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
	)	
	)	
	)	

NOTICE OF PROPOSED RULEMAKING

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By the Commission: Chairman Wheeler and Commissioners Clyburn, Rosenworcel and O'Reilly issuing separate statements.

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I. INTRODUCTION

1. We initiate this proceeding to address how 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 broadcast live sports events. They enhance event productions in a variety of settings – including theaters and music venues, film studios, conventions, corporate events, houses of worship, and internet webcasts. They also help create high quality content that consumers demand and value. Recent actions by the Commission, and in particular 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,[2] which necessitates our addressing how to accommodate wireless microphone users in the future.

2. Today, wireless microphone users rely heavily on access to unused channels in 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

[1] *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). When we use the term "wireless microphones" in this proceeding, we collectively refer to wireless microphones and related audio devices.

[2] *See generally* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order*, 29 FCC Rcd at 6696-6704 ¶¶ 299-316, 6844-6847 ¶¶ 682-688.

UHF band available for use for wireless microphone operations. In taking 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 – the Commission also recognized 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.[3] To facilitate wireless microphone users' ability to make these adjustments, the Commission provided that users could continue to access spectrum repurposed for wireless services for a substantial period of time as they transition affected services to alternative spectrum.[4] The Commission stated that it would initiate this proceeding to explore steps to address wireless microphone users' longer term needs, including potentially accessing spectrum resources in additional frequency bands.[5] Our goal here is to issue an order in this proceeding before the commencement of the incentive auction.

3. As we assess the options available to meet the ongoing needs of wireless microphone users, we also will consider how best to ensure that our actions are consistent with the Commission's overall spectrum management goals. These goals include promoting the best and most efficient use of spectrum. We will look for additional opportunities for wireless microphone users to share frequency bands with other users in more efficient and effective ways, while also continuing to safeguard the other users' interests. Wireless microphone operations generally are low power and short range, and have generally shared frequency bands on a secondary or unlicensed basis with other users, and we do not envision a broad expansion of rights beyond these sharing models. We also recognize that, like other wireless users, wireless microphone users and manufacturers must continue to work to achieve greater spectral efficiency over time.

4. In this Notice of Proposed Rulemaking (Notice), we examine wireless microphone users' needs and technologies that can address them, and seek comment on a variety of existing and new spectrum bands that might accommodate those respective needs. We seek ways of improving access to the TV band spectrum that remains available for wireless microphones, as well as how to facilitate the transition of wireless microphones out of the 600 MHz Band spectrum repurposed for wireless services. In addition, we examine access to other spectrum bands where wireless microphones currently operate, propose various revisions, and seek comment on potential revisions that may better accommodate wireless microphones in these bands, while protecting the interests of other users that may operate in these bands. Further, we seek comment on proposals for authorizing wireless microphone operations in additional spectrum bands, consistent with the Commission's overall spectrum management goals. We intend to enable the development of a suite of wireless microphone devices and applications, and to provide wireless microphone users with access to spectrum through efficient and effective sharing of the spectrum with other users.

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

[4] *See id.* at 6844-6847 ¶¶ 682-688.

[5] *Id.* at 6704 ¶ 316. In addition to this proceeding, we are concurrently initiating a separate proceeding that addresses unlicensed 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, *Notice of Proposed Rulemaking,* __ FCC Rcd __ (Part 15 NPRM) (adopted Sept. 30, 2014) (FCC 14-144). With respect to wireless microphones, that proceeding generally addresses unlicensed wireless microphones in the TV bands and the repurposed 600 MHz band, as well as the technical rules for licensed wireless microphone operations in the 600 MHz Band duplex gap. We cross-reference that proceeding where appropriate.

II. BACKGROUND

5. In this proceeding we use the term "wireless microphones" to reference wireless microphones and other related wireless audio devices.[6] As discussed more fully below, these devices operate under different band-specific rules and may be authorized on a licensed or on an unlicensed basis.

A. Bands Currently Available for Wireless Microphones

6. Over the years, the Commission has authorized wireless microphone operations in different spectrum bands to accommodate the growing use of these devices by different users. The technical and operational rules for wireless microphone operations in these different bands have varied, depending on the band, and generally are designed to enable wireless microphone users to operate in shared bands along with other users. The Commission has authorized wireless microphones to operate both on a licensed basis, limited to specified users, and on an unlicensed basis.

7. Prior to 1977, when the Commission first authorized wireless microphone operations in a portion of the TV bands, only three types of wireless microphones operations were authorized: low power unlicensed wireless microphone operations in the 88-108 MHz FM broadcast band; licensed operations in the 26.10-26.48 MHz, the 450-451 MHz, and the 947-952 MHz bands; and licensed operations under the Part 90 Business Radio Service rules.[7] Recognizing that broadcasters and other program producers required access to additional spectrum to accommodate a large number of microphones at a given location, the Commission in 1977 authorized wireless microphones and similar devices used for program production (e.g., cuing and control communications) to operate as "low power auxiliary stations" (LPAS), on a licensed secondary basis, on unused spectrum on VHF-TV channels 7-13 (the 174-216 MHz band).[8] The Commission limited license eligibility to broadcasters and other entities with similar programming and production needs (i.e., motion picture producers, television program producers, and cable television operators), though it recognized that other groups such as live entertainment program producers may have similar needs that could be addressed on a case-by case basis.[9] In authorizing licensed wireless microphone operations on a secondary basis in the upper VHF-TV band, the Commission adopted specific technical rules – including restricting wireless microphones to low power operations, and requiring minimal specified separation distances from television stations for co-channel operations – to provide wireless microphone licensees with access to additional spectrum that both was free from interference for the wireless microphone operations and would not cause harmful

[6] The devices encompassed under the term "wireless microphones" include wireless microphones and similar devices such as cue and control communications, synchronization of TV camera signals, and in-ear monitors. These devices are, for instance, authorized under the rules applicable for "low power auxiliary stations" under the Commission's Part 74 rules. *See* 47 C.F.R. § 74.801. To the extent that the devices serve to provide these same types of functions, we refer to them generally as wireless microphones.

[7] *See* Amendment of Part 2, and Subpart D, Part 74 of the Commission's Rules and Regulations with respect to the Use of Wireless Microphones, Docket No. 20195, RM-2041, RM-2659, *Report, Memorandum Option and Order*, 63 F.C.C. 2d 535 (1977); Amendment of Subpart D, Part 74, of the Commission's Rules and Regulations with respect to the Use of Wireless Microphones, Docket No. 20195, RM-2041, *Notice of Inquiry and Notice of Proposed Rulemaking*, 48 F.C.C. 2d 1140 (1974). Wireless microphone operations continue to be permitted in the 947-952 MHz band, which subsequently was expanded to 944-952 MHz band, as well as pursuant to Part 90 rules, as discussed in Sections III.C.4 and III.C.5.a below.

[8] *See generally* Amendment of Part 2, and Subpart D, Part 74 of the Commission's Rules and Regulations with respect to the Use of Wireless Microphones, Docket No. 20195, RM-2041, RM-2659, *Report, Memorandum Option and Order*, 63 F.C.C. 2d 535 (1977). It was in this order that the Commission established the Part 74, Subpart H "Low Power Auxiliary Station" rules. *Id.*

[9] *Id.* at 541-542.

interference either to television reception or to other incumbent systems (cable television, home video, and closed circuit TV systems) using these VHF or adjacent television channels.[10]

8. In 1987, recognizing the growing use of wireless microphones for production purposes and in order to alleviate the congestion on the limited TV channels available for use by wireless microphones in some locations (e.g., major cities), the Commission provided access to significantly more spectrum for licensed wireless microphone use by authorizing access to unused channels across the balance of the TV bands spectrum – the UHF TV 14-69 (the 470-806 MHz band, excluding channel 37, 608-614 MHz) as well as on the lower VHF TV channels 2-6 (54-72 MHz and 78-88 MHz bands) – on a secondary basis.[11] The same entities previously eligible for LPAS licenses to operate wireless microphones on VHF TV channels 7-13 were now permitted to access the unused TV channels throughout the entire TV bands.

9. Through the years, manufacturers also have developed various types of wireless microphones that operate on particular frequency bands on an unlicensed basis under the Commission's Part 15 rules, and thus are available for use by the general public. The frequency bands on which these microphones operate include the 902-928 MHz band, the 1920-1930 MHz band, the 2.4 GHz band, and the 5 GHz band, where these users can share the spectrum with other unlicensed users pursuant to the specified technical parameters for unlicensed device operations in those bands.[12]

10. *Recent actions affecting operations in the TV bands.* In recent years, the Commission has taken several actions in three proceedings (discussed below) 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), the development of rules for TV White Spaces (TVWS) devices in the TV bands, and the repurposing of the 600 MHz Band that will follow the upcoming incentive auction – that have affected and will affect the future availability of spectrum for wireless microphone uses in these bands. As discussed throughout this Notice of Proposed Rulemaking (NPRM), these proceedings inform the instant proceeding, providing the foundation for many of the issues we are addressing as part of our comprehensive evaluation of how to accommodate wireless microphone uses both in the near and longer term.

11. In January 2010, following the repurposing of TV channels 51-69 in the 700 MHz band for wireless services, the Commission adopted the *TV Bands Wireless Microphones R&O and FNPRM* (WT Dockets 08-166 and 08-167, ET Docket No. 10-24), which required that all wireless microphones cease operations on the 700 MHz band no later than June 12, 2010, one year after the end of the DTV transition.[13] In that decision, the Commission also first authorized unlicensed wireless microphone operations in the TV bands spectrum (channels 2-51, except channel 37), pursuant to a limited waiver and certain Part 15 rules, pending adoption of final rules for unlicensed operations in the TV bands.[14]

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[10] *See generally id.*

[11] *See generally* 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 (1987).

[12] See discussion in Section III.C, below, on each of these bands.

[13] *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*).

[14] *See TV Bands Wireless Microphones R&O and Further Notice*, 25 FCC Rcd at 676-687 ¶¶ 71-90. Prior to this, many users operated wireless microphones in the TV bands on an unauthorized basis. *See generally id.*

12. In September 2010, the Commission adopted the *TV White Spaces Second MO&O*, which took several actions that affected the availability of the TV bands spectrum for wireless microphones, including adopting rules pursuant to which wireless microphone users and unlicensed TVWS device users would have access to unused TV bands channels.[15] Specifically, the Commission provided that the two unused television channels (where available) nearest channel 37 (above and below) would be designated for wireless microphone operations and not be made available for TVWS devices.[16] The Commission also provided that, to the extent that unused TV channels were available for use by both wireless microphones and TVWS devices at a particular location, licensed wireless microphone operators and certain qualifying unlicensed wireless microphone operators could obtain interference protection from TVWS devices by reserving channels at the specified locations during the times of operation through use of the TV bands databases.[17]

13. In the *Incentive Auction R&O* adopted on May 15, 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.[18] 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,[19] permitting wireless microphone operations in the newly-designated 600 MHz Band guard bands,[20] 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.[21]

14. Finally, concurrent with adoption of the *Incentive Auction R&O*, the Commission adopted the *TV Bands Wireless Microphones Second R&O* 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 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.[22]

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[15] *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*).

[16] *TV White Spaces Second MO&O*, 25 FCC Rcd at 18675-18676 ¶ 29; 47 C.F.R. § 15.712(f). TVWS devices are not permitted on the first channel on each side of TV channel 37 that is not occupied by a licensed service. 47 C.F.R. § 15.712(f)(2).

[17] *TV White Spaces Second MO&O*, 25 FCC Rcd at 18675-18676 ¶¶ 32-33; 47 C.F.R. §§ 15.713(h)(8)-(9).

[18] *See generally Incentive Auction R&O*, 29 FCC Rcd 6567.

[19] *Id.* at 6697-6702 ¶¶ 303-311.

[20] *Id.*at 6703-6704 ¶¶ 313-315.

[21] *Id.* at 6847 ¶¶ 686-688.

[22] *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*).

15. *Table of bands in which wireless microphones are authorized today.* In the table below, we set forth the bands in which wireless microphones and related audio devices generally operate today pursuant to the Commission's rules.

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

16. *Additional spectrum resources used by wireless microphone operators.* Apart from operating wireless microphones in the bands where wireless microphones are specifically authorized, as identified in the table above, some wireless microphone users have gained access to other bands for temporary operations under specified conditions. For instance, in recent years professional sound engineering companies providing major event productions (e.g., major sports events) have obtained conditional access to the 1435-1525 MHz band for wireless microphone operations on a temporary, location-specific basis pursuant to time-limited grants of Special Temporary Authority (STA).[23] In seeking temporary access to this spectrum, which is allocated for Aeronautical Mobile Telemetry (AMT) services, these parties have represented that the spectrum resources otherwise available to them at those locations are insufficient to enable them to provide the desired level of coverage for scheduled events, and they must fully coordinate their operations with representatives of the AMT service.[24]

B. Overview of Operations Today

17. 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. This use can be attributed to several factors. The TV bands have long been licensed for wireless microphone operations by broadcasters and similar program producers, where they have had access to many unused television channels. In addition, this spectrum has favorable propagation conditions, the signals do not suffer significantly as a result of body loss, antenna sizes are manageable, and there is relatively lower power consumption leading to longer battery life – all of which can be helpful for many wireless microphone purposes. Manufacturers have supplied numerous devices, operating on varying segments of the TV bands, that provide a range of users with wireless microphones suitable for their different needs. Although there has at times been a shortage of sufficient available channels in major cities and congested areas, where unused channels are limited and numerous microphones might be needed for particular events, the overall availability of spectrum in the TV bands has enabled wireless microphone users generally to address their needs.

18. As noted above, in addition to operations in the TV bands, many wireless microphones users address their needs by operating in other spectrum bands. This includes, for instance, operations on a licensed basis by broadcasters and broadcast networks in the 944-952 MHz band or by a variety of entities in the 169-172 MHz band.[25] This also includes operations of many different groups of users on an

[23] See Section III.C.8, below.

[24] *Id.*

[25] See Sections III.C.4 and III.C.5.a, below.

unlicensed basis in different bands, such as the 902-928 MHz band, the 1920-1930 MHz band, and the 2.4 GHz band.[26]

19. *Types of users and uses*. Broadcasters have long used wireless microphones and other similar devices (e.g., cue and control) for their professional program productions. These uses include electronic news gathering (ENG) activities at itinerant locations in the field as well as studio production activities on news sets. In providing their broadcasting services, these users often deploy several different types of wireless microphones (discussed below), including many high-end high-quality devices for production purposes. The number of microphones used depends on the particular activity or situation, and may involve a significant number of microphones (as many as 100 or more).[27] Movie and cable programmers also use wireless microphones in similar ways. These particular users are currently eligible to operate wireless microphones and similar devices on a licensed basis as LPAS in the TV bands.[28] Broadcasters also are authorized to operate wireless microphones on a licensed basis in several other bands.[29] In addition, any licensed wireless microphone users may operate wireless microphones in other bands on an unlicensed basis, and may do so to the extent that those particular microphones serve to meet some of their production needs.

20. Major sports leagues and theater/entertainment entities also extensively use wireless microphones. These groups include major professional sports leagues (e.g., NFL, NHL, NBA, MLB, PGA, etc.) and college sports teams, professional theater groups, and music concerts, among others. These users also may employ numerous types and numbers of microphones at a given location to meet their needs. Some of these users operate on a licensed basis as part of the programming associated with broadcast or cable programming. Others, however, have operated on an unlicensed basis in recent years,[30] though now may be eligible to hold LPAS licenses for operations in the TV bands as a result of the Commission's decision earlier this year in the *TV Bands Wireless Microphones Second R&O* to expand LPAS license eligibility to include the owners and operators of large venues used by these entities and the professional sound companies that serve them.[31]

21. Wireless microphones also are used by other entities, from large to small, in numerous other settings to serve a variety of needs. These include convention and conference centers, corporations, schools, houses of worship, theme parks, music bands, internet webcasts, karaoke bars, and numerous other users and settings not elucidated here. The wireless microphones used often do not tend to include the same types of high-performance devices as used by LPAS licensees for their programming and production needs, and the numbers of microphones (e.g., auditoriums, music bands, karaoke bars) used often are limited to only a few microphones. These users generally are authorized to operate only on an unlicensed basis in the TV bands (pursuant to a waiver) and other bands available for unlicensed uses.

22. *Types of wireless microphones.* There are a wide number of wireless microphones on the market today, serving different needs. These include hand-held or body-worn wireless microphones, in-ear monitors, interruptible foldback (IFB) devices (for cueing for on-air talent), and intercom systems (e.g., for backstage communications, crew communications for event productions).[32] Some of these

[26] See Sections III.C.6 and III.C.7, below.

[27] *See, e.g.*, Shure Comments (GN 12-268) at 13-14.

[28] *See generally* 47 C.F.R. § 74.832.

[29] See Sections III.C.2 and III.C.5.a, below.

[30] We note that many of these operators were first authorized to operate in the TV bands in 2010 in the *TV Bands Wireless Microphones R&O and Further NPRM. See TV Bands Wireless Microphones R&O and Further Notice*, 25 FCC Rcd at 676-687 ¶¶71-90. Prior to that time, these users (as well as many other users) may have been operating in TV bands spectrum without Commission authorization. *Id.*

[31] *See TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-6112 ¶¶ 8-24.

[32] *See, e.g.*, Shure Comments (GN 12-268) at 7.

devices must meet extremely high technical standards to achieve the requisite performance demands (i.e., high audio quality with low latency), while others do not require or meet the same level of performance to achieve their particular purposes (e.g., many voice communications that do not necessitate high audio quality can tolerate more latency). The requisite form factors of particular devices also differ depending on the specific purposes for which they are used. They may range, for instance, from very compact devices that operate at low power to conserve battery power (e.g., microphones used by performers on stage), to handheld microphones or camera microphones that are larger or have access to larger batteries or other power sources. Some of the microphones may be essential or "mission critical" to a particular activity (performers' microphones, in-ear monitors), while others are less so, and assist with other types of wireless microphone functions (e.g., cue and control).

23. As noted, the technical rules under which wireless microphones operate will differ depending on the band. For instance, in the TV bands and the 944-952 MHz band, these devices operate under the technical and policy rules for LPAS in Part 74, Subpart H of the Commission's rules (with rules that differ in certain respects depending on whether they operate in the VHF television, UHF television, or 944-952 MHz band spectrum).[33] When operating on an unlicensed basis in other bands, they operate pursuant to different set of technical and policy rules under Part 15.[34] Other wireless microphones operate on a licensed basis under the Commission's Part 90 rules.[35]

24. Wireless microphone manufacturers generally market a range of wireless microphone systems.[36] When operating in the TV bands, for instance, a particular wireless microphone system often is designed to operate on a discrete set of TV channels (e.g., on VHF-only channels, or on channels 14-17, or channels 18-21, or channels 42-51, etc.), though some high-end systems may cover the entire range of UHF band spectrum. In other bands, the wireless microphones may cover the entire band, such as in the 944-952 MHz band, or in the bands available for unlicensed uses (e.g., 902-928 MHz, 1920-1930 MHz, or 2.4 GHz).

25. The costs associated with wireless microphone systems also range widely. High performance systems may cost many thousands of dollars, while some consumer systems may cost only a few hundred dollars or even much less. The many types of wireless microphones that are manufactured and distributed reflect that different types of wireless microphone operators use different types of microphones of various design and performance quality to address their respective and diverse needs.

26. *Varying operational environments.* The specific operational environment in which a wireless microphone operates can affect the ability of the microphones to perform. Wireless microphones operate at low power and transmit over short distances. In the TV bands, for instance, LPAS devices are designed to transmit over distances of approximately 100 meters or less.[37] To operate effectively, they need access to spectrum sufficiently interference-free to enable the necessary levels and types of wireless microphone communications needed. The ability of a particular wireless microphone to function effectively could well depend on the operational environment in which it is operating. For instance, from an operational standpoint, indoor locations may create an environment with more interference-free

[33] See discussion below on technical rules relating to LPAS operations in the VHF/UHF TV bands, Section III.C.1, and the 944-952 MHz band, Section III.C.5.a. As noted above, unlicensed users also operate in the TV bands pursuant to a waiver and certain Part 15 rules.

[34] While the general parameters of operations in the ISM bands (the 902-928 MHz, the 2.4 GHz, and the 5 GHz bands) are similar, as discussed in Section III.C.6 below, the technical rules for operation in the 1920-1930 MHz band are different, as discussed in Section III.C.7.

[35] See Section III.C.4.

[36] With respect to a wireless microphone, the system includes the wireless microphone, which is the transmitter, and the receiver.

[37] 47 C.F.R. § 74.801 (definition of "low power auxiliary station").

channels because building structures can attenuate other signals (e.g., TV signals) external to that location. In contrast, outdoor operations may be more susceptible to interference from signals transmitted from beyond that immediate location. Also, if the particular setting in which wireless microphones are being used occurs over a large enough area (e.g., a theme park), or in different rooms or buildings, microphones operating sufficiently separated from each other may often re-use the same channels within the same general vicinity.

27. *Technologies and technological advances.* Wireless microphones and related audio devices employ different types of technologies. These technologies may differ because of the particular band(s) in which they operate, which may have different technical requirements (e.g., with respect to permitted power levels or particular channelization restrictions). They also include analog devices and digital devices, again depending on the band and the state of technological developments.

28. In recent years manufacturers have been developing and marketing more digital wireless microphones, touting their uses for certain types of applications.[38] While some of these digital devices operate in the TV bands, others operate on outside those bands, including in the 902-928 MHz, the 1920-1930 MHz, and the 2.4 GHz bands on an unlicensed basis.[39]

29. *Migration of many operations to bands outside the UHF-TV bands.* In recent years, based on our certification records and on the new devices that now are being marketed, we observe that many manufacturers increasingly have been developing, and operators have been using, wireless microphones that operate on spectrum outside of the TV bands that are available for unlicensed devices, such as in the 902-928 MHz, the 1920-1930 MHz, and the 2.4 GHz band.

III. DISCUSSION

30. In this Notice of Proposed Rulemaking, we explore additional steps that the Commission can take so that wireless microphone users can have access in the coming years to a suite of devices operating in different spectrum bands that can address their respective needs. We seek to develop a comprehensive record in this proceeding to enable us to address these needs, while also achieving our spectrum management goals of promoting spectral efficiency. We first set forth an overall framework for addressing wireless microphone users' needs. We explore the role of technological advances, which will be a key component in meeting the needs of wireless microphone users over the long term. Then we discuss particular frequency bands. In bands currently available for wireless microphone operations, we propose or seek comment on revisions that could facilitate more access and efficient use by those operations, while also protecting other users that may share use of these bands. In addition, we seek comment on authorizing licensed wireless microphone operations in other bands. We also discuss wireless microphone operations in bands available for unlicensed use, and seek to promote use of these bands where feasible.

