subsequently filed ex parte, the Professional Audio Community (which includes BSI, SBE, Sennheiser, and Shure) asks that the entire 7 GHz band be made available for licensed wireless microphone use and that eligibility for licensed use should be extended to include the entities eligible to hold LPAS licenses under Part 74.[337] Shure notes the higher frequencies and shorter wavelengths of this band could pose unique challenges for form-factor and power-limited wireless microphone uses but nevertheless states there may be applications where this band proves valuable.[338] Sennheiser supports access to this band limited to Class A licensed entities, but argues the poor propagation characteristics of the band make its application limited.[339]

130. In their initial comments, BSI and Shure advocate for access to two separate channels in the band, whereas SBE advocates making one 25 megahertz channel available.[340] BSI asserts that having

[330] *NPRM*, 29 FCC Rcd at 12395 ¶¶ 197-198.

[331] *Id.* at 12395-96 ¶¶ 199, 203.

[332] *Id.* at 12396 at ¶ 201 & n.238 (citing *Wireless Backhaul R&O*, 26 FCC Rcd at11622-23 ¶ 15).

[333] *Id*. at 12396 ¶ 204.

[334] Audio-Technica Comments at 24; BSI Comments at 15, 18; Sennheiser Comments at 25; Shure Comments at 44; SBE Comments at 15; National Football League Reply Comments at 4.

[335] BSI Comments at 3, 10, 12, 18.

[336] *Id.* at 15-16.

[337] Professional Audio Community June 22 *Ex Parte* Attachment at 9.

[338] Shure Comments at 44. Such applications might include microphones and complementary auxiliary equipment used for short-range Electronic News Gathering (ENG) applications and at certain high-profile sporting events (e.g., race car or race track mounted microphones intended to capture the sound of the cars, or microphones used at professional golf tournaments). *Id.*

[339] Sennheiser Comments at 25 (arguing the spectrum has potential for short range broadcast audio applications compatible with existing point-to-point operations – such as a reporter with a handheld microphone ten feet in front of a camera).

[340] BSI Comments at 15-16 & Appendix A (argues for two 13 megahertz channels at top and bottom of band); Shure Comments at 44 (two 13 megahertz channels at the top and bottom of band); SBE Comments at 16 (one 25 MHz

(continued….)

the same channel set aside in each market would avoid mixing wireless microphones with microwave backhaul services, BAS, CARS or LTTS mobile TV pickup station or fixed BAS operations.[341] In contrast, SBE contends that allowing wireless microphones in this band should have no effect on fixed wireless backhaul operations, which are authorized only in areas where BAS and CARS television pickup operations are not licensed.[342] The Professional Audio Community assert that we should apply existing Part 74 technical rules to operations in these bands, but replace occupied bandwidth and spurious limits with the ETSI standards for all new equipment.[343] Finally, with respect to equipment availability, BSI notes wireless microphone equipment necessary for operation in the 7 GHz band is available right now and has been manufactured in Europe for several years.[344]

131. *Discussion.* We will permit BAS and CARS eligible entities, as well as the other entities eligible to hold LPAS licenses under Part 74, to operate wireless microphones on a licensed, secondary basis in the 7 GHz band on two 25 megahertz channels that we will set aside for such use on the top and bottom channels of this band (6875-6900 MHz and 7100-7125 MHz). We decline to make the entire band available for wireless microphone use because there has been no demonstration that there is a need for all 250 megahertz of spectrum to be made available for wireless microphone use. We are particularly concerned about compatibility between wireless microphones and itinerant BAS operations in the two channels reserved for nationwide use. SBE originally supported use of one 25 megahertz channel in the band, and by offering twice as much spectrum, we hope to create the necessary flexibility for wireless microphones to opportunistically find frequencies they can use on a secondary basis without interfering with, or receiving interference from, primary users with whom they must share and who typically operate at a higher power. Additionally, we are reassured in our approach to the 7 GHz band by the commenters stating that equipment for these bands is readily available internationally and could be easily brought to market. While BSI favored setting aside 13 megahertz spectrum segments only for wireless microphone use on a primary basis, we decline to do so because the 7 GHz band should remain fully available for BAS, CARS, and point-to-point operations. We are concerned that granting LPAS exclusive or co-primary status could impede the growth of the important existing uses of the band. Furthermore, under our existing rules, LPAS users are required to avoid causing harmful interference to any other class of station authorized under the Commission's rules or the Table of Allocations.[345] BSI has not explained why a different rule is necessary or appropriate in the 7 GHz band. Moreover, we have endeavored to make two 25 megahertz channels available at the top and bottom of the band (more than BSI requested) so that wireless microphones will have additional flexibility to select specific frequencies within the channel that will not cause interference to other services in the bands.

132. With respect to coordination, generally, in lieu of mandating specific interference criteria in our rules, we expect applicants and licensees to work out interference issues in the frequency coordination process. FS, BAS, and CARS (other than mobile or temporary fixed operations) already operate in the 7 GHz band subject to a formal Part 101 coordination process pursuant to which all fixed station applicants must provide affected licensees and contemporaneous applicants with 30-day prior notification and an opportunity to participate in frequency coordination before filing their applications

(Continued from previous page)
channel); Sennheiser Comments at 25. However, BSI, argues changes to the Part 74 service rules will be necessary in order to permit the use of this 26 megahertz of spectrum by Part 74 eligible entities. BSI Comments at 17.

[341] BSI Comments at 16. However, given the short range of these devices, and the frequency re-use that is available in the band, BSI also states that low-power auxiliary licensees could "share with themselves" on the same private sector, frequency coordinated basis that exists for the use of BAS mobile shared spectrum now. *Id.*

[342] *Id.* at 16 & n.22.

[343] *See* Professional Audio Community June 22 *Ex Parte* Attachment at 9.

[344] BSI Comments at 16.

[345] *See* 47 C.F.R. §74.861(g).

with the Commission.[346] Mobile and temporary fixed stations are generally coordinated through local SBE coordinators pursuant to the requirements in Section 74.638(d).[347] We will require new wireless microphone operations in the band to coordinate their operations through the local SBE coordinator. We will permit licensees to aggregate channels in these bands for wider-band transmission. Finally, we will apply the same Part 74 technical rules applicable to wireless microphones in the TV broadcast bands to their operations in these bands, require that wireless microphones comply with the emission masks in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2011-08) and will require that emissions beyond +/- 1 MHz from the carrier or center frequency to be attenuated by 90 dB.[348]

10. Ultra-wideband

133. *Background.* The Commission's rules for ultra-wideband (UWB) unlicensed devices are set forth in Part 15, subpart F.[349] Operating pursuant to the technical rules set forth in Part 15, UWB devices can use spectrum occupied by existing radio services without causing harmful interference, thereby permitting scarce spectrum resources to be used more efficiently.[350] Wireless microphones operating under these rules would be required to operate pursuant to the UWB rules for communications systems, which permit operations in the 3.1-10.6 GHz band.[351] Under the UWB rules, these devices must be designed to ensure that operation can occur indoors only, or must consist of hand-held devices that may be employed for such activities as peer-to-peer operation.[352] We noted that at least one wireless microphone manufacturer has developed and markets wireless microphones that operate under these rules.[353]

134. In the *NPRM*, we sought comment on the current and potential uses of UWB devices for wireless microphone applications. We asked whether there are there particular uses for which wireless microphones operating under UWB rules are well suited, such as indoor and/or short-range operations, and whether manufacturers are promoting the use of UWB wireless microphones for particular applications. Finally, we invited comment regarding steps that the Commission should take to facilitate

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[346] *See* Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses, WT Docket 10-153, *Report and Order and Further Notice of Proposed Rulemaking*, 26 FCC Rcd. 11614, 11626 para. 26 & n.94 (2011)(citing Revisions to Broadcast Auxiliary Service Rules in Part 74 and Conforming Technical Rules for Broadcast Auxiliary Service, Cable Television Relay Service and Fixed Services in Parts 74, 78 and 101 of the Commission's Rules, ET Docket No. 01-75, *Report and Order*, 17 FCC Rcd 22979, 22980 n.1 (2002)). The prior coordination procedures of Part 101 are now mirrored in Part 74 for BAS and Part 78 for CARS. *Id.* at n.94 (citing 47 C.F.R. §§ 101.103(d), 74.638 and 78.36).

