



## FEDERAL COMMUNICATIONS COMMISSION

### 47 CFR Parts 15 and 74

[ET Docket No. 21-115; RM-11821; FCC 24-22; FR ID 207656]

### 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

**AGENCY:** Federal Communications Commission.

**ACTION:** Final rule.

**SUMMARY:** In this document, the Federal Communications Commission (Commission) revises the technical rules for low-power auxiliary station (LPAS) devices to permit a recently developed type of wireless microphone system, termed herein as a Wireless Multichannel Audio System (WMAS), to operate in the broadcast television (TV) bands and other LPAS frequency bands on a licensed basis. The Commission adopts technical rules for licensed WMAS operations in specific frequency bands under our LPAS rules and also permits WMAS to operate on an unlicensed basis under the rules in the TV bands and 600 MHz duplex gap. The Commission updates its existing LPAS and 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, the Commission updates the wireless microphone rules to reflect the end of the post-Incentive Auction transition period. The Commission's goal in the FCC document is to increase wireless microphone spectral efficiency and enable more intensive use in the spectrum available for such operations.

**DATES:** This rule is effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. The incorporation by reference of certain material listed in this rule is approved by the Director of the Federal Register as of [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

**FOR FURTHER INFORMATION CONTACT:** Hugh VanTuyl of the Office of Engineering and Technology, at [Hugh.VanTuyl@fcc.gov](mailto:Hugh.VanTuyl@fcc.gov) or 202-418-7506.

**SUPPLEMENTARY INFORMATION:** This is a summary of the Commission’s *Report and Order*, ET Docket No. 21-115 and RM-11821; FCC 24-22, adopted and released on February 15, 2024. The full text of this document is available for public inspection and can be downloaded at:

<https://docs.fcc.gov/public/attachments/FCC-24-22A1.pdf>. Alternative formats are available for people with disabilities (Braille, large print, electronic files, audio format) by sending an email to [FCC504@fcc.gov](mailto:FCC504@fcc.gov) or calling the Commission’s Consumer and Governmental Affairs Bureau at (202) 418–0530 (voice), (202) 418–0432 (TTY).

### **Procedural Matters**

*Regulatory Flexibility Act.* The Regulatory Flexibility Act of 1980, as amended (RFA), requires that an agency prepare a regulatory flexibility analysis for notice and comment rulemakings, unless the agency certifies that “the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities.” Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of the rule changes contained in the *Report and Order* on small entities. The FRFA is set forth in Appendix C of the FCC document, <https://docs.fcc.gov/public/attachments/FCC-24-22A1.pdf>.

*Paperwork Reduction Act.* The Report and Order does not contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In 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).

*Congressional Review Act.* The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs, that this rule is non-major under the Congressional Review Act, 5 U.S.C. 804(2). The Commission will send a copy of the *Report and Order* to Congress and the Government Accountability office, pursuant to 5 U.S.C. 801(a)(1)(A).

*Accessing Materials. 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).

*Incorporation by Reference.* Incorporation by reference (IBR) is the process that federal agencies use when referring to materials published elsewhere to give those materials the same force and effect of law in the Code of Federal Regulations (CFR) as if the materials' text had actually been published in the *Federal Register*. By using IBR, the Commission is able to give effect to technical instructions, testing methodologies, and other process documents that are developed and owned by standards development organizations. Referencing these documents in the Commission's rules in accordance with requirements established by the Office of the Federal Register substantially reduces the volume of material that the Commission otherwise would have to publish in the *Federal Register* and the CFR. Once the Commission has completed any necessary notice-and-comment rulemaking proceedings and determined based on the record that any standards the Commission adopts is sound and appropriate, the Commission need only update the references to the standards in the Commission's rules.

## **Synopsis**

The Commission amends the part 74 low-power auxiliary station (LPAS) technical rules to permit the use of Wireless Multichannel Audio Systems (WMAS) in most of the frequency bands where wireless microphones are currently permitted to operate. WMAS devices uses wider channelization than currently is permitted for wireless microphones under part 74, along with a more efficient operating protocol, that can enable more microphones to be deployed within the same amount of spectrum. Specifically, the Commission adopts a definition of WMAS and specifies the frequency bands in which WMAS will be permitted, along with the technical requirements (spectral efficiency, channel bandwidth, maximum output power, and emission masks) that govern the operation of these systems on a licensed basis under part 74. The Commission adopts technical rules for WMAS consistent with the recently updated, i.e., 2021, European Telecommunication Standards Institute (ETSI) standard for WMAS. The Commission also updates its existing technical rules for currently authorized part 74 LPAS wireless microphones, which already rely on certain ETSI standards, to require the applicable portions of the 2021 ETSI standard for WMAS. In addition, the Commission revises the part 15 technical rules for unlicensed wireless microphone devices that operate in the TV bands and the 600 MHz duplex gap to permit WMAS

operations in those bands and to require use of the 2021 ETSI standard. Finally, the Commission makes minor updates to the part 15 and part 74 rules to reflect the end of the post-Incentive Auction transition. The existing licensing mechanisms and eligibility requirements under part 74 subpart H of the Commission's rules remain unchanged.

At the time the Commission released the *Notice*, the latest ETSI standard for wireless microphones was the version released in 2017, but the Commission noted the possibility that ETSI could further update its standard during the pendency of the FCC document. The standard was updated in November 2021 after the Commission released the NPRM (86 FR 35046, July 1, 2021). In assessing the changes between the 2017 and 2021 versions, the Commission finds that none of the changes affecting the parts of the standard that pertain to the FCC proceeding were of a substantive nature; thus, the changes between the two versions does not affect the overall proposals or the nature of the record. Consistent with the Commission current practices regarding the ETSI wireless microphone standard, the Commission will continue to require only specific portions in its rules, i.e., the transmit emission masks and spurious emission limits. As noted, the Commission finds that there are no significant differences between the 2017 and 2021 ETSI standards in that regard. Several parties recognize the pending update to the ETSI standard in their comments and explicitly support adoption of the 2021 version.

The OFR has regulations concerning incorporation by reference. These regulations require that, for a final rule, agencies must discuss in the preamble to the final rule the way in which materials that the agency incorporates by reference are reasonably available to interested parties, and how interested parties can obtain the materials. Additionally, the preamble to the final rule must summarize the material. Sections 15.236(g), 74.861(d)(4), and (e)(7) of the final rules require certain wireless microphones to comply with the transmit emission masks and spurious emission limits in European Telecommunications Standards Institute (ETSI) standard EN 300 422-1 V2.2.1 (2021-11): Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Audio PMSE Equipment up to 3 GHz; Harmonised Standard for access to radio spectrum. This standard specifies the technical characteristics and methods of measurements for “audio programme making and special events” (PMSE) equipment operating with up to 250 mW output power on radio frequencies up to 3 GHz. PMSE equipment within the scope of this standard is equipment that is used in wireless applications for audio transmission purposes including, but not limited to, wireless

microphones, in-ear monitoring systems, conference systems, talkback systems, tour guide systems, cognitive PMSE, Wireless Multichannel Audio Systems (WMAS), and assistive listening devices. ETSI EN 300 422-1 V2.2.1 (2021-11) is available from ETSI at 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France. It may be downloaded at no charge from ETSI at: [https://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.02.01\\_60/en\\_30042201v020201p.pdf](https://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.02.01_60/en_30042201v020201p.pdf).