A. Overall Framework for Addressing Wireless Microphone Needs

31. In this section, we seek to develop a full record and framework for understanding the various needs of different wireless microphone users and the types of microphones that effectively can address those needs.[40] This record will be useful as a framework for our analysis as we explore, in later sections of this NPRM – both in Section B ("Promoting Technological Advances") and Section C ("Operations in Specific Bands") – the specific actions we should take to help accommodate these different needs.

[38] *See, e.g.*, http;//shure.com/Americas/products/wireless systems.

[39] Several manufacturers market wireless microphones that operate in these bands on an unlicensed basis.

[40] We recognize that comments with respect to any one of the subsections below may overlap with other subsections.

1. Users and uses

32. Given that many different types of users employ wireless microphones in a variety of settings, we seek to develop a more complete record on the various different users of wireless microphones and to better understand their particular needs for wireless microphones. 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 a given setting.

33. We seek on comment on the different groups of wireless microphone operators and their various uses of microphones, including the particular applications served by the microphones, the types and number of devices used, the extent to which the devices are analog or digital, the settings in which they are used, and the frequency bands they use. We ask that the different user groups, or the manufacturers of products for these groups, provide detailed information about the particular nature of wireless microphone uses by different groups of users.

34. We start by asking for specific information from broadcasters, who have relied heavily on access to the TV bands, regarding their wireless microphone uses and needs. For instance, what are their specific needs for wireless microphones with regard to ENG? What kinds of wireless microphones are used, and to what extent are the TV bands currently used for these microphones? What is the full range of types of devices and applications needed? What is the range of quality of microphones that are needed, in terms of performance quality, voice representation, latency, etc. We ask that commenters discuss the different types of wireless microphones that may be needed in for different applications, including the microphones that need to have high audio quality as well as those that do not require such high fidelity. Recognizing that different numbers of microphones may be used in different settings, both in studio and on an itinerant basis, what number of microphones are used in which settings? Do broadcasters make use of bands outside of the TV bands, and if so, in what ways and for what type of applications? We ask commenters to provide information on the range of devices and types of applications that they employ, and the bands in which they operate.

35. Similarly, we request information from the other licensed users of the TV bands, including movie and cable program producers, other content producers, as well as the newly eligible sound engineering companies and large venue operators, about their uses and needs. We ask for comment on the same types of issues, including current uses, the operational environment in which they may operate, the numbers that may be used, the range in quality of microphones used, the bands used for different wireless microphone applications, etc.

36. In addition we seek comment from other wireless microphone users, large and small, that use wireless microphones in numerous settings. As discussed above, these users include convention and conference centers, corporations, schools, houses of worship, theme parks, music bands, internet webcasts, karaoke bars, and numerous other users.[41] What are their particular wireless microphone uses, what types of devices do they use, the numbers used depending on the settings, in which bands, etc.?

37. As noted above, users range from the professional user, who may employ many microphones and coordinate their operations with other uses in the band, to the amateur user who may use only one microphone. We seek general comment on how the Commission should be thinking about these different types of users as it evaluates how to accommodate these users and uses over the long term.

38. We also seek comment on the nature of the demand for wireless microphones by various wireless microphone users. Have users been employing more wireless microphones in recent years? Has demand for their use changed, and is it growing? We request that commenters provide a full explanation

[41] See discussion above, paragraph 19-21.

of the nature of their wireless microphone uses today and what they anticipate their uses will be in the future.

2. Suitability of different bands

39. In Section III, below, we seek comment on additional ways in which we could accommodate various wireless microphone operations in different bands, which include a range of frequencies as low as the television VHF bands and as high as 7 GHz. These bands also vary in terms of potentially available bandwidth, including some with very small channel bandwidth. In addition, some of these bands are available for wireless microphone use only on a licensed basis, while others only an unlicensed basis.[42]

40. We seek comment how the nature of different bands, including the propagation features that are associated with them, should inform our consideration of how to accommodate wireless microphones. For what types of applications is lower band spectrum most suitable? What types of uses can be effective in middle or higher frequency bands? How much bandwidth is necessary for different types of wireless microphone uses? What kinds of applications are most suitable for unlicensed operations?

3. Development, manufacturing, and distribution of new types of wireless microphones

41. As we explore how to accommodate wireless microphones uses in different bands, we seek comment on the factors that manufacturers take into account as they consider and evaluate whether to develop and manufacture new devices for distribution in the near and longer term. We seek general comment here on these various factors, and expect that commenters also would address these considerations with regard to the discussion specific bands and proposals in Section III below.

42. As manufacturers consider developing new wireless microphone devices in different bands, to what extent do the propagation features, the size of band, that potential availability (or lack of availability) of different segments of the band, the extent to which the band allows licensed or unlicensed uses, the technical rules (existing or as revised), the certainty that the band will continue to be available over the long term, or other aspects contribute to the likelihood that new devices will be made for a particular band? What factors do manufactures consider with respect to developing different types of wireless microphones for different users and applications, whether for highest audio quality or for communications that do not require such performance quality? What kinds of economic factors do manufacturers consider? How important are economies of scale? To what extent will manufacturers develop microphones that are designed only for niche markets? To what extent do considerations of the harmonization of potential harmonization of our rules with those of other countries affect a manufacturer's decision to develop new microphones?

43. In addition, assuming the Commission were to adopt revised rules, or make available additional spectrum for access by wireless microphone operators, we seek comment on manufacturer's expectations regarding the time-to-market for newly developed devices. What factors would enable devices to be developed and introduced quickly into the marketplace? Based on these factors, are certain bands more likely candidates for nearer term introduction of devices than others? What factors would result in introduction of new devices only over the longer term? What are reasonable timelines for the development, manufacture, marketing, and distribution for new wireless microphones, and what factors contribute to shorter or longer timelines? We invite comment on any other related factors that we should consider.

[42] See discussion of operations in specific bands in Section III.C.

4. Transition issues

44. With the likelihood of there being less UHF television band spectrum available for wireless microphone operators following the incentive auction, we invite general comment on a range issues affecting transitioning of wireless microphone users – whether to the use of different devices operating outside of repurposed 600 MHz Band spectrum, or the use of devices in different bands that can effectively serve their needs in a more efficient fashion.

45. Although the precise amount of TV bands spectrum that will be repurposed will be known only following the auction, we anticipate that many wireless microphone users will need to move their operations out of the repurposed spectrum no later than 39 months following issuance of the *Channel Reassignment PN*.[43] At the same time, many wireless microphone users accessing spectrum that may remain allocated for television services may seek to transition to different devices, including more efficient digital devices, or replace older devices, that may operate both in the bands likely to remain allocated for television or in other bands. We invite comment on these transition issues, the extent to which they are interrelated, and how best to ensure that wireless microphone users transition to new, more efficient devices to the full extent possible.

46. What types of actions would facilitate the transitions that will be required in order to accommodate different wireless microphone operators' needs over the long term? As we consider these various transition issues, what lessons might be drawn from the transition of wireless microphone operations out of the 700 MHz band following the repurposing of that band? How can we best communicate the nature of the transitions along with the necessary actions users must undertake to the large community of disparate microphone users? What timeframes are needed for users of various size and sophistication to plan for, purchase, and install new systems? How is this affected by users' decisions to remain in the TV bands or to migrate to other bands and types of microphones?

47. What actions should the Commission, wireless microphone manufacturers and distributors, and organizations representing wireless microphone users take to facilitate a smooth transition out of the repurposed 600 MHz Band,[44] and to promote the use of more efficient devices to the extent possible, including devices that operate outside of the TV bands? For instance, should users be encouraged to transition their operations to new devices that meet their needs in a more efficient manner, such as digital devices? Is there a particular role that the Commission should play in helping inform consumers of these transitions and the types of devices in different bands that can accommodate their respective needs?

48. As we consider these transition issues, we request information on the timeframes that may be necessary for design, manufacture, certification, and marketing of new wireless microphone devices, such as those that would include any technical changes that we may adopt in this proceeding. What considerations or factors affect these timeframes? Similarly, we seek comment on the life-cycles and/or replacement cycles associated with different wireless microphones. What are the general life cycles associated with different wireless microphones, including both high-end microphones and consumer devices? What types of factors, other than regulatory changes, necessitate replacement or otherwise affect or influence decisions by particular users to purchase new equipment? Given that different users are continually replacing equipment, what steps should the Commission or manufacturers be taking now and in the future to help address wireless microphone users' needs over the long term?

5. Operations in other countries

49. We invite comment on whether the regulatory schemes for wireless microphone operations in other countries should inform our approach in this proceeding. Are there other regulatory

[43] We seek more focused comment on these users in Section III.C.1.b(iii), below.

[44] See Section III.C.1.b(iii) (discussion specifically focusing on transition of wireless microphones out of the repurposed 600 MHz Band spectrum).

models that are particularly effective? Would any of those models be appropriate for particular bands as we consider revisions to our rules?

B. Promoting Technological Advances

50. As we seek to accommodate the needs of wireless microphone operators, we also seek to leverage technological advances that can help ensure that these needs can be met effectively, and in a manner that promotes the efficient use of spectrum. We explore here the kinds of technological advances that achieve these goals.

1. Advances in wireless microphone radio technologies

51. *Advances in analog and digital transmission.* We have already sought comment on the extent to which wireless microphone users today use analog or digital devices.[45] As discussed earlier, most users in the TV bands currently use analog devices, though digital devices increasingly are being developed and sold for operations in the TV bands.[46] In other bands, devices today may be only analog or digital, or both. We seek to develop a full record here regarding technological developments in the basic design of wireless microphones that can enable more efficient wireless microphone operations, whether analog or digital, and promoting their uses in various spectrum bands.

52. We begin by asking for comment on the state of analog and digital wireless microphone technologies that are available for use today. We ask that commenters address the state of technologies available in the different bands. Are there improvements in analog technologies that are enabling more efficient uses for various wireless microphone applications? What are they, and what additional efficiency gains are foreseen? What about for digital technologies? We ask that commenters provide detailed information about the kinds of improvements in digital technologies that are being made with respect to microphone's performance capabilities for different types of uses.

53. In those bands in which both analog and digital devices operate, to what extent can the use of analog devices or digital devices, or some combination of the two, affect whether the spectrum is being used most efficiently to serve wireless microphone users' needs? While we recognize, as discussed more fully below, that analog devices may be appropriate or necessary at this time for certain types of applications, digital devices can be effective for others, and we seek comment on the range of efficiency gains that may be possible depending on whether analog or digital devices, or a mix of the two, are used.

54. In particular, we request that commenters provide information on the state of analog and digital technologies that operate in the TV bands, and the extent to which operators are using the most efficient microphones that can serve their particular needs. In earlier proceedings, the Commission has noted that the number of analog wireless microphones operating on a six-megahertz television channel may be as few as 6-8 microphones.[47] More recently, manufacturers have developed microphones that operate more efficiently, including analog microphones that may allow twice that number on a six megahertz channel.[48] We ask that commenters provide information technological advancements that enable more efficient analog use. To what extent does the number of wireless microphones that can be deployed on a channel number depend on the power levels used, other operational factors, or the specific application(s) for which the wireless microphone is being used? Similarly, how many digital devices can operate on a television channel, and what operational factors or use factors might affect this number?

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[45] See Section III.A.1, above.

[46] See paragraph 28, above.

[47] *TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 703 ¶ 147; *TV White Spaces Second MO&O*, 25 FCC Rcd at 18676 ¶ 33.

[48] *Incentive Auction R&O,* 29 FCC Rcd at 6699 ¶ 306.

55. We also invite comment on analog and digital devices in other bands, and the numbers of wireless microphones that can be accommodated by use of those particular technologies. In bands where analog devices are being used, are they necessary in these bands or can digital devices be used instead? What steps can manufacturers take to make analog and digital devices more efficient, if any? How much more efficient could these devices be, and how many more microphones might be able to operate on the same amount of spectrum, and for what types of uses? Do manufacturers have plans to take such steps, and if not, why not?

56. We request that commenters fully address the benefits and tradeoffs associated with use of analog and digital technologies. In earlier proceedings on the TV bands, wireless microphone manufacturers have indicated that analog devices may be necessary for certain types of uses (e.g., those with need for high quality audio, with lower latency).[49] We seek to develop a full record on this issue, and seek comment on the extent to which this may continue to be the case. For what types of applications are analog devices necessary or appropriate? For what types of operations are digital devices well suited? To what extent are improvements in digital technologies (e.g., reductions in latency, improvements in fidelity) enabling more wireless microphone applications to be effectively served through digital technologies?

57. Are there rule changes that we can adopt generally, or with respect to operations in particular bands, that would help promote more efficient use of spectrum by wireless microphone operations, whether analog or digital? For instance, are there technological standards for wireless microphone devices that should be adopted, such as the European Telecommunications Standards Institute (ETSI) standards for analog and digital emission masks,[50] that would help promote more efficient use?[51] Should such standards apply to particular operations in particular bands, or be adopted more generally across bands? As more efficient standards are developed, what actions should the Commission take to ensure that these standards are utilized by wireless microphone manufacturers in the future or that our rules are updated where necessary or appropriate?

58. To the extent more efficient analog or digital devices can effectively serve the needs of particular users, we seek comment on how best to encourage wireless microphone users to employ these more efficient technologies. Is the transition to more efficient devices already occurring? Have users been migrating to the use of more efficient wireless microphones, and if so how and why? Are manufacturers and distributors taking steps to promote the transition to use of more efficient wireless microphones in cases in which those microphones would be effective in meeting the needs of the particular users? What role should manufacturers and distributors play in this respect?

59. Considering that use of more efficient wireless microphones is an important component of accommodating wireless microphone users' needs in the future, what actions should the Commission take to encourage or promote the use of more efficient technologies? Should we require the use of digital technologies for certain types of uses, and if so, by what mechanisms would we accomplish that? Should we phase out the certification or sale of inefficient wireless microphone technologies, and if so, how would we define "inefficient," and in what bands and on what timetable?

60. *Use of general purpose wireless standards.* The past several decades have seen widespread development and deployment of "general purpose" wireless technology standards that may be used for a wide variety of end-user applications. For example, the 802.11 family of standards serves as the basis of Wi-Fi technologies in the 2.4, 5 GHz bands, and other bands; the DECT standard provides for

[49] *See, e.g.,* Shure Reply Comments (ET Docket 10-24) at 17-18; Sennheiser Comments (ET Docket 10-24) at 6-9.

[50] ETSI EN 300 422, *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* (2008).

[51] We propose adopting these ETSI standards for operations in specific frequency bands, below. See Section III.C.1.b(i)(c).

digital audio transmission in the 1920-1930 MHz band; and the LTE standard serves, increasingly, as a basis for broadband transmissions in several different licensed spectrum bands. We inquire about the extent to which these, and other, general purpose technologies are now, or will be in the future, suitable for use in the wireless microphone context. We are specifically interested to understand what kinds of use cases are appropriate for general-purpose wireless technologies and which are not. To what extent do general purpose technologies increase the ability of wireless microphones to share spectrum with other kinds of applications (e.g., in the Wi-Fi bands, discussed below[52]), thereby potentially increasing the quantity of spectrum available for wireless microphones? Could the use of such technologies potentially improve performance and reduce cost of wireless microphone equipment? Should the Commission endeavor to promote the use of general purpose wireless technologies by wireless microphone users? What are the tradeoffs?

2. Other technological advancements

61. In this section, we seek comment on other technological developments that could promote more opportunities for accommodating wireless microphone operations in different bands over the longer term. Developments in these areas are not mutually exclusive.

62. *Equipment with replaceable components.* We seek comment on the development of replaceable components (e.g., modules) for the transmitters and receivers in the wireless microphone systems that operate on specific frequencies and can be exchanged with different components that operate on other frequencies available for wireless microphone operations. The use of such components potentially could reduce the costs to consumers to the extent changes need to be made in the way they operate their microphones in the future, *e.g.* in the event that the certain frequencies are no longer available to them, or if they update their equipment to newer, more efficient devices that may be capable of dynamically using the spectrum. Do wireless microphones today incorporate modular radio components? Do manufacturers contemplate including this kind of modularity in future models? To what extent would such components mitigate the costs of replacing wireless microphones that may no longer be permitted on certain frequencies? To what extent do they add new costs? If manufacturers are not including these component features, why not? Are there performance tradeoffs associated with respect to including such components? What steps, if any, should the Commission take to promote the use of such microphones in certain bands, such as the TV bands?

63. *Tunability of Equipment within Bands.* We ask for comment on the extent to which equipment is designed to be tunable within a band. Which types of microphones are tunable for which types of users? Are tunable microphones marketed only to more sophisticated users? What costs are associated with designing a tunable wireless microphone system? Do manufacturers anticipate developing more tunable microphones in the future? We request that commenters explain their considerations when determining whether or not to design tunable microphones.

64. *Multi-Band Equipment.* We invite comment on the extent to which manufacturers are, or in the future will be, developing wireless microphones that can operate in more than one spectrum band. What kinds of technical or other issues are raised, and to what extent would these issues vary to the bands may not be adjacent or nearby? For instance, to what extent might this raise design issues (e.g., antenna, battery, or other component issues)? Could these devices help ensure that users have devices that can meet their needs when operating at locations where the availability of spectrum in different bands may vary? Could development of such devices promote economies of scale? Could they help ensure that users purchasing such devices would be more assured of having access to the spectrum resources they need? If there were multi-band devices, could this allow greater reliability that the microphones could address users' needs depending on the particular locations where those wireless microphones were needed? What are the tradeoffs with regard to developing such devices?

[52] See discussion in Sections III.C.6 (b)-(c), below.

65. *Use of databases.* Wireless microphone technologies today do not use a database as a mechanism for indicating to the wireless microphone user that particular frequencies in a particular area were available, such as at particular locations that were not being used by other users with priority over the wireless microphone users. White space devices operating in the TV bands must access a database to determine that spectrum is available for their operations and that they would not potentially be interfering with other users at specified locations and times.[53] Would wireless microphone systems potentially benefit from the ability to access to a database? Could requiring use of a database for gaining access to spectrum in a particular band or identifying particular locations and times where they may operate without causing interference to other users in the band help to mitigate or eliminate the concerns of other users in the band that wireless microphone operations might cause harmful interference to these other users? What might be the costs and benefits of developing and using a database, and would these differ depending on the needs of particular types of wireless microphone users?[54]

66. *Electronic key or similar mechanisms.* Are there particular technologies, such as an "electronic key" or similar mechanism, that would ensure that a wireless microphone device be able to access and operate only on particular frequencies at particular locations and times, but nowhere else, thus eliminating the potential for harmful interference to other users (such as other users with primary or superior spectrum rights are particularly sensitive to harmful interference) and by so doing provide additional opportunities for wireless microphone operations in bands?[55] Are there other approaches that would effectively limit wireless microphone operation to particular locations, thus protecting other operators from harmful interference? We seek broad comment on the development and use of these types of mechanisms and the tradeoffs or practicalities associated with them. Are there particular scenarios or bands in which use of these mechanisms could provide additional opportunities to access spectrum?

67. *Use of other technologies that promote opportunities to access additional spectrum.* We seek comment on other technological advancements that could promote greater opportunities for wireless microphones to share use of spectrum in different bands. Are there technological advances that are currently available or contemplated that better enable wireless microphones to adjust dynamically to a particular interference environment, either automatically or through coordination, to promote more efficient use among the wireless microphones or among wireless microphones and other users in the band? For instance, could devices that include sophisticated dynamic power variability capabilities help promote more intensive use of the spectrum resource in a given area? Would these more dynamic capabilities enable wireless microphones to vary or adjust power levels to minimize or eliminate interference to other users in a particular setting, or facilitate more re-use of the available spectrum? We invite comment on whether technological advances along these lines could both facilitate more efficient use of the spectrum while also helping to ensure that they do not cause harmful interference to other users of the spectrum. Are there technologies that could enable certain wireless microphone applications to operate on spectrum licensed to wireless providers, subject to agreements reached with such providers? Are there other technological advancements that could help accommodate the various different wireless microphone users' needs over the longer term? What are they? Are there actions the Commission should take to promote these developments so that they occur in a timely fashion?

C. Operations in Specific Bands

68. In this section, we examine opportunities for wireless microphone operations in different spectrum bands – both those in which wireless microphones currently are authorized to operate and other

[53] 47 C.F.R. § 15.711(b)(3)(i)-(ii).

[54] In the Part 15 NPRM, we seek comment on the extent to which unlicensed wireless microphone users must rely on a database when operating in the guard bands. See Part 15 NPRM Section III.B.2.a (Wireless microphones in the guard bands and duplex gap).

[55] See discussion of using an electronic key in Section III.C.8.

bands that may hold potential for accommodating wireless microphone uses, whether in the near or longer term.

1. VHF/UHF Television Bands

a. Background

69. The Commission's 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).[56] 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.[57] The Commission's rules permit licensed LPAS operations on a secondary, non-exclusive basis.[58] Entities eligible for these LPAS licenses include broadcasters, television producers, cable producers, motion picture producers, and qualifying professional sound companies and operators of large venues.[59] 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.[60]

70. The Commission's Part 74 LPAS rules establish specific operational requirements for licensed operations in these bands, permitting a maximum bandwidth of 200 kHz (made up of one or more 25 kHz segments).[61] 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, which include the 470-608 MHz and 614-698 MHz frequencies), power levels can range up to 250 mW.[62] 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).[63] Pursuant to the revisions adopted in the *Incentive Auction R&O*, 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.[64] In addition, the Commission now permits licensed

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[56] 47 C.F.R. §§ 74.801 *et seq.* ("Subpart H – Low Power Auxiliary Stations").

[57] 47 C.F.R. § 801 (definition of "low power auxiliary station").

[58] *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 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).

[59] 47 C.F.R § 74.832(a); see Section II.A above.

[60] *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. The Commission has not, however, adopted final rules for unlicensed wireless microphone operations.

[61] 47 C.F.R. § 74.802(c).

[62] 47 C.F.R. § 74.861(e).

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

[64] *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.

LPAS users to operate on a co-channel basis even closer to television stations provided that such operations have been coordinated with affected broadcasters.[65]

71. 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 TVWS devices.[66] The Commission currently designates the two unused television channels (where available) nearest channel 37 (above and below) for wireless microphone uses, prohibiting TVWS devices on those channels.[67] 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.[68] On channels where both wireless microphones and TVWS 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 TVWS devices by reserving channel(s), on an as-needed basis, at specified locations and times of operation in the broadcast TV bands databases.[69] In addition, under existing rules certain qualifying unlicensed wireless microphone operators can obtain interference protection from unlicensed TVWS devices at specified times by registering with the Commission, enabling them to have their operations included within the broadcast TV bands databases.[70] 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 TVWS device operations.[71]

72. 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. We seek 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

73. In this section, we seek comment on Part 74 rule revisions that we can make 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

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[65] *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*).

