

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

In the Matter of )
Amendment of Parts 15 and 74 of the Rules for )
Wireless Microphones in the TV Bands, 600 MHz ) ET Docket No. 21-115
Guard Band, 600 MHz Duplex Gap, and the 941.5- )
944 MHz, 944-952 MHz, 952.850-956.250 MHz, ) RM-11821
956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 )
MHz and 7100-7125 MHz Bands )

NOTICE OF PROPOSED RULEMAKING

Adopted: April 22, 2021

Released: April 22, 2021

Comment Date: [30 days from publication in the Federal Register]
Reply Comment Date: [60 days from publication in the Federal Register]

By the Commission: Acting Chairwoman Rosenworcel issuing a statement.

TABLE OF CONTENTS

Heading Paragraph #
I. INTRODUCTION..... 1
II. BACKGROUND..... 2
III. DISCUSSION ..... 9
A. Revisions to the Part 74 LPAS Rules to Authorize WMAS ..... 10
1. Definition of WMAS..... 10
2. Frequency Bands of Operation..... 12
3. Technical Requirements ..... 16
B. Updating Technical Rules for Existing Part 74 LPAS Wireless Microphones to Revised ETSI Standards ..... 35
C. Revisions to the Technical Rules for Part 15 Unlicensed Wireless Microphone Operations in the TV Bands, the 600 MHz Guard Band, and the 600 MHz Duplex Gap..... 39
D. Updating Wireless Microphone Rules Following the End of the Post-Incentive Auction Transition..... 49
IV. PROCEDURAL MATTERS..... 54
V. ORDERING CLAUSES..... 60
Appendix A – Proposed Rules
Appendix B – List of Parties Filing Comments
Appendix C – Initial Regulatory Flexibility Analysis

I. INTRODUCTION

1. In this Notice of Proposed Rulemaking (NPRM), we propose to revise the applicable technical rules for operation of Part 74 low-power auxiliary station (LPAS) devices to permit a recently

developed type of wireless microphone system,<sup>1</sup> termed herein as a Wireless Multi-Channel Audio System (WMAS), to operate in the broadcast television (TV) bands and other Part 74 LPAS frequency bands on a licensed basis. This emerging technology would enable more wireless microphones to operate in the spectrum available for wireless microphone operations, and thus advances an important Commission goal of promoting efficient spectrum use. We propose and seek comment on technical rules for WMAS operations under our Part 74 LPAS rules for licensed wireless microphone operations as well as the particular frequency bands in which WMAS wireless microphones would be permitted to operate. We also seek comment on whether we should permit WMAS under the Part 15 rules that allow unlicensed wireless microphone operations in the TV bands, the 600 MHz guard band, and 600 MHz duplex gap. We also propose to update our existing Part 74 LPAS and Part 15 technical rules for wireless microphones, which already rely on certain European Telecommunications Standards Institute (ETSI) standards, to incorporate the latest version of that standard where appropriate. Finally, we propose to update the wireless microphone rules to reflect the end of the post-Incentive auction transition period. Our aim in this proceeding is to enhance the spectral efficiency of wireless microphone use. We do not intend to alter the existing spectrum rights – or expectations regarding access and availability of spectrum – vis-à-vis all the various authorized users, whether broadcast licensees, white space device users, the wireless microphone users themselves, or others, that share frequency bands with wireless microphones.

## II. BACKGROUND

2. Many types of users employ wireless microphones in a variety of settings including theaters and music venues, film studios, conventions, corporate events, houses of worship, and Internet webcasts.<sup>2</sup> Wireless microphone operations range from professional uses, with the need for numerous high-performance microphones, to an individual consumer's use of a handheld microphone at a conference or in a karaoke bar.<sup>3</sup> These devices are authorized for operations both on a licensed and unlicensed basis, depending on the frequency band.<sup>4</sup> Most licensed wireless microphones operate under the Part 74 rules for low power auxiliary stations (LPAS) on a secondary basis.<sup>5</sup> Under those rules, they can operate on unused spectrum in the TV bands (both VHF and UHF), a 4-megahertz portion of the 600 MHz duplex gap, certain frequencies in the 900 MHz band, the 1435-1525 MHz band (shared with federal Aeronautical Mobile Telemetry (AMT) service), and portions of the 7 GHz band.<sup>6</sup> Entities eligible for Part 74 licenses include broadcast station licensees and networks, certain cable television operators, motion picture/TV producers, and professional sound companies and venue operators that routinely use 50 or more wireless microphones.<sup>7</sup> Unlicensed wireless microphones also operate in certain

---

<sup>1</sup> When we use the term “wireless microphones” in this proceeding, we collectively refer to wireless microphones and related wireless audio devices such as cue and control communications, synchronization of TV camera signals, and in-ear monitors, as the Commission has in other proceedings concerning these devices. *See, e.g., Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket Nos. 14-166, 12-268, Report and Order, 30 FCC Rcd 8739, 8740, para. 1 n.1 (2015) (*Wireless Microphones R&O*).

<sup>2</sup> *Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket Nos. 14-166, 12-268, Order on Reconsideration and Further Notice of Proposed Rulemaking, 32 FCC Rcd 6077, 6080-81, para. 4 (2017) (*Wireless Microphones Order on Reconsideration*).

<sup>3</sup> *Id.*

<sup>4</sup> *See generally Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket Nos. 14-166, 12-268, Report and Order, 30 FCC Rcd 8739, 8742, paras. 5-6 (2015) (*Wireless Microphones R&O*); *Wireless Microphones Order on Reconsideration*, 32 FCC Rcd at 6080-81, paras. 4-5.

<sup>5</sup> 47 CFR part 74 subpart H.

<sup>6</sup> 47 CFR § 74.802.

<sup>7</sup> 47 CFR § 74.832.

bands under the Part 15 rules – including the VHF and UHF-TV bands where they generally share the same basic technology used by licensed LPAS wireless microphones (although unlicensed operations are limited to lower, more restrictive power levels than licensed operations).<sup>8</sup>

3. Historically and currently, most wireless microphones – both licensed and unlicensed -- operate on unused spectrum in the TV bands where they share use of unused TV band spectrum with unlicensed white space devices.<sup>9</sup> The spectrum available for these devices has decreased in recent years as a result of the Commission's actions that repurposed some portions of the TV bands for wireless services and repacked the TV bands.<sup>10</sup> In 2015 and 2017, the Commission took several actions focused either on promoting more efficient use of the spectrum by both licensed and unlicensed wireless microphone operations in the repacked TV bands, 600 MHz guard band, and 600 MHz duplex gap, or finding spectrum in additional frequency bands that could be used to accommodate licensed wireless microphone operations.<sup>11</sup>

4. In 2015, the Commission adopted several changes to ensure sufficient spectrum would continue to be available for wireless microphone use following the Incentive Auction and broadcast television band repacking.<sup>12</sup> The Commission revised its rules to provide more opportunities for wireless microphones to access spectrum by allowing greater use of the VHF broadcast television channels and more co-channel operations with television stations.<sup>13</sup> It expanded eligibility for licensed use of a 4-megahertz portion of the 600 MHz duplex gap to all entities eligible to hold wireless microphone licenses.<sup>14</sup> The Commission also took actions to promote use of spectrum bands outside of the broadcast

---

<sup>8</sup> 47 CFR § 15.236.

<sup>9</sup> Licensed and unlicensed wireless microphones and white space devices can operate on TV channels 2-36 at locations where a channel is unused, and unlicensed wireless microphones and white space devices can operate in the upper 6-megahertz portion of the 600 MHz duplex gap. 47 CFR §§ 74.802(a); 15.236(c); 15.707. Licensed wireless microphone users can register TV channel usage in the white space database, and white space devices must avoid operating on TV channels at those registered times and locations. 47 CFR § 15.712(f). Unlicensed wireless microphone users must share spectrum in the TV bands and the upper 6-megahertz portion of the 600 MHz duplex gap on an equal basis with white space devices. 47 CFR § 15.5(b).

<sup>10</sup> See generally *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268, Report and Order, 29 FCC Rcd 6567 (2014) (*Incentive Auction R&O*); *Incentive Auction Closing and Channel Reassignment Public Notice: The Broadcast Television Incentive Auction Closes; Reverse Auction and Forward Auction Results Announced; Final Television Band Channel Assignments Announced; Post-Auction Deadlines Announced*, Public Notice, 32 FCC Rcd 2786 (2017) (*Channel Reassignment Public Notice*). The final 600 MHz band plan repurposed TV channels 38-51 for wireless services, and wireless microphones may now operate only in small portions of the 600 MHz band, specifically, in designated segments of the guard band and duplex gap. 47 CFR § 74.802(a)(2) (permitting licensed wireless microphones to operate in the 653-657 MHz segment of the 600 MHz duplex gap; 47 CFR § 15.236(c)(3),(5) (permitting unlicensed wireless microphones to operate in the 614-616 MHz segment of the 600 MHz guard band and the 657-663 segment of the 600 MHz duplex gap.)

<sup>11</sup> *Wireless Microphones R&O*, 30 FCC Rcd 8739; *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, and Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket No. 14-165 and GN Docket No. 12-268, Report and Order, 30 FCC Rcd 9551 (2015) (*White Spaces R&O*); *Wireless Microphones Order on Reconsideration*, 32 FCC Rcd 6077.

<sup>12</sup> See generally *Wireless Microphones R&O*, 30 FCC Rcd 8739. In the 2015 *White Spaces R&O*, issued contemporaneously the *Wireless Microphones R&O*, the Commission codified rules for unlicensed wireless microphone operations in the broadcast television bands. *White Spaces R&O*, 30 FCC Rcd at 9554-55, para. 7.

<sup>13</sup> *Wireless Microphones R&O*, 30 FCC Rcd at 8744, para. 11.

<sup>14</sup> *Id.*

television band, including providing new opportunities for use of UHF spectrum in portions of the 900 MHz, 1.4 GHz, and 7 GHz bands.<sup>15</sup> In addition, the Commission updated the technical rules, which had been in place since 1987, to require compliance with the then-applicable European Telecommunications Standards Institute (ETSI) standards for emission masks concerning analog and digital wireless microphones, which enabled more efficient use of the available spectrum.<sup>16</sup> The Commission also codified rules for unlicensed wireless microphones that operate in the TV bands, a 2-megahertz portion of the 600 MHz guard band and a 6-megahertz portion of the 600 MHz duplex gap, and required unlicensed wireless microphones to comply with the same ETSI emission mask as licensed wireless microphones.<sup>17</sup>

5. In 2017, in the *Wireless Microphones Reconsideration Order and Further Notice*, the Commission furthered its goal of promoting wireless microphone operations and ensuring sufficient spectrum would be available following the Incentive Auction and repacking process.<sup>18</sup> Specifically, it made technical revisions to rules it had adopted in 2015 for both licensed and unlicensed wireless microphone operations in the TV bands, and in the 600 MHz guard band and duplex gap, as well for licensed wireless microphone operations in several frequency bands outside of the TV bands.<sup>19</sup> These technical revisions included adoption of additional ETSI standards regarding spurious emission limits that apply to wireless microphones.<sup>20</sup>

6. *Petition for rulemaking.* On August 17, 2018, Sennheiser Electronic Corporation (Sennheiser) filed a petition for rulemaking requesting that the Commission modify the Part 74 LPAS rules for licensed wireless microphones.<sup>21</sup> Specifically, it requests that the Commission define a new class of wireless microphone, which it terms a “Wireless Multi-Channel Audio System (WMAS),” that digitally combines the signals of multiple LPAS wireless microphones into a wider channel than currently permitted in the TV bands or other LPAS frequency bands.<sup>22</sup> Sennheiser states that other wireless

---

<sup>15</sup> *Wireless Microphones R&O*, 30 FCC Rcd at 8744, para. 11. Specifically, the Commission adopted revisions to provide new opportunities for wireless microphone operations in the 169-172 MHz band and the 944-952 MHz band, and allowed use in three other spectrum bands – the 941-944 MHz and 952-960 MHz bands (on each side of the 944-952 MHz band), the 1435-1525 MHz band, and portions of the 6875-7125 MHz band – for licensed wireless microphone operations under specified conditions. *Id.*

<sup>16</sup> *Wireless Microphones R&O*, 30 FCC Rcd at 8752-53, paras. 29-32. Specifically, the Commission required that emissions from analog and digital unlicensed wireless microphones comply with the emission masks in Section 8.3 of ETSI EN 300 422-1 v1.4.2 (2011-08), *Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; Part 1: Technical characteristics and methods of measurement* (EN 300 422-1 (2011)). *Id.* at 8753, para. 32.

<sup>17</sup> *White Spaces R&O*, 30 FCC Rcd at 9588-9590, para. 95-101.

<sup>18</sup> *Wireless Microphones Order on Reconsideration*, 32 FCC Rcd 6077.