## **Revisions to the Part 74 LPAS Rules to Authorize WMAS**

### **Definition of WMAS**

The Commission adopts the WMAS definition in the 2021 ETSI standard, “wireless audio transmission systems using digital broadband transmission techniques for microphone and in-ear monitor systems applications, and other multichannel audio PMSE use, e.g. with the ability to support three or more audio channels per MHz,” with two modifications. The Commission does not include the term “PMSE,” which is not used in the Commission rules and is not needed because the part 74 rules already define the device categories to which the rules apply. The Commission also does not include the phrase concerning “the ability [of WMAS] to support three or more audio channels per MHz” since that is listed merely as an example in the definition, but the Commission separately specifies a similar spectral efficiency requirement in the rules. Accordingly, for purposes of parts 15 and 74, the Commission defines “Wireless Multichannel Audio Systems” as “[w]ireless audio transmission systems using broadband digital transmission techniques for microphone and in-ear monitor system applications and other multichannel audio use.” The Commission believes that this definition will encompass the types of WMAS devices that manufacturers are developing, and is consistent with several commenters’ requests to adopt a WMAS definition similar to ETSI’s definition.

### **Frequency Bands of Operation**

The Commission permits WMAS to operate on a licensed basis in all of the bands it proposed in the *Notice*, 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. Several of these bands, including the TV bands, allow for WMAS channel sizes

of 6 megahertz or greater, while the smaller bands (the 653-657 MHz segment of the duplex gap, the 952.850-956.250 MHz band, and the 956.45-959.85 MHz) each contain three to four megahertz of spectrum. While Sennheiser argues that WMAS works best with at least 6 megahertz of spectrum, it and other parties indicate that WMAS can work with a lesser amount.

The Commission disagrees that it should prohibit either WMAS or the types of wireless microphones currently permitted under part 74 from operating in the 6875-6900 MHz and 7100-7125 MHz bands that are available for use by low power indoor Unlicensed National Information Infrastructure (U-NII) devices under part 15 of the rules. The Commission first permitted licensed wireless microphones to use these bands in the 2015 *Wireless Microphones R&O*, 80 FR 71702, November 17, 2015, which was intended to accommodate the future needs of wireless microphones by making additional spectrum available where they could operate. Some parties now argue that the 6875-6900 MHz and 7100-7125 MHz bands should be removed from the list of frequencies available for licensed wireless microphone operations because the bands are not heavily used by wireless microphones at this time, retaining these bands creates regulatory uncertainty, and wireless microphones operating at these frequencies may have limited range as compared to wireless microphones in other bands. However, such a decision is beyond the scope of this order as the Commission did not seek comment in the *Notice* on the removal of the 6875-6900 MHz and 7100-7125 MHz bands from the list of bands available for part 74 wireless microphones. In any event, the Commission does not believe that the relatively low current usage of these bands is a reason to remove them since they provide 50 megahertz of spectrum that could accommodate licensed wireless microphones at locations where additional spectrum capacity for microphones may be needed.

Moreover, other parties express concern that WMAS operations in the 6875-6900 MHz and 7100-7125 MHz bands could negatively impact unlicensed devices and recommend that WMAS not be permitted to operate in those bands or that the WMAS power level be limited to reduce the potential for harmful interference. Because the Commission established rules for licensed wireless microphones in these bands prior to the 2020 *6 GHz Report and Order*, 85 FR 31390, May 26, 2020, that established rules for unlicensed devices in these bands, parties developing or operating unlicensed devices were already aware that they will have to share spectrum with licensed wireless microphones operating at power levels

up to one watt. Allowing WMAS to operate in the 6875-6900 MHz and 7100-7125 MHz bands in addition to the part 74 wireless microphones currently permitted will not negatively impact unlicensed operations as some parties suggest. As discussed below, WMAS must comply with the same power limit as other part 74 wireless microphones in the 6875-6900 MHz and 7100-7125 MHz bands, i.e., one watt, but the Commission is establishing a wider 20-megahertz maximum allowable bandwidth for WMAS. Therefore, WMAS power spectral density (PSD) in these bands will be lower than that permitted by the current rules, so the interference potential of WMAS to unlicensed devices will be lower than current wireless microphones. Further, as parties noted, the wireless microphone operating range in the 6875-6900 MHz and 7100-7125 MHz bands is short, which means that the distance at which unlicensed devices could potentially receive harmful interference from them is also short. And finally, the Commission notes that unlicensed 6 GHz devices in that band are limited to low-power-indoor devices. These devices are required to incorporate a contention-based protocol that will help promote co-existence with other band users, including wireless microphone users. For these reasons, the Commission disagrees that the decision to permit WMAS and other part 74 wireless microphones to operate in the 6875-6900 MHz and 7100-7125 MHz bands will create regulatory uncertainty for manufacturers and users of unlicensed devices in these bands.

The Commission disagrees with ViacomCBS that it should prohibit WMAS from operating in the UHF-TV band or make WMAS operations secondary to narrowband wireless microphones. The UHF-TV band has historically been used by wireless microphones for reasons such as good signal propagation and compact device size, and multiple parties support its use by WMAS. Prohibiting WMAS operation in this band would severely reduce the public benefits that more efficient wireless microphone systems will provide. In any event, it is not clear that allowing WMAS in the UHF-TV band would have a significant impact on narrowband wireless microphone use by broadcasters. Because the Commission will not permit licensed WMAS to operate with any greater power than a single licensed narrowband wireless microphone and the wider bandwidth will result in lower PSD, the distance at which a WMAS could interfere with other wireless microphones will be short, meaning that any impact on narrowband wireless microphone usage will be extremely localized. Further, under the part 74 rules, licensees operating wireless microphones are expected to work with other nearby licensees to avoid mutual

interference, and ViacomCBS has provided no evidence that this process would not work between licensees using WMAS and narrowband wireless microphones. The Commission declines to make WMAS secondary to narrowband wireless microphones and therefore gives narrowband wireless microphones users greater spectrum rights. Such an action could result in undesirable situations where a single licensed narrowband wireless microphone user could preclude a more efficient WMAS from operating, as opposed to those users being required to work cooperatively to enable both types of wireless microphones to operate.

### **Licensed WMAS Technical Requirements**

The Commission adopts technical requirements for WMAS devices operating on a licensed basis under part 74 of the rules. While the current part 74 rules for wireless microphones are based on narrower bandwidths than those required for WMAS, the Commission permits wider bandwidths for WMAS at no higher power levels than the current rules permit and specify emission masks for these devices.

#### **Bandwidth**

The Commission permits licensed WMAS to operate with a maximum bandwidth of 6 megahertz in the VHF-TV and UHF-TV bands specified in part 74 of the rules. This corresponds to the size of a TV channel and is supported by the record. The Commission also adopts its proposal to require a WMAS device to operate entirely within a single 6 MHz channel and not span parts of two adjacent channels to promote more efficient spectrum sharing between narrowband wireless microphones, WMAS, and white space devices. WMAS devices operating in the 4 megahertz portion of the 600 MHz duplex gap available to licensed wireless microphones will be limited to the width of that band.