[66] Under current rules, some unused TV channels available for use by wireless microphones are not available for TVWS devices. For instance, while wireless microphones may operate on channels adjacent to channels occupied by television stations, this is not the case for TVWS spaces below channel 21, where only fixed TVWS devices are permitted but which are prohibited from operating on such adjacent channels. *See* 47 C.F.R. §§ 15.703(c), 15.707, 15.711, and 15.712. In the Part 15 NPRM, we are proposing some changes to these rules. See Part 15 NPRM, Section III.A.1.

[67] *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).

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

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

[70] *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.

[71] *Incentive Auction R&O*, 29 FCC Rcd at 6702¶ 311, 6845-6846 ¶ 685.

incentive auction. We also invite comment on how best to facilitate the smooth transition of wireless microphones out of the repurposed 600 MHz Band following the incentive auction.

74. We do not, in this proceeding, address certain issues relating to wireless microphone operations in the TV bands and in the repurposed 600 MHz Band since these matters will be addressed instead in the Part 15 proceeding. 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 will be addressed as part of the Part 15 proceeding.[72] 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.[73] Nor do we 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.[74] Finally, as noted above, we will address revisions pertaining to the white spaces databases in our Part 15 Proceeding.[75]

(i) TV Bands

75. In this proceeding, we invite 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 invite 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.

(a) VHF band revisions

76. *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.[76] 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.[77] We note that several manufacturers have developed wireless microphones that make use this VHF spectrum.[78] Our understanding, however, is that licensees make only limited use of this band for wireless microphone operations due to the limited power levels permitted.

77. *Discussion.* We seek comment on the current uses of the VHF television channels for wireless microphone operations, and the potential for expanding use of this spectrum for wireless

[72] Part 15 NPRM, Sections III.B.1 and III.B.3 (Wireless microphones in the TV bands and repurposed 600 MHz Band).

[73] *Id.*, Section III.B.2.a (Wireless microphones in the 600 MHz guard bands and duplex gap).

[74] *Id.*, Section III.B.2.b (Licensed wireless microphones in the duplex gap).

[75] *Id.*, Sections III.C.2 (Changes to database procedures). This section proposes to decrease the time required to share wireless microphone registrations between databases and to increase the frequency at which white space devices check the database. It also proposes to remove the provisions allowing users of large numbers of unlicensed wireless microphones to register in the database to obtain protection from white space devices.

[76] As noted above, this VHF spectrum includes the 54-72 MHz, 76-88 MHz, and 174-216 MHz bands.

[77] 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).

[78] *See, e.g.*, http://www.audio-technica.com/cgi-bin/product_search/wls/wls.pl.

microphone operations in the future. Are there technical impediments to making greater use of this spectrum for wireless microphones?

78. In particular, we invite comment on 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? What would be the benefits or risks associated with making such revisions? Due to the propagation characteristics of this band, would allowing higher power limits 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?[79] Would the minimum co-channel separation distance of 4 kilometer from the contour need to be increased? If so, to what distance? Or could a tiered requirement be implemented, such as where wireless microphones operating at 50 mW or less could comply with the 4 kilometer separation distance, while higher power operations would have to comply with a greater separation distance? We ask that commenters explain fully the benefits or risks, including the kinds of wireless microphone operations that would be facilitated by such changes.

79. We also invite comment on any other rule revisions concerning use of the VHF television spectrum that would facilitate more use of this spectrum for wireless microphone operations. We ask that commenters provide specifics about any proposals, and address the benefits and risks associated with such changes.

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

80. *Background.* In the *Incentive Auction R&O*, the Commission permitted licensed wireless microphone users to operate closer to television stations that 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.[80] It stated that, based on the record that was before us in that proceeding, our decision requiring coordination effectively addressed any general concerns expressed by broadcasters that such wireless microphone operations might interfere with broadcast television operations.[81] 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, such as where the microphones are shielded from the TV signals due to building attenuation, or where no over-the-air television receivers are in operation.[82]

81. *Discussion.* In this proceeding, we seek to develop a more extensive record on whether we should 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, provided that certain specified conditions at the locations where the wireless microphone operations would take place. Our goal is to provide more opportunities for licensed wireless microphone operations in the spectrum that will continue to be allocated for television services where the wireless microphone operations would not cause harmful interference to TV operations. Permitting such operations could help ensure that licensed operators have access to more channels, particularly in indoor locations.

82. We propose to allow LPAS licensees to operate co-channel with television closer to the television station than provided by the separation distance rules, including inside the DTV contour, in those locations in which the co-channel TV signal is below a specified threshold, which would indicate that the over-the-air TV signal unlikely to be received or receivable. Provided that an appropriate TV

[79] 47 C.F.R. § 74.870(c) ("Wireless video assist devices").

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

[81] *Id*.

[82] *Id.* at 6699-6700 ¶ 307 n.931 (citing comments of Sennheiser, PISC, Shure, WSA).

signal threshold were established, we believe that such a rule serve to ensure that wireless microphone operations could have access to additional channels in the TV bands spectrum without causing harmful interference to any over-the-air television viewers at those particular locations.

83. If we take this approach, what would the suitable TV signal threshold be? One commenter in the incentive auction proceeding proposed that the suitable threshold would be -80 dBm over 200 kHz.[83] We seek comment on this threshold, or any other suitable threshold. We ask that commenters provide technical analyses of the threshold that they propose that we adopt.

84. In addition, we request comment on whether, apart from establishing such a TV signal threshold, we should adopt any other safeguards to ensure that licensed wireless microphone operators comply with this threshold and do not otherwise cause harmful interference to TV reception. We note at the outset that because we would limit these types of operations to licensed wireless microphone users, we would expect such users 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 any threshold rule that we adopted. Is this a reasonable expectation? To what extent would a wireless microphone operations require a low TV signal to be able operate effectively on a co-channel basis? Should we require licensed wireless microphone users to register their co-channel operations in the TV bands databases, which could provide information to any television licensee concerned about possible harmful interference? Are there other actions we should take?

85. As an alternative approach, we seek comment on whether we should permit co-channel licensed wireless microphone operations in indoor venues, such as in theaters or music auditoriums. Could an appropriate approach towards indoor operations be developed that would also effectively preclude harmful interference to any potential TV viewers at indoor locations? For instance, could certain locations be readily identified where wireless microphone operations can be permitted, provided of course that they are operated consistent with applicable technical requirements, including power limits and out-of-bound emissions requirements? Or, considering that in order to operate effectively wireless microphones need access to channels that are sufficiently interference-free, is it reasonable to expect that co-channel wireless microphone operations would only take place in indoor locations on channels with relatively low or effectively non-existent TV signal, and thus conclude that such operations would not be likely to effectively harm TV viewers? Some commenters in the incentive auction proceeding suggested that such operations may already take place without incident.[84] As we explore this approach, we seek comment on the benefits or downsides of allowing licensed wireless microphone operations at indoor locations, or at specified types of indoor locations. We ask that commenters provide any technical analysis bases for their recommendations.

86. We also invite comment on other approaches that we should take on expanding wireless microphone operations on a co-channel basis closer to television station operations. Again, commenters proposing any alternative approaches should provide technical analyses to support their approaches, and discuss the benefits of such an approach and how their approaches would not cause harmful interference to channels that would be used for wireless microphone operations.

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

87. *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.[85] These rules have not been revised since 1987.[86]

[83] Sennheiser Reply Comments (Docket No. 12-268) at 18.

[84] *See, e.g.*, *id*..

[85] *See* 47 C.F.R. § 74.861(e)(6).

88. The European Telecommunications Standards Institute (ETSI), which produces globally applicable standards for radio communications equipment, has developed emission mask standards for analog and digital wireless microphones that, while also permitting operations on a 200 kilohertz channel, differ from the Commission's generic emission mask for LPAS devices.[87] One wireless microphone manufacturer, Shure, has suggested in an earlier proceeding that the Commission consider adopting these standards to promote more efficient wireless microphone use.[88] Shure indicated that adoption of the ETSI-based emission masks for both analog and digital wireless microphones could significantly reduce the permissible out-of-band emissions a wireless microphone can generate, which would facilitate tighter spacing of wireless microphones operating together within a TV channel.[89]

89. *Discussion.* To promote more efficient use of the available channels in the spectrum in the TV bands spectrum, we propose revising the emission masks applicable to wireless microphones and LPAS devices, both with respect to 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 propose 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.*[90] We believe that 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. We seek comment on this proposal.[91]

90. In particular, we seek comment on the benefits of requiring unlicensed wireless microphones to comply with the ETSI limits, and whether these benefits would outweigh the costs. To what extent would adoption of the standards improve the efficiency of wireless microphone operations? If so, in what ways? To what extent would more microphones, whether analog or digital, be able to make use of the TV bands spectrum? Are these limits necessary to protect authorized services in adjacent frequency bands? To what extent would compliance with the proposed limits improve spectrum sharing by wireless microphones? To what extent have wireless microphone manufacturers developed wireless microphones that already comply with these standards? Would equipment manufacturers have difficulty in complying with these limits? Would a requirement to meet the ETSI standard affect the cost of a wireless microphone system?

91. We also seek comment on whether we should specify separate emission masks for analog and digital microphones, or whether a single mask is sufficient. For example, ETSI EN 300 422-1 suggests that its mask for digital microphones could also be used for analog microphones. If we were to decide to adopt these standards, how quickly should we require new devices to comply with the new standards? 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 seek comment on the emission limits

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[86] *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)).

[87] 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.

[88] *See* Shure Comments (ET Docket 10-24) at 29 (filed March 1, 2010).

[89] *Id.*

[90] This standard is available at www.etsi.org.

[91] In the Part 15 NPRM, we also are proposing to apply the ETSI standard to unlicensed wireless microphone operations in the TV bands. See Part 15 NPRM, Section III.B.1.

that should apply outside of this frequency range. For example, should this limit be the same as the emission limits at the outer edges of the ETSI masks (-90 dBc)? Is some other limit more appropriate?

92. In addition to the ETSI standards, or as an alternative, are there other technical standards that we should adopt to promote more efficient use of the spectrum available for wireless microphone operations in the TV bands? If so, we ask that commenters explain the bases for adoption of these standards, along with the associated benefits or potential costs. How quickly should we require that wireless microphones comply with such standards?

(d) Other TV Bands revisions

93. We also seek 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 in a manner that would be consistent with the secondary status of LPAS operations in the band. To the extent that commenters contend that other rule revisions would be appropriate, we ask that commenters provide detailed information on reasons for the proposed changes and the types of specific rules that they advocate.

(ii) Eligibility for Licensed Operations in the Duplex Gap

94. *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.[92] As noted above, we are addressing the technical issues concerning licensed wireless microphone operations in the duplex gap in the companion Part 15 proceeding.

95. *Discussion.* In this proceeding, we seek comment on whether we should expand eligibility for licensed wireless microphone operations in the duplex gap to include all of the entities eligible for Part 74 LPAS licenses in the TV bands. Would expanding eligibility to those entities eligible for Part 74 LPAS licenses in the TV bands create problems for broadcasters or cable programming networks operating on this spectrum, or would these different users for the most part operate at different locations, such that their operations would not likely interfere with each other?

(iii) Transition Out of the 600 MHz Band Repurposed for Wireless Services

96. In this section, we seek 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 (i.e., 39 months after the issuance of the *Channel Reassignment PN*).[93] 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. Although the specific UHF band frequencies that will be repurposed for 600 MHz Band wireless services will not be known until following the incentive auction, beginning preparation for transition as soon as possible will contribute to a smoother transition.

[92] *Incentive Auction R&O*, 29 FCC Rcd at 6703-6704 ¶ 314.

[93] Our inquiry and request for comments in this section also extends 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. *See* 47 C.F.R. §§ 74.801, 74.870; *Incentive Auction R&O*, 29 FCC Rcd at 6846¶ 687 & n.1904; *Id*. at Appendix A (amending 47 C.F.R. § 74.870). Wireless video assist devices must cease operations in the 600 MHz Band no later than the end of the post-auction transition. *See Incentive Auction R&O*, 29 FCC Rcd at 6846 ¶ 687 & n.1904.

(a) Background

97. Following the upcoming incentive auction, certain existing television channels in the UHF band will be repurposed for 600 MHz Band wireless services. Considering that many wireless microphone users currently rely on access to existing TV channels in the portions of the UHF spectrum that will be repurposed for 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.[94] Specifically, following the auction these operators may continue to access the 600 MHz Band during the transition period, but no later, subject to certain conditions.[95] 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.[96]

98. 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.[97] 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.[98]

99. As previously discussed, wireless microphones that operate 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. For instance, some 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.[99] Thus, some wireless microphones will be capable of operating on repurposed channels, while others will not. Although the information relating to the frequencies on which particular wireless microphones operate may be included with the owner's manual, the channels often are not evident on the devices themselves.

(b) Discussion

100. In this section, we seek comment on steps we should take to facilitate a smooth transition in which wireless microphone operations vacate the repurposed spectrum in the 600 MHz Band. We ask for comment on the extent to which consumer education and outreach can help to achieve this goal, and the means by which information can be made available to wireless microphone users in order to inform them of the need to vacate the band. We also request that commenters address whether labeling requirements, such as point of sale disclosure, can help to facilitate the transition. In addition, we propose revising our rules to prohibit certification of Part 74 wireless microphones that operate in repurposed 600 MHz Band spectrum beginning nine months after the release of the *Channel Reassignment PN*, and to

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[94] *Id.* at 6846-6847 ¶¶ 686-688.

[95] This 39-month transition period will commence once the Commission releases the *Channel Reassignment PN*. *Id.* at 6846 ¶ 687.

[96] *Id.* at 6846-6847 ¶¶ 686-688.

[97] *See id.* at 6872 ¶ 525.

[98] *Id.* at 6605 ¶ 82.

[99] See paragraph 24 above.

prohibit the manufacture, import, sale, offer for sale, or shipment of such wireless microphones in the 600 MHz band in the United States, 18 months after the release of the *Channel Reassignment PN*. Finally, we propose to modify by rule LPAS licenses with frequencies that will be in the repurposed 600 MHz band and to delete these frequencies from LPAS licenses because they will not be available for such use after the end of the transition.

101. In addition to the specific issues we raise below, comments should discuss how particular steps will promote ready access to the repurposed spectrum by 600 MHz Band wireless licensees, while at the same time providing for an orderly transition process for secondary and unlicensed users that currently are serving various important consumer needs using this spectrum.[100]

(i) Consumer education and outreach; disclosure requirements

102. In this section, we seek comment on how to inform users of wireless microphones on 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 anticipate that there will be a need for significant education and outreach directed at wireless microphone users that must commence well before the auction and continue for a number of years beyond the end of the 39-month transition period. These education and outreach efforts must 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 to educate consumer awareness on developments concerning the operation of wireless microphones, we also propose requiring that written disclosures accompany new devices at the point of sale to provide further education to wireless microphone users on the devices' operations.[101]

103. *Consumer Education and Outreach.* We seek comment on the consumer education and outreach efforts that should be employed to educate wireless microphone users, particularly unlicensed users operating in the repurposed 600 MHz band. Our goals are to make information available so users are aware that they must cease operating their wireless microphones on the repurposed 600 MHz Band 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. A successful consumer education and outreach campaign will involve the Commission staff working with a broad group of interested entities, including wireless microphone manufacturers, wireless microphones users, and user representatives.

104. Given that a portion of the UHF spectrum that is currently used and available for wireless microphone operations may no longer be available following the incentive auction,[102] we seek comment on how wireless microphone users can be provided access to information on the specific frequencies and the geographic areas of repurposed spectrum that will no longer be available for wireless microphone use at the end of the transition. 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? Although the *Channel Reassignment PN* will provide information on the spectrum that will be repurposed and no longer available for wireless microphones,[103] we first seek comment on what steps can be taken to provide wireless microphone users

[100] *Incentive Auction R&O*, 29 FCC Rcd at 6845-6846 ¶ 685.

[101] Our request for comments and proposals in this section include the operation of wireless video assist devices under the Part 74, Subpart H rules. *See* 47 C.F.R. §§ 74.801, 74.870.

[102] *Incentive Auction R&O*, 29 FCC Rcd at 6704 ¶ 316.

[103] In addition to initiating the 39-month transition period, the *Channel Reassignment PN* will identify the new channel assignments for full power and Class A television stations that have been reassigned to different channels (continued….)

with information on the transition prior to the auction. For example, we seek comment on whether explanations could be provided on the Commission's website and on the websites of manufacturers that would explain the steps required under the Commission's rules to vacate the repurposed 600 MHz Band, and any information on alternative spectrum that is currently available outside of this spectrum, as well any additional spectrum bands that may become available for wireless microphone operations beyond those already provided for in the rules.[104]

105. What other means should be employed to provide wireless microphone users notice of the repurposed spectrum that will be assigned to new wireless licensees, including the specific frequencies in the UHF spectrum and the geographic locations that will no longer be available for wireless microphone operations? We seek comment on whether it would it be beneficial for wireless microphone users to have access to a database that identifies spectrum in the repurposed 600 MHz Band. For example, should some form of online mapping tool be made available to allow users to enter the location and operating frequencies of a wireless microphone and determine whether it operates in the repurposed 600 MHz Band? In the event that a database or similar approach is adopted, we seek comment on who should be responsible for developing and maintaining (hosting) it, including who should be responsible for its cost. Commenters should provide quantitative and qualitative data on costs and benefits of their proposals.

106. Further, should the Commission work with wireless microphone manufacturers to obtain information on models of wireless microphones that the Commission could list on its website? For example, this information could include a list all models of wireless microphones sold in the U.S., and all wireless microphone models that operate in the repurposed 600 MHz Band, as well as where on the device or in its product literature the user could look to determine the frequencies on which it is capable of operating.[105] We seek comment on whether making this type of information publically available would help to facilitate a smooth transition from the 600 MHz Band. We also seek comment on the costs and benefits of this approach, as well as alternative approaches.

107. In addition to steps that may involve manufacturers, we seek comment on what steps other parties associated with the sale and operation of wireless microphones may be able to take to provide users with information relevant to the transition. These other parties may include: wireless microphone distributors and retailers; parties that lease or manage wireless microphones; trade associations and user groups, including those that have participated in Commission proceedings concerning wireless microphones; organizations that host websites and publish information that addresses wireless microphone operations and use or are reasonably expected to have significant numbers of wireless microphone users among their members and readers; and engineering and industry associations or other groups with members that use or operate wireless microphones. Involvement in education and outreach by these parties will be essential, given users' investment in wireless microphone equipment and the upcoming changes regarding wireless microphone use, including the requirement that they vacate the 600 MHz Band. Further, it is important that education and outreach extend to information concerning any newly-allocated spectrum for wireless microphone operations and the potential for users to opt for a suite

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resulting from the incentive auction and the repacking process. *See Incentive Auction R&O*, 29 FCC Rcd at 6796 ¶ 559.

[104] Elsewhere in this Notice, we seek comment on whether a number of other spectrum bands should be allocated for wireless microphone use.

[105] As part of the transition of wireless microphones from the 700 MHz band, the Commission made available a list of many wireless microphones that operated on the 700 MHz band, as provided by a number of manufacturers. *See* http://www.fcc.gov/encyclopedia/wireless-microphones-manufacturers-equipment-list. Wireless microphone users could look at this information and determine if their devices were 700 MHz wireless microphones and thus could not be used after the transition deadline, or given information to contact the Commission for additional assistance if the manufacturer of their devices was not listed.

of wireless microphones operating in different spectrum bands and with different capabilities, depending on the user's specific requirements. We note that wireless microphone users can encompass a wide range of entities, including both licensed and unlicensed users, and parties with differing levels of wireless microphone needs and expertise covering many different applications. Based on these considerations, it is likely that the need for information on the various spectrum bands that will be available for wireless microphone operations, and the conditions specific to each, will be vital. We seek comment on these matters, and on what steps can be taken to assure that the information to educate users on the transition will be commensurate with the appropriate needs and levels of expertise of all users.

108. We seek 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. We further seek comment on how to release or distribute these materials in order to most effectively and efficiently reach the target audience of wireless microphone users.

109. We seek comment on the specific 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 seek comment on whether and to what extent these entities can make this type of information available, including, as appropriate, by posting it on their websites, including it in all sales literature, or taking other steps to inform current or potential wireless microphone users of matters concerning the operation of their devices. We also seek comment on whether manufacturers would consider rebates, equipment trade-ins, or similar programs to facilitate the transition, and what effect the 39-month transition period would have on a decision to implement such a program. In addition, we seek comment on the economic costs and benefits of adopting consumer outreach measures.

110. *Disclosure Requirements*. We propose to revise our point-of-sale disclosure requirement that the Commission adopted in the *Wireless Microphone Report and Order* 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. 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).[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.[107] The Commission also provided that persons who manufacture or market wireless

[106] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 688-91 ¶¶ 95-106.

[107] *See id.* at 688-89 ¶ 96; 47 C.F.R. § 15.216. The required disclosure states: "Most users do not need a license to operate this wireless microphone system. Nevertheless, operating this microphone system without a license is subject to certain restrictions: the system may not cause harmful interference, and must operate at a power level not in excess of 50 milliwatts; it has no protection from interference received from any other device. Purchasers should also be aware that the FCC is currently evaluating use of wireless microphone systems, and these rules are subject to change. For more information, call the FCC at 1-888-CALL-FCC (TTY: 1-888-TELL-FCC) or visit the FCC's wireless microphone Web site at http://www.fcc.gov/cgb/wirelessmicrophones." *See* 47 C.F.R. § 15.216, Appendix. The Commission noted that manufacturers and distributors could satisfy the disclosure requirement in more than one way, including by displaying the text in a prominent manner on the product box via a label or sticker; displaying the text immediately adjacent to the device in a manner clearly associated with the device; and, for wireless

(continued….)

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.[108]

111. We propose to revise the existing point-of-sale disclosure requirement in order to facilitate a smoother transition in which wireless microphone users are informed of the need to vacate the repurposed 600 MHz Band, while fully understanding their rights and obligations during the transition period and at the end of the transition period. With regard to sales of wireless microphones that are capable of operating in repurposed spectrum, we propose 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 seek 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.[109] We propose that the revised point-of-sale disclosures should 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 the600 MHz Band. Should we 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? What other information should be included in the disclosure?