[347] See 47 C.F.R §74.638(d).

[348] For analog emissions, we will apply the analog mask contained in Section 8.3.1.2 of the standard (Figure 3). For digital emissions, we will apply the above 1 GHz digital emission mask contained in Section 8.3.2.2 (Figure 5).

[349] 47 C.F.R. §§ 15.501 *et seq.*

[350] *See* Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems, ET Docket No. 98-153, *Report and Order*, 17 FCC Rcd 7435 (2002). UWB devices operate by employing very narrow or short duration pulses that result in very large or wideband transmission bandwidths. UWB technology enables development of an array of applications, including imaging systems, vehicular radar systems, and communications and measurement systems.

[351] *See id.* at 7436-38 ¶¶ 1, 5.

[352] *See* 47 C.F.R. §§ 15.517 (technical rules for indoor UWB systems); 15.519 (technical rules for hand held UWB systems); 15.521 (technical rules applicable for all UWB systems).

[353] *NPRM*, 29 FCC Rcd at 12397 ¶ 206. Audio-Technica has developed wireless microphones that operate under the UWB rules. *Id.*

use of UWB devices for wireless microphone uses. We did not propose or seek comment on any rule revisions that would be designed to accommodate wireless microphone applications.[354]

135. Sennheiser believes UWB technologies can be appropriate for certain line-of-site indoor wireless microphone applications.[355] Audio-Technica asserts that UWB technologies could be used for professional wireless microphone uses if the rules were revised devices to permit operations outdoors under the currently specified indoor mask and power levels.[356] SBE also believes that UWB technologies could be useful employed for wireless microphone applications could be updated, including to permit more outdoor operations.[357]

136. *Discussion.* While we did not propose, nor are we adopting any changes to these rules, we do encourage further developments that can enable various wireless microphone applications to meet particular consumers' needs. Any changes to the existing rules would require much more extensive technical justification and analyses, as an initial matter, which are not before us.

11. Other potential bands

137. *Background.* In the *NPRM*, we invited comment on whether there are other bands not currently available for wireless microphone operations that may be useful in helping to accommodate their needs, whether in the nearer term and over the longer term. In particular, we inquired about the 2020-2025 MHz band, asking whether this band might be technically suitable for wireless microphone operations, the potential equipment availability, and other issues that would need to be considered. We also requested comment on how a decision to permit wireless microphone operations in this band would affect the Commission's earlier decision to allocate those five megahertz for non-federal fixed and mobile service, whether allowing access would be helpful in accommodating wireless microphone operations, and whether use of this band for wireless microphones would advance the Commission's spectrum management goals, including promoting efficient use of spectrum.[358]

138. Audio-Technica and the Professional Audio Community generally support use of the 2020-2025 MHz band for wireless microphone use.[359] Shure and Sennheiser request a rulemaking to consider pairing the 2020-2025 MHz band with the 1920-1930 MHz band for wireless microphone uses.[360] The Professional Audio Community proposes applying Part 74 technical rules and ETSI standards to this band.[361]

139. *Discussion.* We decline to take any action with respect to 2020-2025 MHz at this time. In the *NPRM*, we asked commenters who were interested in this band to address the technical suitability of this band for wireless microphones, to identify the potential availability of equipment for operations in the band, and to explain how wireless microphone use would be consistent with the Commission's earlier decision to allocate this band for non-federal fixed and mobile service. We also sought comment on how permitting wireless microphone operations would be advance spectral efficiency and other spectrum

[354] *NPRM*, 29 FCC Rcd at 12397 ¶ 207.

[355] Sennheiser Comments at 25.

[356] Audio-Technica Comments at 24.

[357] SBE Comments at 17-18.

[358] *NPRM*, 29 FCC Rcd at 12397-98 ¶¶ 209-210. As we noted in the *NPRM*, in 2008 the Public Interest Spectrum Coalition (PISC) filed a petition for rulemaking to create a general wireless microphone service in the 2020-2025 MHz band. Public Interest Spectrum Coalition (PISC) Petition for Rulemaking to Create a General Wireless Microphone Service (GWMS) (filed July 16, 2008). *Id.* at 12397 ¶ 209 & n.244.

[359] Professional Audio Community June 22 *Ex Parte* Attachment at 8, Audio-Technica Comments at 24.

[360] Shure Comments at 42; Sennheiser Reply Comments at 17.

[361] Professional Audio Community June 22 *Ex Parte* Attachment at 8.

management goals.[362] While certain parties express support for using this band for wireless microphones, the record currently before us does not provide sufficient basis to make this spectrum available for wireless microphone operations at this time, particularly in light of the substantial steps we take in this Order to accommodate wireless microphone operations in other bands. Accordingly, while we do not foreclose future consideration of wireless microphone operations in the 2020-2025 MHz band, we are not permitting wireless microphone access to this band at this time.

IV. PROCEDURAL MATTERS

A. Paperwork Reduction Analysis

140. This Report and Order contains new or modified 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 or modified information collection requirements contained in this proceeding. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, 44 U.S.C. 3506(c)(4), we previously sought specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

B. Final Regulatory Flexibility Analysis

141. 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 Report and Order on small entities. The Final Regulatory Flexibility Analysis is set forth in Appendix B.

C. Congressional Review Act

142. The Commission will send a copy of this Report and Order 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

143. 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. Sections 151, 154(i), 154(j), 157(a), 301, 302a, 303(f), 303(g), and 303(r), this Report and Order IS ADOPTED.

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

145. 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 those rules and requirements which contain new or modified information collection requirements that require approval by the OMB 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.

146. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Report and Order, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

147. IT IS FURTHER ORDERED, pursuant to Section 4(i) of the Communications Act of 1934, as amended, 47 U.S.C. § 154(i), and Section 1.925 of the Commission's Rules, 47 C.F.R. § 1.925, that the waiver request filed on July 16, 2009 and revised on September 23, 2009 by the Nuclear Energy

[362] *NPRM*, 29 FCC Rcd at 12397-98 ¶¶ 209-210.

Institute and the United Telecom Council for waiver of Parts 2 and 90 of the Commission's Rules IS DISMISSED AS MOOT IN PART as set forth above AND OTHERWISE DENIED.

148. IT IS FURTHER ORDERED that, pursuant to Section 5(c) of the Communications Act of 1934, as amended, 47 U.S.C. § 155(c), authority is delegated to the Commission's Consumer and Governmental Affairs Bureau to prepare the specific language that must be used in the Consumer Disclosure, as set forth in this Report and Order, and publish it in the Federal Register.

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 33 is revised.

   b. In the list of United States (US) Footnotes, footnote US84 is added.

§ 2.106 Table of Frequency Allocations.