Outside of the TV bands and 600 MHz duplex gap, the Commission permits WMAS to operate with bandwidths up to 20 megahertz in spectrum bands where licensed microphone use is permitted by the part 74 rules and that contain sufficient spectrum, consistent with the 2021 ETSI standard, which requires a WMAS bandwidth that is less than or equal to 20 megahertz. Wireless microphones operating in bands that are less than 20 megahertz wide will be limited to the width of those bands. If ETSI adopts a standard in the future permitting bandwidths greater than 20 megahertz and the Commission, after notice and comment, adopts that standard and makes corresponding amendments to the rules, parties will be permitted to operate WMAS with wider bandwidths in frequency bands that contain sufficient

spectrum to do so. The Commission does not believe that a 20 megahertz bandwidth limit is overly restrictive since there is no indication in the record that wireless microphone manufacturers are interested in developing systems with greater bandwidths, and in the event a party has a need to operate in a larger amount of spectrum, it could use multiple WMAS systems. The Commission also does not believe that allowing bandwidths of greater than 6 megahertz outside the TV bands will increase the likelihood of harmful interference to other services or unlicensed operations. On the contrary, as discussed in more detail below, the Commission is requiring WMAS devices operating under part 74 to comply with the same power limits currently in the rules, resulting in a lower power spectral density and thus reducing the likelihood of harmful interference to other users in the bands where WMAS operates. The Commission declines to require WMAS devices operating in the 6875-6900 MHz and 7100-7125 MHz bands to avoid specific frequencies that could be used for unlicensed operations because under the rules unlicensed devices do not receive interference protection from licensed services. However, the Commission expects that any potential impact to unlicensed operations would be limited as wireless microphones generally only operate over relatively short distances and are generally itinerant and intermittent. Additionally, there are other channels in the 6 GHz band that unlicensed devices could move to at the times that they might be near a wireless microphone operation.

The Commission notes Sennheiser's argument that WMAS may not work as well using bandwidths less than 6 megahertz and other parties' assertions that WMAS should not be permitted in a bandwidth of less than 1 or 1.5 megahertz. However, the Commission declines to specify a minimum bandwidth for WMAS devices operating in any frequency bands because parties are developing systems that can operate in smaller bandwidths (e.g., 1 or 2 megahertz) and the Commission does not wish to preclude WMAS technical advancements that could allow more efficient operation in smaller bandwidths.

### **Spectral Efficiency**

Consistent with the 2021 ETSI standard and the suggestions of Sennheiser and Waves, the Commission requires WMAS to have an operational mode capable of providing at least three audio channels per megahertz, but the Commission will not require WMAS to operate with a specific minimum number of channels at all times. As Sennheiser notes, WMAS allows dynamic resource allocation within a single TV channel for improved wireless microphone efficiency, e.g., higher audio quality for an act

performing on stage, fewer resources (lower audio quality) for an act testing equipment prior to going on stage, and even fewer resources (intercom quality) for an act that has just finished. Because of this ability to modify channel usage, e.g., number of channels and/or their sizes, the Commission agrees with Sennheiser that a single spectral efficiency metric that must be met at all times would be inappropriate since the amount of spectrum needed can vary rapidly over time and may not always equal or exceed three audio channels per megahertz. Moreover, requiring a WMAS system to operate with at least three audio channels per megahertz at all times could create other inefficiencies and hardships for users. As noted, microphone usage requirements vary based on specific requirements at the time a microphone is needed. If the Commission were to require by rule that there be at least three audio channels per megahertz in operation at all times, then users would either need to have one or more narrowband microphone systems installed along with a WMAS system for those times when the spectral efficiency requirement was not being met, or the WMAS system would have to establish a connection to microphone(s) not actually needed at a given time just to meet the requirement. Neither outcome is desirable as they lead either to additional cost and complexity for users or inefficient spectrum use without any corresponding benefits to the public. The Commission therefore believes that ETSI's suggestion for WMAS to be capable of operating with three audio channels per megahertz is more appropriate than its initial proposal to require WMAS to meet this efficiency requirement at all times.

The Commission recognizes the concerns of Microsoft, Lectrosonics, and Shure/NAB/Paramount about the need for efficient spectrum use by WMAS, but note that WMAS is expected to be high-end, and therefore significantly more complex and expensive equipment than current narrowband wireless microphone systems, making it likely to be used only at events where a large number of simultaneous audio channels is necessary. As Sennheiser indicates, WMAS' inherent design efficiencies mean that in the vast majority of cases WMAS will operate with 24 or more audio channels within a 6 megahertz TV channel, thereby using more wireless microphones than required by the minimum capability mode the Commission is requiring. Also, under the part 74 rules, licensed wireless microphone users are required to coordinate among themselves to ensure that they do not cause mutual interference. This required coordination will help ensure efficient spectrum use by and promote co-existence among parties using both WMAS and conventional narrowband wireless microphones. Finally, the Commission notes that

any potential conflicts between WMAS and narrowband wireless microphones are likely to raise similar scenarios as those that occur between parties operating narrowband wireless microphones under the existing rules and for which such users successfully manage and coordinate today, in that a single party could operate multiple narrowband wireless microphones that fill a single 6 megahertz TV or multiple TV channels.

### **Output Power**

The Commission permits WMAS to operate on a licensed basis under the part 74 rules at the same power levels currently permitted under these rules, i.e., 50 milliwatts EIRP in the VHF-TV bands, 250 milliwatts conducted power in the UHF band, 20 milliwatts EIRP in the 600 MHz duplex gap, 250 milliwatts conducted power in the 1435-1525 MHz band, and 1 watt conducted power in all other bands. These power levels are supported by the record. Because the Commission is permitting WMAS to operate with wider bandwidths than the part 74 rules currently permit, the power spectral density for WMAS, which will operate using wider bandwidths than that used for narrowband wireless microphones, will be lower than for a single narrowband wireless microphone, and therefore significantly lower than when multiple narrowband wireless microphones operate within a single channel. This will result in a decreased potential for WMAS to cause harmful interference to other users in the bands where they operate, including broadcast TV, licensed and unlicensed wireless microphones (narrowband or WMAS), unlicensed white space devices, and aeronautical mobile telemetry (AMT) operations in the 1435-1525 MHz band.

The Commission declines to modify the rules to remove the inconsistency in the power specification for licensed wireless microphones in the TV bands (EIRP in the VHF-TV bands and conducted power in the UHF-TV band). Wireless microphone manufacturers argue that there is no need for changes, and Microsoft does not indicate any specific harms from maintaining the current rules. Because no party has shown a need to modify the rules, the Commission retains the current power specifications for part 74 wireless microphones in the TV bands without change.