112. We propose that the effective date for any disclosure requirement, including a point-of-sale requirement, which we may adopt in connection with this or a related proceeding, shall be 18 months after the release of the *Channel Reassignment PN* – which will mark the effective date of channel reassignments based on the repacking process, specify any specific channel assignments for television stations that will continue to broadcast, and start the clock running on the post-auction transition period – or should some other date be used instead? We seek comment on the particular factors that should enter into this determination. We note that in adopting the current disclosure requirement, the Commission stated that it would remain in effect until the effective date of the final rules adopted in response to the 2010 *TV Bands Wireless Microphones Further Notice*.[110]

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

113. 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 for

(Continued from previous page)
microphones offered online or via direct mail or catalog, displaying the text in close proximity to the images and descriptions of each wireless microphone. *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 689 ¶ 100.

[108] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 674 ¶ 64; *see also* 47 C.F.R. § 74.851(h). In the *TV Bands Wireless Microphones Further Notice*, the Commission also sought comment on whether to adopt labeling and other marketing restrictions to help ensure that devices certificated as low power auxiliary stations under Part 74 were marketed only to parties eligible for a Part 74 license. In particular, the Commission sought comment on whether to require manufacturers to direct marketing of Part 74-certificated devices only to parties eligible to operate them; whether to require manufacturers to track the parties to whom their products are marketed; whether to require manufacturers to provide a label visible at the time of purchase or instructions in the user manual advising purchasers of the requirement to obtain a license; and whether to prohibit manufacturers and distributors from selling devices certificated under Part 74 unless the sale is to a party that has committed in writing that it is a bona fide reseller or eligible for a license under Part 74. *See TV Bands Wireless Microphones Further Notice,* 25 FCC Rcd at 701-02 ¶¶ 141-144.

[109] See Section III.A.1.b(iii), below.

[110] *See TV Bands Wireless Microphones Further Notice*, 25 FCC Rcd at 689 ¶ 100.

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*.[111] 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.

114. Because of these future changes in the permitted operating frequency range for wireless microphones, plus the rule changes for these devices that we propose in this Notice and in the Part 15 Notice,[112] we need 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 that cannot be legally used after a certain date. Cutoff dates will encourage manufacturers to concentrate on developing wireless microphones that operate in compliance with new Part 74 and Part 15 rules. Because similar technical requirements would apply to both licensed and unlicensed wireless microphones,[113] we propose to apply to both the same transition rules for certification, manufacturing, and marketing. This approach would be the least disruptive to wireless microphone manufacturers and users. This Notice addresses these issues for licensed wireless microphones, and the Part 15 Notice addresses these issues for unlicensed wireless microphones.[114]

115. 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 propose 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.[115] We propose taking this action pursuant to our authority under Section 302(a) of the Communications Act.[116]

116. We propose this prohibition to ensure that wireless microphones will vacate the 600 MHz spectrum by the end of the transition. This action would be consistent with Commission actions when it required wireless microphones to cease operating in the former TV bands that were repurposed for 700 MHz Band wireless services and prohibited the manufacturer and marketing of wireless microphones intended for use in the 700 MHz Band.[117] We are concerned that without this prohibition there may be greater potential for unauthorized use in the repurposed 600 MHz Band, given the difficulty in educating

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

[112] See Part 15 NPRM, Section III.B.1 (Unlicensed wireless microphones in the TV bands).

[113] The maximum power permitted for unlicensed microphones would be lower than that permitted for licensed microphones. Bandwidth and minimum separation distances from co-channel television stations would be the same, and we are proposing to adopt the same out-of-band emission limits for both licensed and unlicensed microphones.

[114] See Part 15 NPRM, Section III.D.2 (Equipment certification/wireless microphones).

[115] Our request for comments and proposals in this section include the operation of wireless video assist devices under the Part 74, Subpart H rules. *See* 47 C.F.R. §§ 74.801, 74.870.

[116] 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).

[117] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 672-73 ¶¶ 59-62. The Commission determined that this would serve the public interest by assuring that the 700 MHz band would be available for public safety and new commercial licensees. *See id.* at 672 ¶ 59. The prohibition adopted by the Commission included all frequencies in each of the spectrum blocks made available to new commercial licensees in the 700 MHz band.

users about the scope of the devices' operations and problems we may otherwise encounter in enforcing a requirement that all wireless microphones users leave the band by the end of the transition. We seek comment on this proposal. We note, 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.[118] We propose that parties may 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*. We also propose that we will 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 seek comment on these proposals. In particular, we seek comment on the appropriateness of the proposed cutoff dates. Should we provide longer or shorter time periods? Should we also require that, in any event, parties may not submit applications to certify wireless microphones that operate in repurposed TV spectrum later than 24 months after the effective date of the service rules we adopt in this proceeding, 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?

117. We also propose 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*. We note that the particular frequencies that will need to be vacated will not be known until the release of the *Channel Reassignment PN*, although parties have been on notice since at least 2012 that wireless microphones may have to transition out of portions of the 600 MHz Band. We also seek comment on the extent to which manufacturers and other entities have already begun to educate current and potential wireless microphone users about the potential for a transition out of the 600 MHz Band. In addition, we seek comment on the economic costs and benefits of different effective dates for the proposed prohibition on manufacturing or marketing.

118. Finally, to the extent that the Commission determines to prohibit such manufacture or marketing, we propose that any such ban would not apply to devices manufactured in the United States solely for export. We seek comment on this proposal.

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

119. Pursuant to our authority under Section 316 of the Communications Act,[119] we propose 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. The Commission has 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.[120]

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[118] For the purposes of this request for comment, we define the word "impaired" in the same manner in which the Commission defined it in the context of "impaired" spectrum blocks or "impaired" licenses in the *Incentive Auction R&O*. For example, the Commission treated a license or block as impaired in the proceeding when "a wireless provider is restricted from operating in the entire geographic boundary of a particular license area in order to prevent harmful interference to remaining television operations in or near the 600 MHz Band; or conversely, those licenses in which a wireless provider may receive harmful interference from remaining television operations in or near the 600 MHz Band." *Incentive Auction R&O*, 29 FCC Rcd at 6604-6605 ¶ 81.

[119] 47 U.S.C. § 316.

[120] *See TV Bands Wireless Microphone Second R&O*, 29 FCC Rcd at 6114 ¶ 29. Similarly, to facilitate clearing wireless microphones from the 700 MHz Band, which had been repurposed for public safety and commercial services, the Commission in the *TV Bands Wireless Microphone R&O* modified existing LPAS licenses to delete authorizations to operate on frequencies in the 700 MHz Band, effective on the deadline for clearing the band. *See TV Bands Wireless Microphone R&O*, 25 FCC Rcd at 675 ¶ 69.

Our proposed action in the instant proceeding would similarly 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. In addition, we propose 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.[121] Finally, we propose 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.

120. We seek comment on these proposals, and on the extent to which their adoption would promote the public interest by facilitating the clearing of all licensed wireless microphone operations from the repurposed 600 MHz Band by the end of the transition period.[122]

2. 26.100-26.480 MHz, 161.625-161.775 MHz, 450-451 MHz, and 455-456 MHz Bands

121. *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 26.100-26.480 MHz, the 161.625-161.775 MHz, the 450-451 MHz, and the 455-456 MHz bands.[123] Eligibility for operating in these bands is limited to broadcasters and broadcast network entities.[124] There are nearly 200 licenses for operating wireless microphones in the 26.1-26.48 MHz band, approximately 30 in the 161.625-161.775 MHz band, and a little more than 100 in the 450-451 and 455-456 MHz bands.[125]

122. *Discussion.* We seek comment on the current use of these bands for wireless microphone operations, and the future for more expansive use of these bands. What particular types of wireless microphones are used in the bands, and for which types of applications are they best suited. Considering the small bandwidths available in each of these bands, what kinds of limitations are there on the types of applications that can be served using these bands? How many microphones can operate on these bands using today's technologies? Are there technological advances that may promote more intensive use? We seek comment on any potential revisions that we should make to facilitate the use of these bands for wireless microphone operations.

3. 88-108 MHz FM Band

123. *Background.* Over the years there have been some wireless microphone operations in the 88-108 MHz FM band on an unlicensed basis. As discussed above, wireless microphone operations on this spectrum was permitted before wireless microphones were authorized to access any channels in the

[121] 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.

[122] Our request for comments and proposals in this section include the operation of wireless video assist devices under the Part 74, Subpart H rules. *See* 47 C.F.R. §§ 74.801, 74.870.

[123] *See* 47 C.F.R. § 74.802.

[124] 47 C.F.R. § 74.832(a), (d).

[125] As of September 12, 2014, ULS records indicate that there are 211 low power auxiliary licenses (ULS radio service code "LP") in the 26.1-26.48 MHz band; 29 in the 161.625-161.775 MHz band, and 117 in the 450-451 and 455-456 MHz band.

TV bands.[126] Wireless microphones that comply with the rules for unlicensed device operations in this band, as sets forth in Section 15.239 of our Part 15 rules, may operate on no more than a 200 kHz bandwidths with low emissions (field strength of emissions must not exceed 250 microvolts/meter at 3 meters).[127]

124. *Discussion.* To what extent do wireless microphone users continue to make use of this band for their operations? If so, for what types of wireless microphone applications? To what extent will use of the spectrum in this band be useful for accommodating wireless microphone users' needs in the future? Are there any rule revisions that would facilitate use of this spectrum while also preserving these channels for use by the primary FM broadcast services? We ask that commenters proposing any rule revisions submit technical information in support of their proposals, as well as analysis of the benefits of such revisions and likely impact on FM broadcasters.

4. 169-172 MHz Band

125. *Background.* Under the Commission's Part 90 rules, entities eligible to hold a Public Safety Pool or Industrial/Business Pool license may operate wireless microphones on a secondary basis on certain frequencies in the 169-172 MHz band, which is allocated primarily for federal use.[128] 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.[129] The emission bandwidth may not exceed 54 kHz, the frequency stability of the microphones must limit the total emission to within ± 32.5 kHz of the assigned frequency, and operations may not exceed an output power level of 50 milliwatts.[130] 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,[131] including: state and local government entities; commercial entities in general; educational, philanthropic or ecclesiastical institutions; clergy; hospitals; clinics; and medical associations.[132]

126. 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.[133] The federal systems in the band are required to be capable of narrowband operations on 12.5 kHz channels.[134] The other non-federal licensed operations in the band, which also are secondary to the federal allocation in the band, operate on

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[126] See paragraph 7 above (mentioning that the 88-108 MHz FM band as available for wireless microphone operations at the time the Commission authorized wireless microphone uses in the upper VHF TV band in 1977).

[127] 47 C.F.R. § 15.239.

[128] The 162.0125-173.2 MHz and 173.4-174 MHz bands are allocated to the fixed and mobile services on a primary basis for Federal use. Here, we refer to the 169-172 MHz segment of those bands. Non-federal use of the 169-172 MHz band is limited to the operations authorized pursuant to footnotes US8, US11, US13, and US300.

[129] *See* 47 C.F.R. § 90.265(b). *See also* 47 C.F.R. § 2.106, footnote US300.

[130] 47 C.F.R. § 90.265(b)(1)-(3).

[131] 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.

[132] 47 C.F.R. §§ 90.20(a), 90.35(a).

[133] 47 C.F.R. § 90.265(b)(4).

[134] *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, ET Docket No.04-243, *Report and Order*, 20 FCC Rcd 5793, 5799 ¶ 12 (2005).

narrowband channels[135] and include: (1) operations by licensees on 36 specified assignable channels, no larger than 11.25 kHz, between 169.425 MHz and 171.925 MHz, for the purpose of transmitting hydrological or meteorological data:[136] (2) operations by licensees on 9 assignable channels, no larger than 11.25 kHz, between 170.425 MHz and 172.375 MHz, for forest firefighting and conservation purposes (four assignable east of the Mississippi River and five assignable west of the Mississippi River);[137] and (3) operations assignable on one 11.25 kHz channel for public safety activities ; and remote pickup broadcast stations on one 12.5 kHz channel at 170.15 MHz in certain parts of the country.[138]

127. In the 2010 *TV Bands Wireless Microphones R&O and Further Notice*, the Commission sought comment on whether it should revise these Part 90 rules to facilitate broader wireless microphone use in these frequencies.[139] Some commenters in that proceeding suggested that operating in this band may offer additional opportunities for some licensed wireless microphone operations,[140] though several indicated that wireless microphone operations under these rules may not currently provide a viable option for all wireless microphone users, particularly where "premium professional audio quality" is required.[141] One comment also indicated that the few available frequencies were insufficient except for small users.[142]

128. *Discussion.* In this proceeding, we request information about the current use of spectrum in the 169-172 MHz band for wireless microphone operations, and we request comment on the potential for more expansive and intensive use of this spectrum. In particular, we ask for comment on different ways in which the spectrum in the band could be used for wireless microphone operations without interfering with the federal operations, and the other secondary services that may use portions of this band at particular locations. We also inquire about the technical rules that we should adopt were we to authorize additional wireless microphone use of this band.

129. Commenters should provide information about how this spectrum is currently used by wireless microphones and describe the specific uses and applications for such devices under Part 90. In particular, we ask that commenters address why relatively few entities are licensed to operate wireless microphones in this band.[143] To what extent, for instance, does the relatively narrow bandwidth permitted under Part 90 (with 54 kHz emission mask limitation) affect the audio quality and the types of usage on

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[135] Although these other secondary licensees are required to operate on narrowband channels, the Commission did not require that wireless microphones operate on narrowband on their specified channels because they operate at very low power (50 mW output power), with minimal likelihood of interference to high-power land mobile operations. *Id.* at 5817 ¶ 64.

[136] 47 C.F.R. § 90.265(a) (listing specified channels). *See also* 47 C.F.R. § 2.106, footnote US13.

[137] 47 C.F.R. § 90.265(c) (listing specified channels).

[138] 47 C.F.R. §§ 74.402(d)(8), 90.265(d). Licensees may also operate on 166.250 MHz under these provisions. *See also* 47 C.F.R. § 2.106, footnote US11..

[139] *TV Bands Wireless Microphones R&O and Further Notice*, 25 FCC Rcd at 704 ¶¶ 150-51; *see also* The Wireless Telecommunications Bureau and the Office of Engineering and Technology Seek to Update and Refresh Record in the Wireless Microphone Proceeding, WT Docket Nos. 08-166, 08-167, ET Docket No. 10-24, *Public Notice*, 27 FCC Rcd 12067 (WTB/OET 2012).

[140] *See* Audio Technica Refresh Comments WT Docket No. 08-166 at 15 (Jan. 25, 2013); Josephson Engineering Comments WT Docket No. 08-166 at 2 (Feb. 2, 2010).

[141] *See* Audio-Technica Comments (WT Docket No. 08-166) at 12 n.5, 13-14 (Mar. 1, 2010); Professional Wireless System Comments WT Docket No. 08-166 at 7-8 (Feb. 28, 2010) (Jason Eskew in ECFS), 9; Sennheiser Reply Comments WT Docket No. 08-166 at 10 (Mar. 22, 2010).

[142] *See* Audio-Technica Refresh Comments WT Docket No. 08-166 at 15 (Jan. 25, 2013); *see also* Shure Reply Comments, WT Docket No. 08-166 at 12 (Mar. 22, 2010) ("[T]he available frequencies and technical requirements set forth in Part 90 do not accommodate typical wireless microphone operations").

[143] As of August 15, 2014, there were 219 active licenses on the 169-172 MHz wireless microphone frequencies.

those frequencies when compared with Part 74 LPAS systems in the TV bands (permitting as much as 200 kHz)?

130. We also seek comment on whether and what steps we could take to make the existing frequencies a more viable option for more wireless microphone users. The applicable technical rules are over thirty years old,[144] and we seek comment on the extent of subsequent technical improvements in wireless microphone technology in this band. We also seek comment on the technical specifications of current microphones in this band and what rule changes would be necessary to enable improved fidelity to support additional wireless microphone applications.

131. Commenters should also discuss the potential for future wireless microphone use in these frequencies, as well as how revisions could make this spectrum more useful for wireless microphone applications. Since the current channels available for microphones include four sets of channels that are close to each other, one possible action we might take would be to allow wireless microphone licensees to combine each of the neighboring sets of channels with each other, making four channels with larger bandwidth available for wireless microphone operations. For instance, the authorizations for operating on channels 169.445 MHz and 169.505 MHz could be combined, allowing for operations across the two channels over a bandwidth of approximately 120 kHz, with the center frequency being at 169.475 MHz. Would allowing these channels to be combined to this larger bandwidth accommodate additional wireless microphone uses, and do commenters support such action? Commenters also should discuss whether such a revision would increase the likelihood of interference to federal use or other secondary non-federal use of the spectrum, and whether the rules also should include additional provisions to protect these other users.

132. Another approach would be to make as much of the 169-172 MHz band as possible available for wireless microphone use on a secondary basis. Secondary operations are not normally coordinated with primary operations. Given the relatively low power of wireless microphones and the limited nature of their use we believe the risk to primary services is relatively small except perhaps in rare instances of operation in close proximity. Nevertheless, are there certain circumstances where coordination with the federal government or other incumbent services may be appropriate? What impact might this have on wireless microphone operations in the band, as well as on other operations in the band? Alternatively, should certain areas be excluded for licensed wireless microphones operating in this band? In considering this possible expansion of wireless microphone use across the band, we note that there are many locations, or many frequencies at particular locations, where the spectrum is not being used either by the federal government or by other secondary users. We seek comment on whether wireless microphone licensees should be allowed to operate on channels of bandwidths up to 200 kHz (if available at particular locations), the same as permitted in the TV bands, and in addition should be required to comply with the ETSI standards that we are proposing to adopt with respect to wireless microphone operations under the technical rules for LPAS device operations in the TV bands and other bands.[145] We seek comment on this approach, and whether such an approach could be designed in such a way as to protect federal and other secondary operations from interference from wireless microphone operations. Under this approach, to what extent could certain types or locations of wireless microphone use (e.g., indoor uses) be more easily be accommodated? If we were to provide authorization for more expansive use by wireless microphones licensees, we seek comment on the service rules that we should adopt. We also seek comment on the technical rules that should apply for wireless microphone operations. For instance, under this approach, to what extent should we adopt other technical requirements that would apply to LPAS devices that operation in the VHF TV bands that currently apply (including restricting power to 50 mW, the same as permitted wireless microphones currently in the 169-

[144] *See* Allocation of Frequencies to Operate Low Power Wireless Microphones on a Secondary Non-Interference Basis in the 169-172 MHz Band, 49 Fed. Reg. 20505 (May 15, 1984).

[145] See Section III.C.1.b(i) ((discussion on adopting ETSI standard).

172 MHz band), or under our proposed revisions for operations in the TV VHF band (which would permit higher power levels, up to 250 mW)?[146]

133. In addition, we seek comment on any other approaches we could take to facilitate wireless microphones operations in the 169-172 MHz band. Commenters proposing other approaches should provide the rationale for such approaches, including how those approaches could be designed to protect incumbent operations of other services in the band. To the extent that we revise technical rules to provide more access to spectrum in these bands, we ask that manufacturers address how quickly new devices might be manufactured and made available in the marketplace. Are there other equipment issues that we should address?

5. 944-952 MHz Band and Adjacent 941-944 MHz and 952-960 MHz Bands

134. Under current rules, broadcasters and broadcast network entities already are permitted to operate wireless microphones and other LPAS devices in 8 megahertz of spectrum in the 944-952 MHz band on a licensed basis.[147] In this section, we seek comment generally on LPAS operations in the 944-952 MHz band, and we propose to adopt the ETSI standards for analog and digital wireless microphone operations and to expand eligibility for licensed LPAS operations to include the same additional entities that currently are eligible to operate LPAS devices on a licensed basis in the TV bands (discussed above). We also propose to permit LPAS operations on a licensed basis in portions of the two spectrum bands immediately adjacent to the 944-952 MHz band (941-944 MHz and 952-960 MHz bands), which potentially could enable licensed wireless microphone users access to up to nineteen megahertz of spectrum across the 941-960 MHz frequencies, depending of course on the availability of unused spectrum across these frequencies.

a. 944-952 MHz Band

135. *Background.* The Commission's Part 74, Subpart H rules authorize operations of wireless microphones and related LPAS devices on a licensed basis in the 944-952 MHz band.[148] These LPAS operations are authorized on a co-primary basis along with fixed Aural Studio to Transmitter links (STL) stations and fixed Aural Intercity Relay Links stations (ICR).[149] Entities eligible for a license to operate wireless microphones are limited to broadcast licensees and broadcast network entities.[150] 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.[151] Under the applicable technical rules, the operating bandwidth for LPAS operations may not exceed 200 kHz, and the maximum transmitter power is 1 watt.[152]

136. Currently approximately 100 LPAS licenses have been authorized in the 944-952 MHz band.[153] Most of these licenses authorize operation in specific cities or markets. Several manufacturers have developed wireless microphones that use this band, often with the same type of features as devices

[146] See Section III.C.1.b(i) (discussion on VHF TV bands).

[147] 47 C.F.R. §§ 74.802(a); 74.831.

[148] 47 C.F.R. § §§ 74.802(a); 74.831.

[149] *See* 47 C.F.R. § 74.502(b).

[150] 47 C.F.R. § 74.832(c)-(d).

[151] 47 C.F.R. § 74.831.

[152] 47 C.F.R. § 74.861(d)(1), (e)(5).

[153] These licenses make up a small fraction of the total number of licenses that have been authorized. As of September 12, 2014, there are 106 LPAS licenses, 10,000 Aural STL licenses, and 810 Aural Intercity Relay licenses.

that operate in the TV bands.[154] It appears that many devices may be made for high-end, professional sound quality uses, including so-called "mission critical" uses.[155]

137. *Discussion.* We request that commenters provide information about the current uses of this band for licensed wireless microphone operations, as well as the potential for more intensive use of this band for these operations among the other broadcast services that use the band. How extensively do LPAS licensees make use of this 8-megahertz band, and in what types of locations? How much spectrum is available for wireless microphone uses in the band, considering that the other authorized services are point-to-point operations are at fixed locations? We seek comment on both outdoor and indoor uses. For what types of wireless microphone operations is that band used? What are the advantages and disadvantages of using this band for wireless microphone operations?

138. Similarly, we request comment on the potential for more intensive use of this band in the future. Considering that less spectrum may be available for wireless microphone operations in the UHF television bands, do licensees expect to make greater use of this band in this band, including migration particular types of uses to this spectrum when they are spectrum-constrained in the TV bands? If so, for what types of applications? Do the propagation features associated with this spectrum band, and its relatively close proximity to the UHF television band, facilitate particular types of wireless microphone applications? For instance, is this band particularly well-suited for high-quality uses? What are the potential limitations on the use of this band for licensed wireless microphone operations? Commenters should provide whatever information they believe may be helpful to the Commission as we evaluate the role that this band can play in helping accommodate the various needs of wireless microphone users over the near and long term.

