

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

In the Matter of)
)
 Unlicensed White Space Device Operations in the) ET Docket No. 20-36
 Television Bands)
)
 Amendment of Part 15 of the Commission’s Rules) ET Docket No. 14-165
 for Unlicensed Operations in the Television Bands,)
 Repurposed 600 MHz Band, 600 MHz Guard)
 Bands and Duplex Gap, and Channel 37)

**ORDER ON RECONSIDERATION, REPORT AND ORDER, AND
 MEMORANDUM OPINION AND ORDER**

Adopted: April 11, 2023

Released: April 12, 2023

By the Commission:

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I. INTRODUCTION

1. As the Commission continues taking steps to sustain and spur growth within the white space ecosystem, we adopt three orders addressing pending issues associated with white space devices. These actions will provide additional certainty to white space device users and manufacturers to enable unlicensed white space devices to operate efficiently while protecting other spectrum users. In the Report

and Order we adopt rules specifying the database re-check interval for the new categories of mobile and narrowband white space devices established in 2020. In the Order on Reconsideration, we dismiss in part and, on alternative and independent grounds, deny a petition for reconsideration of two rule changes for white space devices operating in the broadcast television (TV) bands. In the Memorandum Opinion and Order, we decline to modify the rules to permit white space databases to use more complex terrain-based models to determine the available frequencies for white space devices and will instead continue to rely on the simpler established model that has worked reliably to prevent interference to TV and other protected services.

II. BACKGROUND

2. Unlicensed white space devices, which operate in the TV broadcast bands and portions of the 600 MHz band at locations where frequencies are not in use by licensed services or other protected entities, provide a variety of wireless services to the public.¹ For example, Wireless Internet Service Providers (WISPs) use fixed white space devices to provide Internet connectivity in rural and underserved areas, including broadband data for schools and libraries, and on tribal lands. These devices obtain a list of available channels and data on power levels that may be used at their particular locations from databases administered by private entities approved by the Commission.² Fixed and mobile white space devices must incorporate a geo-location capability and a means to access a database.³ Personal/Portable white space devices can either acquire a list of available channels via another white space device (Mode I), or themselves include geo-location and database access capabilities (Mode II).⁴ Once the white space device acquires channel and power information for its location, it selects an appropriate frequency from that list for transmitting.

3. Since 2008 when the Commission first authorized unlicensed white space device operations in the VHF and UHF TV bands, it has taken a number of further actions to make the white space rules more flexible while protecting incumbent services to facilitate improved broadband services to all Americans, particularly those in rural, Tribal and other underserved areas.⁵ Operating in the TV and 600 MHz Service bands allows these devices to operate over long distances at moderate power levels making them ideal for connecting these areas. The Commission continues to examine and modify, as needed, the white space device rules to maximize their efficiency and ensure that the American public continues to reap their benefits.

4. In its *2015 White Spaces Order*, the Commission modified the technical rules for white space device operations in the spectrum that continues to be TV band spectrum following the incentive auction.⁶ It maintained the requirement for fixed and Mode II personal/portable devices to re-check the

¹ See generally 47 CFR Part 15 subpart H.

² 47 CFR §§ 15.711(c)(2), (d)(2) and 15.715.

³ 47 C.F.R. § 15.711(c)(1), (k)(2), (5).

⁴ 47 CFR §§ 15.703(i) and 15.711(d-e). A Mode I device is not required to incorporate geo-location and database access capabilities.

⁵ *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket Nos. 04-186 and 02-380, Second Memorandum Opinion and Order, 25 FCC Rcd 18661 (2010) (*2010 Second MO&O*); *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, ET Docket Nos. 04-186 and 02-380, Third Memorandum Opinion and Order, 27 FCC Rcd 3692 (2012); *Amendment of Part of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37; Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and the 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, 30 FCC Rcd 9551 (2015) (*2015 White Spaces Order*).

⁶ See generally *2015 White Spaces Order*.

white space database at least once per day, but it also adopted additional requirements intended to better protect licensed wireless microphone operations registered in the white space database. Specifically, the Commission required the white space databases to “push” changes in channel availability information to fixed and Mode II personal/portable devices when a licensed wireless microphone is registered on a previously vacant TV channel (“push notifications”).⁷ In response to petitions for reconsideration arguing that the push notification requirement was overly burdensome and would need modifications to be effective, the Commission waived this requirement pending final action on the petitions for reconsideration.⁸ The Commission, acting on these petitions in 2022, removed the push notification requirement.

5. In the *2020 White Spaces Order and FNPRM*, the Commission made targeted changes to the rules for white space devices in the TV bands to provide improved broadband coverage for American consumers in rural and underserved areas and improved access to narrowband Internet of Things (IoT) applications in all areas.⁹ Specifically, the Commission permitted higher EIRP and higher antenna height above average terrain (HAAT) for fixed white space devices in “less congested” geographic areas, i.e., those areas where at least half the TV channels in a device’s band of operation are vacant.¹⁰ In addition, the Commission permitted higher power mobile device operation within defined geo-fenced areas in “less congested” areas and adopted rule changes designed to facilitate the development of new and innovative narrowband IoT services.¹¹ Mobile devices, which operate within a bounded area at power levels comparable to fixed devices, were implemented as a new class of white space device.¹² Narrowband devices are a subset of fixed or personal/portable devices, and are subject to technical rules which permit narrower channel bandwidths than other fixed and personal/portable devices.¹³ The Commission, consistent with existing rules, required narrowband and mobile devices to comply with a once daily database check.¹⁴

6. Shure Incorporated filed a petition for reconsideration of two Commission decisions in the *2020 White Spaces Order and FNPRM*, expressing concern about possible interference to wireless

⁷ *2015 White Spaces Order*, 30 FCC Rcd at 9662-64, para. 273-78.

⁸ *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*, Order, 31 FCC Rcd 13798 (2016) (*Push Notification Waiver Order*). The original waiver was due to expire June 23, 2017, but the Office of Engineering and Technology subsequently extended this waiver multiple times. The waiver expired upon the effective date of the rules adopted by the Commission in January 2022 that removed the push notification requirement and replaced it with a requirement for more frequent database re-checks by white space devices. *Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37; Amendment of Part 74 of the Commission’s Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and the 600 MHz Duplex Gap, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Unlicensed White Space Device Operations in the Television Bands, Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 14-165, GN Docket No. 12-268, ET Docket Nos. 20-36 and 04-186, FCC 22-6, at 15 (January 26, 2022) (*2022 White Spaces Order and FNPRM*).

⁹ *Unlicensed White Space Device Operations in the Television Bands*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 12603 (2020) (*2020 White Spaces Order and FNPRM*).

¹⁰ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12606, para. 7.

¹¹ *Id.*

¹² *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12623-24, para. 53.

¹³ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12626-29, paras. 62-67.

¹⁴ 47 CFR § 15.711(c)(2)(iii), (d)(4), (k)(9).

microphones.¹⁵ Shure believes that the 16-watt EIRP limit that the Commission permitted for geo-fenced mobile devices is too high and requests that this limit be reduced.¹⁶ Shure also objects to narrowband IoT devices being permitted to operate anywhere rather than limited to “less congested” areas, and wants the Commission to consider imposing additional requirements on narrowband IoT devices, such as requiring device operators to register the times, locations and technical operating parameters in the white space database.¹⁷

7. The Commission sought comment in the *2020 White Spaces Order and FNPRM* on whether it should allow the use of a terrain-based propagation model such as the Longley-Rice Irregular Terrain Model for determining white space channel availability.¹⁸ It sought to develop a record on whether or not to implement such a model, the effect use of such a model would have on white space device channel availability, how a terrain-based model could be implemented within the current white space device framework, the technical parameters necessary to use such a model for identifying available spectrum while protecting incumbents from harmful interference, and various database and device implementation issues.

8. Unlicensed proponents support permitting the use of terrain-based models by white space database administrators as an optional alternative to the current model that requires white space devices to comply with minimum separation distances outside the protected service contours of co-channel and adjacent channel TV stations.¹⁹ These parties generally argue that the current protection model can be overly conservative and that permitting terrain-based models would make more spectrum available for white space devices.²⁰ However, TV broadcast interests oppose allowing the use of terrain-based models for determining white space channel availability due to concerns about interference to TV reception.²¹

9. In its 2022 *White Spaces Order and FNPRM*, the Commission addressed the 2015 petitions for reconsideration of the push notification requirement. It replaced this requirement with a simpler requirement that all fixed and Mode II personal/portable devices, with the exception of narrowband devices, must comply with a more frequent database re-check interval (once per hour instead of once per day).²² The Commission did not apply the more frequent re-check requirement to the newer classes of mobile and narrowband white space devices established in 2020 but instead sought comment on what database re-check interval should apply to mobile and narrowband devices, e.g., once per hour, once per day, or some other interval.²³ Commenters support an hourly database re-check interval for mobile

¹⁵ Petition for Reconsideration of Shure Incorporated, ET Docket No. 20-36, at 5, 15 (filed Feb. 11, 2021), [https://www.fcc.gov/ecfs/file/download/DOC-5de50adf5a400000-A.pdf?file_name=Shure%20-%20TVWS%20Petition%20for%20Reconsideration%20-%20ET%20Docket%20No.%2020-36%20\(2.11.21\).pdf](https://www.fcc.gov/ecfs/file/download/DOC-5de50adf5a400000-A.pdf?file_name=Shure%20-%20TVWS%20Petition%20for%20Reconsideration%20-%20ET%20Docket%20No.%2020-36%20(2.11.21).pdf) (Shure Petition). Shure submitted two attachments with their petition. Attachment A - Mobile WSD Impact Assessment on Wireless Microphones, https://www.fcc.gov/ecfs/file/download/DOC-5de50adf5a400000-B.pdf?file_name=Attachment%20A%20-%20Mobile%20WSD%20Impact%20Assessment%20on%20Wireless%20Microphones.pdf; Attachment B - Environment Study for 900 ISM Projects (ULXD/QLXD), https://www.fcc.gov/ecfs/file/download/DOC-5de50adf5a400000-C.pdf?file_name=Attachment%20B%20-%20Environment%20Study%20for%20900%20ISM%20Projects.pdf.

¹⁶ Shure Petition at 5.

¹⁷ Shure Petition at 15, 20.

¹⁸ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12632-33, para. 79.

¹⁹ Microsoft Comments at 7; WISPA Comments at 8; DSA Comments at 8; PISC Comments at 13.

²⁰ Microsoft Comments at 2; WISPA Comments at 3; DSA Comments at 2; PISC Comments at 11.

²¹ NAB Comments at 4; Smith and Fisher Comments at 4; Cohen, Dippell and Everist Reply at 2; BitPath Reply at 3; ONE Media Reply at 6.

²² *2022 White Spaces Order and FNPRM* at 10, para. 22.

²³ *2022 White Spaces Order and FNPRM* at 10, 16-17, paras. 22, 38-41.

devices,²⁴ but are divided on the appropriate re-check interval for narrowband devices. Unlicensed interests support a once daily re-check interval for narrowband devices, while broadcasters and wireless microphone interests support an hourly re-check interval.²⁵

III. ORDER ON RECONSIDERATION

10. In this Order on Reconsideration, we dismiss in part and, on alternative and independent grounds, deny Shure's petition for reconsideration and uphold the Commission's decisions allowing mobile devices to operate at 16 watts EIRP and permitting narrowband white space devices to operate in all areas rather than limiting them to "less congested" areas.