### **Emission Mask and Spurious Emission Limits**

The Commission requires WMAS operating under part 74 to comply with the emission mask and spurious emission limits in ETSI EN 300 422-1 (2021). Specifically, emissions within the band from 2.5

$x B$  below to  $2.5 x B$  above the carrier frequency, where  $B$  is the channel bandwidth, shall comply with the emission mask in Figure 3 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11); and emissions outside of this mask shall comply with the spurious emission limits specified in section 4.2.4.1.2 of ETSI EN 300 422-1 V2.2.1 (2021-11). This mask and these emission limits will protect licensed operations in adjacent bands from WMAS operations, including broadcast TV and licensed wireless microphones, and will enable coexistence with unlicensed operations, including white space devices and unlicensed wireless microphones. Wireless microphone manufacturers support these requirements. While Microsoft expresses concern about adopting ETSI standards finalized after the 2017 standard, the Commission observes that there is no significant differences in the WMAS emission mask and the spurious emission limits between the 2017 standard and the 2021 standard. Specifically, both the 2017 and 2021 masks are identical up to a frequency offset 2.5 times the WMAS bandwidth above and below the carrier, which for WMAS on a 6-megahertz TV channel covers the operating channel as well as the upper and lower first and second adjacent TV channels. The only difference between the masks is the point at which a WMAS must comply with the ETSI spurious emission limits (more than 2.5 times the WMAS bandwidth removed from the carrier in the 2021 standard, as opposed to 5 times the WMAS bandwidth from the carrier in the 2017 standard). Microsoft raises no objection to the use of the mask in the ETSI 2021 standard in response to wireless microphone manufacturers' filings in support of this standard.

The spurious emission limits are specified differently in the 2021 ETSI standard than in the 2017 standard (in dBm rather than microwatts or nanowatts), but the limits themselves are equivalent. Because the ETSI spurious emission limit in the TV bands is generally more stringent than the limit at the edge of the WMAS emission mask, and because the 2021 mask covers a narrower frequency range, the emission mask in the 2021 ETSI standard will provide slightly greater protection to operations in adjacent bands than the 2017 ETSI mask since the lower spurious emission limits apply at a lesser frequency separation from the carrier. In addition, the ETSI spurious emission limit generally provides greater protection than the part 15 out-of-band emission limits. Thus, incorporating the 2021 ETSI WMAS emission mask and spurious emission limits instead of those in the 2017 standard will not result in any increased likelihood of harmful interference to operations in adjacent bands, including other wireless microphones and

unlicensed white space devices.

The Commission declines to require wireless microphones, either narrowband or WMAS, to comply with the ETSI intermodulation distortion limits, as suggested by Shure and Sennheiser. The Commission's rules do not currently specify any comparable type of limits for wireless microphones, so requiring wireless microphones to comply with these limits would be a new requirement. The record does not indicate specific benefits associated with adopting this requirement, and there is no information on potential costs or other burdens, such as increased complexity for certification testing or the need for manufacturers to redesign equipment to comply with a new requirement.

The Commission notes Wave's assertion that the 2021 ETSI standard contains errors in the measurement procedure for determining compliance with the emission mask. To the extent that Waves believes that there are errors, it should work with ETSI to address its concerns. However, in response to Wave's request that the Commission permit alternative measurement procedures for determining compliance, the Commission notes its rules already provide flexibility in the measurement procedures that parties may use in preparing data for an application for certification. Specifically, test data must be measured in accordance with 1) bulletins or reports prepared by the Commission's Office of Engineering and Technology (OET); 2) those procedures acceptable to the Commission and published by national engineering societies; or 3) any other measurement procedure acceptable to the Commission. Thus, the rules have provisions that could allow Waves to use a procedure that is a variation of, or an alternative to, the 2021 ETSI measurement procedure for determining compliance with the emission mask. If Waves wishes to do so, it should contact OET prior to applying for certification to determine whether its proposed alternative measurement procedures are acceptable to the Commission.

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

The Commission will require analog and digital narrowband (i.e., non-WMAS) wireless microphones operating under part 74 for which an application for certification is filed on or after the effective date of the rules to comply with the emission masks and spurious emission limits in ETSI EN 300 422-1 (2021). Specifically, emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with either the emission mask in

Figure 1 (analog) or Figure 2 (digital) of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11); and emissions outside of this mask shall comply with the spurious emission limits specified in section 4.2.4.1.2 of ETSI EN 300 422-1 V2.2.1 (2021-11). These masks and emission limits will protect licensed operations in adjacent bands, including broadcast TV and licensed wireless microphones, and will enable coexistence with unlicensed operations, including white space devices and unlicensed wireless microphones. In addition, incorporating the latest ETSI emission masks and spurious emission limits into the rules will harmonize certain Commission wireless microphone requirements with those used in other parts of the world, which will reduce the number of different regulatory requirements with which manufacturers must comply, reducing development and manufacturing costs as well as costs to consumers. While Microsoft expresses concern about adopting ETSI standards finalized after the 2017 standard, the Commission observes that the differences between the narrowband emission masks in the 2017 standard and in the 2021 standard are not significant and would not increase the potential for harmful interference to operations in adjacent bands, such as unlicensed white space devices. The Commission therefore adopts the 2021 ETSI standard for narrowband emission masks. As discussed above, the 2021 ETSI standard for spurious emission limits is equivalent to the 2017 standard, so the Commission requires narrowband wireless microphones to comply with the spurious emission limits in the 2021 ETSI standard. Because there are no significant differences between the 2021 ETSI standard and the 2011 ETSI standard currently referenced in the rules, and because no party indicated that there is a need for a significant transition period to comply with the 2021 ETSI standard, the Commission will make the rule changes referencing the 2021 standard effective 30 days after publication in the *Federal Register*. Applications for certification for part 74 narrowband wireless microphones filed on or after that date must demonstrate compliance with the 2021 ETSI standard, although manufacturers may begin to use it sooner if they choose.

**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**

**Unlicensed WMAS operation under Part 15**

**Frequency bands**

The Commission will permit WMAS to operate on an unlicensed basis under part 15 in the VHF-TV and UHF-TV bands and in the upper 6-megahertz segment of the 600 MHz duplex gap (657-663 MHz), under the same definition of WMAS that it adopts for licensed WMAS. As Shure notes, there are many professional applications for wireless microphones where the operator is not eligible for a part 74 license because it does not use 50 or more wireless microphones. Thus, the benefits of WMAS cannot be fully realized unless the Commission allows WMAS to operate on an unlicensed basis in addition to a licensed basis. The Commission agrees with Sennheiser that WMAS allows for more efficient use, i.e., fewer TV channels are required for large events that use a large number of wireless microphones, thus making more spectrum available for other applications, such as narrowband (non-WMAS) wireless microphones and white space devices. The Commission is not permitting unlicensed WMAS to operate in the 600 MHz guard band (614-616 MHz) since no party indicated that there is a need to do so.

The Commission disagrees with Lectrosonics and ViacomCBS on limiting WMAS to licensed part 74 operations only. Similar to licensed WMAS operations, unlicensed WMAS operations are unlikely to cause harmful interference to licensed wireless microphones since the wider bandwidth will result in a low PSD, limiting the range at which interference could occur. WMAS operating under part 15 must not cause harmful interference to licensed operations, including licensed wireless microphones, so in the event a part 15 WMAS system causes harmful interference to a licensed wireless microphone, the part 15 system would have to move to a different frequency or cease operation. It should not be difficult for a licensed wireless microphone user to locate an unlicensed WMAS system that causes interference since the range at which a system could cause interference to licensed wireless microphones will be short, and a WMAS system a short distance away should be easily identifiable by a large number of wireless microphones communicating with a sophisticated centralized base station. With regard to ViacomCBS' concern about efficient spectrum use, unlicensed WMAS will be subject to the same spectral efficiency requirements as licensed WMAS, and there is no evidence in the record that unlicensed WMAS operations will be less efficient than licensed. Furthermore, in response to NCTA's request that the Commission limits eligibility to operate WMAS in the 6 GHz band to part 74 licensees, the Commission notes that unlicensed WMAS are not authorized in the 6875-6900 MHz and 7100-7125 MHz bands since only entities with a part 74 license are eligible to operate wireless microphones in those bands.