The revision and addition read as follows:

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
1400-1427 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341			1400-1427 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) 5.341 US246		
1427-1429 SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 5.338A 5.341			1427-1429.5 LAND MOBILE (medical telemetry and medical telecommand) US350 5.341 US79	1427-1429.5 LAND MOBILE (telemetry and telecommand) Fixed (telemetry) 5.341 US79 US350 NG338A	Private Land Mobile (90) Personal Radio (95)
1429-1452 FIXED MOBILE except aeronautical mobile 5.338A 5.341 5.342	1429-1452 FIXED MOBILE 5.343 5.338A 5.341		1429.5-1432 5.341 US79 US350	1429.5-1432 FIXED (telemetry and telecommand) LAND MOBILE (telemetry and telecommand) 5.341 US79 US350 NG338A	
			1432-1435 5.341 US83	1432-1435 FIXED MOBILE except aeronautical mobile 5.341 US83 NG338A	Wireless Communications (27)
1452-1492 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	1452-1492 FIXED MOBILE 5.343 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.344 5.345		1435-1525 MOBILE (aeronautical telemetry) US338A 5.341 US84 US343		Low Power Auxiliary (74H) Aviation (87)
1492-1518 FIXED MOBILE except aeronautical mobile 5.341 5.342	1492-1518 FIXED MOBILE 5.343 5.341 5.344	1492-1518 FIXED MOBILE 5.341			
1518-1525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	1518-1525 FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.344	1518-1525 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341			

UNITED STATES (US) FOOTNOTES

* * * * *

US84 In the band 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.

* * * * *

Part 15 – RADIO FREQUENCY DEVICES

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

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

4. Section 15.37 is amended by adding new paragraphs (i), (j), and (k) to read as follows:

§15.37 Transition provisions for compliance with the rules.

* * * * *

(i) [Reserved]

(j) [Reserved]

(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, three months following issuance of the Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter, is subject to the following disclosure requirements:

(1) Such persons must display the consumer disclosure text, as specified by the Consumer and Governmental Affairs Bureau, at the point of sale or lease of each such unlicensed wireless microphone. The text must be displayed in a clear, conspicuous, and readily legible manner. One way to fulfill the requirement in this section is to display the consumer disclosure text in a prominent manner on the product box by using a label (either printed onto the box or otherwise affixed to the box), a sticker, or other means. Another way to fulfill this requirement is to display the text immediately adjacent to each unlicensed wireless microphone offered for sale or lease and clearly associated with the model to which it pertains.

(2) If such persons offer such unlicensed wireless microphones via direct mail, catalog, or electronic means, they shall prominently display the consumer disclosure text in close proximity to the images and descriptions of each such unlicensed wireless microphone. The text should be in a size large enough to be clear, conspicuous, and readily legible, consistent with the dimensions of the advertisement or description.

(3) If such persons have Web sites pertaining to these unlicensed wireless microphones, the consumer disclosure text must be displayed there in a clear, conspicuous, and readily legible manner (even in the event such persons do not sell unlicensed wireless microphones directly to the public).

(4) The consumer disclosure text described in paragraph (k)(1) of this section is set forth as an appendix to this section.

Appendix to §15.37(k)(1) – [Reserved]

* * * * *

5. Section 15.216 is removed and reserved.

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

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

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

7. Section 74.801 is amended by adding the following definitions.

§ 74.801 Definitions

* * * * *

600 MHz duplex gap. An 11 megahertz guard band that separates part 27 600 MHz service uplink and downlink frequencies, in accordance with the terms and conditions established in GN Docket No. 12-268, pursuant to section 6403 of the Spectrum Act.

600 MHz guard bands. Designated frequency bands that prevent interference between licensed services in the 600 MHz service band and either the television bands or channel 37, in accordance with the terms and conditions established in GN Docket No. 12-268, pursuant to section 6403 of the Spectrum Act.

600 MHz service band. Frequencies that will be reallocated and reassigned for 600 MHz band services as determined by the outcome of the auction conducted pursuant to part 27, in accordance with the terms and conditions established in GN Docket No. 12-268, pursuant to section 6403 of the Spectrum Act

Spectrum Act. Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Pub. L. No. 112-96).

Note to definitions of *600 MHz duplex gap*, *600 MHz guard bands*, and *600 MHz service band*: The specific frequencies will be determined in light of further proceedings pursuant to GN Docket No. 12-268 and the rules will be updated accordingly pursuant to a future public notice.

* * * * *

8. Section 74.802 is amended by revising paragraphs (a) and (b)(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
941.500-952.000 MHz
952.850-956.250 MHz
956.45-959.85 MHz
1435-1525 MHz
6875.000-6900.000 MHz
7100.000-7125.000 MHz

(2) [Reserved]

(b) * * *

(2) Low power auxiliary stations may operate closer to co-channel TV broadcast stations than the distances specified in paragraph (b)(1) of this section provided that such operations either –

(a) are coordinated with TV broadcast stations that could be affected by the low power auxiliary station operation, and coordination is completed prior to operation of the low power auxiliary station; or

(b) are limited to an indoor location that is not being used for over-the-air television viewing, and the following conditions are met with respect to the TV channel used: the TV signal falls below a threshold of -84 dBm over the entire channel; the signal is scanned across the full 6 megahertz channel where the wireless microphones would be operated; and to the extent that directional antennas are used, they are rotated to the place of maximum signal.

* * * * *

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

§ 74.803 Frequency selection to avoid interference.

* * * * *

(c) In the 941.500-952.000 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. 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 stations (LPAS) are limited to operations at specific fixed locations that have been coordinated with the frequency coordinator for aeronautical mobile telemetry, the Aerospace and Flight Test Radio Coordinating Committee. LPAS devices must complete authentication and location verification before operation begins, 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. Use is limited to situations where there is a need to deploy large numbers of LPAS for specified time periods, and use of other available spectrum resources is insufficient to

meet the LPAS licensee's needs at the specific location. All LPAS devices operating in a particular area in the band may have access to no more than 30 megahertz of spectrum in the band at a given time.

10. 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 941.5-952 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.

11. Section 74.832 is amended by revising paragraphs (a)(6) and (d) to read as follows:

§ 74.832 Licensing requirements and procedures.

(a) * * *

(6) Licensees and conditional licensees of stations in the Broadband Radio Service as defined in §27.1200 of this chapter, or entities that hold an executed lease agreement with a Broadband Radio Service or Educational Broadband Service licensee.

* * * * *

(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 941.500-952.000 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.

* * * * *

12. Section 74.851 is amended by replacing the section title, revising subsection (i), and adding subsections (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 Band or the 600 MHz Band; labeling for 700 MHz or 600 MHz band equipment destined for non-U.S. markets; disclosures.

* * * * *

(i) Effective nine months after the release of the Commission's Channel Reassignment Public Notice issued pursuant to Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order, GN Docket No. 12-268, 79 Fed. Reg. 48442-01 (Aug. 15, 2014), 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 bands, or for low power auxiliary stations that are capable of operating in the 600 MHz duplex gap unless the operations are limited to the four megahertz segment from one to five megahertz above the lower edge of the 600 MHz duplex gap.

(j) Effective eighteen months after the release of the Commission's Channel Reassignment Public Notice issued pursuant to Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order, GN Docket No. 12-268, 79 Fed. Reg. 48442-01 (Aug. 15, 2014), 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 four megahertz segment from one to five megahertz above the lower edge of the 600 MHz duplex gap. This prohibition does not apply to devices manufactured solely for export.

(k) Effective eighteen months after the release of the Commission's Channel Reassignment Public Notice issued pursuant to Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order, GN Docket No. 12-268, 79 Fed. Reg. 48442-01 (Aug. 15, 2014), any person who manufactures, sells, leases, or offers 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 four megahertz segment from one to five megahertz above the lower edge of the 600 MHz duplex gap, 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 station 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 assist devices that are capable of operating in the 600 MHz service band three months following issuance of the Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter, is subject to the following disclosure requirements:

(1) Such persons must display the consumer disclosure text, as specified by the Consumer and Governmental Affairs Bureau, at the point of sale or lease of each such low power auxiliary station or wireless video assist device. The text must be displayed in a clear, conspicuous, and readily legible manner. One way to fulfill the requirement in this section is to display the consumer disclosure text in a prominent manner on the product box by using a label (either printed onto the box or otherwise affixed to the box), a sticker, or other means. Another way to fulfill this requirement is to display the text immediately adjacent to each low power auxiliary station or wireless video assist device offered for sale or lease and clearly associated with the model to which it pertains.