A. Mobile device power limits

11. *Background.* In the *2020 White Spaces Order and FNPRM*, the Commission established a new class of mobile white space device which is permitted to operate within defined geo-fenced areas in "less congested" areas.²⁶ It permitted these mobile devices to operate with up to 16 watts EIRP, which is the same power level permitted for fixed devices in "less congested" areas.²⁷ The white space database must determine channel availability in the geo-fenced area using the same separation distances applicable to 16 watt fixed devices, and the database may indicate a channel as being available for a mobile device only if it is available at the same power level throughout the entire geo-fenced area.²⁸ A mobile device must incorporate a geo-location capability and check its location at least once every 60 seconds to determine whether it is still within the geo-fenced area where its operating channel is available.²⁹ It must cease operation if it moves to within 1.9 kilometers of the boundary of the geo-fenced area or is outside of the area.³⁰

12. Shure filed a petition for reconsideration of this decision, expressing concern about possible interference to unlicensed wireless microphones. Shure believes that the 16-watt EIRP limit that the Commission permitted for geo-fenced mobile devices is too high and recommends that the power limit be reduced to 100 milliwatts, but in no case greater than 4 watts.³¹ It argues that the Commission's decision to authorize high power mobile white space devices is irreconcilable with a 2010 decision denying a request for higher power mobile operation and is not in the public interest.³² Shure also argues that the *2020 White Spaces Order and FNPRM* misguidedly conflates the interference profiles of fixed and mobile white space devices, fails to consider substantial risks of harm to the many users of unlicensed wireless microphones in less congested areas, and indefensibly deviates from the Commission's consistent policy of exercising caution when introducing new white space services.³³ Microsoft opposes Shure's petition, arguing that the Commission's decision to adopt a 16-watt EIRP limit for mobile devices operating within geo-fenced areas was well-reasoned, cautious, and consistent with precedent.³⁴

²⁴ NAB Comments at 1-2; Shure Comments at 5; Sennheiser Comments at 5; Microsoft Comments at 3.

²⁵ Microsoft Comments at 3; CTA Reply at 2; OTI and PK Reply at 2; NAB Comments at 5; Shure Comments at 5; Sennheiser Comments at 3.

²⁶ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12623, para. 53.

²⁷ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12624, para. 54.

²⁸ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12624, para. 55.

²⁹ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12625, paras. 57-58.

³⁰ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12625, para. 58.

³¹ Shure Petition at 5.

³² Shure Petition at 6.

³³ Shure Petition at 7-13.

³⁴ Microsoft Opposition at 1.

13. We uphold the Commission’s decision to allow the new class of mobile white space devices to operate at up to 16 watts EIRP. We disagree with Shure’s contention that this decision is irreconcilable with past Commission actions.³⁵ The Commission made the 2010 decision that Shure cites in response to a Motorola petition for reconsideration of the 100 milliwatt power limit for personal/portable devices that the Commission established in 2008.³⁶ Motorola had requested on reconsideration that the Commission establish a new class of vehicle mounted portable devices that could operate at up to four watts EIRP either under the control of a fixed device or that contacted a white space database to obtain a list of available channels, i.e., analogous to the operation of Mode I and Mode II personal/portable devices, but at a higher power level.³⁷ The Commission denied Motorola’s request, stating that personal/portable devices generally pose a greater risk of harmful interference to authorized operations than fixed devices because these devices will change locations, making identification of both unused TV frequencies and the devices themselves, if interference occurs, more complex and difficult.³⁸ The Commission also noted the significant distances at which interference could occur from a personal/portable device operating at greater than 100 milliwatts would make it very difficult to identify a device that is the source of interference.³⁹ However, the rules the Commission adopted in the *2020 White Spaces Order and FNPRM* to allow higher power mobile devices are different from what Motorola previously suggested in that they contain requirements to minimize the likelihood of interference that were not considered in 2010.

14. Specifically, mobile devices must operate within a pre-defined (geo-fenced) area in which the white space database has determined in advance that at least one TV channel is available at all locations within the area.⁴⁰ A channel is considered available for a mobile device if it meets the minimum required separation distances applicable to 16-watt fixed devices from all protected services in the TV bands, including TV broadcast services (full power, Class A and low power), licensed wireless microphones, land mobile radio services, and registered TV and broadcast auxiliary service receive sites.⁴¹ In addition to the geo-fencing requirement, mobile devices are limited to operation in “less congested” areas, which are defined as those areas where at least half the channels within the band of operation are vacant.⁴² For example, for devices operating in the UHF TV band (channels 14-36), a location is considered “less congested” if at least 12 of the 23 UHF TV channels are vacant. These two requirements, limiting the new class of higher power mobile device to areas with more available spectrum, substantially reduces the likelihood of harmful interference to authorized services in the TV bands, and enables all unlicensed devices, including other white space devices and unlicensed wireless microphones, to have an opportunity to access spectrum in the TV bands.⁴³ Limiting operation of mobile devices to geo-fenced areas also addresses the concern the Commission previously noted about difficulties mobile devices may have in identifying vacant spectrum because the database will determine in advance which

³⁵ Shure Petition at 6; *2010 Second MO&O*, 25 FCC Rcd at 18694, para. 78; Petition for Reconsideration and Clarification of Motorola, Inc.; ET Docket No. 04-186, at 15-19 (filed Mar. 19, 2009), <https://www.fcc.gov/ecfs/file/download/6520201876.pdf> (Motorola Petition).

³⁶ *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 04-186, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, 16852, para. 126 (2008) (*2008 Second R&O and MO&O*).

³⁷ Motorola Petition at 16; *2008 Second R&O and MO&O*, 23 FCC Rcd at 16852, para. 124. A Mode I device operates under the control of a fixed or Mode II device, while a Mode II device has its own geo-location and database access capabilities.

³⁸ *2010 Second MO&O*, 25 FCC Rcd at 18694, para. 78.

³⁹ *Id.*

⁴⁰ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12624, para. 55.

⁴¹ *Id.*

⁴² *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12623, para. 53; 47 CFR § 15.703.

⁴³ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12626, para. 59.

channels are available over an entire geo-fenced area. Thus mobile devices will have flexibility to move freely within the area without causing harmful interference. The requirement for mobile devices to comply with the same separation distances as fixed devices, which have the same power limits as mobile devices, will ensure that mobile devices have no greater interference potential than fixed devices, and that services in the TV bands are adequately protected, even at the larger separation distances required from higher power mobile devices. The potential for mobile devices to interfere with unlicensed wireless microphones could in some cases be lower than fixed devices because mobile devices will generally operate with an antenna height above ground of no more than 4 meters due the necessity for vehicle clearance under bridges, power lines, trees, etc., so a mobile device signal could be attenuated by clutter such as buildings, trees and hills between a mobile device and a wireless microphone.⁴⁴ In addition, because a mobile device may operate at the maximum 16 watts EIRP only if it uses a highly directional antenna with a gain of at least 12 dBi, which would require use of an electrical antenna beam steering system, mobile device operators may choose the less costly option of operating with an omnidirectional antenna which would have a lower gain, resulting in an EIRP of less than 16 watts.⁴⁵

15. We disagree with Shure's contention that the technical limits for mobile devices (maximum in-band power, antenna gain, power spectral density, adjacent channel and out-of-band emissions) require additional study by the Commission.⁴⁶ Shure's petition focuses on the EIRP limit for mobile devices, which is a function of the in-band conducted power and antenna gain.⁴⁷ While it requests a lower EIRP limit for mobile devices which we decline to adopt, it does not request specific changes to the in-band conducted power and antenna gain limits and does not raise specific concerns about the suitability of any other technical limits, e.g., power spectral density, adjacent channel and out-of-band emissions, nor does it suggest any modifications to them.⁴⁸ We therefore make no changes to the technical limits for mobile devices adopted in the *2020 White Spaces Order and FNPRM*.

16. We recognize that the white space database does not have the capability to track the exact location of a mobile device, making it more difficult to identify an interfering mobile device than a registered fixed device. However, the database will contain information on the devices operating within the boundaries of each geo-fenced area, and can determine the TV channel(s) that are available within that area. This information could be used to help identify potentially interfering devices if the need arises. Because mobile devices will operate primarily within rural areas where it is likely that there will be only a single or very limited number of white space devices operating within a geo-fenced area, we expect that it should not be difficult to find out which device is causing interference. Also, the rules require the white space database administrator to cease providing lists of available channels to specific white space devices

⁴⁴ The Interstate Highway System requires a minimum clearance of 16 feet (4.9 meters) under bridges, although many bridges in both urban and rural areas have a clearance of 14 feet (4.3 meters). https://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_verticalclearance.cfm.

⁴⁵ The maximum allowable transmitter power for mobile devices is one watt (30 dBm). In order to achieve an EIRP of 42 dBm, and antenna with a gain of 12 dBi is required. 47 CFR § 15.709(b)(1), (c)(2). We do not have specific information on the gain of commercially available omnidirectional antennas suitable for mobile white space applications, but if, for example, a mobile device used an antenna with a gain of 6 dBi, the maximum EIRP would be four watts, and if it used an antenna with a gain of 0 dBi, the EIRP would be one watt.

⁴⁶ Shure Petition at 8-9.

⁴⁷ 47 CFR § 15.709(b)(1), (c)(2).

⁴⁸ The Commission established power spectral density limits to prevent multiple white space devices from simultaneously operating at the maximum allowable power with transmit bandwidths of less than six megahertz within a single television channel, which would result in a total transmitted power within that channel significantly greater than the limit. *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12626, para. 61. The adjacent channel and out-of-band emission limits protect services outside the channel where a white space device operates. 47 CFR § 15.709(b)(1), (d).

upon request by the Commission.⁴⁹ The Commission could request that the database administrator stop providing lists of available channels to all mobile devices operating within a specific geo-fenced area where interference has occurred. As discussed in the Report and Order below, we are requiring mobile white space devices to re-check the database at least once per hour, which will ensure a device ceases operation quickly if the database ceases providing lists of available channels to it.

17. We also recognize Shure’s concern about potential interference from high power mobile devices to unlicensed wireless microphones operating in “less congested” areas.⁵⁰ We do not believe it is appropriate to lower the mobile device power limit to a level (e.g., 100 milliwatts EIRP) intended to allow coexistence with co-channel wireless microphones at short distances since that would severely limit the utility of mobile devices. We disagree that Shure’s example of a white space device made by Redline Communications, which purportedly has a range of 50 kilometers, supports a lower power limit for mobile devices.⁵¹ The web page Shure referenced for Redline is no longer active, but the power levels Shure cites for these devices (100 milliwatts for the CPE and 1 watt for the base unit) are conducted power levels, whereas the white space device power limits for both fixed and mobile devices are specified in terms of EIRP, i.e., a maximum of one watt conducted power plus antenna gain.⁵² Thus, the Redline devices could operate with high gain antennas to achieve an EIRP much higher than 100 milliwatts or 1 watt.⁵³ Additionally, fixed devices can be mounted with both the transmit and receive antennas high above ground to clear terrain and other obstacles to achieve long range, whereas mobile device antennas are limited to approximately four meters above ground. We expect that a device operating with 100 milliwatts or 1 watt of conducted power would require both high gain transmit and receive antennas and high antenna heights to achieve a range of 50 kilometers.