<sup>19</sup> *Id.* at 6079-70, para. 2. In the Further Notice of Proposed Rulemaking, the Commission proposed to permit certain professional theater, music, performing arts, and similar organizations that currently operate wireless microphones on an unlicensed basis to obtain licenses to operate in the broadcast television bands and other frequency bands available under the Part 74 LPAS rules. *Id.* at 6119, para. 77. That proposal remains pending before the Commission.

<sup>20</sup> *Wireless Microphones Order on Reconsideration*, 32 FCC Rcd at 6083-88, paras. 9-16. Specifically, the Commission required that emissions more than one megahertz above and below a wireless microphone carrier frequency (i.e., outside the defined ETSI mask) must comply with the limits in Section 8.4 of ETSI EN 300 422-1 (2011). *Id.* at 6085-86, para. 13.

<sup>21</sup> Sennheiser Electronic Corporation Request for Amendment of Part 74 of the Commission’s Rules to Advance the Use of Spectrum Efficient Wireless Microphone Equipment, RM-11821 (filed Aug. 17, 2018), [https://ecfsapi.fcc.gov/file/108170272204061/Sennheiser%20WMAS%20Petn%20RM%202018-08-17%20AS%20FILED%20\(01225842xB3D1E\).pdf](https://ecfsapi.fcc.gov/file/108170272204061/Sennheiser%20WMAS%20Petn%20RM%202018-08-17%20AS%20FILED%20(01225842xB3D1E).pdf) (Sennheiser Petition).

<sup>22</sup> Sennheiser Petition at 4-6, 7, 9.

microphone manufacturers are developing similar systems.<sup>23</sup> Sennheiser specifically requests that such systems be permitted to operate with a maximum channel bandwidth of 6 megahertz, the same size as an entire TV channel, rather than 200 kilohertz channels as the rules currently allow for LPAS devices in the TV bands, and that they be permitted to operate not only in the TV bands, but also in the 600 MHz duplex gap and in the 941.5-944 MHz, 944-952 MHz, and 1435-1525 MHz bands that also are available for licensed LPAS wireless microphone operations.<sup>24</sup> Sennheiser explains that, rather than placing each wireless microphone on its own separate frequency, as under current technical rule specifications, WMAS digitally combines the signals from multiple devices into a 6-megahertz channel, eliminating intermodulation and permitting denser use of the spectrum while lowering the average power spectral density across the channel.<sup>25</sup> Sennheiser notes that a potential downside of authorizing WMAS is the possibility that an operator connects too few devices on the wider channel to realize WMAS's potential for improved spectrum efficiency, and proposes rules that would require WMAS devices to operate a minimum of 12 wireless microphones in a 6-megahertz channel.<sup>26</sup> Sennheiser asserts that this technology will improve spectrum efficiency by allowing an increased number of devices to operate in a 6-megahertz channel and thus help to counter a severe spectrum shortage for wireless microphones.<sup>27</sup>

7. The Commission sought public comment on the Sennheiser petition.<sup>28</sup> Two wireless microphone manufacturers, Alteros and Shure, filed comments, as did Microsoft, whose concern focuses on white space device operations.<sup>29</sup> Sennheiser, Microsoft, and the Aerospace and Flight Test Radio Coordinating Council (AFTRCC), which must approve any LPAS operations in the 1435-1525 MHz band, filed reply comments. Commenters generally support increasing the spectral efficiency of wireless microphones,<sup>30</sup> but raise some potential concerns about Sennheiser's proposals. In particular, Alteros and Microsoft express concerns that WMAS not adversely affect the coexistence of wireless microphones systems made by different manufacturers and request that the Commission not adopt rule changes that benefit only a single manufacturer.<sup>31</sup> Alteros, Shure, and Microsoft argue that the minimum number of wireless microphones that should be required in a 6-megahertz band should be higher than the 12 suggested by Sennheiser.<sup>32</sup> In addition, Microsoft expresses concern about the potential impact that

---

<sup>23</sup> Sennheiser Petition at 4.

<sup>24</sup> Sennheiser Petition at 7, 9.

<sup>25</sup> Sennheiser Petition at 4-5. Sennheiser states that a WMAS would approximately double the wireless microphone capacity of a 6-megahertz channel for when the best audio quality is needed and would triple the capacity for uses, such as intercoms, that can satisfactorily function with lower audio quality. *Id.* at 6.

<sup>26</sup> Sennheiser Petition at 7, 9.

<sup>27</sup> Sennheiser Petition at 1, 5-6.

<sup>28</sup> *Consumer & Governmental Affairs Bureau Reference Information Center Petition for Rulemakings Filed*, RM-11821, Public Notice, Report No. 3108 (CGB Nov. 28, 2018).

<sup>29</sup> Microsoft Comments at 4.

<sup>30</sup> *See* Alteros Comments at 3; Shure Comments at 4; Microsoft Comments at 10; *cf.* AFTRCC Reply at 5 (no present objection to the Sennheiser petition).

<sup>31</sup> Alteros Comments at 4 (does not believe it is appropriate, responsible or in the public interest to suggest amending rules such that a single company or entity would potentially be the only candidate able to operate under the rules); Microsoft Reply at 4 (the Commission should ensure that any new rules are vendor neutral and encourage coordination and interoperability between microphone vendors to ensure efficient use of spectrum).

<sup>32</sup> Alteros Comments at 3, 5 (a minimum of 24 simultaneous audio channels should be required in a 6-megahertz RF channel); Shure Comments at 4 (any proposed change to the Commission's rules should reflect a spectral efficiency of at least three audio channels per megahertz, regardless of frequency band of operation); Microsoft Comments at 10 (if Sennheiser's WMAS is capable of supporting many more than 12 users in a 6-megahertz channel, the Commission should encourage Sennheiser to maximize efficiency).

permitting WMAS operations may have on white space device operations. While Microsoft does not oppose using WMAS on TV band frequencies and in the 4-megahertz portion of the 600 MHz duplex gap in which licensed LPAS wireless microphones are authorized, it opposes permitting WMAS operations in the unlicensed 6-megahertz portion of the 600 MHz duplex gap, which it views as critical for white space devices because this spectrum is available for white space device operations throughout the United States.<sup>33</sup> Alteros asks that any rule changes apply to all Part 74 LPAS frequency bands, including the expanded 900 MHz bands and the 1435-1525 MHz band.<sup>34</sup> In its initial comments, Shure suggests that the Commission consider permitting WMAS in only certain bands as a preliminary matter, and in particular consider not permitting WMAS operations in the 1435-1525 MHz band initially due to concerns that specific equipment authentication and software-based controls for coordination with AFTRCC in that band are under development,<sup>35</sup> but in more recent filings Shure now indicates its support for permitting WMAS in all frequency bands available for licensed wireless microphone operations under the Part 74 LPAS rules – including the TV bands, the 600 MHz duplex gap, and the 900 MHz bands, the 1435-1525 MHz band, and the 7 GHz band.<sup>36</sup> AFTRCC states that it has no objection to the petition as long as the current coordination and authentication requirements for the 1435-1525 MHz band are not modified.<sup>37</sup> Shure and Microsoft also generally request that the Commission examine the compatibility of WMAS with other systems or operations in the frequency bands in which WMAS would operate.<sup>38</sup>

8. In its most recent *ex parte* filings, submitted in December 2020 and January 2021, Shure recommends that the Commission update the technical rules consistent with the updated 2017 version of the ETSI standard concerning wireless microphones.<sup>39</sup> Shure notes that this latest version already permits certain types of WMAS devices in Europe and thus would allow the United States to harmonize its wireless microphone rules and promote greater spectral efficiency for wireless microphone operations.<sup>40</sup> It also notes that updating the rules to reflect the newest version of the ETSI standard would allow the Commission to reference a single document for both the single carrier emission limits as well as the limits for WMAS.<sup>41</sup>

### III. DISCUSSION

9. We propose to amend the Part 74 LPAS technical rules to permit the use of WMAS in most of the LPAS frequency bands where wireless microphones are currently permitted to operate. If adopted, WMAS devices would be a new type of wireless microphone system that, by using wider channelization than currently is permitted for wireless microphones under Part 74 along with a more efficient operating protocol, would enable more microphones to be deployed within the same amount of spectrum. Three wireless microphone manufacturers – Sennheiser, Alteros, and Shure – request that we permit WMAS in certain frequency bands,<sup>42</sup> and Microsoft and AFTRCC also generally support WMAS

---

<sup>33</sup> Microsoft Comments at 1-6.

<sup>34</sup> Alteros Comments at 3.

<sup>35</sup> Shure Comments at 5.

<sup>36</sup> Shure Dec. 30, 2020 *Ex Parte* at 5.

<sup>37</sup> AFTRCC Reply at 5. Operation in the 1435-1525 MHz band is governed by rules requiring prior coordination with AFTRCC, to avoid causing harmful interference to aeronautical telemetry users who have primary rights in the band. 47 CFR § 74.803(d).

<sup>38</sup> Shure Comments at 5-6; Microsoft Comments at 5.

<sup>39</sup> Shure Dec. 30, 2020 *Ex Parte* at 6; Shure Jan. 29, 2021 *Ex Parte* at 2, 14.

<sup>40</sup> Shure Dec. 30, 2020 *Ex Parte* at 6; Shure Jan. 29, 2021 *Ex Parte* at 2, 14.

<sup>41</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>42</sup> Sennheiser Petition at 1 (requesting that WMAS be permitted to operate in the TV bands, the 600 MHz duplex gap, and the 941.5-952 MHz and 1435-1525 MHz bands); Alteros Comments at 3 (asks that WMAS be permitted to

(continued....)

provided that their concerns can be addressed.<sup>43</sup> Specifically, we propose and seek comment on the definition of WMAS, the frequency bands in which WMAS would be permitted, and the appropriate technical requirements (e.g., spectral efficiency, channel bandwidth, maximum power, and emission masks) that would govern operation of these systems. As part of our proposal, we specifically propose applying technical rules for WMAS consistent with the recently updated ETSI standard for WMAS. We also take this opportunity to propose updating our existing technical rules for currently authorized Part 74 LPAS wireless microphones, which already rely on certain ETSI standards, in order to incorporate the applicable portions of the recently updated ETSI standard. In addition, we also seek comment on whether the Commission should revise the Part 15 technical rules for unlicensed wireless microphone devices that operate in the TV bands, the 600 MHz guard band, and the 600 MHz duplex gap to permit WMAS operations for those devices in some or all of those frequency bands, and whether we should revise the Part 15 wireless microphone rules to require use of an updated ETSI standard. Finally, we propose and seek comment on updating our rules to reflect the end of the post-Incentive Auction transition.<sup>44</sup>

## A. Revisions to the Part 74 LPAS Rules to Authorize WMAS

### 1. Definition of WMAS

10. *Background.* In its petition, Sennheiser proposes that the Commission use the term “Wireless Multi-Channel Audio System” for this new type of wireless microphone device, and to broadly define this system as “[a] system that digitally combines the signals of multiple low power auxiliary station devices onto one radio-frequency channel.”<sup>45</sup> Shure agrees.<sup>46</sup> Alteros asks that any definition not limit the system to use by a single company such as Sennheiser.<sup>47</sup> We note that the most recent version of the ETSI standards uses the same name for this system, “Wireless Multi-Channel Audio System,” though it does have a slightly different definition, namely a “wireless audio transmission system[] using broadband transmission technique for microphone and in-ear monitor systems, and other multichannel audio [Programme Making and Special Events] use.”<sup>48</sup>

11. *Discussion.* We propose to adopt the terminology proposed by Sennheiser, as well as the definition it proposes. We seek comment on this proposed designation and definition. Is it appropriate for the type of wireless microphone system we are proposing to permit? Would a different name or

(Continued from previous page) \_\_\_\_\_  
operate in all Part 74 LPAS frequency bands, including the expanded 900 MHz bands and the 1435-1525 MHz band); Shure Dec. 30, 2020 *Ex Parte* at 8 (suggesting rule changes that would also permit WMAS to operate in the 952.850-956.250 MHz, 956.45-959.85 MHz, 6875-6900 MHz and 7100-7125 MHz bands).

<sup>43</sup> Microsoft Comments at 11; AFTRCC Reply at 1.

<sup>44</sup> The 39-month transition period ran from April 13, 2017 to July 13, 2020. *Channel Reassignment Public Notice*, 32 FCC Rcd at 2807, para. 68. After the transition, wireless microphones, both licensed and unlicensed, are no longer permitted to operate in the 600 MHz service bands (617-652 MHz and 663-698 MHz). *Incentive Auction R&O*, 29 FCC Rcd at 6846, para. 687.

<sup>45</sup> Sennheiser Petition at 7, 9.

<sup>46</sup> Letter from Catherine Wang and Ross Slutsky, Counsel to Shure Incorporated, to Marlene H. Dortch, Secretary, FCC, dated Dec. 30, 2020 at 8 (Shure Dec. 30, 2020 *Ex Parte*).