(2) If such persons offer such low power auxiliary stations or wireless video assist device via direct mail, catalog, or electronic means, they shall prominently display the consumer disclosure text in close proximity to the images and descriptions of each such low power auxiliary station or wireless video assist device. The text should be in a size large enough to be clear, conspicuous, and readily legible, consistent with the dimensions of the advertisement or description.

(3) If such persons have Web sites pertaining to these low power auxiliary stations or wireless video assist devices, the consumer disclosure text must be displayed there in a clear, conspicuous, and readily legible manner (even in the event such persons do not sell low power auxiliary stations or wireless video assist devices directly to the public).

(4) The consumer disclosure text described in paragraph (l)(1) of this section is set forth as an appendix to this section.

Appendix to §74.851(l) – [Reserved]

* * * * *

13. Section 74.861 is amended by revising subsection (d) and (e)(1)(i)-(ii) and adding subsections (e)(7) and (i) to read as follows:

§ 74.861 Technical requirements.

* * * * *

(d) * * *

(1) For all bands except the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 1 watt. In the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 250 milliwatts. Licensees may accept the manufacturer's power rating; however, it is the licensee's responsibility to observe specified power limits.

(2) If a low power auxiliary station employs amplitude modulation, modulation shall not exceed 100 percent on positive or negative peaks.

(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 nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter.

(4) (i) For the 941.5-952 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 be attenuated 90 dB below the level of the unmodulated carrier.

(ii) For the 941.5-952 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 be attenuated 90 dB below the level of the unmodulated carrier.

(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 be attenuated 90 dB below the level of the unmodulated carrier.

(iv) For the 944-952 MHz band, the requirements of this section (d)(4) shall not apply to the applications for certification of equipment for that band until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in § 73.3700(a)(2) of this chapter**.**

(e) * * *

(1) * * *

(i) 54-72, 76-88, and 174-216 MHz bands: 50 mW EIRP

(ii) 470-608 and 614-698: 250 mW conducted power

* * * * *

(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 be attenuated 90 dB below the level of the unmodulated carrier. 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**.**

* * * * *

(i) The standard required in this section is incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Commission must publish notice of the change in the Federal Register and the material must be available to the public. All approved material is available for inspection at the FCC Reference Information Center, 445 12th Street, SW, Room CY-A257, Washington, DC 20554. The information is also available from the European Telecommunications Standards Institute, 650 Route des Lucioles, 06921 Sophia Antipolis Cedex, France. A copy of the standard is also available at http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/01.03.02_60/en_30042201v010302p.pdf. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal-register/cfr/ibr-locations.html.

Part 87 – AVIATION SERVICES

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

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

15. Section 87.303 is amended by revising paragraph (d)(1) to read as follows:

§ 87.303 Frequencies

* * * * *

(d)(1) Frequencies in the band 1435-1525 MHz are also available for low power auxiliary station use on a secondary basis.

* * * * *

Part 90 – PRIVATE LAND MOBILE RADIO SERVICES

16. 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.

17. Section 90.265 is amended by revising paragraphs (b), (b)(1), and (b)(3), and adding paragraph (b)(5), 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
169.475
169.505
170.245
170.275
170.305
171.045
171.075
171.105
171.845
171.875
171.905

(1) On center frequencies 169.475 MHz, 170.275 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.

* * *

(3) For emissions with a bandwidth not exceeding 54 kHz, the frequency stability of wireless microphones shall limit the total emission to within ±32.5 kHz of the assigned frequency. Emissions with a bandwidth exceeding 54 kHz 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.*

* * * * *

(5) The standard required in this section is incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any

edition other than that specified in this section, the Commission must publish notice of the change in the Federal Register and the material must be available to the public. All approved material is available for inspection at the FCC Reference Information Center, 445 12th Street, SW, Room CY-A257, Washington, DC 20554. The information is also available from the European Telecommunications Standards Institute, 650 Route des Lucioles, 06921 Sophia Antipolis Cedex, France. A copy of the standard is also available at http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/01.03.02_60/en_30042201v010302p.pdf. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to http://www.archives.gov/federal-register/cfr/ibr-locations.html.

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APPENDIX B

Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[1] and Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the in the Notice of Proposed Rule Making (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] The Commission sought written public comment on the proposals in the NPRM, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.[3]

A. Need for, and Objectives of, the Report and Order

2. In this Report and Order, we take several actions to accommodate wireless microphone users' needs in the coming years. Many types of users employ wireless microphones in a variety of settings. Wireless microphone operations range from professional uses, with the need for numerous high-performance microphones along with other microphones, to the need for a handheld microphone to transmit voice communications, to a range of different uses and needs for different numbers of microphones in different settings. Through these actions, we seek to enable wireless microphone users to have access to a suite of devices that operate effectively and efficiently in different spectrum bands and can address their respective needs.

3. We adopt several changes in our rules for operations in the TV bands, where most wireless microphone operations occur today. With respect to the TV bands, we revise our rules to provide more opportunities to access spectrum by allowing greater use of the VHF channels and more co-channel operations without the need coordination where use would not cause harmful interference to TV service. We also open up the licensed use of the duplex gap to all entities eligible to hold LPAS licenses for using TV band spectrum. We also will require new wireless microphones operating in the TV bands and certain other bands to meet the more efficient analog and digital ETSI standards, which will ensure more efficient use of the spectrum. In addition, we address consumer education and outreach efforts that can help consumers 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. We also discuss several additional actions we are taking with respect to other spectrum bands currently available for wireless microphone operations to enable greater use of these band to accommodate wireless microphone uses in the future. Specifically, we adopt revisions to provide new opportunities in the 169-172 MHz band and the 944-952 MHz band. Finally, we open up three other sets of spectrum bands – portions of the 941-944MHz and 952-960 MHz bands, the 1430-1525 MHz band, and the 6875-7125 MHz band – for sharing with licensed wireless microphone operations under specified conditions.

B. Summary of Significant Issues Raised by Public Comments in Response to the IFRA

4. There were no public comments filed that specifically addressed the rules and policies proposed in the IRFA.

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[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; GN Docket No. 14-166 and Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket 12.268 (FCC 14-145) *Notice of Proposed Rulemaking*, 29 FCC Rcd 12343, adopted September 30, 2014.

[3] *See* 5 U.S.C. § 604.

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

5. Pursuant to the Small Business Jobs Act of 2010, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration, and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

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

6. 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 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]

7. **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.[8] First, nationwide, there are a total of 28.2 million small businesses, according to the SBA.[9] 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."[10] Nationwide, as of 2012, there were approximately 2,300,000 small organizations.[11] 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."[12] Census Bureau data for 2012 indicate that there were 90,056 local governments in the United States.[13] Thus, we estimate that most governmental jurisdictions are small.

8. **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

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[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 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] *See* 5 U.S.C. §§ 601(3)–(6).

[9] *See* SBA, Office of Advocacy, "Frequently Asked Questions," http://www.sba.gov/sites/default/files/FAQ_March_2014_0.pdf (last visited May 2, 2014; figures are from 2011).

[10] 5 U.S.C. § 601(4).

[11] NATIONAL CENTER FOR CHARITABLE STATISTICS, THE NONPROFIT ALMANAC (2012).

[12] 5 U.S.C. § 601(5).