18. The Commission decided to limit operation of mobile devices to less congested areas to enable all unlicensed devices, including other white space devices and unlicensed wireless microphones, to have an opportunity to access spectrum in the TV bands.⁵⁴ Because mobile devices operate only in “less congested” areas, there will, by definition, be multiple vacant TV channels available where unlicensed wireless microphones can operate, e.g., at least 12 in the UHF band. Thus, if mobile devices operate on one or even several TV channels in an area, there will still be multiple vacant channels available for use by unlicensed wireless microphones where mobile white space devices do not operate. As noted above, the white space database will contain information on geo-fenced areas used for mobile devices, and this information could be used by unlicensed wireless microphone users to determine whether any mobile devices could operate in their area.⁵⁵ We also point out that unlicensed wireless

⁴⁹ 47 CFR § 15.715(k).

⁵⁰ Shure Petition at 9, Attachment A at 1, 5. We dismiss on procedural grounds Shure’s reliance in its Petition on its technical study, which it did not submit earlier in this proceeding in response to the NPRM, which specifically requested comment on whether “four watts [is] an appropriate maximum power to permit for such operations or should a different maximum power level be permitted (e.g., 10 watts or 16 watts EIRP).” *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 20-36, Notice of Proposed Rulemaking, 35 FCC Rcd 2101, 2115, para. 42 (2020). Shure has not shown why it was unable to present this study before adoption of the *2020 White Spaces Order and FNPRM*. See 47 C.F.R. § 1.429(b).

⁵¹ Shure Petition at 12-13.

⁵² The URL Shure provided now connects to a web site for Aviat Networks which purchased Redline Communications. It is not clear whether they are still marketing the Redline devices that Shure referenced.

⁵³ A white space device with one watt conducted power could use an antenna with a gain up to 12 dBi in “less congested” areas to achieve an EIRP of 16 watts. A white space device with a conducted power of 100 milliwatts would achieve 1.6 watts EIRP using a 12 dBi gain antenna, or could use an even higher gain antenna to achieve a higher power level.

⁵⁴ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12626, para. 59.

⁵⁵ 47 CFR § 15.715(m). All information in the white space database required by the rules must be publicly available, with the exception of certain information provided by 600 MHz licensees on the areas where they have

(continued....)

microphones operate on an equal basis with white space devices in the TV bands and that neither one has priority over the other. As with all unlicensed devices operating under our Part 15 rules, unlicensed wireless microphones are subject to the condition that they may receive interference—including interference from other unlicensed devices.⁵⁶ As such, while the presence of multiple vacant channels in “less congested” areas indicates that there will likely be spectrum available for both white space devices and unlicensed wireless microphones, the unlicensed wireless microphones operate under the same spectrum access provisions as all Part 15 unlicensed devices where all such devices have equal access to the spectrum and must accept interference that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator.⁵⁷

B. Narrowband devices

19. *Background.* The Commission established a new class of “narrowband white space device” that can be used in IoT applications, which it defined as a type of fixed or personal/portable white space device operating in a bandwidth of no greater than 100 kilohertz.⁵⁸ The Commission’s rules require narrowband devices to comply with the same power spectral density (PSD), antenna gain and adjacent channel emission limits as four watt EIRP fixed devices, and limit them to a one percent duty cycle (36 seconds per hour).⁵⁹ It also requires narrowband devices to comply with a channelization plan (55 narrowband carriers within the center 5.5 megahertz of a TV channel) which ensures that the maximum instantaneous power within a TV channel can never be greater than four watts EIRP.⁶⁰ The Commission noted that because the transmission time is limited to no more than thirty-six seconds per hour, the interference potential of narrowband white space devices will actually be significantly less than that of four-watt EIRP fixed devices, since it is extremely unlikely that devices would transmit at maximum power on all 55 narrowband channels simultaneously, and even if they did, that would occur for no more than 36 seconds per hour.⁶¹ The Commission decided not to limit narrowband device operation to “less congested” areas as suggested by wireless microphone interests, noting that the white space database will ensure that narrowband devices do not operate on channels at locations where registered licensed wireless microphones operate.⁶² It also noted that unlicensed wireless microphones must already share spectrum with four watt EIRP white space devices, and that narrowband devices will generally have a significantly lower interference potential in the vast majority of cases.⁶³

20. Shure believes that the Commission erred in authorizing narrowband IoT white space device operations on a nationwide basis.⁶⁴ It argues that the Commission failed to justify authorizing a new nationwide class of IoT services within a rural access proceeding and that it did not consider the negative public interest impact nationwide narrowband white space devices will have on coequal

commenced operation. The white space database does not yet support mobile white space device operation, but when this capability is added we will ensure that information on registered geo-fenced areas is publicly available as the rules require.

⁵⁶ 47 CFR § 15.5(b).

⁵⁷ 47 CFR § 15.5(b).

⁵⁸ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12627, para. 64.

⁵⁹ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12628, para. 65.

⁶⁰ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12629, para. 67.

⁶¹ *Id.*

⁶² *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12629, para. 68.

⁶³ *Id.*

⁶⁴ Shure Petition at 15.

unlicensed users scanning for available spectrum.⁶⁵ Shure further argues that the Commission failed to consider mitigation measures that would ease the feasibility of coexistence with other spectrum users, such as disclosing the times, locations, and technical operating parameters to the white space database, or requiring IoT devices to incorporate a transmission signal that would enable wireless microphone users to better identify clear and occupied channels.⁶⁶ Microsoft responds that the Commission appropriately authorized nationwide IoT mobile device operations and is not required to restrict these devices to rural areas, and that the rules adopted in the *2020 White Spaces Order and FNPRM* consider and mitigate the impact on coequal unlicensed users.⁶⁷

21. *Discussion.* We affirm the Commission's decision to allow narrowband devices to operate in all areas and decline to adopt additional requirements for narrowband devices suggested by Shure that are intended to facilitate their detection or that would require additional information to be submitted to the white space database.⁶⁸ As an initial matter, the Commission previously noted that narrowband devices have no greater interference potential than four watt EIRP devices, and that as a practical matter their interference potential will be significantly lower because a device is unlikely to transmit on all possible 55 narrowband channels simultaneously, and if it did the transmissions are limited to a one percent maximum duty cycle.⁶⁹ Unlicensed wireless microphones are already required to share spectrum with white space devices operating at up to four watts EIRP (outside of "less congested" areas) on an equal basis, and the *2020 White Spaces Order and FNPRM* made no changes to this sharing regime.⁷⁰ Unlicensed wireless microphones must accept interference from white space devices, and conversely, white space devices must accept interference from both licensed and unlicensed wireless microphones.⁷¹ However, as discussed below, we expect that there will generally be spectrum available for unlicensed wireless microphones in areas where narrowband white space devices are used, and there are steps that wireless microphone users can take under the current rules to help identify where narrowband devices may be in use.

22. We disagree with Shure's contention that the Commission should not have permitted nationwide deployment of narrowband devices in this proceeding.⁷² The fact that this proceeding focuses primarily on rural areas does not preclude the Commission from adopting rules that benefit persons in all areas. While Microsoft noted that several major narrowband IoT use cases and applications are predominately in rural areas, it did not suggest, and the Commission did not propose or even seek comment on whether to limit narrowband white space device operation to only less congested areas.⁷³ Thus, Shure had notice that the Commission was considering allowing narrowband devices to operate in all areas. In adopting rules to permit the new class of narrowband devices, the Commission already considered and rejected requests by wireless microphone interests to limit narrowband devices to "less

⁶⁵ Shure Petition at 16-17.

⁶⁶ Shure Petition at 20.

⁶⁷ Microsoft Opposition at 10-12.

⁶⁸ Shure Petition at 15-21.

⁶⁹ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12629, para. 67. Narrowband devices are subject to a channelization plan that allows up to 55 narrowband (100 kHz) channels within a 6-megahertz TV channel. The Commission noted that it is extremely unlikely that all 55 channels would be used simultaneously.

⁷⁰ *Id.*; 47 CFR § 15.5(a)-(b).

⁷¹ 47 CFR § 15.5(b).

⁷² Shure Petition at 16.

⁷³ Petition for Rulemaking, ET Docket No. 14-165 and RM-11840, at 15 (filed May 3, 2019), [https://ecfsapi.fcc.gov/file/1050380945109/White%20Spaces%20Petition%20for%20Rulemaking%20\(May%203%202019\).pdf](https://ecfsapi.fcc.gov/file/1050380945109/White%20Spaces%20Petition%20for%20Rulemaking%20(May%203%202019).pdf) (Microsoft Petition), *Unlicensed White Space Device Operations in the Television Bands*, Notice of Proposed Rulemaking, 35 FCC Rcd 2101, 2117-18, paras. 45-49 (2020) (*2020 White Spaces NPRM*).

congested” areas, noting that these devices have no greater interference potential than four watt EIRP white space devices that were already permitted to operate in any area.⁷⁴

23. We expect that there will generally be spectrum available for unlicensed wireless microphones at locations where narrowband devices are used outside of “less congested” areas for several reasons. First, narrowband white space devices must comply with the same separation distances from TV contours and other protected services as four watt EIRP fixed devices.⁷⁵ These rules require that a four watt EIRP device operate outside the protected contours of both co-channel and adjacent channel TV stations, which means that a narrowband device can operate only at a location where there are at least three contiguous vacant TV channels, with the white space device operating in the center 6 megahertz channel and both adjacent channels vacant.⁷⁶ Thus, at a location where a narrowband white space device is being used outside of a “less congested” area, there will be a minimum of 12 megahertz of spectrum available for wireless microphones that cannot be used by a narrowband white space device.⁷⁷ Further, a narrowband white space device would not preclude operation of unlicensed wireless microphones over large distances. Licensed wireless microphones are protected to a one kilometer distance from co-channel white space devices operating with up to ten watts EIRP.⁷⁸ Since a narrowband device will generally have a much lower interference potential than a four watt EIRP device, and therefore even less than a ten watt EIRP device, the distance at which it could potentially interfere with wireless microphones will be significantly less than one kilometer.⁷⁹

24. Because narrowband devices have a lower interference potential than other fixed white space devices with which unlicensed wireless microphones must already share spectrum, and because there will continue to be spectrum available for unlicensed wireless microphones at locations where narrowband devices operate, we decline to adopt additional requirements for narrowband devices as suggested by Shure.⁸⁰ We recognize Shure’s concern about the difficulty in scanning spectrum for the presence of white space devices that transmit for short periods of time, but there is no clear solution to this concern.⁸¹ The white space rules have never specified any requirements on the time interval over which devices may transmit, and establishing a minimum transmission time to facilitate detection by wireless microphone users could require devices to transmit unnecessarily, potentially affecting battery life in battery-powered devices or impacting the use of spectrum by other white space devices and unlicensed wireless microphones.⁸² Similarly, requiring white space devices to transmit a beacon signal could also affect the battery life of battery powered devices, and depending on the nature of the signal transmitted could also impact spectrum use by other white space devices or wireless microphones.

25. We will not require operators of narrowband devices to register additional information in the white space database. The Commission previously rejected requests to require white space devices to provide additional information to the white space database, including their specific operating channel, in the interest of keeping the rules simple and avoiding the imposition of unnecessary requirements that

⁷⁴ 2020 *White Spaces Order and FNPRM*, 35 FCC Rcd at 12629, para. 67.

⁷⁵ 47 CFR § 15.712.

⁷⁶ 47 CFR § 15.712(a)(2).

⁷⁷ There will be considerably more spectrum available for wireless microphones in “less congested” areas, since by definition at least half the TV channels in the band of operation must be vacant. 47 CFR § 15.703.

⁷⁸ 47 CFR § 15.712(f)(1).

⁷⁹ A narrowband device will reach a power level of 4 watts only if all 55 narrowband carriers within the channel transmit simultaneously.

⁸⁰ Shure Petition at 20.