<sup>47</sup> Alteros Comments at 4 (noting that Sennheiser filed a patent application for its system in which it employed that proposed definition).

<sup>48</sup> European Telecommunications Institute Standard ETSI EN 300 422-1 v2.1.2 (2017-01), [https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.01.02\\_60/en\\_30042201v020102p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.01.02_60/en_30042201v020102p.pdf), Section 3.1, at 15 [EN 300 422-1 (2017)]. Programme Making and Special Events (PMSE) is a term used to denote equipment that is used to support broadcasting, news gathering, theatrical productions and special events, such as culture events, concerts, sporting events, and conferences. “Audio PMSE” is defined by ETSI as an “inclusive description consisting of radio microphones, in ear monitoring systems, [and] audio links.” *Id.* at 13.

definition be more appropriate? If so, how should the proposed name or definition be modified to provide more accuracy or a better description of WMAS?

## 2. Frequency Bands of Operation

12. *Background.* In its petition, Sennheiser specifically requests that WMAS be permitted to operate in the TV bands, in the 600 MHz duplex gap, and in the 941.5-944 MHz, 944-952 MHz, and 1435-1525 MHz bands that also are available for licensed LPAS wireless microphone operations.<sup>49</sup> Alteros asks that any WMAS apply to all Part 74 LPAS frequency bands, including the expanded 900 MHz bands and the 1435-1525 MHz band,<sup>50</sup> while Shure similarly supports permitting WMAS in all frequency bands available for licensed wireless microphone operations under the Part 74 LPAS rules – including the TV bands (VHF and UHF), the 600 MHz duplex gap, the 900 MHz bands, the 1435-1525 MHz band, and the 7 GHz band.<sup>51</sup>

13. *Discussion.* We propose to allow WMAS to operate in most of the bands where Part 74 wireless microphones are permitted to operate, including the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 653-657 MHz segment of the 600 MHz duplex gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands.<sup>52</sup> These are all of the frequency bands available for LPAS operations in which we believe that wireless microphones using a wider channelization system are technically feasible and thus could enable more efficient use of the limited spectrum available for wireless microphone operations. We are not, however, proposing to allow WMAS operation in the 26.100-26.480 MHz, 161.625-161.775 MHz, 450.000-451.000 MHz and 455.000-456.000 MHz bands because we believe that the available spectrum (1 megahertz or less in each band) make them less suited for WMAS operation.<sup>53</sup>

14. We seek comment on this proposal. Are all of the bands where we have proposed to permit WMAS operation suitable for such operation? Our goal is to promote more efficient use of spectrum for LPAS operations. We are mindful that not all LPAS operations would use WMAS and that other operations share the affected frequency bands. Thus, we seek to permit WMAS while not adversely affecting these other operations. Are there special considerations that should be taken into account for any of the bands proposed for WMAS? In the TV bands wireless microphones are secondary to broadcast TV stations and share use of spectrum unused by broadcasters with white space devices. Wireless microphones are secondary to both federal and non-federal systems operating in the 941.5-944 MHz band and the 1435-1525 MHz band<sup>54</sup> and are secondary to broadcast or other licensed services in the 944-952

---

<sup>49</sup> Sennheiser Petition at 1; Sennheiser Reply at 4 (seeking to use WMAS for microphones licensed under Part 74).

<sup>50</sup> Alteros Comments at 3.

<sup>51</sup> Shure Dec. 30, 2020 *Ex Parte* at 5.

<sup>52</sup> 47 CFR 74.802(a). While this paragraph indicates that the 608-698 MHz band (former TV channels 38-51) is available for wireless microphones under Part 74, effective July 13, 2020, only the 653-657 MHz portion of this band (now part of the 600 MHz duplex gap) is available under Part 74. 47 CFR § 74.802(f); *Channel Reassignment Public Notice*, 32 FCC Red at 2807, para. 68.

<sup>53</sup> 47 CFR § 74.802(a)(1).

<sup>54</sup> For example, operation of wireless microphones in the 941.5-944 MHz and 1435-1525 MHz bands is subject to specified coordination requirements to protect Federal Government operations in those bands. 47 CFR § 74.803(c)-(d). We propose no changes to these coordination requirements. The 941.5-944 MHz band is allocated to the Fixed service on a primary basis, and Federal government agencies make extensive use of this band for important point-to-point and point-to-multipoint communications. Two major users are the Federal Aviation Administration (FAA), which uses the band for critical data communications links for its Terminal Doppler Weather Radar (a radar that is part of Air Traffic Control (ATC) that increases the safety of the National Airspace System), and the Department of Energy (DOE), which uses the band for critical energy control of the electric power grid at its electric power

(continued....)

MHz and portions of the 952-960 MHz, the 6875-6900 MHz and the 7100-7125 MHz bands, and wireless microphone operations must be coordinated under specified coordination requirements.<sup>55</sup> Would WMAS operations in any of the proposed bands raise concerns about adversely affecting incumbent systems or authorized users? For instance, when coordinating WMAS operations, are there any additional interference mitigation techniques or technologies that would be necessary or can be used to help prevent harmful in-band interference? Are specific rules needed to reflect that all uses continue to be available and that users have flexibility to operate equipment and devices that best meet their needs? In light of recent changes to the 6 GHz band,<sup>56</sup> we invite specific comment on WMAS operation in the 6875-6900 MHz and the 7100-7125 MHz bands. To what extent are LPAS operations making use of these bands? If we authorize WMAS generally, how might this affect use of these bands by Part 74 wireless microphone operations? Should WMAS not be authorized in these bands, or should Part 74 wireless microphones no longer be permitted to operate in these bands altogether, considering the recent changes and expected future usage of this spectrum?<sup>57</sup>

15. Are there any other LPAS bands where we should permit WMAS to operate? Would it be feasible or appropriate to allow WMAS operation in any of the bands that we have proposed to exclude? Is there a minimum amount of bandwidth necessary for WMAS to operate? How does the amount of available channel bandwidth affect efficiency? Does the number of microphones that can be supported increase linearly with increasing spectrum or is there a different relationship? Finally, we ask that commenters discuss the costs and benefits associated with their recommended approach regarding the authorization of WMAS in particular frequency bands. In particular, we seek information and data about operations in these bands and any other bands that commenters suggest for WMAS use. This information and data should include details regarding current wireless microphone usage, such as quantitative measures describing how many microphones are used per channel at various locations, how wireless microphones are used and the types of users as well as how these measures, uses and users would change if WMAS were used instead of currently authorized wireless microphones that operate using narrower bandwidths.

### 3. Technical Requirements

16. In this section we propose and seek comment on technical requirements for WMAS devices. Because the current Part 74 rules for wireless microphones are based on the use of narrower bandwidths than would be used for WMAS operation, we will need to specify appropriate and possibly different technical requirements for these wider bandwidth systems for wireless microphones, including output power limits and emission masks.

(Continued from previous page) \_\_\_\_\_  
utilities. The 1435-1525 MHz band is used by Federal government and industry for aeronautical mobile telemetry (AMT) operations.

<sup>55</sup> 47 CFR § 74.803(c), (d)(2).

<sup>56</sup> In April 2020, the Commission made the 5975-7125 MHz band (the “6 GHz band”) available for new types of unlicensed operations, specifically including low-power indoor operations in the 6875-7125 MHz portion of this band (referenced as the “U-NII-8” band). *Unlicensed Use of the 6 GHz Band*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 3852, 3888-3917, paras. 96-713 (2020) (*6 GHz Report and Order*).

<sup>57</sup> Letter from Michael Daum, Director Technology Policy, CELA Privacy & Regulatory Affairs, Microsoft Corporation, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 21-115, at 1-3 (filed Apr. 16, 2021) (Microsoft Apr. 16, 2021 *Ex Parte* Letter) (expressing concern about the potential effect of WMAS in the 6875-6900 MHz and 7100-7125 MHz bands on newly authorized unlicensed operations in the 6 GHz band and about whether Part 74 LPAS operations should continue to be permitted in these bands); Letter from Michael Calabrese, Director Wireless Future Program, New America’s Open Technology Institute, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 21-115, at 2 (filed Apr. 15, 2021) (OTI Apr. 15, 2021 *Ex Parte* Letter) (expressing concern about potential impact of WMAS in the 6875-6900 MHz and 7100-7125 MHz on future unlicensed Wi-Fi operations).

**a. Bandwidth**

17. *Background.* The Part 74 rules limit wireless microphones operating in the TV bands and 600 MHz duplex gap to a 200 kilohertz maximum bandwidth.<sup>58</sup> Wireless microphones operating in the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands do not have bandwidth limits specified in the Part 74 rules, but are required to meet the emission masks specified in the 2011 ETSI wireless microphone standard, i.e., ETSI EN 300 422-1 v1.4.2 (2011-08) [“EN 300 422-1 (2011)”], which precludes the use of wide bandwidths, e.g., 1 megahertz or greater.<sup>59</sup> Accordingly, the Commission’s existing rules would preclude WMAS operations as proposed by Sennheiser (i.e., use of a 6 megahertz channel for the wireless microphone system). We note that the most recent version of the ETSI standard, established in 2017, permits WMAS to operate using wider channels up to 20 megahertz.<sup>60</sup>

18. *Discussion.* We propose to allow WMAS devices to use a 6-megahertz maximum bandwidth as suggested by Sennheiser and Shure, subject to any technical or other limitations inherent to the particular frequency band.<sup>61</sup> A 6-megahertz channel corresponds to the size of channels in the TV bands where many Part 74 wireless microphones currently operate. We also note that no commenter suggested a larger channel size for WMAS. Under our proposal, the bandwidth of a WMAS device could be smaller than 6 megahertz, either by system design or as needed to comply with the amount of spectrum available under the Commission’s rules. For instance, the bandwidth of a WMAS device for licensed wireless microphone operations in the 4 megahertz of spectrum available for LPAS operations in the 600 MHz duplex gap (653-657 MHz) would be limited to 4 megahertz, and the amount of spectrum available in each of the 952.850-956.250 MHz and 956.45-959.85 MHz bands is less than 6 megahertz.<sup>62</sup> We further propose that for WMAS devices operating in the TV bands, the 6 megahertz (or less) WMAS channel must fall entirely within a single TV channel (2-36) that is available for Part 74 wireless microphones in accordance with the separation requirements under Section 74.802(b).<sup>63</sup> This requirement will prevent a WMAS device from occupying portions of two unused TV channels simultaneously, potentially excluding other uses that require a full 6-megahertz channel, such as unlicensed white space devices or other wireless microphone operations using WMAS.

19. We seek comment on these proposals. In particular, we seek comment on whether 6 megahertz is the appropriate maximum channel size for WMAS Part 74 LPAS wireless microphone devices in the TV bands and other frequency bands (apart from the smaller sized 4-megahertz portion of the 600 MHz duplex gap), or whether we should allow larger channel sizes. For example, Shure notes that the 2017 ETSI standard EN 300 422-1 V2.1.2 (2017-01) [“EN 300 422-1 (2017)”] permits a channel bandwidth of up to 20 megahertz for WMAS systems.<sup>64</sup> If we were to allow channel sizes greater than 6 megahertz, in which bands should we allow them? For instance, should a wider channel for WMAS be permitted only outside the TV bands (e.g., in the 944-952 MHz band, the 1435-1525 MHz band or the 6875-6900 MHz and 7100-7125 MHz portions of the 7 GHz band) that do not involve pre-existing 6-

---

<sup>58</sup> 47 CFR § 74.861(e)(5).

<sup>59</sup> 47 CFR § 74.861(d)(4). The emission masks in Section 8.3 of ETSI EN 300 422-1 (2011) require certain levels of attenuation at specified frequency offsets from the wireless microphone carrier frequency over a frequency range from one megahertz below to one megahertz above the carrier frequency. Section 5.1 of the ETSI standard specifies a maximum channel bandwidth of 200 kilohertz at frequencies below 1 GHz, and 600 kilohertz at frequencies above 1 GHz, but the Commission’s rules do not require wireless microphones to comply with this section of the standard.

<sup>60</sup> ETSI EN 300 422-1 (2017) at 18, Section 5.1.1.

<sup>61</sup> Sennheiser Petition at 1, 4, 7, 9; Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>62</sup> 47 CFR § 74.802(a)(2).

<sup>63</sup> 47 CFR § 74.802(b).

<sup>64</sup> Shure Comments at 6.

megahertz channels? Are 6-megahertz wide channels for WMAS appropriate in all of the bands outside the TV bands (for example in the 944-952 MHz band where other services use a channel plan consisting of 25 kHz segments)? Should WMAS operating in bands outside of the TV bands also be required to operate within the limits of a single channel as defined by the channel plans of the other services using those bands (for example in the 6875-6900 MHz band where the channel plans of other services are based on 25 megahertz channel sizes, should WMAS systems be required to fall entirely within one of the existing channels)? Should wider channels be allowed within the TV bands at locations where there are two or more contiguous unused channels available for licensed LPAS wireless microphone use?