The Commission disagrees with Microsoft that it should prohibit unlicensed WMAS in the TV bands due to the potential impact on white space devices, particularly personal/portable devices. As an initial matter, there are currently no certified personal/portable white space devices. However, the Commission's decision to allow unlicensed WMAS in the TV bands does not change the relationship between any future personal/portable white space devices and unlicensed wireless microphones. That is, both types of devices must share spectrum in the TV bands on an equal basis; neither type of device has priority over the other. As discussed below, unlicensed WMAS will operate with no greater power than the rules currently permit for two narrowband unlicensed wireless microphones, so the impact of unlicensed WMAS on white space devices will be no greater than two narrowband wireless microphones, and will be significantly less than if many narrowband wireless microphones operate simultaneously within a single TV channel as the rules currently permit. Because personal/portable white space devices may operate with up to 100 milliwatts EIRP in the TV bands, the same maximum power at which unlicensed WMAS could operate, personal/portable white space devices would have at least as much impact on unlicensed WMAS as unlicensed WMAS would have on personal/portable white space devices. There is no expectation under the rules that unlicensed WMAS would have priority over other unlicensed uses, such as white space devices. In the event of a conflict between two unlicensed devices, the device operators would have to resolve the conflict among themselves by taking actions such as changing the operating channel, reorienting antennas, or changing location.

The Commission also disagrees with Microsoft that it needs to consider the FCC proceeding simultaneously with the 2017 wireless microphones notice of proposed rulemaking that sought comment on whether the Commission should expand the eligibility for a part 74 license to additional entities, e.g., those that routinely use fewer than 50 wireless microphones. In the event the Commission decides to expand eligibility for part 74 licensing, that action would increase the number of parties eligible to register wireless microphones for protection in the white space database and thus could increase the number of TV channels reserved for licensed wireless microphones in the database. However, the Commission's decision to allow unlicensed WMAS in the TV bands does not increase the number of parties eligible to register wireless microphones and, therefore will not increase the total number of TV channels reserved in the database. If the Commission expands licensing eligibility, the procedure for

registering a WMAS on a TV channel by newly eligible entities would be no different than the procedure for registering narrowband wireless microphones. In either case, the registration process reserves an entire TV channel regardless of whether a party registers a single narrowband wireless microphone or a WMAS that fills an entire 6-megahertz channel. Because of the increased spectral efficiency provided by WMAS, i.e., more wireless microphones in a single TV channel, WMAS could actually reduce the number of TV channels that must be reserved in the white space database, thus leaving more vacant channels available for white space devices.

### **Technical requirements**

*Bandwidth.* Consistent with the Commission's actions with respect to licensed WMAS, it will permit unlicensed WMAS to operate in the VHF-TV and UHF-TV bands with a maximum bandwidth of 6 megahertz, which corresponds to the size of a TV channel. Also consistent with the Commission's actions with respect to licensed WMAS, the Commission will require unlicensed WMAS devices to operate entirely within a single 6 megahertz channel and not span parts of two adjacent channels to promote more efficient spectrum sharing between narrowband wireless microphones, WMAS, and white space devices. The Commission will also permit unlicensed WMAS to operate within the 6-megahertz portion of the 600 MHz duplex gap (657-663 MHz) that is available to unlicensed wireless microphones. As with licensed WMAS, the Commission does not specify a minimum bandwidth for unlicensed WMAS because some parties may choose to operate systems with smaller bandwidths (e.g., one or two megahertz, as suggested by Shure), and the Commission does not wish to preclude WMAS technical advancements that could allow it to operate more efficiently with smaller bandwidths. Thus, Shure will be able to operate its WMAS system under the rules the Commission adopts, subject to the power limits discussed below. Because many wireless microphones used in unlicensed applications are identical to those used in licensed applications (except for the maximum allowable power in the UHF TV band), establishing the same technical requirements for wireless microphones under both parts 74 and 15 of the rules will enable manufacturers to produce wireless microphones at lower cost since they will not have to develop multiple variations to comply with differing regulatory requirements.

The Commission disagrees with Shure/NAB/Paramount that all unlicensed WMAS systems should be limited to a channel size of only one or two megahertz to enable coexistence with narrowband

wireless microphones. Such a restriction could severely limit the maximum number of audio channels that an unlicensed WMAS could use, and the Commission notes that other wireless microphone manufacturers, such as Sennheiser, are developing systems that operate across the full 6 megahertz TV channel bandwidth. Limiting the maximum permissible bandwidth of unlicensed WMAS to one or two megahertz would not ensure that portions of a vacant TV channel remain available for licensed narrowband wireless microphones since an unlicensed WMAS operator could simply use multiple one or two megahertz systems and occupy an entire 6-megahertz TV channel. For users that require many microphones, and depending on the usage requirements and operating protocols, employing WMAS over a wider bandwidth channel may permit more microphones to share that single channel than could operate on multiple smaller adjacent WMAS channels within that single TV channel. Thus, permitting WMAS to operate on channels up to 6 megahertz bandwidth can promote spectrum efficiency by allowing wireless microphones to operate using fewer TV channels than they do now since a WMAS system on a single 6 megahertz channel could have the same or greater capacity than multiple narrowband wireless microphones using multiple TV channels. This can leave more spectrum available for other wireless microphone users, as well as other spectrum users, e.g., white space devices.

The Commission does not believe that an unlicensed WMAS bandwidth restriction is necessary to enable spectrum sharing between unlicensed WMAS and narrowband wireless microphones used in electronic news gathering, as NAB suggests. Based on the record, the Commission expects that WMAS will generally be relatively expensive and complex systems designed for events, such as concerts and live theater, where large numbers of wireless microphones are used, and it seems unlikely that these systems would be deployed for purposes such as covering breaking news events, where simpler narrowband wireless microphones could be deployed more quickly and easily. Therefore, the Commission expects that conflicts between unlicensed WMAS and nearby narrowband wireless microphones used for electronic news gathering are unlikely to occur. And in instances where such conflicts may occur, the Commission believes that the disparate users should be able to easily coordinate usage as both WMAS and narrowband microphones are generally designed with capability to operate over multiple channels.

The Commission disagrees that the brief operational tests performed by Shure and NAB/Paramount demonstrate that unlicensed WMAS must be limited to a 1 or 2 megahertz bandwidth.