[13] U.S. CENSUS BUREAU, GOVERNMENT ORGANIZATION SUMMARY REPORT: 2012 (rel. Sep. 26, 2013), http://www2.census.gov/govs/cog/g12_org.pdf (last visited May 2, 2014).

meters.[14]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.[15] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[16] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[17] Thus, using this data, we estimate that the majority of wireless firms can be considered small. There are a total of more than 1,200 Low Power Auxiliary Station (LPAS) licenses in all bands and a total of over 600 LPAS licenses in the UHF spectrum.[18]

9. **Low Power Auxiliary Device Manufacturers: Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.** The Census Bureau defines this category as follows: "This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment."[19] The SBA has developed a small business size standard for Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.[20] According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for the entire year.[21] Of this total, 912 establishments had employment of less than 500, and an additional 10 establishments had employment of 500 to 999.[22] Thus, under this size standard, the majority of firms can be considered small.

10. **Low Power Auxiliary Device Manufacturers: 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)."[23] The SBA has

[14] 47 C.F.R. § 74.801.

[15] 13 C.F.R. § 121.201 (NAICS code 517210).

[16] U.S. Census Bureau, Table No. EC0751SSSZ5, *Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007* (NAICS code 517210), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[17] *Id*. Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with 1000 employees or more.

[18] FCC, Universal Licensing System (ULS), *available at* http://wireless.fcc.gov/uls/index.htm?job=home (last visited May 13, 2014).

[19] U.S. Census Bureau, 2012 NAICS Definitions: 334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334220&search=2012 (last visited May 6, 2014).

[20] 13 C.F.R. § 121.201, NAICS code 334220.

[21] U.S. Census Bureau, Table No. EC0731SG3, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2007 (NAICS code 334220), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_31SG3. The number of "establishments" is a less helpful indicator of small business prevalence in this context than would be the number of "firms" or "companies," because the latter take into account the concept of common ownership or control. Any single physical location for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in this category, including the numbers of small businesses.

[22] *Id*. An additional 17 establishments had employment of 1,000 or more.

[23] 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 May 6, 2014).

developed a small business size standard for Other Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.[24] According to Census Bureau data for 2007, there were a total of 452 establishments in this category that operated for the entire year.[25] Of this total, 448 establishments had employment below 500, and an additional 4 establishments had employment of 500 to 999.[26] Thus, under this size standard, the majority of firms can be considered small.

11. **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 Commission has estimated the number of licensed commercial television stations to be 1,388.[29] 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.[30] We therefore estimate that the majority of commercial television broadcasters are small entities.

12. We note, however, that in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations must be included.[31] 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.

13. In addition, the Commission has estimated the number of licensed noncommercial educational (NCE) television stations to be 396.[32] These stations are non-profit, and therefore considered to be small entities.[33]

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[24] 13 C.F.R. § 121.201, NAICS code 334290.

[25] U.S. Census Bureau, Table No. EC0731SG3, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2007 (NAICS code 334290), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_31SG3&prodType=table (last visited May 6, 2014). The number of "establishments" is a less helpful indicator of small business prevalence in this context than would be the number of "firms" or "companies," because the latter take into account the concept of common ownership or control. Any single physical location for an entity is an establishment, even though that location may be owned by a different establishment. Thus, the numbers given may reflect inflated numbers of businesses in this category, including the numbers of small businesses.

[26] *Id*. There were no establishments that had employment of 1,000 or more.

[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 May 6, 2014).

[28] 13 C.F.R. § 121.201 (NAICS code 515120) (updated for inflation in 2010).

[29] *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.

[30] We recognize that BIA's estimate differs slightly from the FCC total given.

[31] "[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).

[32] *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.

14. There are also 2,414 low power television stations, including Class A stations and 4,046 television translator stations.[34] 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.

15. **Cable Television Distribution Services.** Since 2007, these services have been defined within the broad economic census category of Wired Telecommunications Carriers; that category is defined as follows: "This industry comprises establishments primarily engaged in operating and/or providing access to transmission facilities and infrastructure that they own and/or lease for the transmission of voice, data, text, sound, and video using wired telecommunications networks. Transmission facilities may be based on a single technology or a combination of technologies."[35] The SBA has developed a small business size standard for this category, which is: all such firms having 1,500 or fewer employees.[36] Census data for 2007 shows that there were 3,188 firms that operated for the duration of that year.[37] Of those, 3,144 had fewer than 1,000 employees, and 44 firms had more than 1,000 employees. Thus under this category and the associated small business size standard, the majority of such firms can be considered small.

16. **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.[38] Industry data indicate that of approximately 1,100 cable operators nationwide, all but ten are small under this size standard.[39] In addition, under the Commission's rules, a "small system" is a cable system serving 15,000 or fewer subscribers.[40] Current Commission records show 4,945 cable systems nationwide.[41] Of this total, 4,380 cable systems have fewer than 20,000 subscribers, and 565 systems have 20,000 or more subscribers, based on the same records. Thus, under this standard, we estimate that most cable systems are small entities.

17. **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

(Continued from previous page)

[33] *See generally* 5 U.S.C. §§ 601(4), (6).

[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] U.S. Census Bureau, *2012 NAICS Definitions: 517110 Wired Telecommunications Carriers*, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517110&search=2012 (last visited May 5, 2014).

[36] U.S. Small Business Administration, Table of Small Business Size Standards Matched to North American Industry Classification System Codes, at 28 (2014), http://www.sba.gov/sites/default/files/files/size_table_01222014.pdf.

[37] *See* U.S. Census Bureau, American FactFinder, 2007 Economic Census of the United States, Table No. EC0751SSSZ5, Establishment and Firm Size: Employment Size of Firms for the United States: 2007, NAICS code 517110, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5 (last visited May 7, 2014).

[38] 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).

[39] Industry Data, National Cable & Telecommunications Association, https://www.ncta.com/industry-data (last visited May 6, 2014); R.R. Bowker, *Broadcasting & Cable Yearbook 2010*, "Top 25 Cable/Satellite Operators," p. C-2 (data current as of December, 2008).

[40] 47 C.F.R. § 76.901(c).

[41] 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.

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.

18. **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 2007. According to that source, there were 3,188 firms that in 2007 were Wired Telecommunications Carriers. Of these, 3,144 operated with less than 1,000 employees, and 44 operated with more than 1,000 employees. However, as to the latter 44 there is no data available that shows how many operated with more than 1,500 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 Corporation ("EchoStar") (marketed as the DISH Network).[49] Each currently offers subscription services. DIRECTV[50] and EchoStar[51] 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.

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

[43] 47 C.F.R. § 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 C.F.R. § 76.909(b).

[46] *See* 13 C.F.R. § 121.201 (NAICS code 517110).

[47] *Id*.

[48] *See* U.S. Census Bureau, Table No. EC0751SSSZ5, *Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007* (NAICS code 517110), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[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.

19. **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 2007, a total of 659 establishments operated for the entire year.[54] Of that 659, 197 operated with annual receipts of $10 million or more. The remaining 462 establishments operated with annual receipts of less than $10 million. Based on this data, the Commission estimates that the majority of establishments operating in this industry are small.

20. **Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.** The Census Bureau defines this category as follows: "This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment."[55] The SBA has developed a small business size standard for Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.[56] According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for part or all of the entire year. Of this total, 912 had less than 500 employees and 17 had more than 1000 employees.[57] Thus, under that size standard, the majority of firms can be considered small.

21. **Audio and Video Equipment Manufacturing.** 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.[58] Data contained in the 2007 U.S. Census indicate that 492 establishments operated in that industry for all or part of that year. In that year, 488 establishments had fewer than 500 employees; and only 1 had more than 1000 employees.[59] Thus, under the applicable size standard, a majority of manufacturers of audio and video equipment may be considered small.

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[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 Mar. 6, 2014).