⁸¹ Shure Petition at 17.

⁸² Shure Petition at 18. Shure states that the short transmissions expected from a narrowband device, e.g., 10 milliseconds or less, will be difficult to detect with current scanning equipment.

could hamper innovation.⁸³ These same considerations lead us to decline to require operators of narrowband devices to register additional information in the white space database. However, unlicensed wireless microphone operators can use the white space database to identify locations where fixed devices, including narrowband devices, are in use. This information is publicly available and can allow unlicensed wireless microphone users to determine whether any fixed devices are in their vicinity, e.g., less than 1 kilometer.⁸⁴ In addition, the white space database can provide a list of available channels at an unlicensed wireless microphone's location, which can indicate where narrowband devices could potentially operate (i.e., groups of three vacant channels) and thus, where they could not.

IV. REPORT AND ORDER

26. In this Report and Order, we require mobile white space devices, which operate on TV channels 2-35, to comply with the same hourly database re-check interval that the Commission recently required for most fixed and Mode II personal/portable white space devices.⁸⁵ We continue to require narrowband white space devices, which also operate on TV channels 2-35, to re-check the white space database once per day rather than once per hour due to their lower potential for causing harmful interference to protected services in the TV bands, including licensed wireless microphones.

A. Mobile devices

27. *Background.* Because of the technical similarities between fixed and mobile devices, the Commission proposed in the *2022 White Spaces Order and FNPRM* to require mobile devices to comply with the same hourly database re-check interval as fixed devices (excluding narrowband) that operate in the TV bands to more effectively protect licensed wireless microphones.⁸⁶ The Commission also proposed to require mobile devices to comply with the other database re-check requirements for fixed devices (excluding narrowband) in the TV bands, specifically, the requirement to cease operation no more than 120 minutes after the last successful database contact in the event a device is no longer able to successfully contact the database, and the requirement to adjust their use of TV channels in accordance with wireless microphone scheduling information provided by the white space database for the two hour period beginning when the device last contacted the database.⁸⁷ The Commission further proposed that any modified rules would become effective six months after publication in the Federal Register.⁸⁸ NAB, Shure, and Sennheiser support an hourly re-check interval for mobile white space devices, and Shure also suggests decreasing the amount of time that a mobile device can continue to operate from 60 minutes to 10 minutes in the event it is unable to make its hourly contact with the database.⁸⁹ Microsoft states that it has no objection to an hourly database re-check requirement for mobile devices.⁹⁰

28. We will require mobile devices to re-check the white space databases at least once per hour; the same re-check interval required for fixed devices (excluding narrowband). We believe this is an appropriate re-check interval due to the technical similarities between mobile and fixed devices, e.g., maximum transmitter power, power spectral density, antenna gain, requirement to connect to a database

⁸³ *2010 Second MO&O*, 25 FCC Rcd at 18709, para. 117.

⁸⁴ 47 CFR § 15.715(m). We note, however, that information includes only the device's location and not the specific channels that are in use. All currently certified white space devices are fixed devices.

⁸⁵ *2022 White Spaces Order and FNPRM* at 10, para. 22. The changes apply only to mobile devices, which are permitted to operate on TV channels 2-35, and not to any other types of devices or in any other frequency bands. See GE Healthcare Comments at 3.

⁸⁶ *2022 White Spaces Order and FNPRM* at 17, para. 40.

⁸⁷ *Id.*

⁸⁸ *Id.*

⁸⁹ NAB Comments at 1-2; Shure Comments at 5; Sennheiser Comments at 5.

⁹⁰ Microsoft Comments at 8.

to obtain a list of available channels, and protection criteria for other services in the TV bands.⁹¹ We will also require mobile devices to comply with the other database re-check requirements applicable to fixed devices, specifically, the requirement to cease operation no later than 120 minutes after the last successful database contact and the requirement to adjust their use of TV channels in accordance with wireless microphone scheduling information provided by the white space database for the two hour period beginning when the device last contacted the database.⁹² We are implementing this change by removing the mobile device database re-check requirements from Section 15.711(k)(9) and replacing them with a cross-reference to Section 15.711(h), which will specify the database re-check requirements applicable to fixed, mobile, and Mode II personal/portable devices.⁹³

29. We disagree with Shure that it is necessary to shorten the time period that a mobile device can continue to operate if it is unable to make its hourly contact with the database. There is 12 megahertz of spectrum available for wireless microphones nationwide in the 600 MHz duplex gap and guard band where they can be immediately operated without advance registration.⁹⁴ Further, as discussed above, since mobile white space devices may operate only in “less congested” areas where at least half the TV channels in the band of operation are vacant, there will by definition be at least 12 unused TV channels out of the 23 in the UHF TV band, so there will be multiple TV channels available for wireless microphones in addition to the 12 megahertz of spectrum available nationwide in the 600 MHz duplex gap and guard band. Therefore, a potentially slightly longer time interval for operation after a failed database re-check (60 minutes as opposed to Shure’s suggestion of 10 minutes) should not be problematic for licensed wireless microphone operators as it will not substantially increase the potential of harmful interference because other spectrum is available where licensed wireless microphones can operate until a TV channel occupied by a white space device is cleared. In the case of large events held in “less congested” areas where a licensed wireless microphone operator registers TV channels in advance, this slightly longer time interval is even less likely to be problematic because operators will have the information necessary to register wireless microphones (e.g., location, times, dates, channels required) well in advance of an event, so a small amount of extra time needed to release a channel after registration is insignificant. Finally, we note that the extra time that a device is permitted to operate beyond a failed database re-check is expected to be an infrequent occurrence limited to those instances when a device is unable to contact the database; it is not a device’s normal mode of operation.

30. While the Commission proposed a 6-month transition period for parties to comply with a changed database re-check interval for mobile devices, upon further consideration we do not believe that a transition period is necessary since the white space database is not yet capable of supporting mobile devices and there are as of yet no certified mobile white space devices. No party indicated a need for a transition period. Accordingly, we make the rules changing the database re-check interval for mobile white space devices effective 30 days after publication in the Federal Register.

⁹¹ See, e.g., 47 CFR §§ 15.709(a)(2)(i)(A) and 15.709(a)(5) (maximum 16 watts EIRP for both fixed and mobile devices); 47 CFR § 15.709(b)(1) (same conducted power, power spectral density and adjacent channel emission limits for fixed and mobile devices), 47 CFR § 15.709(c)(2) (same requirement for fixed and mobile devices to reduce conducted power when an antenna with a gain greater than 12 dBi is used), 47 CFR § 15.711(k)(6) (mobile devices must comply with the same separation distances from protected services as fixed devices).

⁹² 47 CFR § 15.711(h)(1).

⁹³ 47 CFR § 15.711(h)(1), (k)(9).

⁹⁴ A four megahertz segment of the duplex gap (653-657 MHz) is available for licensed wireless microphones. 47 CFR § 74.802(a)(2). The 600 MHz guard band (614-616 MHz) is available for unlicensed wireless microphones. 47 CFR § 15.236(b)(5). The upper six megahertz segment of the 600 MHz duplex gap (657-663 MHz) is available for both unlicensed wireless microphone and 40 milliwatt white space device use. 47 CFR §§ 15.236(b)(3), 15.707(a)(2) and 15.709(a)(4).

B. Narrowband devices

31. *Background.* The rules currently require narrowband white space devices to re-check the database at least once daily and permit them to operate until 11:59 PM the following day if they are unable to contact the database on a given day.⁹⁵ Microsoft previously argued that requiring narrowband fixed white space devices used for IoT applications to comply with an hourly database re-check would negatively impact battery life, limit potential form factors, and increase the cost of those devices.⁹⁶ It requests that the Commission maintain its existing requirement that narrowband fixed devices check the white space database once a day to ensure capturing wireless microphone reservations rather than hourly.⁹⁷

32. The Commission sought comment in the *2022 White Spaces Order and FNPRM* on the database re-check interval that should be required for narrowband white space devices.⁹⁸ It sought comment on whether to retain the current requirement for a once daily database check and allow continued operation until 11:59 PM the following day if a device is temporarily unable to contact the database, or whether narrowband devices should comply with the same hourly re-check interval as other fixed and Mode II personal/portable devices.⁹⁹ The Commission further sought comment on the types of devices to which a different re-check interval should apply, e.g., both fixed and Mode II personal/portable narrowband devices, battery-powered devices only or to AC powered devices as well.¹⁰⁰ It also sought comment on the impact of the database re-check interval on the protection of licensed wireless microphones.¹⁰¹

33. Microsoft, CTA, and OTI/PK support a once daily database re-check requirement for narrowband devices, generally arguing that a more frequent re-check interval (e.g., once per hour) would be overly burdensome, have a negative impact on device design, including battery life, and is not necessary to prevent harmful interference to licensed wireless microphones.¹⁰² Microsoft and OTI/PK argue that because narrowband devices can only be used in areas where there are at least three contiguous vacant channels, operation will be precluded in urban and most suburban locations, and this three-channel requirement means channels adjacent to one used by a narrowband device will remain available for wireless microphone use.¹⁰³ They also argue that the low duty cycle of narrowband devices (36 seconds per hour) further reduces the likelihood of harmful interference to wireless microphones.¹⁰⁴ However, NAB, Shure and Sennheiser support an hourly re-check interval for narrowband devices.¹⁰⁵ NAB does not believe that an hourly re-check is burdensome, while Shure and Sennheiser express concern about the potential for interference to licensed wireless microphones from a longer re-check interval.¹⁰⁶

34. We decline to require narrowband white space devices to re-check the database on an hourly basis instead of once daily. However, we believe that modifying the rule to eliminate the grace

⁹⁵ 47 CFR § 15.711(h)(2).

⁹⁶ *2022 White Spaces Order and FNPRM* at 15, para. 37.

⁹⁷ *Id.*

⁹⁸ *2022 White Spaces Order and FNPRM* at 16, para. 38.

⁹⁹ *Id.*

¹⁰⁰ *Id.*

¹⁰¹ *2022 White Spaces Order and FNPRM* at 16, para. 39.

¹⁰² Microsoft Comments at 3-7; CTA Reply at 2; OTI/PK Reply at 2-5

¹⁰³ Microsoft Comments at 5; OTI/PK Reply at 3.

¹⁰⁴ Microsoft Comments at 2; OTI/PK Reply at 4.

¹⁰⁵ NAB Comments at 5; Sennheiser Comments at 3; Shure Comments at 5.

¹⁰⁶ NAB Comments at 7; Sennheiser Comments at 4; Shure Comments at 4.

period that permits narrow band white space devices to operate until 11:59 PM the following day if they are unable to successfully contact a database will provide a better balance among competing interests for spectrum access in this band. Instead, we will require narrowband white space devices to successfully contact the database at least once within each 24-hour period it will be operating. Microsoft urges the Commission to retain the current rules specifying a once per day recheck interval along with grace period permitting continued operation until 11:59 PM the following day absent a successful contact with the database.¹⁰⁷ OTI/PK also urges the Commission to retain the current recheck rules for narrowband white space devices.¹⁰⁸ In contrast, Shure notes that operation under the existing rules could result in a white space device operating for a nearly 48-hour period where there is no communication with the database and in addition to modifying the recheck time to once per hour, recommends changing the grace period to 10 minutes.¹⁰⁹ By modifying the rules to eliminate the grace period that could extend narrowband white space device usage up to almost an entire day without contacting the database, we believe we can provide more certainty to wireless microphone operators regarding their ability to access spectrum to cover late breaking news events without detrimental impact to narrowband white space device operation.