139. In our discussion of licensed LPAS operations in the TV Bands, above, we propose to adopt the ETSI emission mask standards both for analog and digital microphones.[156] Here we propose adopting those standards for LPAS operations in the 944-952 MHz Band. As above, we seek comment on this proposal.

140. In addition to seeking comment on use of this band by existing licensees, we propose expanding eligibility in the 944-952 MHz band to include additional classes of wireless microphone users, in particular all of the other entities eligible for operation of LPAS devices in the TV bands on a licensed basis, which have wireless microphone needs similar to those of broadcasters and broadcast network entities and merit license status in the TV bands. Considering that these other entities are sophisticated users, and often already coordinate their wireless microphone operations in the TV bands with broadcasters,[157] we believe that such users should be able to effectively work with broadcasters when accessing spectrum at different locations. Expanding eligibility for these uses potentially could help ensure that entities that merit licensee protection in the TV bands, and may have access to less TV bands spectrum following the incentive auction, have access to additional spectrum that they may need for their

[154] For example, Shure manufactures several wireless microphone systems (e.g., ULF-P, UHF-R, ULX-S, ULX-D) that, depending on the particular system, is designed to operate on portions of the TV bands or on the 944-952 MHz band; one of its systems (Axient) is designed to operates across both all of the UHF television band and the 944-952 MHz band). *See generally* http;//shure.com/Americas/products/wireless systems. Several other manufactures, including Audio Technica and Nady, also manufacture 944-952 MHz LPAS systems that are also designed to operate on particular frequencies in the TV bands.

[155] *See, e.g.,* http://shure.com/Americas/products/wireless systems (marketing information on, e.g., ULX-P, UHF-R, ULX-D, and Axient systems).

[156] See Section III.C.1.b (i).

[157] *See, e.g.*, *TV Bands Wireless Microphones Second R&O*, 29 FCC Rcd at 6107-6111 ¶¶ 10-22 (general discussion of the Commission's expansion of LPAS license eligibility in TV bands to include professional sound companies and large venues with sophisticated knowledge and capability of coordinating wireless microphone operations with broadcasters and other licensed LPAS operations).

licensed operations. We seek comment on this proposal. Alternatively, should the Commission expand eligibility to include a subset of these other TV bands LPAS licensees, or some other group of entities? If so, for what reasons?

141. Are there technical limitations and other considerations should we weigh when assessing expansion of licensee eligibility in this band? Would expansion have the effect of limiting the spectrum at particular locations available for use by broadcasters? Alternatively, would the likely operations of these LPAS wireless microphones by different users at different locations help ensure that the low power, short-range operations would not overlap or cause interference among LPAS operations? Considering the technical characteristics of the fixed Aural Broadcast Auxiliary (STL and ICR) stations, and noting that these fixed services currently share use of the band with LPAS operations, what additional safeguards, if any, would be needed to insure that these fixed Aural Broadcast Auxiliary stations are protected if additional, non-broadcast classes of users are added to the band?

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

142. *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. 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,[158] and fixed Aural Broadcast Auxiliary Services (STL and ICR) authorized under Part 74,[159] 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.[160]

143. *941-944 MHz band.* Most of this three megahertz – the two and a half megahertz between 941.5-944 MHz – is available for licensing for Private and Common Carrier Fixed Microwave Services. Broadcast auxiliary stations licensed prior to November 21, 1984 (including STL and ICR) may continue to operate in the 942-944 MHz band on a co-primary basis.[161] After applicants were given the opportunity to file applications and to resolve disputes over frequency pairs internally and then by lottery, subsequent licenses were obtained on a first-come-first-served-basis,[162] operating in different parts of this spectrum on channels that range from 25 kHz to 200 kHz in bandwidth. The Commission has issued approximately 820 licenses in this 941.5-944 MHz portion, where the vast majority are for Private Operational Fixed Point to Point Microwave Service,[163] with some for Aural Broadcast Auxiliary Service

[158] *See* Part 101, Subparts H & I.

[159] *See* Part 74, Subpart E.

[160] *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*).

[161] *See* 47 C.F.R. § 74.502(a). In addition, broadcast stations in Puerto Rico may continue to be authorized to operate aural broadcast auxiliary frequencies on a co-primary basis on certain frequencies in the 942-944 MHz band. *See* 47 C.F.R. § 74.502(a) n.1.

[162] *See* 47 C.F.R. § 101.101, fn.a (stating that after an initial one-week filing period for applications in the 941.5-944 MHz band, applications were to be processed on a daily first-come, first-served basis). Those applications that were found to be mutually exclusive in the initial filing window were given the opportunity to choose alternate frequency pairs or, if no alternates were available, to obtain a frequency pair by lottery. *See id.* at § 101.45(g).

[163] *See* Part 101, Subpart H. The private operational fixed microwave service includes business industrial and public safety microwave as well as site based MAS services. As of September 12, 2014, ULS records indicate that there are 712 private operational fixed microwave licenses in this band (ULS radio service codes "MG" and "MW" excluding site based MAS services that are licensed under the same radio service codes).

(including STL and ICR),[164] and a few for Common Carrier Fixed Point to Point Microwave Service.[165] Fixed point-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.

144. The other portion, the half megahertz between 941-941.5 MHz, is authorized for MAS operations. The MAS authorizations involve discrete portions of the 941-941.5 MHz band that is paired with spectrum in the 932-932.5 MHz band; more particularly, these paired blocks consist of thirty-six 12.5 kHz channel pairs (25 kHz total per pair) and one paired 50 kHz channel (100 kHz total per pair) in the 932.0-932.5 MHz and 941.0-941.5 MHz bands.[166] The Commission designated twenty of the thirty-six 12.5 kHz channel pairs in these bands for public safety and/or private internal use.[167] Five of these twenty are reserved for public safety services (as defined in Part 90),[168] and the other fifteen are available for both private internal and traditional public safety services.[169] With respect to the remaining channels consisting of sixteen 12.5 kHz paired channels and one 50 kHz paired channel (a total of 0.250 megahertz of spectrum in 941-941.5 MHz), the Commission has issued licenses on a geographic basis through a system of competitive bidding without any user restrictions, and these licensees are permitted to provide both fixed and mobile services on a co-primary basis.[170] The 941.0 -941.5 MHz portion of the band is designated for 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. The rules for MAS operations were adopted by the Commission in 1999.[171] 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 attempted to accommodate these past and present uses.[172] In the 941-941.5 MHz portion, there are 1,340 geographically-based MAS licenses[173] and 1,175 site-based MAS licenses.

145. *952-960 MHz band.* Similarly, most of this eight megahertz of spectrum – 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.[174]

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[164] *See* Part 74, Subpart E. The Aural Broadcast Auxiliary Service includes Aural Studio to Transmitter Links (STL) and Aural Intercity Relay Links (ICR). Aural Broadcast Auxiliary services are concentrated in the 942-944 MHz portion of the band. As of September 12, 2014, ULS records indicate that there are 66 Aural STL licenses and 24 Aural Intercity Relay licenses in this band (ULS radio service codes "AS" and "AI," respectively).

[165] *See* Part 101, Subpart I. As of September 12, 2014, ULS records indicate that there are nine common carrier fixed point to point licenses in this band (ULS radio service code "CF").

[166] *See MAS Report and Order*, 15 FCC Rcd 11956, 11959 n.1.

[167] *See id.* at 11968 ¶ 31.

[168] *See id.* at 11971 ¶ 37. These five channels are also shared with the Federal Government.

[169] *See id.*

[170] *See id.* at 11972 ¶ 40, 11976 ¶ 52, 11999 ¶ 103. The single 50 kHz channel was intended to provide more flexibility in developing non-traditional MAS services like Narrowband PCS. *See id.* at 11972 ¶ 40.

[171] *See id.*

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

[173] As of September 12, 2014, ULS records indicate that there are 1340 Market-Based MAS stations authorized on an EA basis in this band (ULS radio service code "MS").

[174] *See* Part 101, Subparts H & I.

The Commission has issued approximately 2,850 Private Operational Fixed Point to Point Microwave Service licenses authorizing operations in the 952-960 MHz band.[175]

146. The remaining portions of the band are authorized for MAS operations in three distinct portions, totaling 1.2 megahertz. Specifically, the MAS bands are divided into two groups with differing licensing and service characteristics. The first, commonly known as the 928/952/956 bands, include sixty-eight 12.5-kilohertz (kHz) channel pairs (25 kHz total per pair) in the 928-928.85 and 952-952.85 MHz bands (a total of 850 kilohertz in the 952-960 MHz band), and sixteen unpaired 12.5-kHz channels in the 956.25-956.45 MHz band (200 kHz total).[176] These bands are reserved for "private internal services," which are defined as those where licensees use their authorized frequencies purely for internal business purposes or public safety communications, and not for any for-hire (for-profit) or non-profit cost-shared application.[177] The Commission awarded licenses to these bands on a first-come, first-served, site-by-site basis.[178] The Commission has issued approximately 10,000 site-based MAS licenses in these bands.[179]

147. The second MAS band, commonly known as the 928/959 MHz bands, consists of twelve 12.5 kHz channel pairs (25 kHz total per pair) in the 928.85-929 and 959.85-960 MHz bands (300 kHz total) .[180] We licensed these bands on a geographic basis through a system of competitive bidding for use by for-profit CMRS and paging network incumbents.[181] There are 484 geographically-based MAS licenses and approximately 120 site-based MAS licenses in this band.[182] In addition, approximately 50 licenses permit Part 22 paging operations in the 959.85-960 MHz band on a grandfathered basis.[183]

148. In the *MAS Report and Order*, the Commission adopted flexible rules that permit licensees to conduct point-to-point and point-to-multipoint operations, and also to provide fixed or mobile services on a co-primary basis in the geographically licensed portions of the bands.[184] The *MAS Report and Order* also grandfathered incumbent operations in the 928/952/956 MHz bands, and permitted those operations to expand services subject to the Commission's rules on interference protection and co-channel spacing.[185] Although a system of geographic licenses using Economic Areas (EAs) awarded via auction now overlays the 928/959 bands and part of the 932/941 bands, we permitted incumbent licensees to remain in the in the 928/959 band indefinitely, but we did not permit any expansion of their services.[186]

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[175] The specific bands that are assigned for point-to-point use are the 952.95-956.15 MHz and 956.55-959.75MHz bands. As of September 12, 2014, ULS records indicate that there are 2,826 private operational fixed microwave licenses in this band. (ULS radio service code "MG" and "MW," excluding site based MAS services that are licensed under the same radio service codes).

[176] *See id.* at 11951 n.1.

[177] *See id.* at 11965 ¶ 20, 11966 ¶ 22.

[178] *See id.* at 11966 ¶ 23.

[179] As of September 12, 2014, ULS records indicate that there are 9,946 site-based MAS licenses in this band. (ULS radio service code "MG" and "MW").

[180] *See id.* at 11951 n.1, 11967 ¶ 26-27.

[181] *See id.* at 11951 n.1, 11974 ¶ 47.

[182] As of September 12, 2014, ULS records indicate that there are 484 geographically based MAS licenses (ULS radio service code "MS") and 117 site-based MAS licenses (ULS radio service code "MG" and "MW") in this band.

[183] *See* Part 22, Subpart E. As of September 12, 2014, ULS records indicate that there are 47 Paging and Radiotelephone Service licenses in this band (ULS radio service code "CD").

[184] *See id.* at 11999 ¶ 103.

[185] *See id.* at 11978 ¶ 58.

[186] *See id.* at 11978 ¶ 58, 11982 ¶ 68. The 932/941 bands were unlicensed at the time of the *MAS Report and Order*. *See id.* at 11964 ¶ 17.

The Commission expected that interference from these "grandfathered" operations would be minimal, given that they were subject to a co-channel mileage separation based on an assumed 25-mile service area.[187]

149. *Discussion*. We propose 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. We request that commenters provide information about the potential availability of unused spectrum in these bands at locations where wireless microphones are used, and the extent to which it is suitable and could effectively be used for wireless microphone operations. We seek comment on the particular rules that we should adopt to facilitate wireless microphone operations in this spectrum that would also ensure that incumbent operations are not harmed. We invite comment on the benefits of permitting such operations, as well as any specific concerns about how such operations might affect currently authorized users in these bands.

150. We first seek comment on whether there are potential benefits to making these bands available for wireless microphone operations to the same entities licensed for LPAS operations in the 944-952 MHz band. Considering the mix of services and licensees that currently operate in different segments in various portions of these bands, we seek comment on whether there nonetheless 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. We request that commenters supporting wireless microphone operations in these bands explain fully how access to the available spectrum in these bands would be important for accommodating wireless microphone needs in the coming years, both in the near and longer term. Would the fact that this spectrum is adjacent to the 944-952 MHz band make this spectrum particularly suitable or involve valuable synergies (e.g., same spectrum propagation, more readily available equipment, more efficient management of wireless microphone operations, etc.)? And would the types of uses suitable for these bands be the same as for the 944-952 MHz band discussed above?

151. Given that wireless microphones operate at low power over short distances, we believe they are not likely to cause interference to the types of fixed or mobile operations that operate at higher power in these bands. Thus, we believe that wireless microphones should be able to co-exist and share access to the spectrum in these bands with incumbent services on a secondary basis without causing harmful interference. We seek comment. As we consider this issue, we request comment on how we can design rules for wireless microphone operations in these bands to enable effective sharing. Would users of wireless microphones often seek to operate in locations that overlap with existing services, or would they operate in other places not served by those operations?

152. Considering the different services and service rules that apply to portions of these bands, we seek comment on permitting wireless microphone operations on each of these portions. With the mix of point-to-point and point-to-multipoint services already operating in these bands, are there specific sub-bands that would be more suitable than others for sharing with wireless microphones?

153. With respect to those portions of the spectrum available for licensing for fixed microwave services other than MAS, which constitutes the majority of the spectrum in these bands, how much spectrum is unused by these fixed services at locations that could be effectively used for wireless microphone operations? To what extent can potential wireless microphone users determine the availability of suitable spectrum at particular locations? What issues and factors should we take into account to make spectrum available for wireless microphone operations while protecting the incumbent fixed services that operate in these bands?

154. We similarly inquire about making the portions of the spectrum in these bands that are authorized for MAS operations also available for wireless microphone operations. For instance,

[187] *See id.* at 11978 ¶ 57.

considering that many MAS systems are used by utilities for Supervisory Control and Data Acquisition (SCADA) operations, we seek comment on whether these existing users operate in the same general geographic areas as wireless microphone users, or whether the wireless microphone operations would be separated geographically because these are different types of uses? Given the nature of MAS operations, how much spectrum is unused and available for wireless microphone operations? Are there practical considerations, including the fact that there is only a relatively small amount of spectrum in discrete segments potentially unused and available, that would make authorizing wireless microphone operations more problematic or less practical in these bands? If so, are there ways in which the Commission could effectively address these concerns? Would the spectrum associated with the geographic area MAS licenses be suitable for wireless microphones, and if so could wireless microphone operations be accommodated on this spectrum through leasing arrangements with the existing market-based licensees? What other factors should we consider when determining whether and how to permit wireless microphone operations in these MAS portions?

155. We also seek specific comment on designing rules that would be necessary to address any interference concerns with incumbent operations that could arise. If we were to authorize wireless microphone operations in these bands, to what extent are protections necessary to prevent harmful interference to incumbent operations from the low power, short-range wireless microphone operations? Would certain types of services, such as fixed microwave services, generally not be prone to interference? Would other types of operations be more susceptible to interference, such as certain MAS operations involving SCADA operations, and would those operations benefit from rules that would provide protection (e.g., rules to specify minimum separation distances or creation of protection zones)? What specific technical requirements or limitations should we place on wireless microphone operations in the bands? On frequencies licensed for SCADA operations that involve transmissions between master stations and outdoor remotes, should we place limitations on power levels used by wireless microphones or limit wireless microphones to indoor uses? We ask commenters to provide technical analyses to support their positions on these issues.

156. We ask that commenters propose any specific technical rules that would apply to wireless microphone operations in these bands. As indicated above, we propose permitting wireless microphones to operate under the 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)), which would include the ETSI standards that we propose to apply to such operations. We seek comment on this proposal, and whether these rules should apply in whole or in part with respect to these bands, or portions of these bands, and if not, why not? Commenters should explain and provide technical analyses on these issues. We also seek comment on the equipment issues that would pertain to wireless microphone operations in these bands, including the certification process. Commenters also should address any equipment issues pertaining to wireless microphone operations in these bands. What is the potential availability of equipment for operations in these bands? Realizing that it may depend on the particular rules, how long might it take for manufacturers to develop equipment that operates in these bands? Would the availability of devices operating in the adjacent 944-952 MHz band help speed development and distribution of these devices? To the extent that manufacturers may need to modify equipment designed for the 944-952 MHz band, or use equipment designed for use in other bands, what are the constraints on such modifications, and how long would it take to bring such modified equipment to market? As regards certification, should manufacturers be able to certificate equipment under the same rules and procedures for LPAS devices that operate in the 944-952 MHz band, or do they need to develop new equipment for these bands that would be certificated in a different manner?

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

157. 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. Earlier this year, the Commission consolidated the rules for the digitally modulated devices that

operate in the 5 GHz band under Section 15.407.[188] Wireless microphones are among the devices that operate on an unlicensed basis in these bands under these rules.

158. Wireless microphones operating in these bands pursuant to section 15.247, like other unlicensed devices operating under this rule, are required to operate as spread spectrum transmitters,[189] and are limited to frequency hopping systems and systems using digital modulation.[190] Digitally modulated systems must use a minimum bandwidth of 500 kHz but are not required to hop frequencies.[191] Both frequency hopping and digitally modulated systems are permitted to use output powers of up to 1 watt, however, most devices use lower power for various design reasons, such as conserving battery life. Spread spectrum modulation reduces the power density of the transmitted signal at any frequency, thereby reducing the possibility of causing interference to other signals occupying the same spectrum. Similarly, at the receiver end, the power density of interfering signals is minimized, making spread spectrum systems relatively immune to interference from outside sources.[192]

159. Wireless microphones operating in these bands pursuant to Section 15.249, as with any other unlicensed device operation, is permitted subject to the field strength limits specified in this section.[193] There are no requirements for devices operating under this provision to hop frequencies or use a minimum transmit bandwidth, and there are no maximum bandwidth or transmission duration limits.[194] Devices operating under this rule could be either analog or digital devices. Many types of devices operate under this rule section including cordless telephones, video transmitters, wireless speaker and headphone systems, and automated utility meter reading equipment.

160. Section 15.407 provides general technical requirements for unlicensed national information infrastructure (U-NII) devices that operate in the 5 GHz band. The recently revised Section 15.407 rules are intended to better ensure that unlicensed 5 GHz band devices do not cause harmful interference to authorized Federal and non-Federal users in these bands and to eliminate a loophole in the former rules that allowed devices to be certified under the Section 15.247 rules and then modified to operate as U-NII devices without complying with all of the technical requirements of the U-NII rules.[195]

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[188] *See* Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, *First Report and Order*, ET Docket 13-49, 29 FCC Rcd 4127 (2014).

[189] *See* 47 C.F.R. § 15.247.

[190] In frequency hopping systems, an information signal, usually a data stream, modulates a radio frequency carrier that is hopped among a number of frequencies in concert with a receiver.

[191] There is no maximum bandwidth limit for digitally modulated systems other than the requirement to stay within the designated bands of operation, and there is no limit on the duration of transmissions.

[192] *See, e.g.,* Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking,* ET Docket No. 03-201, 22 FCC Rcd 11383, 11386-87 ¶ 7 (2007).

[193] *See* 47 C.F.R. § 15.249. The 5.8 GHz band differs slightly between Sections 15.247 and Sections 15.249. Under Section 15.247, operation is permitted in the band 5725-5850 MHz, and under Section 15.249, operation is permitted in the 5725-5875 MHz band. The limit for transmitters in these bands is 50,000 microvolts per meter in-band, and 500 microvolts per meter out-of-band, measured at a distance of three meters. This in-band signal level is nearly 100 times lower than the maximum level permitted for spread spectrum transmitters.

[194] *See, e.g.,* Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking,* ET Docket No. 03-201, 22 FCC Rcd 11383, 11387 ¶ 8.

[195] Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, *First Report and Order*, ET Docket 13-49, 29 FCC Rcd 4127 (2014).

a. 902-928 MHz Band

161. *Background.* As discussed above, the Commission permits various devices, including devices that function as wireless microphones, to operate in the 902-928 MHz band on an unlicensed basis under the Commission's Part 15 rules.[196] The 902-928 MHz band is shared by a variety of licensed and unlicensed users operating pursuant to a hierarchy of spectrum usage rights. Specifically, the band is allocated for primary use by Industrial, Scientific and Medical (ISM) equipment and Federal Government radiolocation systems. Federal Government fixed and mobile services are secondary to both of these primary uses. Location and Monitoring Service (LMS) licensees are next in order of priority and may not cause interference to and must tolerate interference from all Federal Government uses and ISM devices. Amateur radio operations, in turn, are secondary to all Federal Government users and LMS licensees and must accept any interference caused by ISM equipment. Finally, unlicensed devices authorized under Part 15 are not entitled to interference protection from and may not cause harmful interference to any authorized services in the band.[197] Many types of unlicensed devices operate in this band, including cordless telephones, video transmitters, wireless speaker and headphone systems, and automated utility meter reading equipment. We note that several manufacturers have developed and marketed devices that serve wireless microphone needs.

162. *Discussion.* We seek to develop a full record on the current and potential uses of the 902-928 MHz band for various wireless microphone uses. We ask that commenters provide information on devices currently in the marketplace that serve such needs. To what extent are these devices digital, operating as spread spectrum devices under the technical rules set forth in Section 15.247, or analog or digital operating under Section 15.249 requirements? What specific types of applications are these devices best suited, and what are the limitations on the types of applications for which they may be used? To what extent can devices operating in this band address the needs, for instance, of non-professional users? We ask that commenters provide relevant technical data regarding performance features (e.g., with respect to latency, voice fidelity, etc.) that inform and may affect the suitability of these devices for particular types of applications. To what extent is the effectiveness of the applications dependent on the operating environment (e.g., outdoor or indoor uses)? Are wireless microphone users whose needs can effectively be addressed through devices that operate in this band migrating their operations from other bands, such as the TV bands, to this band? What are manufacturers and those marketing wireless microphone devices promoting use of devices that use this band?

163. Have there been technological advances that have improved the ability of these devices to co-exist and share use of the band with the other users that also have access to the band? If so, what types? What kinds of advancements might be anticipated in the future that could increase the use of this band for wireless microphone applications?