[53] *See* 13 C.F. R § 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] U.S. Census Bureau, 2012 NAICS Definitions: 334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing,

http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334220&search=2012 (last visited Mar. 6, 2014).

[56] 13 C.F.R § 121.201 (NAICS code 334220).

[57] *See* U.S. Census Bureau, Table No. EC0731SG3, *Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2007* (NAICS code 334220), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_31SG3.

[58] 13 CFR § 121.201 (NAICS code 334310).

[59] *See* U.S. Census Bureau, Table No. EC0731SG3, *Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2007* (NAICS code 334310), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_31SG3.

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."[60] The appropriate 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.[61] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[62] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[63] 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.[64] Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.[65] 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. **Manufacturers of unlicensed devices**. In the context of this FRFA, manufacturers of Part 15 unlicensed devices that are operated in the UHF-TV band (channels 14-51) for wireless data transfer fall into the category of Radio and Television and Wireless Communications Equipment Manufacturing. The Census Bureau defines this category as follows: "This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment."66 The SBA has developed the small business size standard for this category as firms having 750 or fewer employees.[67] According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for the entire year.[68] Of this total, 912 had less than 500 employees and 17 had more than 1000 employees. Thus, under that size standard, the majority of firms can be considered small.

24. **Personal Radio Services/Wireless Medical Telemetry Service ("WMTS").** Personal radio services 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

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[60] 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 Mar. 6, 2014).

[61] 13 C.F.R. § 121.201 (NAICS code 517210).

[62] U.S. Census Bureau, Table No. EC0751SSSZ5, *Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007* (NAICS code 517210), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[63] *Id*. Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with 1000 employees or more.

[64] *See Trends in Telephone Service* at Table 5.3.

[65] *See id*.

[66] U.S. Census Bureau, *2012 NAICS Definitions: 334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing*, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=334220&search=2012 (last visited Mar. 6, 2014).

[67] 13 C.F.R § 121.201 (NAICS code 334220).

[68] U.S. Census Bureau, Table No. EC0731SG3, *Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2007* (NAICS code 334220), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_31SG3.

spectrum licensed under Part 95 of our rules.[69] 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").[70] There are a variety of methods used to license the spectrum in these rule parts, from licensing by rule, to conditioning operation on successful completion of a required test, to site-based licensing, to geographic area licensing. Under the RFA, the Commission is required to make a determination of which small entities are directly affected by the rules adopted. Since all such entities are wireless, we apply the definition of Wireless Telecommunications Carriers (except Satellite), pursuant to which a small entity is defined as employing 1,500 or fewer persons.[71] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[72] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[73] Thus under this category and the associated small business size standard, the Commission estimates that the majority of personal radio service and WMTS providers are small entities.

25. 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.

26. **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."[74] The SBA has developed a small business size standard for this category, which is: all such businesses having $30 million dollars or less in annual receipts.[75] Census data for 2007 show that there were 9,478 establishments that operated that year.[76] Of that number, 9,128 had annual receipts of $24,999,999 or less, and 350 had annual receipts ranging from not less than $25,000,000 to $100,000,000 or more.[77] Thus, under this size standard, the majority of such businesses can be considered small entities.

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[69] 47 C.F.R. Part 95.

[70] 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.

[71] 13 C.F.R. § 121.201 (NAICS Code 517210).

[72] U.S. Census Bureau, Table No. EC0751SSSZ5, *Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007* (NAICS code 517210), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[73] *Id*. Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with 1000 employees or more.

[74] 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 Mar. 6, 2014).

[75] 13 C.F.R § 121.201, 2012 NAICS code 512110.

[76] U.S. Census Bureau, Table No. EC0751SSSZ5, *Information: Subject Series - Establishment and Firm Size: Employment Size of Firms for the United States: 2007* (NAICS code 512110), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ5.

[77] *See id*.

27. **Radio Broadcasting.** The SBA defines a radio broadcast station as a small business if such station has no more than $38.5 million in annual receipts.[78] Business concerns included in this industry are those "primarily engaged in broadcasting aural programs by radio to the public."[79] 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) affiliations[80] 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.

28. 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.

29. **Radio, Television, and Other 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."[81] 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.[82] According to Census Bureau data for 2007, there were 11,358 firms in this category that operated for the entire year.[83] Of this total, 11,323 firms had annual receipts of under $25 million, and 35 firms had receipts of $25 million or more but less than $50 million.[84] Thus, the majority of firms in this category can be considered small.

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[78] 13 C.F.R § 121.201, 2012 NAICS code 515112.

[79] U.S. Census Bureau, *2012 NAICS Definitions: 515112 Radio Broadcasting*, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=515112&search=2012 (last visited Mar. 6, 2014).

[80] *See* n.14.

[81] U.S. Census Bureau, *2012 NAICS Definitions, 443142 Electronics*, http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=443142&search=2012 NAICS Search (last visited May 6, 2014).

[82] 13 C.F.R. § 121.201, NAICS code 443142.

[83] U.S. Census Bureau, 2007 Economic Census, Subject Series: Retail Trade, Estab & Firm Size: Summary Statistics by Sales Size of Firms for the United States: 2007, NAICS code 443142 (released 2010), http://www2.census.gov/econ2007/EC/sector44/EC0744SSSZ4.zip (last visited May 7, 2014). Though the current small business size standard for electronic store receipts is $30 million or less in annual receipts, in 2007 the small business size standard was $9 million or less in annual receipts. In 2007, there were 11,214 firms in this category that operated for the entire year. Of this total, 10,963 firms had annual receipts of under $5 million, and 251 firms had receipts of $5 million or more but less than $10 million. *Id.*

[84] *Id*. An additional 33 firms had annual receipts of $50 million or more.

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

30. In this proceeding, we invited comment on potential revisions to the existing rules for Part 74 wireless microphone (and other LPAS) operations in the spectrum that will remain allocated for TV services following the repacking process. Specifically, we invited comment on revisions to the technical rules for LPAS operations on the VHF band; on permitting licensed LPAS operations on channels in locations closer to the television stations (including within the DTV contour), without the need for coordination, provided that the television signal falls below specified technical thresholds; on adoption of the ETSI emission mask standard for analog and digital wireless microphones; and general comment on other potential revisions concerning licensed LPAS operations in the TV bands.

31. We understand the importance of the 944-952 MHz band for broadcasters as well as other licensed, professional wireless microphone users. Consistent with this record and in accord with adoption of the ETSI standard for LPAS devices in the TV bands. we also adopt the ETSI standards EN 300 422-1, Section 8.3.1.2 for analog emissions and Section 8.3.2.2 for digital emissions uniformly for future wireless microphones that will use this band – applying these revised standards to new equipment certified under Part 74 in the 944-952 MHz band 9 months after issuance of the *Channel Reassignment PN*, consistent with the requirements for new equipment certified for LPAS devices that operate in the TV bands. Further, we expand eligibility for operations in the 944-952 MHz band to include all entities currently eligible to hold LPAS licenses for operation in the TV bands, which should help address the need for additional spectrum outside of the TV bands for this entire group of licensed users.

32. Licensed LPAS users operating in the 944-952 MHz band (as in the TV bands) are subject to the frequency selection requirements contained in Section 74.803 of our Rules.[85] SBE runs a local frequency coordination program for this band and asserts its coordination would have to be mandatory in order to avoid interference among different licensees.[86] Accordingly, we will also require wireless microphone users seeking access to this band to coordinate their proposed use through the local SBE coordinator.[87]

33. *Consumer Outreach*. We find that several means should be employed to provide as much notice as possible to users of the need to clear the 600 MHz Band of wireless microphones. We direct CGB, working with WTB and OET, to establish a webpage on the Commission's website, and prepare and release consumer publications, including a Consumer Fact Sheet and answers to Frequently Asked Questions (FAQs), that inform the public of our decisions affecting wireless microphone operations in the repurposed 600 MHz Band and the guard bands, as set forth in the *Incentive Auction R&O*, this Report and Order, and the Part 15 Report and Order.[88] We further direct Commission staff to identify and contact organizations that represent entities that are known to be users of wireless microphones in the 600 MHz Band, including groups that represent theaters, houses of worship, and sporting venues. We will inform these entities of our decisions affecting wireless microphone operations in the repurposed spectrum and available resources for information on options for wireless microphone use going forward.