20. In addition, we seek comment on co-existence between WMAS and other operations with which it would share the spectrum. Would wider channel bandwidths make spectrum co-existence and sharing more difficult with narrower bandwidth wireless microphones, or between WMAS devices produced by different manufacturers? Should we adopt any requirements to better enable co-existence and sharing between different types of wireless microphone systems? Would permitting channels wider than 6 megahertz for WMAS in the TV bands potentially alter the balance between licensed LPAS wireless microphone operations and white space devices that share available unused channels in the TV bands? We also seek comment on whether there should be a minimum bandwidth specified for WMAS. For example, because we proposed to exclude spectrum bands where 1 megahertz or less is available for wireless microphones, should we restrict WMAS to a minimum 1-megahertz bandwidth? Is there a different minimum that should be specified, or should we not specify a minimum bandwidth at all? We seek comment on how specifying a minimum or maximum bandwidth may affect spectrum efficiency and the ability for systems of different types (e.g., currently authorized wireless microphones and WMAS wireless microphones) to co-exist. We also seek comment on the costs and benefits with respect to equipment cost and spectrum usage of specifying specific minimum and maximum bandwidths for WMAS.

#### **b. Spectral Efficiency**

21. *Background.* In its petition requesting that the Commission authorize WMAS, Sennheiser notes that a potential downside is the possibility that an operator connects too few devices on the wider channel to realize WMAS's potential for improved spectrum efficiency.<sup>65</sup> To ensure that users operating WMAS would use spectrum as or more efficiently than currently authorized wireless microphones (e.g., wireless microphones restricted to 200 kilohertz in the TV bands), Sennheiser proposes that operators be required to operate a minimum of 12 wireless microphones on a WMAS in a 6-megahertz channel.<sup>66</sup> Alteros contends that there should be a minimum of 24 wireless microphones in a 6-megahertz channel, while Shure proposes WMAS use a minimum of 3 wireless microphones per 1-megahertz of spectrum.<sup>67</sup> Microsoft states more generally that the Commission should encourage that WMAS maximize efficient use.<sup>68</sup>

22. *Discussion.* Sennheiser, Alteros, and Shure agree that the Commission should establish spectral efficiency requirements for WMAS devices to ensure sufficient use of the spectrum by any WMAS, although they disagree on what those should be.<sup>69</sup> As suggested by Shure, we propose that WMAS devices comply with a spectral efficiency requirement of at least three audio channels per

---

<sup>65</sup> Sennheiser Petition at 7.

<sup>66</sup> Sennheiser Petition at 7, 9.

<sup>67</sup> Alteros Comments at 3, 5 (a minimum of 24 simultaneous audio channels should be required in a 6-megahertz RF channel); Shure Comments at 4 (any proposed change to the Commission's rules should reflect a spectral efficiency of at least three audio channels per megahertz, regardless of frequency band of operation).

<sup>68</sup> Microsoft Comments at 10 ("If Sennheiser's WMAS technology is... capable of supporting many more than 12 users in a 6-megahertz channel, the Commission should encourage Sennheiser to maximize efficiency.").

<sup>69</sup> Sennheiser Petition at 9; Alteros Comments at 3, 5; Shure Comments at 4.

megahertz (18 audio channels per 6 megahertz) to ensure that these wider bandwidth devices do not occupy more spectrum than necessary. This proposal is consistent with ETSI's requirement that WMAS must have at least one mode that supports a minimum of three audio links per megahertz.<sup>70</sup> We believe that Sennheiser's suggestion of 12 channels per 6 megahertz does not represent an improvement over what is currently achievable with existing technology.<sup>71</sup> We are also concerned that Alteros' suggestion of 24 channels per 6 megahertz might not be achievable in some cases, such as when an operator needs to use many very high-quality audio channels.<sup>72</sup> We therefore propose to require WMAS devices to operate with a minimum spectral efficiency of three audio channels per megahertz as suggested by Shure.<sup>73</sup> We believe that a spectral efficiency requirement specified over one megahertz may be more appropriate and more flexible than a requirement specified over the WMAS device maximum channel bandwidth because it provides an easier method to scale total power to different bandwidths, thus allowing manufacturers to produce devices in which the bandwidth could be varied as necessary based on the number of audio channels required and the spectrum available for use in any particular frequency band while also ensuring more efficient use of spectrum for wireless microphone operations.

23. We seek comment on these proposals. In particular, we seek comment on whether the proposed spectral efficiency metric is appropriate. How does this metric, which would require at least 18 wireless microphones within a 6-megahertz channel, compare to what is achievable using the types of analog and digital microphones permitted under existing rules? How should an audio channel be defined in this context? Should the metric be higher or lower, and if so why? We also seek comment on whether there are any other spectral efficiency metrics that we could specify in place of, or in addition to, the number of audio channels. For example, the audio for actors in a stage production or vocalists performing a concert may need the highest quality audio while lower quality audio may be acceptable for other uses. Should a spectral efficiency requirement consider the type of audio channel, e.g., voice or high quality, in a specification of the minimum number of channels required per megahertz of spectrum? Alternatively, would a minimum data rate (e.g., X bits per second per megahertz) be more appropriate rather than tying efficiency to number of audio channels?<sup>74</sup> If so, what data rate would be appropriate and over what bandwidth? Commenters should provide details regarding advantages or disadvantages of such an approach as compared to the proposed three audio channel per megahertz efficiency requirement. How could a spectral efficiency requirement be enforced at the equipment authorization level, at the time of licensing, and/or in the field? That is, in addition to ensuring that the equipment can meet any spectral efficiency requirement during the equipment approval process, are there ways to ensure that WMAS users actually operate in accordance with any spectral efficiency requirement? Should a condition be placed on a LPAS license stating the requirement that users employing WMAS must meet that standard?

24. What are the costs and benefits of establishing a spectral efficiency requirement for WMAS devices? Is a higher efficiency requirement more difficult or expensive to meet, and does it limit wireless microphone operators' ability to make use of the spectrum? On the other hand, what are the costs of not establishing a spectrum efficiency requirement, or not taking other steps to ensure that WMAS would be used efficiently, with respect to white space device operations or other users' operations that share use of the same frequency bands that would be available for WMAS use? We seek any quantitative support regarding the answers to these questions.

---

<sup>70</sup> EN 300 422-1 (2017) at 17, section 4.4; Shure Comments at 4.

<sup>71</sup> Sennheiser Petition at 5 (showing 12 "best quality" conventional wireless microphones in a 6-megahertz channel).

<sup>72</sup> Sennheiser Petition at 5 (showing 18 "best quality" WMAS audio links in a 6-megahertz channel).

<sup>73</sup> Shure Comments at 4.

<sup>74</sup> The Commission has specified similar requirement in other bands. *See, e.g.*, 47 C.F.R. § 90.203(j) (where the Commission specifies an efficiency standard for VHF and UHF land mobile radios that requires a certain number of voice channels per specified amount of bandwidth or be capable of supporting a minimum data rate of 4800 bits per second per 6.25 kHz of channel bandwidth).

### c. Output Power

25. *Background.* Under the current Part 74 rules, wireless microphones in the TV bands are limited to 50 milliwatts equivalent isotropically radiated power (EIRP) in the VHF band, 250 milliwatts conducted power in the UHF band, 20 milliwatts EIRP in the duplex gap, 250 milliwatts conducted power in the 1435-1525 MHz band, and 1 watt conducted power in all other bands.<sup>75</sup> These power limits apply to each individual wireless microphone, so that if, for example, there are 12 wireless microphones operating in close physical proximity within a single 6-megahertz channel, the total power within that channel will be 12 times greater than if there were a single wireless microphone. We note that, as a practical matter, wireless microphones generally operate at less than the maximum power the rules allow due to a number of considerations, such as the need to extend battery life, reduced interference between wireless microphones, and because the maximum power is simply not necessary in many applications.<sup>76</sup>

26. Sennheiser did not request higher power for WMAS devices than the Part 74 rules currently allow for wireless microphones. It states that WMAS devices would operate at a lower power spectral density (PSD) which allows for greater frequency re-use, thereby improving spectrum efficiency over a geographic region with heavy wireless microphone use.<sup>77</sup> However, Shure argues that we should clarify that the current Part 74 power limits are limits per channel, and that WMAS should be allowed to use PSD levels up to 750 milliwatts per megahertz in the UHF-TV band and most other bands available for wireless microphones under Part 74.<sup>78</sup> Shure argues that this PSD limit is equivalent to a single channel power limit of 250 milliwatts (i.e., three audio channels per megahertz).<sup>79</sup>

27. *Discussion.* We propose to allow WMAS to operate at up to the same maximum power levels as other Part 74 LPAS devices, but seek comment on whether we should allow higher power levels as Shure suggests or make other changes to the power limits for WMAS. What is the appropriate maximum power level for each of the bands where WMAS would operate? Should the power limit be expressed in terms of PSD, absolute maximum power, or some combination of the two, and should they be conducted or radiated (EIRP) limits? Should the power be capped or permitted to scale with the number of audio channels being delivered? For example, should more power be permitted if a WMAS provides more channels than any minimum we might specify? For example, if we were to adopt our proposal to require at least three audio channels per megahertz, should we permit more power for a device that provides four or more audio channels per megahertz? How does the power we permit and/or the way we specify it affect re-use distance between systems? Commenters should specify how whatever power limit it supports provides the ability to re-use WMAS in crowded areas (e.g., among the many theaters in New York's theater district). Should WMAS devices be required to incorporate transmit power control to limit power to the minimum necessary for a particular application? What are the costs and benefits of higher or lower power limits and a requirement to incorporate transmit power control? To the extent that the higher power levels are considered, as proposed by Shure, should they be permitted in particular bands or in all bands? For instance, should higher power be precluded from the 6875-6900 MHz and 7100-7125 MHz bands in light of recent changes to the 6 GHz band?<sup>80</sup>

---

<sup>75</sup> 47 CFR § 74.861(d)(1), (e)(1).

<sup>76</sup> The Commission previously noted that many wireless microphones typically operate at power levels between 10 and 20 milliwatts, which is less than the maximum permissible power for both licensed and unlicensed wireless microphones. *White Spaces R&O*, 30 FCC Rcd at 9607, para. 139.

<sup>77</sup> Sennheiser Petition at 5-6.

<sup>78</sup> Shure Dec. 30, 2020 *Ex Parte* at 6, 8-9. Shure's suggested PSD limit would not apply in the VHF-TV band or 600 MHz duplex gap.

<sup>79</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>80</sup> See Microsoft Apr. 16, 2021 *Ex Parte* Letter at 2-3 (citing *6 GHz Report and Order*); OTI Apr. 15, 2021 *Ex Parte* Letter at 2. See *6 GHz Report and Order*, 35 FCC Rcd 3852.

28. We also seek comment on the potential for WMAS to affect licensed broadcast services in the TV bands, other uses of the TV bands such as unlicensed white space devices, as well as other licensed and unlicensed operations where authorized in portions of the 900 MHz, 1.4 GHz, and 7 GHz bands. How would WMAS power levels and wider bandwidths affect the potential of these devices to cause harmful interference to broadcast services in the TV bands or to authorized services in other bands? Is WMAS more or less likely to affect broadcast services or other authorized services than the wireless microphones currently permitted under Part 74? Similarly, what impact would WMAS have on unlicensed white space devices that operate in the TV bands and in the upper 6-megahertz portion of the 600 MHz duplex gap? Would WMAS make it more difficult for white space devices to operate, or would the potentially greater spectral efficiency of WMAS have a positive effect on the availability of spectrum for white space devices by reducing the number of TV channels that wireless microphones would need to use in a given area? Could WMAS devices and currently authorized wireless microphones co-exist within the same channel? Or do they need to operate on distinct channels thereby potentially using more spectrum than is used today when only currently authorized microphones are used? How would the power limit affect such co-existence?

29. In addition, we seek comment on whether there is a need to modify the rules to resolve an inconsistency in the power limits for Part 74 wireless microphones that operate in the TV bands. Section 74.861(e)(1) specifies the power limit for wireless microphones in the UHF-TV band in terms of conducted power, while the power limits for wireless microphones in the VHF-TV bands and the duplex gap are expressed in terms of EIRP.<sup>81</sup> This difference stems from the 2015 *Wireless Microphone R&O* when the Commission changed the power limit for wireless microphones in the VHF-TV band from a conducted limit to an EIRP limit to make the VHF-TV band more usable by wireless microphones.<sup>82</sup> However, the Commission did not address the power limit for wireless microphones in the UHF-TV band in that proceeding, leaving it unchanged as a conducted power limit (250 milliwatts). Should we modify the power limit for Part 74 wireless microphones in the UHF-TV band (470-608 MHz) from a conducted limit to an EIRP limit, consistent with rules for Part 74 wireless microphones in the VHF-TV bands and Part 15 wireless microphones in both the VHF and UHF-TV bands?<sup>83</sup> What are the advantages and disadvantages of such a change? What would be the impact in terms of benefits and costs on manufacturers and users? How would such a change affect the interference potential of Part 74 wireless microphones, either within or outside of the UHF-TV band? How would such a change affect existing, already approved microphones? Commenters should provide information regarding why any equipment or uses may need any accommodations, such as grandfathering, based on any advocated changes in this matter.