164. To the extent devices operating in this band are effective in meeting wireless microphone applications, should manufacturers and those marketing wireless microphones do more to promote use of devices that operate in this band, or to indicate that devices operating in this band may be effective in addressing their needs that historically have operated in the TV bands? What steps, if any, should the Commission take to promote more use of this band for wireless microphone applications?

b. 2.4 GHz Band

165. *Background.* The rules for unlicensed operations in the 2.4 GHz band also have enabled development and marketing of a variety of devices that serve different users' needs. These include wireless local area networks (WLANs), which may operate pursuant to different technological standards

[196] *See generally* 47 C.F.R. §§ 15.247; 15.249.

[197] *See* Modification of Parts 2 and 15 of the Commission's Rules for Unlicensed Devices and Equipment Approval, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 03-201, 22 FCC Rcd 11383, 11384-85 ¶ 5.

(e.g., IEEE 802.11b or 802.11g), cordless phones, wireless medical telemetry equipment, or Bluetooth devices. Several manufacturers have developed wireless microphone devices that use this spectrum as well, and market them for particular types of wireless microphone applications.[198]

166. *Discussion.* As with our discussion on the 902-928 MHz band above, we also seek to develop a full record on the current and potential uses of the 2.4 GHz band for various wireless microphone uses. We ask that commenters provide information on devices currently in the marketplace, and the extent are these devices digital, operating as spread spectrum devices under the technical rules set forth in Section 15.247, or analog or digital operating under Section 15.249 requirements. For what types of specific applications are 2.4 GHz wireless microphones best suited, and what limitations are associated with their use, including any that may result from the nature of signal propagation in the band. To what extent can devices operating in this band address the needs of non-professional users? As above, we ask that commenters provide relevant technical data regarding performance features (e.g., with respect to latency, voice fidelity, etc.) that inform and may affect the suitability of these devices for particular types of applications. What types of operating environment (e.g., outdoor or indoor uses) affect their effectiveness for specific applications? How are manufacturers and those marketing wireless microphone devices promoting use of devices that use this band?

167. We also ask that commenters discuss technological advances that have improved the ability of these devices to co-exist and share use of the band with the other users that operate in the band. Are advancements anticipated that could increase the use of this band for wireless microphone applications? Finally, to the extent devices operating in this band are effective in meeting wireless microphone applications, should more be done to promote use of devices that operate in this band?

c. 5 GHz Band

168. *Background.* Similarly, the rules for unlicensed operations in the 5 GHz band permit operations of a variety of devices in this band. These bands support numerous widespread wireless services, including Wi-Fi, Bluetooth, and cordless phones. Wireless broadband providers and cable operators increasingly rely on the 5 GHz bands to expand broadband services and deploy Wi-Fi networks to provide consumers with fast and reliable service. Currently, three sets of Wi-Fi standards are used for the 5-GHz U-NII bands, with each standard specifying different channel bandwidths and data rates.[199] Although the higher frequency wireless signals of 5 GHz networks may not penetrate solid objects and walls nearly as well as 2.4 GHz signals, the 5 GHz band offers higher throughput at a shorter distance and is less likely to be as congested as the 2.4 GHz band. Earlier this year, the Commission adopted and an order designed to increase the utility of the 5 GHz band for unlicensed devices.[200] Among other things, this decision removed certain restrictions on indoor operation, increased the permitted power, and extended the upper edge of the 5.725-5825 GHz band to 5.85 GHz.[201]

169. *Discussion.* We also ask that commenters provide information on the current and potential uses of this band for different types of wireless microphone operations. To what extent are

[198] These manufacturers include, for instance, Line6 and Shure, among many others.

[199] The 802.11a standard, which defines a 20-megahertz channel bandwidth with maximum data rate up to 54 Mbit/s, is an amendment to the original standard that was ratified in 1999. It was incorporated into the published IEEE 802.11-2007. The 802.11n standard specifies 20- and 40-megahertz channel bandwidths with maximum data rate from 54 Mbit/s to 600 Mbit/s. It is an amendment to the IEEE 802.11-2007 standard and was published in 2009. The 802.11ac standard is the newest standard. It specifies bandwidths of 20, 40, 80, and 160 megahertz with a link data rate of approximately 1 Gbit/s, and promises significant increases in bandwidth and data rates in the 5 GHz band.

[200] Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band, ET Docket 13-49, *First Report and Order*, 29 FCC Rcd 4127 (2014).

[201] *Id.*

devices that function as wireless microphones operating in this band today, and for what kinds of applications? Considering the available bandwidth, the propagation features associated with this spectrum, and other relevant factors, for what types of applications is this band well-suited? What types of users are most likely to make use of wireless microphones in this band? In what types of operational environments do these devices work best? Are there technological advances forthcoming that could create more opportunities for using this spectrum for wireless microphone applications? Should more be done to promote use of this band for wireless microphone applications?

7. 1920-1930 MHz Unlicensed PCS Band

170. *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.[202] 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.[203] 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.[204]

171. 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. 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.[205]

172. Devices operating in this band may use Digital Enhanced Cordless Telecommunications (DECT) technology, which comply 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 hundred meters. 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.[206] DECT technologies minimize interference and can be particularly effective for voice communications.

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[202] *See* 47 C.F.R. §§ 2.106, 15.301.

[203] *See* 47 C.F.R. §§ 15.303(a) and (d); § 15.323(a). UPCS systems may sub-divide the 2.5 megahertz emission bandwidth as long as the sub-divided emission bandwidth is greater than or equal to 50 kilohertz. Under the Part 15 rules, a UPCS channel is defined as the combined time and spectrum windows that a transmission is intended to occupy. 47 C.F.R. § 15.323(c). Spectrum window is defined as the amount of spectrum equal to the intended emission bandwidth in which operation is desired. 47 C.F.R. § 15.303(h).

[204] *See* 47 C.F.R. § 15.5(b).

[205] That threshold is 30 dB above the thermal noise power. *See* 47 C.F.R. § 15.323(c)(1)-(12). To prevent the monopolization of UPCS-band channels by one or more devices, the Commission's rules also include UPCS transmission time limits. *See* 47 C.F.R. § 15.323(c)(3). The access threshold, transmitter power limits, and transmission time limits are designed such that frequency and time reuse both within a system and between systems are possible for indoor operations. If access to the spectrum is not available and a minimum of 20 duplex system channels are defined and monitored, the time and spectrum windows with the lowest power level may be accessed. *See* 47 C.F.R. § 15.323(c)(5).

[206] *See generally* http://www.dect.org

173. While currently the major use of the 1920-1930 MHz band is for unlicensed cordless telephones that operate under Part 15 of the Commission's rules,[207] many manufacturers make wireless microphones using this spectrum.[208]

174. *Discussion.* We invite comment on the current and potential uses of the 1920-1930 MHz UPSC band for wireless microphone applications. We seek comment on current uses of the band for wireless microphones, including the types of purposes for which they are used as well as the types of venues in which they are used. How many microphones generally can be deployed at the same time in a particular area? To the extent that wireless microphones operating in this band may not be sufficient for high-end, professional broadcast, music, or theater uses, are there other types of uses for which they provide effective wireless microphone communications capabilities? What is the range of audio capabilities for wireless microphone devices that operate in this band under our rules? For instance, are there potential advances in technology, such as improvements in the digital protocol to better enable high quality audio? In sum, we invite comments generally on the types of applications for which wireless microphones using this band may be best suited. Should the Commission 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?

8. 1435-1525 MHz Band

175. *Background.* The 1435-1525 MHz band (1.4 GHz band) is shared by the Federal government and industry for aeronautical mobile telemetry (AMT) operations.[209] AMT systems are used for flight testing of manned and unmanned aircraft, missiles, and space vehicles, and associated communications such as range safety, chase aircraft, and weather data.[210] 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. While the DOD, NASA, and DOE assignments are distributed throughout the country, the majority are concentrated in California, Maryland, Florida, Nevada, and New Mexico. 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.[211] 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.[212]

176. In recent years, professional sound engineering companies responsible for major event productions have obtained Special Temporary Authority (STA) to operate wireless microphones and

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[207] *See* DECT Solutions at http://www.dect.org.

[208] Manufacturers include Shure (*see* http://www.shure.com/americas/products/conferencing-discussion/microflex-wireless-systems).

[209] As noted in US footnote 78, 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. Permissible usage includes telemetry associated with launching and reentry into the Earth's atmosphere as well as any incidental orbiting prior to reentry of manned objects undergoing flight tests. The following frequencies are shared with flight telemetry mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz.

[210] The band is used by DOD to support AMT in the flight testing of aircraft, spacecraft, and missiles at test ranges and test facilities.

[211] *See* 47 C.F.R. § 87.303(d).

[212] *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).

similar audio devices, along with video equipment, on a temporary basis (e.g., a few days or a week) to access this spectrum to supplement their access to other spectrum resources (primarily the TV bands) for coverage of sporting events (e.g., golf tournaments or NASCAR races) at specified locations around the country.[213] Generally, as these parties represent in their applications for individual STAs, the spectrum resources otherwise available to them at those locations are insufficient to enable them to provide the desired level of coverage for these scheduled events. Prior to grant of each STA, the applicants must demonstrate that they have fully coordinated their proposed spectrum use with AFTRCC.[214] The STAs provide 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.

177. *Discussion.* We propose, as one option, making the 1.4 GHz band spectrum available for use by wireless microphones on a secondary licensed basis, as detailed below, and seek comment. Because of the importance of ensuring that the AMT systems are protected against harmful interference, and given that most wireless microphone operations can be accommodated within other spectrum, we propose that use of this band be limited to licensed professional users at specified locations and times, and include specified safeguards designed to protect AMT use of the band. We seek comment on how and under what conditions this band can be shared, and on the types of applications best suited for this band.

178. Our proposal to allow wireless microphones to operate in this spectrum is based on several critical factors. We recognize that professional use for certain large events (e.g., major sports or theater productions) often involve use of more than 100 wireless microphones. Where these have previously operated in the TV bands, there is no assurance that sufficient spectrum will remain to accommodate this extent of use, nor is it certain that the other provisions for wireless microphones could accommodate such use. Limiting the licensing for these types of applications, which are typically associated with specific locations, should make sharing of the spectrum manageable. Although we would authorize such use on a secondary basis, in this instance we believe that frequency coordination with federal and non-federal users is critical and is consistent with the practice that already has been used for special temporary authority in this band, although on a more limited basis. In addition, we believe it is necessary to ensure that a mechanism must be established to ensure that wireless microphone systems marketed for use in this spectrum can only be operated after successful coordination, such as through an electronic key or other means. We also seek to ensure that any wireless microphones operating in this spectrum are spectrally efficient and frequency agile when sharing the spectrum. We discuss these topics in detail below. Where we ask general questions they should be viewed through the prism of these principles.

179. Generally, as we consider authorizing wireless microphone operations in the 1.4 GHz band on a secondary use basis, what issues should we consider when evaluating the compatibility of wireless microphone operations in the same band as AMT? What limitations might the Commission consider imposing to ensure that wireless microphone operations would not cause harmful interference to AMT?

180. To what extent is the 1.4 GHz spectrum suited for wireless microphone operations? What type of wireless microphone uses might be best suited to operate in this band, and what types of uses would be less well-suited or unsuitable? How would proponents of access to this spectrum plan to make use of the band for wireless microphone operations? What are the technical advantages and

[213] The particular STAs generally authorize the operation of video and audio feed equipment. *See, e.g.*, CP Communications STA for American Century Celebrity Golf Championship, Las Vegas, NV, July 14-23, 2013 (Call sign WG9XMC); Broadcast Sports, Inc., Belmont Stakes, Elmont, NY, June 2-9, 2014 (Call sign WH9XMB). These STAs were granted as experimental STAs.

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

disadvantages of using 1.4 GHz band spectrum for wireless microphone operations, in terms of signal propagation, types of operations that could be deployed, battery power, form factors, body absorption, or other aspects that would inform the types of wireless microphone uses to which the spectrum might be put?

181. We propose that wireless microphone operations be secondary, and thus must protect the primary AMT services that operate in the band. As we consider the appropriate framework for wireless microphone operations in the band, we note that the Commission already has permitted secondary, low power short-range devices to share use of another band where AMT operations were primary when in 2012 it authorized Medical Body Area Network (MBAN) devices to operate in the 2360-2390 MHz portions of the 2360-2400 MHz band.[215] In permitting MBAN devices to share access to that spectrum, the Commission was careful in developing rules that limited the locations where MBAN systems could operate and in designing a coordination process that would ensure that primary AMT operations would be protected from interference.[216]

182. As a general matter, we propose only limited use of the 1.4 GHz band for wireless microphone applications. While we seek 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, at the same time we are not proposing to open this particular band either for widespread or for itinerant uses throughout the nation. Given the paramount need to protect AMT operations, we are proposing only limited access for wireless microphone operations. In particular, we propose 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 numbers of microphones, e.g., 100 or more. In addition, we propose allowing operations at those locations only at specified times. We seek comment on these proposals.

183. Prior coordination with AFTRCC will be required. We seek to develop appropriate rules that will ensure through this process that wireless microphone operations will not cause interference to the primary AMT operations in the band. In particular, we seek comment on coordination mechanisms that can ensure that wireless microphone operations only occur at the locations and times where authorized through the coordination process, and would be effective in preventing the use of these devices at any other location or time without authorization.

184. As noted above, we authorized MBAN devices to operate on a secondary basis in the 2360-2390 MHz band provided that they registered the devices and followed a coordination framework. With regard to registration, 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.[217] The Commission codified certain coordination procedures as well. These begin 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.[218] The Commission also provided the frequency coordinators with significant flexibility to work out mutually agreeable coordination agreements and MBAN devices' operating parameters at particular locations. The Commission recognized that specific tools, such as electronic

[215] *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) (*MBANS First R&O*).

[216] *See id.*

[217] *MBANS 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").

[218] *MBANS 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.*

keys, could be useful to coordinators as they sought to achieve mutually agreeable coordination agreements, and required that MBAN devices cease transmission in the absence of a control message.[219] At the same time, the Commission did not codify requirements for an electronic key and relied on frequency coordinators to work out the MBAN operating parameters through their agreements as needed.[220] To what extent are the rules for MBAN operations appropriate with regard to permitting wireless microphone use in the 1.4 GHz band at specified locations, frequencies, and times, pursuant to specified operational parameters? We ask that commenters explain in detail the coordination procedures that they assert should apply with regard to operations in the 1.4 GHz band.

185. We also seek comment on the extent to which the Commission might prescribe particular tools to ensure that wireless microphones operate only at the locations and times authorized, and not anywhere else. For instance, we seek comment on requiring that the 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). What kind of technologies can achieve this purpose in an effective manner? If we were to adopt such a requirement, should the authorized operations be enabled only through permission granted by the FCC or an FCC-certified entity once AFTRCC has concurred with the particular wireless microphone operations? Are there other means of coordinating operations that would ensure that the microphones only operate where and when authorized? We seek comment on these proposals, including how an automatic mechanism might be included within design of a wireless microphone system. In addition, we invite 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.

186. In keeping with the types of wireless microphone operations that we envision for this band, we propose 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. We invite comment this proposal.

187. To the extent we decide to authorize wireless microphone operations in this band, we seek comment on the technical rules that would apply to devices that would use the band. Commenters should submit detailed discussions of recommendations for the applicable technical rules. In designing technical rules, what types of technical concerns should we consider and address to ensure that the primary AMT operations protected? We request detailed information about the type(s) of wireless microphone equipment that could use the band. What power levels and bandwidths should we permit for wireless microphones? To what extent should we permit certain devices already on the market today to access the band? Should the technical rules be the similar to wireless microphones that operate in other bands?

188. In particular, we seek comment on adopting the technical rules for LPAS device operations in the TV bands, as well as the ETSI standards that we are proposing to adopt for those devices. To what extent are some or all of these technical standards appropriate for wireless microphones operating in the 1.4 GHz band? We ask that commenters provide any relevant technical information supporting their positions.

189. To preserve maximum flexibility for wireless microphone operations in the band, should we consider requiring wireless microphones to have the capability of tuning across the band? We also seek comment on requiring wireless microphones that are designed to operate in the 1.4 GHz band to

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

[220] *MBANS 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").

have modular transmitting components that, if necessary, could be replaced to enhance frequency agility. How long would it take to develop devices that would operate consistent with the proposals we discussed above? Should there be an interim process for permitting wireless microphone operations in the band as any necessary new devices are being made? In addition, we invite comment on the certification process that should be employed.

190. Consistent with our proposal, we envision 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. We also request comment on any other regulatory or technical issues that would be relevant to our consideration of whether to authorize wireless microphone operations in the 1.4 GHz band. Commenters should provide detailed bases and explanations for their proposals and views.

9. 3.5 GHz Band

191. *Background.* In the *3.5 GHz Band FNPRM* adopted in April 2014, the Commission sought comment on a three-tiered authorization framework that would allow different types of users to access portions of the 3550-3650 MHz Band.[221] To the extent that the band was not being used by incumbent users (primary operations, including incumbent federal users and grandfathered Fixed Satellite Service earth stations) under the Incumbent Access tier, the Commission proposed making spectrum available through the Priority Access and General Authorized Access (GAA) tiers outside of the specified geographic exclusion zones.[222] The Commission also invited comment on whether to allow certain users ("Contained Access Users") to receive interference protection for their device operations within the confines of their facilities on a portion (up to 20 megahertz) of the frequencies included in the GAA tier.[223]

192. We note the comments have been filed in the 3.5 GHz band proceeding (GN Docket No. 12-354) on potential uses of this band by wireless microphone users. Shure indicated that the GAA tier, for instance, could potentially support certain wireless applications, and asserted that were the Commission to establish a class of "Contained Access Users" then indoor wireless microphone use should qualify for such access.[224]

193. *Discussion.* All of the issues regarding the policies and rules for operations in the 3.5 GHz proceeding will be decided in that proceeding, based on the record in that proceeding, and we are not seeking comment in this instant proceeding on those issues. Nonetheless, considering that we are seeking to develop a comprehensive understanding of the potential landscape for different types of wireless microphone operations in different bands, we seek general comment on whether and how wireless microphone operations potentially could be employed in the 3.5 GHz band to help accommodate particular needs of users. Without prejudging the specific rules that the Commission may adopt in the 3.5 GHz proceeding, we invite comment on any impact the proposed rules for the 3.5 GHz band would have on the broader aims of this proceeding. If 3.5 GHz spectrum were made available, how much of a wireless microphone operator's needs could potentially be accommodated in this band, for instance, given the propagation characteristics of the band? If operations were permitted in this band, to what extent might this band potentially serve as a supplement spectrum resource for certain types of uses? To the extent that rules for the 3.5 GHz band are adopted that can help meet wireless microphone users' needs, how long might it take for user equipment to be developed and available for use? To avoid a bifurcated

[221] *See generally* Amendment of the Commission's Rules with Regard to Commercial Operations in the 3350-3650 MHz Band, GN Docket No. 12-354, *Further Notice of Proposed Rulemaking*, 29 FCC Rcd 4273 (2014) (*3.5 GHz Band FNPRM*).

[222] *See generally id.*

[223] *Id.* at 4291-92 ¶¶ 58-61.

[224] Shure Comments (GN Docket No. 12-354) (filed July 14, 2014).

record on issues related to the 3.5 GHz band, we ask that commenters submit any comments on these issues in this docket as well as in the 3.5 GHz band proceeding.

10. 6875-7125 MHz Band

194. *Background.* The 6785-7125 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 stations) under Part 74 and cable television relay stations (CARS) under Part 78 of our Rules.[225] 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.[226] 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.[227] 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.[228] 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.[229] In 2011, the Commission also authorized Fixed Services (FS) fixed 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, to provide microwave backhaul services, subject to certain provisions designed to protect BAS and CARS mobile TV pickup station operations.[230] In particular, FS operations are authorized only in areas where BAS and CARS television pickup operations are not licensed,[231] and are not permitted to operate on two 25 megahertz channels in the middle of the band (channels at 6975-6700 MHz and 6700-7025 MHz) that are reserved nationwide specifically for BAS and CARS to accommodate TV pickup stations covering events that occur outside the license areas of local BAS and CARS operations.[232]

195. 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

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[225] *See generally*, 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*). BAS operations in the 7 GHz band are set forth in Part 74, Subpart F. *See* 47 C.F.R. §§ 74.600 *et seq*. CARS operations in the band are regulated pursuant to Part 78. *See* 47 C.F.R. § 78.18(a)(7).

[226] *See Wireless Backhaul R&O* at 11623-24 ¶¶ 17-18; *see also* 47 C.F.R. § 74.602(a) & 78.18(d).

[227] *See Wireless Backhaul R&O* at 11625 ¶ 24 & n.86 (citing 47 C.F.R. § 74.24).

[228] *Wireless Backhaul R&O* at 11620 ¶ 10.

[229] *Id.*

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

[231] While FS generally has co-primary stations, FS stations are not allowed to locate their paths within the service areas of any previously licensed co-channel TV pickup stations. *See Wireless Backhaul R&O* at 11625 ¶ 23, 11627 ¶ 28. Mobile or temporary fixed BAS and CARS ("TV pickup operations") move among different locations and are authorized to transmit program related material from the scenes of events; these use faster informal coordination procedures but occupy a secondary status vis-à-vis fixed BAS operations, and broadcasters in some markets have reserved portions of the 7 GHz spectrum for TV pick-up operations. *See id.* at 11623-24 ¶¶ 17-18.

[232] *See Wireless Backhaul R&O* at 11625-26 ¶ 24.

operation.[233] 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.[234] 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.[235]

196. There are approximately 5,600 licenses in the 7 GHz band. The majority of these, approximately 5,200, authorize Part 74 fixed BAS links (*e.g.*, Aural Studio to Transmitter Links, Aural Intercity Relay Links, TV Studio to Transmitter Links, and TV Intercity Relay Links).[236] The band also includes a mix of licensed Part 74 Television Boosters, Television Pickup operations, Local Television Transmission Service, and Part 78 fixed CARS links, as well as Part 101 FS (Private Operational Fixed Microwave systems, Common Carrier Microwave systems, Public Safety Microwave systems) links.[237]

197. *Discussion.* We propose to permit licensed wireless microphone operations on available channels in this band, on a secondary basis, for entities that are eligible to hold BAS or CARS licenses, and seek comment. Considering the existing fixed and mobile services in the band that currently operate in different portions of this band, and the likelihood of significant areas of unused spectrum throughout this band that potentially could be made available for relatively low power, short-range wireless microphone operations, we request comment on whether access to this spectrum could help accommodate certain types of wireless microphone applications without interfering with existing services. We also seek comment on the applicable rules that should apply, were we to decide to grant such authorization.