34. Further, we expect all manufacturers of wireless microphones to make significant efforts to ensure that all users of such equipment capable of operating in the 600 MHz Band are fully informed of the decisions affecting them, as set forth in the *Incentive Auction R&O*, this Report and Order, and the Part 15 Report and Order. Specifically, we expect these manufacturers, at a minimum, to ensure that these users are informed of the need to clear the 600 MHz Band. Manufacturers also should inform users

[85] *See* 47 C.F.R. § 74.803.

[86] SBE Comments at 13.

[87] These processes are described on SBE's website. *See* The Society of Broadcast Engineers, Frequency Coordination, http://www.sbe.org/sections/freq_local.php.

[88] See Part 15 Report and Order, Section [__] (discussing requirements relating to unlicensed wireless microphones).

of wireless microphones that they may continue to operate in the 600 MHz Band until the end of the post-auction transition period, but only subject to the conditions set forth in these orders, including the early clearing mechanisms. Further, we expect all manufacturers to contact dealers, distributors, and anyone else who has purchased wireless microphones, and inform them of our decisions to help clear the 600 MHz Band. Manufacturers should also provide information on these decisions to any users that have filed warranty registrations for 600 MHz Band equipment with the manufacturer. We also expect manufacturers to post this information on their websites and include it in all of their sales literature.

35. In addition, we urge all manufacturers to offer rebates and trade-in programs for any 600 MHz Band wireless microphones, and widely publicize these programs to ensure that all users of wireless microphones are fully informed. To the extent manufacturers do not offer a rebate or trade-in program for 600 MHz Band wireless microphones, we strongly encourage them to create or re-establish such programs. In contacting dealers and distributors, we expect manufacturers to inform these entities that they should: (1) inform all customers who have purchased wireless microphones that are capable of operating in the 600 MHz Band of our decision to clear the 600 MHz Band of such devices; (2) post such information on their websites; (3) include this information in all other sales literature; (4) provide information in sales literature, including on their websites, on the availability of any manufacturer rebate offerings and trade-in programs related to wireless microphones operating in the 600 MHz Band; and (5) comply with the disclosure requirements that we are adopting in this Report and Order.

36. *Disclosure Requirement*. We require anyone selling, leasing, or offering for sale or lease wireless microphones that operate in the 600 MHz Band to provide certain written disclosures to consumers, pursuant to Section 302. These entities must display the Consumer Disclosure, the text of which will be developed by Commission staff, at the point of sale or lease,[89] in a clear, conspicuous, and readily legible manner. In addition, the Consumer Disclosure must be displayed on the website of the manufacturer (even in the event the manufacturer does not sell wireless microphones directly to the public) and of dealers, distributors, retailers, and anyone else selling or leasing the devices. We delegate authority to the Consumer and Governmental Affairs Bureau, working with the Wireless Telecommunications Bureau and the Office of Engineering and Technology, to prepare the specific language, following issuance of the *Channel Reassignment PN*, that must be used in the Consumer Disclosure and publish it in the Federal Register. As discussed above, there is more than one way in which the point-of-sale Consumer Disclosure may be provided to potential purchasers or lessees of wireless microphones, but each of them must satisfy all the requirements noted above, including that the disclosure be provided in writing at the point of sale in a clear, conspicuous, and readily legible manner. One way to fulfill this disclosure requirement would be to display the Consumer Disclosure in a prominent manner on the product box by using a label (either printed onto the box or otherwise affixed to the box), a sticker, or other means. Another way to fulfill the disclosure requirement would be to display the text immediately adjacent to each wireless microphone offered for sale or lease and clearly associated with the model to which it pertains. For wireless microphones offered online or via direct mail or catalog, the disclosure must be prominently displayed in close proximity to the images and descriptions of each wireless microphone. We will require manufacturers, dealers, distributors, and other entities that sell or lease wireless microphones for operation in the 600 MHz Band to comply with the disclosure requirements no later than three months following issuance of the *Channel Reassignment PN*, and we encourage these entities to provide consumers with the required information earlier.[90]

[89] By "point of sale or lease" we mean the place or website where wireless microphones are displayed or offered for consumers to purchase or lease.

[90] This disclosure requirement requires approval from the Office of Management and Budget (OMB) as a new information collection under the Paperwork Reduction Act (PRA). We anticipate approval of the requirement shortly following publication of a summary of this Report and Order in the Federal Register, sufficiently in advance of the date by which the disclosure requirement goes into effect.

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

37. 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.[91]

38. The rule revisions that we are adopting provide additional opportunities for licensed wireless microphone users, both in frequency bands in which they currently operate and in additional frequency bands. The majority of these changes are permissive, meaning that wireless microphone manufacturers may choose to incorporate new capabilities in future devices. We adopt rules to establish cutoff dates for the certification, manufacturing and marketing of licensed wireless microphones in the 600 MHz band repurposed for wireless services following the incentive auction. We will no longer accept applications to certify licensed wireless microphones that operate in the 600 MHz band nine months after the release of the *Channel Reassignment PN* or no later than 24 months after the effective date of the new rules, whichever occurs first. We will require that manufacturing and marketing of all licensed wireless microphones that would not comply with the 600 MHz Band cease 18 months after release of the *Channel Reassignment PN* or no later than 33 months after the effective date of the new rules, whichever occurs first. .

Report to Congress: The Commission will send a copy of the Report and Order, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.[92] In addition, the Commission will send a copy of the Report and Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.[93]

[91] *See* 5 U.S.C. § 603(c).

[92] *See* 5 U.S.C. § 801(a)(1)(A).

[93] *See* 5 U.S.C. § 604(b).

STATEMENT OF
CHAIRMAN TOM WHEELER

Re: Promoting Spectrum Access for Wireless Microphone Operations, GN Docket No. 14-166, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, Report and Order.

As the Commission continues its preparations for next year's Incentive Auction, we are committed to laying the foundation for an efficient, effective and timely auction that serves the public interest. This week, we adopt two companion items important for achieving these objectives: the Part 15 Report and Order and the Wireless Microphones Report and Order.

These items contain important components that must be in place before the Incentive Auction. We establish clear rules for unlicensed devices and wireless microphones in the 600 MHz band, including the duplex gap and guard bands, that also protect and create certainty and protections for the licensed users – including broadcasters and future 600 MHz band licensees.

We provide for continued operation of the various stakeholders following the incentive auction in the 600 MHz band, Channel 37, and the television band. Wireless medical telemetry devices and radio astronomy services will continue to have interference protection on Channel 37, while unlicensed users gain access to the channel in areas where WMTS and RAS are not using it. Wireless microphones, both licensed and unlicensed, will be able to operate in the 600 MHz band duplex gap and guard bands, and continue to operate in the 600 MHz wireless band during the post-auction transition period.

We fulfill our commitment to ensure unlicensed use of the 600 MHz and TV bands nationwide. Unlicensed spectrum has been a powerful platform for driving innovation, investment, and economic growth. Breakthroughs like Wi-Fi, which relies on unlicensed spectrum, have generated hundreds of billions of dollars of value for our economy and consumers. This item will benefit consumers in the form of increased investment and innovation in unlicensed products and services.