#### d. Emission Mask

30. *Background.* Part 74 wireless microphones operating in the bands where we are proposing to allow WMAS operations are currently required to comply with emission masks associated with the 2011 version of ETSI EN 300 422-1 (2011),<sup>84</sup> which the Commission adopted for wireless microphones under the Part 74 LPAS rules in 2015.<sup>85</sup> As discussed above, these emission masks limit wireless microphones to bandwidths of less than one megahertz and are therefore not suited to WMAS. An updated ETSI standard, EN 300 422-1 (2017), specifies an emission mask that is applicable to WMAS (as defined in the ETSI standard), and Shure suggests in a recent *ex parte* filing that the Commission

---

<sup>81</sup> 47 CFR § 74.861(e)(1).

<sup>82</sup> *Wireless Microphone R&O*, 30 FCC Rcd at 8749, para. 24.

<sup>83</sup> 47 CFR §§ 74.861(e)(1)(i) and 15.236(d)(1).

<sup>84</sup> 47 CFR § 74.861(d)(4), (e)(7). Different masks apply for analog systems, digital systems below 1 GHz and digital systems above 1 GHz. ETSI EN 300 422-1 (2011) at 24, 26-27, Sections 8.3.1.2, 8.3.2.2.

<sup>85</sup> *Wireless Microphone R&O*, 30 FCC Rcd at 8752-53, para. 32.

incorporate that updated version into the Commission's rules.<sup>86</sup> Shure also suggests that the Commission adopt a requirement that transmitter intermodulation distortion comply with limits in section 8.5.3 of EN 300 422-1 (2017) and that the Commission modify the existing Part 74 wireless microphone rules to specify the transmit masks in this standard.<sup>87</sup> Shure underscores that by updating the Commission's rules consistent with the ETSI standards for wireless microphones, including WMAS, we would be harmonizing our rules and thereby benefit the wireless microphone community.<sup>88</sup> Shure also notes that ETSI currently is in the process of further revising and updating the standards relating to WMAS, and Shure recommends that the Commission adopt the updated standards if ETSI adopts them.<sup>89</sup>

31. *Discussion.* We propose to require WMAS devices to comply with the updated 2017 version of ETSI standard EN 300 422-1 (2017) concerning the transmit mask as suggested by Shure. This proposal is consistent with the current Part 74 wireless microphone rules that require wireless microphones to comply with ETSI transmit emission masks (2011 version).<sup>90</sup> We propose to require that WMAS emissions outside the band where the emission mask is defined comply with the spurious emission limits in Section 8.4 of ETSI EN 300 422-1 (2017).<sup>91</sup> If ETSI updates its applicable standards for WMAS during the pendency of this rulemaking, we request comment on whether the Commission should instead adopt the later version instead of the 2017 version. In proposing to update our technical rules by adopting the 2017 ETSI standard relating to WMAS, we seek to achieve the additional benefits associated with harmonizing the Commission's rules with the latest technologies for wireless microphones.

32. We seek comment on our proposal and on the costs and benefits associated with it. Are the ETSI transmit emission masks for WMAS devices and the spurious emission limits sufficient to protect authorized services in adjacent bands? Will they adequately protect broadcast TV and other authorized services? Will these emission limits allow for sharing spectrum between wireless microphone systems, both wider bandwidth WMAS and narrower bandwidth devices operating under the current LPAS rules? What impact would WMAS operating under these limits have on white space devices? Would different emission limits be more appropriate, and if so, which ones and why? What are the costs and benefits of requiring devices to meet the ETSI emission limits or any alternative limit suggested by commenters?

33. We also seek comment on whether there is a need to adopt the ETSI intermodulation distortion limits as suggested by Shure.<sup>92</sup> Shure requests that the Commission make clear that combining multiple users on a single antenna is conceptually distinct from the applicable emissions mask, and suggests that transmitter intermodulation distortion comply with limits in EN 300 422-1 (2017).<sup>93</sup> Is there a need for intermodulation distortion limits as Shure suggests? If so, are the ETSI limits appropriate or would some other limits be more appropriate? What are the costs and benefits of adopting ETSI or some other intermodulation distortion limits?

---

<sup>86</sup>Shure Dec. 30, 2020 *Ex Parte* at 6, 8-9; ETSI EN 300 422-1 (2017) at 32, section 8.3.4.2.

<sup>87</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>88</sup> Shure Jan. 27, 2021 *Ex Parte* at 2, 14.

<sup>89</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>90</sup> 47 CFR § 74.861(d)(4), (e)(7).

<sup>91</sup> *Id.*

<sup>92</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>93</sup> *Id.*

**e. Other Considerations**

34. We also seek comment on whether there are other technical issues that the Commission should consider and address when establishing rules permitting use of WMAS for wireless microphone operations under the Commission's Part 74 LPAS rules. If the Commission were to permit WMAS, we seek comment on any technical issues that would facilitate the Commission's approval of these new devices under the Commission's certification procedures. For instance, are the measurement procedures in EN 300 422 (2017) sufficient for these devices? Are there any other industry standards applicable to the testing of WMAS devices?

**B. Updating Technical Rules for Existing Part 74 LPAS Wireless Microphones to Revised ETSI Standards**

35. *Background.* The existing technical rules for Part 74 LPAS wireless microphones incorporated certain ETSI standards that date to 2011. These ETSI standards currently apply to each of the bands in which we are proposing to authorize WMAS – specifically, the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 653-657 MHz segment of the 600 MHz duplex gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands.<sup>94</sup> As Shure notes, these ETSI standards recently have been updated.<sup>95</sup>

36. *Discussion.* We take this opportunity to propose updating the existing Part 74 LPAS device rules to require the use of an updated ETSI standard that applies to those type of devices (i.e., non-WMAS wireless microphones). Specifically, we propose to update the existing Part 74 wireless microphone rules to specify the transmit emission masks and spurious emission limits in EN 300 422-1 (2017) in place of the emission masks in the 2011 version of this standard which are currently specified in the rules.<sup>96</sup> We also propose to slightly reorganize the rule sections specifying the emission masks and spurious emission limits to make them easier to follow, i.e., separate paragraphs specifying the mask for analog systems, the masks for digital systems, and the spurious emission limits outside the masks.

37. While the spurious emission limits in the 2011 and 2017 versions of the ETSI standard are the same and the newer emission masks are very similar to the older ones, there is one significant difference in the masks for digital wireless microphones. Specifically, the 2011 standard defines the emission mask for digital systems over a frequency range from one megahertz below to one megahertz above the wireless microphone carrier frequency, whereas the newer 2017 standard defines the emission mask over a frequency range from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where  $B$  is the wireless microphone bandwidth in megahertz.<sup>97</sup> This difference means that digital wireless microphones that comply with the newer emission masks could potentially operate with a wider bandwidth than those that comply with the older mask defined in the 2011 standard. We recognize that Section 5.1 of ETSI 300 422-1 (both 2011 and 2017) specifies a maximum wireless microphone bandwidth of 200 kilohertz at frequencies below 1 GHz and 600 kilohertz at frequencies above 1 GHz, but the Part 74 rules do not specify a bandwidth limit outside of the TV bands and duplex gap, and they do not require compliance with the ETSI bandwidth limits.

38. We seek comment on the proposal to apply the ETSI 2017 standard for emission masks and spurious emissions to the types of wireless microphones currently permitted under Part 74. Should

---

<sup>94</sup> 47 CFR § 74.861(d)(4), (e)(7). We also note that other LPAS frequency bands – the ones in which we are not proposing to authorize WMAS – are not governed by any technical rules associated with the ETSI standard. 47 CFR § 74.861(d)(3).

<sup>95</sup> Shure Dec. 30, 2020 *Ex Parte* at 6.

<sup>96</sup> 47 CFR § 74.861(d)(4), (e)(7).

<sup>97</sup> ETSI EN 300 422-1 (2011) at 26-27, Section 8.3.2.2; ETSI EN 300 422-1 (2017) at 30, Section 8.3.3.2.

we update the rules to require using the transmit emission masks and spurious emission limits in ETSI EN 300 422-1 (2017)? What are the advantages or disadvantages of the modified frequency range of the masks for digital systems? Would it provide manufacturers any additional flexibility? Would it affect how efficiently users could use the spectrum? Is there any need to limit the digital system emission masks to a frequency range to +/- 1 MHz from the carrier frequency as the current rules require? We also seek comment on any updates to the ETSI standard that are currently in progress.<sup>98</sup> When is a new version expected to be available, and how does it differ from the 2017 version? Finally, for commenters who support updating the rules for microphones currently permitted under Part 74 to the newer 2017 ETSI standard, we seek comment on whether we need to also adopt an appropriate timeframe to transition to the newer requirements and discontinue certifying equipment under the 2011 standard's emission mask and spurious emissions requirements. We are mindful that any new planned wireless microphone model roll-outs not be disrupted, but also seek to update the rules as expeditiously as possible to garner the benefits they would provide. What impact would imposing the updated emission masks and spurious emission limits from the 2017 standard have on the ability to certify existing equipment? Would equipment being developed to comply with the existing rules also comply with updated rules consistent with the 2017 standard? Or, if a transition period is needed, is 6 months or 1 year a reasonable timeframe to alter the equipment approval process and phase out the rules adopted consistent with the 2011 standard to not impede existing equipment developments?

**C. Revisions to the Technical Rules for Part 15 Unlicensed Wireless Microphone Operations in the TV Bands, the 600 MHz Guard Band, and the 600 MHz Duplex Gap**

39. We note that Sennheiser and other wireless microphone manufacturers did not request that WMAS operations be permitted under our Part 15 rules for unlicensed wireless microphone operations in the TV bands, the 600 MHz guard band, or the 600 MHz duplex gap.<sup>99</sup> We also note that Microsoft expresses concerns about permitting WMAS in these bands.<sup>100</sup> Given, however, that the Commission's rules permit wireless microphones to operate on an unlicensed basis under Part 15 of the rules in the VHF-TV bands (54-72 MHz, 76-88 MHz and 174-216 MHz), the UHF-TV band (470-608 MHz), the 614-616 MHz segment of the 600 MHz guard band, and the 657-663 MHz segment of the 600 MHz duplex gap,<sup>101</sup> that the rules currently provide that unlicensed wireless microphones in these bands must comply with emission masks and spurious emission limits defined in the 2011 version of the ETSI standard for wireless microphones,<sup>102</sup> that wireless microphones in these bands often historically have used the same underlying technologies regardless of whether they operate on a licensed basis under Part 74 or an unlicensed basis under Part 15,<sup>103</sup> and that oftentimes the same users may operate both licensed and unlicensed wireless microphones, we seek comment on the extent to which the Commission should update the applicable rules for these devices to be consistent with the most recent ETSI standard as we are

---

<sup>98</sup> Shure Dec. 30, 2020 *Ex Parte* at 6 (ETSI is currently in the process of drafting an updated version that would supplant v2.1.2.).

<sup>99</sup> Neither Sennheiser nor any other party specifically requests that we permit WMAS operations for unlicensed wireless microphone operations under Part 15. *See, e.g.*, Sennheiser Petition at 6, 9.

<sup>100</sup> Microsoft Comments at 2-6; Microsoft Reply at 2-3.

<sup>101</sup> 47 CFR § 15.236(b). The rules also formerly permitted operation in the 600 MHz service band at locations where a licensee has not yet commenced operation, but wireless microphone operation is not permitted in these bands after July 13, 2020. *See Channel Reassignment Public Notice*, 32 FCC Rcd at 2807, para. 68.

<sup>102</sup> 47 CFR § 15.236(g).

<sup>103</sup> Due to the similarities between the Part 74 and Part 15 wireless microphone requirements, a wireless microphone that operates in the TV bands with a power level of no more than 50 milliwatts (the Part 15 limit) can be certified to operate under either Part 74 or Part 15 or both. KDB Publication Number 206256, <http://www.fcc.gov/labhelp>.

proposing for licensed LPAS wireless microphones, and whether we should otherwise permit use of WMAS for unlicensed wireless microphones in any of these bands.