The Commission does not believe that this brief test, in which it appears that Sennheiser's prototype 6-megahertz wide WMAS was placed within a few meters of a narrowband wireless microphone receiver and resulted in purported harmful interference at extremely short separation distances, demonstrates a need to limit unlicensed WMAS bandwidth. It also appears that NAB's claim that interference could occur to licensed narrowband wireless microphones at 55 meters from unlicensed WMAS is an unlikely occurrence. As Sennheiser notes, NAB's assumed 20 meter or more distance from a narrowband ENG wireless microphone to its associated receiver seems atypical for newsgathering applications. Assuming a much shorter separation distance, such as 3 to 5 meters, which Sennheiser suggests is more realistic, drastically reduces the distance at which interference could occur to narrowband microphone systems from WMAS. Also, parties operating narrowband wireless microphones in the UHF-TV band on a licensed basis are permitted to operate with up to 250 milliwatts rather than 50 milliwatts as NAB assumed. Further, since WMAS would typically be used at locations such as theaters and concert halls, the emissions are generally expected to be attenuated from building walls between an unlicensed WMAS and narrowband wireless microphones used in ENG, further reducing the likelihood of harmful interference.

*Spectral efficiency.* The Commission adopts the same spectral efficiency requirement for unlicensed WMAS that it adopts for licensed WMAS to help ensure consistent requirements between licensed and unlicensed WMAS. That is, an unlicensed WMAS must have an operational mode capable of providing at least three audio channels per megahertz, but the Commission does not require unlicensed WMAS to operate with a specific minimum number of audio channels at all times. As discussed above with respect to licensed WMAS, because of WMAS' dynamic capabilities, a single spectral usage metric would not be appropriate since the number and quality of audio channels can vary during an event and may not equal or exceed a specific threshold, e.g., three audio channels in every megahertz of spectrum at every instance in time. However, as Sennheiser indicates, WMAS spectral efficiency would typically be significantly greater than the three audio channel per megahertz benchmark that the Commission adopts. For these reasons, the Commission declines to adopt a specific spectral efficiency metric that must be met at all times, e.g., 4 audio channels per megahertz as suggested by Shure/NAB Paramount. The Commission instead requires unlicensed WMAS to incorporate an operational mode with the capability of

operating with three audio channels per megahertz.

*Power.* The Commission adopts power levels for unlicensed WMAS to permit them to operate using different technologies developed by different manufacturers, e.g., Shure and Sennheiser. In addition to providing flexibility for multiple technologies, these rules address interference concerns described in the record by minimizing the potential for harmful interference to incumbent licensed wireless microphone operators. The Commission permits unlicensed WMAS in the TV bands with a bandwidth of up to 1 megahertz to operate at 50 milliwatts EIRP, which is the same power level currently permitted for narrowband unlicensed wireless microphones operating with a bandwidth of 200 kHz. For unlicensed WMAS in the TV bands with a bandwidth of 1 to 2 megahertz, the Commission permits operation at up to 100 milliwatts EIRP, which is the same as the power level permitted by the current rules for two narrowband unlicensed wireless microphones, but is less than the 250 milliwatt power level permitted for licensed wireless microphones in the UHF TV band. This higher power level is supported by Shure and NAB/Paramount (subject to the bandwidth restrictions discussed above), and Sennheiser does not object to it. For unlicensed WMAS in the TV bands with a bandwidth greater than 2 megahertz and up to 6 megahertz, the Commission also permits operation at up to 100 milliwatts EIRP. Although NAB/Fox/Paramount claim that “the record does not contain any request seeking greater power than the 50 milliwatt power level for unlicensed WMAS occupying an entire TV channel, the Commission notes that Sennheiser expressly proposes a power level of up to 100 milliwatts for unlicensed WMAS with a bandwidth greater than or equal to 1 megahertz and up to 6 megahertz. The Commission adopts this power level because, as Sennheiser observes, it constitutes a “technology-neutral approach” that will “allow for different types of WMAS implementations.” In other words, this power level will allow manufacturers with different system designs (e.g., Sennheiser’s with a single power level over 6 megahertz and Shure’s where the power scales with bandwidth) to market unlicensed WMAS systems and thus benefit the public by enabling greater availability and use of this more efficient new technology. Additionally, the Commission believes that power level would provide flexibility for the potential development and use of more innovative types of WMAS technology in the future.

NAB/Fox/Paramount express concern that this 100 milliwatt power level for unlicensed WMAS operating in the TV bands with a bandwidth greater than 2 megahertz and up to 6 megahertz could pose a

risk of harmful interference to broadcasters' existing wireless microphones. However, the Commission does not believe this would be the case. Operation at this higher power level will be limited to WMAS, which has significantly greater spectral efficiency than narrowband wireless microphones. Because WMAS systems are more complex and provide support for more microphones per megahertz than traditional narrowband microphones, the Commission expects that they will be operated at fewer locations than narrowband wireless microphones. Moreover, because WMAS can support many more wireless microphones in a 6-megahertz channel as compared to the number of narrowband wireless microphones that can operate at a location in the same bandwidth, WMAS implementations will encumber fewer TV channels as compared to those narrowband wireless microphone systems. Thus, in areas where unlicensed WMAS may operate, the Commission expects more channels to be available for licensed wireless microphones than may be available today. For these reasons, the Commission is not convinced that, in practical use, there would be a "high risk of interference to broadcasters' existing licensed wireless microphones," as was asserted in a recent *ex parte* submission. Even at the 100 milliwatt power level the Commission adopts for unlicensed WMAS operating with greater than 1-megahertz bandwidth, those systems will operate at a lower power spectral density than instances where more than two narrowband wireless microphones operate within a single TV channel and at a significantly lower power spectral density as compared to situations where more expansive narrowband microphone usage is necessary and could occupy an entire 6-megahertz TV channel. In addition, WMAS's higher spectral efficiency will permit a greater number of audio channels in a 6-megahertz TV channel than if multiple narrowband wireless microphones are used further reducing the total amount of spectrum needed for unlicensed operations. This reduced power spectral density and ability to support more microphones on less spectrum compared to narrowband wireless microphones will keep the potential for causing harmful interference low and promote coexistence with other spectrum users. Further, even if the Commission were to limit unlicensed WMAS power to 50 milliwatts for systems with bandwidths of greater 2 megahertz, as NAB/Fox/Paramount suggest, users could still operate multiple 2-megahertz unlicensed WMAS systems at the same location, thus resulting in a power level in a 6 megahertz channel that exceeds the 100 milliwatt limit the Commission adopts, e.g., 200 or 300 milliwatts. In any case, wireless microphone manufacturers have an incentive to design equipment using

the lowest power necessary for an application to conserve battery life, which will further reduce the risk of harmful interference from unlicensed WMAS to licensed narrowband wireless microphones. The Commission does not adopt Sennheiser's proposal to require a WMAS base operating at a power level greater than 50 milliwatts to remain stationary since WMAS will generally be relatively complex systems designed for events such as concerts and live theater, so it seems unlikely that a WMAS base would be deployed in a non-stationary application, e.g., for covering breaking news events.

For unlicensed WMAS operating in the upper 6-megahertz segment of the duplex gap (657-663 MHz), the Commission is retaining the maximum 20 milliwatt EIRP limit consistent with the power level currently permitted for narrowband wireless microphones in this frequency band. No party requested a different power level for that band.