We continue our work to accommodate the long term needs of licensed microphone users by increasing the utility of bands where they already have access and expanding access to other spectrum bands. Added to the steps we took last year to allow more microphone users to become licensed, today's item solidifies our commitment to address the important needs of microphone users.

No party gets everything it wants in these items. The results of auctioning 600 MHz spectrum means the 600 MHz band operating parameters will be new to everyone after the auction. For this reason, today's Part 15 item lays out a number of steps that must be taken before unlicensed operations may begin. It also provides common sense procedures that stop harmful interference if it were to occur.

Collectively, the actions we take in these two Orders promote efficient use of our nation's spectrum resources, address the important needs of the unlicensed and wireless microphone communities, and protect other licensed users in these bands – all of which are critical as we move toward the Incentive Auction next year.

STATEMENT OF COMMISSIONER MIGNON L. CLYBURN

Re: *Promoting Spectrum Access for Wireless Microphone Operations*, GN Docket No. 14-166; *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268.

When there is a crisis, we look for sources of breaking news. Decades ago, that might have been limited to an evening television news program or the radio. Today, we have far more options to keep us informed: Ultra-high-definition TV, a tablet, or smart phone with signals being delivered over licensed spectrum, Wi-Fi or fiber.

Regardless of what collection of services and technologies we use to get the news, there is a good chance someone with a wireless microphone is on the other end. They are one of the unsung elements of the newsgathering business. And wireless microphones are not just for news: sporting events, live concerns, theaters and film studios all rely on wireless mics to provide critical flexibility and high-quality audio.

Wireless microphones rely on the unused portions of the TV spectrum and our recent actions, including our actions today to repurpose portions of the television band for wireless services, have resulted in changes for the wireless microphone community.

So this item is important to the wireless microphone community – and, by extension, to all of us – because it takes several steps to address the long-term needs of the users of wireless mics. It starts with making additional spectrum available for wireless microphones. We are allowing wireless microphones to operate on three new bands. We are revising our rules promote greater use of the television band by permitting more sharing and allowing more wireless mics to use the band. And we are taking steps to help smooth the transition for wireless users out of the TV spectrum that has been repurposed for wireless services.

With so many possible uses for limited spectrum, we are often faced with difficult decisions on how to balance competing uses. With these changes, I am confident that we will be able to protect the long-term needs of the wireless microphone community, even as we repurpose the television bands.

I thank the Office of Engineering and Technology and the Wireless Telecommunications Bureau for their hard work throughout this proceeding.

STATEMENT OF
COMMISSIONER AJIT PAI

Re: *Promoting Spectrum Access for Wireless Microphone Operations*, GN Docket No. 14-166; *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268.

A wireless microphone is not a technology that gets a lot of headlines, but as someone that's been known to frequent a karaoke bar or two, I know the difference they can make. The opportunity to broadcast my musical adventures is critical for me and, I daresay, my captive audiences. I'll concede that, even though I'd like to think my style and vocals resemble some of the all-time greats, like Frank Sinatra and Prince,[1] my friends tell me I have more of the "sand and glue" style of Bob Dylan.[2] But that's okay—I can settle with being the voice of my generation.

In all seriousness, wireless microphones serve important purposes. They enable broadcasters and other video programming networks to meet the needs of consumers by covering breaking news and other live events. And they are critical tools for businesses and productions across the country.

The upcoming incentive auction will leave substantially less room for wireless microphones. It is therefore critical that we find them new homes. This *Order* isn't a perfect solution, but it does adopt a number of rule changes that should help wireless microphones take advantage of additional spectrum bands. I therefore support the *Order* and am voting to approve.

[1] *See also* ☥.

[2] *See* David Bowie, *Song for Bob Dylan* (1971).

STATEMENT OF
COMMISSIONER MICHAEL O'RIELLY
APPROVING IN PART, DISSENTING IN PART

Re: Promoting Spectrum Access for Wireless Microphone Operations, GN Docket No. 14-166, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, Report and Order.

Generally, I appreciate that today's order seeks to adopt changes to our technical rules to allow wireless microphones to be used to the greatest extent possible in the remaining TV bands, and provides new or increased opportunities in other frequencies. It attempts to make the best of a difficult situation resulting from the upcoming incentive auction, envisioned and created by Congress. Everyone involved in this process was aware that it would cause lasting disruptions for many communications providers and manufactures. There are few cases where this is more evident than the wireless microphone community.

Having spent considerable time on this issue and after visiting many venues with wireless microphone systems, I understand the value that they have in many instances. From Broadway and the Super Bowl to your local Shakespeare Theater and place of worship, wireless microphones provide seamless service to improve performance quality and the audience experience. They are also used by local broadcasters in their newsgathering activities to inform their communities. At the same time, the wireless microphone community must adapt, improve technology and migrate to other bands.

On that note, I think it would be unwise for wireless mics to migrate into spectrum bands that could be reallocated for commercial wireless use in the future. For instance, this item contemplates additional wireless mic operations in the 1.4 GHz Band. This spectrum, however, is being considered by the wireless industry and the international community for future licensed wireless services. While we do not know if such an allocation will happen, we do know that the demand for licensed spectrum is high and it is going to have to come from somewhere. In fact, CTIA has found that 350 megahertz of spectrum needs to be allocated for licensed use by 2019 to meet consumer demand for mobile broadband.[1] And this does not take into account the spectrum that will be needed to meet the demand that is envisioned past 2019.[2] For this reason, I am disappointed that my requested edit to highlight the potential for commercial wireless allocations in the 1.4 GHz Band was rejected.

I also have serious concerns about the mandatory "written" disclosures that are required in this item and, therefore, I must dissent in part. Specifically, the Commission delegates to staff the authority to draft specific language to inform consumers that operation of wireless mics in the 600 MHz Band will be restricted to the guard bands and duplex gap going forward. First, industry should be allowed to create disclosures that they feel will best inform their consumers. While it may be acceptable to suggest the type of information that should be included, providing the language is unnecessary and perhaps counterproductive. Second, I cannot agree to delegate this authority to staff. The Commission should review any and all burdens that we place on industry. Third, this item requires that this disclosure must be displayed on websites and at the point-of-sale by manufacturers, "dealers, distributors, retailers, and

[1] Coleman Bazelon & Giulia McHenry, *Substantial Licensed Spectrum Deficit (2015-2019): Updating the FCC's Mobile Data Demand Projections* (June 23, 2015), http://www.ctia.org/docs/default-source/default-document-library/bazelon_mchenry_spectrum-deficit_2015-06-23.pdf; Thomas K. Sawanobori & Dr. Robert Roche, *From Proposal to Deployment: The History of Spectrum Allocation Timelines to Re-Allocate the Additional 350 MHz of Licensed Spectrum Needed by 2019, Policymakers Must Act Now*, http://www.ctia.org/docs/default-source/default-document-library/072015-spectrum-timelines-white-paper.pdf.

[2] Bazelon & McHenry, *supra* note 1, at 19.

anyone else selling or leasing the devices." I cannot agree to such retail mandates. While we have jurisdiction over licensees and equipment manufacturers, our authority does have limits as it applies to the retail market.

The Commission also "expects" that manufacturers will conduct burdensome consumer outreach so that wireless mics users are informed about the Commission's decisions. In reading the exact text of the document, I take these outreach methods as suggestions, not enforceable requirements. Accordingly, I will not be supportive of any actions by the Enforcement Bureau to penalize manufacturers who were unable to make contact with past customers. Additionally, we should have deleted language in the draft that encourages manufacturers to offer rebate and trade-in programs for 600 MHz Band wireless mics. If manufacturers believe that such programs are in their best interest, they will provide such enticements to maintain their consumer base. It is not the Commission's role to promote or press such activities on industry.