40. *Background.* The Commission generally applies the same technical rules to unlicensed and licensed wireless microphones operations in the TV bands and the 600 MHz duplex gap, with certain differences relating to operation. In the TV bands, the technical requirements applicable to unlicensed wireless microphones are the same as those under Part 74,<sup>104</sup> while the maximum permissible power for unlicensed wireless microphones in the UHF-TV band is lower (i.e., 50 milliwatts) than permitted for licensed LPAS wireless microphone operations (i.e., 250 milliwatts) in that band.<sup>105</sup> The rules for operation the 600 MHz duplex gap (652-663 MHz) differ between unlicensed wireless microphone and licensed Part 74 LPAS wireless microphone operations in that licensed LPAS wireless microphones may operate in a 4-megahertz portion (653-657 MHz), while unlicensed wireless microphones may operate in a separate 6-megahertz portion (657-663 MHz), both limited to 20 milliwatts EIRP.<sup>106</sup> Unlicensed wireless microphones share this 6-megahertz portion of the 600 MHz duplex gap with unlicensed white space devices, which operate under other Part 15 rules.<sup>107</sup> The emission mask and the spurious emission limits that apply to unlicensed wireless microphones in the TV bands and the 600 MHz guard band and duplex gap are the same as those that apply to licensed LPAS devices.<sup>108</sup>

41. Microsoft asks that the Commission prohibit WMAS use by unlicensed wireless microphone operators in the TV bands and the 600 MHz duplex gap if such operations would be inconsistent with other existing Part 15 technical rules.<sup>109</sup> It notes that the current rules governing unlicensed wireless microphones allow such devices to operate with a higher spectral density than Part 15 white space devices.<sup>110</sup> Microsoft expresses concern that permitting 6-megahertz WMAS systems for unlicensed wireless microphones could “break this careful balance and allow co-channel operation with [w]hite [s]pace devices at significantly higher power levels than the FCC intended.”<sup>111</sup> It asserts that the 6-megahertz channel in the 600 MHz duplex gap is especially critical for white space device operations because that is the only channel available for white space device operations throughout the entire United States.<sup>112</sup>

42. *Discussion.* Consistent with our proposals to update the emission masks and spurious emission limits in the existing Part 74 LPAS rules for licensed wireless microphones (i.e., wireless microphones that are limited to 200 kHz channels), we similarly propose to update the Part 15 rules to specify the transmit emission masks and the spurious emission limits in EN 300 422-1 (2017) in place of the emission masks and spurious emission limits in the 2011 version of this standard which are currently specified in the rules.<sup>113</sup> While the newer masks are very similar to the older ones, there is one significant difference in the masks for digital wireless microphones. Specifically, the older masks for digital systems

---

<sup>104</sup> Licensed and unlicensed wireless microphones must comply with the same bandwidth, channelization, frequency stability, emission mask and spurious emission limits. 47 CFR §§ 74.802(c); 74.861(e)(4)-(5), (7); 15.236(f)-(g).

<sup>105</sup> 47 CFR § 15.236(d)(1) (limiting power in the VHF and UHF-TV bands to 50 milliwatts EIRP); 47 CFR § 74.861(e)(1) (limiting power in the VHF-TV bands to 50 milliwatts EIRP and in the UHF-TV band to 250 milliwatts conducted).

<sup>106</sup> Compare 47 CFR § 74.861(e)(1)(iii) with *id.* § 15.236(d)(2).

<sup>107</sup> 47 CFR §§ 15.236(c)(3), 15.707(a)(2).

<sup>108</sup> Compare 47 CFR § 74.861(e)(7) with *id.* § 15.236(g).

<sup>109</sup> Microsoft Comments at 1.

<sup>110</sup> Microsoft Comments at 1.

<sup>111</sup> Microsoft Comments at 1-2.

<sup>112</sup> Microsoft Comments at 2.

<sup>113</sup> 47 CFR § 15.236(g).

were defined over a frequency range from one megahertz below to one megahertz above the wireless microphone carrier frequency, whereas the newer masks are defined over a frequency range from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where  $B$  is the wireless microphone bandwidth in megahertz.<sup>114</sup>

43. We seek comment on this proposal. Should we update the rules to require the use of the transmit emission masks in ETSI EN 300 422-1 (2017)? What are the advantages or disadvantages of the modified frequency range of the masks for digital systems? Would it provide manufacturers any additional flexibility? Would it affect the efficiency of spectrum use? Is there any need to limit the digital system emission masks to a frequency range to  $\pm 1$  MHz from the carrier frequency as the current rules require? We also seek comment on any updates to the ETSI standard that are currently in progress.<sup>115</sup> When is a new version expected to be available, and how does it differ from the 2017 version? How would updating the rules to harmonize with the ETSI standard create or hinder opportunities for wireless microphone manufacturers? What are the ramifications on the ability to easily manufacture and sell these products on a global scale?

44. While we note that Sennheiser and other wireless microphone manufacturers did not request that WMAS operations be permitted for unlicensed wireless microphone operations in the TV bands, 600 MHz guard band, or the 600 MHz duplex gap,<sup>116</sup> and that Microsoft opposed permitting WMAS in the unlicensed portion of the 600 MHz duplex gap,<sup>117</sup> we nonetheless seek comment on whether WMAS should be permitted for unlicensed wireless microphone operations in any of these bands, and, if so, any technical rules or restrictions that should apply. We recognize that there are unlicensed entities that operate wireless microphones in UHF bands that have a need to operate a large number of wireless microphones, but do not fall into any of the categories of entities eligible for a license under Part 74 of the rules, and thus must operate wireless microphones on an unlicensed basis in the TV bands, the 600 MHz guard band, and the unlicensed portion of the 600 MHz duplex gap.<sup>118</sup>

45. If we were to allow WMAS under Part 15 of the rules, in which bands should they be permitted to operate? Should they be allowed in only the TV bands, or also in the 600 MHz guard band, where unlicensed wireless microphones are permitted, and in the unlicensed upper 6-megahertz portion of the duplex gap (657-663 MHz)? Alternatively, should we allow WMAS in the TV bands and the 600 MHz guard band, but not in the unlicensed portion of the 600 MHz duplex gap given the concerns raised by Microsoft? If we were to allow such operation, what technical requirements should apply? Specifically, should they be permitted to operate with the current power limits of 50 milliwatts EIRP in the TV bands and 20 milliwatts EIRP in the 600 MHz guard band and 600 MHz duplex gap? Should the same bandwidth and spectral efficiency requirements apply as we proposed for licensed WMAS? Would the ETSI emission masks and spurious emission limits that we propose for Part 74 licensed WMAS devices be suitable for unlicensed WMAS devices?

46. We do not intend to take any action in this proceeding that would constrain spectrum availability for or otherwise adversely impact the use of this spectrum for white space device operations.

---

<sup>114</sup> ETSI EN 300 422-1 (2011) at 26-27, Section 8.3.2.2; ETSI EN 300 422-1 (2017) at 30, Section 8.3.3.2.

<sup>115</sup> Shure Dec. 30, 2020 *Ex Parte* at 6 (ETSI is currently in the process of drafting an updated version that would supplant v2.1.2.).

<sup>116</sup> Neither Sennheiser nor any other party specifically requests that we permit WMAS operations for unlicensed wireless microphone operations under Part 15. *See, e.g.*, Sennheiser Petition at 6, 9.

<sup>117</sup> Microsoft Comments at 2-6; Microsoft Reply at 2-3.

<sup>118</sup> Eligible entities include broadcast station licensees, broadcast network entities, cable television system operators, motion picture producers, television program producers, licensees and certain operators in the Broadband Radio Service, large venue owners or operators that routinely use 50 or more wireless microphones, and professional sound companies. 47 CFR §§ 74.801, 74.832.

Accordingly, we also seek comment on the impact of permitting WMAS operations, both licensed and unlicensed, on Part 15 white space devices which can operate in the VHF and UHF-TV bands and in the upper segment (657-663 MHz) of the 600 MHz duplex gap.<sup>119</sup> White space devices must share spectrum with unlicensed wireless microphones on an equal basis but may not operate on channels at locations and at times that have been registered in the white space database for use by licensed wireless microphones.<sup>120</sup> Would the rules we are proposing for Part 74 WMAS negatively impact white space devices in any way? Could the higher spectral efficiency of WMAS devices actually improve the availability of spectrum for white space devices since the same number of licensed wireless microphones could potentially operate in fewer channels?

47. Finally, for commenters who support updating the rules for Part 15 unlicensed wireless microphones to the newer 2017 ETSI standard, we seek comment on whether we need to also adopt an appropriate timeframe to transition to the newer requirements and discontinue certifying equipment under the 2011 standard's emission mask and spurious emissions requirements. What impact would imposing the updated emission masks and spurious emission limits from the 2017 standard have on the ability to certify existing equipment? Would equipment being developed to comply with the existing rules also comply with updated rules consistent with the 2017 standard? Or, if a transition period is needed, is 6 months or 1 year a reasonable timeframe to alter the equipment approval process and phase out the rules adopted consistent with the 2011 standard to not impede existing equipment developments?

48. Similarly, we seek comment on whether allowing Part 15 unlicensed WMAS devices would have any negative impact on white space operations, or whether that could improve the availability of channels for white space devices due to the higher spectral efficiency of WMAS devices? In particular, we seek comment on whether allowing unlicensed WMAS devices to operate in the upper 6-megahertz segment of the 600 MHz duplex gap would be a problem for white space devices as Microsoft suggests?<sup>121</sup> Under the current rules, unlicensed wireless microphones may operate in the duplex gap with a power level of up to 20 milliwatts EIRP.<sup>122</sup> Because unlicensed wireless microphones have a bandwidth limit of 200 kilohertz, multiple unlicensed wireless microphones can operate in the duplex gap simultaneously, resulting in a total radiated power level of well over 20 milliwatts in the 6-megahertz band where they operate.<sup>123</sup> Could WMAS permit the operation of multi-channel wireless microphones in the duplex gap at lower total power or power spectral density levels than the current rules permit, and thus reduce the likelihood of interference to white space devices? Are there other factors that could affect the coexistence of unlicensed wireless microphones and white space devices in the duplex gap or the TV bands?

#### **D. Updating Wireless Microphone Rules Following the End of the Post-Incentive Auction Transition**

49. Wireless microphones, both licensed and unlicensed, were previously permitted to operate in the 600 MHz band (former TV channels 38-51) that was reallocated for wireless services in the *Incentive Auction R&O*.<sup>124</sup> In that action, the Commission established a 39-month period during which TV stations would transition out of the 600 MHz band, and decided that wireless microphones would no longer be able to operate in the 600 MHz service band after this transition period, although they could still

---

<sup>119</sup> Unlike licensed and unlicensed wireless microphones, white space devices are permitted to continue operating in the 600 MHz service bands after the end of the post-Incentive Auction transition period (July 13, 2020) on frequencies and at locations where a Part 27 licensee has not yet commenced operations. 47 CFR § 15.707.

<sup>120</sup> 47 CFR § 15.712(f).

<sup>121</sup> Microsoft Comments at 2.

<sup>122</sup> 47 CFR § 15.236(d)(2).

<sup>123</sup> 47 CFR § 15.236(f)(2).

<sup>124</sup> See generally, *Incentive Auction R&O*, 29 FCC Rcd 6567.

operate in the 600 MHz guard band(s) and 600 MHz duplex gap.<sup>125</sup> In 2015 and 2017, the Commission established rules for both licensed and unlicensed wireless microphones that operate in the 600 MHz service band, certain segments of the 600 MHz guard band(s) and 600 MHz duplex gap, as well as transition requirements to implement the Commission's decision that all wireless microphones must cease operation in the 600 MHz service band at the end of the 39-month transition period.<sup>126</sup> After the end of the transition period on July 13, 2020, wireless microphone operations in the 600 MHz band are limited to segments of the 600 MHz guard band and 600 MHz duplex gap as specified in the Part 15 and 74 rules.<sup>127</sup>

50. We propose to modify the Part 74 and Part 15 rules to reflect the end of the 39-month transition period. Some of these changes are not substantive and simply implement previous Commission decisions. Because we are proposing to amend the Part 74 and Part 15 wireless microphone rules to allow WMAS and update references to ETSI standards, we are including these additional changes in the proposed rules. We seek comment on whether these proposed changes are appropriate and whether there are any other rules not included in the proposed rules that also should be updated to reflect the end of the transition period.