35. First, with respect to narrowband white space devices, the rules require frequency selection based on accessing a white space database. Inherent in that requirement is the expectation that the device has established a good, stable, long lasting connection with the database. In addition, we are not aware that the database has experienced any significant downtime to date. Thus, we do not foresee many, if any, situations where a narrowband white space device will be impacted by a lack of connectivity to a white space database. Even if a device was unable to contact a database, we note that it still may transmit for 24-hours since its last successful connection which should provide ample time to transmit any data the device has collected. Moreover, we expect that most IoT information that will be transmitted on these data links is not time critical information and can tolerate some delay in the event that the database cannot be contacted. And in such situations, we do not expect any outages or loss of connection to a database to persist over a significant amount of time. Finally, we note that as an unlicensed device, narrowband white space devices already operate under a best effort framework with no guarantee regarding quality of service. For these reasons, we do not believe that eliminating the grace period will negatively impact narrowband white space device operation nor do we believe it will alter users' expectations.

36. We do believe that changing the recheck time to one-hour from the current once per day requirement will have significant impact on narrowband white space devices that could render them impractical and deprive their utility to users. As noted by Microsoft, requiring narrowband devices to recheck the database once daily rather than once hourly will provide longer battery life and a smaller form factor for battery-powered devices.¹¹⁰ Although the transmission time and amount of data sent by a narrowband device when re-checking the database may be small as suggested by NAB,¹¹¹ requiring hourly checks will require 24 times the battery power of once daily checks, which could have a negative impact on battery life of very small battery-powered devices. While we have no specific data regarding the impact on battery size or cost, we note that many IoT devices (e.g., optical sensors for streetlights or internal sensors embedded in machinery) are designed to be very small due to environmental constraints (e.g., size of the structure or machine they are attached to) and correspondingly necessitate small batteries that must last for long periods of time as the IoT device's location may make replacement difficult and costly. Thus, size and form factor are essential characteristics that may drive device design and in turn limit maximum battery size. Given that a battery's capacity is at maximum levels at installation, decreases over time with use, and that more use intuitively causes the battery to drain faster and

¹⁰⁷ Microsoft Comments at 2.

¹⁰⁸ OTI and PK Reply at 2.

¹⁰⁹ Shure Comments at 4-5.

¹¹⁰ Microsoft Reply at 8.

¹¹¹ NAB Comments at 7.

necessitate replacement sooner, we agree with Microsoft that our rules should accommodate such applications. The alternative would be either larger devices that cannot be installed where needed or devices that have inadequate battery life and must be serviced more frequently which could be costly and may be impractical for many locations.

37. We believe that by making this change, we will provide a more predictable spectrum environment for wireless microphones and continue to maintain a low potential for harmful interference. As an initial matter, we note that licensed wireless microphones have access to a registration system in which users can preregister locations to ensure that white space devices do not operate on certain television channels during specific times. In contrast, unlicensed wireless microphones operate on an equal basis with white space devices and neither device type has any spectral rights over the other. We also note that wireless microphones are generally used for two types of events – preplanned events known well in advance (such as sporting events, concerts, shows and conventions) and late breaking events (such as on-site news reporting). For the former case, we expect licensed wireless microphone users to use the tools available to them and register their usage well in advance of these events to ensure that the television channels they intend to use are clear when they need them. With respect to the latter case, wireless microphone users have always operated in an environment where many microphone users converge on an area and on-the-scene frequency coordination and management must be accomplished in real time; users often have flexibility to choose among several television channels on which to tune their microphones. In such situations, our rules ensure that ample spectrum should be available even if a narrowband white space device is operating nearby.

38. Because narrowband white space devices must comply with the same separation distances from co-channel and adjacent channel TV station contours as four-watt fixed white space devices, they may only operate when there are at least three contiguous television channels available and may not operate on the lowest or highest channel.¹¹² Thus, for late breaking events where licensed microphone users may not have ample time to register their usage, there will still be spectrum available. Wireless microphones could operate on the available television channels adjacent to the channel being used by the narrowband white space device, or on any other vacant TV channels where narrowband devices cannot operate, i.e., channels on which one or both of the adjacent channels are occupied. In addition, as noted above other spectrum will also be available for wireless microphone usage, including 12 megahertz in the 600 MHz guard band and duplex gap. In all cases, fixed white space devices, including narrowband devices, must be registered in the white space database and those registrations are publicly available, thus allowing prospective wireless microphone users to determine the precise locations where fixed narrowband devices are in use.¹¹³ The white space database can also show which channels cannot be used by narrowband devices, i.e., those where four-watt fixed devices cannot operate due to occupied adjacent channels and thus, are available for microphone use.

39. For late breaking events where licensed microphone users are unable to preregister their usage, it is not apparent that changing the database recheck requirement from once per day to once per hour would result in any difference regarding the channels on which narrowband white space devices operate as in many cases, microphone users may not be able to register their usage at all as they are focused on getting to the scene, not on registering their usage. However, even in instances where a wireless microphone may operate in the vicinity of a narrowband white space device, the potential for harmful interference is low. As discussed above, the interference potential of a narrowband device is significantly less than that of a four watt EIRP device due to the fact that it operates intermittently with narrowband carriers with a duty cycle of less than one percent. These rules working in tandem will provide a spectrum environment where wireless microphones users, that for whatever reason cannot operate on one of the available channels or chooses not to, will be able to operate in close proximity to a narrowband white space device without experiencing any detrimental effect. In this regard, our rules

¹¹² 47 CFR § 15.712.

¹¹³ Personal/portable devices, however, are not required to register in the database.

require fixed white space devices operating at up to 40 dBm (10 watts) EIRP to maintain a 1 km buffer from registered wireless microphone locations.¹¹⁴ Narrowband white space devices operate with maximum 18.6 dBm/100 kHz EIRP. In the unlikely situation that all narrowband channels are in use at any given time, the total equivalent energy is no worse than a 36 dBm (4 watts) white space device and the duration of any such situation will be extremely short due to the one percent duty cycle limit. Also, because the rule requiring geographic separation is based on devices operating at maximum antenna height (250 meters generally and 500 meters in less congested areas) and devices operating at lower antenna heights have shorter line-of-sight distance and experience more clutter losses, coupled with the extremely low potential of all narrowband white space devices operating at the same time,¹¹⁵ we expect that wireless microphones will be able to operate without experiencing harmful interference at much closer distances. Due to this low interference potential, we do not see a need to require a more frequent database re-check interval than once daily. Sennheiser does not clearly state why it believes narrowband devices have a higher potential for causing interference than other white space devices.¹¹⁶ Also, the primary use case of narrowband devices is in rural and other less populated areas where there is less likelihood that one will be used in close proximity to a licensed wireless microphone.¹¹⁷ The fact that narrowband devices can operate only at locations where there are three contiguous channels will help ensure that they are used only in areas where there are fewer TV stations in operation and thus more spectrum available for wireless microphones.

40. In sum, we find that a once daily database check will facilitate a wide variety of IoT devices, will not affect the potential for narrowband white space devices to cause harmful interference and will continue to allow widespread wireless microphone use. We are therefore maintaining the current daily re-check interval for all types of narrowband devices (e.g., AC and battery-powered). No party indicated a need for different requirements for different types of devices. We find that an hourly re-check interval is not necessary for narrowband devices due to the very low likelihood of them to cause harmful interference to licensed wireless microphones and because other protected services in the TV bands such as broadcast TV change operating parameters on a less frequent basis.¹¹⁸ In the rare event of a conflict between narrowband white space devices and licensed wireless microphones used in applications that require immediate spectrum access, there will typically be other spectrum available where the microphones can operate until a newly registered TV channel is cleared of white space devices. In cases where a channel is reserved more than a day in advance for large planned events, a daily re-check interval will be sufficient to ensure that licensed wireless microphones have access to that TV band spectrum. However, to better accommodate licensed microphone usage when such usage is registered a day in advance, we are eliminating the grace period that would otherwise permit narrowband white space devices to operate until 11:59 PM the following day if it does not successfully contact a database. We find that due to the expected use cases for narrowband white space devices, such a change will not adversely impact their ability to deliver their intended services. Accordingly, we are modifying the rules to require narrowband white space devices to successfully contact a database at least once every 24-hours or cease operating until such time at it does communicate with a database and obtains an up-to-date available channel list.¹¹⁹

¹¹⁴ 47 CFR § 15.712(f).

¹¹⁵ From a practical standpoint, narrowband white space devices cannot operate on all channels simultaneously to avoid interfering with other devices operating on adjacent or nearby narrowband channels.

¹¹⁶ Sennheiser Comments at 4.

¹¹⁷ Microsoft Comments at 6-8; OTI/PK Comments at 5; CTA Comments at 1-2.

¹¹⁸ The only protected use for which white space database information generally changes more frequently than once daily is wireless microphones. *2015 White Spaces Order*, 30 FCC Rcd at 9661, para. 271.

¹¹⁹ 47 CFR 15.711(h)(2).

V. MEMORANDUM OPINION AND ORDER

41. In this Memorandum Opinion and Order, we decline to allow the white space database to use terrain-based models, such as the Longley-Rice Irregular Terrain Model (Longley-Rice) to determine which TV channels are available for white space device operation at a particular location. We instead require that white space databases continue to use only the current model for determining TV channel availability.¹²⁰

A. Background.

42. Under current rules, white space devices must generally operate outside the defined protected contours of co-channel and adjacent channel TV stations.¹²¹ The rules provide a table of separation distances beyond the protected contour that white space devices must meet that is based on the white space device's EIRP and HAAT.¹²² These distances are based on a desired-to-undesired (D/U) signal ratio of 23 dB at the edge of the protected contour for co-channel operation, and -33 dB at the edge of the protected contour for adjacent channel operation, with a 14 dB allowance for TV receive antenna front-to-back ratio.¹²³

43. The Longley-Rice propagation model is used to make predictions of radio signal field strength using the median attenuation calculated as a function of distance and the signal variability in time and space.¹²⁴ The model can be run in point-to-point mode where it examines a specific radio signal path between a transmitter and a receiver, or in area mode in which it predicts field strength at many geographic points within a specified area. Each operational mode uses a terrain elevation profile in making predictions; in the point-to-point mode path-specific parameters can be determined from the terrain profile between the transmitter and receiver, and in area mode the elevation profile between the transmitter and each specific reception point is examined. The model may require a large number of reception points to be individually examined. It also requires a large set of input parameters encompassing system parameters (e.g., frequency, polarization, antenna heights), environmental parameters (e.g., terrain irregularity, electrical ground constants, surface refractivity, climate information), deployment parameters, and statistical parameters (e.g., reliability and confidence level).¹²⁵ Based on the predicted radio signal attenuation and using additional factors such as transmitter power and antenna directivity, the D/U signal ratio can be estimated and compared against the 23 dB co-channel and -33 dB adjacent channel standards used as the basis when developing the white space device rules to predict whether harmful interference is likely to occur to television reception.

44. In the *2020 White Spaces Order and FNPRM*, the Commission sought comment on whether the use a terrain-based model such as Longley-Rice for determining white space channel availability would better serve the white space device community as well as television broadcasters and other protected entities in the television bands.¹²⁶ In particular, it sought comment on how the Longley-Rice propagation model could be used to determine available white space channels and whether it could

¹²⁰ 47 CFR § 15.712. This section requires white space devices to meet minimum separation distances from the protected contours of co-channel and adjacent channel TV stations, as well as from other protected services including licensed wireless microphones, land mobile stations, and certain receive sites.