198. To what extent would access to the 7 GHz band help address needs of wireless microphone operators? Considering the propagation features or other factors associated with this spectrum, what types of wireless microphone applications may be well-suited for operations in this band? Given that BAS and CARS licensees already use the 7 GHz spectrum for certain types of video applications and programming production, would there be synergies in permitting wireless microphone operations that could supplement those existing applications? How much spectrum in the 7 GHz band may be potentially available at those kinds of locations, whether indoors or outdoors, where users may have need for wireless microphones?

199. What particular rules would facilitate wireless microphone operations in the band while also protecting existing services? Could we make spectrum in any part of the 7 GHz band available for wireless microphone operations on a secondary, non-interfering basis, under rules drawn from the LPAS technical rules for operations in the TV bands or on the 944-952 MHz band? To what extent would low power wireless microphone operations pose the potential of interfering with any of the current mix of fixed and mobile BAS services and private and commercial fixed microwave that operate in the band?

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[233] *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).

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

[235] *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).

[236] As of September 12, 2014, ULS records indicate that there are 3153 TV Studio to Transmitter Links, 1703 TV Intercity Relay Links and 242 TV Translator Relay stations in this band (ULS radio service codes "AS", "AI,", "TS" and "TI" respectively).

[237] As of September 12, 2014, ULS records indicate that there are 473 licenses in this mix of services (ULS radio service codes "TB", "TP", "CT", "MG, "MW" and "CF" respectively).

200. Alternatively, should we consider making certain portions of the 7 GHz band available for wireless microphone operations, both as a means to facilitate wireless microphone operations as well as to preclude any possibility of harmful interference to existing operations? For instance, are there certain 25-megahertz channels, or smaller-sized portions of such channels, that we should make available for wireless microphone operations, and if so, how much and where? Would some channels or portions of channels be preferable for wireless microphone operations? As noted above, while BAS and CARS are authorized to operate on the entire 25 megahertz in a channel, FS services may operate on 5, 8.33, and 25 megahertz channels. Are there opportunities for wireless microphone operations on portions of particular channels to the extent not being used by incumbent licensees at a given location? For instance, if an incumbent licensee were using only 5 or 8.33 megahertz channels, could wireless microphones operate on some balance of that 25-megahertz channel without interfering with existing services? Are there particular segments in the 7 GHz band that would be more suitable, such as the 25 megahertz segments that are currently reserved for BAS use nationwide? Are other channels or portions of channels more suitable, and if so should we take steps to restrict additional authorizations in that spectrum or otherwise open that spectrum for wireless microphone uses? If commenters have specific ideas about whether certain portions of the 7 GHz band should be made available, we ask that they submit a full discussion of which portions, and how that might affect any existing BAS, CARS, or FS authorized in those portions of the band.

201. To what extent should coordination of wireless microphone operations be required? Should we require formal or informal coordination of operations? We also seek comment on 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.[238]

202. We are proposing that any wireless microphone operations in these bands be licensed to entities eligible for BAS or CARS licensees. We generally would expect that these are the entities that may wish to operate wireless microphones in the band for some of their production-related services. We also believe that licensing wireless microphone operations to these entities would help address interference or coordination concerns that may arise when making use of the 7 GHz band spectrum. We seek comment on this proposal. We also invite comment on alternative proposals.

203. We also invite comment on the technical rules that would apply to wireless microphone operations in the band. In particular, we seek comment on whether the technical rules should be modeled on those that apply to LPAS operations, including the ETSI standards that we are proposing. We ask that commenters provide information on any proposed rules and the rationale for adopting such rules. Commenters should also address any potential interference concerns that could arise. If we were to allow wireless microphone operations in the band, would any incumbent operations need geographic exclusion zones? Apart from exclusion zones, is there interference criteria that could facilitate sharing? What OOBE limits would be appropriate to protect incumbent services in the bands directly adjacent to wireless microphone operations? Considering the propagation characteristics in the 7 GHz band and recognizing that operation in this band typically requires line of sight between the transmitter and receiver, would limiting wireless microphones to indoor use create greater sharing possibilities? We ask commenters to provide technical analyses to support their position on these issues.

204. In addition, we seek comment on equipment availability for wireless microphones in these bands. Does wireless microphone equipment already exist for these bands? How much time would manufacturers need to develop new equipment for these bands?

[238] *See Wireless Backhaul R&O*, 26 FCC Rcd at11622-23 ¶ 15.

11. Ultra-wideband

205. *Background.* The Commission's rules for ultra-wideband (UWB) unlicensed devices are set forth in Part 15, subpart F.[239] 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. 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.[240]

206. 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.[241] 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.[242] We note that at least one wireless microphone manufacturer has developed and markets wireless microphones that operate under these rules.[243]

207. *Discussion.* We seek comment on the current and potential uses of UWB devices for wireless microphone applications. Recognizing that UWB operates across a number of frequencies, we ask commenters to discuss the ways in which UWB devices could be used effectively for wireless microphone uses. Are there particular uses for which wireless microphones operating under UWB rules are well suited, such as indoor and/or short-range operations? What are the benefits and constraints associated with the UWB rules, including the wide bandwidths associated with operations and the propagation aspects related to operating in these high frequency bands? Are manufacturers promoting the use of UWB wireless microphones for particular applications? Finally, we invite comment regarding steps that the Commission should take to facilitate use of UWB devices for wireless microphone uses.

12. Other potential bands

208. In this section, we invite comment on whether there are other bands not currently available for wireless microphone operations that may be useful in helping their use. We seek comment on bands that might offer opportunities both in the nearer term and over the longer term.

209. For instance, 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.[244] PISC argued that, as a result of the Commission's proposal to license the 2175-2180 MHz band on an unpaired basis, the 2020-2025 MHz band could be allocated for wireless microphones on a primary basis and free of white space devices and interference.[245] Would this band be suitable for wireless microphone use? If so, we ask that commenters address the technical suitability of this five megahertz band, the potential equipment availability, and other issues that would have to be addressed. We also ask commenters to address how a decision to permit wireless microphones to operate in the 2020-2025 MHz band would

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[239] 47 C.F.R. §§ 15.501 *et seq.*

[240] *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).

[241] *See id.* at 7436-38 ¶¶ 1, 5.

[242] *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).

[243] AudioTechnica has developed wireless microphones that operate under the UWB rules.

[244] Public Interest Spectrum Coalition (PISC) Petition for Rulemaking to Create a General Wireless Microphone Service (GWMS) (filed July 16, 2008) at 33.

[245] *Id.* at 33.

impact or be affected by the Commission's earlier decision to allocate those five megahertz for non-federal fixed and mobile service.

210. To the extent that commenters propose additional bands for consideration, we ask that they provide a full explanation for the proposal. In particular, we seek comment on the ways in which the band or bands could be helpful in accommodating wireless microphone operations while advancing the Commission's spectrum management goals, including promoting efficient use of spectrum.

IV. PROCEDURAL MATTERS

A. Paperwork Reduction Analysis

211. This Notice of Proposed Rulemaking contains proposed new information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and OMB to comment on the proposed information collection requirements contained in this document, as required by the PRA. In addition, pursuant to the Small Business Paperwork Relief Act, we seek specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

B. Initial Regulatory Flexibility Analysis

212. As required by the RFA, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the policies and rules proposed in the Notice of Proposed Rulemaking. The analysis is found in Appendix B. We request written public comment on the analysis. Comments must be filed in accordance with the same deadlines as comments filed in response to the Notice, and must have a separate and distinct heading designating them as responses to the IRFA. The Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, will send a copy of this Report and Order and Further Notice of Proposed Rulemaking, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.

C. Congressional Review Act

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

D. Other Procedural Matters

1. *Ex Parte* Presentations

214. This proceeding shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules.[246] Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of

[246] 47 C.F.R. §§ 1.1200 *et seq.*

electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

2. Comment Filing Procedures

215. Pursuant to sections 1.415 and 1.419 of the Commission's rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: http://fjallfoss.fcc.gov/ecfs2/.

- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

  Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

  - All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12th St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.

  - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.

  - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12th Street, SW, Washington DC 20554.

216. People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

217. *Availability of Documents*. Comments, reply comments, and ex parte submissions will be publically available online via ECFS.[247] These documents will also be available for public inspection during regular business hours in the FCC Reference Information Center, which is located in Room CY-A257 at FCC Headquarters, 445 12th Street, SW, Washington, DC 20554. The Reference Information Center is open to the public Monday through Thursday from 8:00 a.m. to 4:30 p.m. and Friday from 8:00 a.m. to 11:30 a.m.

218. *Additional Information*. For additional information on this proceeding, contact Paul Murray, Office of Engineering and Technology, Paul.Murray@fcc.gov (202) 418-0688, or Chad Breckinridge, Wireless Telecommunications Bureau, Chad.Breckinridge@fcc.gov (202) 418-2035.

[247] Documents will generally be available electronically in ASCII, Microsoft Word, and/or Adobe Acrobat.

V. ORDERING CLAUSES

219. IT IS ORDERED that pursuant to Sections 1, 4(i), 7(a), 301, 303(f), 303(g), 303(r), 307(e) and 332 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 151, 154(i), 157(a), 301, 303(f), 303(g), 303(r), 307(e), and 332, this Notice of Proposed Rule Making IS ADOPTED.

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

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A

Proposed Rules

The Federal Communications Commission proposes to amend 47 C.F.R. Part 74 as follows:

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

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

2. Section 74.801 is amended by adding the following definition:

Repurposed 600 MHz Band. Frequencies that will be reallocated and reassigned for part 27 600 MHz Band services as determined by the outcome of the auction conducted pursuant to *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order*, GN Docket No. 12-268 (FCC 14-50) (rel. June 2, 2014).

3. Section 74.832 is amended to read as follows:

§ 74.832 Licensing Requirements and procedures

* * * * *

(d) Cable television operations, motion picture and television program producers, large venue owners or operators, and professional sound companies may be authorized to operate low power auxiliary stations in the bands allocated for TV broadcasting and in the 944-952 MHz band.

* * * * *

4. Section 74.851 is amended to replace the section title, to revise subsection (i), and to add subsections (j), (k) and (l), 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 (FCC 14-50) (rel. June 2, 2014), certification may no longer be obtained for low power auxiliary stations or wireless video assist devices that are capable of operating in the repurposed 600 MHz band as defined in § 74.801.

(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 (FCC 14-50) (rel. June 2, 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 repurposed 600 MHz band as defined in § 74.801. 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 (FCC 14-50) (rel. June 2, 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 repurposed 600 MHz band as defined in § 74.801, 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 U.S.

(l) Any person, whether such person is a wholesaler or a retailer, who manufactures, sells, leases, or offers for sale or lease low power auxiliary stations or wireless video assist devices that operate in the

repurposed 600 MHz band is subject to the disclosure requirements in §15.216 of this chapter.

* * * * *

5. Section 74.861 is amended to add subsections (d)(4) and (e)(7) to read as follows:

§ 74.861 Technical Requirements

* * * * *

(d) * * *

6. Effective as of [___], emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3 of ETSI EN 300 422-1, *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.*

* * * * *

(e) * * *

7. Effective as of [___], emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in Section 8.3 of ETSI EN 300 422-1, *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.*

APPENDIX B

Initial Regulatory Flexibility Analysis

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

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

2. This proceeding is initiated to explore additional steps we can take to accommodate the needs of wireless microphone users over the coming years by ensuring that they have access to available spectrum resources that they need.[4] Wireless microphones play an essential role in enabling broadcasters and other video programming networks to serve consumers, including helping to cover breaking news and broadcasting live sports events. They are used to significantly 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 have become integral to creating high quality content that consumers demand and value, and as part of that content production process contribute substantially to our economy.[5] Recent actions by the Commission, and in particular 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[6]and we see an urgent need to assess new options for wireless microphone users going forward.

3. Wireless microphone users rely heavily on access to unused channels in the television band to provide their important services. 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. In taking 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 – the Commission also recognized that the reduction of total available UHF band spectrum will require

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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* 5 U.S.C. § 603(a).

[3] *See id.*

[4] *See* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order* (FCC 14-50), 29 FCC Rcd 6567, 6704 ¶ 316 (adopted May 15, 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). When we use the term "wireless microphones" in this proceeding, we collectively refer to wireless microphones and related audio devices.

[5] *See, e.g.*, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order* (FCC 14-50), 29 FCC Rcd 6567, 6696 ¶ 300 (adopted May 15, 2014) (*Incentive Auction R&O*).

[6] *See generally* Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268, *Report and Order* (FCC 14-50), 29 FCC Rcd 6696-6704 ¶¶ 299-316; 6844 -6847 ¶¶ 682-688, (adopted May 15, 2014) (*Incentive Auction R&O*).

many wireless microphone users to make adjustments over the next few years regarding the spectrum that they access and the equipment they use.[7] To help ensure that wireless microphone users could make these adjustments, the Commission provided that users could continue to access spectrum repurposed for wireless services for a substantial period of time as they transition affected services to alternative spectrum.[8] The Commission promised to initiate this proceeding to explore steps that it can take to address wireless microphone users' longer term needs, including accessing spectrum resources in additional frequency bands.[9]

B. Legal Basis

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

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

5. 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.[10] The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[11] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[12] 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.[13]

6. **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.[14] First, nationwide, there are a total of 28.2 million small businesses, according to the SBA.[15] 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."[16] Nationwide, as of 2012, there were approximately 2,300,000 small organizations.[17] Finally, the term "small governmental jurisdiction" is defined generally as "governments of cities, towns, townships, villages, school districts, or special districts, with a population

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[7] *See Incentive Auction R&O*, 29 FCC Rcd at 6567 ¶¶ 299-315.

[8] *See Incentive Auction R&O*, 29 FCC Rcd at 6567 ¶¶ 682-688.

[9] *Incentive Auction R&O*, 29 FCC Rcd at 6567 ¶ 316.

[10] 5 U.S.C. § 603(b)(3).

[11] 5 U.S.C. § 601(6).

[12] 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).

[13] Small Business Act, 15 U.S.C. § 632 (1996).

[14] *See* 5 U.S.C. §§ 601(3)–(6).

[15] *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).

[16] 5 U.S.C. § 601(4).

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

of less than fifty thousand."[18] Census Bureau data for 2012 indicate that there were 90,056 local governments in the United States.[19] Thus, we estimate that most governmental jurisdictions are small.

7. **LPAS Licensees.** 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.[20] Existing LPAS operations are intended for uses such as wireless microphones, cue and control communications, and synchronization of TV camera signals. These low power auxiliary stations transmit over distances of approximately 100 meters.[21]

8. **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."[22] 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.[23] According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for the entire year.[24] Of this total, 912 establishments had employment of less than 500, and an additional 10 establishments had employment of 500 to 999.[25] Thus, under this size standard, the majority of firms can be considered small.

9. **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)."[26] The SBA has developed a small business size standard for Other Communications Equipment Manufacturing, which is: all such firms having 750 or fewer employees.[27] According to Census Bureau data for 2007, there were a

[18] 5 U.S.C. § 601(5).

[19] 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).

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

[21] 47 C.F.R. § 74.801.

[22] 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).

[23] 13 C.F.R. § 121.201, NAICS code 334220.

[24] 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.

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

[26] 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).

[27] 13 C.F.R. § 121.201, NAICS code 334290.

total of 452 establishments in this category that operated for the entire year.[28] Of this total, 448 establishments had employment below 500, and an additional 4 establishments had employment of 500 to 999.[29] Thus, under this size standard, the majority of firms can be considered small.

10. **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."[30] The SBA has created the following small business size standard for Television Broadcasting firms: those having $38.5 million or less in annual receipts.[31] The Commission has estimated the number of licensed commercial television stations to be 1,388.[32] 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.[33] We therefore estimate that the majority of commercial television broadcasters are small entities.

11. We note, however, that in assessing whether a business concern qualifies as small under the above definition, business (control) affiliations must be included.[34] 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.

12. In addition, the Commission has estimated the number of licensed noncommercial educational (NCE) television stations to be 396.[35] These stations are non-profit, and therefore considered to be small entities.[36]

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[28] 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.

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

[30] 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).

[31] 13 C.F.R. § 121.201 (NAICS code 515120) (updated for inflation in 2010).

[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.

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

[34] "[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).

[35] *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.

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

13. There are also 2,414 low power television stations, including Class A stations and 4,046 television translator stations.[37] 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.

14. **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."[38] The SBA has developed a small business size standard for this category, which is: all such firms having 1,500 or fewer employees.[39] Census data for 2007 shows that there were 3,188 firms that operated for the duration of that year.[40] 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.

15. **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.[41] Industry data indicate that of approximately 1,100 cable operators nationwide, all but ten are small under this size standard.[42] In addition, under the Commission's rules, a "small system" is a cable system serving 15,000 or fewer subscribers.[43] Current Commission records show 4,945 cable systems nationwide.[44] 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.

16. **Cable System Operators.** The Communications Act of 1934, as amended, also contains a size standard for small cable system operators, which is "a cable operator that, directly or through an affiliate, serves in the aggregate fewer than 1 percent of all subscribers in the United States and is not affiliated with any entity or entities whose gross annual revenues in the aggregate exceed

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[37] *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.

[38] 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).

[39] 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.

[40] *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).

[41] 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).

[42] 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).

[43] 47 C.F.R. § 76.901(c).

[44] 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.

$250,000,000."[45] 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.[46] Industry data indicate that of approximately 1,100 cable operators nationwide, all but ten are small under this size standard.[47] 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,[48] and therefore we are unable to estimate more accurately the number of cable system operators that would qualify as small under this size standard.

17. **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,[49] 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.[50] 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.[51] 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).[52] Each currently offers subscription services. DIRECTV[53] and EchoStar[54] 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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[45] 47 U.S.C. § 543(m)(2); *see* 47 C.F.R. § 76.901(f) & nn. 1-3.

[46] 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).

[47] 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.

[48] 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).

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

[50] *Id*.

[51] *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.

[52] *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*").

[53] 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.

[54] 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.

18. **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.[55] 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.[56] Based on U.S. Census data for 2007, a total of 659 establishments operated for the entire year.[57] 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.

19. **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."[58] 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.[59] 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.[60] Thus, under that size standard, the majority of firms can be considered small.

20. **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.[61] 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.[62] Thus, under the applicable size standard, a majority of manufacturers of audio and video equipment may be considered small.

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[55] 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).

[56] *See* 13 C.F. R § 121.201 (NAICS code 515210).

[57] *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.

[58] 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).

[59] 13 C.F.R § 121.201 (NAICS code 334220).

[60] *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.

[61] 13 CFR § 121.201 (NAICS code 334310).

[62] *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.

21. **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."[63] 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.[64] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[65] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[66] 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.[67] Of these, an estimated 261 have 1,500 or fewer employees and 152 have more than 1,500 employees.[68] 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.

22. **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."69 The SBA has developed the small business size standard for this category as firms having 750 or fewer employees.[70] According to Census Bureau data for 2007, there were a total of 939 establishments in this category that operated for the entire year.[71] 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.

23. **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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[63] 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).

[64] 13 C.F.R. § 121.201 (NAICS code 517210).

[65] 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.

[66] *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.

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

[68] *See id*.

[69] 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).

[70] 13 C.F.R § 121.201 (NAICS code 334220).

[71] 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.[72] 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").[73] 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.[74] For this category, census data for 2007 show that there were 1,383 firms that operated for the entire year.[75] Of this total, 1,368 firms had employment of 999 or fewer employees and 15 had employment of 1000 employees or more.[76] 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.

24. 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.

25. **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."[77] 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.[78] Census data for 2007 show that there were 9,478 establishments that operated that year.[79] 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.[80] Thus, under this size standard, the majority of such businesses can be considered small entities.

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[72] 47 C.F.R. Part 95.

[73] 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.

[74] 13 C.F.R. § 121.201 (NAICS Code 517210).

[75] 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.

[76] *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.

[77] 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).

[78] 13 C.F.R § 121.201, 2012 NAICS code 512110.

[79] 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.

[80] *See id*.

26. **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.[81] Business concerns included in this industry are those "primarily engaged in broadcasting aural programs by radio to the public."[82] 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[83] 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.

27. 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.

28. **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."[84] 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.[85] According to Census Bureau data for 2007, there were 11,358 firms in this category that operated for the entire year.[86] 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.[87] Thus, the majority of firms in this category can be considered small.

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[81] 13 C.F.R § 121.201, 2012 NAICS code 515112.

[82] 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).

[83] *See* n.14.

[84] 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).

[85] 13 C.F.R. § 121.201, NAICS code 443142.

[86] 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.*

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

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

29. *Use of databases.* The NPRM seeks comment on the use of use of databases. Wireless microphone technologies today do not use a database as a mechanism for indicating to the wireless microphone user that particular frequencies in a particular area were available, such as at particular locations that were not being used by other users with priority over the wireless microphone users. White space devices operating in the TV bands must access a database to determine that spectrum is available for their operations and that they would not potentially be interfering with other users at specified locations and times.[88] Would wireless microphone systems potentially benefit from the ability to access to a database? Could requiring use of a database for gaining access to spectrum in a particular band or identifying particular locations and times where they may operate without causing interference to other users in the band help to mitigate or eliminate the concerns of other users in the band that wireless microphone operations might cause harmful interference to these other users? What might be the costs and benefits of developing and using a database, and would these differ depending on the needs of particular types of wireless microphone users?

30. *Use of other technologies that promote opportunities to access additional spectrum.* We seek comment on other technological advancements that could promote greater opportunities for wireless microphones to share use of spectrum in different bands.

31. Are there technological advances that are currently available or contemplated that better enable wireless microphones to adjust dynamically to a particular interference environment, either automatically or through coordination, to promote more efficient use among the wireless microphones or among wireless microphones and other users in the band? For instance, could devices that include sophisticated dynamic power variability capabilities help promote more intensive use of the spectrum resource in a given area? Would these more dynamic capabilities enable wireless microphones to vary or adjust power levels to minimize or eliminate interference to other users in a particular setting, or facilitate more re-use of the available spectrum? We invite comment on whether technological advances along these lines could both facilitate more efficient use of the spectrum while also helping to ensure that they do not cause harmful interference to other users of the spectrum.

32. Are there particular technologies, such as an "electronic key" or similar mechanism, that would ensure that a wireless microphone device be able to access and operate only on particular frequencies at particular locations and times, but nowhere else, thus eliminating the potential for harmful interference to other users (such as other users with primary or superior spectrum rights are particularly sensitive to harmful interference) and by so doing provide additional opportunities for wireless microphone operations in bands?[89] Are there other approaches that would effectively limit wireless microphone operation to particular locations, thus protecting other operators from harmful interference? We seek broad comment on the development and use of these types of mechanisms and the tradeoffs or practicalities associated with them. Are there particular scenarios or bands in which use of these mechanisms could provide additional opportunities to access spectrum?