51. *Part 74.* We propose to modify the list of frequencies in Section 74.802(a) that are available for low power auxiliary stations by removing the 614-698 MHz band (former TV channels 38 to 51) and replacing it with the 653-657 MHz band (a segment of the 600 MHz duplex gap), which is the only portion of the 600 MHz band now available under Part 74.<sup>128</sup> We also propose to modify the technical requirements in Section 74.861(e)(1) to remove the reference to the 614-698 MHz band in paragraph (ii) and to add the frequency band for the segment of the duplex gap where wireless microphones can operate in paragraph (iii).<sup>129</sup> We also note that a number of Part 74 rules specify deadlines related to the post-Incentive Auction transition or other rule changes that have since passed. For example, Sections 74.802(f) and 74.851(i)-(l) contain provisions related to the now ended 600 MHz band transition.<sup>130</sup> Section 74.870(c) lists 600 MHz band frequencies for Wireless Video Assist devices that are no longer available after the end of the transition, and Sections 74.861(d)(3), (e)(6) and 74.870(i) contain transition dates that have passed.<sup>131</sup> We seek comment on our proposals to modify these rules as well as whether there are any other Part 74 rules that can be removed or modified.

---

<sup>125</sup> *Incentive Auction R&O*, 29 FCC Rcd at 6845-46, paras. 684, 687.

<sup>126</sup> *See generally Wireless Microphones R&O*, 30 FCC Rcd 8739; *White Spaces R&O*, 30 FCC Rcd 9551; *Wireless Microphones Order*, 32 FCC Rcd 6077.

<sup>127</sup> *Channel Reassignment Public Notice*, 32 FCC Rcd at 2807, para. 68; 47 CFR §§ 15.236(c)(3), (5); 74.802(a)(2).

<sup>128</sup> 47 CFR § 74.802(a). As shown in the attached Appendix A, these changes would also eliminate paragraph (a)(2) and change paragraph (a)(1) to (a).

<sup>129</sup> 47 CFR § 74.861(e)(1)(ii)-(iii).

<sup>130</sup> 47 CFR §§ 74.802(f); 74.851(i-l). Section 74.802(f) specifies requirements for wireless microphone operators to meet minimum separation distances from Part 27 licensees during the transition and to cease operation in the 600 MHz service band by the end of the transition. Section 74.851(i-l) specifies cutoff dates on the certification, importation and marketing of devices that operate in the 600 MHz service band, as well as equipment labeling and consumer disclosure requirements.

<sup>131</sup> 47 CFR §§ 74.861(d)(3), (e)(6); 74.870(c), (i). Section 74.861(d)(3) states that devices operating in the 944-952 MHz band must meet the emission limits in that section until January 13, 2018. After that date, they must meet the emission limits specified in paragraph (d)(4), i.e., the emission masks in ETSI EN 300 422-1 (2011). Section 74.861(e)(6) contains the emission limits that devices operating in the TV bands had to meet until nine months after release of the Commission's *Channel Reassignment Public Notice*, which was January 13, 2018. After that, they must meet the emission mask specified in paragraph (e)(7), i.e., the emission masks in ETSI EN 300 422-1 (2011). Section 74.870(c) states that operation of Wireless Video Assist Devices is permitted in the entire 470-698 MHz band (TV channels 14-51), with the exception of the 608-614 MHz band (channel 37), whereas operation after the

(continued....)

52. *Part 15.* We propose to make certain edits to the Part 15 rules to remove unnecessary references to transition dates that have passed and to make the rules clearer and easier to follow. Specifically, with regard to Section 15.236, we propose to amend paragraph (a) to remove the definition of 600 MHz service band since it is no longer available for wireless microphone use, as well as the definition of Spectrum Act, since it is not referenced anywhere else in this rule section.<sup>132</sup> We also propose to remove paragraph (c)(2) which lists the 600 MHz service band as being available for unlicensed wireless microphones and paragraph (e)(2) which lists minimum required separation distances from 600 MHz service band licensees, as well as modify paragraph (d)(1) to remove a reference to the 600 MHz service band.<sup>133</sup> We further propose to remove Section 15.236(c)(6) which requires that prior to operation in 600 MHz service band, 600 MHz guard band(s) or 600 MHz duplex gap, wireless microphone users must rely on the white space database to determine that their intended operating frequencies are available for unlicensed wireless microphone operation at the location where they will be used, and to make corresponding revisions to the white space rules to reflect the removal of this section.<sup>134</sup> This requirement appears unnecessary after the end of the post-incentive auction transition since with the removal of all TV stations from the 600 MHz band, there are no licensed services to protect in either the 600 MHz guard band or the upper 6-megahertz portion of the 600 MHz duplex gap. We also propose to remove Section 15.37(i) (transition provisions for compliance with modified wireless microphone rules) since the certification, manufacturing, marketing and operational cutoff dates have all passed and there does not appear to be a need to retain this section.<sup>135</sup> We further propose to remove Section 15.37(k) (disclosure requirements for unlicensed wireless microphones capable of operating in the 600 MHz service band) since all marketing of unlicensed wireless microphones that operate in the 600 MHz service band is now prohibited, so there does not appear to be a need for this rule on consumer disclosure.<sup>136</sup>

53. We seek comment on these proposals. Do we need to retain any of the rules that we are proposing to eliminate? Is there a need for a rule specifically prohibiting unlicensed wireless microphone operation in the 600 MHz service band, or is it sufficient to simply remove all rules related to operation in this band, thus indirectly indicating that such operation is prohibited? With regard to the proposed removal of Section 15.236(c)(6), we note that the Spectrum Act states that operation of unlicensed devices in the 600 MHz guard bands “shall rely on a database or subsequent methodology as determined by the Commission.”<sup>137</sup> While we are proposing to remove the database access requirement for unlicensed wireless microphones operating in the guard bands (including duplex gap) as no longer necessary, we believe the fact that these bands are now unavailable to licensed services nationwide constitutes a subsequent methodology that will ensure unlicensed wireless microphones do not cause harmful interference to licensed services, thus complying with the requirements of the Spectrum Act.<sup>138</sup> We seek comment on this assessment.

#### IV. PROCEDURAL MATTERS

54. *Paperwork Reduction Act Analysis.* This document does not contain proposed information collection(s) subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In

(Continued from previous page) \_\_\_\_\_

end of the transition is permitted only in the 470-608 MHz (TV channels 14-36) and 653-657 MHz portions of the 470-698 MHz band. Section 74.870(i) contains transition provisions that have passed.

<sup>132</sup> 47 CFR § 15.236(a)(4)-(5). We would also remove the unnecessary note between these paragraphs.

<sup>133</sup> 47 CFR § 15.236(c)(2), (d)(1), (e)(2).

<sup>134</sup> 47 CFR § 15.236(c)(6); Appendix A, Sections 15.703, 15.713 and 15.715.

<sup>135</sup> 47 CFR § 15.37(i).

<sup>136</sup> 47 CFR § 15.37(k).

<sup>137</sup> 47 U.S.C. § 1454(d).

<sup>138</sup> 47 U.S.C. § 1454(d), (e).

addition, therefore, it does not contain any new or modified information collection burden for small business concerns with fewer than 25 employees, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4).

55. *Initial Regulatory Flexibility Analysis.* As required by the Regulatory Flexibility Act,<sup>139</sup> the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities of the proposals addressed in this Notice. The IRFA is found in Appendix C. We request written public comment on the IRFA. Comments must be filed in accordance with the same filing deadlines as comments filed in response to the Notice of Proposed Rulemaking 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 Notice, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration, in accordance with the Regulatory Flexibility Act.<sup>140</sup>

56. *Ex Parte Presentations.* This proceeding is a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules.<sup>141</sup> 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 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.

57. *Filing requirements.* 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://www.fcc.gov/ecfs/>.
- 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 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

---

<sup>139</sup> 5 U.S.C. § 603.

<sup>140</sup> 5 U.S.C. § 603(a).

<sup>141</sup> 47 CFR § 1.1200 *et seq.*

Secretary, Federal Communications Commission.

- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street NE Washington, DC 20554.
- Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19. See FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy, Public Notice, 35 FCC Rcd 2788, 2788-89 (OS 2020). <https://www.fcc.gov/document/fcc-closes-headquarters-open-window-and-changes-hand-delivery-policy>.

58. *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](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (TTY).

59. *Additional Information*. For additional information on this proceeding, contact Hugh L. Van Tuyl, [Hugh.VanTuyl@fcc.gov](mailto:Hugh.VanTuyl@fcc.gov), (202) 418-7506.

## V. ORDERING CLAUSES

60. IT IS ORDERED, pursuant to the authority found in Sections 4(i), 301, 302, and 303 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 201, 302a, 303, and Sections 1.407 and 1.411 of the Commission's Rules, 47 C.F.R §§ 1.407 and 1.411, that this *Notice of Proposed Rulemaking* IS HEREBY ADOPTED. The petition for rulemaking of Sennheiser Electronic Corporation, RM-11821, is hereby GRANTED to the extent discussed herein, and shall be consolidated into ET Docket No. 21-115.

61. IT IS FURTHER ORDERED that NOTICE IS HEREBY GIVEN of the proposed regulatory changes described in this *Notice of Proposed Rulemaking*, and that comment is sought on these proposals.

62. 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 Rulemaking*, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

**Appendix A****Proposed Rules**

Parts 15 and 74 of the Code of Federal Regulations is proposed to be amended as follows:

**PART 15 – RADIO FREQUENCY**

The authority citation for Part 15 continues to read as follows:

**AUTHORITY:** [TO BE INSERTED PRIOR TO PUBLICATION OF SUMMARY IN FEDERAL REGISTER.].

1. Amend section 15.37 by removing and reserving paragraphs (i) and (k).
2. Amend section 15.38 by revising paragraph (e) to read as follows:

**§ 15.38 Incorporation by reference.**

\* \* \* \* \*

(e) The following document is available from the European Telecommunications Standards Institute (ETSI), 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France, or at [https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.01.02\\_60/en\\_30042201v020102p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.01.02_60/en_30042201v020102p.pdf).

(1) ETSI EN 300 422-1 V2.1.2 (2017-01): “*Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*” Copyright 2017, IBR approved for § 15.236(g).

(2) [Reserved]

\* \* \* \* \*

3. Amend section 15.236 by revising the title and paragraphs (a), (c), (d)(1), (e) and (g) to read as follows:

**§ 15.236 Operation of wireless microphones in the bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-608 MHz, 614-616 MHz and 657-663 MHz.**

(a) *Definitions.* The following definitions apply in this section.

(1) *Wireless Microphone.* An intentional radiator that converts sound into electrical audio signals that are transmitted using radio signals to a receiver which converts the radio signals back into audio signals that are sent through a sound recording or amplifying system. Wireless microphones may be used for cue and control communications and synchronization of TV camera signals as defined in §74.801 of this chapter. Wireless microphones do not include auditory assistance devices as defined in §15.3(a) of this part.

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

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

(b) \* \* \*

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

- (1) Channels allocated and assigned for the broadcast television service.
- (2) The 657-663 MHz segment of the 600 MHz duplex gap.
- (3) The 614-616 MHz segment of the 600 MHz guard band.

(d) \* \* \*

(1) In the bands allocated and assigned for broadcast television: 50 mW EIRP.

\* \* \* \* \*

(e) Operation is limited to locations at least four kilometers outside the following protected service contours of co-channel TV stations:

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
Analog: Class A TV, LPTV, translator and booster	Low VHF (2-6)	47	F(50,50)
	High VHF (7-13)	56	F(50,50)
	UHF (14-51)	64	F(50,50)
Digital: Full service TV, Class A TV, LPTV, translator and booster	Low VHF (2-6)	28	F(50,90)
	High VHF (7-13)	36	F(50,90)
	UHF (14-51)	41	F(50,90)

(f) \* \* \*

(g) *Emission masks.*

(1) *Analog systems.* Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(2) *Digital systems.* Emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 of ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(3) *Spurious emission limits for analog and digital systems.* Emissions outside of the bands listed in paragraphs (g)(1) and (g)(2) shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

4. Amend section 15.703 by revising the definition of White space database to read as follows:

**§ 15.703 Definitions.**

\* \* \* \* \*

*White space database.* A database system approved by the Commission that maintains records on authorized services and provides lists of available channels to white space devices.

5. Amend section 15.713 by removing and reserving paragraph (a)(2), revising paragraph (a)(3) and removing and reserving paragraphs (f) and (i) to read as follows:

**§ 15.703 White space database.**

(a) \* \* \*

(2) [Reserved]

(3) To register the identification information and location of fixed white space devices.

\* \* \* \* \*

(f) [Reserved]

\* \* \* \* \*

(i) [Reserved]

\* \* \* \* \*

6. Amend section 15.715 by removing paragraph (q).

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

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

AUTHORITY: [TO BE INSERTED PRIOR TO PUBLICATION OF SUMMARY IN FEDERAL REGISTER.].

8. Amend section 74.801 by adding a definition of Wireless Multi-Channel Audio System to read as follows:

**§ 74.801 Definitions**

\* \* \* \* \*

*Wireless Multi-Channel Audio System.* A system that digitally combines the signals of multiple low power auxiliary station devices onto one radio-frequency channel.