¹²¹ 47 CFR § 15.712(a).

¹²² *Id.*

¹²³ *White Spaces Third MO&O*, 27 FCC Rcd at 3699, para. 16-17 & n.43. The distances were calculated using the F(50,10) curves for separation distances of greater than 15 kilometers, the F(50,50) curves for separation distances of 1.5 to 15 kilometers, and the TM-91-1 model for separation distances of less than 1.5 kilometers.

¹²⁴ See A Guide to the Use of the ITS Irregular Terrain Model in the Area Prediction Mode, NTIA Report 82-100; https://www.ntia.doc.gov/files/ntia/publications/ntia_82-100_20121129145031_555510.pdf.

¹²⁵ *Id.*

¹²⁶ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12634, para. 84.

be used to protect other services in the TV bands (e.g., licensed wireless microphones, translator receive sites, land mobile stations) in addition to TV.¹²⁷ The Commission also sought comment on whether the use of a terrain-based model should be mandatory or an optional alternative to the current protection model and on the technical parameters that would be necessary to use such a model for identifying available spectrum while protecting incumbents from harmful interference.¹²⁸ In addition, the Commission sought comment on various white space database and device implementation issues that would need to be addressed if the Commission were to allow or require use of a terrain-based model.¹²⁹

45. Unlicensed proponents support permitting the use of terrain-based models by white space database administrators as an optional alternative to the current model.¹³⁰ These parties generally argue that the current protection model can be overly conservative and that permitting terrain-based models would make more spectrum available for white space devices.¹³¹ They also state that the increased computer resources to make the calculations are not an issue with current technology.¹³² Microsoft suggests limiting use of terrain-based models to locations outside of a TV station's protected contour, while WISPA and DSA suggest also allowing use within an adjacent channel station's protected contour.¹³³ RED Technologies, the only currently active white space database administrator, suggests using a terrain-based model only for the purpose of calculating TV station protected contours and leaving the current separation distances beyond the contour unchanged.¹³⁴

46. TV broadcast interests oppose allowing the use of terrain-based models by the white space database due to concerns about interference to TV reception.¹³⁵ Commenters argue that a terrain-based model does not work well for protecting individual TV receivers.¹³⁶ Commenters also argue that now is not a good time to change the white space protection requirements due to TV broadcasters transitioning to ATSC 3.0 and recent rule changes regarding distributed transmission systems and white space devices.¹³⁷

B. Discussion.

47. We decline at this time to permit use of terrain-based models in place of, or as an alternative to, the current method of protecting TV and other services using minimum distance separations from defined protected service contours or defined geographic points. We find that we lack a sufficient record to adopt rules on issues such as whether a terrain-based model is an appropriate method for protecting TV services from white space devices, and if so, the exact technical parameters that would need to be specified to implement the model, whether a terrain-based model should be used only outside of a TV station's protected contour or whether it could also be used within a protected contour, whether it should be used only for protecting TV services or for protecting other services as well (e.g., land mobile stations, licensed wireless microphones).

¹²⁷ *Id.*

¹²⁸ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12635-36, para. 85-89.

¹²⁹ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12636, para. 90-93.

¹³⁰ Microsoft Comments at 7; WISPA Comments at 8; DSA Comments at 8; PISC Comments at 13.

¹³¹ Microsoft Comments at 2; WISPA Comments at 3; DSA Comments at 2; PISC Comments at 11.

¹³² Microsoft Comments at 9; WISPA Comments at 4; DSA Comments at 4; PISC Comments at 10.

¹³³ Microsoft Comments at 8; WISPA Comments at 10; DSA Comments at 6.

¹³⁴ RED Technologies Comments at 2.

¹³⁵ NAB Comments at 4; Smith and Fisher Comments at 4; Cohen, Dippell and Everist Reply at 2; BitPath Reply at 3; ONE Media Reply at 6.

¹³⁶ NAB Comments at 3; BitPath Reply at 3; ONE Media Reply at 6.

¹³⁷ NAB Comments at 8; Smith and Fisher Comments at 1; BitPath Reply at 2; ONE Media Reply at 9.

48. The record does not show whether allowing use of a more complex terrain-based model for determining channel availability would yield any significant increase in spectrum for white space devices. While unlicensed interests state that this could be the case in some instances, no party provided analysis to substantiate this claim.¹³⁸ TV spectrum available for white space devices became more limited after the broadcast incentive auction due to the reduction in size of the UHF TV band and the re-packing of UHF TV stations into the remaining portion of the band (channels 14-36). The need to protect adjacent channel TV stations means that a fixed white space device may operate at higher power levels (up to four watts EIRP generally, 16 watts EIRP in “less congested” areas) only at locations where there are at least three contiguous vacant channels, with the white space device operating on the center channel and both adjacent channels vacant.¹³⁹ After the incentive auction, there are fewer groups of three vacant TV channels in most areas, particularly in urban and suburban areas, as well as fewer single or pairs of vacant TV channels where white space devices could operate at lower power levels. There is no evidence in the record that allowing the use of terrain-based models to determine white space channel availability could address these spectrum limitations.

49. The record does not adequately address broadcaster concerns that terrain-based models are not an appropriate method of determining white space channel availability and that their use could result in harmful interference to TV.¹⁴⁰ While we do not conclude that terrain-based models are necessarily inappropriate for determining white space channel availability, we note that there are differences between how these models are currently used as compared to their potential use in determining white space channel availability. For example, the Longley-Rice methodology is used by the Commission for evaluating TV service coverage and interference within a TV station’s protected contour.¹⁴¹ The area within a protected contour is divided into a grid with 1 kilometer by 1 kilometer cells and the station’s coverage and any interference received from other TV stations are calculated at a single point within each grid cell. While the Commission has successfully used this method for determining TV station coverage, it is not clear from the record that it is sufficiently precise to be used in determining white space channel availability since TV receivers are spread over a wide area where their locations are not known, which increases the possibility of interference if a terrain-based model cannot accurately predict TV signal levels at all potentially affected receiver locations.¹⁴² There are also differences in the interference environment for TV reception compared to other applications where the Commission allows calculation of potential interference using terrain-based models, such as for unlicensed devices in the 6 GHz bands and devices in the Citizens Broadband Radio Service.¹⁴³ The record lacks sufficient information on these differences and how broadcasters’ interference concerns could be addressed.

50. We also believe that implementing terrain-based models could create burdens on the white space database administrator, the Commission and other parties.¹⁴⁴ The white space database administrator would have to develop and test new, more complex computer code to determine channel

¹³⁸ PISC Comments at 7; WISPA Comments at 3; Microsoft Reply at 10.

¹³⁹ 47 CFR § 15.712(b).

¹⁴⁰ NAB Comments at 2-6; BitPath Reply at 3-5; Cohen, Dippell and Everist Reply at 2-3; ONE Media Reply at 6;

¹⁴¹ OET Bulletin No. 69, Longley-Rice Methodology for Evaluating TV Coverage and Interference, February 06, 2004.

¹⁴² NAB Comments at 2-6.

¹⁴³ For example, unlicensed devices in the 6 GHz band must protect point-to-point microwave links where both the transmitter and receiver sites are known, and there is a single receive site on each end of the link. In the Citizens Broadband Radio Service, devices must protect various incumbent operations in the bands at known locations or within known areas, including Federal Government radar systems, fixed satellite receive sites and grandfathered wireless users.

¹⁴⁴ RED Technologies is currently the sole active white space database administrator.

availability and also to upgrade its computer system.¹⁴⁵ Even after updated code is developed, the Commission or another party, e.g., a test laboratory, would have to test and validate that the code provides accurate channel availability information.¹⁴⁶ Because there is currently only one active white space database administrator and fewer than 300 registered fixed devices, the implementation costs, including any third party testing, would have to be spread over a relatively small user base or borne by the white space database administrator.¹⁴⁷ In comparison, there are five spectrum access system (SAS) administrators in the Citizens Broadband Radio Service with hundreds of thousands of devices in use, and the Commission recently conditionally approved thirteen 6 GHz automated frequency coordination system (AFC) operators and we expect that 6 GHz device deployment will substantially exceed white space device deployment due to the greater amount of spectrum available.¹⁴⁸ We note that the white space database administrator suggests only a very limited implementation of a terrain-based model, specifically, to calculate TV station protected contours while making no other changes to the current protection model.¹⁴⁹

51. In sum, while we believe the use of a terrain-based propagation model for calculating whether the potential for causing harmful interference exists is appropriate in some instances, it is not clear that it would be beneficial to allow use of a terrain-based model in determining white space channel availability. As noted above, there are unresolved interference concerns as well as implementation costs that may outweigh any potential benefits of the changes. Further, there is already a simple, well-defined model for determining white space channel availability which no party argues is inadequate for protecting services in the TV bands.¹⁵⁰ For these reasons, we decline at this time to permit the use of terrain-based models in determining white space channel availability.

C. Rule correction.

52. We are making a ministerial correction to Section 15.713(e)(6) of the rules, which contains a requirement that white space databases not provide a list of available channels to fixed white space devices that exceed specific antenna height limits.¹⁵¹

53. Prior to 2019, fixed white space devices were generally limited to a maximum antenna height above ground of 30 meters and a maximum HAAT of 250 meters.¹⁵² In the 2019 *White Spaces Order on Reconsideration*, the Commission raised the antenna height above ground limit to 100 meters in

¹⁴⁵ RED Technologies Comments at 1.

¹⁴⁶ The Commission tested white space database systems developed using the current model, but relied on third party testing of Citizens Broadband Radio Service Spectrum Access Systems. The Commission has also specified that 6 GHz automated frequency coordination systems currently under development will be tested by third party laboratories.

¹⁴⁷ DSA Comments at 8 (stating that it is unclear the extent to which the upfront cost of applying a new model can be recouped).

¹⁴⁸ *OET Announces Conditional Approval for 6 GHz Band Automated Frequency Coordination Systems*, ET Docket No. 21-352, Public Notice, DA 22-1146 (OET Nov. 2, 2022).

¹⁴⁹ RED Technologies Comments at 2.

¹⁵⁰ As discussed in the Order on Reconsideration, Shure objects to the Commission's power limit for mobile devices and its decision to allow narrowband devices in all areas. However, Shure's objections are not based on the white space protection model itself, but rather on the maximum power level and permissible operating locations for certain types of white space devices.

¹⁵¹ 47 CFR § 15.713(e)(6).

¹⁵² 47 CFR § 15.709(g)(1); 15.713(e)(6) (2018). Fixed devices operating at 40 milliwatts on a single channel or 100 milliwatts spread across two contiguous channels may operate within the protected service contours of adjacent channel TV stations, and they are limited to an antenna height above ground of 10 meters to reduce their likelihood of causing interference to TV reception.

“less congested” areas while retaining the 30 meter height above ground and 250 meter HAAT limits in all other areas.¹⁵³ In the *2020 White Spaces Order and FNPRM*, the Commission increased the HAAT limit to 500 meters in “less congested” areas, retained the 250 meter HAAT limit in all other areas, and removed the antenna height above ground limit for most fixed white space devices.¹⁵⁴ The Commission revised Sections 15.709(g)(1) and 15.713(e)(6) to reflect these decisions, but in doing so it inadvertently continued to include an outdated reference to the former 30 meter antenna height above ground limit in Section 15.713(e)(6). Accordingly, we modify Section 15.713(e)(6) to remove this reference and conform the text of the rule to the Commission’s decision.¹⁵⁵

VI. PROCEDURAL MATTERS

54. *Paperwork Reduction Act.* This document 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).