33. *Other technological advances.* Are there other technological advancements that could help to ensure that the various different wireless microphone users' needs are accommodated over the longer term? What are they? Are there actions the Commission should take to promote these developments so that they occur in a timely fashion?

34. In this proceeding, we invite 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 invite comment on revisions to the technical

[88] 47 C.F.R. § 15.711(b)(3).

[89] See Section III.C.8, above (discussion of use of an electronic key when accessing the 1.4 GHz band).

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.

35. *Consumer Education and Outreach.* We seek comment on the consumer education and outreach efforts that should be employed to educate wireless microphone users, particularly unlicensed users operating in the repurposed 600 MHz band. Our goals are to make information available so users are aware that they must cease operating their wireless microphones on the repurposed 600 MHz Band 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. A successful consumer education and outreach campaign will involve the Commission staff working with a broad group of interested entities, including wireless microphone manufacturers, wireless microphones users, and user representatives.

36. Given that a portion of the UHF spectrum that is currently used and available for wireless microphone operations may no longer be available following the incentive auction,[90] we seek comment on how wireless microphone users can be provided access to information on the specific frequencies and the geographic areas of repurposed spectrum that will no longer be available for wireless microphone use at the end of the transition. 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? Although the *Channel Reassignment PN* will provide information on the spectrum that will be repurposed and no longer available for wireless microphones,[91] we first seek comment on what steps can be taken to provide wireless microphone users with information on the transition prior to the auction. For example, we seek comment on whether explanations could be provided on the Commission's website and on the websites of manufacturers that would explain the steps required under the Commission's rules to vacate the repurposed 600 MHz Band, and any information on alternative spectrum that is currently available outside of this spectrum, as well any additional spectrum bands that may become available for wireless microphone operations beyond those already provided for in the rules.[92]

37. What other means should be employed to provide wireless microphone users notice of the repurposed spectrum that will be assigned to new wireless licensees, including the specific frequencies in the UHF spectrum and the geographic locations that will no longer be available for wireless microphone operations? We seek comment on whether it would it be beneficial for wireless microphone users to have access to a database that identifies spectrum in the repurposed 600 MHz Band. For example, should some form of online mapping tool be made available to allow users to enter the location and operating frequencies of a wireless microphone and determine whether it operates in the repurposed 600 MHz Band? In the event that a database or similar approach is adopted, we seek comment on who should be responsible for developing and maintaining (hosting) it, including who should be responsible for its cost. Commenters should provide quantitative and qualitative data on costs and benefits of their proposals.

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[90] *Incentive Auction R&O*, 29 FCC Rcd 6704-05 ¶ 316.

[91] In addition to initiating the 39-month transition period, the *Channel Reassignment PN* will identify the new channel assignments for full power and Class A television stations that have been reassigned to different channels resulting from the incentive auction and the repacking process. *See Incentive Auction R&O*, 29 FCC Rcd at 6782 ¶ 525.

[92] Elsewhere in this Notice, we seek comment on whether a number of other spectrum bands should be allocated for wireless microphone use. See Sections III.C.5, III.C.8, and III C.10, above.

38. Further, should the Commission work with wireless microphone manufacturers to obtain information on models of wireless microphones that the Commission could list on its website? For example, this information could include a list all models of wireless microphones sold in the U.S., and all wireless microphone models that operate in the repurposed 600 MHz Band, as well as where on the device or in its product literature the user could look to determine the frequencies on which it is capable of operating.[93] We seek comment on whether making this type of information publically available would help to facilitate a smooth transition from the 600 MHz Band.

39. In addition to steps that may involve manufacturers, we seek comment on what steps other parties associated with the sale and operation of wireless microphones may be able to take to provide users with information relevant to the transition. These other parties may include: wireless microphone distributors and retailers; parties that lease or manage wireless microphones; trade associations and user groups, including those that have participated in Commission proceedings concerning wireless microphones; organizations that host websites and publish information that addresses wireless microphone operations and use or are reasonably expected to have significant numbers of wireless microphone users among their members and readers; and engineering and industry associations or other groups with members that use or operate wireless microphones. Involvement in education and outreach by these parties will be essential, given users' investment in wireless microphone equipment and the upcoming changes regarding wireless microphone use, including the requirement that they vacate the 600 MHz Band. Further, it is important that education and outreach extend to information concerning any newly-allocated spectrum for wireless microphone operations and the potential for users to opt for a suite of wireless microphones operating in different spectrum bands and with different capabilities, depending on the user's specific requirements. We note that wireless microphone users can encompass a wide range of entities, including both licensed and unlicensed users, and parties with differing levels of wireless microphone needs and expertise covering many different applications. Based on these considerations, it is likely that the need for information on the various spectrum bands that will be available for wireless microphone operations, and the conditions specific to each, will be vital. We seek comment on these matters, and on what steps can be taken to assure that the information to educate users on the transition will be commensurate with the appropriate needs and levels of expertise of all users.

40. We seek 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. We further seek comment on how to release or distribute these materials in order to most effectively and efficiently reach the target audience of wireless microphone users.

41. We seek comment on the specific 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 seek comment on whether and to what extent these entities can make this type of information available, including, as appropriate, by posting it on their websites, including it in all sales literature, or taking other steps to inform current or potential wireless microphone users of matters concerning the operation of their

[93] As part of the transition of wireless microphones from the 700 MHz band, the Commission made available a list of many wireless microphones that operated on the 700 MHz band, as provided by a number of manufacturers. *See* http://www.fcc.gov/encyclopedia/wireless-microphones-manufacturers-equipment-list. Wireless microphone users could look at this information and determine if their devices were 700 MHz wireless microphones and thus could not be used after the transition deadline, or given information to contact the Commission for additional assistance if the manufacturer of their devices was not listed.

devices. We also seek comment on whether manufacturers would consider rebates, equipment trade-ins, or similar programs to facilitate the transition, and what effect the 39-month transition period would have on a decision to implement such a program. In addition, we seek comment on the economic costs and benefits of adopting consumer outreach measures.

42. *Disclosure Requirements.* We propose to revise our point-of-sale disclosure requirement that the Commission adopted in the *Wireless Microphone Report and Order* 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. 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).[94] 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.[95] 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.[96]

43. We propose to revise the existing point-of-sale disclosure requirement in order to facilitate a smoother transition in which wireless microphone users are informed of the need to vacate the repurposed 600 MHz Band, while fully understanding their rights and obligations during the transition period and at the end of the transition period. With regard to sales of wireless microphones that are capable of operating in repurposed spectrum, we propose 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 seek comment on how point-of-sale disclosures could be designed to effectively address any ban on manufacturing and marketing of wireless microphones that are

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[94] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 687-691 ¶¶ 91-106.

[95] *See TV Bands Wireless Microphone R&O*, 25 FCC Rcd at 688-689 ¶ 96; 47 C.F.R. § 15.216. The required disclosure states: "Most users do not need a license to operate this wireless microphone system. Nevertheless, operating this microphone system without a license is subject to certain restrictions: The system may not cause harmful interference; it must operate at a low power level (not in excess of 50 milliwatts); and it has no protection from interference received from any other device. Purchasers should also be aware that the FCC is currently evaluating use of wireless microphone systems, and these rules are subject to change. For more information, call the FCC at 1-888-CALL-FCC (TTY: 1-888-TELL-FCC) or visit the FCC's wireless microphone Web site at http://www.fcc.gov/cgb/wirelessmicrophones." *See* 47 C.F.R. § 15.216, Appendix. The Commission noted that manufacturers and distributors could satisfy the disclosure requirement in more than one way, including by displaying the text in a prominent manner on the product box via a label or sticker; displaying the text immediately adjacent to the device in a manner clearly associated with the device; and, for wireless microphones offered online or via direct mail or catalog, displaying the text in close proximity to the images and descriptions of each wireless microphone. *See TV Bands Wireless Microphones Report and Order*, 25 FCC Rcd at 689 ¶ 100.

[96] *See TV Bands Wireless Microphones R&O*, 25 FCC Rcd at 666 ¶ 43; *see also* 47 C.F.R. § 74.851(h). In the *TV Bands Wireless Microphones Further Notice*, the Commission also sought comment on whether to adopt labeling and other marketing restrictions to help ensure that devices certificated as low power auxiliary stations under Part 74 were marketed only to parties eligible for a Part 74 license. In particular, the Commission sought comment on whether to require manufacturers to direct marketing of Part 74-certificated devices only to parties eligible to operate them; whether to require manufacturers to track the parties to whom their products are marketed; whether to require manufacturers to provide a label visible at the time of purchase or instructions in the user manual advising purchasers of the requirement to obtain a license; and whether to prohibit manufacturers and distributors from selling devices certificated under Part 74 unless the sale is to a party that has committed in writing that it is a bona fide reseller or eligible for a license under Part 74. *See TV Bands Wireless Microphones Further Notice,* 25 FCC Rcd at 701-702 ¶¶ 141-144.

capable of operating in the repurposed 600 MHz Band.[97] We propose that the revised point-of-sale disclosures should 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 of 600 MHz Band. Should we 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? What other information should be included in the disclosure?

44. We propose that the effective date for any disclosure requirement, including a point-of-sale requirement, which we may adopt in connection with this or a related proceeding, shall be 12 months after the release of the *Channel Reassignment PN* – which will mark the effective date of channel reassignments based on the repacking process, specify any specific channel assignments for television stations that will continue to broadcast, and start the clock running on the post-auction transition period – or should some other date be used instead? We seek comment on the particular factors that should enter into this determination. We note that in adopting the current disclosure requirement, the Commission stated that it would remain in effect until the effective date of the final rules adopted in response to the 2010 *TV Bands Wireless Microphones Further Notice*.[98]

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

45. 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.[99]

46. In the NPRM we request comment on whether, apart from establishing such a TV signal threshold, we should adopt any other safeguards to ensure that licensed wireless microphone operators comply with this threshold and do not otherwise cause harmful interference to TV reception. We note at the outset that because we would limit these types of operations to licensed wireless microphone users, we would expect such users 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 any threshold rule that we adopted. Is this a reasonable expectation? To what extent would a wireless microphone operations require a low TV signal to be able operate effectively on a co-channel basis? Should we require licensed wireless microphone users to register their co-channel operations in the TV bands databases, which could provide information to any television licensee concerned about possible harmful interference? Are there other actions we should take?

47. As an alternative approach, we seek comment on whether we should permit co-channel licensed wireless microphone operations in indoor venues, such as in theaters or music auditoriums. Could an appropriate approach towards indoor operations be developed that would also effectively preclude harmful interference to any potential TV viewers at indoor locations? For instance, could certain locations be readily identified where wireless microphone operations can be permitted, provided of course that they are operated consistent with applicable technical requirements, including power limits and out-

[97] *See infra* Section III.C.1.b(iii).

[98] *See TV Bands Wireless Microphones Further Notice*, 25 FCC Rcd at 689 ¶ 100.

[99] *See* 5 U.S.C. § 603(c).

of-bound emissions requirements? Or, considering that in order to operate effectively wireless microphones need access to channels that are sufficiently interference-free, is it reasonable to expect that co-channel wireless microphone operations would only take place in indoor locations on channels with relatively low or effectively non-existent TV signal, and thus conclude that such operations would not be likely to effectively harm TV viewers? Some commenters in the incentive auction proceeding suggested that such operations may already take place without incident.[100] As we explore this approach, we seek comment on the benefits or downsides of allowing licensed wireless microphone operations at indoor locations, or at specified types of indoor locations. We ask that commenters provide any technical analysis bases for their recommendations.

48. We also invite comment on other approaches that we should take on expanding wireless microphone operations on a co-channel basis closer to television station operations. Again, commenters proposing any alternative approaches should provide technical analyses to support their approaches, and discuss the benefits of such an approach and how their approaches would not cause harmful interference to channels that would be used for wireless microphone operations.

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

49. None.

[100] *See, e.g.*, Sennheiser Reply Comments (Docket No. 12-268) at 18.

STATEMENT OF
CHAIRMAN TOM WHEELER

Re: *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*

Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

The FCC's Incentive Auction is an innovative approach to making efficient, market-driven use of our spectrum resources, which could revolutionize how our airwaves are allocated. We continue to make steady progress toward implementing this historic auction.

In May, the Commission adopted an Incentive Auction Report and Order, and, in the four months since, the Incentive Auction team and multiple bureaus and offices have done tremendous work to advance a number of significant related items, as promised in the Incentive Auction R&O.

The Commission is approving two of those items today.

First, we are proposing to change our Part 15 rules to allow for more robust unlicensed service and efficient spectral use. These changes would extend opportunities for innovative unlicensed use in the 600 MHz band guard bands, Channel 37, and remaining TV bands, while preventing harmful interference to licensed services.

Second, we are exploring how best to address the needs of wireless microphone users over the long term, while encouraging development of technologies that will better facilitate sharing with other wireless uses in an increasingly crowded spectral environment.

Both items bring home once again the fact that both licensed and unlicensed spectrum are critical inputs to our wireless ecosystem. They also recognize the importance of sharing our valuable, but limited, spectrum resources, even when such sharing may not be entirely comfortable – or easy – for incumbent users.

Thank you to the Incentive Auction Task Force, the Office of Engineering and Technology, the Wireless Bureau, and all the Commission staff who worked on these items.

STATEMENT OF
COMMISSIONER MIGNON L. CLYBURN

Re: *In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Guard bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*

Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

To casual observers, the world's first ever reverse incentive auction is only about broadcast TV stations turning in their spectrum licenses so they can be resold for commercial wireless services. But a successful incentive auction will also impact the amount of spectrum available for other important communications services, such as wireless microphones, wireless medical telemetry and TV White Space services. So I am glad that, when we initiated the incentive auction proceeding in 2012, the FCC took an approach to explore how we could protect as many incumbent services as possible.

These two Notices continue with this commitment. Since the Incentive Auction Order would permit TV White Space devices and wireless microphones to use the duplex gap and other guard bands, the Part 15 NPRM proposes detailed technical rules that would allow those services to operate without interfering with each other or neighboring services. Although there is a proposal to allow TV White Space devices to operate in channels where they were previously excluded, the Notice proposes rules that are intended to protect the incumbent services such as medical telemetry.

There are also a number of great proposals in the companion NPRM on wireless microphones. In that Notice, we are developing a framework to accommodate the current and future needs, of licensed and unlicensed wireless microphones. We are considering rule changes for licensed operations in all the bands, where wireless microphones currently operate. We also identify new spectrum bands, for wireless microphones.

If you review the record in this proceeding, you will notice many presentations from broadcasters and other parties, who manufacture or use wireless microphones, advocates for deployment of unlicensed TV White Spaces, and users of wireless medical telemetry services. All of these presentations have a common refrain. Our technology provides critical services. The prior Commission decisions have taken too much spectrum from us. The technical arguments of our opponents are flawed.

In my opinion, these Notices respond to these charges, in three simple, but important ways. First, we agree that these technologies provide important services. Second, all parties will have to learn to live together in a spectrum constrained environment. Third, and with apologies to the lawyers on my staff and those in the room, now is the time to kick the lawyers out of the room, and let the engineers rule.

Well; ok. I know the lawyers will never leave the room, but, the engineers must lead the way. I trust they will collaborate on tests in order for us to establish the proper technical rules that will accommodate all these services. We owe this to the consumers who use these technologies. Thank you, Hugh Van Tuyl and Paul Murray for your presentations, and I commend Gary Epstein, Julie Knapp, Ira Keltz, Geraldine Matise, and Roger Sherman and all of the staff members, who worked so hard on these excellent Notices.

STATEMENT OF
COMMISSIONER JESSICA ROSENWORCEL

Re: *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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*

Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

In this pair of rulemakings the Commission asks a lot of questions about the 600 MHz band. The answers we provide will have historic consequences for broadcasting, broadband, wireless microphones, medical telemetry, radio astronomy—and unlicensed spectrum.

It is this last service—unlicensed spectrum—that I want to focus on now, because I think what we are doing here in the 600 MHz band requires context. So I want to pause for a moment and look back to when this agency first started asking questions about unlicensed spectrum.

Rewind 30 years. Three decades ago the Commission was looking at what to do with a handful underused frequencies, including portions of the 900 MHz, 2.4 GHz, and 5.8 GHz bands. These were airwaves that had been designated for industrial, scientific, and medical uses. But the services we thought would develop in these bands never did, because under our rules they had to contend with interference from some widely used devices, like microwave ovens.

In fact, so little was happening in this spectrum, these airwaves were known as "garbage bands." The conventional wisdom was that they were junk. They were scraps of spectrum where demand for wireless licenses would just be limited. Cue the sighs.

But this is where the Commission did something interesting. Instead of following the traditional route and trying to provide licenses to allow single operators to control in these bands for specific purposes, the agency called for creative ideas.

Once the Commission got started, the questions multiplied—fast. Why should the Commission dictate what technologies should use these frequencies? What if we set some basic technical parameters instead? And what if we gave the public access to these airwaves?

These were not easy questions to answer. There were skeptics who preferred command and control spectrum policy. There were those for whom thinking differently about interference and optimizing the airwaves was outside of their comfort zone. But there were also innovative engineers who believed that with the right technical know-how, they could make these bands work.

The Commission ultimately decided to side with these innovators and think differently about this patch of spectrum. As a result, three decades ago the Commission designated its first swath of unlicensed spectrum in these so-called "garbage bands." Now a lot happened in the interim that was important, including the development of a standard known as 802.11. But step back and you can clearly see how this is the spectrum where Wi-Fi was born. And today, the economic impact of unlicensed spectrum has been estimated at as much as $140 billion annually. So in retrospect, the leap the Commission took 30 years ago paid off—in a big way. In fact, it may have been the most important experiment ever in wireless communications.

Back to the present. Thirty years later we are facing the same kind of question, but for the next generation of unlicensed services. In short, can we make unlicensed spectrum—the jet fuel of innovation—work in low band spectrum?

I think the answer is yes. But once again we are going to need to think differently. We can start by discarding the tired notion that more Wi-Fi comes only at the expense of those who want to use the airwaves for licensed services. Because good spectrum policy requires both. Because, let's not forget, nearly one-half of all wireless data connections in this country are now offloaded onto unlicensed spectrum. So it may not be intuitive, but it means that unlicensed spectrum is essential for managing the flow of traffic on licensed airwaves. Moreover, we need to keep an eye on what is coming up next. We have new technologies like dynamic databases can allow multiple services to co-exist harmoniously. And we are seeing new services that can overcome spectral and physical challenges by moving from frequency to frequency, sometimes on spectrum that is licensed and sometimes on spectrum that is unlicensed.

While we plan for this future, we also need to recognize that key services striving for space in the 600 MHz band—like wireless microphones, low power television, medical telemetry, and radio astronomy—deserve attention under the law. Wireless microphones are critical for newsgathering, essential for Broadway productions, and widely-used in churches and schools. These microphones deserve a home. Low power television and translators also play an important role in communities across the country—and can extend the reach of television in rural areas. Plus, lives depend on medical telemetry and radio astronomy helps us understand the universe. That's big stuff. So we need to pay heed. We also need to be creative. Because I think that our engineers—some of the same smart minds who sparked the invention of Wi-Fi 30 years ago—can find ways to make this all work. I think optimism here can pay dividends that will yield not only more services in the 600 MHz band, but more innovation and more Wi-Fi.

So thank you to the Office of Engineering and Technology and the Wireless Telecommunications Bureau for your hard work, past, present, and future—as you wrestle with the questions these rulemakings pose. Thank you also to Chairman Wheeler for keeping our efforts in the 600 MHz band barreling down the track and making sure that unlicensed spectrum is on board.

STATEMENT OF
COMMISSIONER MIKE O'RIELLY

Re: In the Matter of Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Guard bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

Before I begin, let me acknowledge the hard work of the Gentlelady from Connecticut for all that she has done to promote unlicensed spectrum use. Like Commissioner Rosenworcel, I have been and remain a strong supporter of unlicensed wireless use and the unknown possibilities that the creative entrepreneurs that use it will continue to bring to the American people.

These two items, which I will approve, are the direct result of Congress's work to provide for a spectrum incentive auction. That effort, of which I appreciated being a part, has generated both opportunity and concern for many in the communications sector. The area we focus on today is the effect of the incentive auction on the spectrum that can be used for unlicensed wireless devices and wireless microphones, which are not necessarily mutually exclusive groups. I understand the trepidation that these communities and others, including existing broadcasters, have over the reduction in spectrum allocated at 600 MHz for commercial broadcast services.

Over the last many months, I have visited and met with a wide array of interested parties to discuss and learn more about their ideas as to how the Commission might address the needs and spectrum demands of unlicensed wireless device providers and wireless microphones (both licensed and unlicensed). From Broadway to Silicon Valley and in between, each of these meetings was highly informative and somewhat frustrating as there are no easy answers.

At the heart of both of these items is science and fact, or at least it should be. I am generally pleased by the work of the Office of Engineering and Technology to focus on the technical side of the equation in preparing these two items. While I may not agree with every outcome or proposal, the NPRMs have been drafted in way to allow parties to provide comments, including contradictory evidence and technology studies, to frame our work going forward. I expect an ample record that includes the granular data necessary to fully inform our decision making. I am particularly interested in hearing about tests of the technical aspects of the various ideas and proposals. Let's find out, to the best of our abilities, what works and what does not.

There are definitely some areas where we need to look into pushing further, and I appreciate the Chairman and Commission staff incorporating my edits. For instance, I see great value in exploring opportunities for mobile unlicensed operations in Channel 37. To argue that it can't be done in a way that provides protection to incumbent users reminds me of the early debates over even allowing television white space devices. Many of us were right then, and we should allow science and fact to lead us again.

On the opposite side, I have heard from many industry participants that the current proposal regarding wireless mics and unlicensed wireless use in the duplex gap may be infeasible. There are strong views on this, and I am not sure whether all the information needed to make a decision is available yet. This issue needs to be fleshed out further, and I trust the NPRM will allow everyone to debate the merits fully.

I will keep an open mind as the Commission moves ahead to fill out details of the framework set forth in the Incentive Auction Order and refine potentially temporary decisions. To the extent that we receive data that requires the Commission to reconsider or alter the framework's decisions, I trust we will be willing to do so, as necessary and appropriate.

In addition, I am pleased to see today's companion notice, which seeks comment on proposals for treatment of wireless microphones. This notice is comprehensive and asks many of the necessary questions. For instance, we need to encourage wireless mics to be more spectrally efficient and move to frequencies that are not likely to be sought after for commercial purposes. In other words, any new bands that we open to wireless mics should be those that will not require that they relocate again in the future.

I thank the folks in the Office of Engineering and Technology, the Wireless Telecommunications Bureau, and the Incentive Auction Team for your thoughtful, diligent work on these notices.