9. Amend section 74.802 by revising paragraph (a) to read as follows:

**§ 74.802 Frequency assignment.**

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

26.100-26.480 MHz

54.000-72.000 MHz

76.000-88.000 MHz

161.625-161.775 MHz (except in Puerto Rico or the Virgin Islands)

174.000-216.000 MHz

450.000-451.000 MHz

455.000-456.000 MHz

470.000-488.000 MHz

488.000-494.000 MHz (except Hawaii)

494.000-608.000 MHz

653.000-657.000 MHz

941.500-944.000 MHz

944.000-952.000 MHz

952.850-956.250 MHz

956.45-959.85 MHz

1435-1525 MHz

6875.000-6900.000 MHz

7100.000-7125.000 MHz

\* \* \* \* \*

10. Amend section 74.861 by revising paragraphs (d)(4), (e)(1), (e)(5) and (i) to read as follows:

**§ 74.861 Technical requirements.**

\* \* \* \* \*

(d) \* \* \*

(4)(i) *Analog systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(ii) *Digital systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 (Figure 4 below 2 GHz or Figure 5 above 2 GHz) of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(iii) *Wireless Multi-Channel Audio Systems.* For the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands, emissions within the band from 5 x B below to 5 x B above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.4 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.* The operating bandwidth (B) may not exceed 6 megahertz, and the device must transmit at least three audio channels per megahertz.

(iv) *Spurious emission limits.* Emissions outside of the emission masks specified in paragraphs (d)(4)(i) through (d)(4)(iii) shall comply with the limits specified in section 8.4 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(e) \* \* \*

(1) \* \* \*

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

(ii) 470-608 MHz band: 250 mW conducted power

(iii) 653-657 MHz band: 20 mW EIRP

\* \* \* \* \*

(5) The operating bandwidth shall not exceed 200 kilohertz, except that a wireless multi-channel audio system may have an operating bandwidth not exceeding 6 megahertz and must transmit at least three audio channels per megahertz. For wireless multi-channel audio system devices operating in the TV bands, the 6 megahertz (or less) channel must fall entirely within a single TV channel (2-36) that is available for Part 74 LPAS use under §74.802(b). The provisions of §74.802(c) regarding frequency of operation within TV channels do not apply to wireless multi-channel audio systems.

(6) \* \* \*

(7) *Emission masks.*

(i) *Analog systems.* Emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(ii) *Digital systems.* Emissions within the band from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.3 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(iii) *Wireless Multi-Channel Audio Systems.* Emissions within the band from  $5 \times B$  below to  $5 \times B$  above the carrier frequency, where B is the wireless microphone bandwidth in megahertz, shall comply with the emission mask in section 8.3.4 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

(iv) *Spurious emission limits.* Emissions outside of the bands listed in paragraphs (e)(7)(i) through (e)(7)(iii) shall comply with the limits specified in section 8.4 of the European Telecommunications Standards Institute, ETSI EN 300 422-1 V2.1.2 (2017-01), *Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.*

\* \* \* \* \*

(i) \* \* \*

(1) The following document is available from the European Telecommunications Standards Institute (ETSI), 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France, or at [https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.01.02\\_60/en\\_30042201v020102p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.01.02_60/en_30042201v020102p.pdf).

(i) ETSI EN 300 422-1 V2.1.2 (2017-01): “*Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Class A Receivers; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*” Copyright 2017, IBR approved for §§74.861(d)(4) and 74.861(e)(7).

(ii) [Reserved]

(2) [Reserved]

**Appendix B**

**List of Parties Filing Comments**

Comments

1. Alteros, Inc.
2. Microsoft Corporation
3. Shure Incorporated

Reply comments

1. Aerospace and Flight Test Radio Coordinating Council, Inc.
2. Microsoft Corporation
3. Sennheiser Electronic Corporation

## Appendix C

### Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies and rules proposed in this Notice of Proposed Rule Making (NPRM). 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 on the *NPRM* provided in paragraph 57 of the item. The Commission will send a copy of the *NPRM*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).<sup>2</sup> In addition, the *NPRM* and IRFA (or summaries thereof) will be published in the Federal Register.<sup>3</sup>

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

2. The *NPRM* addresses issues raised in a petition for rulemaking filed by Sennheiser Electronic Corporation on August 17, 2018 which requested that the Commission modify the Part 74 rules for wireless microphones in a number of respects. Specifically, it requests that the Commission define a new class of wireless microphone called a Wireless Multi-Channel Audio System (WMAS) that digitally combines the signals of multiple low power auxiliary station devices into one radio-frequency channel. Sennheiser requests that such systems be permitted to operate with a maximum channel bandwidth of 6 megahertz, rather than 200 kilohertz as the rules currently allow, and that they be permitted to operate in the TV bands, 600 MHz duplex gap, and in the 941.5-944 MHz, 944-952 MHz, and 1435-1525 MHz bands. It further requests that WMAS devices be required to operate with at least 12 audio channels in a 6-megahertz band to ensure efficient use of spectrum.

#### B. Legal Basis

3. The proposed action is taken pursuant to Sections 4(i), 301, 302, and 303 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 201, 302a, 303.

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

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

---

<sup>1</sup> 5 U.S.C. § 603. The RFA, 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).

<sup>2</sup> 5 U.S.C. § 603(a).

<sup>3</sup> 5 U.S.C. § 603(a).

<sup>4</sup> 5 U.S.C. § 603(b)(3).

<sup>5</sup> 5 U.S.C. § 601(6).

same meaning as the term “small business concern” under the Small Business Act.<sup>6</sup> A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>7</sup>

5. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.<sup>8</sup> 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.<sup>9</sup> The SBA has established a small business size standard for this industry of 1,250 employees or less.<sup>10</sup> U.S. Census Bureau data for 2012 show that 841 establishments operated in this industry in that year.<sup>11</sup> Of that number, 828 establishments operated with fewer than 1,000 employees, 7 establishments operated with between 1,000 and 2,499 employees and 6 establishments operated with 2,500 or more employees.<sup>12</sup> Based on this data, we conclude that a majority of manufacturers in this industry are small.

#### **D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities**

6. Part 74 of the Commission’s rules contains requirements for Low Power Auxiliary Service (LPAS) devices, including wireless microphones, that operate on a licensed basis. Many Part 74 wireless microphones operate on unused channels in the UHF-TV band (TV channels 14-36; 470-608 MHz). In addition, a number of other bands are available for wireless microphones under Part 74 of the rules, including the VHF-TV bands (channels 2-13; 54-72 MHz, 76-88 MHz and 216-174 MHz) and the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands. Wireless microphones may also operate on an unlicensed basis under Part 15 of the rules in the VHF and UHF-TV bands, and in the 614-616 MHz and 657-663 MHz bands. Both the Part 74 and Part 15 rules have limits on the maximum transmit power and specify transmit emission masks, i.e., limits on emissions outside a wireless microphone’s operating

---

<sup>6</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

<sup>7</sup> 15 U.S.C. § 632.

<sup>8</sup> See U.S. Census Bureau, *2017 NAICS Definition, “334220 Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing,”* <https://www.census.gov/naics/?input=334220&year=2017&details=334220>.

<sup>9</sup> *Id.*

<sup>10</sup> See 13 CFR § 121.201, NAICS Code 334220.

<sup>11</sup> See U.S. Census Bureau, *2012 Economic Census of the United States, Table ID: EC1231SG2, Manufacturing: Summary Series: General Summary: Industry Statistics for Subsectors and Industries by Employment Size: 2012, NAICS Code 334220,* <https://data.census.gov/cedsci/table?text=EC1231SG2&n=334220&tid=ECNSIZE2012.EC1231SG2&hidePreview=false>.

<sup>12</sup> *Id.* The available U.S. Census Bureau data does not provide a more precise estimate of the number of firms that meet the SBA size standard.

channel. In addition, Part 74 contains eligibility requirements for obtaining a license to operate wireless microphones under that part.

7. Most RF transmitting equipment, including Part 15 and 74 wireless microphones, must be authorized through the certification procedure. Certification is an equipment authorization issued by a designated Telecommunication Certification Body (TCB) based on an application and test data submitted by the responsible party (e.g., the manufacturer or importer).<sup>13</sup> The NPRM does not propose any changes to the authorization procedure for Part 15 or Part 74 wireless microphones.

8. The NPRM proposes rules for a new class of Part 74 wireless microphone called a Wireless Multi-Channel Audio System (WMAS) that can operate on channels up to 6 megahertz wide, which is wider than the rules currently permit (e.g., 200 kilohertz in the TV bands). WMAS devices would have to meet a spectral efficiency requirement of three audio channels per megahertz and would have to meet an emission mask specified for these types of devices in European Telecommunications Institute Standard ETSI EN 300 422-1 v2.1.2 (2017-01). Operation of WMAS devices would be permitted in the VHF and UHF-TV bands and the 653-657 MHz, 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz bands. The current rules for narrower bandwidth wireless microphones would not be changed except to update references to reflect the latest version of the ETSI standard that contains emission masks for narrower bandwidth wireless microphones.

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

9. The RFA requires an agency to describe any significant, specifically small business, 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 and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”<sup>14</sup>

10. The proposed rules would permit wireless microphone manufacturers to develop a new class of multichannel, wider bandwidth devices. These changes are permissive, meaning that manufacturers can continue to develop, manufacture and market narrower bandwidth wireless microphones as the rules currently allow. No changes are required to previously approved wireless microphones, and current users of these devices may continue to operate them. Manufacturers that choose to make equipment that operates under the proposed rules would have to obtain a new certification for the equipment.

---

<sup>13</sup> 47 C.F.R. § 2.907. The Commission or a TCB may test a sample of a device to verify that it complies with the rules before granting approval for the equipment to be marketed. Examples of devices subject to certification include, but are not limited to, mobile phones; wireless local area networking equipment, remote control transmitters; land mobile radio transmitters; wireless medical telemetry transmitters; cordless telephones; and walkie-talkies.

<sup>14</sup> 5 U.S.C. § 603(c)(1) – (c)(4).

11. The NPRM also proposes and seeks comment on rule changes to reflect the fact that Part 15 and Part 74 wireless microphones may no longer operate after July 13, 2020 in the 600 MHz service bands (617-652 MHz and 663-698 MHz) where they were previously permitted to operate. Because these are simply clean-up changes to implement a previous Commission decision, they will not have any significant economic impact on small entities.

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

None.

**STATEMENT OF  
ACTING CHAIRWOMAN JESSICA ROSENWORCEL**

Re: *Amendment of Parts 15 and 74 of the Rules for Wireless Microphones in the TV Bands, 600 MHz Guard Band, 600 MHz duplex Gap, and the 941.5-944 MHz, 944-952 MHz, 952.850-956.250 MHz, 956.45-959.85 MHz, 1435-1525 MHz, 6875-6900 MHz and 7100-7125 MHz Bands*, ET Docket No. 21-115, RM 11821.

Unless you're in video and audio production, the odds are you haven't thought much about wireless microphones. But they're everywhere. You'll find them in big Broadway productions and small-town theaters. They're present on film sets. They're commonly used in churches, stadiums, and schools. These nearly ubiquitous devices operate in a mix of licensed and unlicensed airwaves in the 600 MHz and 900 MHz bands, as well as the 1.9 GHz and 7 GHz bands. These airwaves are shared with a range of other wireless services, including broadcasting, aeronautical activities, Wi-Fi, and unlicensed operations that use white spaces to expand the availability of broadband.

Making sure all of these services can function at the same time without interference is a significant task. So when a new technology for wireless microphones comes along it merits a close and careful look. That's what the Federal Communications Commission is doing today. We're starting a rulemaking to assess changes needed to our rules to support a new kind of wireless microphone system called Wireless Multi-Channel Audio Systems, or WMAS. These systems have the potential to significantly improve the efficiency of wireless microphone operations. So much so, that under the rules we propose here, three times as many microphones may be able to operate while putting the same amount of power over the air as a single wireless microphone does under our rules today.

This promotes spectral efficiency—which is a good thing. Because here that could mean that other spectrum interests using these bands might benefit from more efficient microphone operations, too. In fact, this new spectral efficiency could mean more opportunities for broadband technologies like white spaces and Wi-Fi. So we seek detailed comment on these matters.

I look forward to the record that develops. For making this rulemaking possible, thank you to David Duarte, Ira Keltz, Paul Murray, Siobahn Philemon, Ron Repasi, and Hugh Van Tuyl from the Office of Engineering and Technology; Patrick Brogan, Kate Matraves, Michelle Shaefer, and Aleks Yankelevich from the Office of Economics and Analytics; David Horowitz, Keith McCrickard, and Bill Richardson from the Office of General Counsel; Jeremy Marcus, Ashley Tyson, and Raphael Sznajder from the Enforcement Bureau; Hillary DeNigro, Barbara Kreisman, and Evan Morris from the Media Bureau; and Chris Andes, Steve Buenzow, Kari Hicks, Paul Malmud, and Blaise Scinto from the Wireless Telecommunications Bureau.