55. *Final Regulatory Flexibility Analysis.* The Regulatory Flexibility Act of 1980 (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.”¹⁵⁶ Accordingly, we have prepared a Final Regulatory Flexibility Analysis (FRFA) concerning the possible impact of the rule changes contained in this Order on Reconsideration, Report and Order, and Memorandum Opinion and Order on small entities. The FRFA is set forth in Appendix E.

56. *Congressional Review Act.* [The Commission will submit this draft Order on Reconsideration, Report and Order and Memorandum Opinion and Order to the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, for concurrence as to whether this rule is “major” or “non-major” under the Congressional Review Act, 5 U.S.C. § 804(2).] The Commission will send a copy of this Order on Reconsideration, Report and Order, and Memorandum Opinion and Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. § 801(a)(1)(A).

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

58. *Additional Information.* For additional information on this proceeding, contact Hugh L. Van Tuyl, Hugh.VanTuyl@fcc.gov, (202) 418-7506 or Syed Hasan, Syed.Hasan@fcc.gov, (202) 418-418-2454.

¹⁵³ *Amendment of Part 15 of the Commission’s Rules for Unlicensed White Space Devices; 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; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, ET Docket Nos. 16-56 and 14-165 and GN Docket No. 12-268, Report and Order and Order on Reconsideration, 34 FCC Rcd 1827, 1851-53, paras. 64-67 (2019) (*2019 White Spaces Order*).

¹⁵⁴ *2020 White Spaces Order and FNPRM*, 35 FCC Rcd at 12609-10, 12614-15, paras. 20, 32-33. The Commission retained the 10 meter height above ground limit for fixed devices operating within the contour of adjacent channel TV stations.

¹⁵⁵ This rule update is ministerial in nature, implementing the Commission’s prior rulemaking decision issued following notice-and-comment procedures. Accordingly, for good cause, we find that further notice and public procedure before this update is unnecessary under the terms of the Administrative Procedure Act (APA). *See* 5 U.S.C. § 553(b)(B) (setting forth the “good cause” exception to the notice-and-comment requirements of the APA).

¹⁵⁶ *See* 5 U.S.C. § 605(b).

VII. ORDERING CLAUSES

59. Accordingly, IT IS ORDERED that, pursuant to the authority contained in Sections 4(i), 302, 303(b), (c), (e), (f), (r), and 307 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. No. 112-96, 126 Stat. 156, 47 U.S.C. §§ 154(i), 302, 303(b), (c), (e), (f), (r), 307, 1452, 1454, this Order on Reconsideration, Report and Order, and Memorandum Opinion and Order IS HEREBY ADOPTED.

60. IT IS FURTHER ORDERED that the petition for reconsideration filed by Shure Incorporated on February 11, 2021 in ET Docket No. 20-36 IS DISMISSED IN PART on procedural grounds and, as an independent and alternative basis, DENIED.

61. IT IS FURTHER ORDERED that the amendments of the Commission's rules as set forth in Appendix A ARE ADOPTED, effective thirty days from the date of publication in the *Federal Register*.

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

63. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Order on Reconsideration, Report and Order, and Memorandum Opinion and Order, including the Final Regulatory Flexibility Analysis, to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

Appendix A**Final Rules**

For the reasons set forth in the preamble, the Federal Communications Commission amends part 15 of Title 47 of the Code of Federal Regulations to read as follows:

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.

Source: 54 FR 17714, Apr. 25, 1989, unless otherwise noted.

2. Amend section 15.711 by revising paragraph (h)(1) introductory text and paragraph (h)(2) introductory text, adding a new paragraph (h)(3) and revising paragraph (k)(9) to read as follows:

§ 15.711 Interference avoidance methods.

* * * * *

(h) * * *

(1) Mobile devices and fixed and Mode II personal/portable devices, excluding narrowband devices, operating in the television bands.

(i) * * *

(ii) * * *

(2) Fixed and Mode II personal/portable devices operating outside of the television bands.

(i) * * *

(ii) * * *

(3) Narrowband devices operating in the television bands.

(i) A device that has been in a powered-on state shall access the database at least once each 24-hour period to verify that the operating channel(s) and associated maximum power levels continue to be available at its location.

(ii) A device must cease operating if it fails to successfully access the database once 24 hours from its last successful contact elapses until it re-establishes contact with the white space database and re-verifies its list of available channels and corresponding power levels.

* * * * *

(k) * * *

(9) A mobile white space device shall access the database at least as frequently as specified in paragraph (h) of this section to verify that the operating channel(s) and corresponding power levels continue to remain available.

* * * * *

3. Amend section 15.713 by revising paragraph (e)(6) to read as follows:

§ 15.713 White space database.

* * * * *

(e) * * *

(6) A fixed device with an antenna height above average terrain (HAAT) that exceeds 250 meters generally, or 500 meters in less congested areas, shall not be provided a list of available channels. The HAAT is to be calculated using computational software employing the methodology in § 73.684(d) of this chapter.

* * * * *

Appendix B**List of Parties Filing Comments – ET Docket No. 14-165**Comments

1. GE Healthcare
2. Microsoft Corporation
3. National Association of Broadcasters (NAB)
4. Sennheiser Electronic Corporation
5. Shure Incorporated

Reply comments

1. Consumer Technology Association (CTA)
2. Microsoft Corporation
3. National Association of Broadcasters
4. Open Technology Institute at New America and Public Knowledge (OTI and PK)

Appendix C

List of Parties filing Petitions for Reconsideration and Oppositions – ET Docket No. 20-36

Petition for Reconsideration

Shure Incorporated

Opposition to Petition for Reconsideration

Microsoft Corp.

Reply to Opposition to Petition for Reconsideration

Shure Incorporated

Appendix D**List of Parties Filing Comments – ET Docket No. 20-36**Comments

1. Cohen, Dippell and Everist
2. Dynamic Spectrum Alliance
3. Microsoft Corporation
4. National Association of Broadcasters
5. Public Interest Spectrum Coalition
6. RED Technologies
7. Smith and Fisher, LLC
8. Wireless Internet Service Providers Association

Reply comments

5. BitPath
6. Cohen, Dippell and Everist
7. Microsoft Corporation
8. National Association of Broadcasters
9. ONE Media 3.0, LLC
10. Wireless Internet Service Providers Association

Appendix E

FINAL REGULATORY FLEXIBILITY ANALYSIS

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),¹ an Initial Regulatory Flexibility Analysis (IRFA) was incorporated into the Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37; Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and the 600 MHz Duplex Gap, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Unlicensed White Space Device Operations in the Television Bands, Unlicensed Operation in the TV Broadcast Bands, *Second Order on Reconsideration, Further Notice of Proposed Rulemaking, and Order*, ET Docket No. 14-165, et al² and Unlicensed White Space Device Operations in the Television Bands, *Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 20-36.³ The Commission sought written public comment on the proposals in the *Further Notices of Proposed Rulemaking*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.⁴

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

2. The Order on Reconsideration dismisses in part and, on alternative and independent grounds, denies a petition for reconsideration of two rules adopted in Unlicensed White Space Device Operations in the Television Bands, Report and Order and Further Notice of Proposed Rulemaking.⁵ Specifically, it denies a request to reduce the maximum permissible power for mobile white space devices (16 watts EIRP) and a request to limit operation of narrowband devices to "less congested" areas, which are defined as those areas where at least half the TV channels in a device's band of operation are vacant. The Report and Order increases the frequency at which mobile white space devices must re-check a database to determine channel availability from once daily to once hourly, but declines to make a similar change for narrowband white space devices. The Memorandum Opinion and Order declines to allow white space databases to use a different and more complex method for determining channel availability for white space devices. It also corrects a minor error in the rule specifying the maximum allowable antenna height for fixed white space devices.

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

3. There were no comments filed that specifically addressed the IRFA.

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

² *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37; Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and the 600 MHz Duplex Gap, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Unlicensed White Space Device Operations in the Television Bands, Unlicensed Operation in the TV Broadcast Bands, Second Order on Reconsideration, Further Notice of Proposed Rulemaking, and Order*, ET Docket No. 14-165, GN Docket No. 12-268, ET Docket Nos. 20-36 and 04-186, FCC 22-6 (January 26, 2022) (*2022 White Spaces Order and FNPRM*).

³ *Unlicensed White Space Device Operations in the Television Bands, Report and Order and Further Notice of Proposed Rulemaking*, 35 FCC Rcd 12603 (2020) (*2020 White Spaces Order and FNPRM*).

⁴ See 5 U.S.C. § 604.

⁵ *2020 White Spaces Order and FNPRM*.

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

4. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.⁶

5. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

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

6. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.⁷ The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”⁸ In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.⁹ 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).¹⁰

7. *Small Businesses, Small Organizations, Small Governmental Jurisdictions.* Our actions, over time, may affect small entities that are not easily categorized at present. We therefore describe, at the outset, three broad groups of small entities that could be directly affected herein.¹¹ First, while there are industry specific size standards for small businesses that are used in the regulatory flexibility analysis, according to data from the Small Business Administration’s (SBA) Office of Advocacy, in general a small business is an independent business having fewer than 500 employees.¹² These types of small businesses represent 99.9% of all businesses in the United States, which translates to 32.5 million businesses.¹³

8. Next, the type of small entity described as a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”¹⁴ The Internal Revenue Service (IRS) uses a revenue benchmark of \$50,000 or less to delineate its annual

⁶ *Id.* § 604(a)(3).

⁷ *Id.* § 604(a)(4).

⁸ *See* 5 U.S.C. § 601(6).

⁹ *See* 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.”

¹⁰ *See* 15 U.S.C. § 632.

¹¹ *See* 5 U.S.C. § 601(3)-(6).

¹² *See* SBA, Office of Advocacy, Frequently Asked Questions, “What is a small business?,” <https://cdn.advocacy.sba.gov/wp-content/uploads/2021/11/03093005/Small-Business-FAQ-2021.pdf>. (Nov 2021).

¹³ *Id.*

¹⁴ *See* 5 U.S.C. § 601(4).

electronic filing requirements for small exempt organizations.¹⁵ Nationwide, for tax year 2020, there were approximately 447,689 small exempt organizations in the U.S. reporting revenues of \$50,000 or less according to the registration and tax data for exempt organizations available from the IRS.¹⁶

9. Finally, the small entity described as a “small governmental jurisdiction” is defined generally as “governments of cities, counties, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”¹⁷ U.S. Census Bureau data from the 2017 Census of Governments¹⁸ indicate there were 90,075 local governmental jurisdictions consisting of general purpose governments and special purpose governments in the United States.¹⁹ Of this number, there were 36,931 general purpose governments (county,²⁰ municipal, and town or township²¹) with populations of less than 50,000 and 12,040 special purpose governments—independent school districts²² with enrollment

¹⁵ The IRS benchmark is similar to the population of less than 50,000 benchmark in 5 U.S.C § 601(5) that is used to define a small governmental jurisdiction. Therefore, the IRS benchmark has been used to estimate the number small organizations in this small entity description. See Annual Electronic Filing Requirement for Small Exempt Organizations – Form 990-N (e-Postcard), “Who must file,”

<https://www.irs.gov/charities-non-profits/annual-electronic-filing-requirement-for-small-exempt-organizations-form-990-n-e-postcard>. We note that the IRS data does not provide information on whether a small exempt organization is independently owned and operated or dominant in its field.