*Emission mask and spurious emission limits.* Consistent with the Commission's action with respect to part 74 licensed WMAS, it will require unlicensed WMAS to comply with the emission mask and spurious emission limits in the 2021 ETSI standard. These limits will ensure that WMAS protects operations in adjacent bands, including the broadcast TV bands. This action will ensure consistent requirements for both licensed and unlicensed WMAS, which will benefit manufacturers and WMAS users by eliminating the need for manufacturers to design multiple equipment models to comply with differing standards, thus reducing equipment costs.

#### **Updated ETSI standards for Part 15**

The Commission adopts the same emission masks for unlicensed analog and digital narrowband (i.e., non-WMAS) wireless microphones as it does for part 74 licensed wireless microphones, specifically, those in the 2021 ETSI standard. As with the Commission's action harmonizing the emission masks for licensed and unlicensed WMAS, this action will ensure consistency in the requirements for both licensed and unlicensed narrowband wireless microphones, which will benefit manufacturers and narrowband wireless microphone users by eliminating the need for manufacturers to design multiple equipment models to comply with varying standards, thus reducing equipment costs.

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

*Part 74.* The Commission makes changes to §§ 74.802(a), 74.861(e)(1), and 74.870(c) to reflect

the frequencies currently available for low power auxiliary stations. The Commission also modifies § 74.802(b)(1) by removing the entries for analog TV stations from the table of TV service contours that licensed wireless microphones must protect and correcting the upper channel number of the UHF-TV band. Because all analog TV broadcasting ceased in 2021, it is no longer necessary to specify these contours, and the upper channel in the UHF-TV band is now channel 36. However, the Commission will not at this time make additional revisions to the part 74 rules to remove all paragraphs with transition dates that have passed. It is possible that there are parties still in possession of wireless microphones that can no longer be used because they operate on frequencies where operation is now prohibited, e.g., the 600 MHz service bands, and retaining the rules with the transition requirements can enable parties to more easily determine which equipment may or may not be used now.

*Part 15.* The Commission adopts its proposals to modify §15.236 to reflect the currently available frequencies for unlicensed wireless microphones, except it is making additional modifications to § 15.236(e) by removing the entries for analog TV stations from the table of TV service contours that unlicensed wireless microphones must protect and correcting the upper channel number of the UHF-TV band. All analog TV broadcasting ceased in 2021, so it is no longer necessary to specify these contours, and the highest channel in the UHF-TV band is now channel 36. Consistent with the Commission's actions with respect to licensed wireless microphones, the Commission retains the transition requirements in § 15.37 so parties can more easily determine which wireless microphones comply with the current rules, e.g., permissible frequencies of operation.

With regard to removing § 15.236(c)(6), 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.” The Commission is removing the database access requirement for unlicensed wireless microphones operating in the guard bands (including the duplex gap) as no longer necessary since these bands are now unavailable to licensed services nationwide. The Commission believes that this constitutes a “subsequent methodology” that will ensure that unlicensed wireless microphones does not cause harmful interference to licensed services, thus complying with the Spectrum Act requirements. Consistent with removing the database access requirement for unlicensed wireless microphones, the Commission also removes references to this requirement in §§ 15.703, 15.713 and 15.715 of the white

space rules.

### **Ordering Clauses**

Accordingly, IT IS ORDERED that, pursuant to the authority contained in sections 4(i), 301, 302, and 303 of the Communications Act of 1934, as amended, and sections 6403 and 6407 of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat. 156, 47 U.S.C. 154(i), 301, 302a, 303, 1452, 1454, the Report and Order IS HEREBY ADOPTED.

IT IS FURTHER ORDERED that parts 15 and 74 of the Commission's rules ARE AMENDED as specified in Appendix A of the Report and Order, and such rule amendments WILL BECOME EFFECTIVE 30 days after the date of publication in the *Federal Register*.

IT IS FURTHER ORDERED that the Commission's Office of the Secretary, SHALL SEND a copy of the Report and Order, including the Final Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

IT IS FURTHER ORDERED that the Office of the Managing Director, Performance Program Management, SHALL SEND a copy of this Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, 5 U.S.C. 801(a)(1)(A).

### **List of Subjects**

#### **47 CFR Part 15**

Communications equipment, Incorporation by reference, Radio.

#### **47 CFR Part 74**

Communications equipment, Incorporation by reference, Television.

FEDERAL COMMUNICATIONS COMMISSION.

**Marlene Dortch,**  
*Secretary.*

## Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 15 and 74 as follows:

### **PART 15 – RADIO FREQUENCY DEVICES**

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

**Authority:** 47 U.S.C. 154, 302a, 303, 304, 307, 336, 544a, and 549.

2. Section 15.38 is amended by:

- a. Revising the introductory text;
- b. Redesignating paragraphs (a) through (f) as paragraphs (b) through (g) and adding new paragraph (a);
- c. Revising newly redesignated paragraph (e); and
- d. Removing notes 1 and 2 to § 15.38.

The revisions and addition read as follows:

#### **§ 15.38 Incorporation by reference.**

Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Federal Communications Commission (FCC) must publish a document in the Federal Register and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at the FCC and at the National Archives and Records Administration (NARA). Contact FCC at the address indicated in 47 CFR 0.401(a); phone: (202) 418-0270. For information on the availability of this material at NARA, visit [www.archives.gov/federal-register/cfr/ibr-locations](http://www.archives.gov/federal-register/cfr/ibr-locations) or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov). The material may be obtained from the following sources:

(a) The IBR material may be obtained from the sources in the following paragraphs of this section or from one or more private resellers listed in this paragraph (a).

(1) Accuris Standards Store, 321 Inverness Drive, South Englewood, CO, 80112; phone: (800) 332-6077; website: <https://accuristech.com>.

(2) American National Standards Institute (ANSI), see paragraph (b) of this section.

(3) GlobalSpec, 257 Fuller Road, Suite NFE 1100, Albany, NY 12203-3621; phone: (800) 261-2052; website: <https://standards.globalspec.com>.

(4) Nimonik Document Center, 401 Roland Way, Suite 224, Oakland, CA, 94624; phone (650)591-7600; email: [info@document-center.com](mailto:info@document-center.com); website: [www.document-center.com](http://www.document-center.com).

\* \* \* \* \*

(e) European Telecommunications Standards Institute (ETSI), 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France; phone: +33 4 92 94 42 00; email: [webstore@etsi.org](mailto:webstore@etsi.org); website: [www.etsi.org/](http://www.etsi.org/).

(1) ETSI EN 300 422-1 V2.2.1 (2021-11), Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Audio PMSE Equipment up to 3 GHz; Harmonised Standard for access to radio spectrum, published November 2021; IBR approved for § 15.236(g). (Available at: [www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.02.01\\_60/en\\_30042201v020201p.pdf](http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.02.01_60/en_30042201v020201p.pdf).)

(2) [Reserved]

\* \* \* \* \*

3. Section 15.236 is revised and republished 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.

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

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

*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.

*Wireless Multichannel Audio Systems.* Wireless audio transmission systems using broadband digital transmission techniques for microphone and in-ear monitor system applications and other multichannel audio use.

(b) *Permissible operations.* Operation under this section is limited to wireless microphones and wireless multichannel audio systems as defined in this section.

(c) *Frequency bands.* Operation of wireless microphones is permitted in all of the following frequency bands. Wireless multichannel audio systems may operate only in the bands listed in paragraphs (c)(1) and (2) of this section.