¹⁶ See Exempt Organizations Business Master File Extract (EO BMF), “CSV Files by Region,” <https://www.irs.gov/charities-non-profits/exempt-organizations-business-master-file-extract-eo-bmf>. The IRS Exempt Organization Business Master File (EO BMF) Extract provides information on all registered tax-exempt/non-profit organizations. The data utilized for purposes of this description was extracted from the IRS EO BMF data for businesses for the tax year 2020 with revenue less than or equal to \$50,000 for Region 1-Northeast Area (58,577), Region 2-Mid-Atlantic and Great Lakes Areas (175,272), and Region 3-Gulf Coast and Pacific Coast Areas (213,840) that includes the continental U.S., Alaska, and Hawaii. This data does not include information for Puerto Rico.

¹⁷ See 5 U.S.C. § 601(5).

¹⁸ See 13 U.S.C. § 161. The Census of Governments survey is conducted every five (5) years compiling data for years ending with “2” and “7”. See also Census of Governments, <https://www.census.gov/programs-surveys/cog/about.html>.

¹⁹ See U.S. Census Bureau, 2017 Census of Governments – Organization Table 2. Local Governments by Type and State: 2017 [CG1700ORG02], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. Local governmental jurisdictions are made up of general purpose governments (county, municipal and town or township) and special purpose governments (special districts and independent school districts). See also tbl.2. CG1700ORG02 Table Notes_Local Governments by Type and State_2017.

²⁰ See *id.* at tbl.5. County Governments by Population-Size Group and State: 2017 [CG1700ORG05], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 2,105 county governments with populations less than 50,000. This category does not include subcounty (municipal and township) governments.

²¹ See *id.* at tbl.6. Subcounty General-Purpose Governments by Population-Size Group and State: 2017 [CG1700ORG06], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 18,729 municipal and 16,097 town and township governments with populations less than 50,000.

²² See *id.* at tbl.10. Elementary and Secondary School Systems by Enrollment-Size Group and State: 2017 [CG1700ORG10], <https://www.census.gov/data/tables/2017/econ/gus/2017-governments.html>. There were 12,040 independent school districts with enrollment populations less than 50,000. See also tbl.4. Special-Purpose Local Governments by State Census Years 1942 to 2017 [CG1700ORG04], CG1700ORG04 Table Notes_Special Purpose Local Governments by State_Census Years 1942 to 2017.

populations of less than 50,000.²³ Accordingly, based on the 2017 U.S. Census of Governments data, we estimate that at least 48,971 entities fall into the category of “small governmental jurisdictions.”²⁴

10. *Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing.* This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment.²⁵ 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.²⁶ The SBA small business size standard for this industry classifies businesses having 1,250 employees or less as small.²⁷ U.S. Census Bureau data for 2017 show that there were 656 firms in this industry that operated for the entire year.²⁸ Of this number, 624 firms had fewer than 250 employees.²⁹ Thus, under the SBA size standard, the majority of firms in this industry can be considered small.

11. *Television Broadcasting.* This industry is comprised of “establishments primarily engaged in broadcasting images together with sound.”³⁰ These establishments operate television broadcast studios and facilities for the programming and transmission of programs to the public.³¹ These establishments also produce or transmit visual programming to affiliated broadcast television stations, which in turn broadcast the programs to the public on a predetermined schedule. Programming may originate in their own studio, from an affiliated network, or from external sources. The SBA small business size standard for this industry classifies businesses having \$41.5 million or less in annual receipts as small.³² 2017 U.S. Census Bureau data indicate that 744 firms in this industry operated for the

²³ While the special purpose governments category also includes local special district governments, the 2017 Census of Governments data does not provide data aggregated based on population size for the special purpose governments category. Therefore, only data from independent school districts is included in the special purpose governments category.

²⁴ This total is derived from the sum of the number of general purpose governments (county, municipal and town or township) with populations of less than 50,000 (36,931) and the number of special purpose governments - independent school districts with enrollment populations of less than 50,000 (12,040), from the 2017 Census of Governments - Organizations tbls.5, 6 & 10.

²⁵ 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>.

²⁶ *Id.*

²⁷ See 13 CFR § 121.201, NAICS Code 334220.

²⁸ See U.S. Census Bureau, *2017 Economic Census of the United States, Employment Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEEMPFIEM, NAICS Code 334220, <https://data.census.gov/cedsci/table?y=2017&n=334220&tid=ECNSIZE2017.EC1700SIZEEMPFIEM&hidePreview=false>.

²⁹ *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.

³⁰ See U.S. Census Bureau, *2017 NAICS Definition*, “515120 Television Broadcasting,” <https://www.census.gov/naics/?input=515120&year=2017&details=515120>.

³¹ *Id.*

³² See 13 CFR § 121.201, NAICS Code 515120.

entire year.³³ Of that number, 657 firms had revenue of less than \$25,000,000.³⁴ Based on this data we estimate that the majority of television broadcasters are small entities under the SBA small business size standard.

12. As of December 31, 2022, there were 1,375 licensed commercial television stations.³⁵ Of this total, 1,282 stations (or 93.2%) had revenues of \$41.5 million or less in 2021, according to Commission staff review of the BIAKelsey Media Access Pro Online Television Database (MAPro) on January 13, 2023,³⁶ and therefore these licensees qualify as small entities under the SBA definition. In addition, the Commission estimates as of December 31, 2022, there were 383 licensed noncommercial educational (NCE) television stations, 383 Class A TV stations, 1,912 LPTV stations and 3,122 TV translator stations.³⁷ The Commission, however, does not compile and otherwise does not have access to financial information for these television broadcast stations that would permit it to determine how many of these stations qualify as small entities under the SBA small business size standard. Nevertheless, given the SBA's large annual receipts threshold for this industry and the nature of these television station licensees, we presume that all of these entities qualify as small entities under the above SBA small business size standard.

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

13. White space devices are unlicensed devices that operate in the television bands, the upper portion of the 600 MHz duplex gap, the 600 MHz service bands and on channel 37 at locations where frequencies are not in use by licensed services. These devices may be fixed, mobile or portable. To prevent harmful interference to broadcast television stations and other protected users³⁸ of these bands, fixed, mobile and some portable white space devices must obtain a list of available channels that may be used at their location from databases administered by private entities selected by the Commission. Fixed and mobile white space devices incorporate a geo-location capability and a means to access a database that provides a list of available channels and power levels that may be used at their operating location (a single point for fixed devices or a geo-fenced area for mobile devices). Personal/portable white space devices can either acquire a list of available channels via another device (Mode I) or include geo-location

³³ See U.S. Census Bureau, *2017 Economic Census of the United States, Selected Sectors: Sales, Value of Shipments, or Revenue Size of Firms for the U.S.: 2017*, Table ID: EC1700SIZEREVFIRM, NAICS Code 515120, <https://data.census.gov/cedsci/table?y=2017&n=515120&tid=ECNSIZE2017.EC1700SIZEREVFIRM&hidePreview=false>.

³⁴ *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. We also note that according to the U.S. Census Bureau glossary, the terms receipts and revenues are used interchangeably, see https://www.census.gov/glossary/#term_ReceiptsRevenueServices.

³⁵ *Broadcast Station Totals as of December 31, 2022*, Public Notice, DA 22-721 (rel. Jan. 11, 2022) (*December 2022 Broadcast Station Totals PN*), <https://www.fcc.gov/document/broadcast-station-totals-december-31-2022>.

³⁶ BIA Advisory Services, BIAKelsey Media Access Pro Online Television Database, <http://www.biakelsey.com/data-platforms/media-access-pro> (last visited on Jan. 13, 2023).

³⁷ *Broadcast Station Totals as of December 31, 2022*, Public Notice, DA 22-721 (rel. Jan. 11, 2022) (*December 2022 Broadcast Station Totals PN*), <https://www.fcc.gov/document/broadcast-station-totals-december-31-2022>.

³⁸ White space devices must protect: 1) digital television stations, and digital Class A TV, low power TV, TV translator and TV booster stations; 2) certain TV translator, low power TV (including Class A) and Multi-channel Video Programming Distributor (MVPD) receive sites; 3) fixed Broadcast Auxiliary Service (BAS) links; 4) Private Land Mobile Radio Service and Commercial Mobile Radio Service (PLMRS/CMRS) operations; 5) Offshore Radiotelephone Service; 6) low power auxiliary services, including wireless microphones; 7) border areas near Canada and Mexico; 8) radio astronomy services; 9) 600 MHz band services; 10) Wireless Medical Telemetry Service (WMTS) on channel 37; and (11) 488-494 MHz band in Hawaii. 47 CFR § 15.712(a)-(k).

and database access capabilities (Mode II) that provides a list of available channels that may be used at their location.

14. Fixed, mobile and Mode II personal/portable devices were all previously required to contact a white space database at least once per day to obtain a list of available channels and adjust their use of channels in accordance with channel availability schedule information provided by the database for the 48-hour period beginning at the time the device last accessed the database. If a white space device cannot contact a database on a given day, it may continue to operate until 11:59 PM the next day, after which time it must cease operation if it is unable to contact a database. In the *2022 White Spaces Order*, the Commission increased the frequency at which fixed and Mode II personal/portable devices (excluding narrowband devices), must contact the white space database. It required these device to check the database hourly, and decreased the amount of time that a device can continue to operate if it cannot contact the database to 120 minutes. The Commission proposed that mobile devices comply with an hourly re-check requirement and sought comment on whether an hourly re-check requirement should also apply to narrowband devices.\

15. Most RF transmitting equipment, including white space devices, must be authorized through the certification procedure. Certification is an equipment authorization issued by a designated Telecommunication Certification Body based on an application and test data submitted by the responsible party (e.g., the manufacturer or importer). The Order on Reconsideration, Report and Order, and Memorandum Opinion and Order does not change the authorization procedure for white space devices, but it modifies certain technical requirements for them. Specifically, it requires mobile white space devices to comply with the same hourly database re-check requirement the Commission previously adopted for fixed and Mode II personal/portable devices (excluding narrowband devices). The Commission is retaining the daily re-check requirement for narrowband devices.

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

16. 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.”³⁹

17. The *Order on Reconsideration, Report and Order* requires mobile white space devices to comply with the same hourly database re-check requirement that the Commission previously adopted for fixed and Mode II personal/portable devices (excluding narrowband devices). The Commission adopted this requirement to better protect licensed wireless microphones that can register for protection from white space devices. It noted that mobile devices have similar technical characteristics to fixed devices, such as the maximum power level and minimum separation distances from protected services, so the Commission decided it is appropriate to require the same database re-check interval for mobile devices as fixed devices.

18. The Commission is retaining the daily re-check requirement for narrowband devices because these devices have a significantly lower likelihood of causing harmful interference to licensed wireless microphones than mobile devices or other fixed devices.

19. The Commission proposed a transition period of six months for mobile white space devices being certified, imported, marketed or operated to comply with the more frequent database re-check interval. However, because there are currently no certified mobile devices and the white space

³⁹ See 5 U.S.C. § 603(c)(1) – (c)(4).

database is not yet capable of supporting mobile devices, the Commission determined that a transition period is not necessary.

G. Report to Congress

20. The Commission will send a copy of the *Order on Reconsideration, Report and Order, and Memorandum Opinion and Order*, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.⁴⁰ In addition, the Commission will send a copy of the *Order on Reconsideration, Report and Order, and Memorandum Opinion and Order*, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the *Order on Reconsideration, Report and Order, and Memorandum Opinion and Order* and FRFA (or summaries thereof) will also be published in the Federal Register.⁴¹

⁴⁰ See 5 U.S.C. § 801(a)(1)(A).

⁴¹ See 5 U.S.C. § 604(b).