(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) *Power limits.* The maximum radiated power shall not exceed the following values:

(1) In the bands allocated and assigned for broadcast television:

(i) Wireless microphones: 50 mW EIRP.

(ii) Wireless multichannel audio systems with a bandwidth up to 1 MHz: 50 mW EIRP.

(iii) Wireless multichannel audio systems with a bandwidth greater than 1 MHz: 100 mW EIRP.

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

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

**Table 1 to Paragraph (e)**

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
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 (14-36)	41	F(50,90)

(f) *Operating frequency and bandwidth –(1) Wireless microphones.* The operating frequency within a permissible band of operation defined in paragraph (c) of this section must comply with the following requirements.

(i) The frequency selection shall be offset from the upper or lower band limits by 25 kHz or an integral multiple thereof.

(ii) One or more adjacent 25 kHz segments within the assignable frequencies may be combined to form a channel whose maximum bandwidth shall not exceed 200 kHz. The operating bandwidth shall not exceed 200 kHz.

(iii) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.005\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

(2) *Wireless multichannel audio systems.* A wireless multichannel audio system may have an operating bandwidth not exceeding 6 megahertz and must have a mode of operation in which it is capable of operating with at least three audio channels per megahertz. For wireless multichannel audio systems operating in the TV bands (channels 2-36), the 6 megahertz (or less) channel must fall entirely within a single TV channel.

(g) *Emission masks* –(1) *Analog systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 1 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 15.38).

(2) *Digital systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 2 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 15.38).

(3) *Wireless Multichannel Audio Systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 3 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11), (incorporated by reference, see § 15.38).

(4) *Spurious emission limits.* Emissions outside of the emission masks listed in paragraphs (g)(1) through (g)(3) shall comply with the limits specified in section 4.2.4.1.2 of ETSI EN 300 422-1 V2.2.1 (2021-11), (incorporated by reference, see § 15.38).

4. Section 15.703 is amended 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. Section 15.713 is amended by:

- a. Removing and reserving paragraph (a)(2);
- b. Revising paragraph (a)(3); and
- c. Removing and reserving paragraphs (f) and (i).

The revision reads as follows:

**§ 15.713 White space database.**

(a) \* \* \*

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

\* \* \* \* \*

**§ 15.715 [Amended]**

6. Section 15.715 is amended 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:** 47 U.S.C. 154, 302a, 303, 307, 309, 310, 325, 336 and 554.

8. Section 74.35 is added to read as follows:

**§ 74.35 Incorporation by reference.**

Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Federal Communications Commission (FCC) must publish a document in the Federal Register and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at the FCC and at the National Archives and Records

Administration (NARA). Contact the FCC at the address indicated in 47 CFR 0.401(a); phone: (202) 418-0270. For information on the availability of this material at NARA, visit [www.archives.gov/federal-register/cfr/ibr-locations](http://www.archives.gov/federal-register/cfr/ibr-locations) or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov). The material may be obtained from the European Telecommunications Standards Institute (ETSI), 650 Route des Lucioles, F-06921 Sophia Antipolis Cedex, France; phone: +33 4 92 94 42 00; email: [webstore@etsi.org](mailto:webstore@etsi.org); website: [www.etsi.org/](http://www.etsi.org/).

(a) ETSI EN 300 422-1 V2.2.1 (2021-11), Wireless Microphones; Audio PMSE up to 3 GHz; Part 1: Audio PMSE Equipment up to 3 GHz; Harmonised Standard for access to radio spectrum, published November 2021; IBR approved for § 74.861(d)(4) and (e)(7). (Available at: [www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/02.02.01\\_60/en\\_30042201v020201p.pdf](http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/02.02.01_60/en_30042201v020201p.pdf).)

(b) [Reserved]

9. Section 74.801 is amended by adding a definition for “*Wireless Multichannel Audio System*” in alphabetical order to read as follows:

**§ 74.801 Definitions.**

\* \* \* \* \*

*Wireless multichannel audio systems.* Wireless audio transmission systems using broadband digital transmission techniques for microphone and in-ear monitor system applications and other multichannel audio use.

10. Section 74.802 is amended by revising paragraphs (a) and (b)(1) 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

(b)(1) Operations in the bands allocated for TV broadcasting are limited to locations at least 4 kilometers outside the protected contours of co-channel TV stations shown in the following table. These contours are calculated using the methodology in § 73.684 of this chapter and the R-6602 curves contained in § 73.699 of this chapter.

**Table 1 to Paragraph (b)(1)**

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
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 (14-36)	41	F(50,90)

\* \* \* \* \*

11. Section 74.861 is amended by revising paragraphs (d)(4) and (e)(1), (5), and (7) and removing paragraph (i).

The revisions read as follows:

**§ 74.861 Technical requirements.**

\* \* \* \* \*

(d) \* \* \*

(4) The following emission limits apply 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.

(i) *Analog systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where  $B$  is the channel bandwidth, shall comply with the emission mask in Figure 1 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

(ii) *Digital systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where  $B$  is the channel bandwidth, shall comply with the emission mask in Figure 2 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

(iii) *Wireless Multichannel Audio Systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where  $B$  is the channel bandwidth, shall comply with the emission mask in Figure 3 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35). A wireless multichannel audio system must have an operating bandwidth  $B$  not exceeding 20 megahertz and must have a mode of operation in which it is capable of transmitting at least three audio channels per megahertz.

(iv) *Spurious emission limits.* Emissions outside of the emission masks specified in paragraphs (d)(4)(i) through (iii) of this section shall comply with the limits specified in section 4.2.4.1.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

(e) \* \* \*

(1) The power may not exceed the following values.

(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 multichannel audio system must have an operating bandwidth not exceeding 6 megahertz in the TV bands or 4 megahertz in the 653-657 MHz band and must have a mode of operation in which it is capable of transmitting at least three audio channels per megahertz. For wireless multichannel audio systems 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 multichannel audio systems.

\* \* \* \* \*

(7)(i) *Analog systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 1 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

(ii) *Digital systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 2 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

(iii) *Wireless Multichannel Audio Systems.* Emissions within the band from  $2.5 \times B$  below to  $2.5 \times B$  above the carrier frequency, where B is the channel bandwidth, shall comply with the emission mask in Figure 3 of section 4.2.4.2.2 of ETSI EN 300 422-1 V2.2.1 (2021-11), (incorporated by reference, see § 74.35).

(iv) *Spurious emission limits.* Emissions outside of the emission masks listed in paragraphs (e)(7)(i) through (e)(7)(iii) shall comply with the limits specified in section 4.2.4.1.2 of ETSI EN 300 422-1 V2.2.1 (2021-11) (incorporated by reference, see § 74.35).

\* \* \* \* \*

12. Section 74.870 is amended by revising paragraph (c) introductory text to read as follows:

**§ 74.870 Wireless video assist devices.**

\* \* \* \* \*

(c) Wireless video assist devices may operate with a bandwidth not to exceed 6 MHz on frequencies in the bands 180-210 MHz (TV channels 8-12) and 470-608 MHz (TV channels 14-36) subject to the following restrictions:

\* \* \* \* \*